National Centre for Academic and Cultural Exchange

How does academic research generate arts and culture-related impact?

A thematic analysis of Research Excellence Framework (REF) 2014 impact case studies

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Executive Summary

Introduction

This study was undertaken for the newly established National Centre for Academic and Cultural Exchange (NCACE) as part of a new body of primary research being carried out over the next few years to assist the centre in its development of a robust evidence base on the nature of knowledge exchange and wider relations between Higher Education Institutions and the arts and culture sectors. This work sits at the core of NCACE's activities of which there are four key strands as follows: Brokerage, Collaboration support and Networking; Skills and Capacity Development, Evidencing and Impact; and Communication. NCACE is funded by Research England. It was conceived and is led by The Culture Capital Exchange (TCCE) and in collaboration with regional partners including: Bath Spa University, Birmingham City University, Manchester Metropolitan University and Northumbria University.

Relations between academia and the arts and culture sector are no new thing. Collaborations, partnerships and exchanges of many kinds have deep roots and manifestations across many disciplines and art form areas. It is also no longer the case that such relationships are solely between individuals. We are increasingly witnessing the emergence of more complex and often large-scale partnerships between institutions, often involving a diversity of cross-sector actors. This is why it is important for us at NCACE to look at REF and other such mechanisms and frameworks. They have so much to tell us about how universities and the arts work together, and how these relations are narrated. REF 2014 case studies firmly indicate the substantial scale of this connectivity and leaves us with no doubt that academic research is deeply and widely intertwined and affiliated with the arts and culture sector and vice versa.

REF: What is it and why is it important

The Research Excellence Framework is a major national assessment that is undertaken by UK based universities every seven years or so. It is a system for measuring the quality of academic research. REF 2014 was its first round, replacing the previous RAE (Research Assessment Exercise) and narrative case studies were included in the exercise. The latest REF took place earlier this year and at the time of writing, the results are not yet published.

REF also measures the impact of research, defined by Research England as that which has 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia.'

REF Data Set

REF 2014 yielded 6679 case studies in total and from that number, we extracted 1188 relevant case studies whose details of impact included the word "art" or "culture" and their composites. After manual checking for relevance, our sample consists of 793 cases; quantitative and in-depth thematic analyses were carried out on this sample.

Whilst previous research has investigated the impact on arts and culture emerging from REF 2014 case studies, including Draux and Szomszor (2015) and Hewlett et al. (2017), this is the largest study of its kind to focus on the *research process* underpinning the production of arts and culture-related impact: analysing *who performs* research that generates arts and culture-related impact, the nature of *those who benefit* from such impact, and the *nature of the research process* leading to arts and culture-related impact.

Key Findings

The Units of Assessment that had the most arts and culture-related impact cases are also those that have the greater shares of submitted cases with arts and culture-related impact. In particular, around 62% of cases submitted to Art and Design: History, Practice and Theory and to Music, Drama, Dance and Performing Arts. Furthermore, 59% of cases submitted to English Language and Literature have arts and culture-related impact. Only 3.66% of arts and culture-related impact cases have been submitted to Classics, but they constitute about half of all the cases submitted to that Unit.

It is also important to note the wide variety of disciplines and sectors that work together. The knowledge base supporting arts and culture related impact falls mainly within four subject areas, namely: Cultural Studies, Historical Studies, Literary Studies and Film, Television and Digital Media. However, case studies are reported across a very wide range of areas across many other units of assessment, right across the Arts and Humanities as well as the Social Sciences with some, albeit fewer case studies within STEM based subjects.

There are strong differences across Units of Assessment in terms of the types of academic units that perform the underpinning research. Individually-driven research

(either by individuals or informal collaborations between individuals) is prevalent in the arts and humanities, while team research (either done in the context of formal organizational units or formal research projects) is prevalent in most of the social sciences, and in science, technology engineering and maths (though both approaches are to some extent present in all subjects).

Considering the set of eight impact categories provided in the REF database, self-selected by the submitting units, the majority of the impact (76.92%) is cultural in nature, followed by societal (19.04%) and then, as a distant third, technological (2.02%). The other categories of impact only have marginal importance.

Overall, 84% of case studies have impacted the arts and culture sector, while 75% of case studies have had some impact on sectors other than the arts and culture.

Through our thematic analysis of the REF 2014 case studies, we identified nine key research processes generating arts and culture related-impact, which can be described as follows:

- Analysis of artistic/cultural production by others;
- Artistic/cultural production;
- Development of technology;
- Research in other areas inspiring artistic/cultural production;
- Analysis of artistic/cultural work conditions and processes;
- Creation of archive/database of arts/culture outputs;
- Creation of archive/database in other fields (which can benefits arts and culture sectors);
- Service/process design;
- Research in other areas advocating for (or benefitting/impacting) the arts and culture sector.

Unsurprisingly the two key types of process accounting for the majority of the case studies were: 'Analysis of artistic/cultural research and production by others' and 'Artistic or cultural production', with a third category on 'Research supporting or inspiring artistic production'.

These different research processes are associated with different ways of producing research (e.g. different types of academic units, different knowledge bases) and to different types of impact.

Some processes - including: analysis of artistic and cultural work conditions and processes; development of technology; service/process design; creation of archives/databases of artistic/cultural outputs or other outputs - involve mainly research produced by teams. These are processes that often build on more technical knowledge bases, such as computer science (in the case of development of technology), library and information management (in the case of service/process design) and that require considerable resources (development of technology, construction of databases and archives). Other research processes - including: artistic/cultural production, analysis of artistic/cultural production by others, research inspiring artistic/cultural production - mainly originate from individually-driven research.

Whilst most research processes have cultural impact, some also refer to cases that have mainly societal impact, including research inspiring artistic/ cultural production and research that advocates/benefits/impacts the arts and culture sector, analysis of artistic/ cultural work conditions and processes. Some cases that involved the development of technology and construction of archives/databases had mainly technological impact.

In terms of impacted sectors, we find that for most research processes, a majority of cases (more than 70%) have impact on the arts and culture sectors, with one exception: artistic and cultural production, where only about 40% of cases have impact on the arts and culture sector, while almost 90% have impact on other sectors, particularly the general public and the education sector.

Implications for policy and evaluations

As has been evidenced, not only through key research papers (such as Crossick, 2006; Universities UK, 2010; AHRC, 2016) and blog platforms such as the Widening the Register, (created by TCCE as part of Creativeworks London), not to mention anecdotal evidence, knowledge is constituted within the interaction between people (and between people and creative objects and practices) and it is from that engagement that the value itself is derived. In the context of REF 2014 however, evidence suggests that those panels representing STEM disciplines tended to grade more highly than those in the social sciences, humanities and the arts (Kellard and Sliwa, 2016). This may indicate that research on or with the arts and culture sector is somehow harder to value or measure within existing frameworks.

REF as a globally recognised framework indicates the value of case studies as an appropriate method to clearly articulate for policy-makers, funders and the public

how academic research can have an impact on culture. Furthermore, there is an opportunity to more widely share and disseminate the rich findings from REF case studies to enable them to serve a wider function as a resource for sectors including arts and culture.

It has been observed that understanding the way in which cultural impacts occur for individuals and groups is not straightforward (Kaszynska, 2015) and could draw on wider techniques from the social sciences, such as ethnography and anthropology, to explore the way in which cultural experiences occur. It would be very interesting and useful to further apply this observation to research impacts, across a range of types, with the arts and culture sector.

Our findings confirm that the process of academic research and the process of impact generation are intertwined and complex:

- the processes of academic research generating impact on the arts and culture sector take many forms, with vast differences in elements such as the scale of research endeavour, the duration of the processes, and the scale and number of interactions involved;
- there are cross-cutting impacts between disciplines and sectors: research in the arts and humanities generates impact on the arts and culture sectors as well as on other sectors (the general public, education, health, tourism, vulnerable groups...) while research in other disciplines such as STEM generates impact on the arts and culture sectors.
- It is not possible to identify one to one correspondence between research processes and types of impact / impacted categories within the arts and culture sector / impact on other sectors.

At the same time, the identification of a set of research processes leading to arts and culture-related impact can yield some useful insight for impact measurement. In particular:

- While the narrative approach seems to be the most suitable method for collecting information on research case studies, people should be given a broad range of possible ways to demonstrate impact, with the possibility to pick which metrics best suit the nature of their research.

- Such metrics include quantitative indicators that could be meaningful particularly in the context of some types of research processes; for example:

  - Particularly for artistic/cultural production, their analysis and research that inspires artistic/cultural productions, which are consumed by an audience: number of copies sold/licensed, number of downloads/views, number of attendees and other indicators of engagement
  - Particularly for databases and development of technology: number and types of artistic and cultural output generated; and indicators of use and engagement with the latter
  - Particularly for service / process design and research that benefits the arts and culture sector: efficiency gains, improvements in quality, new products/processes generated as a result of implementing the service/process design or the research findings

- Importantly, this data collection should be undertaken with no assumptions on what process is most impactful.

Going forward

Our study has shown that 11.87% of case studies submitted to REF 2014 related to the arts and culture sector. This substantial percentage (which is a conservative estimate for reasons explained in section 3.2) indicates the close proximity of research with the arts and culture sector. Whilst the largest focus emerging from the research case studies tends to be 'on' the arts and culture sector, it is also very interesting to note how strongly artistic and cultural production itself is also featured in the case studies. This may indicate that practice-based research - as well as emergent ways of identifying practices that are located both in and beyond the academy, such as pracademia - constitutes a major part of the research ecosystem, and that this ecosystem is in turn likely to be one that is supported and nurtured through a variety of mechanisms.

As we move forward, we are now keen to compare the results from REF 2014 with those from the recently submitted REF 2021[1], which is due to be published next year. It will be particularly useful to see whether, and if so how, REF 2021 indicates and narrates the effects of a range of significant funding initiatives - for example, the AHRC's Knowledge Exchange Hubs - as well as wider external factors and policy developments. It may still be a little early for evidence to emerge through REF 2021 on the still ongoing large-scale Creative Industries Clusters Programme, but the extent to which it relates to the arts and culture sector and how that is articulated will also be valuable to know more about in due course.

[1] Home - REF 2021 (https://www.ref.ac.uk/)

As the connections between research and policy arguably intensify, especially with key policy developments over the last few years including the Industrial Strategy[2] and the more recent R&D Roadmap[3], it will also be useful to see if it is possible to detect research responding to policy agendas such as Place-making and Levelling Up agenda. These are also both areas in which the arts and culture sector are being encouraged to play a role. Furthermore, the additionality and enhanced knowledge base arising from the Knowledge Exchange Framework[4] will feed into future developments of this work as will the many pieces of work being undertaken in relation to the Covid-19 pandemic.

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[2] The UK's Industrial Strategy (https://www.gov.uk/government/topical-events/the-uks-industrial-strategy)

[3] The UK Government UK Research and Development Roadmap (https://www.gov.uk/government/publications/uk-research-and-development-roadmap)

[4] Knowledge exchange framework (https://re.ukri.org/knowledge-exchange/knowledge-exchange-framework/) | Research England

1. Introduction

Higher education institutions (HEIs) are increasingly encouraged to contribute to economic and social development by generating impact outside the narrow boundaries of academia. This includes research performed by academics working in the arts and humanities fields, as the latter are argued to hold the potential to generate significant impact - for example, on the creative industries, an important sector of the UK economy. In spite of the growing emphasis on the generation of external impact from research activities, there is still a lack of understanding of the impact of research that relates to arts and culture – intended both as research *on* arts and culture, and also as research *of any kind* that does have an impact on the arts and culture sector. Developing greater understanding of the different ways in which HEIs perform research that generates impact related to arts and culture is important in order to improve support for HEIs in their efforts to 'make a difference' through their academic research, as well as to support assessment and evaluation practices in this domain.

