

*November 2024*

# **Impact Assessment Study on Innovation in COST Actions**

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**Final Report**



Version 3

*November 2024*

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### **Final Report**

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## Executive Summary

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The COST Association has commissioned Technopolis with carrying out an impact assessment to better **understand impact pathways that lead to innovation**. While the impact paths foreseen by the COST impact model were analysed in previous studies, this study fills the knowledge gap regarding the different types of and paths to innovation of COST Actions.

The study uses a broad definition of innovation. It refers both, to novel approaches at the activity level (in the design and implementation of COST Actions) as well as at the output level, which can include (economic) product and process innovation as well as social innovation. To explore innovation in and through COST Actions, the study first applies a partly AI-based, quantitative approach, identifying the innovative potential of past COST Actions. This was done by developing indicators we expect to approximate innovative potential, namely an unusual combination of COST instruments, the involvement of many non-academic partners and output indicators for economic and social innovation. The respective data was acquired via scientometric and (AI) document analysis of the COST Actions' final reports. Based upon that analysis, 12 COST Actions were selected as case studies. The case studies were analysed in depth via document analysis and interviews.

The case studies managed to illustrate various ways in which COST Actions can be innovative in their **design and implementation**. The cases show that COST Actions can be innovative regarding their partner structure development, namely the involvement of non-scientific stakeholders in various ways, including using specific COST networking tools. The case studies also acknowledge that the thematic context facilitates or impedes stakeholder engagement. This means the necessary efforts COST Actions have to make differ substantially across Actions.

COST Actions can also result in various **innovative outputs**, like business models, new products (patents) or educational formats. Relevant factors for these results are, again and as expected, the involvement of non-scientific partners, but also key characteristics of COST Actions. These include the openness of COST Actions for new participants, the involvement of Young Researchers and Investigators (YRIs) and a high degree of interdisciplinarity. No clear patterns could be identified regarding the innovative potential of specific networking activities or the size of or involvement in a network. In terms of potential challenges, some case studies pointed out that interaction with policymakers is often difficult for researchers. The Science for Policy training by COST was not used by any of the COST Actions analysed but could potentially counteract this in the future. Another challenge is the question of further development and sustainable continuation of innovative outputs and their effects. For economic innovations, this was supported effectively by COST Innovators Grants in some cases but was more challenging for social innovations.

The study concludes with various recommendations for future COST Actions to support innovations in their network. COST Actions with an interest in (economic) product innovations should consider involving economic stakeholders at an early stage, combining experienced and well-connected researchers with YRI, supporting Short Term Scientific Missions with industry and developing forums for the exchange of industry and academia. For COST Actions that aim towards social innovations, it is recommended to involve societal stakeholders from the outset, to concentrate on countries with high impact potential, to involve SMEs in educational formats and to include governmental actors in trainings. Essential are also communication activities, which includes involving local media and developing professional outreach products.

## 1 Introduction

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COST was established in 1971 as an intergovernmental initiative to enable bottom-up networking around nationally funded research activities in a broad variety of subject fields. The instrument is a founding pillar of the European Research Area (ERA). The programme's objective is to promote transnational networks among researchers from COST member countries<sup>1</sup> as well as from partner countries known as Near Neighbour Countries (NNC) and International Partner Countries (IPC).<sup>2</sup> These activities aim to promote excellence and interdisciplinarity of research as well as the embeddedness of (young or less-well connected) researchers in an international research environment. The long-term goal of the programme is to narrow the gap between science, politics and society in Europe.

The main instrument of COST is the funding of COST Actions, which are networks of researchers funded for four years and provide a framework to collaborate across borders, disciplines, and sectors to address common challenges and advance scientific knowledge and innovation in Europe. During the funding period, COST Actions participants can engage in various activities to foster cooperation, e.g. meetings, short-term scientific missions, training schools, or conference grants. Moreover, there are instruments and activities particularly dedicated to the facilitation of knowledge transfer and enhancement of innovation:

- COST Innovators Grants (CIG)<sup>3</sup> offer ending COST Actions possibilities to create additional impact during the year after the end of the Action, aiming at enhancing pace and success of research breakthroughs, building bridges between scientific research and marketable applications and/or societal solutions,
- COST Connect comprises a series of thematic workshops involving COST Actions participants, policymakers and R&I stakeholders, addressing stakeholder input and highlighted needs, aligning with the current EU policy agenda and considering major societal challenges and research fields,
- COST Science informed policy advice is an initiative to connect COST experts into science-informed policy advice on relevant EU topics

COST Actions aim at “boost[ing] research, *innovation* and *careers*” (see COST webpage, highlight added by author). Innovation is also mentioned in the impact model of COST<sup>4</sup>, as in the long-term the programme is expected to unfold scientific as well as societal impact by fostering breakthrough science and bridging the innovation gap. The COST impact model therefore places innovation at the centre of expected impacts, but the paths to innovation go beyond the currently known impact paths.<sup>5</sup>

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<sup>1</sup> COST today has 41 member states, as well as 1 Cooperating Member and 1 Partner Member, among them the EU-27, as well as Albania, Armenia, Bosnia and Herzegovina, Georgia, Iceland, Norway, Montenegro, Republic of Moldova, Republic of North Macedonia, Serbia, Switzerland, Türkiye, Ukraine, and United Kingdom. The Cooperating Member is Israel and the Partner Member is South Africa.

<sup>2</sup> See website for a list of NNC and IPC.

<sup>3</sup> While the COST Innovators Grant has been awarded to several of the Actions under study (see chapter 4), the study is about innovation in Actions at-large and it does not zoom in on the Innovator Grants only.

<sup>4</sup> See [https://www.cost.eu/uploads/2020/02/COST\\_ImpactBrochure\\_7\\_WEB\\_IP.pdf](https://www.cost.eu/uploads/2020/02/COST_ImpactBrochure_7_WEB_IP.pdf).

<sup>5</sup> In a nutshell, through its activities, the programme is supposed to foster interdisciplinary research collaborations, project proposals, and co-authored publications. These outputs shall promote transnational collaboration and networking, leading to coordinated, interdisciplinary, and innovative research on the one hand, and individual career advancements for participating scholars on the other.

As the COST Actions facilitate collaborative networks and knowledge exchanges, they potentially contribute to important driving factors for innovation according to the OECD.<sup>6</sup> However, while previous studies on COST Actions analysed different aspects of impact<sup>7</sup>, there is **a knowledge gap regarding the different types of and paths to innovation of COST Actions**. The present study fills this gap in an exploratory way. It detects COST Actions with a high potential for innovation, describes this potential, and the way it is addressed by the COST Action in a way it serves as a good example for the future.

The study focuses on both innovative activities within the Actions and innovative results, asking:

### 1. How do COST Actions include innovative aspects in their design and implementation?

For this research question we have to look at the **COST Actions at design and implementation stage** ("activities" in the impact model). From a theoretical point of view, COST Actions can, in their design, be innovative regarding the **usage of COST networking instruments** and regarding their **partner structure**. An indicator for an innovative usage of instruments are uncommon combinations, the unusual frequent use of specific instruments or the usage/ award of the above-mentioned innovation related activities (COST Innovators Grant, COST Connect, COST policy advice). Indicators for innovative partner structure are strong involvements (involvement in multiple tasks, more active than passive involvement) of civil society, public sector or private sector partners.

These indicators are used as a starting point for identifying promising cases with innovative approaches at design/ implementation stage. However, as this is an exploratory study, the case study work was left open to identify further paths of innovation (see next chapter for the methodological approach).

The second research question is:

### 2. How do COST Actions contribute to innovative outputs?

This question focuses on the **output and outcome level** of COST Actions. Here, we differentiate between product innovations, process/ method innovations and social output innovations. **Product innovations** can be for example the creation of new or improved software, consumer products, services or digital content. **Process or method innovations** as results of COST Actions could for instance manifest as new manufacturing processes, business models, new scientific methods or theories, or decision-making processes. Finally, the results of COST Actions could also lead to **innovations that address socio-economic or environmental issues**, are developed co-creatively with civil society actors or are used by them. Social output innovation could also manifest in social entrepreneurship or products that are non-technical.

To explore how COST Actions can contribute to such or other innovations, this study looks closely at COST Actions that might cover several types of innovation and shed light on how the COST Actions managed to be innovative. Eventually, other COST Actions could learn from the good practices selected.

The following report is structured as follows. In chapter 2 we describe the methodology we used for selecting cases and collecting and analysing data on the cases. Chapter 3 gives an

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<sup>6</sup> According to an OECD report (Pralhad et al. 2009), the way enterprises are innovating is changing due to four driving factors: global challenges and changes in the public sector, global knowledge procurement, new collaborative networks, and new ways of co-creation with users of innovative products.

<sup>7</sup> For instance, the relevance of COST Action participation for a successful application in European research funding was analysed (Final Impact Assessment Horizon 2020) as well as the impact of STSMs on enhancing research collaboration and individual development.



overview of all cases that were available for selection as well as the selected cases. Chapter 4 contains all case studies in full length and chapter 5 explores as a conclusion which overall patterns could be identified for innovations in COST Actions and what COST Actions and COST can learn from the cases.



## 2 Methodology

Overall, the methodological approach was divided into two phases. In phase 1, an overview of 100 COST Actions completed in 2022 and 2023 was created based on indicators for innovation potential. The data on the indicators was collected via quantitative methods, namely AI-based report analysis and scientometric analysis. On this basis, 12 case studies with high innovation potential were selected. In phase 2, these selected cases were analysed in greater depth via desk research and interviews, supported by the results of the quantitative analyses. Each method for data collection in phase 1 and phase 2 is explained in further detail in the following paragraphs.

In phase 1, we collected data on six different indicators with AI-based analysis of reports and scientometric analysis and considered indicators from the data available (see Table 1). The indicators are explained in further detail in each methodological section in 2.1 and 2.2.

*Table 1 Overview of indicators and methods*

Method/ indicator type	Activity indicators	Output indicators
AI-based analysis of reports	<ul style="list-style-type: none"> <li>• Usage COST networking instruments</li> <li>• Partner structure</li> <li>• Dissemination strategies</li> </ul>	<ul style="list-style-type: none"> <li>• Innovative products/ processes (data collected via AI-based analysis of reports)</li> <li>• Social innovation outputs (products or processes that were developed co-creatively with societal actors and improve the welfare of communities) (data collected via AI-based analysis of reports)</li> </ul>
Scientometric analysis		<ul style="list-style-type: none"> <li>• Economic potential: publications with patent citations, industrial co-publications</li> <li>• Societal/policy potential: governmental co-publications, publications with policy citations, SDG relevant publications</li> </ul>
Data made available by COST	<ul style="list-style-type: none"> <li>• Diversity of disciplines</li> <li>• Diversity of Chair countries</li> </ul>	

### 2.1 AI-based analysis of reports

This assignment leveraged an AI-assisted approach to systematically and comprehensively process COST Action reports. By conducting an in-depth assessment of 100 final COST Action reports, the tool detected relevant insights at COST Action level, streamlining the case selection process, which formed the foundation for subsequent case study analysis. Specifically, the assignment deployed the Technopolis AI Policy Concierge — an internal tool developed to customise generative AI capabilities for individual projects, thereby enhancing the efficiency and accuracy of the analysis.

The main overarching themes of the exercise consisted of identifying:

- Innovative combination of instruments (the extent to which projects mix unusual combinations of specific instruments and networking tools such as CIGs, Science informed policy advice, Short Term Scientific Missions (STSMs), conference grants, communication and dissemination activities, Virtual Networking Grants, or training schools.)

- Innovative partner structures (unusual mix of actors within COST Actions such as civil society, for-profit organisations, governmental organisations, or hospitals; and their degree of involvement).
- Innovative dissemination strategies (for example, targeting different target groups with online dashboards, social media presence, Podcasts, TEDx talks, Science festivals, or MOOCs)
- Innovative product outputs other than publications and patents<sup>8</sup> (examples including software, prototypes, trademarks, copyrights, design patents, new devices, clinical trials, or startups).
- Innovative processes (such as new decision-making processes, manufacturing processes, new business models or methods)
- Innovative social outputs (including new solutions aiming to improve the welfare and well-being of individuals and communities, for example, related to societal challenges such as migration, ageing, unemployment, public health, or social inclusion)

For each broad theme, we developed various sub-topics or indicators to search for with the AI Policy Concierge and identified their presence in each report. As a result of this exercise, we computed COST Action-level tables mapping the presence of each indicator per report, along with quotes and page numbers justifying each detection for transparency and cross-validation. Moreover, the tool generated tables to explore innovative combinatorial use of indicators by counting the number of times individual COST Actions implement unusual mixes of indicators.

This task demonstrated the power of an AI-assisted approach to process and analyse COST Action reports with significant gains in efficiency and precision. Deploying the Technopolis AI Policy Concierge helped streamline the project selection process by forming a robust foundation for subsequent case study analysis. The tool's ability to detect critical insights across the main themes provided a comprehensive starting point for evaluating each COST Action's unique innovation potential. Ultimately, the AI tool facilitated the analysis of innovative combinations of these indicators across projects, highlighting unique approaches to addressing scientific and societal challenges.

## 2.2 Scientometric analyses

The first step of the scientometric analysis was extracting all the publications associated with COST Actions. Two data sources were used in this step: the COST Action final reports and the Crossref database. From the COST Action reports we scraped DOIs and the Crossref database was searched for publications that mentioned COST Action codes in their funding acknowledgements. The output of this step was subsequently enriched by linking it to various other databases and sources to include all scientometric indicators as listed in Table 2.

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<sup>8</sup> These were also included in the scientometric analysis.

*Table 2 Overview of indicators and data sources for scientometrics*

Dimension	Indicator (index)	Operationalisation	Data Source
Economic	Industrial co-publications	Authors with industrial affiliations listed on publications attributed to COST	OpenAlex
	Patent citations	Scientific publications that are cited by patents	Patstat
Societal/policy	Policy influence	Policy citations	Overton
	Governmental co-publications	Authors with governmental affiliations listed on publications attributed to COST	OpenAlex
	SDG relevance	Share of publications relevant to one or more SDGs	OpenAlex

Based on the indicators listed in the table above, five indices were calculated on which the cases could be easily selected. The indices were computed using a percentile-based ranking method. This approach allows us to normalise the ranks of COST Actions across all indicators on a percentile scale, which reflects each project's relative performance as a percentage. For each indicator, the final index is calculated by summing the percentile ranks for total publications, share of publications, and average share for each of the indicators.

At this point of the study, 12 cases were selected for more in-depth research. The selection of cases occurred building upon the quantitative data collected. The aim was to identify highly innovative COST Actions. The data underpinning the selection process and the selected cases themselves are further described in chapter 3.

### 2.3 Desk study

Supporting the AI-based document analysis, a qualitative desk study of final and progress reports as well as MoUs by the COST Actions shortlisted was conducted. The results of the desk study were important in gathering further evidence on innovations in the COST Actions and supported the selection of Actions for in-depth case studies. In phase 2, the desk study was then used to prepare the interviews and inform the case studies.

### 2.4 In-depth interviews

For each COST Action that was selected as a case study for closer examination, 2-3 interviews were conducted. In most cases, the Chair of the COST Action was interviewed first to a) validate the potential innovative approaches identified in phase 1 and b) possibly identify other unexpected approaches. Depending on the specific innovative approach and based on the recommendation of the first interview partner, a second or third interview partner was identified. In many cases these were other COST Action participants that came from the non-academic sector and provided a different perspective on the innovative approach.

Based on this data, the case studies were developed. The focus was on the path to innovation and what other COST Actions can learn from it. The following chapter provides an overview of all COST Actions analysed regarding indicators and of the selected cases.

