

Mapping stakeholder engagement in academic research: evidence from Polish impact case studies

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Abstract

Impact Case Studies (ICS) produced for research evaluation exercises offer a unique window into how academic research engages with societal stakeholders. The growing use of these narratives as evidence of research impact makes it possible to uncover patterns of stakeholder involvement, both in terms of who is involved and how these actors engage with academia, that are otherwise difficult to observe and capture systematically. This study provides a comprehensive analysis of stakeholder engagement as represented in 2,661 Impact Case Studies submitted to the Polish national research evaluation system. Drawing on a hybrid text-mining approach, we systematically identify stakeholder organizations, classify them into sectoral categories, and map the roles they play in the research and impact processes described in the cases. Based on this analysis, we develop a typology comprising 63 distinct engagement types. The findings suggest that engagement logics are sector-specific and institutionally shaped, with application-oriented forms of engagement appearing particularly salient in the Polish context. Our study also finds cross-disciplinary differences: while the overall intensity of collaboration does not vary significantly across disciplines, scholars in SSH&A tend to engage with a broader range of sectors and to participate in more collaborative forms of engagement than their STEM counterparts. Our findings have important implications for research evaluation, suggesting that prevailing evidence requirements in performance-based research funding systems may systematically privilege short-term, transactional forms of engagement while underrepresenting co-productive and process-oriented impacts that are more difficult to document.

Keywords stakeholder engagement, impact case studies, Poland, text mining, academia-practice interactions

1. Introduction

The inclusion of stakeholders in the production of academic knowledge has become an increasingly prominent topic in discussions on research funding and science policy (e.g. Boaz et al. 2018; Jonsson and Iwarsson 2022; OECD 2023). At the same time, the growing emphasis on societal impact in research evaluation has led to the creation of large collections of Impact Case Studies (ICS), which document how academic research engages with non-academic actors and contributes to societal change. Beyond their evaluative function, these narratives provide a valuable source of evidence for studying patterns of stakeholder engagement across research fields and institutional contexts.

Interest in stakeholder engagement reflects a broader recognition that engaging non-academic partners is one of the most effective ways to promote the uptake of research findings, thereby strengthening the societal relevance, visibility, and impact of academic work (Oliver et al. 2014; De Jong and

Muhonen 2020; D'Este and Robinson-García 2023). Stakeholder engagement enhances the uptake of research in a variety of ways. First, it often leads to the formulation of more practice-oriented research questions and generation of more actionable outputs, increasing the relevance of academic research (De Jong and Muhonen 2020; D'Este and Robinson-García 2023). Second, through collaborative approaches—such as practice-based or participatory research—enable findings to be implemented as the research unfolds, thereby accelerating the transition from knowledge creation to real-world application (Lewandowska and Bojnarowicz 2025; Von Thiele Schwarz et al. 2025). Third, stakeholder engagement fosters a deeper understanding of the research processes among non-academic actors, thereby cultivating more favorable attitudes towards applications of research outputs in practice settings (Boaz et al. 2018; Borst et al. 2019).

With the growing emphasis on societal impact in research evaluation procedures, stakeholder engagement is gaining

37 categories of beneficiaries (e.g. “companies,” “patients,” “ministers” or “farmers”); [Stevenson et al. \(2023\)](#) used the same approach for REF 2021 and identified 59 types. The application of computational text mining for identifying non-academic actors in ICS was further advanced by Bonaccorsi and colleagues ([Chiarello et al. 2018](#); [Bonaccorsi et al. 2021a,b](#)), who developed an extensive lexicon of research users (76,857 entries) by integrating user lists from diverse sources (e.g. public profession registries, patient roles) and enriching them with new user types automatically extracted from patent texts using a trained classifier. The enriched lexicon was then applied to extract user types from the REF ICS and identify patterns of impact across research fields.

While these computational approaches have significantly advanced the field, they focus exclusively on the UK, leaving other national contexts unexplored. This is an important consideration, as impact narratives are shaped by specific national research funding contexts ([Wróblewska 2025](#)), and may vary substantially in how research impact is understood and described across countries.

Second, how non-academic actors are defined in these studies is crucial for how the nature of research engagement and impact is interpreted. The distinction between “general” and “exact” identification of stakeholders ([Yaqub et al. 2023](#)) is particularly important in this regard. In the former, impact statement refers to broad categories of actors (e.g. “government” or “company”), whereas in the latter, specific end-users and organizations are defined (e.g. XYZ Ltd). General identification can be assumed to correspond to broad “target” groups of users and thus may reflect intended or “imagined” impact ([Yaqub et al. 2023](#)), while exact identification is more likely to indicate more tangible and proximate relationships, closer to what [Spaapen and Van Drooge \(2011\)](#) conceptualize as “productive interactions.” To date, text mining studies have primarily focused on general identification, while approaches capable of capturing more specific stakeholder relationships remain largely underdeveloped.

Finally, existing research has primarily focused on stakeholder identification, while the forms of engagement through which impact unfolds, as well as the roles stakeholders play within case studies remain less well understood.

2.2. Mechanisms of stakeholder engagement in academic research

Societal stakeholders are broadly defined as actors who influence or are influenced by a system or organization in pursuit of its objectives ([Freeman 1984](#)). A substantial body of research demonstrates that the active involvement of societal stakeholders in knowledge-creation processes increases the likelihood that research outputs will be taken up and used. [Olmos-Peñuela et al. \(2015\)](#) suggest that early engagement with stakeholders makes it more likely that research outputs inspire, engage, and influence societal actors, although such engagement does not guarantee that knowledge will ultimately be adopted or used ([Landström et al. 2024](#)). Interactions between academics and societal stakeholders are therefore widely regarded as a key precondition for the societal impact ([Spaapen and Van Drooge 2011](#)).

This emphasis reflects a broader shift away from linear models of knowledge transfer towards approaches that stress interaction, co-creation, and joint knowledge production, highlighting the importance of engagement processes and the contexts in which knowledge is produced and used. As synthesized by [D’Este et al. \(2018\)](#), this transition draws on diverse conceptual frameworks, including national innovation systems, post-normal science ([Funtowicz and Ravetz 1993](#)), Mode 2 knowledge production ([Gibbons et al. 1994](#)), and the Triple Helix model ([Etzkowitz and Leydesdorff 2000](#)), with subsequent extensions such as the Quadruple Helix further emphasizing the role of civil society ([Carayannis and Campbell 2009](#)). Despite this rich conceptual landscape, most empirical studies remain confined to specific sectors, disciplines, or exemplary cases, leaving a limited systematic understanding of how different forms of engagement unfold across the academic system as a whole.

At the same time, interactions between academics and societal stakeholders occur through a variety of mechanisms. [Spaapen and Van Drooge \(2011\)](#) distinguish between direct interactions (e.g. face-to-face or digital personal contact), indirect interactions (e.g. publications, patents, or other knowledge artefacts), and financial interactions (e.g. contract research and commissioned projects). While such typologies provide a useful analytical lens, prior research indicates that the prevalence and forms of interaction vary substantially across academic disciplines and stakeholder types ([Cao et al. 2025](#)).