This report is being prepared as part of the Evidencing and Impact activities of the newly established National Centre for Academic and Cultural Exchange (NCACE). It sets out to examine how research performed in higher education institutions (HEIs) contributes to generating impact that is related to (that is affected by, or affecting) artistic and cultural production. It responds to calls from policymakers on better evidence about the outcomes and impacts of knowledge exchange and the reasons for its significance.[5]

1.1. Background to NCACE

NCACE is led by TCCE and funded by Research England. Its key purpose and mission is to champion and support capacity for Knowledge Exchange and wider relations between Higher Education and the arts and culture sector across the UK, with a particular focus on evidencing and showcasing the social, cultural, environmental, as well as economic, impacts of such activities. It aligns with developments in Higher Education (including the Knowledge Exchange Framework and the Knowledge Exchange Concordat[6]), the arts and culture sector (including Arts Council England's new 10 year plan Let's Create) and across the wider policy landscape, NCACE began as

[5] E.g. 'What did knowledge exchange ever do for us? (outcomes, impacts)' and 'Why would we want more of it? (demand); Hamish McAlpine, presentation, 16 March 2021.

[6]

a four-year initiative in late 2020, had its public launch in February 2021 and will run in its first phase until 2024.

NCACE's key work sits across four interconnected areas, highlighted below, to support its mission and this work in turn is being delivered in partnership with a number of HEIs across the country, all of whom are dedicated to the wider potential and impacts of Knowledge Exchange (KE) within and beyond their communities. These include: Bath Spa University, Birmingham City University, Manchester Metropolitan University and Northumbria University.

1.2. Objectives of the analysis

To address the need for more and better evidence about research impact in relation to arts and culture, we have carried out an exploratory analysis of impact case studies submitted to the Research Excellence Framework (REF) 2014. The objective is to identify the key actors and processes involved in the generation of impact: the research performers, the sectors that benefit from the research, and the research process which leads to impact generation.

We adopt a broad definition of arts and culture-related impact, considering both:

(i) arts and culture-related knowledge and practice produced by HEIs that generate impact outside academia (including the arts and culture sector as well as on other sectors); and
(ii) knowledge and practice produced by HEIs in other fields that generate impact on the arts and culture sector.

After identifying the subset of impact case studies that have (some kind of) arts and culture-related impact according to the above-mentioned definition, we have performed a thematic analysis with the objective to identify:

- **who performs** research that generates arts and culture-related impact (which academic fields, which types of academic units)

- **who is impacted** by this research (which sectors, whether arts and culture related or not; which countries)
- **which type of research process** leads to the generation of arts and culture-related impact.

The REF 2014 impact case studies database (https://impact.ref.ac.uk/casestudies) is a rich base of evidence that is publicly and freely available, and one of the most comprehensive – indeed perhaps the most comprehensive - exercise of collection of narrative descriptions of the non-academic impact generated by academic research.[7] Another advantage of relying on this database as a source of evidence is that the evidence has been produced quite recently (2014), though the actual case studies can span a period of up to 20 years. Since the REF research assessment exercise is being repeated in 2021, requiring HEIs to submit new impact case studies, we can expect that the database will eventually be extended with the impact case studies that will be submitted to the REF 2021, allowing for further analyses and possibly for longitudinal comparisons. Of course, the case studies submitted to the REF focus on impact emerging from academic research, whereas we must bear in mind that HEIs and the arts and culture sector collaborate in multiple ways that do not necessarily involve formal research processes, and which remain outside the scope of the present investigation.

This report is structured as follows. In section 2, we provide a brief review of previous studies that have attempted to capture and model the impact of research in relation to arts and culture. In section 3, we present our data and methodology. In section 4, we present our findings in relation to the various ways in which HEIs contribute to arts and culture-related impact. Section 5 will conclude and provide some recommendations for future research and policy.

[7] Another example is the Better World database which is a collection of technology transfer studies produced by the Association of University Technology Managers in the US (https://autm.net/about-tech-transfer/better-world-project/bwp-advanced-search/)- (https://autm.net/about-tech-transfer/better-world-project/bwp-advanced-search/)-) however this database is smaller (only about 450 cases) and heavily focused on technology.

2. Capturing and modelling research impact in relation to arts and culture

The problem of identifying the way in which research endeavours involving artistic and cultural production generate impact outside academia was clearly articulated by Crossick (2006). In an influential paper, he pointed out that the process through which artistic and cultural production generates impact is not something akin to a 'transfer of widgets', where knowledge is formed and then transmitted to others; rather, knowledge is constituted within the interactions between people (and between people and creative objects and practices), and it is from that engagement that value itself is derived. This knowledge is difficult to 'bottle, protect and transmit', as it emerges from the interaction itself, and it involves primarily a process of personal change leading to new ways of thinking and new ways of doing. Hence, almost paradoxically, while artistic and cultural production can often be global in outlook and able to bridge cultural barriers between people, its origins are often based on very personal and local interactions, in the context of 'creative conversations' where people are able to confront their different views and assumptions.

Another interesting aspect is that the best conversations are sustained over time, and follow opportunities and challenges that arise and are then pursued to see where they lead. Interestingly, analysing the impact of interactions between academics in the social sciences and humanities and external stakeholders has led other authors to identify similar aspects of the process of impact generation that differentiate it from the 'transfer of widgets' model of impact in science and technology: (i) the key role of sustained knowledge coproducing interactions; (ii) the fact that impact 'ripples out' serendipitously, indirectly benefiting many stakeholders in ways that often cannot be anticipated; and (iii) the fact that impact unfolds and persists over a long period of time (Knight and Pettigrew, 2007; Meagher et al., 2008; Rossi et al., 2017).

Due to these features of the impact of research in the arts and humanities and to some extent, in the social sciences, it is difficult to apply it to the models developed to describe and measure the impact of science and technology. The latter typically rely on measuring the 'outputs' of research (patents, publications, new products, new spinout companies, etc.) with the assumption that such outputs will be somehow picked up by potential users and eventually find their way into commercial use. In the case of research in the arts and humanities and social sciences, those research 'outputs' are very often missing, and even when they are present they are unlikely to produce impact unless they are accompanied by purposeful activities intended to share knowledge with various audiences. In the context of REF 2014, evidence

suggests that those panels representing science, technology, engineering and mathematics (STEM) disciplines tended to grade more highly than those in the social sciences, humanities and arts (Kellard and Sliwa, 2016). This could be taken to suggest that impact in non-STEM disciplines was harder to demonstrate through the rules governing the REF2014 process. Kellard and Sliwa (ibid.) suggest that, perhaps because the nature of knowledge in these disciplines is more dispersed and distributed among unconnected scholars from many institutions, linking impact to the work of a single scholar or group of scholars within a particular university becomes problematic (Smith et al., 2011). It is also possible that the serendipitous and long term nature of impact makes it harder to track. Hence, if we are to engage with these issues, then we need more appropriate tools for doing so (Crossick, 2006). But which ones?

The literature on how to capture the impact of creative endeavours involving artistic and cultural production is not particularly broad. We can glean a few insights from a number of different reports that were put together in the last ten years. In particular, Guthrie et al. (2018) reviewed methods "used to determine cultural impact" (Guthrie et al., 2018, p.46) pointing out that, in many cases, case studies are an appropriate method to clearly articulate for policymakers, funders and the public how academic research can have an impact on culture, and in fact case studies and interviews have been used in several reports (Krapels et al. 2015; AHRC, 2016; Universities UK, 2010). They also discuss how attempts have been made to use secondary datasets and surveys to measure cultural impact in a more systematic manner. These include efforts to measure participation in cultural activities (Bunting and Knell, 2014; Crossick and Kaszynska, 2016) and the impact of and value placed on such engagement (Fujiwara, 2014; Miles and Sullivan, 2010). These studies all showcase possible metrics to measure such complex constructs.

However, one of the key issues in the definition of metrics in general is that good metrics require a clear prior understanding of the process that generates the outputs, outcomes and impacts that are intended to be measured. In the case of creative endeavours involving artistic and cultural production, the process of impact generation is understood and modelled only to a limited extent. For example, it has been observed that understanding the way in which cultural impacts occur for individuals and groups is not straightforward (Kaszynska, 2015), and would need to draw on wider techniques from the social sciences, such as ethnography and anthropology, to explore the way in which cultural experiences occur. While this type of work is starting to emerge in terms of assessing cultural experiences, according to Guthrie et al. (2018) this has yet to be linked back to the role that research plays in forming these cultural experiences, or the context in which they are created. Hence,

better understanding of the processes through which creative endeavours involving artistic and cultural production (including research activities in these areas) generate impact is required. Drawing on multiple sources, the efforts to understand such processes should lead us to better differentiate who are the stakeholders engaging with these processes, and which metrics would be more appropriate for each of them.

Some efforts to analyse impact arise from research activities using the REF 2014 database. Work by Kellard and Sliwa (2016) on REF 2014 shows that those HEIs that submitted impact case studies which were evaluated more positively by the REF 2014 assessors, were able to showcase the work of small teams with predominantly established researchers - some of whom had been in post for 20 years or longer - had developed a solid research base and had been successful in attracting external funding. This was more easily achieved by traditional research oriented universities. Instead, case studies submitted by less research intensive institutions were to a greater extent likely to be based on the work of one key researcher, with fewer research outputs underpinning the case studies and a lower amount of funding.

Alternatively, Draux and Szomszor (2015) performed an extensive text mining exercise of all REF 2014 impact case studies and identified 3,709 unique different ways that the research to impact pathway takes. Focusing in particular on 139 case studies in film and theatre, they analysed the range of beneficiaries of the impact and they further identified three distinct stages in the research pathways in these case studies that contributed to their impact story:

1. Impact as a result of the research process
2. Impact as an outcome of the research, and
3. Impact through final coverage of the research, often mainly through the media.

Around one-fifth of the case studies involved some form of participatory process within their research, which as the authors noted, resulted in an impact on the research participants.

Hewlett et al. (2017) also performed an analysis of REF 2014 impact case studies, specifically aimed at analysing cases with impact on the creative and cultural sector. Based on a topic modelling approach, they identified 1,582 cases with impact within the creative and cultural sector, relating to 60 different topics. They then conducted a more in-depth qualitative study of a subset of 417 impact cases in order to investigate the type of impact produced and the pathways or mechanisms through which impact is achieved. By doing so, they identified 2,602 different impact pathways, showcasing

the variety of means (e.g. publications, workshops, conferences, films, software, and many more) through which research has an impact on the creative and cultural sector.

In the present study, we take a different perspective from the above-mentioned studies that analyse the multiple pathways through which impact is generated. Since research impact arises over time and it is strongly intertwined with the activities of the individuals and teams performing the research, we focus on the *research process* underpinning the production of arts and culture-related impact, by analysing *who performs* research that generates arts and culture-related impact, the nature of *those who benefit* from such impact, and the *nature of the research process* leading to arts and culture-related impact. To do so, we first identified the distribution of cases with arts and culture-related impact across Units of Assessment. We analysed the subject areas of the underpinning research and the types of academic units that produced it. Second, we analysed *who is impacted* by this research, considering the types of impact produced, the geographical scope of the impact, and types of impacted sectors. Third, we analysed *what kind of research processes led to impact on the arts and culture sector*; the various processes were identified through thematic analysis.

3. Data and methodology

3.1. Data sources

This analysis builds on the database of impact case studies submitted to REF 2014. The total number of impact cases submitted to the REF 2014 was 6,975, but 296 of these were deemed as being confidential or sensitive in nature, reducing the number of non-redacted case studies to 6,679. The publicly available database of REF impact case studies contains 6,637 different impact cases.[8]

For each impact case study, the database includes the name of the institution that submitted it, the Unit of Assessment to which it was submitted, the impact case's title, a short summary of the impact, a longer description of the details of the impact, a description of the underpinning research, relevant academic references, and sources to corroborate the impact. The database also includes some fields - populated on the basis of the information provided by the units that submitted the impact cases – that allow for some simple categorizations of the impact generated by these cases. In particular, it contains information about: the subject area of the underpinning research; the continent where the impact occurred; the country where the impact occurred; the UK location where the impact occurred; the type of impact generated. Additionally, the database was further integrated with information about the REF evaluation scores obtained by the unit that submitted each case study, and about the number of their full time equivalent (FTE) staff; these can also be separately downloaded from the REF website[9]. The full list of variables in the database thus integrated is reported in Appendix 1.