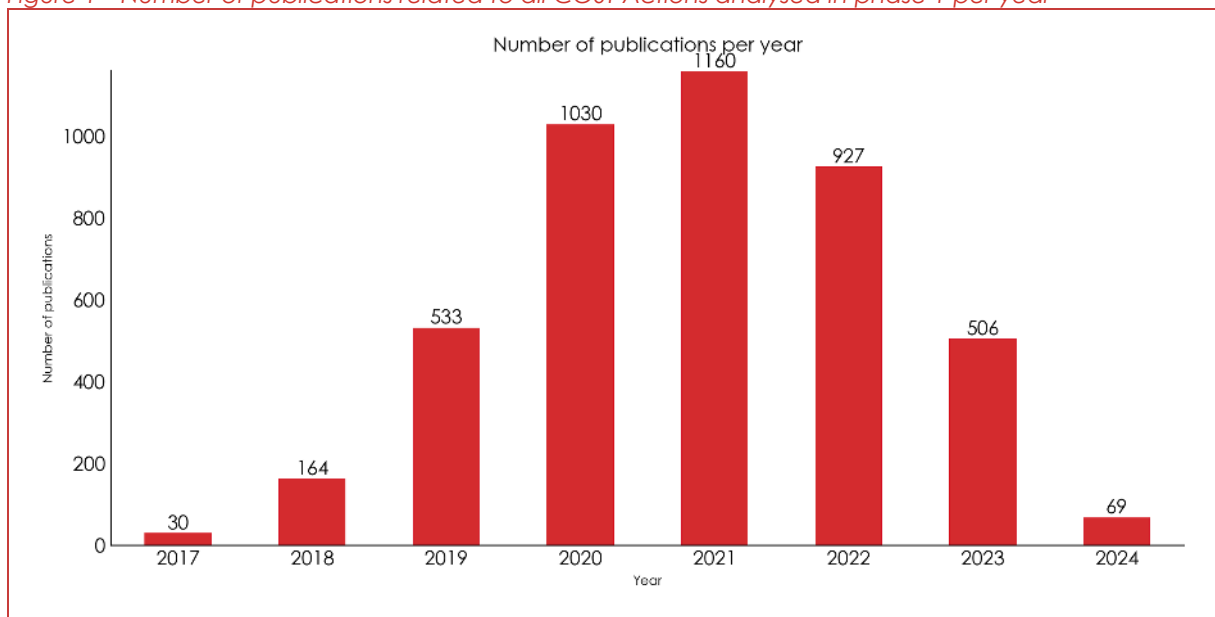
### 3 Overview of all COST Actions and the selected cases regarding innovation indicators

#### 3.1 Overview of all COST Actions

##### Results from the scientometric analysis

Initially, the focus was on understanding the volume of the publications that are related to the COST Actions under investigation. The first step, scraping the final reports and enriching them with Crossref data, resulted in 20.586 publications since 2011 (see Figure 1). The drop in publication output in 2023 and 2024 is likely due to the time lag associated with the publication process and this number is expected to rise.

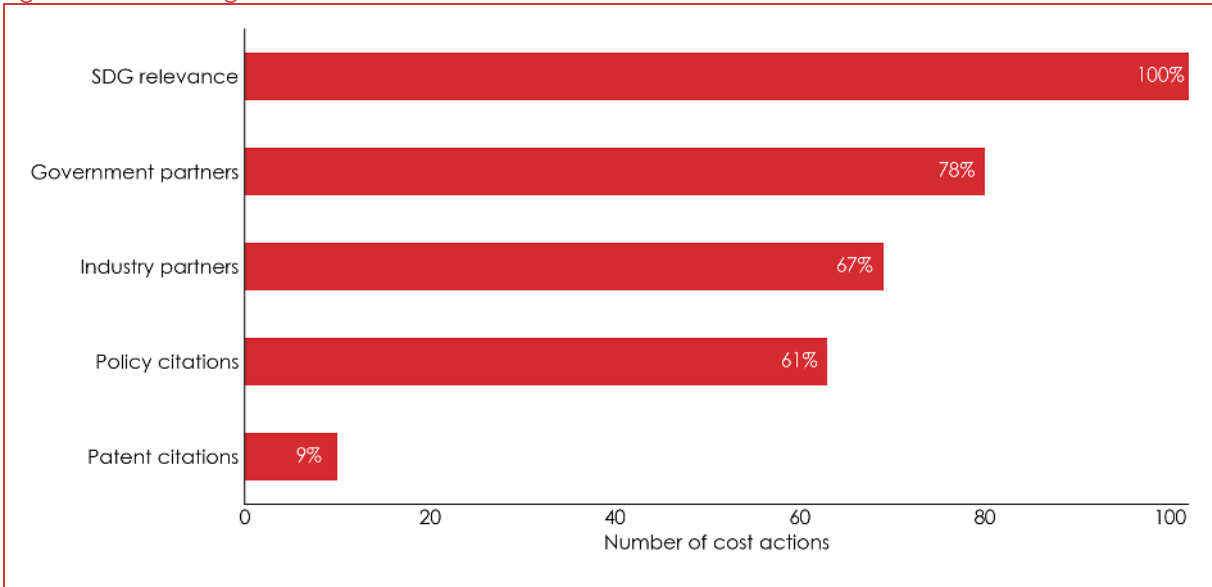
Figure 1 Number of publications related to all COST Actions analysed in phase 1 per year



Technopolis, based on Crossref data

The figure below shows what percentage of COST Actions have at least one publication a) with a policy citation, b) that is relevant to Sustainable Development Goals (SDGs), c) that has governmental co-publication partners, d) patent citations and e) industry co-publication partners from the total of 102 COST Actions. Rather than evaluating each COST Action individually, we examine the overall trends to understand the collective contribution of all COST Actions to these areas. What stands out is that all COST Actions have at least one publication that is relevant to the SDGs. Only 9% of the COST Actions had one or more publications that were cited in patents. The majority of COST Actions do have one or more publications with policy citations and with industrial or governmental co-publication partners.

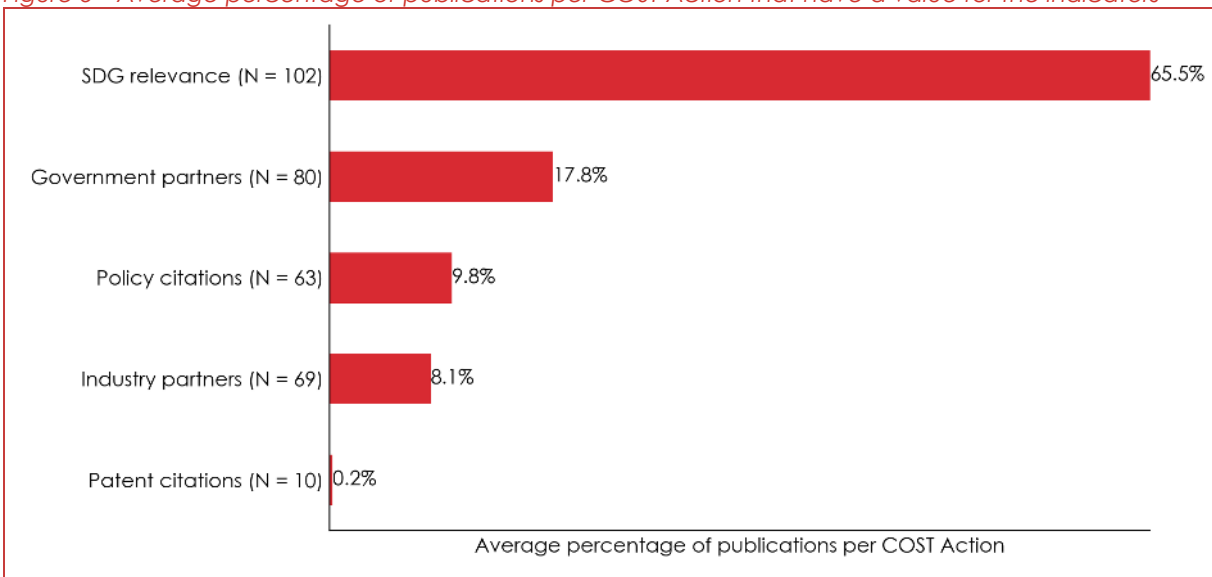
Figure 2 Percentage of COST Actions with value 1 or more for each indicator



Technopolis, based on Crossref data

The below figure shows the average percentage of publications per COST Actions that are relevant to SDGs, have government or industry partners, and that have policy or patent citations. This provides insight into the relative distribution among the COST Actions. As can be seen, whilst all COST Actions have at least one publication that is relevant to SDGs, only 65% of the publications of these COST Actions are relevant to SDGs. Still, relating it to other indicators, such as the presence of governmental partners, policy citations, industry partners or patent citations, the SDG relevance has the highest average percentage of publications per COST Actions.

Figure 3 Average percentage of publications per COST Action that have a value for the indicators



Technopolis, based on Crossref data

## Results from the Technopolis AI Policy Concierge (AIPC)

The AIPC enabled the project team to conduct a macro analysis of COST Action reports as an intermediary step for selecting twelve Actions for the case studies. Technopolis Group developed this internal tool powered by generative AI to support and streamline qualitative analysis of policy-relevant documentation. The process included identifying common tendencies and more unexpected or uncommon features across COST Actions.

Regarding instruments, most project reports acknowledge deploying STSMs, conference grants, virtual networking tools, and multiple communication activities. Less than 40% of the respondents referred to COST Science's informed policy advice, and less than 15% mentioned the CIG, which aligns with expectations. COST science-informed Policy Advice is a centralised activity with only a limited number of COST Actions receiving training in approaching policymakers. In the case of the CIG, the instrument is an additional add-on grant awarded only to a handful of Actions each year to support the development of their innovative ideas. Regarding innovation outputs, only 15% of the project reports allude to start-up activities stemming from cost projects. In contrast, over 60% reported creating relevant databases for science and technology research.

Most projects also deployed similar dissemination strategies, the most common of which included running webinars and virtual conferences using social media tools. About half the projects published online video abstracts on YouTube and created online dashboards. The most original cases included the development of podcasts (11%), Massive Open Online Courses (8%) and mobile applications (6%). Through follow-up interviews, the project team identified that project reports sometimes slightly overstated specific achievements regarding interactions outside academia. For example, over 90% of the projects refer to engaging with non-academic actors by relying solely on information in project reports. However, most reported information about such interactions was vague; therefore, this high percentage is likely to be overstated or correspond only to light forms of engagement. The most common examples include private companies (65%) and public authorities (56%). About 20% of the projects mention interactions with civil society organisations and hospitals.

As a final search approach, we used the AIPC to identify original or highly unexpected outcomes within COST Actions. This approach enabled us to find distinctive contributions. Examples include:

- The introduction of brachytherapy for cervical cancer treatment and collaboration with NASA on the impact of spaceflight on cancer risk.
- The creation of a Pan-European Educational Platform on Multidrug Resistant Tumours and Personalised Cancer Treatment.
- The creation of the first "non-territorial autonomy" university textbook has become an essential resource for higher education courses on ethnic politics, conflict resolution, and minority rights.
- The identification of aerogel technology as a Top 10 emerging technology in chemistry by the International Union of Pure and Applied Chemistry.
- The creation of a "Preparedness Tool connected to Telemedicine Platform" and an innovative observatory for mosquito control.

These examples illustrate the diversity of impactful contributions stemming from COST Actions, many of which were unforeseen at the project's inception. Such findings underscore the value of fostering collaboration across borders, disciplines, and sectors. They also highlight the potential of COST initiatives to produce academic outputs and practical tools and technologies with real-world applications. As we move forward, the AIPC will remain a critical

asset in evaluating and showcasing the outcomes of these projects, ensuring that both anticipated and unexpected innovations continue being shared across scientific communities and beyond. In conclusion, the AIPC provided valuable insights for evaluating and highlighting the outcomes of these projects, ensuring that both anticipated and unexpected innovations were identified and communicated to scientific communities and other key stakeholders.

### 3.2 Overview of the selected cases

As described in chapter 2 on methodology, 12 cases were selected, supported by an indicator-based selection process (see Table 1). The final decision for selection was taken by COST based upon Technopolis' evidence-based preselection.

Table 3 provides an overview of the 12 cases selected. It shows that most of the cases cover three or more indicators. Almost all cases show some economic and policy potential according to the publication analysis. Four cases can be allocated to the medical sciences and another four to chemical sciences or engineering. Two of the cases focus on environmental sciences and another two are in the field of social sciences, law and history.

Table 3 Overview selected cases

#	CA	Research topic	instruments	partners	innovative product	Social innovation	Economic potential	policy/societal potential	discipline	Country chair
1	CA17112	Drug Induced Liver Injury	0	0	0	0	1	1	Clinical medicine	Spain
2	CA18112	Mechanochemistry for sustainable industry	0	0	1	1	0,5	0	Chemical engineering/ sciences	France
3	CA18117	Gynaecological rare cancer research	0	1	0	1	0,5	0,5	Basic/ clinical medicine, health sciences	Malta
4	CA18125	AeroGels for environment and life sciences	1	1	1	0	0,5	0,5	Chemical/ environmental engineering	Spain
5	CA17104	Multidrug resistant tumours	1	0	1	0	0,5	0,5	Basic medicine, biological/ chemical sciences	Italy
6	CA16225	Cardioprotective therapies	0	0	0	0	1	1	Basic medicine, Clinical medicine	UK
7	CA18114	Nonterritorial autonomy	0	1	0	1	#NV	#NV	Law, Political Science, Sociology	North Macedonia
8	CA17109	Compound events	0	0	0	0	0,5	1	Earth & related environmental sciences	Germany
9	CA18109	Tsunami hazard and risk analysis	1	1	0	0	0,5	1	Earth & related environmental sciences	Germany
10	CA18119	Local actors in European welfare	1	1	0	0	0	0	History, political science, sociology	France
11	CA16227	Mosquito nano-tech-repellents	0	0	1	1	0,5	0	Biological sciences, chemical engineering	Portugal
12	CA17113	Trapped ions	0	0	1	0	1	0	Chemical sciences, informatics	Sweden

Technopolis, classifications are based on the document analysis and scientometric analysis.

In the following, each case is presented in a case study of 2-3 pages in more detail.

## 4 Case studies of highly innovative COST Actions

The following chapter includes all COST Actions that were analysed for this study. Three of these case studies are **highlight cases**:



**CA17112 PRO-EURO-DILI-NET**



**CA18114 ENTAN**



**CA17113 TIPICQA**

The highlight cases provide particularly good examples of the different types of innovation in different contexts and stand out visually. They are followed by the other nine case studies.



### 4.1 Highlight Case **PRO-EURO-DILI-NET**: Involving relevant stakeholders from industry and regulatory agencies for groundbreaking impacts in clinical practice

#### PRO-EURO-DILI-NET: Key Figures

<b>Code</b>	CA17112
<b>Name</b>	Prospective European Drug-Induced Liver Injury network (PRO-EURO-DILI-NET)
<b>Duration of Action</b>	10/2018 – 04/2023
<b>Field of research</b>	Clinical medicine
<b>Innovation type</b>	<ul style="list-style-type: none"> <li>• Innovative partner structure</li> <li>• methodological innovation</li> </ul>
<b>Link</b>	<a href="https://proeurodilinet.eu">https://proeurodilinet.eu</a>

#### How can COST Actions contribute to innovation - what this case shows:

The COST Action has contributed to significant innovations by fostering strong collaborations with both industry and governmental organisations. These partnerships were essential for developing clinical guidelines and regulations for drug development in areas in which no consensus had been existing before. The Action's impact is also evident in the long-term success of the EASL DHILI Consortium, which has become one of the key societies in Europe that strengthen the EU research landscape.

#### Why address DILI?

Drug-induced liver injury (DILI) is a disorder whereby drugs (including pharmacological therapies, traditional medicines, and herbal or dietary supplements) cause liver damage. Two forms of DILI exist: intrinsic DILI, which is dose-related and occurs shortly after exposure, and idiosyncratic DILI, which is unpredictable, driven by host factors and can occur after several



weeks. This second form, idiosyncratic DILI, poses a major risk in drug development and clinical practice.

PRO-EURO-DILI-NET was initiated to address the complex challenge of DILI. It recognises the significant unmet need for a deeper understanding of idiosyncratic DILI. The primary goals of the Action were to create a cooperative interdisciplinary network of diverse stakeholders across Europe, which encompasses academic researchers, industry experts, regulatory agencies, and patient advocacy groups. This should coordinate efforts in DILI research, facilitate the exchange of knowledge, and promote the translation of research findings into clinical practice.

In interviews with **Prof Raul Andrade** from University of Malaga, Chair of the Action, and **Francisco Javier Cubero** from University of Madrid, STSM Coordinator and Principal Investigator of Horizon Europe Grant Halt RONIN, we discussed the innovative approach in the Action structure and its impacts for clinicians, regulators, and the pharmaceutical industry.

