# From productive interactions to impact pathways: Understanding the key dimensions in developing SSH research societal impact 🔓

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## Abstract

Impact is increasingly important for science policy-makers. Science policy studies have reacted this heightened urgency by studying these policy-interventions meaning that policy has developed more quickly than theory. This has led to the prevalence of a 'common sense' impact definition: research's societal impact are direct economic effects, such as income generated by licenses, patents, and spin-out companies. These indicators are recognized as weak proxies for research's societal benefits, and in response, science policy has undertaken a huge descriptive effort to more precisely define impact. Social sciences and humanities (SSH) disciplines have been highly active in this because economic metrics are very poor measures of their societal impact. One interesting theoretical development describing diversity was Spaapen and Van Drooge's 'productive interactions' concept. In this article, we seek to realize the potential that Spaapen and Van Drooge's productive interactions concept offers, but which we argue has been lost through its operationaliation as a process of 'counting interactions'. We address the need to pay attention not only to productive interactions, but to the changes they mediate. Therefore, we ask the following research question: how can we develop a typology that captures the diversity of the mechanisms by which SSH research leads to societal impact? Drawing on a comparative analysis of 60 examples of SSH impact, we develop a typology of SSH pathways to societal impact. Considering that the absence of societal impact of research is not necessarily a sign of uselessness of research in impact assessment, we address the importance of paying attention also to the conditions supporting impact processes.

## 1. Introduction

Impact is an increasingly important goal for science policy-makers, driven by a desire to see research organizations deliver benefits in return for past substantive increases in science budgets. The pace of the growth by demands from policy-makers have resulted in a situation where science policy studies have often been lagging in creating theories to deal with situations already undergoing policy-maker interaction (Donovan 2017). As a result of this, these conceptual debates have found themselves shackled by the often opportunistic decisions taken by policy-makers (Benneworth 2015). Certainly, research impact debates have been profoundly framed by the policy popularity of a very limited number of economic indicators advocated by a number of multi-organizations including the OECD, World Bank and European Commission (McCann and Ortega-Argiles 2013). While spin-offs, patents and license incomes might seem like a common-sense proxy measure for research impact, they emerged in a very specific context, of US state universities seeking to justify their public subventions and newly granted patent exploitation powers (Popp Berman 2011). Indeed, these indicators have cast a long shadow over efforts to develop better understandings and measures of the broader impact of research, most notably outside the hard sciences, and most notably in social sciences and humanities (SSH) (Donovan 2007; Morton 2015). Science policy researchers' efforts to more precisely define impact have produced understandings that are accepted by researchers, but in turn lack traction amongst policy-makers because of their imprecision and thinness as a foundation for practical policy interventions (Benneworth et al. 2016).

We therefore contend that this represents a form of irreconcilable stand-off, where conceptualization is held back by a lack of empirical and policy interest in more complex frameworks while current policy practices provide little opportunity to develop richer understandings of impact. One interesting development that progressed some way in bridging this gap was the 'productive interactions' conceptual proposition (Spaapen and Van Drooge 2011), which achieved a degree of uptake on policy communities. Spaapen and Van Drooge (2011) defined productive interactions as:

> 'exchanges between researchers and stakeholders in which knowledge is produced and valued that is both scientifically robust and socially relevant. These exchanges are mediated through various 'tracks', for instance, a research publication, an exhibition, a design, people or financial support. The interaction is productive when it leads to efforts by stakeholders to somehow use or apply research results or practical information or experiences. Social impacts of knowledge are behavioural changes that happen because of this knowledge' (Spaapen and Van Drooge 2011: 212).

In the Netherlands, productive interactions have influenced policy debates as evinced by the recent launch of the Quality and Relevance in the Humanities

(QRIH) metric set.   But even within QRIH, we sense that individual indicators proposed for research evaluation were not based on productive interactions' theoretical criteria, but rather for primarily opportunistic reasons (ease of gathering and deployment).

In this article, we seek to consolidate the potential offered by Spaapen and Van Drooge's productive interactions' concept, but which we argue has been lost through its operationalization as a process of 'counting the final interactions' (cf. Benneworth and Olmos-Peñuela 2018). Impact results not just from academics creating usable knowledge and placing it via productive interactions with users, but also from the conditions by which that knowledge is made useful (Research Council of Australia 2018: 8): we infer that productive interactions can only be interpreted by looking at the contexts (pathways) within which this impact emerges. Considering that the absence of societal impact of research is not necessarily a sign of uselessness of research in impact assessment, we address the importance of paying attention also to the conditions supporting impact processes (cf. Godin and Doré 2005; Bornmann 2013). We ask the following research question: how can we develop a typology that captures the diversity of the mechanisms by which SSH research leads to societal impact? To this aim, we draw on a comparative analysis of 60 examples of SSH impactand develop a typology of SSH pathways to societal impact. We conclude by arguing that this typology is useful for thinking more critically about practical mechanisms and instruments for creating more nuanced tools for impact evaluation.

## 2. Developing a conceptual theory for evaluating SSH research impact

### 2.1 Societal impact in the framework of research evaluation

There is a substantial interest amongst policy-makers in research impact evaluation, driven by their desire to justify allocative decisions, not least real–terms increases in science budgets in which this pressure to evaluate something has run far ahead of the development of comparative understandings (Grant et al. 2010; Martin 2011; Molas-Gallart 2015). More generally, research impact measures seek to provide two characteristics, comparability between impacts as well authenticity to individual impacts. Tensions between those two characteristics in emergent variables has seen impact indicators' legitimacy lagging definitions of 'scientific impact' couched in scientometric terms of subsequent citation[2] (Spaapen and Van Drooge 2011; Petersohn and Heinze 2017). Although scientific research impact is not perfectly measured by citation scores, bibliometrics is sufficiently

conceptualized and operationalized to allow citations to represent a reasonably *proxy* of scientific impact that Petersohn and Heinze (2017) argue can lodge a claim amongst policy-makers and scientists to be valid.

This imbalance with societal impact created an urgent policy pressure to produce a social impact definition that can be operationalized and measured, and that can claim to be legitimate amongst both academics and policy-makers as comparable but authentic (Benneworth et al. 2016; Petersohn and Heinze 2017). This has been manifested in a range of research evaluation systems. From 2002 in the UK, grant applications had to include an impact statement, and from 2014, *ex post* impact creation featured in the REF as a specific area of resource allocation (Bulaitis 2017). In the Netherlands, from 2000, impact was a policy goal, it featured in the 2005 SEP, and from 2009, it started to be taken seriously as a policy goal (Van der Meulen and Rip 2000; Benneworth et al. 2016). But there remained an ambiguity in these assessment processes regarding precisely what need to be assessed and against which criteria (Molas-Gallart 2015). The economic indicators that initially drove impact's rise were clearly too limited to be meaningful impact proxies beyond a guideline for funding decisions such as in the UK's Higher Education Innovation Fund (Benneworth and Jongbloed 2013). Indeed, Donovan (2008) noted Australia's attempts to measure impact in its planned Research Quality Framework, destabilizing beliefs of straightforward impact measurement in evaluation and leading to its complete omission from the *Excellence for Research in Australia* evaluation system.