2.2. Identifying cases with arts and culture-related impact

In order to identify cases with arts and culture-related impact from these 6,637 impact case studies, we could adopt several approaches. One could focus on the cases submitted to Units of Assessment in the arts and humanities, assuming that research from these fields would produce an impact on the arts and culture sector. If we selected all impact case studies submitted to 'Art and Design: History, Practice and Theory', 'English Language and Literature', 'Music, Drama, Dance and Performing

[8] Available from the following link: https://impact.ref.ac.uk/casestudies/search1.aspx (https://impact.ref.ac.uk/casestudies/search1.aspx) (last accessed 10 February 2021).
[9] Available from the following link: https://results.ref.ac.uk/(S(sr44rtn1d142qmvyisnbzdhe))/ (https://results.ref.ac.uk/(S(sr44rtn1d142qmvyisnbzdhe))/) (last accessed 10 February 2021).

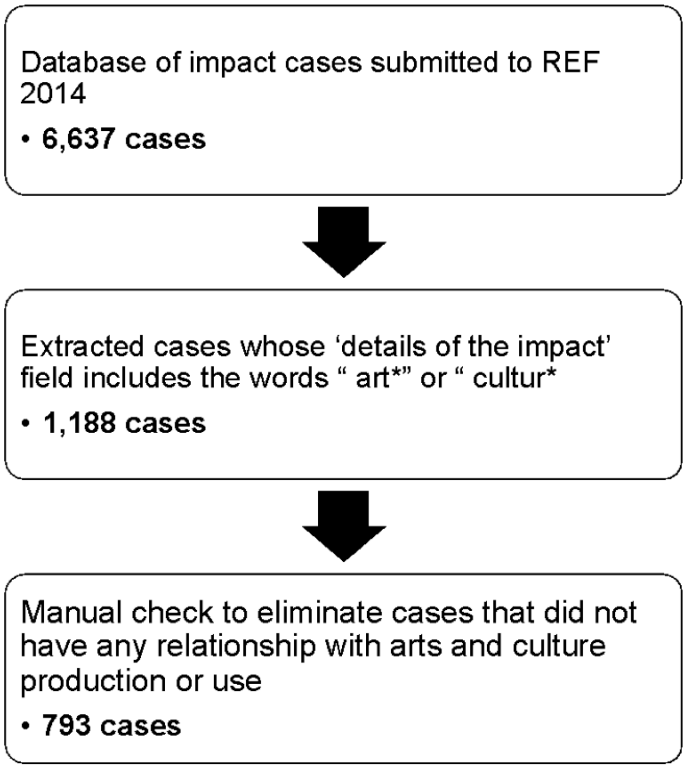
Arts', 'Communication, Cultural and Media Studies, Library and Information Management', 'Classics', and 'History', we would select 1,375 cases submitted by 193 different units. However, this approach would not capture cases with arts and culture related impact arising from research in other fields (or from interdisciplinary research including the arts and humanities but submitted to other Units of Assessment), while conversely it would capture cases originating from the arts and humanities that might not have arts and culture related impact (though these are likely to be very few).

Hence, we have decided to take a different approach and focus on any impact cases where the words 'arts' and 'culture' are mentioned, irrespective of which Units of Assessment they were submitted to. To identify relevant case studies, we extracted all those whose 'details of the impact' field includes the words " art*" or " cultur*". This led to a set of 1,188 cases whose 'details of the impact' field make some reference to arts or culture. These cases were then manually checked to eliminate those that did not have any relationship with arts and culture production or use - for example because the word art* was used in other words like 'arthritis' or 'artificial' or 'state-of-the-art'. This led to a reduced set of 793 cases submitted by 141 different institutions. We call these 'arts and culture-related impact' cases.

Of course, this approach has its own limitations, the most glaring of which is that a case study could have an impact on arts and culture without necessarily using those words. At the same time, this approach allows us to identify cases which *definitely* have arts and culture related impact, and which we can be presumed to cover a large share of such cases. Since we have no reason to believe that the use of these words introduces a bias in the selection, we can assume that the 793 cases constitute an appropriate sampling for all cases with arts and culture related impact.

Interestingly, Hewlett et al. (2017) sampled REF cases that had impact 'within the creative and cultural sector' using a more sophisticated approach based on topic modelling performed on the entire set of 6,679 impact cases. This way, they identified a broader set of 1,582 cases, which they analysed only quantitatively; they then proceeded to do a more in-depth qualitative analysis of 417 cases (just over a quarter of the sample), which were chosen to reflect the breadth of topics identified through topic modelling. While our analysis starts from a smaller sample of 793 cases, the qualitative analysis is performed on the entire sample so we achieve a comparable level of analytical depth.

Figure 1. Identification of relevant impact case studies



While the categorical variables included in the REF 2014 database would allow for some general description of the type of academic research producing the impact (nature and number of research subject areas) and of the impact generated (type of impact, geographical scope of the impact), these descriptions do not uncover the processes through which academic research leads to impact nor the precise types of sectors that are impacted. Therefore we have exploited the rich textual information included in the 'summary of the impact' and 'details of the impact' fields in order to derive further variables. In particular, we have performed a thematic analysis of the 793 cases with arts and culture-related impact in order to identify:

- The type of research unit producing the academic research;
- The nature of the academic research processes leading to arts and culture-related impact;
- The type of artistic/cultural production;
- The impacted sector (within the arts and culture sector, or other).

For each of these four themes, we have developed codes that identified sub-categories within each theme; the lists of categories were built progressively during the coding process (coding 'in vivo') and at the end of the coding process they were streamlined to

avoid repetitions (e.g. different codes that mean the same thing) or vague or overlapping categories. The lists of codes developed through this thematic coding process is presented in Appendix 2.

We then analysed this database, including both the variables that were part of the original REF 2014 impact case studies database, and the variables that were constructed through the thematic analysis of the 'summary of the impact' and 'details of the impact' fields. First, we analysed *who performs* research that generates arts and culture-related impact. We identified the distribution of cases with arts and culture-related impact across Units of Assessment, we analysed the subject areas of the underpinning research and the types of academic units that produced it.

Second, we analysed *who is impacted* by this research, considering the types of impact produced, the geographical scope of the impact, and types of impacted sectors. Third, we analysed the *nature of academic research processes leading to arts and culture-related impact*. Here we considered various processes that were identified through thematic analysis.

Figure 2. Word cloud of the 100 most frequently occurring words in the "Details of the impact" field of the REF 2014 impact cases database, for the 793 cases with arts and culture related impact

4. Data analysis

4.1. Who performs research that generates arts and culture-related impact?

In order to understand what kind of knowledge base the case studies build on, we can rely on two different ways to categorize such knowledge base: (i) the 36 Units of Assessment (https://www.ref.ac.uk/2014/panels/unitsofassessment/) among which each submitting unit could choose to submit their case; and (ii) the subject areas of the underpinning research. While they both loosely capture the knowledge base that the case studies build on, these two categorizations are different. In fact, Units of Assessment broadly reflect the way in which research is organized within universities for administration purposes, while scientific fields reflect the organization of scientific production (irrespective of university structures).

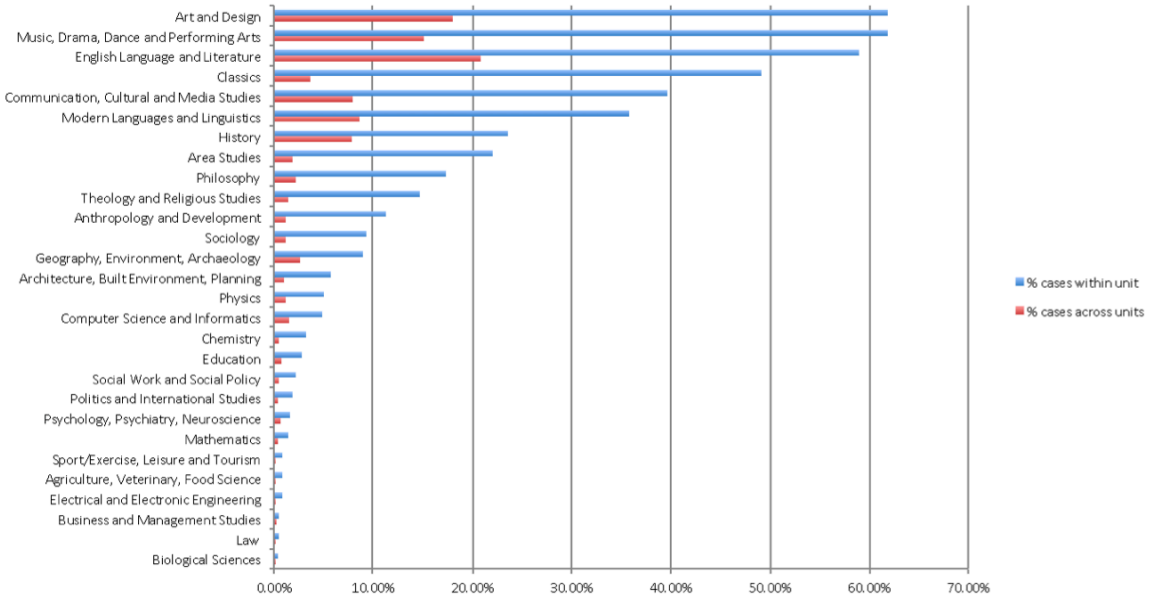
First we consider the distribution of cases across and within Units of Assessment, shown in Figure 3. The red columns show the percentage distribution of the 793 cases across the 36 possible Units of Assessment available in the REF (% of all arts and culture-related impact cases submitted to the Unit of Assessment), while the blue columns shows the share of cases within each Unit of Assessment (% of cases submitted to the Unit of Assessment that have arts and culture-related impact). It is clear that the distribution of impact cases across units (red columns) is very unequal, with more than half of the cases concentrated in three Units of Assessment: English Language and Literature, Art and Design: History, Practice and Theory and Music, Drama, Dance and Performing Arts. Conversely eight Units of Assessment did not have any Arts and Culture-related impact cases, and another 12 had a very small number (each of these Units of Assessment had less than 1% of the impact cases).[10]

The Units of Assessment that had the most arts and culture-related impact cases are also those that have the greater shares of submitted cases with arts and culture-related impact. In particular around 62% of cases submitted to Art and Design: History, Practice and Theory and to Music, Drama, Dance and Performing Arts, and 59% of cases submitted to English Language and Literature have arts and culture-related impact. Only 3.66% of arts and culture-related impact cases have been

[10] Several Units of Assessment did not include any case studies that, according to our definition, produced arts and culture-related impact: Aeronautical, Mechanical, Chemical and Manufacturing Engineering, Allied Health Professions, Dentistry, Nursing and Pharmacy, Civil and Construction Engineering, Clinical Medicine, Earth Systems and Environmental Sciences, Economics and Econometrics, General Engineering, Public Health, Health Services and Primary Care.

submitted to Classics, but they constitute about half of all the cases submitted to that Unit. Similarly, Communication, Cultural and Media Studies, Library and Information Management and Modern Languages and Linguistics account for relatively small shares of cases, but more than a third of cases submitted to these Units have arts and culture-related impact.