### Collaborative efforts with industry and regulatory agencies

The innovative aspect of the Action lies in its **unique partner structure**. The strategic involvement of industry and governmental stakeholders created a powerful and effective network. This partner structure has been key to the Action's success in filling skill gaps, advancing knowledge in DILI, contributing to policy development as well as improving public awareness and clinical practice.

The network with industry and governmental actors was built through a combination of strategic activities and leveraging existing connections. First, an important precondition for building this network was the long-standing **reputation** and extensive experience of the core group of the Action. Having worked in the field for many years, these individuals had already established contacts with many key figures, including regulators and industry professionals. This existing network provided a strong foundation for further collaboration. Secondly, **international conferences and joint meetings with regulatory authorities** funded by the COST Action played a crucial role in establishing effective communication channels between these different stakeholder groups. These meetings held both virtually and physically, facilitated the exchange of interdisciplinary expert opinions and fostered further collaboration.

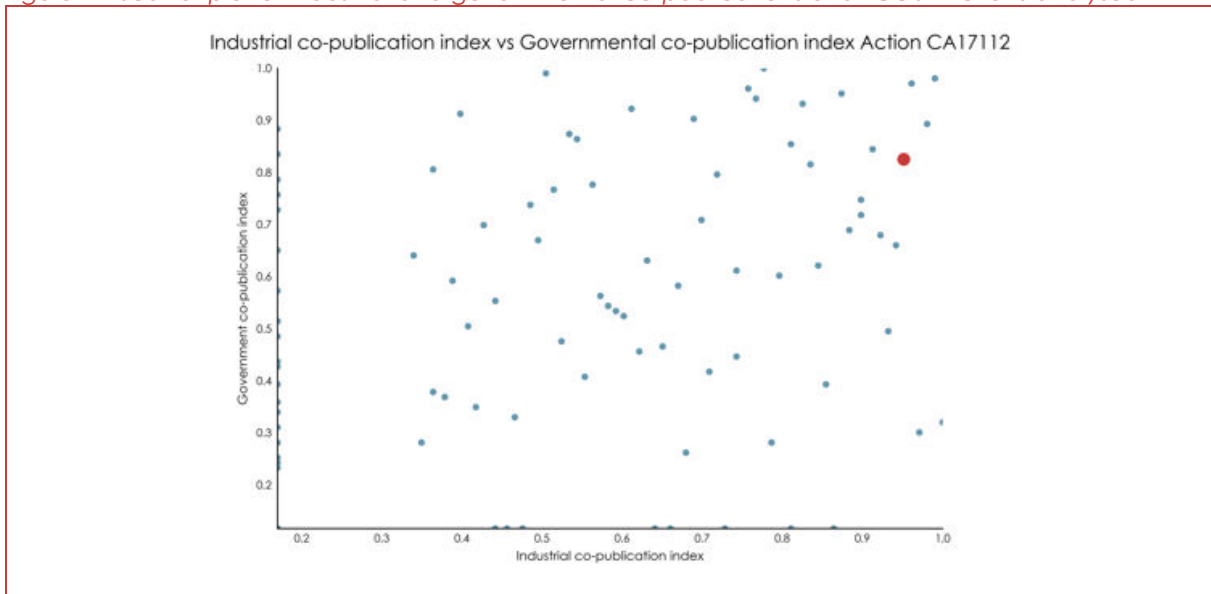
Alongside the highly reputable and well-connected individuals managing the Action, young researchers new to the field were an important part of the COST Action (well-balanced mix). This combination has been crucial in filling skill gaps and teaching new participants the necessary skills to become experts. One of the key activities to develop knowledge and skills and to take advantage of the established research network was **STSMs**. STSMs allowed researchers, especially Young Researchers and Investigators (YRI), to visit other labs or groups and engage in specific projects within the network. This enabled participants to acquire new techniques, manage specific diagnostics, utilise tools and laboratory techniques used in other centres, and establish lasting collaborations. One notable example involves the use of transparent fish models to observe the transfer of drugs through organs. Traditionally, research involves mice, rats, or human cells. Researchers expressed interest in this innovative technique used in a facility in Turkey. They were sent there to receive hands-on training in the applications of these models. Following the initial STSMs, the labs established regular collaborations and meetings.

### Building consensus and advancing clinical practice

The Action's members produced 33 publications with a high share of industry and governmental co-publications, developed a standardised approach to DILI diagnosis and management as well as created a comprehensive database for DILI patients.

The impact of the Action is driven by the unique partner structure, which includes diverse stakeholders, including academic researchers, regulatory agency representatives and industry professionals. This collaborative environment has enabled the creation of significant outputs as evidenced by the strong co-publication record with both industry and governmental actors (see Figure 4).

Figure 4 Scatter plot of industrial and governmental co-publications of all COST Actions analysed



Scientometric analysis by Technopolis. The red spot indicates the location of the publications of PRO-EURO-DILI-NET. Data sources: CrossRef, OpenAlex, Patstat, Overton.

One of the most notable impacts of these collaborations was the development of the **EASL Clinical Guidelines**. These guidelines provide practical strategies for the detection, diagnosis and prevention of DILI, marking a groundbreaking achievement as the first unified protocol in the field that serves as a major guidance for clinicians, regulators, and the pharmaceutical industry.

For leveraging the synergies and competencies of the Action network, members have been awarded a **Horizon Europe Grant** (Halt RONIN) to discover specific biomarkers for detecting DILI during drug development. All members of this consortium are former Action members. This fact highlights the continuity and strength of the network.

### Lessons learned

This COST Action highlights the importance of early, strategic engagement with key stakeholders, experienced leadership, and an inclusive approach to participation.

Involving industry and regulatory stakeholders from the beginning in an open and flexible manner fosters strong networking opportunities and international collaborations. This highly inclusive stakeholder approach helps drive meaningful impact in clinical practice. An

experienced management team, composed of highly reputable and well-connected experts, helps in building collaborations with regulators and industry actors.

A distinctive feature of COST is its emphasis on accessibility, allowing individuals without advanced skills and expertise – but a general interest in the field – to participate. This allows young and inexperienced researchers to get involved, discover their potential and develop into skilled investigators. This inclusiveness is particularly beneficial for research fields where new talents need to be grown and fostered to, making COST an ideal platform to ensure the growth and sustainability of the research community and educate the next generation.

According to Raul,

*“In practical terms, the most visible impact of COST was to welcome anyone with interest, regardless of expertise level. COST creates an open door for people from diverse backgrounds to become part of a dynamic research community. This inclusiveness is crucial for sharing knowledge, sparking education and discovering new talent. COST is all about making it easier for people to step into the research world who might not otherwise have a platform.”*

**Prof Raul Andrade, Chair of PRO-EURO-DILI-NET**

### Outlook

The publications resulting from the collaborations within the Action will address crucial preclinical and clinical phases of drug development as well as the post-marketing setting. These publications are expected to pave the way for a fundamental change in how drug safety is monitored and how liver toxicity is diagnosed and managed. This goes for both the phase of drug development and of clinical practice. Ultimately, patients and healthcare systems worldwide will benefit from this.

The COST Action contributed to the establishment of the EASL DHILI Consortium, which is one of the most important societies in the field. This consortium ensures the continuation and sustainability of the collaborative efforts and advancements that were achieved during the COST Action. This is intended to keep the momentum alive and further strengthening the research landscape in Europe.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Action Chair Prof Raul Andrade & Action participant and PI of Horizon Europe Grant Halt RONIN Francisco Javier Cubero
- Website (<https://proeurodilinet.eu>)



## 4.2 Highlight Case ENTAN: Harnessing a sensitive concept for the benefit of communities

### ENTAN: Key Figures

<b>Code</b>	CA18114
<b>Name</b>	European Non-Territorial Autonomy Network (ENTAN)
<b>Duration of Action</b>	02/2019 – 08/2023
<b>Field of research</b>	Law, Political Science, Sociology
<b>Innovation type</b>	• Social output innovation
<b>Link</b>	<a href="http://entan.org">http://entan.org</a>

### How can COST Actions contribute to innovation - what this case shows:

ENTAN is an example for COST Actions that make use of various innovative outreach activities and educational products to deal with sensitive political research and to enhance their societal impact. This requires a careful inclusion of stakeholders' perspectives and the (professional) development of educational formats.

### What is the concept of NTA?

Minority issues are often difficult to resolve in political systems ('tyranny of the majority'). One solution is, for example, federalism (i.e. decision-making autonomy of regions), but this implies that the minority in question lives in a concentrated area. The concept of non-territorial autonomy (NTA) is a model strengthening rights of self-government for spatially dispersed minorities. It includes decision-making rights for members of (e.g. linguistic or ethnic) minorities. In the social and legal sciences, the concept of NTA was empirically and theoretically underdefined.

The COST Action ENTAN was initiated to address this lack of research. ENTAN aims to build a network that explores comparatively and more profoundly existing concepts of NTA. It also works out the possibilities the concept offers to decision makers in practice.

In interviews with **Prof. Ivan Dodosvki** from University American College Skopje, Chair of the Action, and **Adrian Borka** from the Provincial Secretariat for Education, Administration, Regulations, and National Minorities of the Autonomous Province of Vojvodina, participant of the Action, we discussed the innovative approach in the Action structure and its impacts for the political sphere.

### Innovative products for practitioners and educators

ENTAN was innovative regarding the **activities and outputs aiming at social impacts**, namely that practitioners used its trainings and videos to address social problems and educators utilised the university textbook and videos on NTA for teaching.

Minorities with aspirations to self-determination and resulting tensions exist in many states in Europe. ENTAN aimed to include the perspectives of these different countries and minorities to provide a comprehensive and comparative overview that informs the concept of NTA. However, due to the **political sensitivity** of the topic, the ENTAN consortium faced challenges

in involving participants from several countries. They therefore developed a **strategy to involve researchers from specific countries** targeted by active invitation. After expanding the network of scholars, non-academic stakeholders, including community leaders and civil society activists, were invited to training schools and conferences as participants or speakers.

A particularly innovative approach was used for **training schools**. Here, employees of institutions that deal with minorities and jurisdictions became participants along with YRIs. This was crucial to engage these stakeholders deeply with the concept of NTA, as the example of an inspector for language rights of a provincial government in Serbia illustrates. He participated in a training school on the systems of minority protection in different countries, as well as in the final conference of ENTAN. Through the training school, he gained multiple new perspectives and expanded his network.

Secondly, ENTAN pursued a **strong educational approach**. The consortium set this focus since the concept of NTA has to be explained well to the public and political stakeholders to avoid misunderstandings. As outreach activities, they developed **videos**, produced by a professional company. To reach also the wider public, different media outlets of the countries involved were invited to events. ENTAN participants were also motivated to develop even more innovative products, for instance, an art exhibition. However, this could not be realised within the framework of COST funding. To address also the need for educational material in the university context, the first university textbook on NTA was published by ENTAN.

### Raising awareness about the potential of NTA

ENTAN resulted in multiple deliverables: 22 open-access, peer-reviewed publications, including three conference proceedings volumes, an NTA state-of-the-art report, an NTA university textbook (the first of its kind), and an [online database](#) of NTA research. It also contributed to dissemination deliverables, namely 150 videos, including conference presentation recordings, educational videos, and 12 policy papers.

According to the interview partners, the ENTAN training schools and outreach activities significantly **advanced the understanding of NTA** within the academic community and contributed to changing entrenched assumptions on self-determination and the territoriality principle. It also had benefits for society by raising awareness among policymakers and administrations about the potential of NTA for conflict prevention and social development. For instance, an interview partner reported that since his participation he is more confident with his governmental work on minority rights and uses still the resources that are available on the ENTAN website.<sup>9</sup>

### Lessons learned

ENTAN is an interesting example for other COST Actions that take on the challenge of influencing **the political and social sphere**. First of all, ENTAN shows that a necessary precondition for this is involving researchers who are not only engaged scientifically but also have a social (and teaching) interest. In the case of ENTAN, for instance, individuals participated with a clear interest in supporting specific minorities.

*"We did not expect in the beginning that there would be so many outputs with societal impact [...] But it lies in the nature of our research. We work on issues important to the communities and so we wished to do more than publish a paper."*

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<sup>9</sup> We rely here on qualitative data only, as no citations of ENTAN publications in policy papers could be identified.

*Researchers wanted to step beyond the scientific circles to do something for a country or a national minority. COST supported that."*

**Prof Ivan Dodovski, Chair of ENTAN**

Secondly, it illustrates that societal impact is achieved best when **practitioners are directly involved in COST Action formats like training schools** and are targeted with specific products like videos.

### Outlook

The NTA university textbook has broadened the availability of educational resources and is now and will continue to being used in higher education courses on ethnic politics, conflict resolution and minority rights.

After the end of the COST Action, an informal research group was established. Even though it currently does not receive funding, scholars will be kept involved and informed about each other's work.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Ivan Dodovski (Chair) and Adrian Borca (practitioner that participated in training)
- Website: <http://entan.org/>



### 4.3 Highlight Case TIPICQA: Joining efforts in highly innovative research fields to develop and capitalize on new technologies

#### TIPICQA: Key Figures

Code	CA17113
Name	Trapped Ions: Progress in classical and quantum applications
Duration of Action	09/2018 - 03/2023
Field of research	Quantum technologies
Innovation type	(Economic) output innovation
Link	<a href="https://www.cost.eu/actions/CA17113/">https://www.cost.eu/actions/CA17113/</a>

#### How can COST Actions contribute to innovation - what this case shows:

In highly supported innovative research fields COST Actions can add further momentum by fostering collaborations between individually funded research groups. Joint efforts to share experiences in the development of technologies push the boundaries of knowledge and catalyse the commercialisation of technologies. This COST Action contributed to the advancement of ion trap technologies and facilitated the creation of several start-up companies.

#### Understanding the potential of ion trap technologies

If being further developed, ion trap technologies have the potential to improve everyday life in various areas. They could, for example, enhance encryption methods and make digital communications more secure against cyber threats, or provide extremely accurate timekeeping, which would improve GPS systems or boost the reliability of financial systems that rely on precise timing. The scientific field of quantum technologies in itself is very much pushed through large scale funding initiatives, foremost by the European Union scientific research initiative 'Quantum Flagship', which has a budget of €1 billion.

TIPICQA's main goal was to bring together different research groups, those that conduct basic research and those from Quantum Flagship projects which are targeting higher Technology Readiness Levels (TRLs), to share experiences on how to develop trapped ion technologies. The COST Action provided a platform to develop new tools, technologies and ideas for classical and quantum technologies with trapped ions.

In interviews with **Prof Markus Hennrich** from Stockholm University, Chair of the Action, and **Dr Amado Bautista-Salvador**, Vice Leader of Working Group Tools and Infrastructure & co-founder of QUDORA Technologies, we discussed the Action's contributions on economic output innovation.

#### How COST contributed to advance technologies and capitalise on them

The Action has contributed to **advancing the field of trapped ion technologies scientifically and developing economic product innovations** in form of start-ups. The exchange of ideas, knowledge and experiences as well as collaborative problem-solving between highly specialised research groups enabled breakthroughs in trapped ion technologies that individual

groups might not have been able to achieve alone. The COST Action on trapped ions fostered this collaboration and knowledge sharing across a wide network of research groups, bringing together expertise from theoretical and experimental work. This collaborative environment helped the groups to keep up to date on activities and technologies in the field, leading to more rapid advancements and paving the way for **11 start-up companies**, that were founded during the COST Action for building commercial trapped ion quantum computers and for developing quantum algorithms/software.

An effective measure to strengthen networking within the community was the creation of the **Ion Trapper's Newsletter (ITN)** on recent publications, job postings and conference announcements on trapped ions with a global reach of 1100 subscribers. These monthly updates helped to raise awareness of new technologies and activities appearing in the field, drive new ideas and start collaborations. The newsletter will continue to be published, addressing not only the European but also the global trapped ions community.

For research groups wishing to expand their knowledge of certain technologies, the Action developed a series of focused **virtual one-day meetings** with around 200 to 300 participants. For instance, one research group aimed at setting up a cryogenic trap ion system and demanded deeper knowledge on how to set up and operate such a system. As part of this series, they organised the Cryogenic Ion Trapping Day which focused on the use of ion traps in cryogenic environments and invited speakers from Europe and beyond to share their hands-on experiences with building such systems and best practices for the operation. In addition, one of their PhD students visited a research group in Boulder, Colorado, during a **STSM** to learn how to build cryogenic ion traps.