Empirical research indicates that interactions with industry most frequently take the form of so-called “academic engagement,” that is, person-based interactions such as joint R&D projects, contract research, consultancy, and informal advisory activities, whereas commercialization mechanisms (including patenting, licensing, and spin-off formation) play a comparatively modest role ([Perkmann et al. 2013](#)). Evidence from the Spanish Research Council confirms this pattern and further highlights strong disciplinary variation, with academics in applied and engineering-oriented fields engaging more frequently with industry and through a broader range of interaction modes than the social sciences and humanities ([D’Este et al. 2019](#)). These findings suggest the need for analytical approaches that can capture such variation.

While engagement with industry has received considerable attention, researchers also interact extensively with civil society organizations and the general public. Engagement with civil society is particularly diverse and encompasses practices such as citizen science, understood as collaborative processes in which members of the public contribute to research design, data collection, analysis, or interpretation. This area is characterized by notable conceptual and terminological heterogeneity, including notions such as participatory action research, community science, crowdsourcing, and citizen-generated data ([Fraisl et al. 2020](#)). Previous studies also show that interaction often occurs through dissemination, collaboration, and consultancy, while commercialization remains less prominent ([Borlaug et al. 2024](#)).

Interactions with policy actors represent another important pathway through which scientific knowledge contributes to societal impact by informing decision-making. Academics engage with policymakers through mechanisms such as temporary government positions, advisory roles, responses to practitioners’ requests, and public communication ([Nelson et al. 2024](#)) as well

as policy briefs, evidence syntheses, deliberative dialogues, and the use of intermediaries such as knowledge brokers (Miranda et al. 2025). The academia-government collaboration is further shaped by institutional infrastructures, including formalized partnerships and supportive organizational arrangements facilitating the use of research (Guerrero-Torres et al. 2025). Overall, research rarely influences policy in linear ways; interactions are indirect and mediated, shaped by organizational constraints, political dynamics, and relationship-building processes (Oliver et al. 2014).

While the literature consistently positions stakeholder engagement as central to societal impact, it also emphasizes associated challenges. Academics often engage with multiple stakeholder groups, which entails navigating divergent institutional logics, expectations, and epistemic cultures, as well as differences in motivations, roles, and modes of collaboration. These tensions may complicate knowledge co-production and potential later uptake, particularly when academic autonomy and societal relevance are perceived to be in conflict (Stier and Smit 2021; D'Este et al. 2024).

Prior research primarily focuses on three broad domains of stakeholder engagement, namely industry, civil society and policy. Each domain is associated with distinct motivations, interaction mechanisms, and institutional logics. However, existing studies typically examine these domains in isolation. By analyzing a comprehensive national corpus of impact case studies, our study offers a unique opportunity to observe how these forms of engagement co-exist, overlap, and vary across disciplines and institutional contexts.

Existing studies of Impact Case Studies have significantly improved our understanding of who engages with academic research, yet provide more limited insight into how stakeholder engagement takes place. Drawing on broader literature on research–society interactions, this study addresses this gap by developing a stakeholder engagement typology that combines stakeholder types with the roles they perform. Applying this typology to Polish Impact Case Studies, we systematically examine patterns of engagement across disciplines and societal sectors.

3. Empirical setting and data sources

3.1. Evaluation of research impact in Poland: impact case studies

Poland is among the European countries that have adopted performance-based research funding systems (Hicks 2012). Since the early 1990s, the Polish Ministry of Science and Higher Education has conducted national evaluations of research activity, typically every four years. The resulting scientific category awarded to research units determines degree-awarding powers and has a significant impact on the allocation of state funding (RAD-on 2022). In 2018, societal impact was incorporated into the evaluation system as part of a comprehensive reform of higher education and science (Dziennik Ustaw Rzeczypospolitej Polskiej 2018). The 2022 exercise was the first in which impact was included as one of three core criteria—alongside scientific/artistic outputs and financial effects—and the only one assessed

qualitatively. Units of assessment (discipline-based research units) were required to submit two to five impact case studies depending on research staff size. Impact had to occur within 2017–2021 and be underpinned by research conducted since 1997 (Dziennik Ustaw Rzeczypospolitej Polskiej 2019). In total, 283 institutions submitted 2,661 case studies in Polish and English, which were subsequently published online.

The societal impact evaluation framework, inspired on the UK REF (Wróblewska 2025), required each case to be supported by documentary evidence submitted alongside the narrative. Official guidance specified that evidence must take concrete forms, such as reference letters from companies confirming research use, official reports verifying beneficial outcomes (e.g. employment growth or cost reductions), or statistical indicators documenting measurable change (e.g. reductions in greenhouse gas emissions). Guidelines also emphasized the identification of the social groups or organizations benefiting from the research (Korytkowski and Kulczycki 2019). Impact case studies were assessed by disciplinary panels based on their significance and geographical reach (with international reach required for the highest scores) using a 0–100 scale; societal impact accounted for 15–20% of the global evaluation score. Although the broader reform sparked debate, the societal impact component received limited public scrutiny, and the absence of detailed guidance led to considerable variation in how institutions conceptualized and documented societal impact (Wróblewska 2025), shaping the dataset analyzed in this article.

3.2. Description of the corpus

Our empirical material consists of 2,661 impact case studies (ICS) submitted by Polish research institutions for the 2022 research evaluation exercise. These ICS are publicly available via the POL-on platform.¹ POL-on is an IT system designed to collect and manage data on science and higher education in Poland. It provides a standardized template for each case study, comprising four main sections: (1) basic metadata (e.g. identifiers, affiliation, research field, discipline, title, and summary), (2) information on key findings, research outputs and the institution's role in the described research, (3) descriptions of the achieved impact and supporting evidence, (4) interdisciplinary aspects of the research. Table A1 (Supplemental Appendix A) presents the structure of the case study template.

This study focuses on two sections of the case studies that illustrate the impact: *Title* and *Impact* (Polish version). The analysis also incorporates two classification schemes used in ICS:

- 1) *Research field*, based on the classification provided by the Ministry of Science and Higher Education.
- 2) *Leading area of impact*, categorized into Economy, Environmental Protection, Public Administration, Healthcare, Culture and Art, State Security and Defense, and Other.

The corpus, consisting of the selected sections of the case studies, contains a total of 1,465,061 words, with an average impact description length of 550.57 words per case study. As shown in Fig. 1, the distribution of word counts is left-skewed due to the 5,000-character limit on impact descriptions, with many cases near the maximum and fewer much shorter

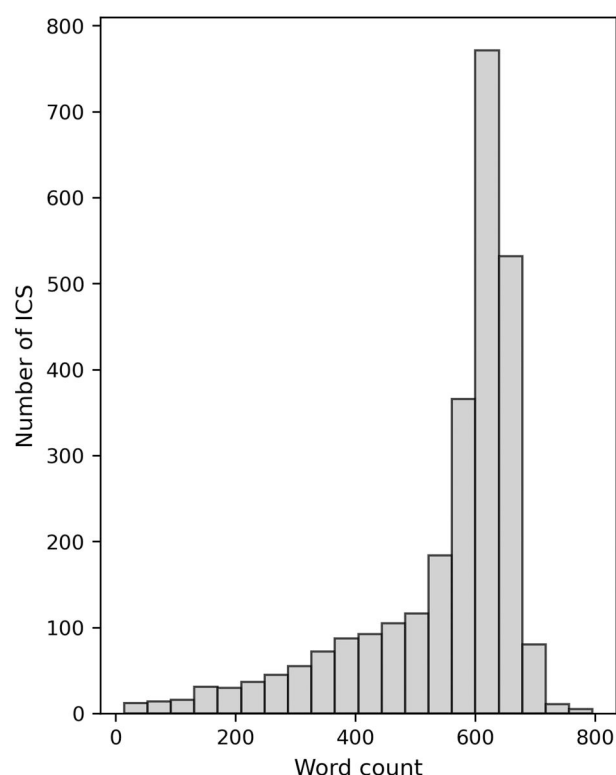


Figure 1 Distribution of word counts across ICS.

submissions forming a left tail. Figure 2 shows that, while the number of case studies per domain varied substantially—reflecting the differing numbers of domain-related departments within Polish higher education—the median word count of impact descriptions was relatively consistent across domains.