Several work-arounds arose in this absence of legitimate metrics: the UK (followed by a number of other countries, Sivertsen 2017a) adopted a peer-review methodology in which research centres submitted case studies that were assessed against three criteria, namely the scale, the scope and the value of the impact (HEFCE 2011; Martin 2011). Scientometrics companies' efforts to develop societal impact measures largely lacked legitimacy (Andrews 2018). Attempts to measure behavioural or even attitudinal aspects of scientists' orientation in SSH disciplines have also taken place (see Hughes et al. 2011 or Olmos-Peñuela et al. 2014 for examples from the UK and Spain respectively). The issue with these various kinds of work-arounds has been that despite these efforts, they failed to build legitimacy amongst both policy-makers and scholars (cf. Wróblewska 2017).

## 2.2 Productive interactions as a concept of research creating impact

Two other similar attempts to provide comparability with authenticity came through the ERIC and Siampi project diptych, which together proposed the productive interactions concept, which has been advocated by the powerful LERU University group as providing a good instrument for evaluating research

impact (Van den Akker and Spaapen 2017). The Netherlands' Evaluating Research in Context project emerged at the interface between science policy and research to create a theoretically justified operationalisable framework for research evaluation, followed by the European Commission 'Siampi'[3] research project (Benneworth et al. 2016). The productive interactions concept emerged from the community around these two projects as a first-cut definition of research impact, operationalizable to individual evaluation contexts through interaction's transaction trails (Van Drooge, pers. comm.).

The framework defines three kinds of productive interactions: direct (personal) interactions, indirect interactions (mediated through artefacts) and financial interactions (mediated through exchange relations), claiming these interactions imply more substantive change because interacting partners are embedded within other systems that change through these interactions. Their definition was proposed in an article within a special issue of *Research Evaluation*, providing arguably the first theoretical vocabulary for a new form of research impact evaluation, providing comparability with authenticity. Comparability came in terms of providing a materiality to the impact definition, the transaction, linked back to an underlying scientific process avoiding two common traps in debates around societal impact, assuming scientific research was intrinsically productive, or demanding extraordinary outcomes (Sivertsen 2017b). The definition also provided a degree of authenticity by being linked to the kinds of activities already routinely undertaken by academics.

A productive interaction represents a moment where science system encounters societal actors, allowing societal actors to influence scientific actors, creating new kinds of scientific value (e.g., such as asking new kinds of research question, Gläser 2012). The encounter simultaneously realises societal benefits by imbuing recipients with assets that can be leveraged and capitalized within different kinds of socio-economic systems hence contributing to 'development' (in the language of Corea's 2007). This value may be financial/economic, such as when technology-based ventures are able to leverage university IP to develop spin-off companies that attract external venture capital investment. But it might also involve other kinds of socio-political value, such as where academic knowledge changes the 'rules of the political game' with the formation of new parties or is used as part of democratic renewal processes (Benneworth et al. 2016). And this might emerge, following Martin (2011), through elongated pathways lacking one-to-one-correspondence between a research activity and a societal outcome, making it hard to see whether these productive interactions are significant and antecedent to impact or mere activity.

We therefore seek to look at the broader context within which productive interactions take place, 'impact pathways', and address the importance of

paying attention also to the conditions supporting impact processes. We follow here the idea implemented in the Australian research evaluation framework; an approach, which seeks to incorporate unpredictability and random chance in measuring research impact by accounting for 'approach to impact' (Research Council of Australia 2018). Their Engagement and Impact Assessment (EI) approach applied to Australian universities assesses societal impact through both tangible outcomes, but also the presence of institutional mechanisms promoting or enabling research impact with outcomes based on qualitative descriptions of how the institutions facilitated impact realization (Research Council of Australia 2018: 8).

## 2.3 The holy grail of impact evaluation: comparisons between incomparable epiphenomena

In this article, we are concerned with the challenge of evaluating and measuring the societal impact created by SSH research, and in particular, a problem that arises when attempting to compare between very different kinds of impact. There is in science and technology studies (STS) an extensive set of literatures on describing the associations between socio-technical change and more basic research activities (Penfield et al. 2014). In this article, we omit an extensive discussion of this literature because it has not proven influential in shaping research impact evaluation policies (Donovan 2017), something we see as being linked to the desire to take allocative decisions (see Section 2.1) rather than to understand research impact. The ground-breaking TRACES study in 1968 attempted to link the emergence of technologies to what it called 'critical moments in science' (Kostoff 1994). From this has been inferred that there are a set of manifold ways in which research activities create impacts in the wider society, whether positive or negative, but also that there was no simple one-off relationship between discrete research activities and societal outcomes (see Martin 2011 for a lucid summary of this situation). Early attempts to measure these were often opportunistic and based on eye-catching and easy to measure indicators, such as numbers of patents or spin-off companies rather than effectively representing this diversity of activity (Benneworth 2015).

More recently, there have been substantive efforts to develop general concepts of research impact and we here highlight two of them, namely the *Payback Framework* (Donovan and Hanney 2011) as one of the most commonly referred concept in the context of impact evaluation, and Rowe & Frewer's participatory framework (2005) presenting not only three applicable engagement concepts, but also one of the most comprehensive list of science-society participation mechanisms. Rowe and Frewer (2005)'s study on the role of public engagement in regulating the flow of knowledge from scientists to societal users introduced three different engagement concepts, namely *public communication, public consultation* and *public participation.* The concept of *public communication* refers to a situation where information flow is one-way:

conveyed from the sponsors (the term they use to refer the party commissioning the engagement initiative) to the public. Regarding the concept of *public consultation,* the direction of the flow of information is instead from members of the public to the sponsors of the initiative; however, the process is initiated by the sponsors and no formal dialogue exists between these two parties. The *public participation* differs from the other two previous concepts of public engagement, because it includes the idea of information exchange between members of public and sponsors including some degree of dialogue (Rowe and Frewer 2005: 254–255). They listed ca. 100 participation mechanisms identified in previous studies (Rowe and Frewer 2005: 257). To outline the results from previous studies and describe how to enable effective involvement in any particular situation, they suggested a typology of public engagement mechanisms based on the three versions of the concept of public engagement described above. However, they did not pay attention to the mechanisms between engagement activities and impacts (Rowe and Frewer 2005: 276–282) as productive interactions do.

