Grant agreement no. 776479

COACCH

CO-designing the Assessment of Climate CHange costs

H2020-SC5-2016-2017/H2020-SC5-2017-OneStageB

D1.10 Findings from thematic working groups and deep engagement case studies

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Summary

The COACCH project (CO-designing the Assessment of Climate CHange costs) has proactively involved stakeholders in the design and delivery of research, as part of a collaborative co-production process. To do this it developed a set of success factors for successful co-design and developed a protocol (process) for implementation. This was implemented for the project, through the use of working group and deep engagement stakeholders. This deliverable reports on the lessons from this co-creation approach.

The deliverable has considered each of the success factors in turn, and considers the potential insights from the COACCH experience. Overall, the project found that the most important benefits of co-design were the improved relevance of research outputs for uptake and use (in decisions) and the improvement in the dissemination and communication of research outputs. However, compared to a normal research project, co-design was found to involve considerably more resources and time, particularly at the start of the project. The use of knowledge brokers was also critical, and the co-production process was found to work best when there was deep and regular engagement.

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Version log

Version	Date	Released by	Nature of Change
1.1	11/APR/2021	Katriona McGlade (EI)	Outline
1.2	20/JUL/2021	Katriona McGlade (EI)	First draft
1.3	19/AUG/2021	Katriona McGlade (EI)	Draft for internal review
1.4	26/AUG/2021	Katriona McGlade (EI)	Draft for quote checking
1.5	01/SEP/2021	Katriona McGlade (EI)	Draft for review by COACCH stakeholders
1.6	29/OCT/2021	Katriona McGlade (EI)	Updated draft to reflect Workshop 4 and new separation between D1.10 and D5.8
1.7	6/NOV/2021	Paul Watkiss (PWA)	Updated to include Deep Engagement results
1.8	14/NOV/2021	Paul Watkiss (PWA)	Updated to include Deep Engagement feedback from partners

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Summary

A key focus of the COACCH project (CO-designing the Assessment of Climate CHange costs) is to proactively involve stakeholders in the design and delivery of research, as part of a collaborative co-production process. This report reflects on this stakeholder process, as applied in the project 2017 – 2021, and draws the findings, lessons and insights from this. The report presents the approach adopted in COACCH, which was built around a set of success factors for successful co-design, and the translation of these into a co-design protocol, which was applied in the project. The deliverable has considered each of the success factors in turn and has assessed the potential insights from the COACCH experience for each. The resulting lessons are summarised below.

1. Identify a group of representative stakeholders;

- While it is possible to identify a group of representative stakeholders, maintaining and holding onto a balanced and representative group is something that needs to be actively monitored and managed.
- Much greater success was found - in terms of collaboration and use of the COACCH results - when a deep engagement process was followed.
- However, the distinction between types of stakeholders ('working group' or 'deep engagement') may cause unnecessary confusion as well as leading to heterogenous experiences of project engagement (i.e. for those not selected).
- For a truly 'representative' group, it is important to target specific people as well as an organisation. Engaging with multiple people from an organisation can increase the extent and impact of knowledge co-production as well as minimising the risk of stakeholder 'bottlenecks' or drop-out.

2. Identify user needs and the potential uses of COACCH information for decisions;

- The co-creation process is challenging within the current EC RTD approach, because of the requirements of the proposal and grant agreements. This limits what can be changed. While it might be possible to build in more flexibility for co-creation, this would only be possible within each partner activity and budget, as it is very unlikely partners would agree to changes in budget allocation from themselves to others once work had started.
- There may be a need to think about exchanging with stakeholders at the proposal stage to develop programmes that match user needs However, this is difficult due to a lack of budget resources (e.g. for workshops) and the fact that proposals may not subsequently get funded. This suggests a potential role for RTD in co-creation for research proposal calls.
- Close bilateral interactions (and deep engagement) with stakeholders helps to provide targeted information within the right timeframe, so that it can be used in strategies and policy processes. This leads to greater impact of the project, through the more direct use of COACCH results in decisions and in policy documents.
- Integrating focused workshops (e.g. sectoral or risk-specific) can be more conducive to effective co-design and co-production of research.

3. Develop a process for co-production including goals, outcomes, and roles and responsibilities

- The focus on process, and the identification of roles and responsibilities was extremely useful and helped to manage the co-creation activities.
- The use of knowledge brokers was critical to the success of the co-creation process, keeping things move between workshops as well as at events. The designation of a wider group of

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relationship managers helped to spread the work involved with managing a large number of stakeholders, although the effectiveness of various partners in delivering this role varied.
- Greater attention could have been paid in the initial phase to discussing the co-design and co-production process with stakeholders, and to revisit roles during regular follow-ups.
- Rather than just checking if stakeholders are 'satisfied' with the process, there may be a need to provide space for more detailed discussion on the process from both research team and stakeholder points of view.

4. Identify a set of joint products (outputs) for the project to work towards;
- Joint knowledge products do offer the opportunity for closer collaboration around defined outputs, and can help ensure outputs are suitable for end-users (e.g. policy makers). There were cases where COACCH results were directly incorporated in stakeholder policy documents, which was a further example of joint production.
- It is important to ensure that initial workshops provide space for stakeholders to engage in shaping the research, its direction and outputs. However, follow-up workshops need to be designed so give stakeholders sufficient opportunities to shape the outputs.
- Sometimes researchers need to be pushed to take stakeholder suggestions on board and to adapt their work to produce useable and shared outputs.
- It may be useful to communicate more clearly about how stakeholder contributions are shaping the research to ensure that the outputs are understood as the product of a collaborative process and not simply a consultation with researchers.