Figure 3. Distribution of arts and culture-related impact cases across and within Units of Assessment

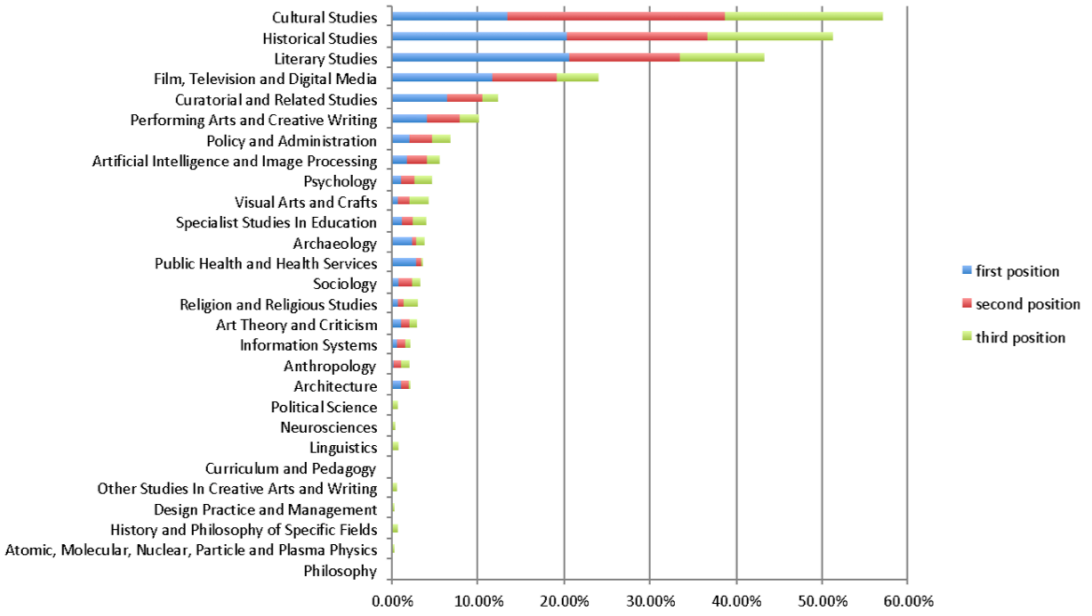


Second, we consider the 53 possible subject areas to which the underpinning research belongs. Each case could indicate up to 3 subject areas, and indeed 601 cases indicated three subject areas, another 167 indicated two, and only 25 cases indicated only one subject area. Figure 4 shows the share of cases that have indicated each of these subject areas as underpinning research, distinguishing between the cases that indicated each subject area in first, second or third place (assuming that they were ordered by importance). Since each case could indicate more than one subject area, the sum of the shares of cases in each subject area is greater than 100%. The figure only includes the 37 subject areas that are mentioned by more than 1% of cases.

The knowledge base underpinning the arts and culture-related impact cases falls mainly within four subject areas: Cultural Studies, Historical Studies, Literary Studies, Film, Television and Digital Media. Between a quarter and over half of the cases indicated that their underpinning research belonged to at least one of these subject areas. A further 10% of cases indicated Curatorial and Related Studies and Performing Arts and Creative Writing. It is also interesting to note that while Cultural

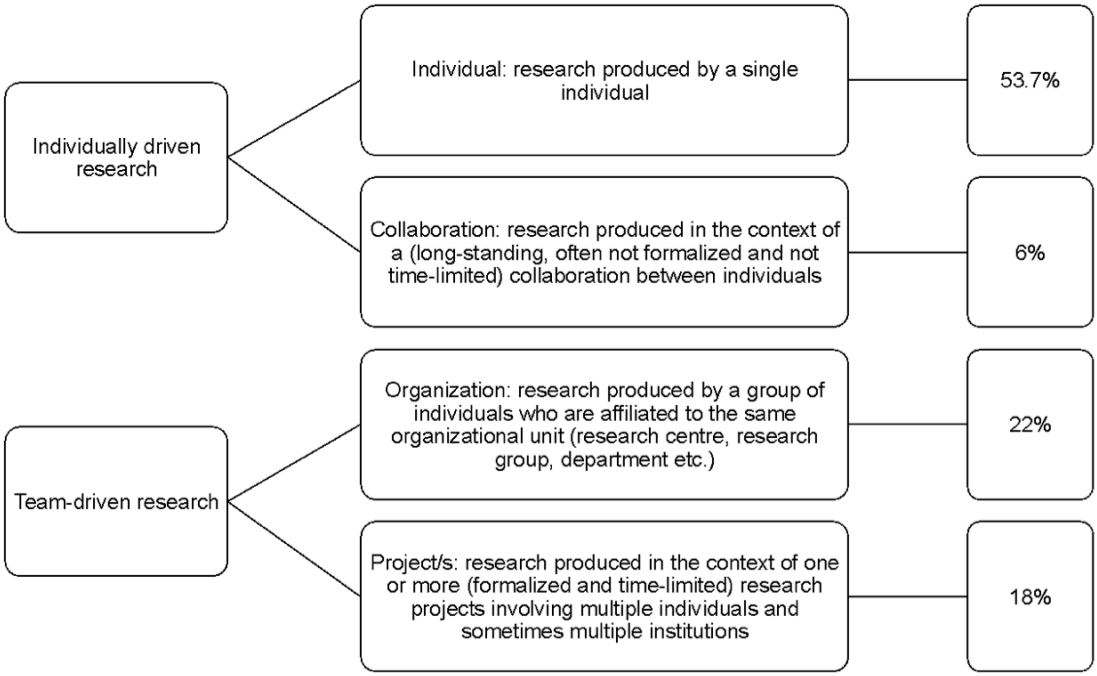
Studies is the most frequently mentioned subject area, it is more often mentioned in second and third place. While Historical, Literary and Film, Television and Digital Media Studies, while mentioned a bit less frequently, are more often in first place.

Figure 4. Distribution of arts and culture-related impact cases by research subject areas



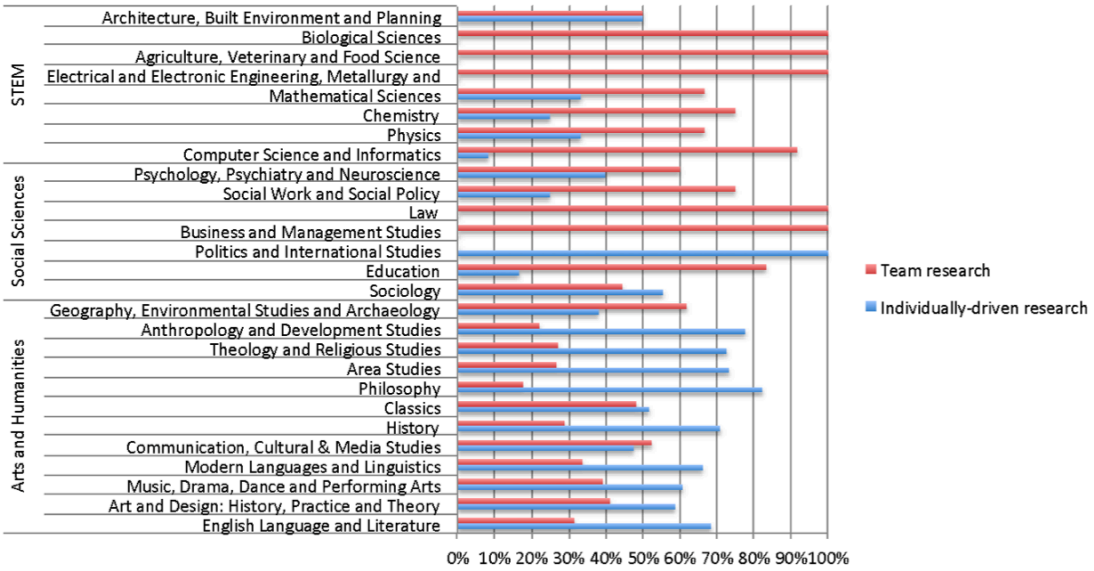
In terms of the types of academic units that produced these cases, our thematic coding of the database led us to identify four different types of academic units, summarized in Figure 5. Two of these types, which we called 'project/s' and 'centres' refer to research that is produced in the context of formal teams, institutionalized thanks to the academics' affiliation to a formal academic organization (centre, department, group, or other) or to their participation to one or more formal research projects. The other two types, which we called 'individual' and 'collaboration' refer to research that is produced either by researchers working on their own or in the context of collaborations between individuals that can be long standing but not are not formalized through specific projects or institutionalized using specific organizational forms.

Figure 5. Academic units involved in the impact cases



There are strong differences across Units of Assessment in terms of the types of academic units that perform the underpinning research. Figure 6, which distinguishes between individually-driven research (either by individuals or informal collaborations between individuals) and team research (either done in the context of formal organizational units or formal research projects), shows that there are clear subject-based patterns, with individual research prevalent in the arts and humanities and team research prevalent in most of the social sciences, and in science, technology engineering and maths (though both approaches are to some extent present in all subjects).

Figure 6. Types of academic units producing the research, by Units of Assessment



4.2. Who is impacted by arts and culture research?

The units that submitted the cases could self-select the type of impact by ticking one of eight possible categories: Cultural, Economic, Environmental, Health, Legal, Political, Societal, Technological. As only one type of impact could be indicated for each case, we assume that the units indicated what they considered to be the main impact generated, but that other impacts could have been possible as well.

Table 1 classifies the arts and culture-related impact cases according to the type of impact they generated, considering the set of eight impact categories provided in the REF database, self-selected by the submitting units. The majority of the impact (76.92%) is cultural in nature, followed by societal (19.04%) and then, as a distant third, technological (2.02%). The other categories of impact only have marginal importance.

Table 1. Impact types of the 793 cases

Impact type	N cases	% cases
Cultural	610	76.92%
Economic	1	0.13%
Environmental	3	0.38%
Health	5	0.63%
Legal	1	0.13%
Political	6	0.76%
Societal	151	19.04%
Technological	16	2.02%
Total	793	100.00%

It must be noted that the main type of impact differs according to the Units of Assessment that the cases were submitted to. While most Units of Assessment included cases that had cultural impact, some Units of Assessment showed different patterns, in particular:

- the cases submitted to Agriculture, Veterinary and Food Science (only 1 case) have environmental impact
- those submitted to Electrical and Electronic Engineering, Metallurgy and Materials (only 1 case) have technological impact
- those submitted to Law (also only 1 case) have legal impact
- political impact is present in Business and Management (2 cases) and Politics (3 cases).

These are, however, very small numbers.

We then consider the geographical scope of the impact of arts and culture-related impact cases. Each submitting unit selected the continent(s) impacted, for a maximum of five continents. The cases with economic impact are those with the widest average geographical scope. Instead, those with health, environmental and political impact have the narrowest scope, perhaps because health and political systems are very country- specific.

Table 2. Geographical scope of impact (continents), by impact type

Impact type	Average n continents impacted	Africa	South America	Europe	North America	Asia	Oceania
Cultural	2.02	8.85%	9.51%	84.92%	37.21%	28.03%	18.85%
Economic	3.00	0.00%	0.00%	100.00%	100.00%	100.00%	0.00%
Environmental	1.33	0.00%	0.00%	100.00%	0.00%	33.33%	0.00%
Health	1.50	0.00%	0.00%	80.00%	20.00%	0.00%	20.00%
Legal	2.00	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%
Political	1.80	16.67%	16.67%	66.67%	16.67%	33.33%	0.00%
Societal	1.95	6.62%	7.28%	78.15%	30.46%	30.46%	15.89%
Technological	1.93	6.25%	6.25%	81.25%	37.50%	31.25%	18.75%

The submitting units could also indicate which specific countries were impacted, up to a maximum of 23. The next table shows that cases with environmental, legal and health impact had the narrowest geographical scope, while cases with economic impact had the widest geographical scope. Most cases with cultural, economic and societal impact had some impact on the UK (as well as possibly other countries) whereas only a third of cases with political impact had impact on the UK. The cases that impact the UK only, are only about a third of those that impact the UK as well as other countries, across all types of impact; so in general, international impact was very prominent.