Apart from STSMs, **Early-Career Conferences on Trapped Ions (ECCTI)** and **Training Schools** also gave YRIs a platform for scientific exchange and collaboration. ECCTIs were organised by PhD students and postdocs and provided opportunities to share work and ideas, fostering vital discussions, collaborations and the development of skills that are necessary for a career in research or the industry. In addition, educational events at these conferences, for instance on proposal or scientific paper writing, contributed to the advancement of careers and skills of YRIs. The series of such ECCTIs has been continued beyond the Action's lifetime.

### Supporting Young Researchers and Innovators

As a result, the Action produced a newsletter to inform the community about recent updates in the field, a public webpage, several databases and 26 publications.

*"This Action was all about sparking the kind of collaboration that leads to new ideas. It's tough to make big advances in quantum technology as isolated teams, so getting people across Europe together helped us explore new directions faster and find the connections needed to bring innovative ideas to market."*

**Prof Markus Hennrich, Chair of TIPICQA**

YRIs particularly benefited from these collaborations by advancing their careers and frequently securing job offers, often in the growing number of start-ups in the trapped ion field. Research groups from smaller European countries that were previously rather isolated within the field (geographically or because of being the only group within their country) are now integrated into the community.

### Lessons learned

This Action offers valuable lessons for other COST Actions, emphasising the importance of interaction and collaboration in advancing the field and fostering the growth of start-up



companies. Progress cannot be made in isolation; thus, knowing and leveraging one's network through topic-focused meetings and STSMs can significantly enhance knowledge exchange and accelerate the transfer of knowledge to socio-economic applications.

Additionally, cultivating an entrepreneurial mindset within the scientific community is crucial for capitalizing on innovative solutions that emerge from research. Early patenting of intellectual property is a vital step toward commercialisation in this context.

Finally, maintaining an active research community can be bolstered by regularly disseminating information through newsletters that highlight Action news, job advertisements, recent publications, upcoming meetings, and collaboration opportunities.

### Outlook

The number of spin-off companies that have been founded by COST Action participants recently prove the economic potential of trapped ion quantum technologies by solving complex numerical problems that were not tractable before. The COST Action accelerated the development of these new technologies and solutions by facilitating collaborations and knowledge exchange. This enabled joint project applications and secured current funding for advanced quantum computation technologies.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Action Chair Prof Markus Henrich and Vice Leader of WG 1 & co-founder of QUDORA start-up Dr Amado Bautista-Salvador
- Website (<https://www.cost.eu/actions/CA17113/>)

#### 4.4 MechSustInd: Enhancing sustainability in chemical industry through strong industrial partnerships and active community engagement

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA18112	Mechano-chemistry for Sustainable Industry (MechSustInd)	02/2019 - 08/2023	Chemical engineering, Chemical sciences	activity & methodological innovation	<a href="http://www.mechsustind.eu">http://www.mechsustind.eu</a>

##### How can COST Actions contribute to innovation - what this case shows:

- The COST Action's innovative partner approach has successfully contributed to the innovation of mechanochemistry and the green transition of the chemical industry by significantly increasing industrial collaborations and establishing a strong and committed research community within the network. These efforts have led to establishing of standardisation efforts, sustainable industrial practices, and secured strong collaborations as well as funding for further research and development.

##### Overview: Starting point, goals and results

The COST Action **MechSustInd** focuses on the development of the field of mechanochemistry and mechanochemical techniques within the context of chemical, pharmaceutical industries and process engineering. It aims at achieving sustainable and environmentally friendly industrial processes. Research has shown that mechanochemistry enables the reduction or elimination of solvents by ensuring increased yields and scope of substrates compared to solution-phase synthesis, the exploration of new synthetic pathways, safer and simplified processing as well as access to products that can be formed only under mechanical activation conditions.

MechSustInd aimed at establishing a multi-disciplinary network of European and international scientists, engineers, technologists, entrepreneurs, industrialists and investors to promote fundamental and applied research in mechanochemistry and raise awareness on its sustainability potentials. The Action is aligned with the strategic view of the European industry (Green Deal – zero waste objective) and with the United Nation Sustainable Development Goals, contributing to accelerating the green transition of the chemical industry.

The Action contributed to more than 200 publications in leading scientific and open access journals in the field of mechanochemistry, produced an educational book on practical mechanochemistry, and made available a database of experimental facilities, expertise and skills in the Action network to foster collaboration.

##### What makes COST Action MechSustInd innovative?

The COST Action stands out because of its **innovative partner approach**, which is extending the network especially through a strong involvement of industry and the motivation and empowerment of new members, especially YRIs. Among other factors, this contributed to **the scientific advancement of the field of mechanochemistry** to make chemistry, especially pharma industry, more sustainable in the future.

##### Involvement of the industry

Although mechanochemistry has been known for millennia, its application in organic synthesis remained largely limited to laboratory-scale experiments. Convincing industry professionals to move away from traditional solvent-based and energy-intensive methods toward

mechanochemical processes proved to be a significant challenge. However, the successful application of mechanical methods across diverse scientific and technological fields in recent decades attracted growing interest in this approach. This COST Action played a key role to unite the community, which was fragmented in many different directions. As a result, the community of researchers currently working in this field and those interested in implementing the topic in their R&D activities gained visibility and were recognised by the relevant stakeholders. Direct contacts with industry partners have proven especially successful in expanding the mechanochemistry network, fostering greater collaboration and interest from industrial sectors.

**Annual working group meetings and conferences** were open not only to academic researchers but also industrial stakeholders, allowing participants to share experiences and recognise mutual interests. Apart from the chance to present research results in presentations and workshops, coffee breaks and social activities in between have proven to be helpful in facilitating direct interactions with industrial stakeholders, leading to joint applications for instruments like STSMs.

Companies played a crucial role to give COST members **access to their facilities**, allowing scientists to use company equipment for free, supply large quantities of chemicals and develop new skills by working in different settings. These collaborations were instrumental in advancing scientific knowledge and techniques.

These industry-academia collaborations proved to be a win-win situation, as they helped companies to learn about the potentials of mechanochemistry in their productions as well as very much trained scientists with new skills and exposed them to industry-specific needs.

#### Encouragement of active membership and sense of ownership

The Action's management was crucial in fostering commitment within the network. The Chair held **individual meetings** with each new member to jointly identify their scientific interests and skills, ensuring they could contribute meaningfully to the Action. This personalised approach, though time-consuming, gave members responsibilities and allowed them to choose tasks that interested them, fostering a higher sense of ownership and responsibility as they were more likely to be invested in topics they found enjoyable and meaningful.

The Action also made use of a variety of COST instruments to engage and give responsibilities to **YRIs**, recognising their commitment, eagerness to learn and strong desire to build networks and enhance their CVs. The Action contributed to the first **training schools** in mechanochemistry, providing YRIs the opportunity to advance their knowledge and interact with leading scientists in the field. After transitioning from in-person to online formats during the pandemic, the training schools adopted a hybrid model to include more participants who might not have the means to attend in person. Additionally, in a **webinar series** started during the pandemic, PhD students were given the chance to present their work. This trained them to present their research, build their own networks and create contacts for future career development. The approach eventually also attracted people working in mechanochemistry from outside the Action, leading to their involvement as members.

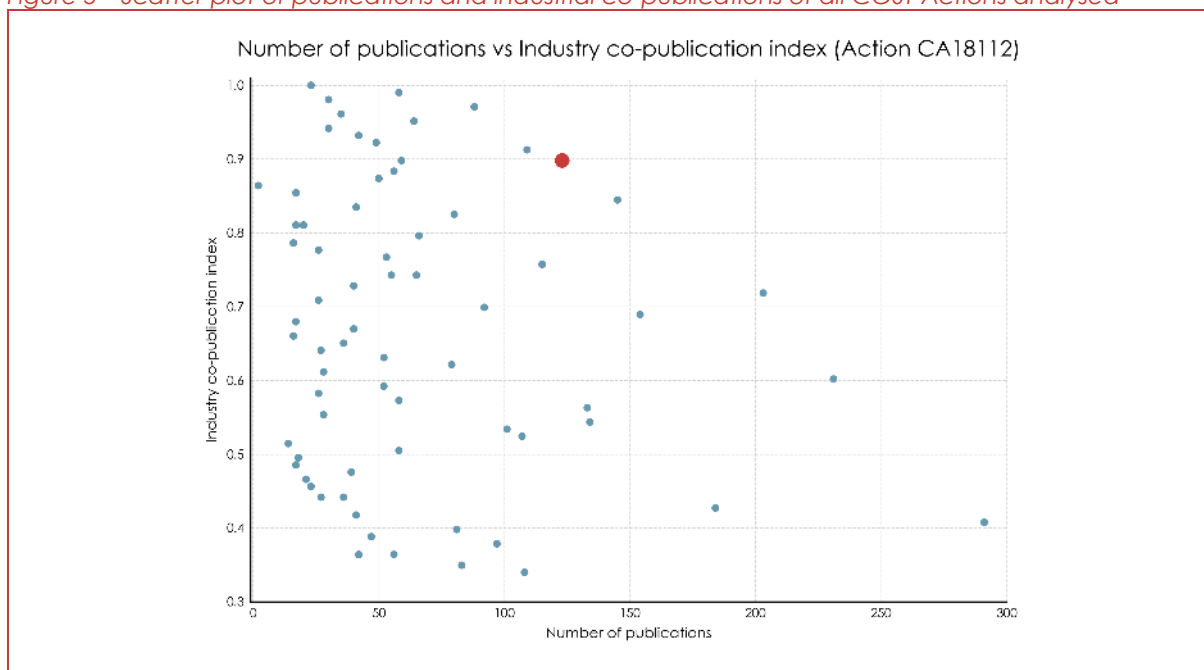
**Clear criteria for grants** such as requiring attendance at meetings to qualify for STSMs further encouraged active participation and collaboration. This inclusive and empowering management strategy significantly contributed to a dynamic and collaborative environment within the Action.

### What is the impact of the innovation?

Given the long history of using solvents in chemistry, transitioning the industry to greener practices is a gradual process. Whereas mechanochemistry was already a reality in some areas at the beginning of the Action, it was rarely adopted in the pharmaceutical industry, which is one of the sectors most prone to issues of pollution. However, proactive efforts to engage industrial stakeholders, both from SMEs and large pharmaceutical companies, have raised awareness of mechanochemistry's potential to make industrial processes greener, more efficient, and cost-effective. An increasing interest from regions such as China, Japan, Mexico, and the US demonstrates a global recognition of this innovative approach to chemistry. An analysis of industrial co-publications by members of this COST Action underlines the strong partner structure with the industry in comparison with other COST Actions.

One of three key achievements out of this Action are negotiations taking place with the International Union of Pure and Applied Chemistry (IUPAC) for defining **symbolisms and terminology in mechanochemistry**. They led to the establishment of a working group and the organisation of a symposium that showed the importance of this work for IUPAC. These efforts in the field of standardisation are important for the expansion of research work in order to find sustainable solutions for the industry.

Figure 5 Scatter plot of publications and industrial co-publications of all COST Actions analysed



Scientometric analysis by Technopolis. The red spot indicates the location of the publications of MechSustInd. Data sources: CrossRef, OpenAlex, Patstat, Overton.

Secondly, the strong community built during the Action's lifetime facilitated the creation of a **European interdisciplinary mechanochemistry community** through establishing a 'Working party on Mechanochemistry' within the European Chemical Society (EuChemS). This ensured that the research and collaborations within the network continued after the Action's termination.

A third crucial impact on the mechanochemistry community was that the increased understanding and awareness of mechanochemistry's impact on sustainability significantly

improved the chances of **securing funding** at both European and global level. This was still a considerable challenge a few years ago. The COST Action's efforts led to the acquisition of several collaborative projects between COST members, including the **Horizon Europe Project IMPACTIVE**, which received €7.7 million in funding. This research project led by the COST Action Chair almost exclusively involves former COST Action members, demonstrating the strong community and network built during the Action. This authoritative community provided a solid foundation that helped engage big pharmaceutical companies in this new research project, ensuring effective capitalisation on EU funding.

### What can other COST Actions learn from this example?

Three main **takeaways** from this Action might be relevant for other Actions.

- **Importance of managerial skills and community building:** Managing such a diverse community requires strong management and soft skills in dealing with different cultures, scientific backgrounds and personalities. Knowing who is doing what in each laboratory, building bridges, communicating effectively, building trust and being inclusive are all essential elements for success. While time-consuming, this personal management approach fosters a sense of personal responsibility and encourages active participation. Additionally, it provides people in leadership positions with opportunities for growth in future tasks.
- **Engagement and empowerment of YRIs:** Engaging and giving responsibilities to YRIs creates a win-win situation. Young scientists are motivated, eager to learn, keen to build networks and enhance their CVs. Carefully aligning tasks with a young member's interests and skills not only motivates but also ensures a dynamic and collaborative environment, training the next generation and securing the future of the field.
- **Combination of in-person and online events:** A mix of in-person meetings, which help build up strong relationships, especially with stakeholders from outside the research community, and online events, which help include a wider variety of participants that might not be able to participate on-site, can be a fruitful strategy. This combination helps extend the network to the right stakeholders and members.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Action Chair **Dr Evelina Colacino** and Action participants **Prof Zara Cherkezova-Zheleva & Prof Aleksandar Cvetkovski**
- Website (<http://www.mechsustind.eu>)

#### 4.5 GYNOCARE : Building bridges between diverse stakeholder groups and countries

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA18117	European network for Gynaecological Rare Cancer research: From Concept to Cure (GYNOCARE)	03/2019 - 09/2023	Basic medicine, clinical medicine, health sciences	Innovative partner approach	<a href="https://gynocare.net">https://gynocare.net</a>

##### How can COST Actions contribute to innovation - what this case shows:

- An unusual partner structure of various stakeholder groups, which ranged from basic researchers to gynaecologists, clinicians, patient advocacy groups, health regulators and policymakers, helped bridge the gap between basic and clinical research and their application in the development of a roadmap for the fight against (rare) cancers. The COST Action demonstrated how to effectively bring together a critical mass of various stakeholders, while specifically being inclusive to involve patient organisations, raising awareness with local policymakers and empowering local organisations to have an impact beyond the Action's life span.

##### Overview: Starting point, goals and results

The COST Action GYNOCARE was established to address the fragmented efforts in research on rare gynaecological cancers, especially involving early diagnosis, treatment and possibly cure. Approximately 18.5 million women are annually affected by gynaecological cancers, with around 50 % classified as rare. These rare cancers pose significant challenges because of their low incidence, which makes it difficult to gather sufficient data and develop effective treatments. GYNOCARE therefore aimed at addressing these challenges and creating a European platform for Gynaecological Rare Cancer research, bridging the gap from concept to cure.

GYNOCARE has compiled a rich resource of more than 40 scientific publications in peer-reviewed scientific journals, book chapters, a reference textbook, webinars, interviews and teaching videos that will remain available even beyond the lifetime of this Action. It has expanded virtual biobanks to further European countries and has established a training curriculum for the diagnosis of rare cancers.

##### What makes COST Action GYNOCARE innovative?

GYNOCARE implemented an innovative stakeholder approach by involving and connecting high-quality scientific communities, clinicians such as oncologists, gynaecologists and surgeons, patient advocacy groups, lawyers, ethicists, health regulators and policymakers as well as representatives from the biotech and pharma industry across Europe and beyond. Without the initiative of the Action, these groups of stakeholders would not have been connected with each other. Bringing together **researchers and practitioners from various disciplines** supported capacity-building and knowledge-sharing, enabling comprehensive solutions that would not be possible within a single discipline. As an example, incorporating nanotechnology applications enhanced research on chemotherapy treatment: nanoparticles can carry drugs directly to targeted issues or cells, such as tumours in ovarian or breast cancer. This targeted delivery system improves the efficacy of the treatment while minimising side effects on healthy tissues.

Additionally, recognising that the most impactful way to address policymakers was through patients, GYNOCARE engaged directly with patient advocacy groups rather than relying solely on academia or clinicians. The network effectively **leveraged patient organisations as well as local media** to raise public awareness and interest in its initiatives, so that its findings and recommendations were not only heard but also acted upon by decision-makers. For instance, the involvement of the local population and press in a conference in Bulgaria garnered the interest of a member of the Bulgarian parliament. Media coverage played a crucial role not only in raising awareness but also in securing translators, thereby enhancing communication and advocacy efforts. This strategy ensured that the voices of those directly affected by rare gynaecological cancers were heard.