The ideology behind the Payback Framework derives from the need to demonstrate the 'payback'of public investments to research, and thus, it is one of the core discussions from where the branch of impact literature derives. The original idea of the Payback Framework consists of two elements: a logic pathway representation of the research processes done for the purposes of research impact evaluation and a variety of categories aiming at to classify paybacks from research (Donovan and Hanney 2011). Thus, in the context of the Payback Framework, both research processes and impacts are taken into account. Differences compared to the concept of productive interactions derives from the fact that where the concept of productive interactions includes the idea of impact or change, in the Payback Framework the aim is to identify a full range of benefits of funding, but not to provide analysis of how impacts arise. The *Payback Framework* (Hanney et al. 2004) is mostly used in health services research, but it has been applied also for the needs of social sciences (Wooding et al. 2007).

In the chapter two, we have discussed earlier studies on research impact addressing particularly the audience in research evaluation. There are numerous studies on impact, studying for instance impact modes or participation mechanisms, like Rowe and Frewer (2005: 257) has demonstrated, or dimensions of impact (Academy of Finland 2016). However, the gap between them—area of impact mechanisms providing analysis on how impacts arise—remains as an overlooked area both in STS and research evaluation literature. In addition, previous literature—whether it is about research impacts, impact modes, mechanisms, or drivers—is mainly discussed only from the viewpoint of science, technology, engineering, and mathematics (STEM) (e.g., Morris and Rip 2006; Jensen et al. 2008; Hessels 2010; Lam 2011; De Jong et al. 2016).

## 3. Operationalization

To address this research question, we conducted a narrative meta-analysis of impact case studies drawn from the SSH (in some cases also involving fields from STEM in multidisciplinary partnerships). These case studies were gathered within the COST ENRESSH Action (European Network for Research Evaluation in the SSH). This network draws together interested scholars in research evaluation, including 55 primarily committed to understanding societal impact in SSH research evaluation. Our data collection approach involved co-creating the instrument together with this expert network to allow them the opportunity to articulate what they felt was important in depicting SSH impact. The method involved circulating a data gathering instrument among these 55 members (the fiche presented in Appendix I) into which they had had the chance to shape the questions and prompts, providing SSH researchers with the opportunity to describe cases of how impact had resulted from research activities in their own words.

Instrument design began with an expert meeting of 10 lead participants from these 55 scholars (April 2016) to agree on a number of key dimensions regarding SSH impact definitions. From that first approach, 13 potential questions were elaborated and distributed among all 55 participants for comments, receiving 29 responses. These responses were analyzed and discussed at a second meeting in July 2016 to determine the questions to be asked in the final circulated instrument (as presented in Appendix I). The definitive instrument asked nine open questions, covering a general description of the case along with more specific elements, including identifying key actors, interaction modes, stimuli, barriers, and hurdles of impact generation and evidence of relevance of the research at hand. We defined scientific research, broadly, merely requiring the originating researcher to have a material link to a higher education institution related to the impact production. Respondents were provided with an example of how to answer the questions and asked to provide answers of approximately 100–200 words per question. A pilot was undertaken in September 2016 and following its successful completion, the first round of data gathering took place in autumn 2016, resulting in 47 completed fiches; a second round in spring 2017 produced 18 more impact cases, giving a total of 65 fiches. The fiches were filled in by members of the expert community who had co-designed the instrument and therefore were aware of the need to avoid taking a non-linear perspective on impact creation.

Empirically, our data covers a range of cases, from the exploitation of decades of research experience in expert settings to publishing a scientific book to popular acclaim. We subsequently excluded 5 of these 65 cases, two for lacking an academic input, one because it was a prospective analysis of research that might create impact, and two that were provided outside the fiche format in a

language other than English. The 60 cases included and analyzed in this study are from 16 different European countries and they cover a wide range of SSH fields, including arts as well as SSH researchers collaborating with STEM fields (see Table 1 ). The responses varied greatly from lengthy and rich descriptions to summaries using bullet points, although in all cases there was sufficient information to undertake a comparable analysis.

**Table 1.**
Overview of the distribution of the cases: countries and fields (n=60)[a]

| Countries | Social Sciences | Arts and Humanities | STEM |
|---|---|---|---|
| • Belgium (9) | • Sociology (1) | • History (7) | • Chemistry (1) |
| • Spain (7) | • Educational sciences (3) | • Linguistics (5) | • Entomology (1) |
| • Croatia (7) | • STS (3) | • Law (3) | • Ergonomic science (1) |
| • Switzerland (6) | • Administrative law (2) | • Classical Studies (2) | |
| • Portugal (5) | • Criminology (2) | • Ethnology (2) | • Forest Engineering (1) |
| • Italy (5) | • Economics (2) | • Philosophy (2) | |
| • Norway (3) | • Gender studies (2) | • African studies (1) | • Industrial engineering (1) |
| • UK (3) | • Political science (2) | • Anthropology (1) | |
| • Netherlands (3) | • Psychology (2) | • Applied linguistics (1) | • ICT (1) |
| • France (2) | • Psychology of work (1) | • Archaeology (1) | • ICT phonetics (1) |
| • Finland (2) | • Public finance (2) | • Architecture (1) | • Medicine (1) |
| • Iceland (2) | • Communication sciences (1) | • Art History (1) | |
| • Serbia (2) | • Cultural Anthropology (1) | • Classical studies (1) | |
| • Slovakia (2) | • Cultural studies (1) | • Documentarism (1) | |
| • Germany (1) | | • English Philology (1) | |
| • Estonia (1) | | • Forest History (1) | |
| | | • Music (1) | |
| | | • Musicology (1) | |
| | | • Philology | |
| | | • Psycholinguistics (1) | |

- Ergonomic science (1)
- Theatre in education and development (1)

- Human geography (1)
- Theatre studies (1)

- Immigration Studies (1)

- Innovation studies (1)

- Management research (1)

- Media Studies (1)

- Minority Studies (1)

- Journalism (1)

- Occupational health (1)

- Political communication (1)

- Religion studies (1)

- Scandinavian Studies (1)

- Social work (1)

- Statistics (1)

- Strategy and entrepreneurship (1)

*Source:* own elaboration from the case studies' analysis.

[a]In brackets are the number of cases that fall into each category. There are more than one field included in 35 cases; therefore, 25 of the cases are based on one single discipline.

# 4. Implementing the meta-analysis approach

## 4.1 Type of knowledge

The first element of the meta-analysis and typology-building was deriving some basic descriptives of the cases under consideration, looking at three main issues, namely the place of the impact in the research process, the vectors by which the productive interaction took place, and the kinds of beneficiaries involved (see Table 2 below). Activities associated with impact creation were found throughout the research process, for instance, where researchers and research funders choose which *research questions* are worth asking (Ronkainen et al. 2014; D'Este et al. 2016), where the decision to study a topic can generate societal impact, for example around neglected minorities or institutional child abuse (case 10: Child abuse and neglects). In some cases, impact emerges from the *content* of research, such as the messages from research finding that social background is more critical for school achievement than ethnic background (case 1: Young descendants of African immigrants). Impact also emerged in terms of the creation of new *products* (case 8: Voice passport) or new *methods* dealing for instance with terrorism (case 7: 11 M Mourning archive). Sometimes research opens up new ways to look at things, new *approaches*, like suggesting sign language as equal to spoken language (case 11b: Sign language). Some impact derived from decades of research experience and *expertise* (case 4: Professor of philosophy). Impact generation in social sciences also came about through *conceptualization* of different phenomena (case 3: All male panel), and could even come through *theory* oriented research, such as with the application of Hegelian notions of evilness in a contemporary court case (case 4: Professor of philosophy).