5. Allow time for the co-production process, and build opportunities for continued engagement
- Spaces for open discussion and informal one-to-one interactions at project meetings were appreciated by both stakeholders and consortium members and led to greater understanding between researchers and end-users.
- Shorter sessions with less space for discussion e.g. the online sessions that were held during the pandemic (discussion at the third workshop), led to lower levels of satisfaction from the stakeholders but not necessarily for the consortium.
- Opportunities for continued engagement between meetings did take place, but very much relied upon the proactive initiative of individuals seeking contact with one another. These processes could perhaps have been further supported through check-ins and reporting.

6. Allocate sufficient financial and staff resources to the co-production process
- While the co-design and co-production approach was found to have large benefits, co-design was found to involve considerably more resources and time compared to a normal research project, particularly at the start of the project, but also later on to ensure user interests were delivered. In COACCH, 10% of the project budget was allocated to co-creation activities (including event costs).
- While resource level was sufficient to drive the overall process, surveys with relationship managers from the project team suggested they found co-design to be resource intensive and the interactions with stakeholders to take up more time than expected.
- There are positive and negative aspects to consider when bringing in an external moderator to a closely collaborative process. It may be more conducive to the process to choose a moderator from within the project if they have adequate facilitation experience.
- The face-to-face meetings were valued by many for the space they provided for informal interactions. The dinners, coffee breaks and other unmoderated exchanges were missed by many after the workshops moved online.

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7. Adopt an iterative approach, providing opportunities to adjust

- The time schedule of the project activities (and outputs) should ideally be aligned with the engagement process. However, often research packages were designed around the research time needs and did not exactly line up. It could be useful to identify check-in points for different work streams to address this.
- A clear conceptual overview on inputs and outputs between different work streams and work packages could be helpful to present to stakeholders, to show central research elements, interlinkages and main outputs of the project.
- There is a need to regularly highlight the stakeholder priorities within the project team discussions. A suitable tool / format to monitor and map planned and implemented project activities regarding stakeholder priorities could support the process. Sufficient time resources should be reserved for discussions within the project team, e.g. at meetings.

8. Ensure an inclusive process that recognises and respects different views

- The stakeholder engagement activities were all executed in a spirit of transparency and respect. The consortium was open to ideas and feedback from stakeholders.
- During a 4-year stakeholder engagement process it is natural that the activities of stakeholders vary and some stakeholders need to reduce their activities, change jobs, etc. Therefore, during the course of the entire project new stakeholders should be contacted to join the discussions. Attempts to gather relevant stakeholders or to reach a certain balance between groups should be a continuous process.
- It should be made clearer from the outset to the research team that the priorities and research needs formulated by stakeholders are of key importance and that research activities will be monitored and evaluated against meeting stakeholder needs.

9. Ensure a continuous process of monitoring and evaluation

- The continuous engagement process, and regular stakeholder evaluation and surveys were extremely useful for the team in understanding stakeholder needs and improving the process and outputs.
- The use a mix of evaluation tools to gather general feedback from the whole group and detailed feedback from individuals worked well. The review of the feedback from the previous event, before the next, provided a useful way of ensuring feedback was incorporated.
- For comparability, it is better to use the same evaluation questions throughout the project to show possible developments and improvements at the end of project.

In terms of the key findings, the experience from the COACCH project is that co-design can deliver important co-benefits, as compared to a traditional research project. The most important benefits are the improved relevance of research outputs for uptake and use (in decisions), and the improvement in the communication of research outputs. However, compared to a normal research project, co-design was found to involve considerably more resources and time, particularly at the start of the project, but also later on to ensure user interests were delivered. In COACCH, 10% of the project budget was allocated to co-creation activities (including event costs). The role of knowledge brokers was critical, at the workshops, but throughout the project to continually drive the engagement and user-focus and ensure the anticipated uptake of results in decision making. The closer collaboration with deep engagement stakeholders and the use of collaborative case studies was also important and was found to lead to the greatest uptake and use of project results by end-users.

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1. Introduction

Background

Stakeholder engagement is highly relevant to climate change risk assessment and decision-making, given the complexity and subjectivity involved, and it has been widely used in the climate domain (Cheng et al. 2008). It has also become a central element of research projects that consider climate change risks, mitigation and adaptation (e.g. Cairns et.al. 2013; Kok et al., 2011). As described in Welp et al. (2006), science-based stakeholder dialogues can be important for: (i) identifying relevant research questions; (ii) providing a reality check for research; (iii) providing access to knowledge, data and inputs.

However, stakeholder engagement (alone) tends to employ workshop sessions and often involves consultation (discussion) rather than direct engagement, so that stakeholder interest and inputs are limited.

More recent literature highlights that participatory stakeholder processes, such as co-design and co-production, should be used throughout the duration of a research project to address these issues (Beier et al, 2016). Furthermore, there is a recent focus on science-practice interactions and participatory practice orientated research (Groot et al, 2014), which aim to jointly develop new knowledge to inform policy and decision-making processes.