Not only did GYNOCARE follow an innovative approach in targeting these diverse stakeholder groups but also by specifically recruiting members from Eastern Europe and setting up conferences and training schools in countries that are not on the 'usual roadmap' and that lack cancer prevention and screening services. By this, GYNOCARE was able to **span geographical barriers** and empower those countries where impact was supposed to be achieved. Conferences and Training Schools in Skopje, North Macedonia, and Sofia, Bulgaria, for example, were crucial to reach intensive research capacities (ITCs) that would otherwise lack such opportunities for capacity building. These experiences gave local organisations the confidence and optimism to advance the ideas discussed during COST events. This, for example, led to the organisation of debates with policymakers, patients and other local stakeholders, driving policy change and practical implementations locally, for instance, in the implementation of education and prevention strategies.

#### How has COST contributed to this innovative approach?

COST significantly supported GYNOCARE's innovative approaches in various ways, especially through encouraging ITCs and YRIs. In general, the **reputation** of being funded by COST helped attract important stakeholders, including policymakers and scientific experts (from Europe and beyond) to attend conferences and give speeches (in person or online), thereby further enhancing the visibility and credibility of GYNOCARE.

The **conference funding**, which is based on the number of participants rather than the cost of living in the host country, incentivised conferences to be held in less prominent countries, providing participants with a higher standard (networking, social activities, etc.) for less money. ITC conference grants for YRIs furthermore enabled young researchers to travel, establish connections for future collaborations and deliver presentations usually given by professors. Members who were granted **STSMs** were able to share experiences on advanced biobanking techniques transnationally, learn about new diagnostic methods and gain insights into patient advocacy and policy making. Moreover, the **virtual mobility grants** were crucial during the pandemic as they helped bring people together and supporting young researchers to establish themselves. Through their publications and virtual mobilities, these researchers felt part of the GYNOCARE community.

#### Overall impacts

Through an inclusive stakeholder approach, which connects various research disciplines, breaking geographic barriers and involving patient organisations as well as the local press to address policymakers, GYNOCARE offers a holistic approach to women's health that addresses a wide range of aspects of rare gynaecological cancers. The GYNOCARE platform facilitated effective interaction between stakeholders, benefiting patients with rare gynaecological cancers across Europe and beyond as well as driving change in the field of gynaecological cancer research and cure. Key impacts included capacity building and networking

opportunities, especially in regions lacking access to cancer prevention and screening services like HPV vaccination and cervical cancer testing. The Action also enabled the availability of brachytherapy in previously underserved countries through collaboration of researchers, healthcare professionals, patient advocacy groups and policymakers. Additionally, by collecting and maintaining comprehensive data from national cancer registries, GYNOCARE has expanded the network of virtual biobanks to further European countries to support smarter clinical trials and compiled a wealth of open-access resources to contribute to the EU's Mission to fight Cancer.

### What can other COST Actions learn from this example?

Three main **takeaways** from this Action might be relevant for other Actions:

- Engaging a wide range of participants can enhance the impact and sustainability of the Action. Directly **involving the target group** – in this case patients and patient organisations – can effectively influence policymakers and ensure that research findings are translated into practical policy changes. This approach can be more impactful than reaching out through academics or clinicians.
- **Utilising local media** helps to amplify the voices of the target groups and attract public and political attention.
- Concentrating efforts in countries where the mission's impact would be most significant by recruiting COST Action members from these countries and hosting local meetings, conferences and training schools helps **build local capacity, foster collaboration and tailor initiatives to the specific needs and contexts** of these regions. Empowering local organisations and raising awareness among local policymakers facilitates sustainable change and enhances the overall impact of the mission, even beyond the lifetime of the Action.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Action Chair **Prof Jean Calleja Aguis**, President of Bulgarian Breast and Gynaecological Cancer Association **Dr Mariela Vasileva Slaveva** & President of the Macedonian Association of Obstetrics and Gynecology **Prof Gligor Tofoski**
- Website/ further readings: [www.gynocare.net](http://www.gynocare.net)



#### 4.6 AERoGELS: Extending the network to new stakeholder groups while keeping a strong community mindset alive

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA18125	Advanced Engineering and Research of aerOGels for Environment and Life Sciences (AEROGELS)	09/2018 - 03/2023	Chemical/ environmental/ materials/ medical engineering, nano-technology	Innovative partner structure & product innovation	<a href="https://cost-aerogels.eu">https://cost-aerogels.eu</a>

##### How can COST Actions contribute to innovation - what this case shows:

- The COST Action has successfully driven innovation by extending the aerogel network to new research fields and industrial stakeholders, for example via industry-academia forums, STSMs, and a COST Innovator Grant, while at the same time fostering an inclusive community. It promoted a collaborative environment where members could openly exchange ideas without hard competition and regardless of their position, country, age or gender. All these factors contributed to the growing influence of this research field in science and industry.

##### Overview: Starting point, goals and results

The COST Action AEROGELS focused on the advanced engineering and research of aerogels for environmental and life sciences applications. Aerogels are a unique class of mesoporous materials characterised by their high porosity and customisable physico-chemical properties such as high air content, low thermal conductivity, high specific surface area, low density, and lightweight. While aerogels have already found applications in construction and aerospace industries, their potential in other areas was still largely unexplored. For instance, in the biomedical field, aerogels could be used for advanced wound dressings or bone grafts. They could also be highly effective in the environmental sector for heat and sound insulation as well as for the detection and treatment of air and water pollutants. These and other potential applications were examined within the Action network.

The **main objective** of AEROGELS was to harness the expertise of European academia, industry and regulatory bodies to explore the use of aerogels in addressing two significant European challenges: the circular economy and active ageing. The multidisciplinary approach aimed to advance the state of the art in aerogel technology, focusing on both material performance and health and environmental implications.

The Action produced more than 150 publications, including scientific reports, joint publications, and review papers, as well as the development of a database available for Action members for the production and characterisation of aerogels.

##### What makes the COST Action AEROGELS innovative?

AEROGELS exemplifies how **strategic collaboration, inclusivity** and **targeted support** can drive innovation. According to the interview partners, the sense of community and the idea that there is no hard competition within the network was key to the success of the Action. The freedom of each member to share ideas and knowledge regardless of age, career level, country or gender has motivated them to put in the extra work and realise what it was worth in the bigger picture. This sense of community and the empowerment of early career researchers paired with the extensive use of various instruments provided by COST to bring together diverse

expertise and align academic research with industry needs has enhanced the practical impact of research in this field.

Originally, the Action brought together a small but dedicated, predominantly academic community of around 20 to 30 people, who were motivated to advance the topic of aerogels and foster its industrial relevance. By the end of the Action, the network had successfully expanded to 48 countries and over 600 members, incorporating a wide range of stakeholders from academia, industry and various scientific disciplines from more than 200 public research institutions and companies. Despite this strong growth, the Action proved able to maintain its **community spirit**. The enhanced synergies between the various stakeholders accelerated the translation of research findings into the improvement of existing technologies and the development of new applications to foster innovation and economic growth.

### Interdisciplinarity and integration of industry

Initially, the development of aerogels was predominantly driven by chemists, who probably underestimated the technological developments required for large-scale industrial production. This led to the misperception that producing an aerogel would only take a few days and deterred industry from taking an interest in its production. **Incorporating engineers and technological groups** into the Action network, who should think about scalability and consider practical needs and expectations of the industry, was therefore a first essential step towards raising awareness of the potential of aerogels. The affinity and experience of these groups in working with industrial stakeholders was key to successful **integration of the industry** into the AERoGELS network.

For extending the AERoGELS network, the Action made use of a variety of COST instruments. In particular, the involvement of the industry and its perspectives was achieved through organising three online and in-person **industry-academia forums**. These were innovative opportunities to find common ground and enhance collaboration between researchers and industrial stakeholders. In addition, Action members shared the objectives of the Action and recent research findings at various events and connected with industrial societies to understand their needs and foster partnerships. Several of these industrial societies, which had little or no knowledge of this topic before the Action began, in turn agreed to collaborate in organising, participating and sponsoring selected COST events. In addition, the collaboration between industry and academia was a prioritised criterion for STSM grants. As a result, the network specifically arranged **STSM research visits hosted by industry partners** to help advance innovative aerogel technologies. Finally, the network applied for and has recently been granted a **COST Innovators Grant** (ECO-AERoGELS) with two main objectives in mind. First, it aims to sustain the community beyond the duration of the Action by establishing an international association of aerogel researchers. Secondly, it seeks to promote new ideas and innovations by providing researchers with the necessary tools to support the creation of start-ups in this field. To achieve this, two pitches were organised for researchers to present their ideas. These pitches were evaluated by a consortium consisting of industrial Action members who provided valuable feedback on the innovations and suggestions for implementation. The grant, which lasts for one year, enables crucial support needed in the early stages, for example in the development of proofs of concept.

### Breaking career levels, age, gender and geographic barriers

Apart from extending the network to industrial stakeholders, the Action emphasised the involvement of **YRIs**, who account for around 70 % of all Action members, across Europe, especially to support researchers from countries with less intensive research capacity (**ITC**) and **gender equality**.

The network set up an intensive training programme to promote inclusiveness within the community regarding age, career stage, countries and genders. Several measures were implemented to favour the involvement of early-career researchers and innovators. These measures were introducing **STSMs** and **ITC conference grants**, which motivate joint publications, project fundings and PhD theses, **training schools** exclusively for early-career researchers, **prizes** for the best collaborative works and YRIs' contributions at COST Action and external events, as well as integrating YRIs in the Action **management structure**, for example in working group co-leaderships or the ITC Grant Committee. Further, as many countries as possible were involved. This effort becomes visible in the fact that **events in over 20 countries** were organised, with a special focus on ITC involvement, that more than 120 **joint publications** with at least two Action countries involved were created as well as that certain parts of the Action website were translated to the official language of each country. Additionally, the Action aimed to achieve gender balance, for example in the attribution of grants and in the management structure. These extensive efforts were one factor, among others, to build a skilled workforce, which is needed in the development of next-generation leaders in the European aerogel community as well as to translate academic research into practical, market-ready solutions.

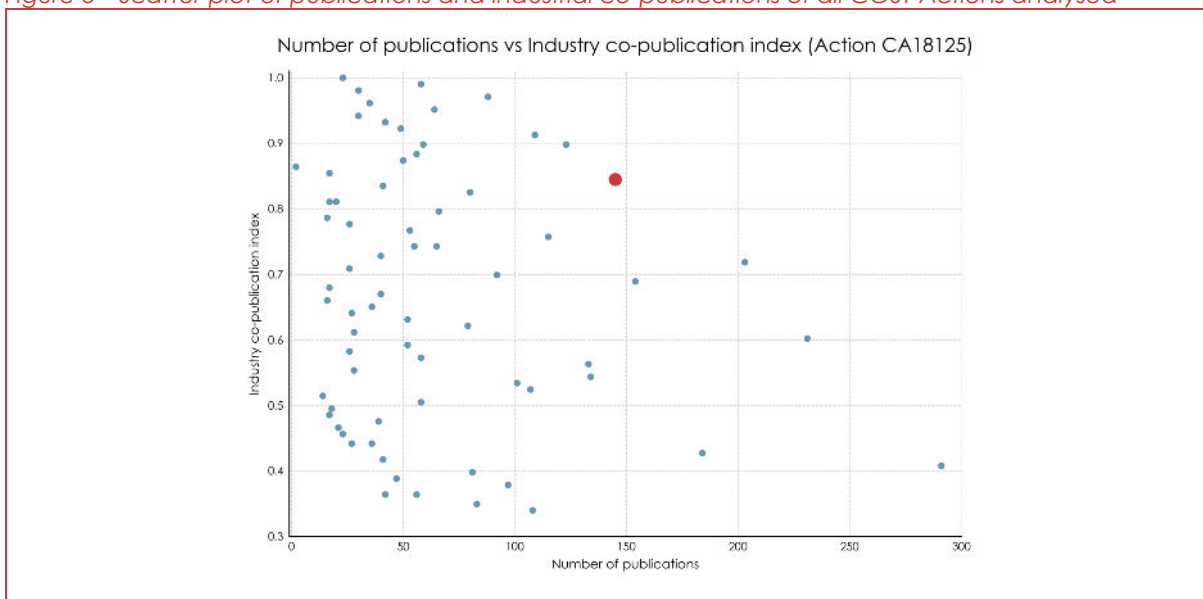
### Overall impacts

The Action contributed to the increased scientific impact of aerogels. Aerogels have been identified by the International Union of Pure and Applied Chemistry (IUPAC) as one of the **top 10 emerging technologies in chemistry in 2022**, which highlights the growing importance and potential of aerogels. In line with this, the number of **publications on aerogels has tripled** during the lifetime of the Action. The high quantity of publications during the COST Action as well as the high share of industrial co-publications, as seen in Figure 6, highlight the dynamic research environment, which is well-integrated with industry, fostering innovation and practical applications.

The increasing research on aerogels and stronger collaboration with industrial stakeholders has led the IUPAC to currently **consider redefining the term aerogel**, which is crucial for both academia and industry. For academia, the definition provides a solid foundation for studies and publications. For the industry, the definition is important for product development, patenting, protection of intellectual property and avoidance of costly legal disputes.

The collaborations with industry have led to the development of **new materials with advanced performance in various fields**. For instance, more reliable and efficient bone implants and bio-based aerogels used for acoustic insulators have been developed. The collaborations also resulted in several **spin-offs** focusing on aerogel technology as well as the filing of a **patent** regarding a material intended to help repair bones during medical treatments. Initially, the core network had to actively reach out to companies. As the COST Action progressed, this changed and companies actively started to approach Action researchers for consultations. For example, many research groups involved in the COST Action are being contacted by water treatment companies to test their materials, highlighting the growing industry interest in aerogel technology.

Figure 6 Scatter plot of publications and industrial co-publications of all COST Actions analysed



Scientometric analysis by Technopolis. The red spot indicates the location of the publications of publications of AERoGELS. Data sources: CrossRef, OpenAlex, Patstat, Overton.

On an individual level, interviewees reported profound impacts of the participation in the Action on the **promotion of careers** at all levels. It provided skills development, extended the individual network for future collaborations and increased visibility and reputation in the field.

In every European country there is now at least one group involved in the research on and production of aerogels. There is a deep interest in continuing the efforts in the form of an **international association** and extending this network to countries and national associations outside Europe.

### Challenges and further potentials

Due to the COVID-19 outbreak, several activities, such as Training Schools or industry-academia forums, had to be cancelled, postponed or converted into online/hybrid formats. The lockdowns and travel restrictions, which lasted almost two years, affected the Action's milestones, deliverables and the involvement of the companies. Despite these challenges, Action members worked hard to keep the initiative alive and showed flexibility in adapting to the new circumstances. They even saw the shift to virtual cooperation as an opportunity to include members from non-European countries, overcoming the distance that previously made in-person events difficult. Virtual mobility grants proved to be helpful for the organisation of hybrid meetings, in particular by financing high-performance computers or programme licenses needed for these meetings.

While the CIG has been a helpful tool to strengthen start-ups in transitioning academic research ideas into viable businesses, a closer link between the Innovators Grant and national start-up support funds would have helped early-stage spin-offs from the Action. Typically, start-up groups come from the same country and leveraging local funding programmes could provide additional financial resources. Organising events where start-ups can pitch their ideas to both the Innovators Grant consortium and national programme representatives could facilitate this connection.

### What can other COST Actions learn from this example?

Three main **takeaways** from this Action might be relevant for other Actions:

- For the success of the Action, it will prove to be rewarding to **invest extensive efforts in empowering young researchers, women and researchers from less-represented countries**. While this is in general incentivised and required by COST already, this approach should also be pursued in the interest of contributions to innovation. This not only motivates members to put in extra work but also creates a living network where everyone pulls in the same direction.
- To extend the network to industry stakeholders, it is crucial to have members in the network with an **affinity and experience in collaboration with industry**. Industry-academia forums as well as STSM research stays in industry can be fruitful instruments to exchange perspectives between academia and industry.
- The **right size of the topic** – broad enough in terms of applications, but with a reasonably small community where people still know each other – can be an important precondition for an Action's mission to be successful.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Chair **Prof Carlos Garcia Gonzalez** and Vice Chair **Prof Irina Smirnova**
- Website (<https://cost-aerogels.eu>)

#### 4.7 STRATAGEM: Involving SMEs for entrepreneurial innovations and education on entrepreneurship

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA17104	New diagnostic and therapeutic tools against multidrug resistant tumours (STRATAGEM)	09/2018 - 09/2022	Basic medicine, Biological & chemical sciences	Activity innovation, economic and social output innovation	<a href="https://stratagem-cost.eu/">https://stratagem-cost.eu/</a>

##### How can COST Actions contribute to innovation - what this case shows:

- This COST Action shows that it can be worth it to concentrate strategically on the transfer of research into practice, in this case the development of therapies and drugs. With this strategic focus the consortium took care of involving non-scientific stakeholders in innovative activities and achieving innovative outputs, namely entrepreneurship trainings for YRIs, an educational platform and patents.