**Table 2.**
Meta-analysis of the narrative impact cases (n=60)

| Type of knowledge | Modes of interaction | Beneficiaries |
| --- | --- | --- |

- Research question
- Content
- Product
- Method
- Approach
- Expertise
- Concept
- Theory

- Scientific publishing, publishing for wider audience
- Media engagement, public engagement, research engagement
- Policy
- Legislation
- Regular interaction with stakeholders and other disciplines
- Epistemic training

- Citizens
- NGOs
- Professionals & practitioners
- Business
- Industry
- Policy makers
- Cultural industry

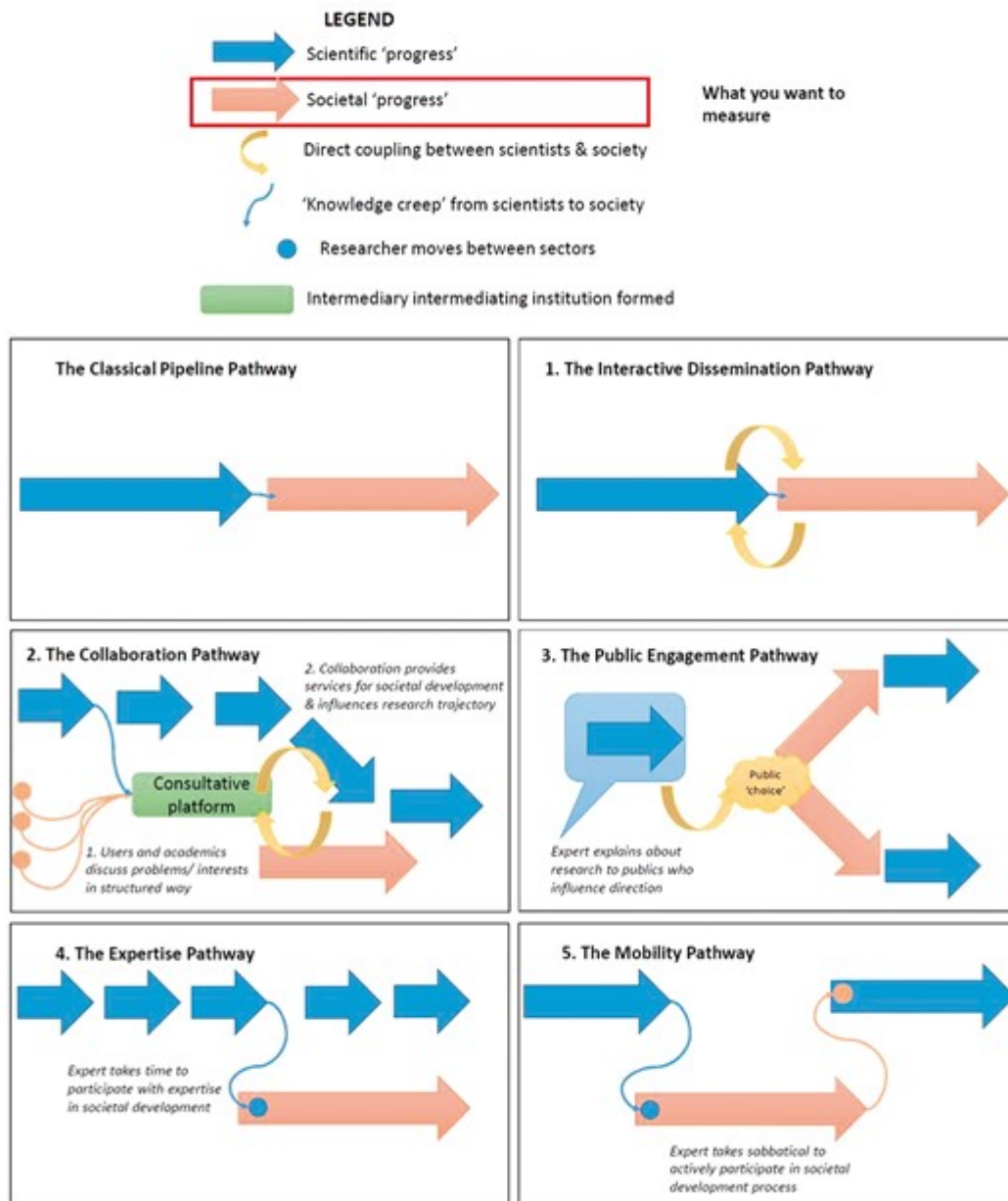*Source:* own elaboration from the case studies' analysis.

Impact creation in SSH emerged through different kinds of *interactions*, through scientific and popular publishing, media, and public engagement, interaction with different stakeholders and disciplines, policy, legislation, and epistemic training (Table 2; cf. Molas-Gallart et al. 2002: 21). Although commercialization was not typical for SSH impact generalization, the study did include cases where impact emerged through commercialization (e.g., case 9: Natural tincture techniques). There was a great variety of *beneficiaries* in the examples ranging from citizens (e.g., theatre audience in the case 2c: Theatre) and professionals (e.g., Spanish scientific police in the case 8: Voice Passport) to business and industry (e.g., fashion industry in the case 9: Natural tincture techniques).

## 4.2 Interaction modes and beneficiaries of SSH research

The second element of the analysis was to structure each case study in terms of the societal and scientific advances involved, the interactions between scientific and societal partners and the emergence of networks and new institutions. We produced a case architecture for each of the 60 cases, and grouped cases on the basis of similarity of these stylized architectures. This produced a total of 13 distinct case study architectures for the elongated interaction pathways, presented in Figure 1 below. Specifically, Figure 1 seeks to visualize the relationships between the elements brought together through a productive interaction and how that progresses over time. These architectures provide a degree of comparability (between elements) but also authenticity (in terms of reflecting the individual research contexts). The starting point for the architecture is what we call the *pipeline pathway*, involving a scientific development, a productive interaction, and a transfer producing a discrete