Table 3. Geographical scope of impact (countries), by impact type

Impact type	Average n countries impacted	UK only	UK and other countries	UK
Cultural	3.33	15.57%	57.05%	73.61%
Economic	6.00	0.00%	100.00%	100.00%
Environmental	1.67	33.33%	66.67%	100.00%
Health	2.25	0.00%	60.00%	60.00%
Legal	2.00	0.00%	0.00%	0.00%
Political	3.40	0.00%	33.33%	33.33%
Societal	3.38	11.92%	54.30%	66.89%
Technological	3.87	18.75%	31.25%	50.00%

Finally, we consider whether there are any links between the type of impact generated and some characteristics of the submitting unit (namely, the nature of its research, its size in terms of FTE staff) and academics (type of academic unit). Table 4 shows that, on average, cases with legal and economic impact are underpinned by less interdisciplinary research, while cases with cultural, societal and environmental

impact are underpinned by more interdisciplinary research. As a measure of interdisciplinarity we consider the number of different research subject areas (where 'Research subject areas' is a field in the REF database; the submitting units would state their research subject areas by selecting them from a menu of 53 areas; the number of possible areas that each case could indicate was comprised between 1 and 3).[11]

The table also reports, in the rightmost column, the average size of the submitting units (in terms of staff FTE), by impact type. Units whose cases generated economic impact are on average smaller, while units whose cases generated technological, legal and environmental impact are on average larger. Larger units tend to produce cases that impact a larger number of continents (correlation 0.134) and countries (correlation 0.034), and also to have more interdisciplinary underpinning research (correlation 0.007) but these correlations are all very weak. Larger units are less likely to impact the UK only (correlation -0.023).

In terms of the types of academic units involved, individually-driven research (individuals and collaborations between individuals) prevails in the case of cultural, economic and societal impact, whereas team-driven research prevails in all other cases.

Table 4. Impact type and characteristics of submitting unit

Impact type	Average n. research subject areas	Average size of the unit (FTE)	Project/s	Centre	Collaboration between individuals	Individual
Cultural	2.78	26.95	19.02%	18.03%	6.07%	56.89%
Economic	2.00	7.90	0.00%	0.00%	0.00%	100.00%
Environmental	2.67	39.67	0.00%	66.67%	0.00%	33.33%
Health	2.60	21.15	20.00%	40.00%	20.00%	20.00%
Legal	1.00	47.04	100.00%	0.00%	0.00%	0.00%
Political	2.17	17.75	33.33%	33.33%	16.67%	16.67%
Societal	2.59	28.15	14.57%	31.79%	5.96%	47.68%
Technological	2.38	36.16	12.50%	68.75%	0.00%	18.75%

In order to understand who the actual beneficiaries of the impact are, we have relied on thematic coding of the 'summary of the impact' and 'details of the impact' fields for

[11] It must be noted that the number of different research subject areas is a rough measure of interdisciplinarity since it simply counts the number of research subject areas and does not attempt to measure how 'close' or 'distant' they are from each other (e.g. if a case includes three subject areas that are very 'close' it is arguably less interdisciplinary than a case that includes three 'distant' subject areas).

all 793 cases. We read all these documents, and identified the impacted sectors. We have distinguished two main groups of codes according to whether the impact was on the arts and culture sector, or on other sectors.

Figure 7 lists the impacted arts and culture sectors we identified, with examples of codes included in each category, and the share of arts and culture-related impact case studies that have impacted each category. Overall, 84% of case studies have impacted the arts and culture sector.

Figure 7. Impact on the arts and culture sector

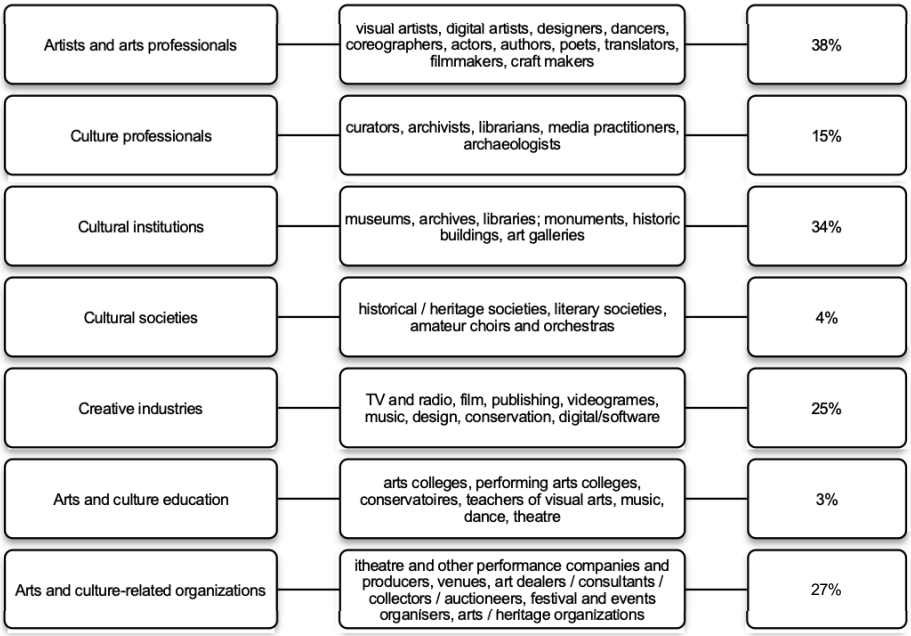
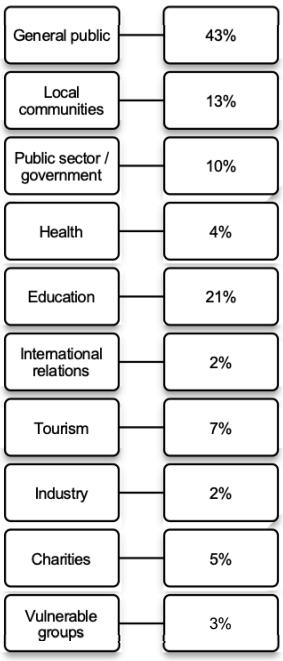


Figure 8 lists the impacted sectors beyond arts and culture we identified, with examples of codes included in each category, and the share of arts and culture-related impact case studies that have impacted each category. Overall, 75% of case studies have had some impact on sectors other than the arts and culture.

Figure 8. Impact on other sectors

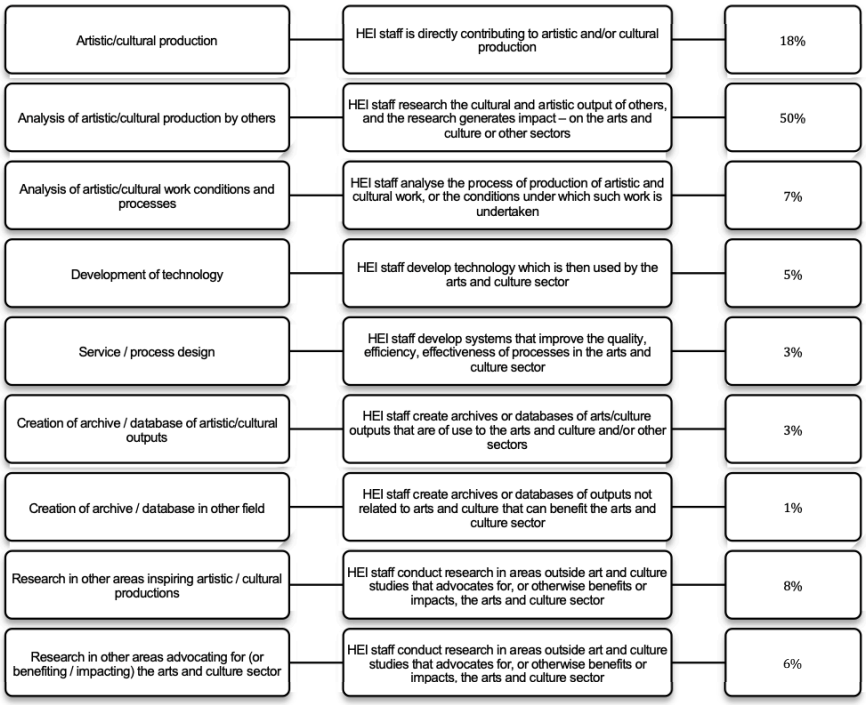


4.3. Academic research leading to impact generation

In order to develop a better understanding of how the HEIs involved in arts and culture-related impact cases have performed research that generated impact, we read and coded the impact descriptions for all 793 case studies. This allowed us to identify a number of 'models' of academic research leading to arts and culture-related impact.

In particular, we identified nine main types of research processes that generate impact related to arts and culture. The following table lists the nine types together with the number of cases belonging to each type. In some cases more than one type of process applied, but these were very limited; the majority of cases could clearly be classified into one main type. So we classified each case into only one main type of process out of the nine that were identified. These are listed in Figure 9.

Figure 9. Research processes leading to impact generation



In the following we briefly describe each of the nine processes. Appendix 3 provides some examples for each of these processes.

Analysis of artistic/cultural production by others is the most frequent type of research process leading to arts and culture-related impact, accounting for half the cases. These are cases where HEI staff research the cultural and artistic output of others (individuals, organizations, cultural movements, societies...) and their research in turn generates impact – on the arts and culture sector, and/or on other sectors. The range of external cultural and artistic outputs analysed is very broad, spanning cultural and artistic heritage, architecture, poetry, literature, theatre, film, music, photography, performance, the visual arts, textiles. This type of HEI contribution also includes the curating of artistic materials for exhibitions and collections.

Artistic/cultural production is the second most frequent type of research process leading to arts and culture-related impact. These are cases where the HEI staff are directly contributing to artistic and/or cultural production. The types of contributions are very varied, including a broad range of fields: animation, dance, film, historical re-enactment, literary translation, literature, music, performance, photography, poetry, theatre, video installation, visual arts.

Development of technology which is then used by the arts and culture sector is the third most frequent research process that leads to arts and culture-related impact. Usually the technology originates from outside artistic and cultural studies, from units submitting to Computer Science, Mathematics, Physics, Chemistry, although there are also examples of technologies developed by units submitting to Music, English Language and Literature and Communication Studies.

Research in other areas inspiring artistic / cultural productions This category includes cases where HEI researchers conduct research in areas outside artistic and cultural studies, but this research inspires artistic and cultural productions (such as novels, films, exhibitions, TV and radio productions).

Analysis of artistic/cultural work conditions and processes consists in research that analyses the process of production of artistic and cultural work, or the conditions under which such work is undertaken. Most of this research is done by art and culture studies researchers who investigate how the process of artistic and cultural production takes place and how it can be improved; however there are some cases from Education and Social Work as well.

Creation of archive / database of arts/culture outputs. Some HEIs create archives or databases of arts/culture outputs that are of use to the arts and culture sector as well as to a variety of other sectors. Such databases concern films, theatre, music, literature, artistic and cultural heritage.

Creation of archive / database in other fields (not art / culture). A smaller category (only 3 cases) include archives or databases of outputs that are not related to arts and culture, but which can benefit the arts and culture sector. Such databases concern biological species, newspapers and biographies.

Service/process design. These are cases where systems – usually information systems – are developed and implemented which increase the efficiency and effectiveness of processes in the arts and culture sector. These three cases come from Arts and Design and Communication, Cultural and Media Studies, Library and Information Management.

Research in other areas advocating for (or benefiting / impacting) the arts and culture sector. The final category relates to research in areas different from arts and culture studies, which advocates for the arts and culture sector – for example looking at the benefits of the arts for mental health, wellbeing, education, and society in general – or

that otherwise benefits or impact the arts and culture sector – for example research on education that can be applied to the teaching of art.

For ease of interpretation, we could aggregate these nine processes into a smaller number of categories according to whether they refer to (i) artistic and cultural research and production, (ii) research that improves practices and systems in the arts and culture sector and (iii) research that supports/inspires artistic production.