These trends were reflected in the Horizon 2020 work programme, which highlighted the need for co-creation of knowledge and co-delivery of outcomes with economic, industrial and research actors, public authorities and/or civil society, and in the call text for SC5-06-2016-2017 (*Pathways towards the decarbonisation and resilience of the European economy in the timeframe 2030-2050 and beyond*), which set out that the research should be built around the co-design of pathways and scenarios with economic and societal actors.

In response, the COACCH project included co-design and co-production as a key principle for the development and delivery of the research programme and the stakeholder engagement process. This is reflected in the project title (**C**O-designing the **A**ssessment of **C**limate **CH**ange costs, COACCH).

The COACCH Project

The objective of the COACCH project is to produce an improved downscaled assessment of the risks and costs of climate change in Europe that can be of direct usability and respond to the different needs of end users from the research, business, investment, and policy making community. To deliver this, COACCH brings Europe's leading climate change impacts and economic modelling teams together with stakeholders to co-develop methods and analyses in an innovative research practice, policy integration.

This objective is further broken down into five specific goals, one of which to develop a challenge-driven and solutions orientated research and innovation approach, involving proactively business, industrial, public decision makers and research stakeholders in the co-design, co-production and co-delivery of policy driven research.

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This involves a major change from previous European economic cost studies on climate change (e.g. the ClimateCost project, Watkiss et al., 2011) which have been science-led, and have used stakeholder engagement only for dissemination to communicate results.

Purpose of this report

The objective of Deliverable 1.10 is to bring together the findings from the thematic working groups and deep engagement case studies. We have taken the development of this report as an opportunity to conduct a wide-reaching evaluation of the co-design as applied in the COACCH project 2017-2021 to underpin the guidelines for best practice in co-designed research (Deliverable 5.8).

In this report, we detail the approach developed at the outset of the project and regular feedback from stakeholders and consortium members to reflect on lessons learned across different types of engagement.

The report begins with an overview of co-design in theory and as planned for in COACCH. It then includes a description of the collaborative process as applied during the project.

This is followed by the main section of the report evaluating the application of co-design in the COACCH project. This includes a more in-depth analysis at some of the deep engagement activities, including the impact of these on the project.

Finally, these insights are brought together as part of a reflective analysis on the process and results, which in turn form the basis for the 'guidelines for future co-designed research project's presented in Deliverable 5.8.

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2. Co-design approach and partners

Co-design review and definitions

One of the project's first activities was a detailed literature review on co-design. This review was used to produced definitions of co-design and co-production. To ensure consistency for the COACCH project, the following definitions were adopted:

Co-design (cooperative design) is the participatory design of the research project with stakeholders (including the users of the research). Co-design is the first phase of the co-production process, in which researchers and non-academic partners jointly develop a research project and define research questions that meet their collective interests and needs.

Co-production (cooperative production) is the participatory development and implementation of a research programme or project with stakeholders. This uses practice orientated research (see below), co-producing the research using an iterative process to help the research translate into useful and useable information or knowledge. This is also sometimes termed **joint knowledge production**.

Co-delivery / co-dissemination (cooperative delivery) is the participatory design and implementation of strategies for the appropriate use of the research, including the joint delivery of research outputs and exploitation of results.

Practice-orientated research is the development of research to help inform decisions and/or decision makers. It is delivered using co-production and trans-disciplinary research. It is also sometimes known as actionable science or science policy practice.

The literature review of the academic and grey literature on co-design and co-production was used to identify a set of common success factors in co-design, from a synthesis of previous studies, evaluations and good practice guidelines. The success factors identified were:

• Process orientated, as the co-production process is as important as the outputs;

• Objective and outcome led, with clearly identified roles and responsibilities;

• Targeted, ensuring representative stakeholders are involved;

• User and decision orientated, to meet user needs and produce information of relevance for decisions;

• Joint product orientated, using outputs to help build the engagement and co-production process;

• Iterative, with an ongoing process of review and learning throughout the project;

• Time managed, with enough time, resources and facilities to deliver the process;

• Transparent and inclusive;

• Part of a cycle of evaluation and learning, drawing lessons from the process for future research programmes.

These success factors were used to design the COACCH approach, which led to the development of a co-design protocol for the project (See Deliverable 1.4).

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The COACCH approach

The COACCH protocol set out the activities across different parts of the co-creation process, with the initial co-design of the project, the co-production phase of research, and then the join dissemination. The different stages of process overlap and are all part of an ongoing evaluation process which has formed the basis of this report (See Figure 1).