societal benefit. The remaining 12 SSH impact pathways each reflect an additional divergence from this linearity, with the emergence of impacts involving interplay and feedback loops between social and science partners, within increasingly complex networks, the formation of intermediary activities and even the emergence of new kinds of social structures.
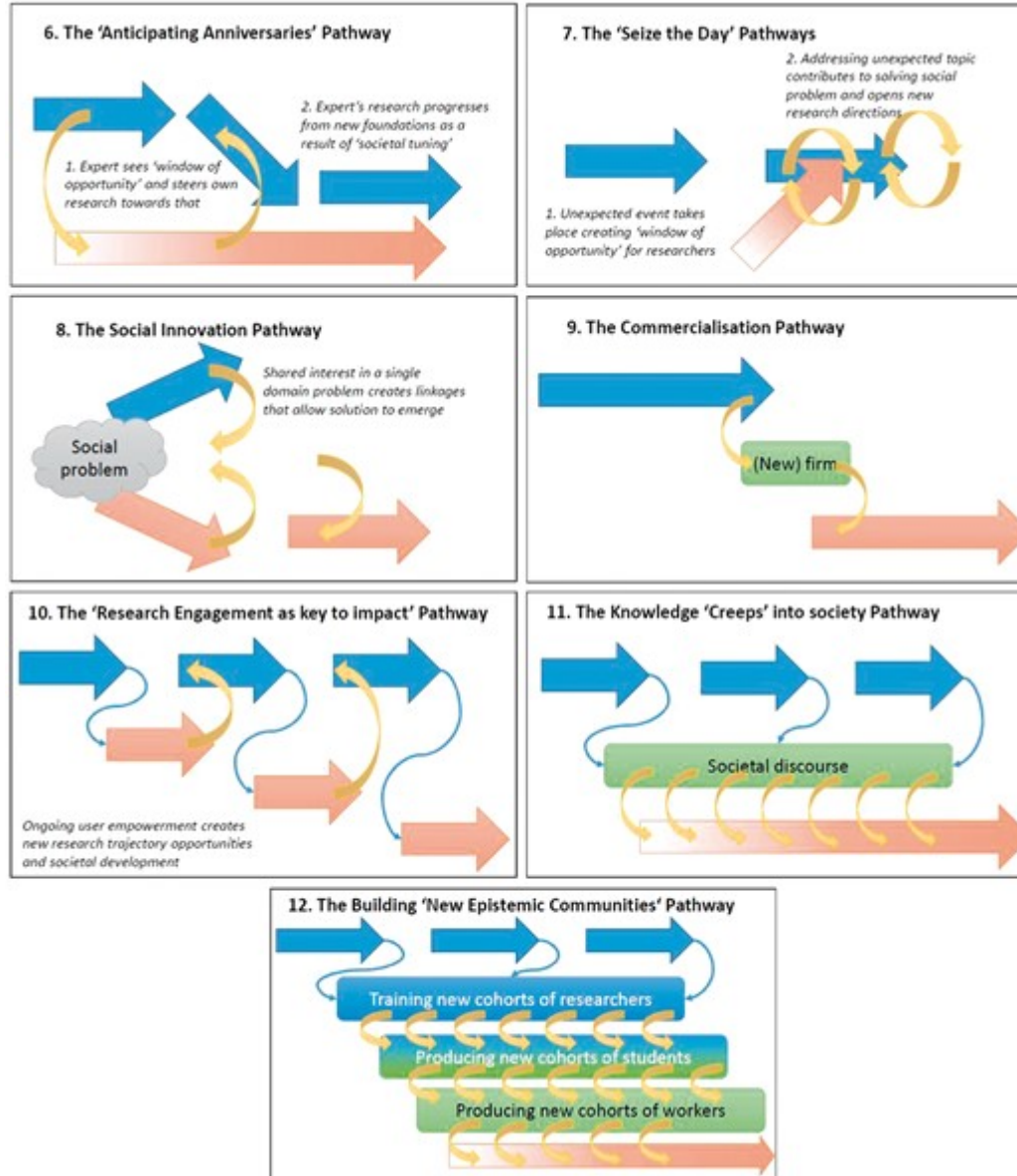
# The key to the typology

**LEGEND**

→ Scientific 'progress'

→ Societal 'progress'    What you want to measure

↻ Direct coupling between scientists & society

↝ 'Knowledge creep' from scientists to society

● Researcher moves between sectors

▭ Intermediary intermediating institution formed

## The Classical Pipeline Pathway

## 1. The Interactive Dissemination Pathway

## 2. The Collaboration Pathway

*2. Collaboration provides services for societal development & influences research trajectory*

Consultative platform

*1. Users and academics discuss problems/ interests in structured way*

## 3. The Public Engagement Pathway

Public 'choice'

*Expert explains about research to publics who influence direction*

## 4. The Expertise Pathway

*Expert takes time to participate with expertise in societal development*

## 5. The Mobility Pathway

*Expert takes sabbatical to actively participate in societal development process*

**Figure 1.** The pipeline model and other SSH pathways to societal impact.

*Source:* own elaboration

We grouped those pathways according to the dominant mechanisms by which impact has been produced, and identified four high-level groups for the ways SSH creates impact in society, namely *dissemination, cocreation, reacting to societal change,* and *driving societal change.* As a creative visualization, we have to be careful in claiming these pathways actually exist, rather they are *ideal type constructions* of SSH pathways to societal impact. One impact case could have features from our different repertoires sequenced in parallel or consecutively, meaning that one impact case can have features from different pathways, which can take place simultaneously or in different phases of impact processes. In the following section, we present each of the pathway architectures illustrated with cases selected to most clearly show the impact mechanisms.

# 5. SSH pathways to societal impact

The main details of the 12 additional impact pathways are presented in Table 3 below, and more information is provided in this section stylising the ways SSH creates impact in society (dissemination, cocreation, reacting to societal change, and driving societal change), along with providing more information on impact exemplars from which the pathways have been derived.

**Table 3.**
SSH pathways to societal impact

| SSH PATHWAYS TO SOCIETAL IMPACT | | | | |
| --- | --- | --- | --- | --- |
| General pathway | Pathway | Mechanism | Example case | Possible conceptu justificat |
| **The pipeline pathway** →→ | | | | |
| Dissemination | **1. The interactive dissemination pathway** | Stakeholders become aware of the results of research through publications, social media, websites, databases, television or radio. | Young descendants of African immigrants, Portugal | 'Public commun (Rowe an 2005). |
| Cocreation | **2. The collaboration pathway** | a. A researcher collaborates regularly with stakeholders | History Lab, Portugal | Working organiza disciplina boundar common problem 2010) |
| | | b. Impact is gained through open access ideology (or citizen science) | Brussels Studies Institute, Belgium | |
| | | c. Impact is gained through interdisciplinary or transdisciplinary approach | Theatre, Spain | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| | **3. The public engagement pathway** | Results of research are taken into action by using society as a laboratory. Publicity is a necessity for impact. | All male panel, Finland | 'Public participa (Rowe an 2005). |
| | **4. The expertise pathway** | Researcher plays a role as an expert, makes policy recommendations, conducts an evaluation study or other kind of contract research. | Professor of philosophy, Norway | Category 'advisory contracts Gallart et p. 21) |
| | **5. The mobility pathway** | Knowledge and skills of a researcher are taken into use in a new context. | Myanmar, UK | Policy im occur via secondm (Wooding 2007) |
| **Reacting to societal change** | **6. The 'anticipating anniversaries' pathway** | Researchers are preparing themselves to coming issues discussed in the media. | Holenstein, Switzerland | Hybridiza (Dogan 1 |
| | **7. The 'seize the day' pathway** | Something happens ranging from ongoing policies and hot topics brought up in media to coincidences like, natural catastrophes and terrorist attacks, which makes *suddenly* some topics more relevant than others. | 11 M Mourning archive, Spain | Changing counts as and fram (Maguire |
| | **8. The social innovation pathway** | Work starts independently and then at some point two sides come back together. | Voice passport, Spain | (Bennew Cunha 20 |