4. Methods: hybrid text mining approach

This study applies a hybrid text mining approach, consisting of two main stages. First, Organization Name Extraction (Section 4.1) is performed to identify the types of professional stakeholders mentioned in the case studies by extracting organization names from the texts and classifying them to sectors. Second, Organization Role Identification (Section 4.2) involves analyzing the roles those organizations play by examining linguistic patterns in the textual data. These two stages are then integrated to develop a typology of engagement types (as detailed in the Results section).

4.1. Organization name extraction

For Organization Name Extraction, we applied a hybrid text mining approach combining machine learning-based Named Entity Recognition (NER), rule-based classification, and manual annotation to extract and categorize non-academic professional stakeholders mentioned in ICS. The workflow consisted of three main stages: (1) NER-based organization name extraction, (2) classification logic development, (3) entity classification. Figure 3 illustrates the process flow in more detail.

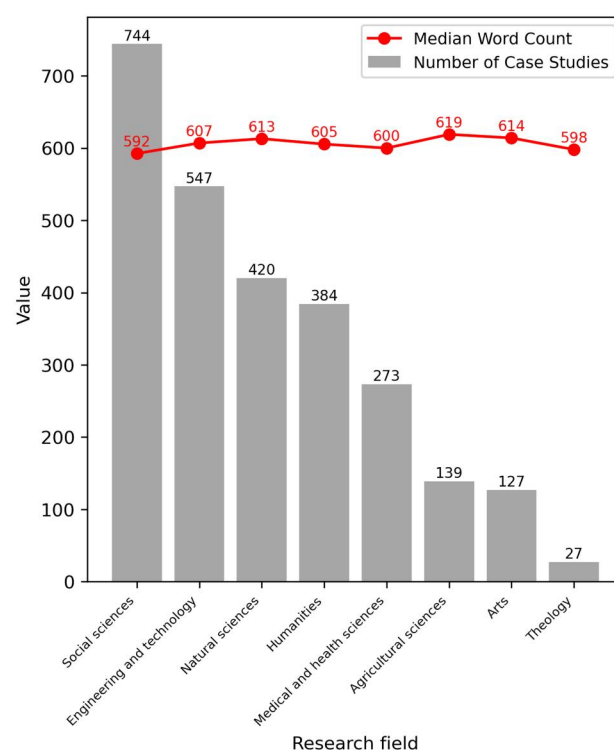


Figure 2 Number of ICS and median impact description word count per research field.

4.1.1. NER-based organization name extraction

The first step was data preparation. From each ICS, we extracted and concatenated the *Impact* and *Title* fields to form a single narrative text per ICS. NER was then applied to these prepared texts using two complementary models: (1) *Stanza* (Stanford NLP): A neural model adapted for Polish, offering linguistically rich entity segmentation and (2) a multilingual transformer model we refer to as *XLM-NER*, which detects organizations and other entities by learning patterns from large datasets across multiple languages. The decision to use both models was guided by the aim of increasing overall coverage, as the two independently trained models tend to recognize complementary entities.

In total, the named entity set comprised 44,393 organization mentions (21,628 unique entities). The Stanza model produced 35,642 mentions (17,988 unique entities), while XLM-NER extracted 17,554 mentions (9,751 unique entities). We identified 6,111 unique common entities—those recognized by both models. This high-confidence subset—referred to as the *core named entity set*—formed the starting point for classification logic development. Model-specific entities (those found only by Stanza or XLM-NER) were retained for later classification.

4.1.2. Classification logic development

The named entity set represented a collection of organization names which, in their raw form, could not yet be meaningfully interpreted. To analyze these data and draw conclusions, it was necessary to establish a typology and develop a classification framework that would group organizations into interpretable categories. We based the development of this framework on the

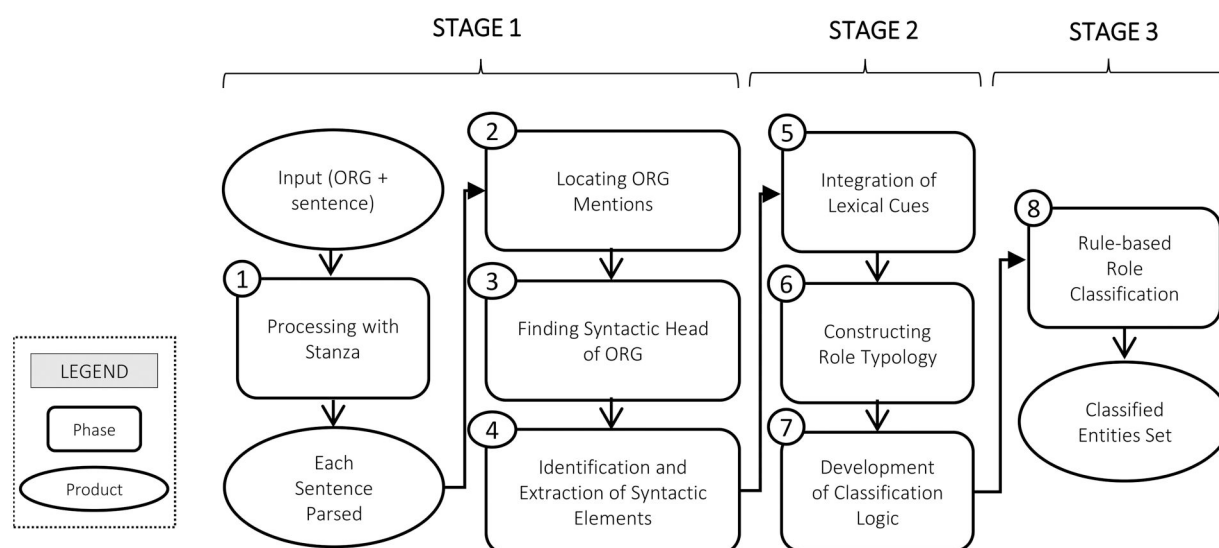


Figure 4 Process flow diagram of Organization Role Identification. The workflow takes as input sentences with organization mentions and produces a classified set of entities with assigned engagement roles.

4.2.1. Dependency parsing

Dependency parsing is a method used to analyze the grammatical structure of a sentence by identifying the relationships between words (Jurafsky and Martin 2026). It represents sentences as sets of directed links between words, showing how they function in relation to one another (e.g. as subject, object, modifier, or agent). This approach allows us to determine whether an organization mentioned in a sentence plays an active role (e.g. as the performer of an action) or appears only in a contextual role (e.g. as a location). An illustrative example of a parsed sentence from our dataset is provided in Supplemental Appendix B.