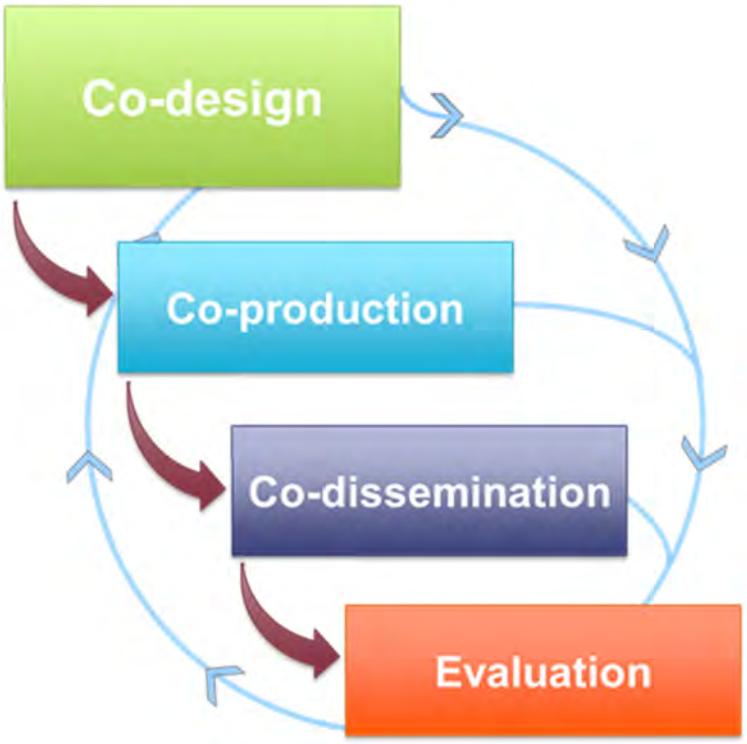

Figure 1. Interactions between different stages of collaboration in COACCH

One important issue that arose in the design of the process is that there are different types of co-design and co-production (Moser (2016); Lövbrand (2011); and Harvey et al. (2017)), which involved different aims and different approaches.

Adapting from Harvey et al., (2017), the aim can be:

- **Instrumental** (also termed utilitarian or prescriptive), which is focused on creating useable knowledge (to inform decision making); and
- **Emergent** (critical/reflexive or descriptive) co-production which proposes new transformative ways of challenging existing thinking and narratives.

And the approach can be:

- **Brokered** (with use of intermediaries or brokers who help to mediate across boundaries); and
- **"Agora"** (the collaborative endeavour of academic and non-academic actors where these communities "confront one another's worldviews in an open intellectual and social space)."

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COACCH had to work within the constraints of the project proposal and agreed description of work, and thus work package descriptions and partner resources had already been determined at the proposal and grant agreement stages. On this basis, a 'bounded' approach to co-design and co-production was taken, placing the project in the area of instrumental and brokered co-production (see Figure 2). This approach does not allow for a fully open-ended deliberative process with stakeholders and is not appropriate for projects with transformative aims of disrupting norms or existing worldviews. However, this type of bounded approach is seen as being more likely to yield tangible output-oriented knowledge products within a limited timeframe (Harvey et al., 2017). These ambitions were in line with the COACCH objectives to provide results of use for decision making.

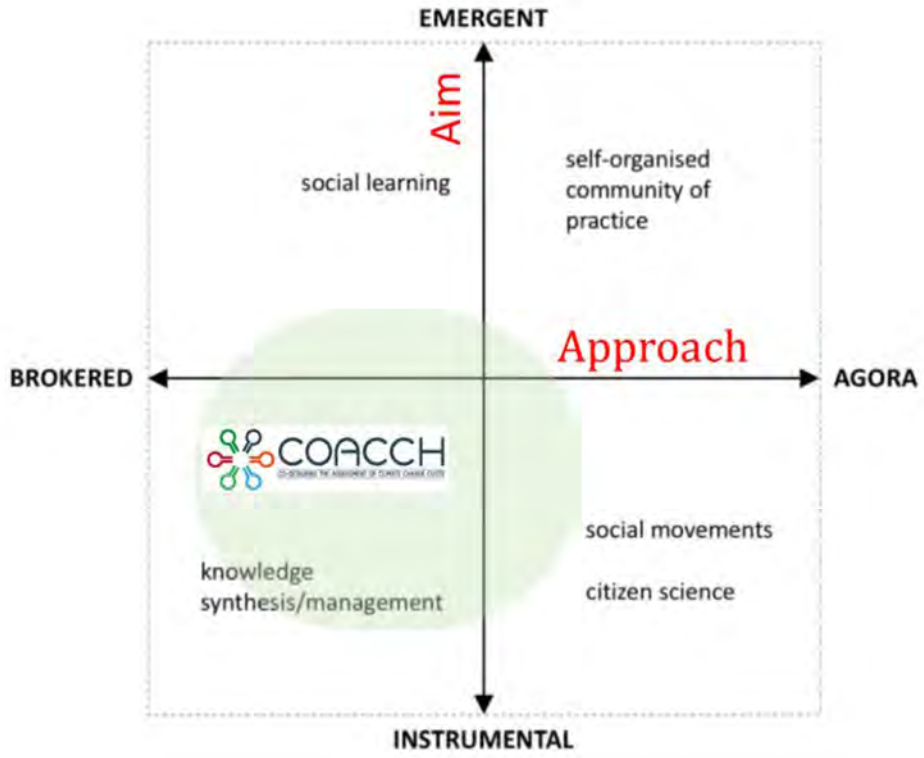

Figure 2. COACCH project in the Co-Production Matrix (adapted from Harvey et al., 2017).

Taking this instrumental and brokered ('bounded') approach and using the common principles, nine principles were developed to produce a usable knowledge for decision-making.