##### Overview: Starting point, goals and results

STRATAGEM focuses on the research on diagnoses and therapies against multidrug resistant (MDR) tumours. This research topic was as such not new at the time but was fragmented into multiple disciplines and had no common platform. Therefore, STRATAGEM **aimed** at creating a transdisciplinary pan-European network and designing and validating new therapeutic tools.

STRATAGEM contributed to the following **deliverables**: creation of a database for drug repositioning ([DRACD](#)), at least 4 patents and 108 scientific publications<sup>10</sup>, as well as technical reports and guidelines. The consortium was also awarded with a CIG, which led to the development of a Pan-European Educational Platform on Multidrug Resistant Tumours and Personalised Cancer Treatment.

##### What makes COST Action CA17104 innovative?

The COST Action STRATAGEM was innovative in its **design**, which involved start-up trainings for Young Researchers and Innovators (YRI) and resulted in a **social innovation** in the form of an eLearning platform as well as (prospectively) **economic innovations** in the form of patents.

STRATAGEM did not only aim at integrating different disciplines, as many COST Actions do, but also **non-scientific stakeholders**. These were closely involved in the activities, namely in three online events organised with diagnostic companies and two training events on skills with private companies. In addition to that, STRATAGEM decided to develop **innovative trainings for researchers on start-up building**. The need for such training emerged from the expectation that in this way research innovations can move closer towards application. It also considered the fact that many PhD candidates leave academia because of limited job opportunities. In these trainings SME representatives with practical experience or national agencies that support SME founding were involved as instructors. The workshops covered different topics such as the different cultures in academia and SMEs, practical trainings on preparing a business plan, presenting to an investor or the acquisition of funding. Care was taken to ensure that the

<sup>10</sup> This number is based on our scientometric analysis.

training could be applied to different countries. On top of that, workshops called “Meet the CEO” were organised, in which YRI could connect and speak with start-up founders about challenges and learnings. Seven to eight founders were involved, in particular in countries with limited start-up support.

During the COST Action the consortium identified a lack **of educational offers on MDR tumours that are interdisciplinary**. With the support of a CIG, they developed the educational platform PANDORA in 2022. It includes twelve online modules ranging from design to validation, toxicological test and the design of clinical trials. Additionally, the CIG included workshops among academics (including YRIs) and companies. This allowed both sides to present their innovations and business plan ideas to each other.

Interdisciplinarity and the new networks established were also crucial for **developing patents** on drugs. At least four patents including at least two co-inventors from the COST Action were developed. They support SMEs or bigger pharma companies that work in new pharmacological solutions against MDR tumours (see expected impact).

### How has COST contributed to the innovation?

Overall, different COST characteristics and elements plausibly contributed to the innovations as described above. Both interview partners stressed that the **openness** of COST Actions was crucial to increase the network to such a big size and to develop innovative outputs. The STRATAGEM Chair, for example, only knew 2-3 people before the start and experienced a significant increase in contacts.

*“That [the openness] was one of the most positive things about COST – everyone can join.”*

COST Action Chair

According to the interview partners, the results would not have been achieved without the size and openness of the COST Action. Accordingly, also individuals without strong research tracks but strong on business applications were included. In some instances, these were researchers bringing in innovative ideas that led to follow up projects. As the network was composed of completely new contacts, familiarity and trust had to be strengthened first. This was supported strongly by STSMs, so that follow up projects like patents (see above) or Marie Curie grants could be acquired. The big size of the network was also considered to be beneficial, as it offered a wide choice of cooperation partners.

Also, the **interdisciplinary** character of the network, as in many COST Actions, was crucial for the development of innovative products like patents. In this case, training schools and STSMs were particularly important. An example is a training school on bioinformatics, which trained biologists and physicians with limited knowledge on existing public data bases.

Finally, the **COST Academy** training for Action Chairs was found to be useful for improving the involvement of non-scientific stakeholders in the network.

### What is the impact of the innovations?

The impact of the start-up training cannot be assessed systematically, as interview partners had no concrete knowledge of such cases. However, they expect that the trainings contributed to participants founding start-ups.

For the educational platform the consortium developed and implemented a business plan: PANDORA obtained a recognition as Erasmus BIP+ program focussed on MDR tumours. This way the online training is sustained. Additionally, small fees for participants and presenters allow both companies and researchers to attend joint workshops and present to a very selected

group of scientists. In the long-term, this mechanism is expected to lead academic researchers to sell their inventions to companies and thereby bring them to patients.

The patents are perceived as a way to foster collaborations between academic and industrial research. According to an interview partner, the inventors are indeed collaboratively validating the compounds with pharma companies. Eventually, the patents lead to the development of drugs for treatment of MDR tumours at pre-market stage.

### What can other COST Actions learn from this example?

For all three innovative aspects of this COST Action the **collaboration and involvement of SMEs** was crucial, even for the development of the educational content. Recognising that involving SMEs is important, also in educational formats, is certainly valuable for other COST Actions. However, there are boundaries to the transfer, as STRATAGEM operated under specific conditions which are not given in many disciplines: the researchers involved were already well connected to companies, as many researchers leave academia for industry in this field. Secondly, as a result of the pandemic, the biotechnological sector found itself in a period with many funding opportunities and was therefore willing to invest (also in risky operations).

Still, STRATAGEM managed to point out various benefits for companies to participate in the COST Action, including gaining knowledge on latest pre-clinical or pre-market inventions, presenting their own technologies to researchers that could become clients, and gaining employees. Vice versa, researchers benefitted from proposing their inventions to companies to start a collaboration on validation and eventually move to the market stage, a step that requires specific infrastructure.

Finally, the interview partners recommend other COST Actions to promote the COST Action via individual participants and invest in **marketing** to make sure that a lively and large network develops.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Chiara Riganti (Chair) and Thomas Mohr (COST Action Working Group Leader and SME founder)
- Websites: COST Action: <https://stratagem-cost.eu/>; Educational Platform PANDORA <https://www.pandoracanceracademy.eu/>



#### 4.8 EU-CARDIOPROTECTION: Supporting transfer of research with methodological innovation and cultural change

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA16225	Realising the therapeutic potential of novel cardioprotective therapies (EU-CARDIOPROTECTION)	10/2017 - 04/2022	Basic medicine, Clinical medicine	Economic output innovation	<a href="http://www.cardioprotection.eu/">http://www.cardioprotection.eu/</a>

##### How can COST Actions contribute to innovation - what this case shows:

- COST Actions can be very useful to not only support networks on basic research but to also address transfer of research into practice. To this end, COST Action EU-CARDIOPROTECTION shows that COST Actions may strongly benefit from the trust that is built with the network activities. This may lead to foster a change of research cultures that prevent innovation and transfer. Furthermore, SMEs' inputs and market access can be used to develop methodological and product innovation.

##### Overview: Starting point, goals and results

EU-CARDIOPROTECTION tackled the problem that innovations and advancement in medical research on cardioprotection had not yet been transferred into practice, i.e. specific therapies or drugs that serve clients and eventually prevent heart failure could not be developed. The COST Action consortium EU-CARDIOPROTECTION found that the failure of transfer is closely linked to the lack of reproducibility of preclinical experiments. The **goal** of establishing and activating a network of various laboratories and researchers was to tackle this challenge and enhance the reproducibility of preclinical research.

The **deliverables** that EU-CARDIOPROTECTION produced are a research database and more than 100 papers, including four review and position papers and guidelines and recommendations for improving the pre-clinical assessment (and further publications ongoing).

##### What makes COST Action CA16225 innovative?

EU-CARDIOPROTECTION has generated innovative outputs at multiple dimensions: it developed a **methodological innovation** (multi-centre trials), which goes hand in hand with a change in research culture and is likely to lead to **economic (product) innovation** in the long term (see impact).

During conferences and meetings of the COST Action and by evaluating the results, the consortium developed the idea to set industry-like quality control systems and implement preclinical testing of novel cardioprotective therapies in multiple laboratories (multi-site testing). This approach had been already common at the clinical stage but was a radical innovation for the preclinical stage. In order to take this innovative methodological step, several hurdles had to be overcome – a task for which the COST networking activities proved essential. High quality control had to be ensured, and everything affecting results had to be tracked. Participating laboratories had to be transparent and open among each other, as everything, including “negative” incidents, had to be reported. To make laboratories agree to this approach of “looking into each other’s kitchen” (quote by interview partner), it was necessary to build trust. The COST networking activities helped to build this trust among multiple institutions via mutual visits in STSMs and getting to know each other in frequent meetings.

The methodological innovation of preclinical multi-centre trials was further established in a CIG and eventually led to the development of a business idea (product innovation). The idea is to offer the service of multi-centre trials to the drug development community (Pharmaceutical and Medical Technology industry). The service is hosted by an SME that participated in the COST Action and is led by the Action's Vice Chair (Pharmahungary Group).

### What is the impact of the innovation?

The methodological and product innovation developed in EU-CARDIOPROTECTION has multiple (anticipated) impacts. First of all, the approach of multi-centre trials at preclinical stage impacts the **research and collaboration culture** in the field. According to the interview partners, the achievement of trust and agreement on collaboration is a starting point for a cultural change towards more open labs and higher quality standards in the field of cardioprotection research.

Secondly, it is expected that the **economic innovation potential** will be increased as soon as the service of the multi-centre network will be launched. This is considered as an important step to finance the research necessary to reduce heart attacks with novel cardioprotective therapies.

Finally, EU-CARDIOPROTECTION was not only followed by a CIG, but also **supported the networking of the research field in the long term**. For instance, the idea for working on the broader topic of reducing infarcts was developed and led to the (successful) application for a new COST Action ([META Heart](#)), which includes also other networks.

### What can other COST Actions learn from this example?

According to the interview partners, EU-CARDIOPROTECTION's success was also related to important factors to be considered by other COST Actions that aim at improving the transfer of research into practice. First, the **involvement of SMEs** was important for entering the market stage (in this case via Pharmahungary Group), but also for developing innovation. Participants that have affiliations with SMEs, as there are in many COST Actions, were crucial to give input regarding standards in quality control. It was also important to involve regulatory authorities (at least indirectly) to know the regulations and standards for quality control. Finally, the **researchers who lead the COST Action** (Chair, Vice Chair) were very active and listening to make sure that Inclusiveness Target Countries are also involved in trust-building activities.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Péter Ferdinandy (Vice Chair, Founder & CEO of a group of SMEs, co-author of multiple publications) and Coert Zurbier (active CA member and co-author of multiple publications)
- Websites: COST Action: <http://www.cardioprotection.eu/>, CIG:  
<https://www.cost.eu/actions/IG16225/>, Pharmahungary Group:  
<https://www.pharmahungary.com/preclinical-rd-services/multicenter-studies/>

#### 4.9 DAMOCLES: Using the momentum with innovative COST Action design

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA17109	Understanding and modeling compound climate and weather events (DAMOCLES)	09/2018 - 03/2023	Earth and related Environmental sciences	(social) output innovation	<a href="http://damocles.compoundevents.org">http://damocles.compoundevents.org</a>

##### How can COST Actions contribute to innovation - what this case shows:

- When a research topic gains momentum in science and practice, a COST Action can potentially contribute to the debate by rapidly developing conceptual contributions. To ensure this, innovative approaches in the COST Action design can lead to dynamism and productivity, for example by giving responsibility to YRI and supporting the development of their careers in the field.

##### Overview: Starting point, goals and results

The COST Action DAMOCLES deals with the **topic of Compound Events**, which are high-impact events resulting from complex combinations of weather and climate factors. At the policy-science interface, compound events had not been considered much, until a definition of compound events was first mentioned in the IPCC report in 2012 and then got challenged by other researchers. Building on this discussion, DAMOCLES **aimed** at exploring this new and under-researched field, as well as creating a new interdisciplinary research community and public impact.

As key **deliverables**, DAMOCLES contributed to research papers including a compound event typology, guidelines on studying compound events, and an analysis of the relation of compound events to the disaster risk reduction cycle.

##### What makes COST Action 17109 innovative?

In DAMOCLES the innovative usage of networking activities and the general setup of its governance contributed to the high productivity that made social impact of research results possible.

In its design, DAMOCLES was able to involve specifically YRI and built up a strong research network via two mechanisms. First, YRIs were given **significant roles** from the beginning on. For instance, working groups were always led by two people, one YRI and one senior researcher as a co-lead. The same principle applied to the other leadership positions of the COST Action with a YRI as Action Chair and an experienced senior researcher as Vice Chair. This approach based on the assumption that YRI have a particularly high interest in developing their career via networking and producing outputs in a new research field, so that dynamism and productivity would be fostered.

Secondly, **training schools and STSMs** were used extensively. Two training schools were carefully organised for full two weeks. While such long training schools are rather unusual, this approach should ensure that YRI had enough time to kick off actual projects and to build a community. This way, for instance four publications were directly connected with one of the training schools. STSMs were used to develop publications further and establish contacts for future career opportunities. As a result, a high number of publications could be produced by active COST Action participants.

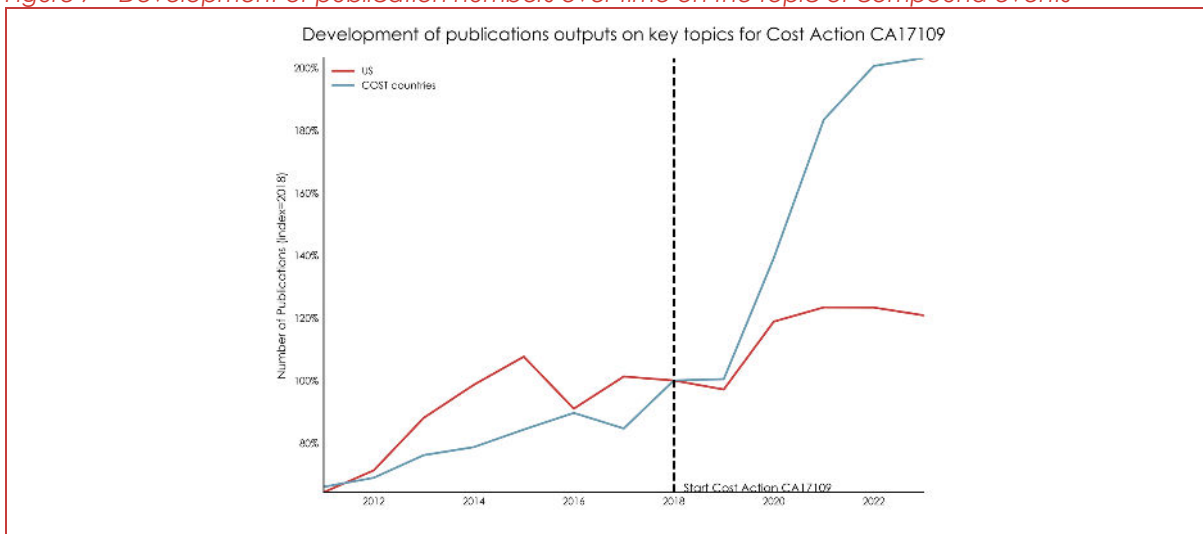
Furthermore, the COST Action effectively supported the **organisation of answering stakeholders' requests**. These requests related to the need of practitioners to take compound events into account in their work, for instance water management authorities which need to ensure effective civil protection systems. Usually, it was individual key experts in the COST Action that received frequent requests by policymakers, local governments or NGOs, which then could be distributed to the wider networks, particularly to YRIs. The conceptual background provided by the work in the COST Action strengthened capabilities to communicate research results to stakeholders. Particularly the educational concepts developed in the training schools where the topic had to be processed in a more tangible way helped reduce the complexity of the topic for stakeholders.