To identify the relationships between organization mentions and other elements in the sentence, we used Stanza—an open-source natural language processing library supporting 66 human languages, including Polish (Qi et al. 2020). Stanza is based on the Universal Dependencies (UD) framework, which provides a standardized way to label syntactic structures using a universal set of dependency labels—such as *nsubj* (nominal subject), *obj* (object), or *obl:agent* (agent in a passive construction). Stanza parses each sentence into its syntactic structure, enabling systematic analysis of how words are grammatically connected.

Our input data consisted of sentences from impact case studies paired with recognized organization names. Each sentence was parsed into a dependency structure. To determine the syntactic role of an organization, we first matched each organization mention to its exact position in the sentence. We then identified the organization’s syntactic head—the key word within the organization name that connects it to the rest of the sentence. Once identified, we extracted: (1) the dependency label describing the grammatical relation between the organization and the word it depends on (its governor); (2) the governor’s surface form, lemma, and part of speech; and (3) the main predicate of the clause, identified by tracing the structure upward to the highest governing verb. This procedure allowed us to systematically capture how organizations are positioned and function within sentences.

4.2.2. Integration of lexical cues and classification development

In addition to this syntactic information, we recoded lexical cues that signal the relationship between professional stakeholders and the research described in a case study. We extracted prepositional markers—that is, prepositional words or phrases (e.g. *in cooperation with*, *in accordance with*, *commissioned by*) indicating particular types of collaboration or involvement. The extraction was based on a compiled list of lexical cues that mapped prepositional phrases to the stakeholder roles. Table C1 in Supplemental Appendix C provides examples of these lexical cues and their associated stakeholder roles.

We also extracted up to two nouns (“object keywords”) linked to the predicate to obtain additional context about the action described in the sentence. For example, in the sentence “*The Pole Dialog Foundation conducted workshops together with the University of Warsaw*” the relevant noun is “workshops,” which we recorded in our database.

To develop the classification logic to assign roles to organization mentions, we first constructed a role typology, based on a manual review of a random sample of approximately 500 sentences with organization mentions. We repeatedly revised the sample to identify recurring patterns. As a result, we derived a list of thirteen role categories, including a fallback “Unclear/ Other” category (for the complete list, see Table 2). In the next step, we developed rule-based criteria for each category, combining the syntactic information, lexical cues (including prepositional markers), and stemmed words indicating the organization’s role. For each category, we created a list of stems which—if present in predicate, governor or object keywords—signaled that the organization played that particular role. Stems rather than lemmas were used to account for the morphological variation in Polish. As an illustration, Table C2 in Supplemental Appendix C presents rules for the “Collaboration/ Partner” role.

Rules for all categories were developed iteratively through repeated manual reviews of random samples of sentences.

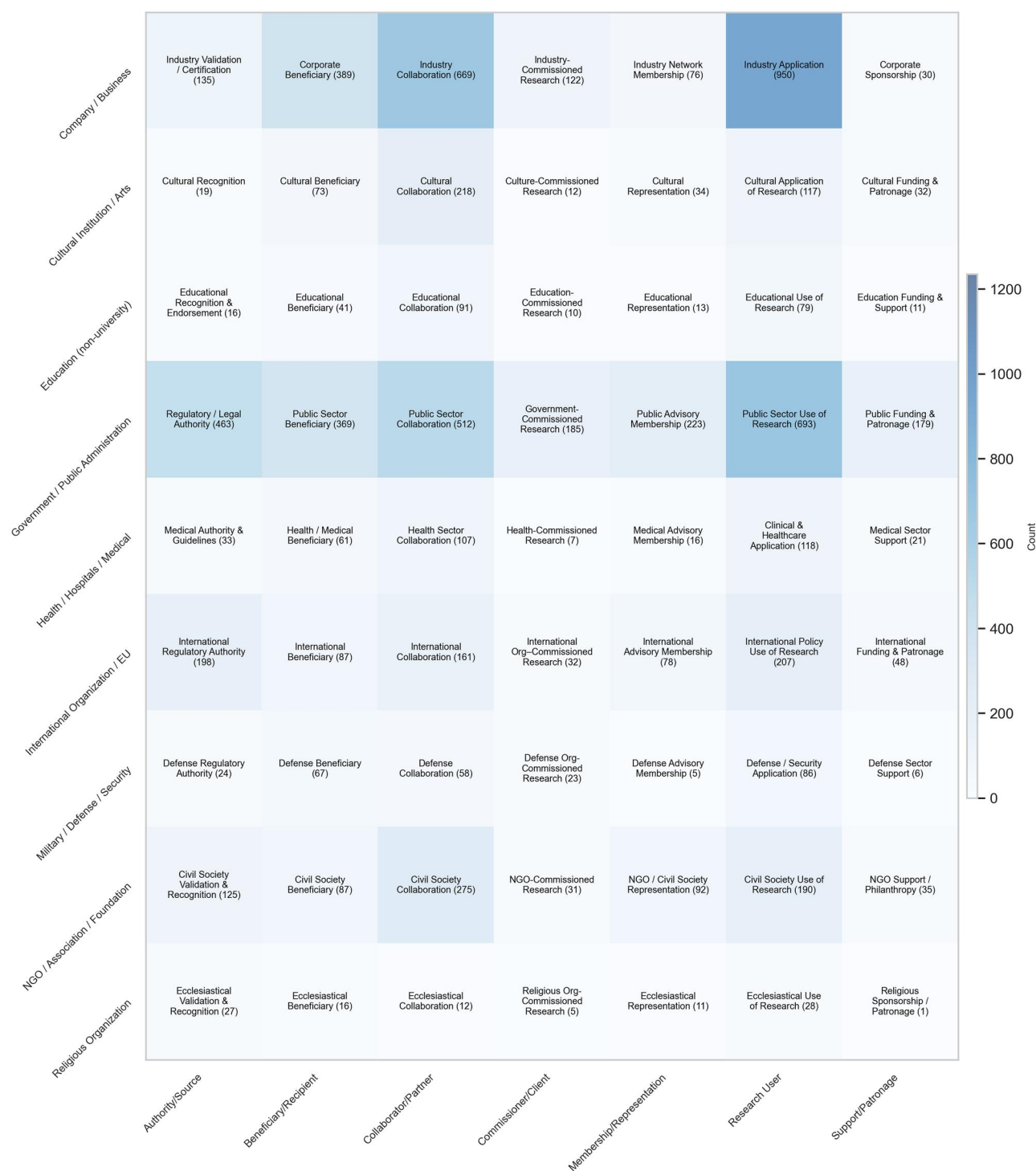


Figure 5 Mapping of organization sectors (y-axis) and roles (x-axis) to engagement types. Bracketed values indicate total engagement counts.

negligible. Figure 5 presents a heatmap highlighting the most frequent cases, while Fig. 6 presents the top 20 stakeholder engagement types across all ICS documents. Five engagement types stand out: *Industry Application*, *Public Sector Use of Research*, *Industry Collaboration*, *Public Sector Collaboration* and *Regulatory/Legal Authority*. This pattern reflects the fact that government/ public administration and industry are much more common stakeholders than others (see Table 1). It also indicates

that these actors are predominantly referenced as active participants—most often as collaborators or users of research—rather than merely recipients, beneficiaries, or funding sources. The prominence of collaboration suggests that person-based interactions are relatively common. At the same time, the data highlight the importance of the practical implementation of results by industry (*Industry Application*) – primarily through commercialization (e.g. the launch of innovative products) and