1. Identify a group of representative stakeholders;

2. Identify user needs and the potential uses of COACCH information for decisions;

3. Develop a process for co-production including the identification of goals, outcomes, and roles and responsibilities for the co-production process (in a roadmap) to be discussed and agreed with stakeholders;

4. Identify a set of joint products (outputs) for the project to work towards;

5. Allow sufficient time for the co-production process, and seek to build opportunities for continued engagement through the project;

6. Allocate sufficient financial and staff resources to the co-production process and use a facilitated process for engagement;

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7. Adopt an iterative approach, providing opportunities to adjust the goals, method and outcomes as the project progresses, and identify checkpoints for discussion;

8. Ensure an inclusive process that recognises and respects different views;

9. Ensure a continuous process of monitoring and evaluation, using this to inform the project as it progresses, and to provide lessons for future co-production at the end.

More detailed information on the COACCH approach is presented in COACCH Deliverable 1.4).

Stakeholders, including Deep Engagement Stakeholders

Stakeholders were initially organised into two groups: working group stakeholders (WGS) and deep-engagement stakeholders (DES). The initial list of these is shown below. The choice of these stakeholders was set out in Deliverable D1.1 Stakeholder Database. In summary

- **Working group stakeholders (WGS).** As part of the co-design initiative, COACCH worked with around 40 stakeholders who were involved in the co-design of the project. These organisations were invited to join the working groups, attending four working group meetings during the project (months 6, 24, 36, 42). The aim was to develop the design and research focus, then continue to provide advice to ensure the research stays relevant to the needs and interests of stakeholders.
- **Deep engagement stakeholders (DES**). From this larger group, around 10 organisations were offered the opportunity to be involved more closely in the project. These so-called 'deep engagement stakeholders' benefit from more targeted-research and co-production (within the boundaries of the project), helping to guide case study analysis to provide insights of direct relevance. This focused on practice orientated research, with a bilateral programme of detailed co-design, co-production and co-dissemination. This was anticipated to involve approximately at least one additional bilateral meeting a year (in addition to the workshop) to co-design and co-produce a deep engagement case study, to help ensure the relevance and user-orientation of the research, and to discuss the synthesis material and outputs from the work.

All stakeholders were sent letters of engagement, to commit to the process, and initial assessments of each stakeholder and their potential needs were identified through surveys (D1.1).

All stakeholders were assigned an individual COACCH relationship manager (a key contact in a specific COACCH partner organisation). The role of the relationship manager was to act as a central point of contact to facilitate the collaborative process throughout the project. For the deep engagement stakeholders, the relationship manager was expected to instigate regular contact to support in-depth collaboration and more targeted analysis. Furthermore, these closer collaborations were intended to support co-delivery of results to specific audiences

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Table 1. COACCH stakeholders (as at the start of the process, 2018). Deep Engagement Stakeholders show in Red, Deep Engagement Research Partner in Blue.

		Thematic working groups			
		Policy making	**Investment**	**Business**	**Research**
Case studies	**Pan-European**	• DG-Clima - mitigation • DG-Clima - adaptation • OECD • JRC • WWF	• EIB • EBRD	• VOeST (Steel) • Munich Climate Insurance Initiative • International Road Federation • Ferrero (Food)	• DG RTD • EEA • UNEP • IUCN • WHO • Wharton • Copernicus CS
	National	• Austrian Federal Ministry of Sustainability and Tourism • UK Government (CCC ASC +UK DFID + BASE) • German Federal Environment Agency (UBA) • Ministero dell'Ambiente Tutela del Territorio e del Mare (Environment) MATTM • Czech Ministry of the Environment • Oficina Española de Cambio Climático (OECC) • Netherlands Ministry of Infrastructure and Water management • Germanwatch	• Austrian Ministry of Finance • CDP Europe	• The Federation of German Industries (BDI) • Unipol (Insurance) • Iren (Energy) • Barilla (Food) • Dutch Association of Insurers • EnBW AG • ARLANXEO Deutschland GmbH (Chemicals) • VCI (German chemical industry association) • LKS Ingeniería	• CISET (Tourism) • ETH • ICH (Instituto Hidráulica de Cantabria)
	Sub-national to local	• Glasgow region / city • Hamburg Port Authority • Barcelona/OCCC			

• Deep engagement stakeholder
• Deep engagement research partner

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3. Collaborative process

In the following section, we provide an overview of the methods used to implement, monitor and evaluate the collaborative process within the COACCH project.

Stakeholder workshops

The main form of engagement with all stakeholders was through four workshops held in project month 7 (May 2018), month 24 (October 2019), month 38 (December 2020) and month 46 (September, 2021). This meant an interval of just over a year between each of the meetings. While this spacing is somewhat long, the intention of the project team was to a) allow for time to work on producing the research outputs necessary for discussion b) to use the time in between these meetings for deeper bilateral engagement.

The focus of the workshops (Table 2) was to identify where stakeholder interests and needs intersected with the COACCH research agenda (co-design or co-production), to use this feedback to adjust activities to co-produce results, and to feed these into collaboratively designed products that would co-delivered for increased uptake and usability. Feedback was gathered through participant surveys after each event and the results were used to inform the design of the subsequent workshop.