Table 5. Research process leading to impact generation (more aggregated categories)

Artistic and cultural research and production that has an impact on arts and culture as well as / or on other sectors (e.g. health, education, diplomatic relations, tourism...)	• Artistic/cultural production • Analysis of artistic/cultural production by others • Creation of archive / database of arts/culture outputs
Research in other areas that improves practices and systems in the arts and culture sector (e.g. technology, management of museums, database construction...)	• Service/process design • Analysis of artistic/cultural work conditions and processes • Research in other areas advocating for (or benefiting / impacting) the arts and culture sector
Research in other areas that supports/inspires artistic production	• Research in other areas inspiring artistic / cultural productions • Development of technology • Creation of archive / database (of arts/culture outputs or in other fields)

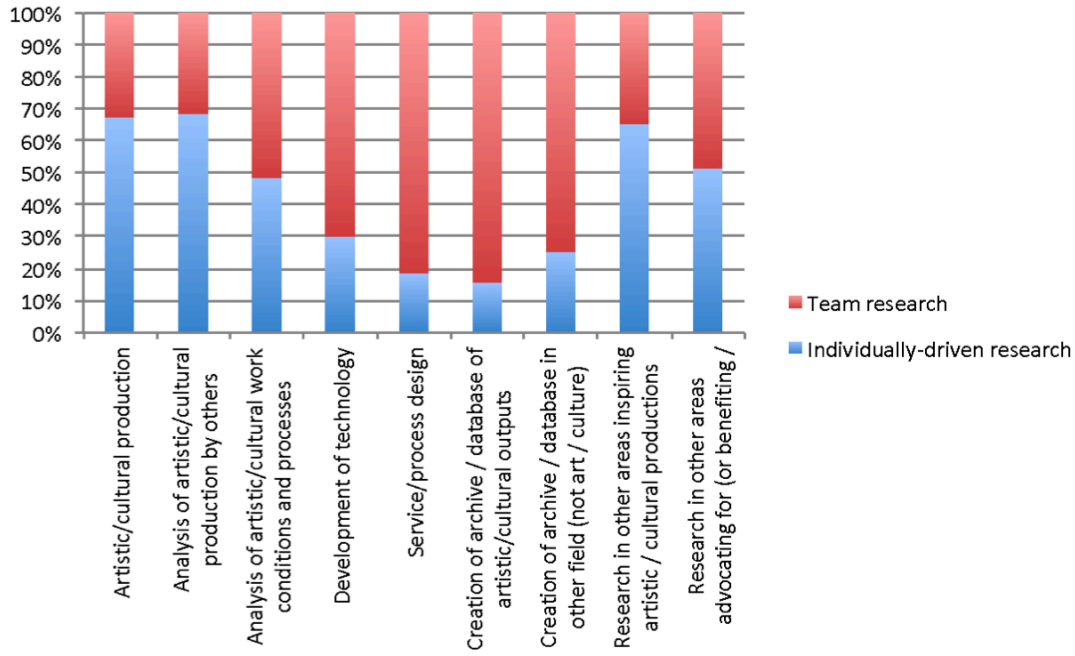
These different research processes are associated with different ways of producing research (e.g. different types of academic units, different knowledge bases) and to different types of impact. Some processes involve mainly research produced by teams (Figure 10), including: analysis of artistic and cultural work conditions and processes; development of technology; service/process design; creation of archives/databases of artistic/cultural outputs or other outputs. These are processes that (as shown in Figure 11) often build on more technical knowledge bases, such as computer science (in the case of development of technology), library and information management (in the case of service/process design) and that require considerable resources (development of technology, construction of databases and archives).

Other research processes mainly originate from individually-driven research, which includes: artistic/cultural production, analysis of artistic/cultural production by others, research inspiring artistic/cultural production. The remaining two research

processes (analysis of artistic/ cultural work conditions and processes, and research that advocates/benefits/impacts the arts and culture sector) are split equally between team-driven and individually-driven research. The same patterns are evident when we aggregate the nine research processes into three categories, with artistic and cultural production deriving mainly from individually-driven research while team-driven research prevails in the case of research that improves practices and systems in the arts and culture sector.

Figure 10. Research processes and types of academic units

(a) Considering the nine research processes separately



(b) Considering the nine research processes aggregated into three categories

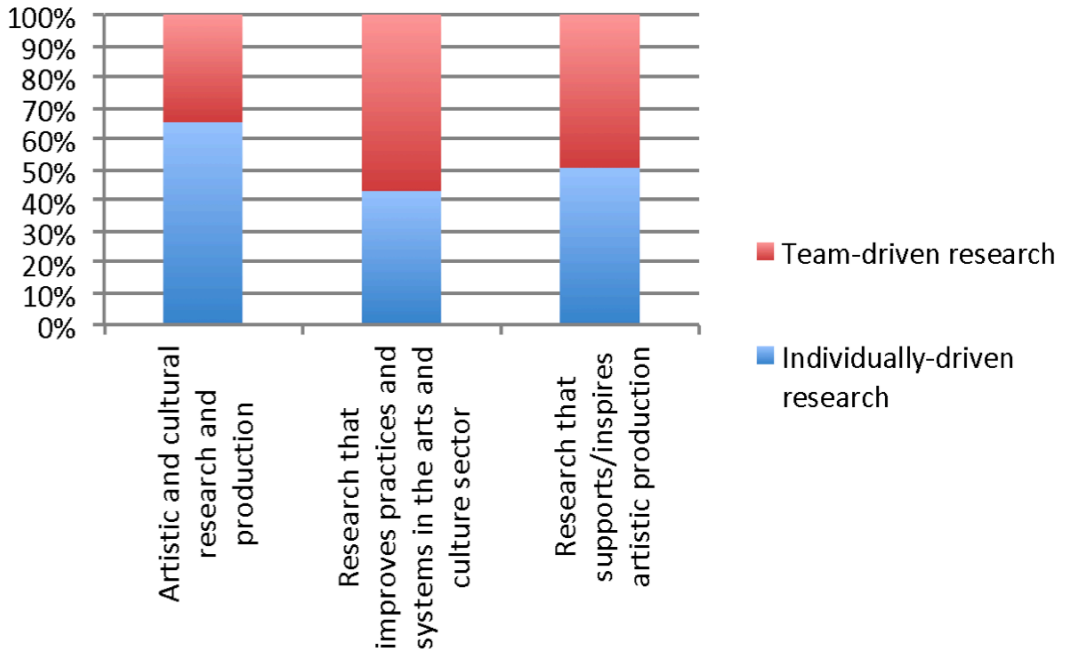
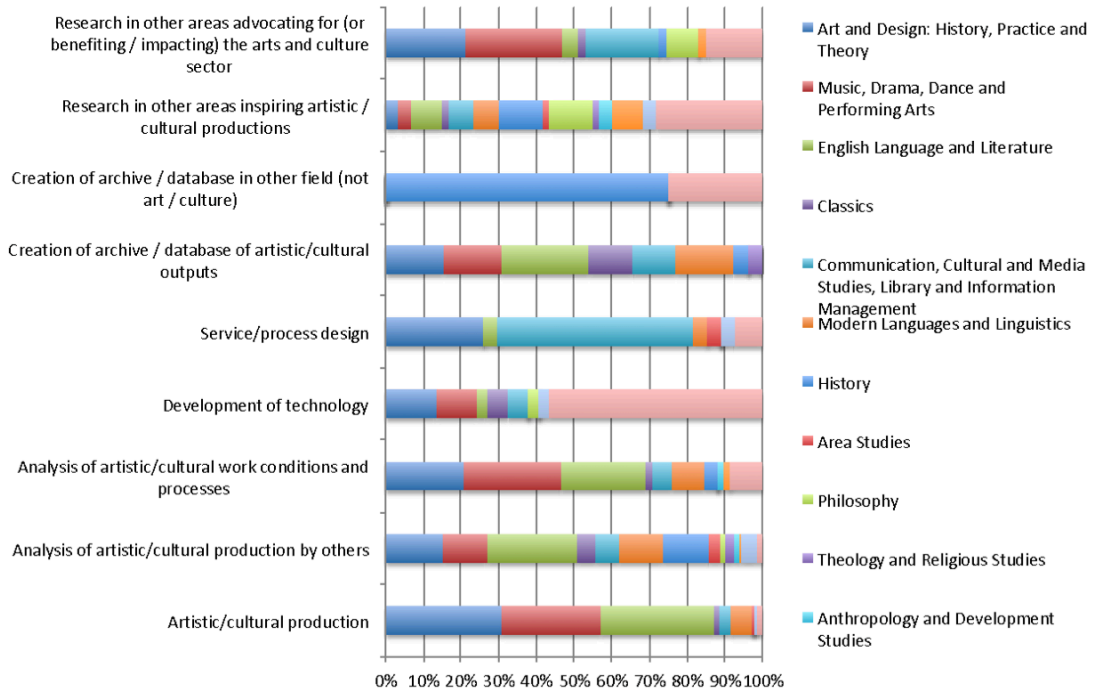
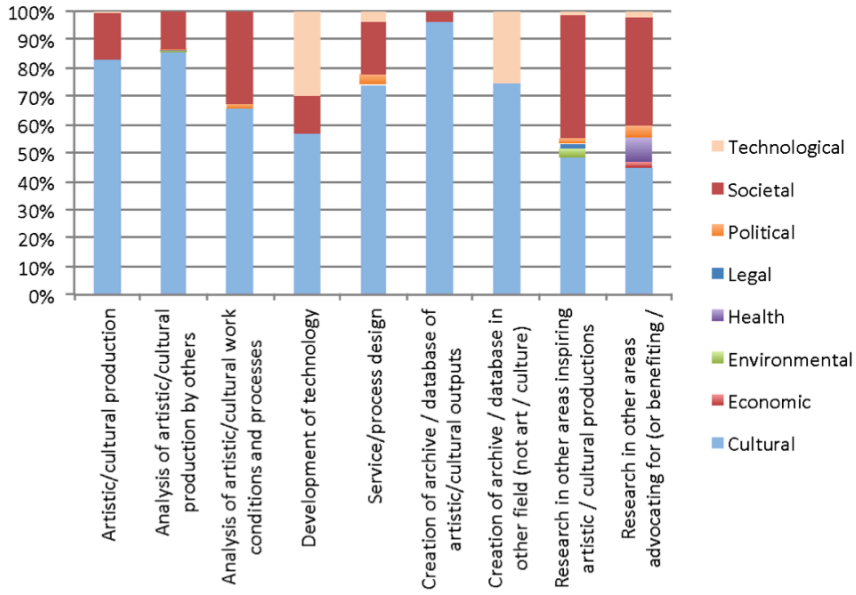


Figure 11. Research processes and knowledge base (Units of Assessment)



We also find some differences across research processes according to the type of impact that they generate. Whilst most research processes have cultural impact, some also refer to cases that have mainly societal impact, including research inspiring artistic/ cultural production and research that advocates/benefits/impacts the arts and culture sector, analysis of artistic/ cultural work conditions and processes. Some cases that involved the development of technology and construction of archives/databases had mainly technological impact.

Figure 12. Research processes and type of impact

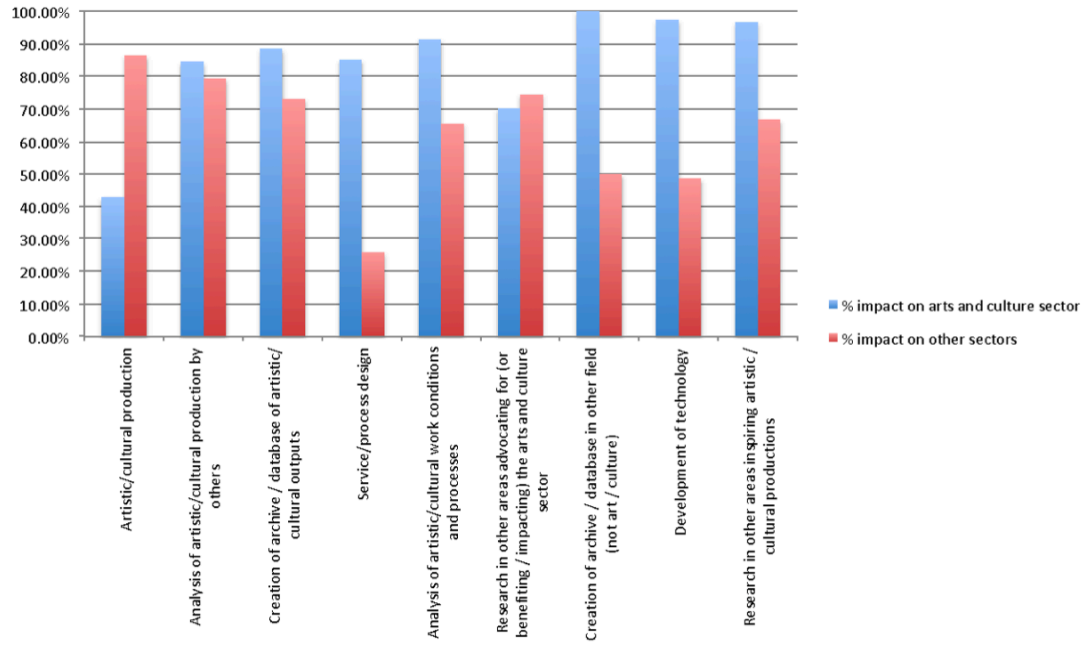


In terms of impacted sectors, we find that for most research processes, a majority of cases (more than 70%) have impact on the arts and culture sectors, with one exception: artistic and cultural production, where only about 40% of cases have impact on the arts and culture sector, while almost 90% have impact on other sectors. These research processes therefore tend to generate impact outside arts and culture, and in particular, as shown in Figure 16, they benefit the general public and the education sector. Figure 15 shows that all research processes impact a variety of actors in the arts and culture sector; notable patterns are that service/process design mainly benefits cultural institutions, while research in other areas that inspires artistic and cultural production mainly benefits artists and arts professionals.