| | | | | |
|---|---|---|---|---|
| | **9. The commercialization pathway** | Research results are taken into use by developing the product based on the idea research brought up and making the product available on the market. | Natural tincture techniques, France | Commerc as typica society collabora (Hughes Kitson 2( |
| **Driving societal change** | **10. The 'research engagement as a key to impact' pathway** | Research process increases awareness of the topic at hand. Targets of the study get recognition and sense of empowerment through the research process. | Child abuse and neglects, Finland | Testimor and Hern justice (F 2007) |
| | **11. The knowledge 'creeps' into society pathway** | Research results 'creep' into daily life and political arena. In parallel or later on, some changes take place in relation to | | Research understa that cree policy (W 1980) |
| | | a. public opinion  or  b. legislation. | Nation State, Iceland | |
| | | | Sign language, Iceland | |
| | **12. The building 'new epistemic communities' pathway** | Researcher introduces a new way of thinking and this changes institutional practices (like curriculum) and provides professionals with new resources to cope with. | Pfenninger, Switzerland | New way thinking institutio practices Gallart et 25) |

*Source:* own elaboration from the case studies' analysis.

## 5.1 Dissemination

The first pathway, *interactive dissemination,* involves stakeholders becoming aware of research results via various dissemination channels, including publications, social media, websites, databases, and broadcasts, with typically, no other interaction being reported. In this pathway, there is a sequencing of developments, with scientific progress preceding societal progress, but with a feedback loop through the dissemination in which the societal response to that research validates the scientific research. The case demonstrating the first pathway comes from the field of sociology (case 1: Young descendants of African immigrants). The research aimed to relaunch a debate on social inequalities in secondary education and to challenge local cultural perspectives that regarded ethnicity rather than social inequality to be a major determinant of non-white students' educational performance. The scientific study demonstrated that when controlling for social class and gender, ethnicity was not a significant determinant of education outcomes. The channels used by the actors to generate societal impact from the research conducted were mostly scientific articles (no other interactions were reported). The public response to that research in turn created the basis for the social change in seeking to eliminate an acceptance of underperformance by certain ethnic groups in education.

## 5.2 Cocreation

The next four pathways in our typology concern *cocreation.* What the cocreation pathways (collaboration, public engagement, expertise, and mobility) all had in common was repeated points of contact (productive interactions) between scientific and societal partners mediating wider changes. There is a mutuality of the relationship: on the scientific side there is the appearance of new practices and the playing of new roles which are not always strictly defined scientific roles. In all cases, wider changes driven by productive interactions are visible within science in terms of creating new infrastructures and concepts, which open new avenues of scientific exploration, while the societal changes were visible by changing the way that societal partners understood a particular situation.

*The collaboration pathway* is divided into three versions: (a) the first stresses the regularity of collaboration; (b) the second focuses on open access approaches, including open access publications and citizen science; and (c) the third covers multidisciplinary, interdisciplinary, and transdisciplinary approaches. Our example of regular collaboration (case 2.a History Lab) was the History Laboratory of the Institute for Contemporary History (IHC), NOVA University of Lisbon, founded to create impact more applicable to secondary school students. The unit formed part of the IHC's communication and dissemination strategies and developed a regular programme with schools, local libraries and other institutions engaging students and other stakeholders in historical research and history contents dissemination. After 2 years, IHC was collaborating with

Escola Secundária de Camões (involving around 200 students and 2 history teachers), involving about 20 researchers, with two new schools having joined the collaboration. The Laboratory mediated with the academics to help them work with teachers and deal flexibly with the schools' needs, calendar and particularities.

All three varieties of the collaboration pathway involve a degree of dialogue in the process serving to transform opinions between both parties. In the *public engagement* pathway archetype there is no formal dialogue. Impact is generated with the active participation of the public, using society effectively as a laboratory and spreading ideas through publicity. Our example (case 3: All male panel) involved political science and gender studies, where a Finnish feminist researcher sought to increase societal awareness of gender issues in society, particularly 'a problem of men dominating the conversation'. In 2015 she began the blog 'Congrats, you have an "All male panel" to publicise scientific and expert panels, board of trustees, and committees consisting exclusively of male members'. Whenever she encountered a photo of such a panel, she published that picture with a photo of the white male actor, David Hasselhoff giving a 'thumbs up' sign inserted. Her work spread quickly via social media, and the story itself spread rapidly from Finnish into international media including the Guardian, The Times, Telegraph and Al Jazeera. Her blog attracted a total of 180 m page views, and turned into a space where people could themselves publically denounce all-male panels, spawning a number of country-specific sites. Her work did much to make all-male panels in academia and policy circles unacceptable, with many subsequently conferences adopting a no-male panels rule.

In the *expertise* pathway archetype, a researcher plays a role of an expert in wider societal contexts on the basis of expert knowledge that the researcher has already developed in scientific contexts. This may be in a range of roles, from open-ended roles (such as a public intellectual) to more specific projects (such as committees and working groups supporting policy makers, professionals, or other stakeholders). Our example case was a professor of philosophy who had a crucial impact on the Norwegian discussion of the legal concept of mental sanity and accountability (case 4: Professor of philosophy). The court trying Anders Breivik for the mass slaughter on Utøya received two conflicting psychiatric reports regarding the extent of the defendant's criminal culpability and fitness to stand trial. The government established a committee to explore this issue of evil and criminal culpability with the professor being appointed to it, studying the case from the Hegelian perspective, taking stands based on his own philosophical research, and ultimately contributing significantly both to the report and the resultant societal healing.