Table 2. Overview of COACCH workshops

	Workshop 1	**Workshop 2**	**Workshop 3**	**Workshop 4**
Date	May 2018	October 2019	December 2020	September 2021
Format & location	Face-to-face Brussels	Face-to-face Brussels	Online	Online
Aims	Identify user information needs and uses for project results. **(CoDes)** Discuss and prioritise key research questions to focus on. **(CoDes)** Discuss and agree on collaboration goals, roles and process goals, outcomes. **(CoDes)** Identify joint products (outputs) to work towards. **(CoDes)**	Discuss interim results **(CoProd)** Consider research interactions with ongoing policy/ decision-making processes **(CoProd, CoDel)** Discuss and jointly shape future research activities and products **(CoDes, CoDel)** Review and adjust co-design approach. **(CoDes)**	Discuss interim results **(CoProd)** Discuss joint products to synthesise research **(CoProd, CoDel**) Gather inputs for upcoming work **(CoProd)**	Discuss results from last work phase **(CoProd)** Discuss joint products to synthesise research **(CoProd, CoDel**) Review evaluation and guidelines for co-designed research **(CoProd, CoDel**)
Full report and further information	Deliverable 1.3 https://www.ecologic.eu/15679	Deliverable 1.7 https://www.ecologic.eu/16988	Deliverable 1.8 https://www.ecologic.eu/17793	Deliverable 1.9 https://www.ecologic.eu/18309
Key: CoDes: co-design; **CoProd**: co-production; **CoDel**: co-delivery				

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In advance of each workshop, documents were prepared and circulated to provide advance information to stakeholders. These took the form of policy briefs (See below), to provide more user-friendly information.

State of the Art review (first workshop)

Sector results (second workshop)

Tipping points (third workshop)

Macro-economic results (third workshop)

Policy results (fourth workshop)

Figure 3. COACCH Policy Briefs.

These are written up as the COACCH deliverables, 5.3, 5.4, 5.5, and 5.6 -see https://www.coacch.eu/policy-briefs/.

Deep engagement

As highlighted earlier, COACCH worked with a set of stakeholders in a more active, co-design approach, using further bi-lateral engagement and case studies.

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Examples of the collaborative outcomes from this deep engagement are outlined in Table 3. All stakeholder managers were asked to complete annual surveys in the first quarter of each year to monitor the frequency and type of interaction. The survey results are presented in more detail in the evaluation in Section 4. Supplementary interviews were conducted in month 44 (June 2021) with stakeholders who had been active in their engagement with the process (n=3).

Table 3. Examples of bilateral collaboration within COACCH

Stakeholder	Relationship manager	Collaboration
DG Clima	Paul Watkiss Associates (PWA) and CMCC	Bi-laterals to present results directly to DG Clima. Engagement on working papers with Commission Staff. COACCH Cited by EC in the work supporting the EC 2050 long-term strategy ((COM (2018) 773)) and used by the EC in the Evaluation of the Adaptation Strategy, (COM/2018/738 final) and in supporting Staff Working Paper for evaluation.
UK Department for International Development, UK Committee on Climate Change, Department for Business, Energy and Industrial Strategy,	PWA	Regular bilateral meetings. PWA produced policy brief with additional interpretation for UK context. Case study work on the UK Climate Change Risk Assessment 3, including economic costs in non-market sector, and analysis of the CBA of adaptation. COACCH referred to and cited in the Climate Change Committee Advice report to Government (CCC, 2021).
Glasgow City Region - Climate Ready Clyde – Sniffer	PWA	Case study work on the economic costs of climate change in Glasgow using COACCH downscaled approach. COACCH results fed into and cited in Glasgow City Region Climate Adaptation Strategy and cited in the Strategy (CRC, 2021).
Arlanxeo	Ecologic / Graz	Engagement during the project, and additionally, the stakeholder workshop on business and industry developed and held (March 2021) to further interaction. Literature screening on climate adaptation targeted to manufacturing industry.
Hamburg Port Authority (HPA)	Ecologic	Case study work undertaken on adaptation pathways for supply chains on HPA's needs
Spanish Climate Change Office (OECC) & Catalan Climate Change Office (OCCC)	BC3	BC3 produced policy brief with interpretation for Spanish/Catalan context COACCH study on costs (expenditure) of adaptation used to support the Spanish OECC Data collected for Catalonian region to support the OCCC in their current development of Adaptation Strategy.
Dutch Association for Insurers & Wharton Risk Management	Vrije universiteit (VU)	COACCH research has influenced a policy position paper of the Dutch Association for Insurers on the development of flood insurance arrangements in the Netherlands Co-produced book chapter using COACCH results with Wharton Risk Management
Rijkswaterstaat	Deltares	Large interest in the spatially-explicit road network damage results produced for the Netherlands.

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		Rijkswaterstaat co-designed the damage curves used in the COACCH EU-wide study. This has been further refined in a dedicated follow-up project.
Italian Government	CMCC	COACCH results have been reported in publications and reports to support-spur policy action. Some of the COACCH findings are being currently used (and cited in the accompanying document) to support the Italian Ministry of Infrastructure, Transportation and Sustainable Mobility to assess climate change risks for the transportation network and provide insights on the cost and effectiveness of adaptation action. COACCH was one of the few existing sources able to provide that information.
Research partners, OECD and Global Commission on Adaptation, UNEP	PWA	Regular contact with partners. Collaboration on research results. COACCH results included in GCA (2021). State and Trends in Adaptation Report 2021: Africa COACCH cited in UNEP Adaptation Gap Report (UNEP 2021).

In many of these cases there was direct uptake and use of results in major policy documents. This adds weight to the greater co-production with deep engagement process, and a greater uptake of COACCH ambitions on the use of results in policy.