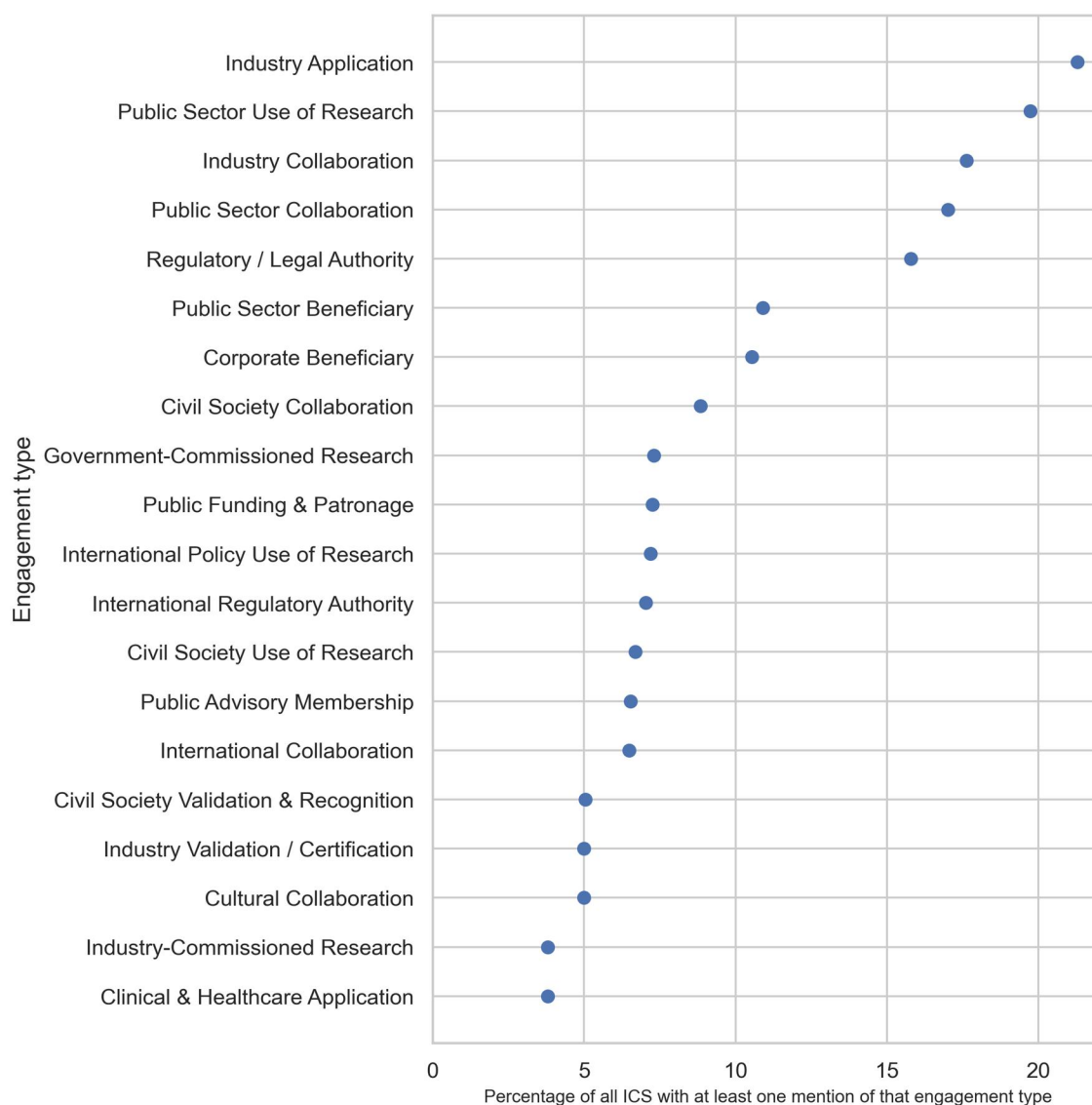


Figure 6 Top 20 stakeholder engagement types across Impact Case Studies.

knowledge transfer (e.g. the optimization of industrial standards based on research-derived know-how).

Some engagement types are rare, largely reflecting the fact that certain stakeholders seldom assume specific roles. For example, cultural or educational organizations (e.g. museums or schools) are infrequently commissionersers of research, but more commonly act as collaborators in joint initiatives. Similarly, religious or healthcare organizations seldom function as sponsors or patrons; and are more typically recipients of support rather than providers. Likewise, regulatory roles are more often associated with public and international organizations than with defense or educational organizations.

5.2. Stakeholder engagement across societal domains

Figure 7 presents the most prevalent engagement types within each *Leading Area of Impact*. This classification, adopted in the Polish evaluation system, captures societal domains in which

research described in ICS is reported to have generated impact (see Section 3.2.). Here, it is used to analyze how stakeholder engagement patterns vary across these domains.

Across societal domains, a consistent pattern emerges: the most frequent engagement types typically combine collaboration-related engagement (e.g. *Public Sector Collaboration*, *Industry Collaboration*) with application or research uptake-oriented engagement (e.g. *Industry Application*, *Public Sector Use of Research*). This suggests a balance between joint activities (indicative of more direct and person-based interactions) and more knowledge transfer-oriented modes of engagement. Within this pattern, collaboration-related forms of engagement appear to be less frequent in National Security and Defense, whereas Culture and the Arts appears to be the most collaboration-intensive domain, with collaboration-related forms of engagement dominating.

In both Economy and Healthcare, reported impact is largely associated with industry applications and collaborations. In the economic domain, case descriptions frequently link impact to the integration of academic inventions and patents into

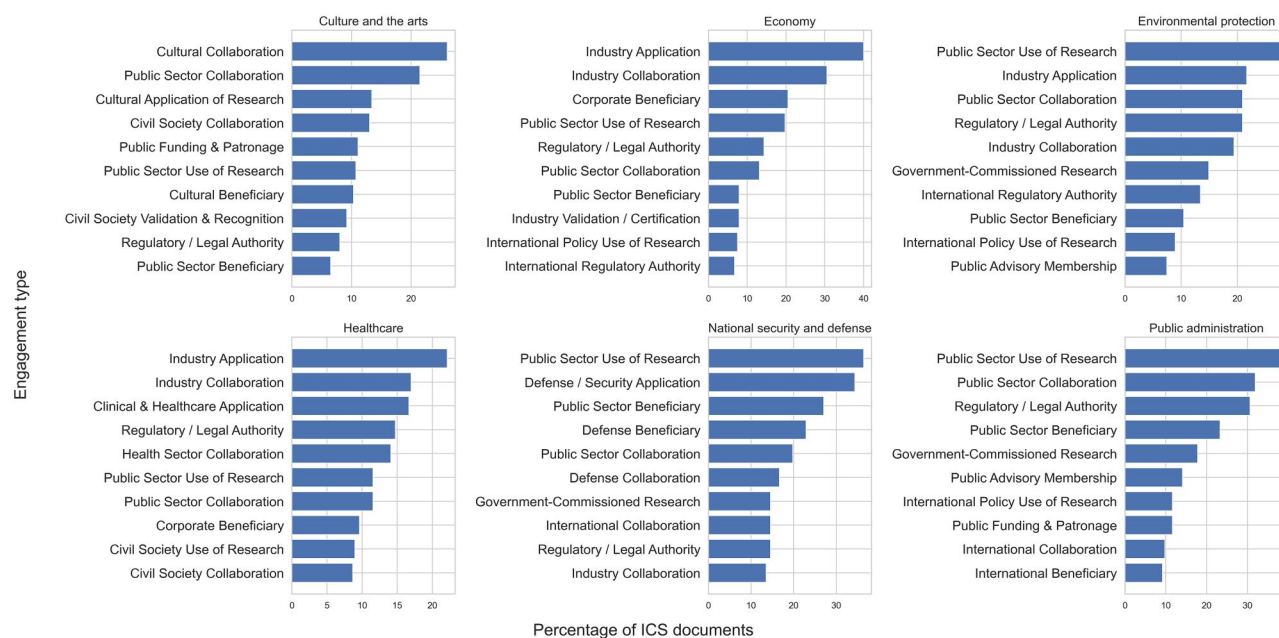


Figure 7 Top 10 stakeholder engagement types within each societal domains.