### What is the impact of the innovation?

Overall, the COST Action contributed to building up a new interdisciplinary research field that is based on a strong research network with its core in Europe (while another network also emerged in the US). This is supported by the results of the scientometric analysis, which indicates that DAMOCLES contributed to a fast significant increase of the topic in research publications in Europe (see Figure 7), but also in policy papers.

The network consists of multiple YRIs that have started or built their career on analysing the topic of compound events (e.g. writing their entire PhD about it) and are connected to practitioners.

Figure 7 Development of publication numbers over time on the topic of compound events



Scientometric analysis by Technopolis, data sources: CrossRef, OpenAlex, Patstat, Overton.

### Challenges and further potentials

Even though many publications that came out of the COST Action raised interest among decision makers, DAMOCLES could potentially have had even **more practice relevance** according to the interview partners. Although an entire working group focused on stakeholder involvement and science-user interface, it was difficult to map and actively involve them. One reason was that the COVID pandemic made it generally more difficult to involve stakeholders. Another reason could have been that stakeholders like flood management agencies or consultants in strategic spatial planning are too heterogeneous and specific in their interests, so that it was difficult to raise their interests and bring them together in one place.

Apparently, in those areas in which little research exists yet more time is needed to establish the topic. It is then more promising to first draw on existing contacts of individuals and to be contacted instead of reaching out actively. As a further potential, the publications, which often contain practice-oriented case studies, could also be further developed into more explicit practical applications, such as guidelines and training material. Finally, because of the complexity of the topic, DAMOCLES faced the challenge of a **trade-off between inclusion** of more countries and researchers with different knowledge level on the one hand and maximising research output on the other hand.

### What can other COST Actions learn from this example?

DAMOCLES was innovative at the design and implementation stage, particularly regarding the support of YRIs, which ensured to establish a very active community of researchers in Europe and in its rapid and timely conceptual contribution to the debate that resulted from this.

However, according to the interview partners, the right **timing** was a central factor for the success of the COST Action. It was able to pick up quickly on an emerging topic that is relevant to the “real world” because of increasingly frequent extreme events.

Other COST Actions in a similar starting position, i.e. being dedicated to a new topic that suggests practical urgency (as in this case triggered by the IPCC process), can benefit from this experience. In order to establish a research topic in a timely manner and develop it effectively and dynamically, they should emphasise the involvement of YRI with support of key senior experts. This gives COST Action participants the feeling that they can contribute and motivates them. In the case of DAMOCLES, this approach was also supported by the fact that climate research is generally a comparatively young field with particularly many YRIs. But even without this prerequisite COST Actions can actively work on developing YRIs, particularly with STSMs and (long) training schools.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (e.g. Overton, OpenAlex bibliometric database)
- Interviews with Chair Prof Jakob Zscheischler and Vice-Chair Bart van den Hurk
- Website (<https://damocles.compoundevents.org/>)

#### 4.10 AGITHAR: Coordination and communication of complex research results for effective transfer into practice

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA18109	Accelerating Global science In Tsunami Hazard and Risk analysis (AGITHAR)	03/2019 - 09/2023	Earth/Environmental sciences (incl. applied mathematics, data sciences, oceanography)	Involvement of practitioners, social innovation	<a href="https://www.agithar.uni-hamburg.de/">https://www.agithar.uni-hamburg.de/</a>

##### How can COST Actions contribute to innovation - what this case shows:

- COST Actions can increase the usability of research results for practitioners by combining innovatively core elements, for example with a pro-active communication strategy for stakeholders and strategic use of interdisciplinary research cooperation that is fostered by accompanying research.
- Facilitating factors are the involvement of well-connected individuals with intrinsic motivation for practical impact and awareness of decision makers of the high relevance of scientific results.

##### Overview: Starting point, goals and results

AGITHAR focuses on a **new** way of dealing with tsunami hazard analyses, namely a **probabilistic approach of assessing tsunami risks and hazards**. This approach was in its early stages at the beginning of the Action and required greater dialogue between scientists.

Already in its **goal formulation**, this COST Action stresses the relevance of the practical application of the results of its research networks: the analysis methods of tsunami hazards and risks shall be improved, but also communicated in form of interactions with external stakeholders to understand societal needs.

Among the **deliverables** of the COST Action are research papers (four reports and two guideline documents) and a data repository. Additional outputs are 104 co-authored Action publications, 11 projects and 3 proposals. Also, a CIG could be secured with the goal of establishing a legal entity for coordinating scientific work.

##### What makes COST Action 18109 innovative?

AGITHAR considered two combined aspects in an innovative approach during implementation: the usability of results to practitioners and a pro-active dissemination approach as well as the reflection on interdisciplinarity.

The practical relevance of tsunami research was taken into account from the beginning on. Other practical activities in this area like the UNESCO coordination activities were considered and representatives, for example, from UNESCO, DG ECHO and insurance companies were pro-actively **invited to conferences**. Many COST Actions dedicate a working group to communication and dissemination. In the case of AGITHAR, this was particularly relevant in combination with the stakeholder outreach, because communication was considered paramount to successfully transferring probabilistic research results to practice. The working group established a coordinated communication approach and worked on a dissemination strategy from the beginning on.

In combination to that, AGITHAR served as a **coordinating body**. Albeit some COST Action participants had some contact to non-scientific stakeholders, AGITHAR has further enhanced a coordinated approach of advising practitioners. This way, participants of AGITHAR were approached to carry out risk analyses for individual countries or regions (e.g. in Oman, Italy, or by French warning centres) who then made use of the approach. Another example of an output of this coordination is a subgroup of AGITHAR that established a standardised tsunami repository (TCS- Tsu, <https://www.tsunamidata.org>) in the European Plate Observing System (EPOS).

The approach of a coordinating body is now being maintained and supported by the **COST Innovators Grant**, aiming to set up a long-term coordination and consulting entity that is financed and used by practitioners. The grant was used to discuss with the practitioners on how to proceed. Again, part of the proposers for the CIG were also representative of UNESCO and insurance companies.

As in most COST Actions, AGITHAR stressed its **interdisciplinary** orientation. However, the interdisciplinary work that eventually should lead to innovation should be fostered in a particular way, namely by a monitoring and evaluation working group that analysed the mechanisms of interdisciplinary work. A report published by members of this working group helped the community reflect on their cooperation: it found that scientists of the tsunami research community were mostly grounded in a specific discipline but were always communicating across disciplinary boundaries. While the communication between natural sciences and engineering disciplines was well established and cohesive through the common goal of saving lives, challenges were mentioned with respect to the communication with social sciences and societal stakeholders. The report also found that modelling and visualising or mapping hazard and risk results were a unifying component of the communication process within the community.

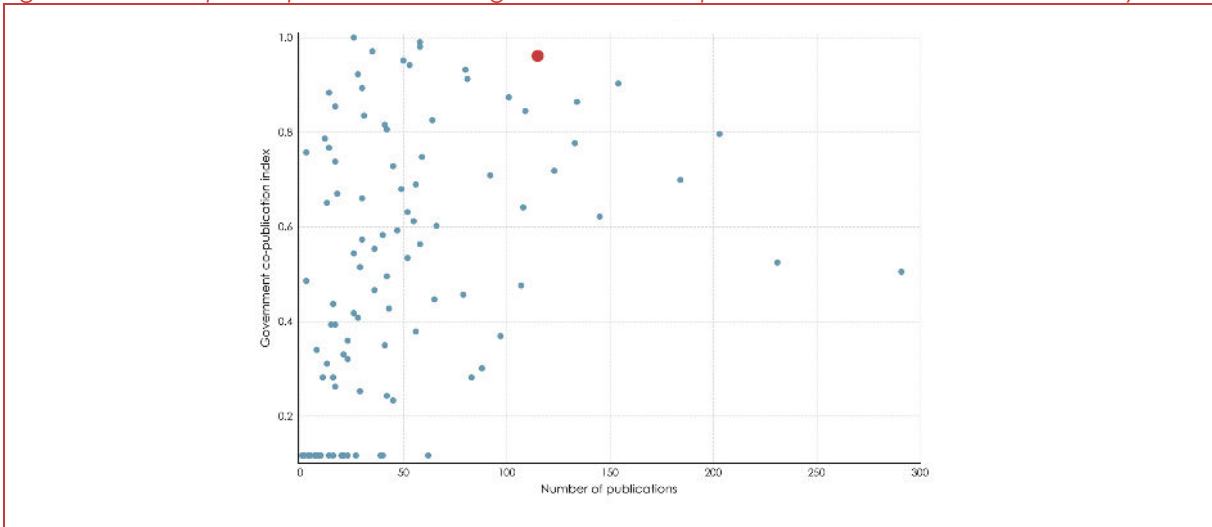
### **What is the impact of the innovation?**

With its innovative approaches, AGITHAR enhanced the usability of research results for practitioners. In combination with the pro-active outreach strategy described above (direct contact with specific practitioner groups instead of general public relations work), more decision makers now have a better understanding of the complex interpretation of probabilistic results and how uncertainty and risk can be communicated.

The scientometric analysis indicates that this also resulted in particularly high numbers of publications that were cited by political/ governmental institutions compared to other COST Actions (see Figure 8).

The impact of the WG on accompanying research was relevant to enhance the research communication of participants and to establish new research projects (more than expected).

Figure 8 Scatter plot of publications and governmental co-publications of all COST Actions analysed



Scientometric analysis by Technopolis. The red spot indicates the location of the publications of publications of AGITHAR. Data sources: CrossRef, OpenAlex, Patstat, Overton.

### What can other COST Actions learn from this example?

The example shows that COST Actions can enhance their impact by innovative engagement with communication towards practitioners. In case of AGITHAR, the research community on tsunamis was already very much oriented towards impact for society, which is an important condition for transferring this practice. If needed, COST Actions could support these aspects with awareness raising measures in this regard and by setting up structures with the goal of dissemination from the beginning on (like the working group in AGITHAR). Also, existing individual contacts among at least a part of the COST Action members is a prerequisite that should be considered with a careful selection or direct approach of well-connected participants. Another important context factor in AGITHAR is the existing awareness of decision makers of the high relevance of scientific results for their own work, for example planning coastal infrastructures. If such awareness does not yet exist, the COST Action should work on creating it, for example with use cases.

### Sources

- Documents (MoU, Final Achievement Report, research paper on interdisciplinarity <https://doi.org/10.3389/feart.2022.949803>)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Jörn Behrens (Chair) and Irina Rafliana (Participant)
- Website (<https://www.agithar.uni-hamburg.de/>)



#### 4.11 Who Cares in Europe?: Societal potentials of innovative scientific models in history

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA18119	Who Cares in Europe?	03/2019 - 09/2023	History, Archaeology, Political Science, Sociology	Activity innovation	<a href="https://whocare.sineurope.eu/">https://whocare.sineurope.eu/</a>

##### How can COST Actions contribute to innovation - what this case shows:

- Who Cares in Europe is a COST Action that operates in a discipline (history) where a methodological innovation and the resulting insights rarely transfer into practice. Despite the adverse circumstances, this COST Action is an example for a change of attitude that was achieved during the funding period and the foundation was laid for new contacts for possible innovation. The case also illustrates that early outreach activities beyond classical research might be beneficial for long-term prospects for innovative research.

##### Overview: Starting point, goals and results

The COST Action „Who cares in Europe?“ focused on the questions of how non-state institutions and individual groups (like families) contributed to the welfare state in Europe and what can be learnt from that for today’s welfare crises. The COST Action aimed at defining and developing this emerging research field and connect researchers and policymakers.

The **deliverables** of “Who cares in Europe?” are mainly scientific publications (31 during the funding period, more to follow), but also three YouTube videos and publications for dissemination.

##### What makes COST Action CA18119 innovative?

“Who cares in Europe?” further developed **an innovative scientific model**, the so-called triangular approach, that prospectively could also contribute to solving **social challenges**.

Already in the application phase, the COST Action consortium developed the idea of looking at social welfare with a bottom-up view, considering the roles of volunteer associations and families. In welfare research, the state is usually considered as the main actor. Therefore, this model of a triadic approach can be understood as a radical innovation in the field. It was further developed in the COST Action and led to a comparative research programme among participating countries.

According to the interview partners, the COST funding contributed significantly to this. The general openness of COST Actions attracted scholars throughout Europe that would have not been reached otherwise. The completely new contacts, which developed unexpectedly, led to different follow-up projects.

The interview partners stressed that originally no specific innovation or stakeholder engagement was intended, instead the consortium rather aimed for classical research outputs like publications. But this intention changed during the COST Action because the consortium realised the contemporary relevance of the of the topic. Whereas initially, the topic had been thought of as a rather historical exercise, the consortium started to see the topic through current mechanisms of health inequality. The network therefore expanded to non-scientific stakeholders. The Chair requested all WG participants to use their contacts with stakeholders and reach out to new ones. This way, for instance, contacts with health care associations were established. The Action developed the idea of teaching social services employees on long-term inequalities, but it could not be further pursued after the end of the COST Action. Another

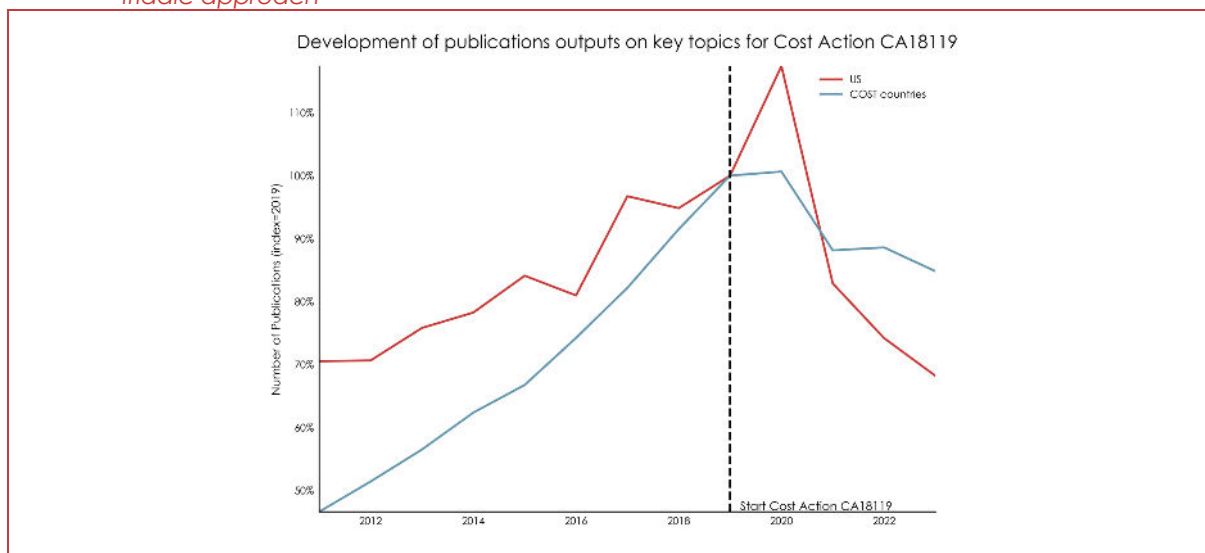
idea of bringing the research results into practice was to cooperate with a UN Think Tank (the European Centre for Social Welfare Policy and Research) on policy briefs for the European Union and governments. This resulted in a joint application for a CIG, which however was not awarded. The idea was therefore not further pursued (yet).

### What is the impact of the innovation?

Following the (comparative) research done during the COST Action, different new research projects were launched. This also included a successful ERC Advanced Grant on 'Social politics in European Borderlands, 1870s to 1990s', that was based on synergies developed during the COST Action. Overall, the COST Action could empower YRIs by offering new research topics and projects and contribute to policy discussions on social welfare and protection by overcoming the top-centred approach. The figure below illustrates that the triadic approach and the topic of local actors in social welfare was growing in both the US and COST countries. In contrast to developments in the USA, the topic remained on a high level of publications in COST countries during the COST Action funding period. While this data cannot be directly attributed to the COST Action, as other influencing factors are also conceivable, the graph shows that the topic has gained relevance, a fact to which the COST Action has made a contribution.

In the long run, the results could contribute to solving social challenges. Now, however, the consortium faces the challenge of sustainably continuing with the new models, in research but in particular regarding application. Currently, no common forum is available for the exchange necessary for this.