The final cocreation pathway archetype is *mobility*, in which a researcher themselves move into a new context and hence take their skills and apply them

in that new context. Our example (case 5: Myanmar) is drawn from the field of religion studies, where research understanding the religious and social standing of Buddhist nuns in Myanmar influenced the work of the country's most influential Buddhist nunnery school and thus influenced more broadly the empowerment of Myanmar women. The researcher had published widely on this issue of religious and social standing, and while becoming involved in founding a nunnery school of which she subsequently became director took forward her own research findings on how structural and social changes could improve these nunneries' social standing. By providing formal monastic education for nuns via the Buddhist school, the school supports wider emancipation in Myanmar, expanding opportunities for the school's women and girls. The changes increased the number of nuns (most recently around 20 annually) passing state scriptural exams, whilst supporting increasing resident student numbers: 500 noviciates trained at the school (2008–13). Its significance in Myanmar's context comes as female access to education often increasingly depends upon these monastic schools, as well as access to socially beneficial and financially independent careers as Buddhist nuns.

## 5.3 Reacting to societal change

The third class of impact pathways were those in which scientists deliberately aligned themselves in a reactive way to topical themes for society that lay beyond the researcher's initial scope, covering four pathways. In these pathways, there are indirect interactions before the material interactions, as researchers seek to tune their research trajectories to be able to (be ready to) respond to windows of opportunity in society's interest in or needs for research. In these cases, wider changes often followed very quickly, following the material interactions because of the preparedness created in society by anticipation of rapid reaction to societal needs. The mutual benefit can also be quite extensive because of the preparations made, as well as the serendipity of the conjuncture.

The '*Anticipating anniversaries'* pathway archetype is based on the idea of researchers being able to recognise the *window of opportunity coming ahead* in relation to topicality of their research interests. Anticipation can take place in relation to occasions like historical anniversaries, forthcoming elections, or global trends stepping up at the agenda, like ageing population or climate change. Our example (case 6: Holenstein) here was drawn from Switzerland when in 2015 the country celebrated three nationally significant centennial anniversaries in the Swiss national narrative, namely the Battle of Morgarten (1315), the Battle of Marignano (1515), and the Congress of Vienna (1815), which have latterly been mobilized by radical right nationalist parties to win votes. A researcher chose to write a history of Switzerland from a novel perspective showing Swiss neutrality was more a status decided by its more powerful neighbours than an act of defiance and independence. The book's publication

and correspondence with the anniversary sparked a big public debate that showed more nuance than the nationalistic narratives allowed, and stimulated a research-council funded project on histories of migration.

*'Seize the day'* also relates to external events where researchers who are prepared are able to react suddenly to a changed situation (whether unexpected political events or natural catastrophes) that at a particular point in time create a demand for scientific answers, *suddenly* making some topics more relevant than others. Our case (11: 11 M Mourning archive) here was the multidisciplinary research team of ethnologists, anthropologists, philologists, and documentarists of the Madrid train station bombings on 11 March 2004, where 192 people were killed and 2,000 wounded. In response, citizens left a diverse range texts and objects as *memento mori.* Spain's CSIC Anthropological Research Group on Heritage and Popular Cultures captured these spontaneous mourning demonstrations (photographs, videos) and, along with grassroots memorials that emerged on railroad tracks and other nearby spaces, organized an urgent anthropological project to collect, protect, document, archive, and analyze these post-attack signs of mourning. They produced '11 M mourning archive' in 2010, handed over to RENFE Foundation containing 2,482 photographs, 495 objects, 6,432 papers, 76 video and audio recordings, and 58,732 electronic messages. The archive was important to various researchers (anthropologists, historians, psychologists, etc.), but also had value for social welfare, civil protection, policy, teachers, psychologists, and pedagogues, with archival analysis facilitating channelling of individual and collective mourning.

The *social innovation pathway* involves reacting to societal change in situations where both society and scientists start addressing the same social problem independently to create knowledge and develop solutions, then later recouple to collectively contribute to their respective knowledge and legitimacy to building a solution within their wider networks, exercising social power to solve that problem. Our example here (case 8: Voice fingerprint) is drew on Spain's CSIC Research Group of Variation and Cognition in Language, specialized in geolinguistics and Spanish language variation. They had characterized the Iberian Romance dialect varieties, with all word variants found in different villages expressed in phonetic transcription, generally readable by professional linguists. The group started collaborating with ICT specialists to develop a 'voice passport' capable of precisely locating the origins of speakers akin to a fingerprint. The knowledge was useful for voice recognition companies and companies running call centres to help better to select more general staff. The voice passport achieved fame when it was used by Spain's Serious Crimes Squad to help convict several leading organized criminals on the basis of voice recordings by demonstrating that recorded pronouncements had been uttered by those accused.

*Commercialization* is relatively atypical for SSH impact, but does still occur however, where third parties incorporate SSH knowledge into products that are then launched to market. The case (9: Natural tincture techniques) is of a historian/archaeologist who had long studied medieval archives accounting for recipes of tincture techniques based on natural pigments. The researcher was committed to preserve the memory of these ancestral techniques and decided to create research in colour archaeology. This led to the creation of CRITT, a research centre of technology transfer involved in the development of natural colouring techniques for the textile, cosmetic and food industries. Her 1990 book provided the first comprehensive inventory of plants' dyes in the world and came at a time when synthetic tinctures were advancing rapidly, whilst CRITT sought to industrialize the extraction of natural dyes. In 1994, drawing on CRITTs applied research, the private company 'Bleu de Lectoure' invented a fast extraction process of a pastel from the plant *Isatis tinctoria L.* and worked together with a local agricultural cooperative to cultivate 15 ha of feedstock crops. In 1998, Olivier Lapidus, a French haute couture designer, developed a collection based on these colours, with Christian Lacroix, and later fashion house Chanel buying the researcher's 'Scottish threads' product.

## 5.4 Driving societal change

The last three archetypes reflect the idea of research driving societal change proactively, with academics changing their own discipline direction to better influence those societal changes. These archetypes typically involve many productive interactions between scientists and societal agents, making it difficult to attribute impacts created to individual productive interactions. There may be larger numbers of scientists and societal actors involved in these changes as the scientific and societal systems evolve in response to societal change, and those actors which help couple the two systems together appear to be significant here in ensuring the production of the wider effects. We here distinguish three kinds of pathways, *research engagement as a key to impact*, *knowledge creep into society*, and *building new epistemic communities.*

*The research engagement as a key to impact* pathway involves research processes having developmental impact on research subjects, empowering them through recognition, and addressing structural exclusion from particular research activities. This might come through acknowledgement of past wrongs in launching an inquiry, through interview processes or public testimony in those inquiries, or offering media platforms. These effects may benefit both victims of past wrongs, as well as create capacity within society at large to come to terms with those malpractices. Our specific example here was a research inquiry into failures of the child welfare system in Finland (1937–83), where a research team with knowledge on history, ethnology, social work, and sociology came together to make future recommendations on avoiding neglect, abuse and violence against children (case 10: Child abuse and neglects).

Former childcare residents were provided through the research interviews with a platform to articulate their experiences of neglect, and to experience a recognition of their maltreatment being taken seriously with several residents being reunited with missing siblings through the process. The research culminated in a rare public ceremony of apology in Autumn 2016, something previously limited to Finnish Holocaust victims in 2000.