Table 3 Distribution of stakeholder mentions and engagement types across research fields.

	No. of ICS	Stakeholder mentions (total)	Avg. stakeholder mentions per ICS	Avg. engagement types per ICS
Agricultural sciences	139	737	5.30	2.07
Arts	127	818	6.44	2.17
Engineering and technology	547	3565	6.52	2.33
Humanities	384	2201	5.73	2.13
Medical and health sciences	273	1521	5.57	2.26
Natural sciences	420	2589	6.16	2.33
Social sciences	744	4914	6.60	2.49
Theology	27	167	6.19	2.13

industrial production processes, as well as to the scaling of academic knowledge through licensing agreements and the creation of spin-off companies. In healthcare, the prominence of industry engagement suggests that business-oriented health organizations play a key role in translating research into reported outcomes. While traditional healthcare providers (e.g. public hospitals) are more often involved in experimental and collaborative phases of research, business entities are more frequently associated with more large-scale commercialization and technical implementation, enabling the translation of academic findings into scalable products.

Environmental Protection, National Security and Defense, and Public Administration are domains in which reported impact is primarily associated with policymaking and regulatory processes. In these domains, impact is described in the ICS as arising when scientific findings are taken up by public authorities and judicial bodies and incorporated into legal frameworks, administrative procedures, and strategic planning. Finally, Culture and the Arts and Healthcare show comparatively stronger involvement of civil society actors and, relative to other areas, a more limited role of

international organizations, suggesting that engagement in these domains is more locally and community oriented.

5.3. Stakeholder engagement across research fields

While the previous section examined stakeholder engagement across different societal domains, this section shifts the focus to variation across research fields. In contrast to Leading Areas of Impact, which denote the societal domains where impact is reported to occur and thus reveal patterns of engagement across different areas of societal activity, research fields refer to the disciplinary basis of the research underpinning ICS. This perspective highlights how stakeholder engagement practices vary across disciplinary contexts.

Table 3 provides a high-level overview, presenting the average stakeholder mentions and engagement types per ICS across research fields. The heatmap in [Fig. 8](#) offers a more detailed view, illustrating the relative prominence of each engagement type across fields. Bubble size indicates the proportion of

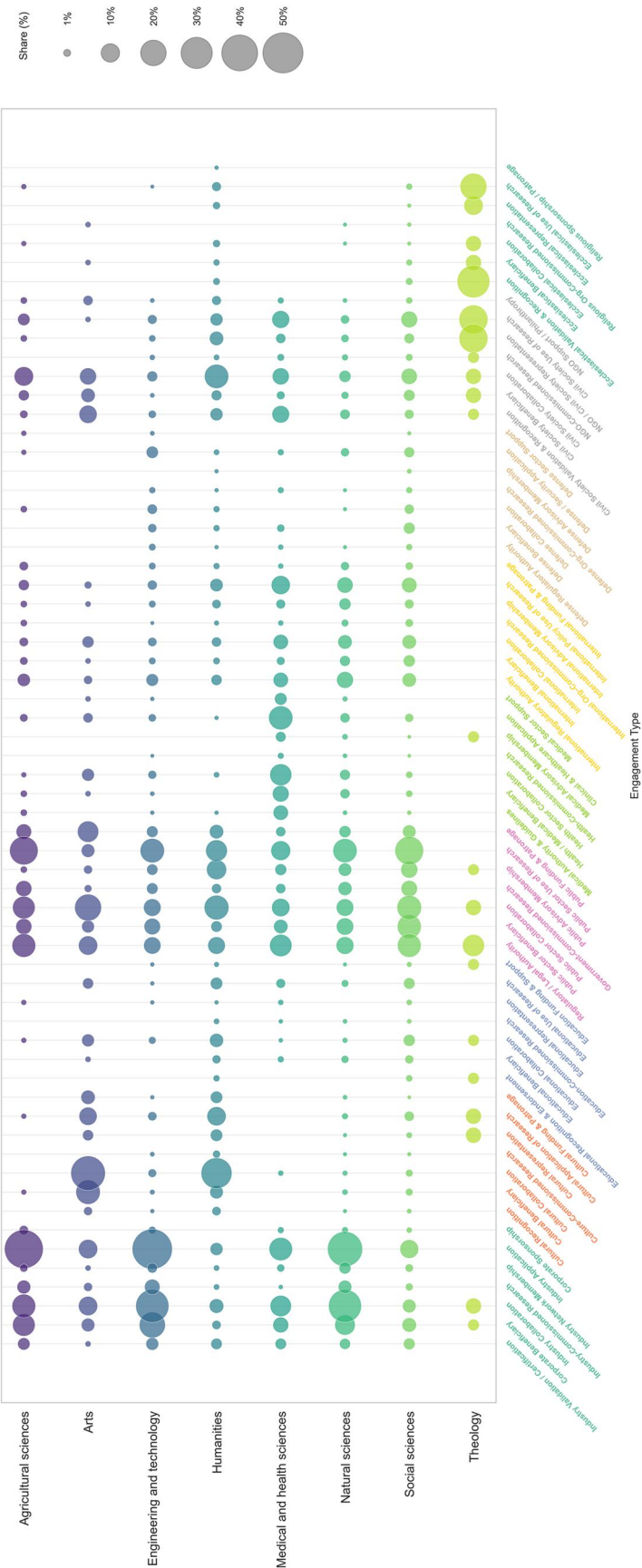


Figure 8 Heatmap illustrating the distribution of engagement types across research fields. Bubble size indicates the proportion of mentions of each engagement type within ICS from a given research field.

occurrences of each engagement type among all ICS within a field. To facilitate interpretation, engagement types are color-coded by stakeholder sector (e.g. pink indicates Government/Public Administration).

While the overall pattern (Table 3) suggests little variation between fields, indicating similar levels of engagement across fields, clear differences emerge in the distribution of engagement types. Agricultural Sciences, Engineering Sciences, and Natural Sciences display broadly similar patterns, characterized by a strong concentration on industry-related engagement. In all three fields, *Industry Application*—such as commercialization, licensing, spin-offs, and the implementation of products or processes—is the engagement type most frequently associated with reported impact. *Industry Collaboration* is also prominent, especially in Engineering and Natural Sciences, highlighting the importance of joint R&D projects and consortia-based work. Overall, these patterns suggest that research in these fields combines collaborative interaction with more transfer-oriented forms of engagement. Engagement with government and public administration is present but plays a secondary role. Agricultural Sciences stand out in this respect, showing stronger links to public-sector use of research and regulatory activities, indicating that research in this field is more often taken up in policymaking and regulatory development. In Engineering and Natural Sciences, regulatory engagement is less pronounced, although public-sector use of research remains evident in the impact case descriptions.