Also, for most research processes, a large share of cases have an impact outside the arts and culture sector, but here the picture is more mixed. As mentioned earlier, most cases of artistic and cultural production generate impact on other sectors. This is also the case for analysis of artistic and cultural production by others and research that inspires artistic/cultural production (whose main impact is on the general public), research that advocates/benefits/impacts the arts and culture sector (whose main impact is on public policy), the creation of databases of artistic and cultural outputs (whose main impact is on education) and the analysis of artistic/cultural work conditions and processes (whose main impacts are on the general public and education). Development of technology, service/process design, are less likely to have impact outside the arts and culture sector.

Figure 13. Research processes and impacts on arts and culture and other sectors

(a) Considering the nine research processes separately



(b) Considering the nine research processes aggregated into three categories

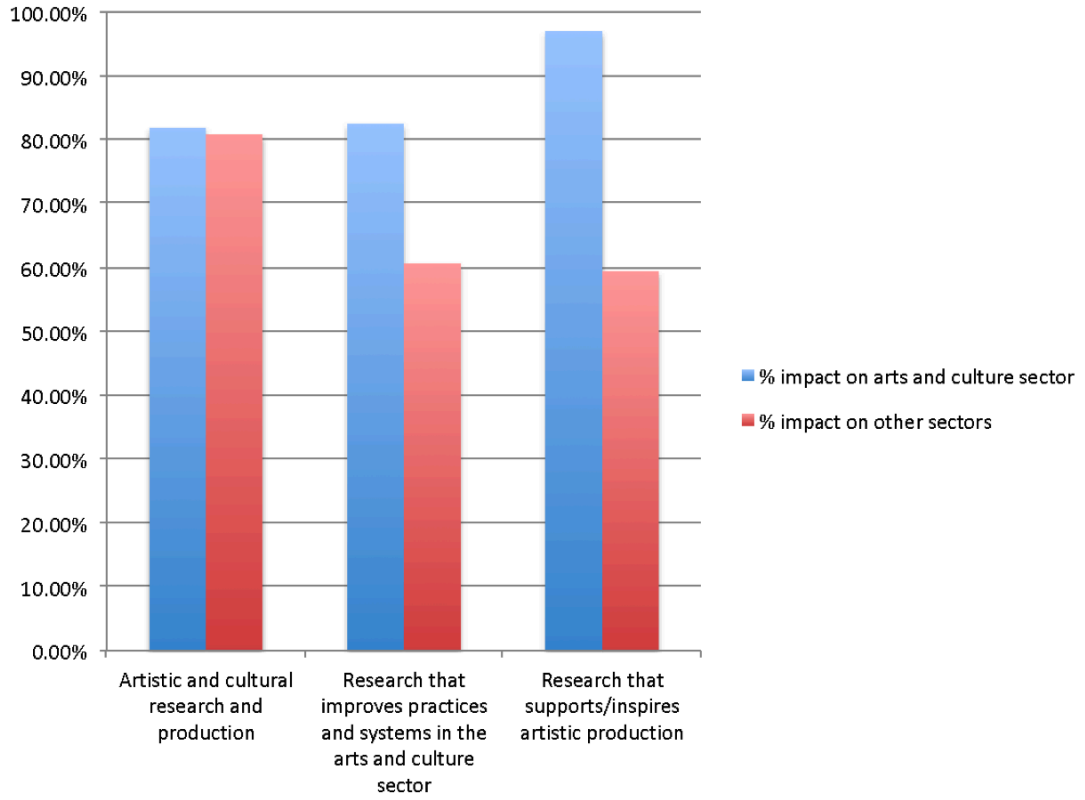


Figure 14. Specific arts and culture sectors impacted according to type of research process

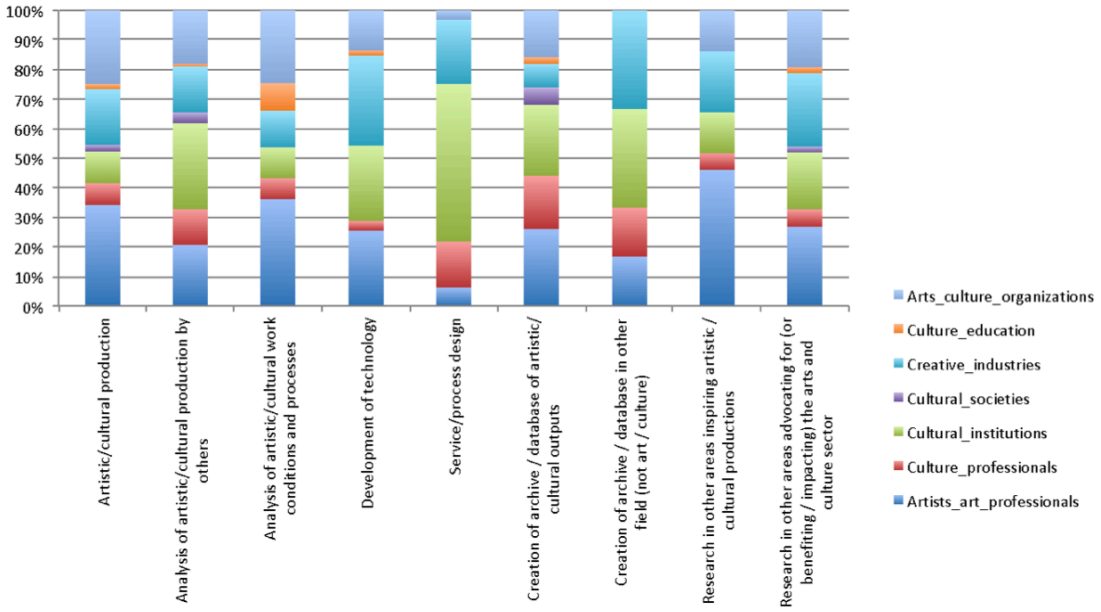
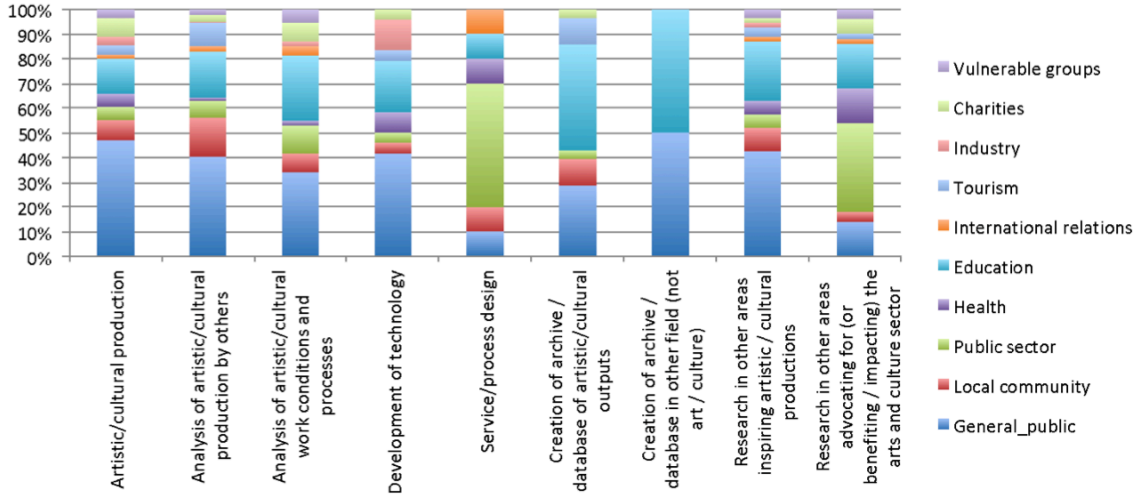


Figure 15. Other sectors impacted according to type of research process



5. Conclusion

Our analysis of 793 impact cases with Arts and Culture-Related Impact has identified nine different types of research processes that lead to impact generation. These are very unevenly distributed, with two types of research processes - 'Analysis of artistic/cultural production by others' and 'Artistic/cultural production' – accounting for the majority of cases examined. Our analysis has not only confirmed these as the main research processes that underpin the generation of arts and culture-related impact, but has also uncovered some less frequently occurring research processes that generate such impact, which are, while less numerous, very interesting and in some cases very impactful.

We see clear subject-level patterns in terms of academic units producing the knowledge (individual vs team science) and in terms of the research processes through which the impact is generated.

The patterns in terms of type of impact generated instead are less evident. The type of impact is strongly related to the underpinning research (subject area and interdisciplinarity) and the size of the unit. However there is some relationship between the type of research process leading to impact generation, and the type of unit that produces the research; and also between the type of research process leading to impact generation and the sectors that are impacted.

Following on from this analysis, there are various implications and considerations for future policy and evaluation. In general, the process of academic research and the process of impact generation are intertwined and complex:

- the processes of academic research generating impact on the arts and culture sector take many forms, with vast differences in elements such as the scale of research endeavour, the duration of the processes, and the scale and number of interactions involved;

- there are cross-cutting impacts between disciplines and sectors: research in the arts and humanities generates impact on the arts and culture sectors as well as on other sectors (the general public, education, health, tourism, vulnerable groups...) while research in other disciplines such as STEM generates impact on the arts and culture sectors.

- It is not possible to identify one to one correspondence between research processes and types of impact / impacted categories within the arts and culture sector / impact on other sectors.

At the same time, the identification of a set of research processes leading to arts and culture-related impact can yield some useful insight for impact measurement. In particular:

- While the narrative approach seems to be the most suitable method for collecting information on research case studies, people should be given a broad range of possible ways to demonstrate impact, with the possibility to pick which metrics best suit the nature of their research.

- Such metrics include quantitative indicators that could be meaningful particularly in the context of some types of research processes; for example:
  - Particularly for artistic/cultural production, their analysis and research that inspires Artistic/cultural productions, which are consumed by an audience: number of copies sold/licensed, number of downloads/views, number of attendees and other indicators of engagement
  - Particularly for databases and development of technology: number and types of artistic and cultural output generated; and indicators of use and engagement with the latter
  - Particularly for service / process design and research that benefits the arts and culture sector: efficiency gains, improvements in quality, new products/processes generated as a result of implementing the service/process design or the research findings

- Importantly, this data collection should be undertaken with no assumptions on what process is most impactful.

However, this study has some limitations. The analysis is based on the REF 2014 impact case studies which focus on how academic research generates impact. There are many other types of engagement between HEIs and the arts and culture sector that arise from activities other than research (such as teaching, consulting, public engagement and other activities), which remain outside the scope of this analysis. These should be investigated through the analysis of other datasets, where available, and through a variety of other methods, more qualitative in nature. Another caveat to bear in mind is that the evidence is composed of a body of narratives built to showcase impact to a panel of reviewers and hence they might have imposed a 'linear' structure

to the process of impact generation whereas the actual processes may be more complex and nonlinear.