In contrast, the *knowledge 'creep' into society* pathway is much less clear in terms of the knowledge diffusion and in particular the original on the novel thinking, which is dispersed into numerous different sources and sequential occasions. The knowledge 'creep' into society stresses the lack of 'eureka' moments in pathway to impact, and how these changes can take a generation to evolve to the state of shifting (a) public opinion and/or (b) legislation. Our example (case 11 a: Nation State) involved research changing the national debate about Icelandic history, the nation and the national state, comparing modern state formation processes in Iceland and France in the late 19th century. It started as a PhD project in 1991 at a time when Iceland's public discourse was relatively naïve and nationalistic, and attracted interest from politicians and journalists, as well as those involved in tourism and heritage through the professor teaching courses for tourist guides. The wider research group wrote their theses and other publications in the local language, Icelandic, and their materials were therefore more immediately accessible, particularly to those involved in spreading ideas through education, the media, and policy-makers. The professor at one point actively shaped the tone of political debate by comparing the public addresses of two consecutive presidents, highlighting how the first president's strident nationalist tone had given way to an emphasis on diversity and direct criticisms of nationalism.

The final pathway was *building 'new epistemic' communities pathway* in which the knowledge shifts from research communities into teaching practices. Our example (case 12: Pfenninger) here was the first and only longitudinal study in Switzerland (2008–16) that analyses issues regarding the amount and type of English input needed for early starters to surpass late starters and be able to retain their learning advantage in the long term. This is a field where there is a persistent professional belief that it is best to start learning second languages as early as possible in life. The study explored the effects of starting age in primary school on English learning outcomes in secondary education, showing that learning success does not depend on starting age or length of exposure. The study enabled a politically important change in Zürich Canton's education system, which was out of step with other Cantons in beginning English education in Grade 2. The study legitimated amongst education professionals this harmonization, by demonstrating that beginning English education a year later would not materially disadvantage Zürich's pupils.

# 6. Conclusion and discussion

In this article, we have asked the research question how can we develop a typology that captures the diversity of the mechanisms by which SSH research leads to societal impact. We have done this in a constructive attempt to realize the potential that Spaapen and Van Drooge's (2011) productive interactions' concept offers by addressing the wider conceptual framework for describing SSH pathways to societal impact. This framework provided the basis for a meta-analysis of a wide range of narrative impact cases in the field of SSH drawn from across Europe and to develop a typology based on those conceptual elements that most came to the fore in the various examples. This has allowed the typology to capture the diversity of impact pathways in SSH, but at the same time to develop the typology on the basis of their similarities. Our empirical analysis of the 60 case studies allowed a characterization of different kinds of pathways, reflecting different types of knowledge and research orientations, different kinds of productive interactions, different kinds of beneficiaries—and the most important, made visible the variety of mechanism, and conditions encouraging SSH societal impact.

Our archetypes are not *sui generis*, but it is possible to see that they correspond in different ways with what other authors have identified as being important for impact generation. Rowe and Frewer's (2005) concepts of public engagement and participation feature in interactive dissemination and public engagement respectively, while Molas-Gallart et al's (2002) advisory work and new practices can be seen in the expertise and building epistemic communities. Dogan (1996) and Klein (2010) explore the ways in which researchers have a capacity to build linkages with other kinds of actors to create shared mutually valuable knowledge bases, creating new organizations around those collaborative activities. Fricker (2007)'s work on epistemic injustice—where less powerful groups are made aware of their exploitation and provided with the tools to challenge it—can be seen in engagement for impact. *Inter alia*Maguire (2002) points to the fact that facing urgent societal challenges, the role played by science in justifying and validating exceptional responses is as important as delivering those exceptional outcomes. The knowledge creep archetype is a more general example of the policy creep observed by Weiss (1980) in exploring how research influences policy, while Wooding et al. (2007) note that secondments are a typical knowledge exchange mechanism (mobility). Benneworth and Cunha (2015) point to the role that researchers play in upscaling knowledge networks in social innovation allowing innovative social provision to achieve a greater impact. Finally, it is unsurprising that commercialization features as a pathway; several studies identified it as a pathway of science-society collaboration, even if its popularity with policy-makers belies the extent to which it is used in practice (Hughes and Kitson 2012).

We contend that this typology of pathways to societal impact is evident in the case of SSH, but at the same time, will be applicable to other fields of science. Given the relatively small size of our sample, and the fact that it was produced by a very diffuse network of contributors, we are necessarily modest about the claims that we make about the comprehensiveness of this study. We also acknowledge that this means that we cannot make claims to comprehensiveness, and that there may be pathways that we have not identified because they were not in our sample. Nevertheless, even if our typology is specific to the SSH, it is this broader conceptualization of conditions encouraging impact that allows us to make a more substantive contribution to academic, policy, and practice debates on how to better support and critically work for creating research impact.

We argue that more policy support could be given to realising these kinds of activities, specific to the needs of the pathways, to ensure that the science policy and academic practices encourage and enable researchers to answer societally valuable questions in their research activities. The typology serves as a tool to reflect the ideal research conditions for impact processes by demonstrating, e.g., the meaning of researcher's ability to anticipate the window of opportunity coming ahead in relation to topicality of their research interests—or respectively to be prepared to react suddenly to a changed situation. It also reminds how sometimes acts of stakeholders, implemented policies, media attention, nature catastrophes or some other factor outside researcher's scope might be crucial in relation to the possible effects of research. We regard there to be clear policy value in further exploring and operationalizing these four dimensions, in terms of 12 sub-categories to produce a more balanced understanding on how to evaluate and support impact, particularly for those kinds of research evaluation, which are about improvement and peer learning rather than the allocation of financial resources (Molas-Gallart 2015).

## Acknowledgements

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## Appendix I

**The 'fiche'**

The questions addressed in the fiche were the following:

0. General information (context information)

1. What motivated the researcher to begin the ultimately relevant/impactful research?

2. The key people active in the story?

3. What is the contribution of the research in terms of societal impact? What and who constituted the impacts?

4. Interactions – how and with whom?

5. What were the obstacles to impact?

6. Did you receive any external support for the engagement?

7. Is there any evidence from the user that the knowledge is relevant or impactful?

8. Are there other elements of this case that might be relevant? Is there anything else that is relevant that we need to know at this stage?

## Footnotes

1      For more information, see https://www.qrih.nl/en

2      Petersohn and Heinze (2017) at the same time also make the point that bibliometrics emerged as the application of a set of practices developed in one context to another context for which they were not necessarily intended; at the same time the scientific structuration processes that bibliometrics underwent are far more advanced than those which have taken place within societal impact measurement discussions.

3      Siampi is an abbreviation which stands for 'Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions between science and society'.

**Issue Section:** Special Section: Societal Impact in the Social Sciences and Humanities