Medical and Health Sciences display a more mixed engagement profile. Impact in this field is associated with a combination of industry partnerships, engagement with public authorities, collaboration with healthcare organizations, and interaction with civil society. Industry engagement includes both joint research projects (collaboration) and knowledge transfer (application). Public bodies play an important role, particularly through regulatory and policy-related engagement, as research evidence is used to inform legislation and national health strategies. At the same time, hospitals and other healthcare organizations serve as key partners, particularly in clinical trials or the introduction of new medical procedures. Engagement with NGOs further extends these activities, for example through public health campaigns and patient-oriented initiatives.

A different pattern is observed in the Social Sciences, where engagement is spread across many types but is most strongly concentrated on government and public administration. In this field, reported impact is most frequently associated with public-sector use of research, public-sector collaboration, and regulatory engagement. Engagement in the Social Sciences combines collaborative problem-solving (e.g. researchers working with policymakers to address concrete social and policy challenges) with more one-directional forms of research uptake by public institutions (e.g. research findings used in decision-making, legal interpretation, and the design of public policies).

Humanities and Arts also show a wide range of engagement types, but with a strong emphasis on collaboration with cultural organizations, public institutions, and civil society actors. Public-sector engagement encompasses both collaboration and patronage, with researchers acting as experts or members of advisory bodies in the cultural domain. Civil society organizations

also play an important role, particularly in educational and community-based cultural initiatives.

Finally, Theology shows a more focused engagement profile, concentrated primarily on religious organizations and NGOs. In this field, reported impact is typically associated with the application of academic knowledge to local community needs, such as religious education, social integration, pastoral care, and training activities. Engagement is generally small-scale, practice-oriented, and closely embedded in local contexts.

Overall, a broad tendency can be identified. Researchers in Agricultural Sciences, Engineering Sciences, and Natural Sciences tend to rely on more focused engagement models, centered primarily on industry collaboration and application, with public-sector engagement playing a more limited role. By contrast, Medical and Health Sciences, Social Sciences, and the Humanities and Arts demonstrate broader engagement profiles, involving a wider range of stakeholders, though the composition of these engagements differ across fields. In Medical and Health Sciences, engagement is broadly distributed across multiple stakeholder groups, including industry, public authorities, healthcare organizations and civil society. In the Social Sciences, it is more strongly oriented toward the public sector, particularly in relation to policy and governance. In the Humanities and Arts, engagement is more frequently directed toward cultural and societal actors.

6. Discussion

This study examines patterns of academic engagement with societal stakeholders in a national corpus of narrative impact cases from Poland, drawing on structured analytical mapping of stakeholder organizations to sectoral categories and associated engagement mechanisms. In doing so, it makes three main contributions. First, it advances the conceptualization of stakeholder engagement by moving beyond generic actor categories and introducing functional differentiation (e.g. authority, user, collaborator, commissioner), portraying engagement as a structured configuration of roles rather than a homogeneous field of “external partners.” Second, it provides large-scale empirical evidence, based on computational analysis of a comprehensive national dataset, identifying systematic patterns of concentration and dominance in specific forms of interaction. Third, it contributes to a more differentiated understanding of academic-societal relations by showing that stakeholder engagement is functionally specialized across sectors and shaped by institutional constraints that influence which roles actors are likely to assume. These contributions extend prior research, which has largely relied on smaller samples of impact narratives from non-Polish contexts, and offer a broader and more nuanced account of how academic engagement operates across sectors and disciplines.

6.1. Mechanisms of engagement

The findings suggest that most impact cases are related to interactions with industry and government, while all other societal stakeholders account for a much smaller share. Previous studies have consistently shown that interactions between academics

and industry are widespread, but they are unevenly distributed across engagement mechanisms, with research projects, consultancy, contract research, and informal exchanges dominating the interactions (Perkmann et al. 2013). By contrast, our results show that Industry Application slightly outweighs Industry Collaboration in overall frequency and clearly predominates within domains such as the economy and healthcare. While collaboration remains highly visible, application-oriented engagement appears particularly salient in the Polish context.

There are at least two plausible explanations. Substantively, this may reflect a growing policy emphasis on translational and market-oriented forms of impact. More importantly, however, the ICS format itself may shape reporting practices. Impact case studies are authored by universities and require formalized evidence, which may favor demonstrable applications (e.g. licenses, certifications, documented uptake) over relational or process-based forms of engagement. Applications are generally easier to evidence than collaborative processes, which may introduce a reporting bias towards tangible implementation mechanisms. Thus, the prominence of Industry Application may reflect both underlying engagement dynamics and the performative logic of impact documentation.

Furthermore, prior research suggests that engagement with government takes diverse forms ranging from consultancy and advisory roles to secondments and temporary embedding of academics within policy structures (Gulbrandsen and Smeby 2005; Abreu and Grinevich 2013). These forms imply direct, person-based interaction. Our findings, however, show that Public Sector Use of Research is the most frequently documented engagement type, exceeding both Public Sector Collaboration and Government-Commissioned Research. This suggests that indirect mechanisms such as research transfer, policy uptake or regulatory incorporation are more prominently documented than direct forms of engagement such as embedding or consultancy.

Although industry and government account for the largest share of interactions with Polish academics, their engagement profiles differ substantially. Industry engagement is more strongly concentrated in a limited set of interaction types, whereas government interactions are distributed more evenly across roles. Moreover, the prominence of “use” and the frequent appearance of Regulatory/Legal Authority in ICS narratives point to institutionalized mechanisms in which research informs regulatory frameworks or policy design, with public actors acting as authoritative gatekeepers without necessarily requiring sustained co-production.

Other sectors display more differentiated engagement patterns. NGOs and civil society show a relatively diversified profile, with collaboration as the slightly more dominant engagement type, particularly within culture and the arts and healthcare domains. Unlike industry or government, they are rarely portrayed as commissioners, sponsors, or regulatory authorities, functioning instead primarily as collaborative partners or users of knowledge. International Organizations and EU actors also display a balanced configuration across: authority, research use, and collaboration, underscoring their hybrid regulatory and policy-oriented position. By contrast, religious organizations

and military or security actors exhibit more skewed and lower-frequency distributions, suggesting more specialized and context-specific engagement patterns rather than broad-based interaction with academics.

Overall, our findings suggest that engagement logics are sector-specific and institutionally shaped. Industry engagement is predominantly framed in terms of application and market uptake, government engagement in terms of policy use and regulation, and civil society in relational and partnership-based terms. At the same time, a small subset of engagement configurations accounts for the majority of cases, while many sector–role combinations remain rare or nearly absent. This indicates that, although engagement is conceptually diverse, it does not necessarily translate into empirical pluralism – or at least not in how engagement is made visible in researchers’ impact reporting.

In this sense, the findings contribute to the literature by distinguishing between potential and realized engagement diversity: while policy discourse often fosters broad stakeholder inclusion, the actual architecture of engagement remains strongly concentrated and role-differentiated.