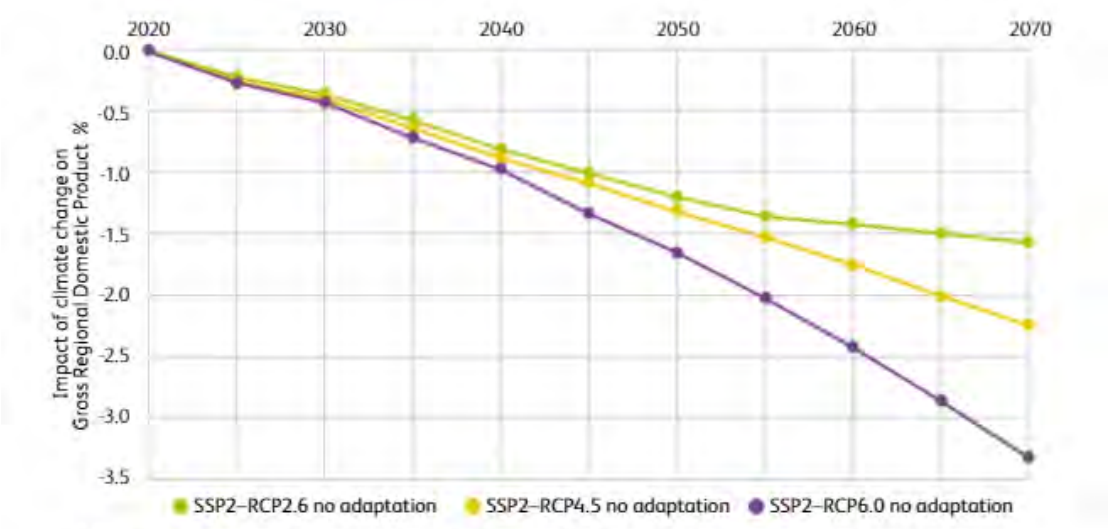

Fig.8. The potential economic costs of climate change in the region for multiple climate futures. Source: COACCH.[5]

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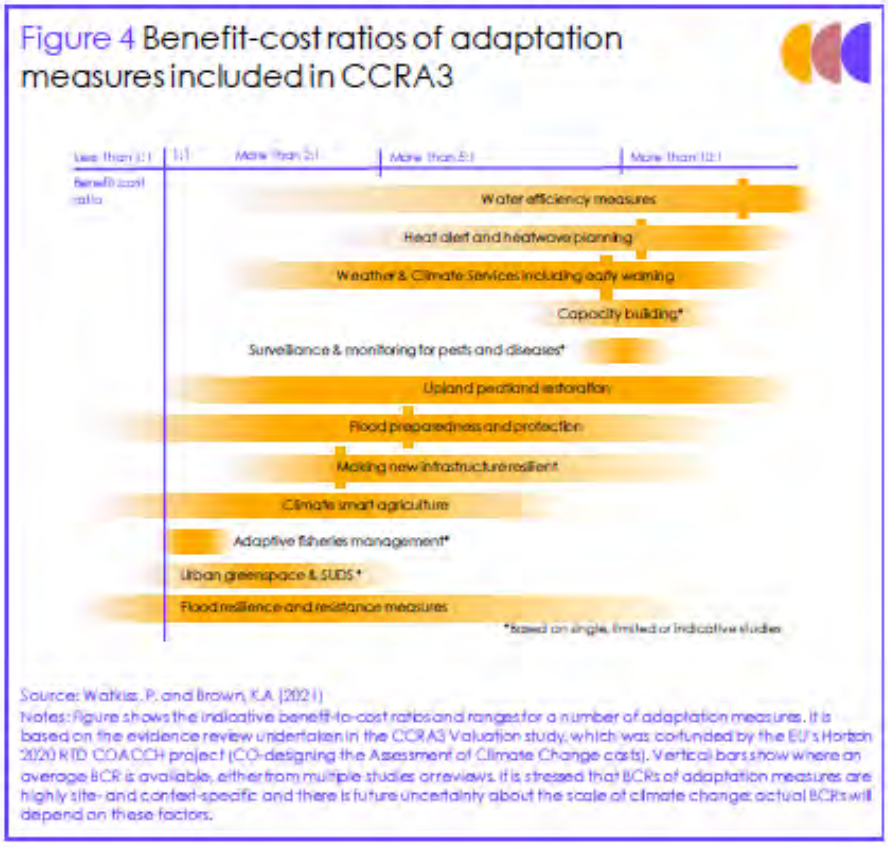

Figure 4. Examples of COACCH outputs in Policy Documents. Top: COACCH macro-economic results presented in the Glasgow Adaptation Strategy. Bottom: COACCH results used in the Climate Change Committee (UK)'s Advice Report to UK Government.

Research team reviews

Stakeholder inputs were regularly gathered at workshops and in bilateral exchanges and possibilities to implement these were discussed within the project team at annual consortium meetings. A key process for monitoring and evaluating progress of responding to the co-designed research priorities was through so-called research topic tables. At the first workshop, 78 proposed research topics were presented by the COACCH consortium. The stakeholders carried out a ranking exercise and were asked to contribute additional ideas for research topics according to their own needs and interests. During this exercise 25 additional topics were proposed by stakeholders to be taken forward for discussion by the research team.