Figure 9 Development of publication numbers over time for the topic of local actors in welfare history/ triadic approach



Scientometric analysis by Technopolis, data sources: CrossRef, OpenAlex, Patstat, Overton.

### What can other COST Actions learn from this example?

The consortium of this COST Action originally had not had innovation in mind but changed its course during the implementation. Other COST Actions can learn from this example with regard to the fact that this can be a challenging process and an early start for working on transfer and reaching out is beneficial. In the context of "Who Cares in Europe?", the fact that the researchers involved in the Action came from history and social sciences and lacked networks

in politics was an additional difficulty. However, a strategy for acquiring these contacts (for example, through partnering with think tanks) can be promising if implemented at an early stage.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Clarisse Berthezène (Chair) and Kai Leichsenring (Executive Director European Centre for Social Welfare Policy and Research)
- Website: <https://whocaresineurope.eu/>

#### 4.12 IMAAC: Transferring research results into practice through unusual collaborations

CODE	Name of COST Action	Duration of Action	Field of research	Innovation type	Link
CA16227	Investigation and Mathematical Analysis of Avant-garde Disease Control via Mosquito Nano-Tech-Repellents (IMAAC)	09/2017 - 03/2022	Biological sciences, chemical/ materials engineering, nano-technology	Product innovation	<a href="https://www.cost.eu/actions/CA16227/">https://www.cost.eu/actions/CA16227/</a>

##### How can COST Actions contribute to innovation - what this case shows:

- The COST Action IMAAC has contributed to innovation by developing mosquito-repellent products in textile and paint industries, offering an environmentally friendly alternative to traditional mosquito control methods. The Action's interdisciplinary approach, which combined expertise from various fields that typically do not collaborate, along with the active involvement of industrial stakeholders facilitated the creation of these practical solutions.

##### Overview: Starting point, goals and results

The COST Action IMAAC was initiated to address the growing need for effective and sustainable mosquito control methods. The collaborative initiative brought together experts from various research fields to develop mosquito-repellent solutions that are both environmentally friendly and effective in diverse settings. It aimed at quantitatively and mathematically analysing the effects of employing advanced mosquito control technologies in textiles and paints to reduce mosquito populations and, consequently, the incidence of mosquito-borne diseases such as malaria, dengue, zika, and yellow fever.

The COST Action's efforts led to around 30 publications, an editorial book, a "Manifesto" to outline guiding principles to combat future pandemics connected to mosquito-transmitted diseases, and the development of several products in the textile, paint and software industries, which are currently getting tested.

##### What makes COST Action IMAAC innovative?

The innovation of IMAAC lies in **transferring research results to textile production and paint industries**. This includes developing textiles with embedded nano or micro capsules that repel mosquitoes as well as mosquito-repellent paints that are designed for usage in living spaces. A significant aspect of IMAAC's innovation is its focus on repellent strategies rather than eradication. This approach is ecologically considerate, recognising the important roles mosquitoes play in ecosystems, such as serving as a food source for various animals and contributing to the pollination of certain plants.

IMAAC initiated unusual collaborations and bridged traditionally separate fields. Typically, mathematical modelers of diseases and insect experts operate in their own silos. Similarly, textile engineers and chemists usually do not collaborate with epidemiologists or entomologists. The interdisciplinary approach of IMAAC provided a comprehensive understanding of the effectiveness of certain mosquito control techniques on populations. **Meetings and conferences** within the COST Action were particularly fruitful, fostering the exchange of ideas and experiences and sparking new collaborations among these diverse disciplines.

Additionally, **industrial stakeholders and policy-makers** were invited to conferences, helping to develop cooperations with SMEs in the textile and paint sectors. These established contacts allowed companies to get their materials tested by research groups of the Action in laboratory

and field studies, which is crucial for improving the next generation of control measures. For example, an industry partner from India produced t-shirts and had them tested in India, Cape Verde and São Tomé and Príncipe by research partners that they met via the COST Action.

### Overall impacts

IMAAC created a robust network of experts from a wide range of fields. The network facilitated cooperation with SMEs in the textile and paint sectors, which resulted in the collaborative development of products like t-shirts or paint which are currently getting tested. Collaborations with companies producing software and consulting products in epidemiology for health institutes were also established.

Additionally, a “Resolution/Manifesto” was signed by many members of IMAAC on political decision-making and combating mosquito transmitted diseases in 2019, suggesting practical steps to combat future pandemics connected to mosquito-transmitted diseases and considering the diverse perspectives that are relevant when implementing measures during epidemics. Efforts will continue through a newly created scientific association called IMAAC-next.

### Challenges and further potential

By the end of the COST Action the network has established a strong infrastructure and connections with relevant actors from research and industry. This strong global network has the potential to facilitate market entry and partnerships. The Action sees a strong need for follow-up funding, foremost to translate the Action results into market products. Action members currently work on securing additional funding through EU research grants to expand the research and development efforts that were initiated during the Action. However, it remains uncertain whether they will succeed without further assistance.

### What can other COST Actions learn from this example?

From the start of the Action the management team should focus on what happens after the COST Action. Early planning for post-Action activities is crucial to ensure continuity and avoid losing progress after the funding period ends. The analysis of follow-up activities to COST Actions from 2020<sup>11</sup> has proven that this holds particularly for policy- and network-oriented actions. This case exemplifies the need for timely efforts to secure further funding for Actions where follow-up research activities are needed for successfully translating research outcomes into tangible results.

### Sources

- Documents (MoU, Final Achievement Report)
- Data bases (Overton, OpenAlex bibliometric database)
- Interviews with Action Chair **Dr Peyman Ghaffari**, Vice Chair **Prof Ana Marija Grancaric**, President of the American Mosquito Control Association **Prof Rui-De Xue** & CEO of Green Acre **Vinayak Thakar**

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<sup>11</sup> See the COST study “Analysis of follow-up activities to COST Actions” by Technopolis.

## 5 Overall conclusions from the cases

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In the following, we give answers to the evaluation questions and identify overall patterns visible in the data. As this is an explorative study, the conclusions can only refer anecdotally to the innovation paths identified in twelve cases which were selected according to their innovation potentials. No statement is made as to how innovative COST Actions are on average but rather what potential COST Actions can have. The COST impact model (see also chapter 1) aims at the outcomes a) promoting transnational collaboration and networking, b) coordinated, interdisciplinary, and innovative research, and c) individual career advancements for participating scholars. Therefore, it only indirectly considers innovation that can result from these outcomes or support them. The following conclusions show which factors and paths beyond and connected to this model could be identified exploratively.

### 5.1 How do COST Actions include innovative aspects in their design and implementation?

At the design and implementation stage, the **composition of instruments and the partner structure** bear innovation potentials for COST Actions. All cases also show the relevance of involving non-scientific stakeholders for innovation as they are crucial for developing social or economic impact. The case studies also show that COST offers a variety of possibilities for involving stakeholders via different networking instruments, depending on the disciplinary circumstances and the goals of the COST Action (research-oriented, network-oriented, policy-oriented<sup>12</sup>).

A common approach is to involve non-scientific stakeholders in **conferences and meetings**, requesting input how to ensure practice orientation of research questions and innovative approaches. But also more innovative involvement paths were taken: one case used **STSMs** explicitly for research visits to companies (case 4), others involved governmental actors as participants in **training schools** (case 7) or SMEs as **facilitators** for trainings (case 6). The **COST Innovators Grant** (awarded to four of the cases selected), is proving to set the useful incentive to involve non-academic stakeholders. As a result, Actions develop innovative formats like educational products, new associations or business models. The cases also differ regarding the type of actors they involve. COST Actions that are interested in economic innovations more likely involve industry stakeholders and regulatory authorities. COST Actions with a policy orientation concentrate more on (local) media, governmental actors and social interest groups (like patient organisations, see case 3).

Some cases, however, also show the difficulties of involving non-scientific stakeholders. In areas in which the stakeholder interests are very diverse, COST Actions have to find ways to be inclusive and connectable, for instance via separate meetings. The cases also demonstrate that the circumstances in some areas facilitate or impede stakeholder engagement. For example, in one case, companies from the biotechnology sector became able to access extensive resources during and after the pandemic, enabling them to participate in networks. Cases from the social sciences, can less often make use of existing links between science and industry and have fewer resources at their disposal. In these thematic areas, therefore, greater efforts and resources are to be aligned by the COST Actions for the purpose of stakeholder engagement.

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<sup>12</sup> See follow up types developed in the study "Analysis of follow-up activities to COST Actions" by Technopolis.

## 5.2 How do COST Actions contribute to innovative outputs?

The case studies illustrate that innovative outputs of COST Actions are often connected to an innovative design of the consortium, as well as to an innovative way of implementing activities. The **involvement of partners**, as already mentioned above, was relevant for all cases analysed in contributing to innovations in all three category dimensions, namely product, process/method and social output innovation. For instance, developing an innovative business model was only possible with the input of SMEs in case 6. Another example for the importance of non-scientific partners is the involvement of founders in developing and facilitating a social output innovation, a new educational format (case 5).

Innovative outputs also resulted from the **characteristics of the research network and COST** itself. Here, the inherent **openness** of COST Actions, namely that everyone interested can join the network without being part of the proposing network, was significant for multiple cases. For instance, in case 5, the sheer number of new connections that resulted from this openness led to numerous follow-up projects and product innovations in the form of patents. This case demonstrates also the importance of participants that might not (yet) have excellent scientific track records but nonetheless can contribute valuably to innovations. No mechanisms could be identified regarding the breadth (high number of diverse COST Action members) or depth (strong involvement of COST Action members) of networks leading to more or less innovation potential. Examples of a very broad, less integrated networks are case 5 and 10, an example for networks with a selected 'hard core' is case 8. Both types of networks seem to promote innovation in their own way and have different advantages in certain contexts (e.g. high complexity tends to favour selected involvement, extensive projects such as country comparisons).

Also, the involvement of **different kinds of academic levels**, as already envisaged by COST, proved to be important in various cases. While experienced researchers were relevant for the constitution of the network also beyond academics, YRI were important to bring in the dynamism and risk affinity that are relevant for innovations. In particular product innovations in the economic, educational or political sphere require individuals to be open and motivated to dedicate work beyond the academic logic (which primarily aims at publications and research grants). COST Actions as networks that focus on research do not require per se such individual characteristics, but individual COST Actions can incentivise them when aiming at such innovative outputs.

Another important characteristic of many COST Actions, **interdisciplinarity**, is an important driver of innovative outputs as well. Almost all selected good practice cases work among disciplines and highlight that the different perspectives that other disciplines offer are an important source for innovative products.

Regarding usefulness of specific COST **networking activities** for specific innovative outputs a clear pattern cannot be derived from the limited number of cases. But there is some anecdotal evidence that STSMs are particularly suitable for working together on patents. Meanwhile, conferences and other outreach activities are important for promoting social innovations, e.g. the use of new concepts by civil society actors.

The COST Actions also report on challenges they had when aiming at innovative outputs. The case studies give the impression that **some innovation outputs** are more difficult for COST Actions to achieve. For example, social innovations, which often, but not only, come from social science fields, were less likely to be found already in the case selection. It can be assumed that social innovations take longer to have an effect than economic innovations, which can take comprehensible steps in the market (e.g. patents and their citations, acquisition of investors etc.). Interview partners have also pointed out that researchers often

find it more difficult to influence political decision-makers than it is to work with industry as the relevant know how is missing. COST addresses this issue with Science for Policy trainings. However, none of the interviewees took advantage of this offer, which could be explained with the fact that the trainings were only rolling out during the start of the COST Actions under scrutiny.

Another challenge for some COST Actions posed the involvement of ITCs. Even if ITCs are able to take part in or lead innovative research and transfer of research into innovative products, it is often difficult in these countries to find follow-up financing to continue with the path established. The question how to continue to work with **innovative outputs** is in general another issue that remains unsolved for several COST Actions. While some cases were able to acquire further funding or private investors/ cooperation with companies (case 5 for instance acquired an Erasmus grant), others do not know yet if they will be able to enter the market (case 6). In these cases, the CIG proved to be an effective instrument to at least explore a path for sustainability. However, in the social sphere, without private investors or markets that could support a long-term strategy, even a bridge like the CIG will not help much in the long term.

### 5.3 Implications for COST Actions

For future COST Actions, the good practice case studies offer a variety of recommendations that can serve as an inspiration for setting up and implementing the network that supports or leads to innovation. The relevance of each recommendation for one's own COST Action depends on the innovation type, as well as of course on various context factors and the Action's main goals. For COST Actions that aim towards **(economic) product and process innovations**, the following practices are recommended:

- Early involvement of economic stakeholders
- Experienced management in combination with empowering of YRI
- STSMs with industry (with the goal to develop patents)
- Forums involving industry and academia

COST Actions that want to develop social innovations, should consider to

- Involve stakeholders like social groups, target representatives from early on
- Use local media (invite them to conferences)
- Concentrate on countries with most expected impact
- Involve SMEs in educational formats
- Develop professional outreach products (for (politically) sensitive topics)
- Involve governmental actors as participants in training schools

Overall, the analysis shows that COST offers support instruments to COST Actions, like the COST Academy Science4Policy trainings. While these were not much used by the COST Actions under investigation, multiple interview partners mentioned they would recommend establishing similar formats (without knowing the COST offer). COST Actions should therefore make more (strategic) use of these instruments.



## Appendix A Interview guides

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### A.1 Interview guide template: Focus innovative activity

#### Introduction

- Information on background and goals of the study, goal of case study, usage of interview results
- Presentation TG
- Presentation interviewee:
  - COST Action chair (first interview)
  - selected grantee/ participant/ third party participant (second interview, will be selected after the first interview, guide will be adjusted respectively)

#### Overview COST Action

- *Prompt: Just if something remains unclear after document analysis:* Please describe briefly the application and implementation process of the COST Action as well as the goals the COST Action wants to achieve.

#### Development of the innovative approach

- What is innovative about the approach (combination of instruments, partner structure etc.) you selected from your point of view?
- For what reason was the approach (instrument combination/ partner constellation etc.) chosen?
- Who was involved/ initiated this approach? At which point in the process? Please describe the process of decision making.

#### Implementation of the innovative approach

- How was the approach implemented?
- What are facilitating factors for the successful implementation?
- Have any obstacles occurred? How have you dealt with them?

#### Overall outcome & impacts on the Action and its participants

- What are the (expected) outcomes/ impacts of this approach?
  - At individual level
  - On the science community
  - On other stakeholders
- Has the approach met your expectations regarding outcome/ impact?
- Would these impacts have been achieved without the COST Action?

*Prompt: Questions from interview guide 2 could be added here if innovative outcomes observed...*

#### Transferability

- Does your approach require any prerequisites?
- If you would start a new COST Action, would you proceed the same way or would you change something?

- What would you recommend other COST Actions when including innovative approaches (like yours, in general)?
- How could COST support innovative activities at the implementation stage our output at finalisation stage better? Do you have any other suggestions for improvement regarding supporting innovation?

#### Closure

- Are there any other insights you would like to share with us/ topics we have not discussed yet?

## A.2 Interview guide template: Focus innovative output/ outcome

### Introduction

- Information on background and goals of the study, goal of case study, usage of interview results
- Presentation TG
- Presentation interviewee:
  - Grantee who was responsible for the output (first interview);
  - selected target audience (second interview, will be selected after the first interview, guide will be adjusted respectively)

### Overview COST Action

- Please describe briefly: what was your motivation to get involved in this COST Action? What role have you had and in what events/ instruments have you participated?

### Development of the output

- Please describe the process of developing the output.
- Where specific COST Action instruments, partners, etc. relevant for this process?
- What other hindering or facilitating factors have you observed?

### Overall impacts on the Action and its participants

- What is the innovative aspect about the output? Prompt: Is it completely new/ new in a specific context/ closed/ open, incremental or radical?
- What impact has the output/ outcome on
  - You
  - Other individuals
  - the public
  - the scientific community?
- Would these impacts have been achieved without the COST Action?

### Transferability

- What prerequisites are necessary/ sufficient to achieve such an output?
- If you would start/ get involved in a new COST Action, would you proceed the same way or would you change something?
- What would you recommend other COST Actions when aiming at innovative outputs (like yours, in general)?



- How could COST support innovative activities at the implementation stage our output at finalisation stage better? Do you have any other suggestions for improvement regarding supporting innovation?

#### Closure

- Are there any other insights you would like to share with us/ topics we have not discussed yet?

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