6.2. Disciplinary differences

Previous research has consistently identified disciplinary differences in the scope and nature of stakeholder engagement. STEM fields are typically described as engaging with more narrowly defined user groups, whereas SSH&A fields tend to engage with more diverse groups of end-users (Bonaccorsi et al. 2021b). At the same time, it has been suggested that SSH researchers are less likely to identify concrete stakeholder categories, instead referring to them in broader, more general and less clearly delineated terms. Our findings, however, point in a somewhat different direction. Rather than analyzing broad stakeholder categories (such as “government” or “industry”), we focus on exact stakeholder mentions (e.g. XYZ Ltd.), capturing instances where researchers explicitly name the organizations with which they interact. At this level of granularity, we observe a relatively even distribution of stakeholder mentions across disciplines, suggesting that SSH&A researchers, similarly to their STEM peers, do identify specific beneficiaries. At the same time, SSH&A scholars tend to do so across a wider range of sectors than STEM researchers, indicating that the difference lies not in whether specific stakeholders are identified but in the breadth of sectors addressed. In this respect, our findings align more with Yaqub et al. (2023) who reported that arts and humanities scholars tend to specify stakeholders more explicitly and engage more in knowledge co-production mechanisms than scholars in engineering and natural sciences.

Furthermore, our results indicate that SSH&A, particularly the Arts, tend to rely more on direct, collaboration-based engagement models than STEM fields, which place relatively stronger emphasis on downstream applications and research use. These differences point to distinct pathways though which disciplines are associated with societal impact: in STEM, impact is often described as unfolding through formalized and proceduralized trajectories, involving clear intermediate steps (e.g. regulatory frameworks, standardization processes, technology transfer mechanisms) between invention and application (Bonaccorsi et al. 2021b). In contrast, impact

in the Humanities and Arts is more frequently portrayed as participatory and immediate, emerging through direct collaboration with cultural institutions and other community-based actors. Moreover, in the Polish higher education context examined in this study, artistic disciplines are largely located in professional schools (e.g. art academies) rather than research-intensive universities; this institutional configuration may further reinforce close, practice-oriented collaboration patterns.

Our findings also indicate that the apparent dichotomy between STEM and SSH&A is nuanced by the position of Medical and Health Sciences, which exhibit a hybrid engagement profile. On the one hand, industry applications and collaborations play a prominent role, reflecting the field's reliance on private-sector investment to translate research into practice (Wang et al. 2024). On the other hand, research in this domain shows strong alignment with governmental and community stakeholders, including healthcare providers and civil society organizations. In this respect, the field resemble SSH&A, particularly in their orientation toward evidence-based policymaking and their tendency to collaborate locally and directly with community actors.

Our findings have implications for how research evaluation is designed and implemented. In Poland, societal impact is assessed as part of a performance-based research funding system (PRFS), where impact case studies contribute directly to funding allocation. Within this framework, guidance explicitly instructs institutions to identify specific beneficiaries, demonstrate “a clear cause-and-effect relationship” (Korytkowski and Kulczycki 2019, 12) between research and societal impact, and support claims with documentary evidence. While such requirements aim to ensure accountability and transparency, they may privilege certain types of impact over others. Documentary proof is often difficult to obtain in cases of co-productive and process-oriented forms of engagement, where outcomes emerge through long-term collaboration, mutual learning, or gradual changes in professional practice. As a result, evaluation systems may inadvertently encourage research institutions and individual scholars to prioritize more transactional and short-term modes of engagement that produce clear, documentable outputs. In this respect, such systems risk disadvantaging not only SSH&A fields but also community-oriented strands of medical and health research, where knowledge transfer to society takes practice-based, relational forms. More broadly, research evaluation systems need to account for the non-linear nature of impact and the difficulty, if not impossibility, of establishing causal links, as well as the fact that research fields operate according to distinct “impact dynamics,” which shape how impact unfolds and can be meaningfully evidenced.

Although the specific characteristics of the Polish PRFS provide an important context for interpreting our findings, we believe that the contributions of our study extend beyond this particular evaluation framework. On the one hand, several of our findings closely resemble patterns previously reported for UK REF impact case studies, including the disciplinary differences in research-society interaction. Given that the Polish evaluation framework was explicitly modelled on the UK REF, these similarities may reflect the ways in which similarly designed evaluation systems shape the documentation and representation of research-society interactions. At the same time, they may also reflect broader and more generic patterns of research-

society interactions that occur across different institutional and national contexts. On the other hand, the study develops a comprehensive typology of stakeholder engagement that captures a broad spectrum of interactions between researchers and societal stakeholders. Many of these engagement types are conceptually consistent with mechanisms described in the broader international literature and would be expected to occur in impact case studies (or other forms of research impact documentation) from other countries. Consequently, while the observed distribution of engagement types is likely to be shaped, at least in part, by research evaluation systems, depending on the forms of engagement they document and incentivize, we believe that the typology itself provides a useful analytical framework for comparative studies across national contexts.

6.3. Limitations and future research

This study provides a comprehensive overview of forms of stakeholder engagement in academic research and identifies broader patterns of engagement across societal areas, research fields, and institution types. However, some limitations should be acknowledged. First, the potential under- or over-identification of engagement types may stem from both the characteristics of data sources and methodological approach. The analysis relied on self-reported cases, whose narratives may be shaped by official evaluation guidelines. While these guidelines are relatively broad, they may implicitly signal which types of projects or evidence are considered desirable. As a result, universities may selectively emphasise certain forms of engagement, and the observed patterns may partly reflect how stakeholder engagement is framed within evaluation contexts rather than representing the full range of engagement practices.

Second, while text mining techniques offer important advantages, particularly in terms of scalability, replicability, and efficiency, they also have limitations. Rule-based matching approaches may fail to capture more nuanced or indirectly described forms of engagement, while interactions expressed using more standardized terminology may be more readily identified. Although automated methods enhance consistency, they cannot fully account for contextual subtleties inherent in qualitative narratives.

Future research should address these limitations. First, comparative studies could examine whether similar configurations of stakeholder engagement emerge in countries operating under different research evaluation regimes. Such analyses would help disentangle the influence of evaluation system design from broader patterns of research-society interaction and assess the transferability of the typology developed in this study. Second, future research could examine how universities conceptualize and demonstrate stakeholder engagement outside the constraints of national evaluation systems, for example, through internally driven assessments. In this context, the typology developed in this study could serve as an analytical framework, for example in a survey-based studies assessing the perceived importance of different engagement types across institutions. Such analyses would help clarify whether the patterns observed in our study reflect underlying institutional values and practices or are shaped primarily by external evaluation pressures.

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AI disclosure

Artificial intelligence tools (ChatGPT, OpenAI) were used to support Python code development and to assist with language editing. These tools were used solely to improve clarity and technical implementation. All conceptualization, analysis, interpretation, and conclusions are entirely the responsibility of the authors. No AI tools were used to generate original research ideas, results, or substantive content.

Supplementary material

Supplementary material is available at *Research Evaluation Journal* online.

Conflicts of interest

One of the authors, Alfredo Yegros-Yegros, serves as a member of the Editorial Board of *Research Evaluation*. The authors declare no other potential conflicts of interest.

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Data availability

Data and code supporting the findings of this study are documented in a publicly accessible GitHub repository: <https://github.com/kami-data/academia-practice-nlp>

Note

1. <https://radon.nauka.gov.pl/dane/opisy-wplywu-dzialalnosci-naukowej-na-funkcjonowanie-spoleczenstwa-i-gospodarki>

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