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Appendix 1. List of variables in the REF 2014 Impact Case Studies database

Variable name	Variable description
CaseStudyId	Unique identifier assigned to case study
UOA	Unit of Assessment to which the case was submitted
ResearchSubjectAreasCombined	Subject areas of the research
ContinentCombined	Continent where the impact occurred
CountryCombined	Country where the impact occurred
InstitutionCombined	Institution submitting the case
UKLocationCombined	UK location where the impact occurred
Title	Title of the case
ImpactType	Type of impact generated
ImpactSummary	Summary of the impact
ImpactDetails	Details of the impact
References	References to research underpinning the impact
Sources	Sources to corroborate the impact
UnderpinningResearch	Description of underpinning research
Unit of assessment number	Number of the Unit of Assessment
UNIT-ID	Unique identifier assigned to the submitting unit
FTE Category A staff	Number of FTE staff in the unit
Outputs-4*	% outputs of the unit rated 4*
Outputs-3*	% outputs of the unit rated 3*
Outputs-2*	% outputs of the unit rated 2*
Outputs-1*	% outputs of the unit rated 1*
Outputs-unclassified	% outputs of the unit rated unclassified
Impact-4*	% impact cases of the unit rated 4*
Impact-3*	% impact cases of the unit rated 3*
Impact-2*	% impact cases of the unit rated 2*
Impact-1*	% impact cases of the unit rated 1*
Impact-unclassified	% impact cases of the unit rated unclassified
Environment-4*	% environment template of the unit rated 4*
Environment-3*	% environment template of the unit rated 3*
Environment-2*	% environment template of the unit rated 2*
Environment-1*	% environment template of the unit rated 1*
Environment-unclassified	% environment template of the unit rated unclassified
Overall-4*	% overall score of the unit rated 4*
Overall-3*	% overall score of the unit rated 3*
Overall-2*	% overall score of the unit rated 2*
Overall-1*	% overall score of the unit rated 1*
Overall-unclassified	% overall score of the unit rated unclassified

Appendix 2. Thematic coding

Codes: Impacted sector (arts and culture)

- Artists and arts professionals (includes: visual artists, digital artists, designers, dancers, choreographers, actors, authors, poets, translators, filmmakers, craft makers...)
- Culture professionals (includes: curators, archivists, librarians, media practitioners, archaeologists)
- Cultural institutions (includes: museums, archives, libraries; monuments, historic buildings, art galleries, scientific institutions)
- Cultural societies (includes: historical / heritage societies, literary societies, amateur choirs and orchestras ...)
- Creative industries (includes: TV and radio, film, publishing, videogrames, music, design, conservation, digital/software...)
- Arts and culture education (includes arts educational organizations such as arts colleges, performing arts colleges, conservatoires ..., and art teachers, such as teachers of visual arts, music, dance, theatre ...)
- Arts and culture-related organizations (includes theatre companies, theatre producers, venues (e.g. arts venues including theatres, cinemas, concert halls), art dealers / consultants, arts organizations, heritage organizations, performance companies, art collectors, auctioneers, festival and events organisers...)

Codes: Impacted sector (others)

- General public
- Local communities
- Public sector / government
- Health
- Education (education, students, children)
- International relations
- Tourism
- Industry (manufacturing, retail, water management, transport, farming, general, consumers)
- Charities (advocacy organisations, NGOs, voluntary organisations, religious organizations)
- Vulnerable groups / minorities (including prisoners, homeless, poor/developing countries, disabled, LGBTQI+, refugees)

Codes: Research process leading to impact

- Artistic/cultural production

- Analysis of artistic/cultural production by others
- Analysis of artistic/cultural work conditions and processes
- Development of technology / techniques / methods
- Service/process design
- Creation of archive / database of arts/culture outputs
- Creation of archive / database in other field (not art / culture)
- Research in other areas inspiring artistic / cultural productions
- Research in other areas advocating for (or benefiting / impacting) the arts and culture sector

Appendix 3. Examples of research processes leading to arts and culture-related impact

	Process	Examples:
Artistic and cultural research and production that has impact on arts and culture as well as / or on other sectors	*Artistic/cultural production*	• *Dr Paul McDonald is an award-winning writer whose comic novels, short stories, and poetry have established him as a leading figure in the literature of the Black Country. His creative output is informed by scholarly research into humour and humour-writing that has national and international reach, and has contributed to the public knowledge of the history and cultural significance of humour. Specifically, he has: benefited economic prosperity through media commissions in the creative sector (e.g. via promotion, sales, and web traffic); contributed to creating, inspiring, and supporting the cultural life of the West Midlands.* • *Simon Read is Senior Lecturer in Fine Art and a practising artist specifically engaged in the investigation of interdisciplinary approaches to environmental change, notably estuarine and coastal processes. His research (from which impacts have arisen over two decades) began with a tidal protection installation, explored further through the value of drawing as a tool for imagining change between researchers and coastal communities. This then led to greater involvement with other researchers, public sector bodies and water engineering companies in coastal/estuarin management and mediation, and to further art and design commissions, which together have led to impact on policy and practice via specific engagement with professionals, catchment communities and policymakers.*
	Analysis of artistic/cultural production by others	• *This case study demonstrates how Timothy Brittain-Catlin's long-term research into a group of historic buildings sharing a common theme, and designed by underappreciated architects, has had wide-ranging impacts on various groups. These groups include general audiences; amenity societies; architectural historians; heritage and conservation enthusiasts; and, in turn, public bodies including planning authorities and government agencies. The impacts of this important research range from informing cultural understanding amongst general audiences to directly influencing policy decisions about the preservation of historic buildings.* • *Rice's research in various aspects of slavery and the black Atlantic (1750-2010) has facilitated museums in the North West to use their internationally important collections to make innovative exhibitions; his research engages artists, performers, schoolchildren, community groups, civil servants and documentary filmmakers on both sides of the Atlantic. His work on Transatlantic black presences in the North was instrumental in the development of outputs that range from a commemorative public performance in Leeds (2009), through an exhibition catalogue in Manchester (2011), public debates with American broadcasters at the International Slavery Museum (2013) to lectures to Civil Servants (2012) about black presence beyond London.*
	Creation of archive / database of arts/culture outputs	• *The Database of Mid-Victorian Illustration (DMVI, www.dmvi.cardiff.ac.uk) used research and technological innovation to bring illustrations of Victorian culture to multiple users. Before DMVI, illustrations accompanying nineteenth-century literary texts were largely forgotten, and there was no structured way of searching for them as images. Despite their cultural importance, illustrations are rarely reproduced in*

		modern editions, and mass digitisation projects omit them or describe them inadequately for independent retrieval. DMVI's bespoke software tools harnessed literary research in a multifaceted mark-up system, to create a tagged 'image bank'. Its content and searchability have made it the resource of choice for designers, publishers, broadcasters, film-makers, and heritage organisations worldwide when presenting images of nineteenth-century life.
Research in other areas that improves practices and systems in the arts and culture sector	*Service/process design*	• *i-DAT has developed an open infrastructure for 'harvesting' and visualising data to support collaborative interdisciplinary projects in environmental, social and cultural contexts. Framed as a series of 'Operating Systems' this research contributes to the strategic activities of not-for-profit, public, private and community sectors, including Arts Council England, Plymouth City Council, UNESCO Biosphere and World Heritage Sites. Through i-DAT's National Portfolio Organisation status, this research delivers significant audience numbers and new work and contributes to and can be measured against impacts in relation to civil society, cultural life, policy making, public services and, to a lesser extent, economic prosperity.*
	Analysis of artistic/cultural work conditions and processes	• *Professor Christopher Bannerman conceived this large-scale project as an extension of the ResCen mission to connect academia more intimately with the arts profession. The project promotes international communication and understanding between the UK, China and Taiwan linking Middlesex University with the Beijing Dance Academy (BDA), China National Academy for Arts Research (CNAAR) and Taipei National University of the Arts (TNUA), amongst others. Through collaborative dance-making between choreographers and dancers from these countries, artists exchange perspectives and artistic and cultural paradigms, and present work to international audiences. In China and Taiwan, this develops platforms for experimenting with European artistic methods, and in the UK, it raises the profile of East Asian dance, art and culture, where these endeavours have been under-represented. Through online forums, discussions, seminars and conferences, the project opens dialogue about encounters with, and understandings of, the other.* • *The 'Impacts 08' research programme was inherently, in and of itself, designed to impact upon policy-makers and practitioners by documenting the process of hosting major cultural events and providing robust evidence of their social, economic and cultural impact. Between 2006 and 2010 regular and easily accessible research based reports were shared with stakeholders and the public. The impact of the work is evidenced in the development of local, UK and EU policy on cultural regeneration and events. These policy developments have addressed approaches to funding, promoting and assessing the value of cultural events.*
	Research in other areas advocating for (or benefiting / impacting) the arts and culture sector	• *This case study details the broader impact of an extensive programme of research on participation in music and arts activities from childhood through to older adulthood. The research shows how people respond to, feel about, and take up opportunities provided to engage with music and the arts. We have shown that developing a robust musical identity in the early stages of childhood is important in a range of educational situations, including decision-making about later educational qualifications and continued involvement or motivation for involvement in music-making in later years. We have also shown that participation in the arts can contribute to enhancing community identity and challenging negative stereotypes about*

		ageing. The research has had an extensive impact on arts education and participation policy in the UK as evidenced by discussion at major forums and inclusion in staff training, on the international music and arts practice community through inclusion in policy documents and multiple invitations to various events, and on wider public debate about the value of music and arts in people's lives as evidenced in the development of community arts events and discussion in editorials.
	Research in other areas inspiring artistic / cultural productions	• *The impact of Dr Andrew Davies' research into youth gangs and violence in Manchester is unusually wide-ranging. Since the publication of his book The Gangs of Manchester in 2008, Davies has made a substantial contribution to public discourse, raising awareness through the media nationally and locally of the historical antecedents of current problems posed by gang conflict and knife-crime. He has made a series of presentations of his core findings to practitioners in education and the criminal justice system. His research has also inspired new forms of artistic and literary expression, notably in the play Angels with Manky Faces (2009). Based closely on Davies' book, this was written and performed by a community theatre company in 2009, and has subsequently been performed in local secondary schools. Davies' work continues to generate interest among poets and musicians, as well as documentary film-makers, while his collaboration with a Manchester tour guide has contributed to the development of tourist provision in the city.*
Research in other areas that supports/inspires artistic production	*Development of technology*	• *Professor Peter Giblin (Department of Mathematical Sciences at the University of Liverpool), together with collaborators, used methods from singularity theory to develop an approach for recovering 3-d information from 2-d images, such as photos. In the past decade, these have been implemented and built upon by software engineers, leading to significant cultural, economic and societal impacts. These include the creation of an innovative 25m high sculpture of the human body in the Netherlands by the sculptor Antony Gormley and the virtual modelling of clothing on online clothing websites such as Tesco's (Virtual Changing Room by Tesco). These have reached thousands of consumers worldwide and represent a significant commercial success for the company which developed the software.* • *Laser cleaning is now a standard technique of great value in the conservation process to which research conducted at Loughborough University made a significant contribution. This work played a major part in introducing laser cleaning to conservators across Europe and further afield and was instrumental to the preservation and restoration of world heritage sites such as the Acropolis at Athens and important works of art including pieces by Henry Moore and Jacob Epstein. In addition to the cultural impact, the availability of laser cleaning techniques has: improved public services and understanding of, and engagement with, the conservation process (live restoration of artefacts); improved health (of restoration workers); influenced conservation practitioners (through an enhanced skill-set).*
	Creation of archive / database in other field (not art / culture)	• *Public understanding of the national past has been expanded by the creation, updating, and widespread use of the Oxford Dictionary of National Biography (ODNB). It is the most comprehensive biographical reference work in the English language and includes (in May 2013) biographies of 58,661 people over two millennia. The ODNB is the 'national record' of those who have shaped the British past, and disseminates knowledge while also prompting and enhancing public debate.*

		The Dictionary informs teaching and research in HEIs worldwide, and is used routinely by family and local historians, public librarians, archivists, museum and gallery curators, schools, broadcasters, and journalists. The wider cultural benefit of this fundamental research resource has been advanced by a programme of online public engagement.

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