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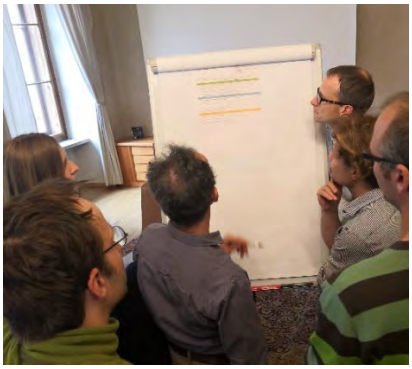

Image 1. (left) Research topic prioritisation exercise at the first workshop (Brussels, May 2018).
Image 2. (right) COACCH team discussing progress on co-designed research topics (Prague, May 2019).

After the workshop, the team of partners responsible for co-design in the project (PWA and Ecologic Institute) collated and presented the research topics to the consortium in the form of tables. These tables were revisited at project meetings in Graz, Prague (see Image 2) and Amsterdam and again in online discussions (see Annex 1: Research topic table. The aim of this exercise was to regularly emphasise the collaborative nature of the research and to support transparency and accountability between stakeholders and researchers.

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4. Evaluation

Section 4 has outlined the methods through which the collaborative process has been implemented, monitored and evaluated in COACCH. The aim of this section is to consider the outcomes of applying these methods and the extent to which COACCH has been able to follow the protocol produced at the beginning of the project (see earlier 9 principles). To do this, we consider each of the protocol's nine principles in turn, analysing relevant evaluation inputs (workshop surveys, bilateral engagement surveys, research topic tables and interviews with stakeholders and research team) (see Table 4 for overview of inputs). We outline the activities undertaken that supported each principle, the feedback from the evaluation inputs and the lessons learned. Section 6 then provides a series of reflections on co-design towards the development of guidelines for best-practice in Deliverable 5.8.

Table 4. Overview of evaluation inputs used in this report

Collaborative process	Evaluation input	When gathered
Workshop 1	Evaluation survey 1 filled by workshop participants	May 2018
Workshop 2	Evaluation survey 2 filled by workshop participants	September 2019
Workshop 3	Evaluation survey 3 filled by workshop participants	December 2020
Workshop 4	Evaluation poll 4 filled by workshop participants	September 2021
Bilateral engagement	Annual surveys filled by relationship managers and interviews with deep engagement stakeholders (n=3)	Q1 of 2019, 2020, 2021
Research team reviews	Research topic tables and interviews with COACCH team sector leads (n=6)	Workshop 1, Annual project meetings 2019, 2020, 2021, Interviews June 2021

Principle 1. Stakeholders

Identify a group of representative stakeholders

a) Activities

One of the first activities undertaken was to consider who COACCH should engage with and how. A literature review carried out in the first months of the project highlighted that effective co-production relied on engagement with a targeted number of representative stakeholders with an interest and expertise to offer on the topic in question (Harvey et al., 2017; Hegger et al., 2012). COACCH built on lessons from Moser et al. (2016) and Vincent et al. (2017) to identify the right mix of participants such as asking questions such as 'who makes decisions that are affected by climate?' or 'Do we have the right mix of individuals across sectors and regions?'

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Such questions were used to guide the selection of COACCH stakeholders; the full approach is detailed in the project internal report 'Deliverable 1.1 Stakeholder Database'.

Around 40 stakeholders were asked to commit (through signed letters of engagement) to three stakeholder workshops over the course of the project as members of the Working Group. The role of the WGS was to develop the design and research focus at the project start and to provide guidance at selected points to ensure research relevance and usability. Stakeholders were broadly allocated to groups (policy, business and industry, non-governmental/research.

A smaller group of organisations with particular interest in the project were offered the opportunity for deeper engagement. These Deep Engagement Stakeholders (DES) were asked to take part in additional bilateral meetings. The aim of these meetings was to engage in closer co-production of research and targeted results for the DES (within the boundaries of the project).

b) Feedback

Feedback during and after the first workshop and survey showed that some stakeholders were not clear why they had been designated as WGS or DES. Many requested closer engagement, while others preferred not to be committed to this extent. While keeping the original DES focus, more flexibility was introduced into the process.

The primary aim of stakeholder selection was to bring organisations on board who would be able to interact with the project at a meaningful level to co-produce research on the topics addressed by COACCH, and who would be interested in using the results.

Stakeholders were focused where there was some existing relationship with consortium members. Although this meant that stakeholders had only a moderate geographical distribution (centered primarily on UK, Spain, Italy, Germany, Netherlands and Austria) this provided sufficient diversity of EU climate impacts needed for the research activities.

While attempts were made to follow the considerations outlined in the literature above, a project can only ever create the conditions for engagement, it cannot force the balance of stakeholders. It was also found that organisations interests changed over time, which is not surprising given the length of the research project.

It was noted that the success of the deep engagement process did vary. The greatest collaboration and co-production were found in the areas where there was considerable effort in bilateral engagement, notably for DG Clima, UK Government, Spanish Climate Change Office (OECC) & Catalan Climate Change Office (OCCC) and Glasgow City Region. In some cases, the engagement process stalled. This happened because of a change in personal (and thus a change in the relationship) as with the European Investment Bank, or because organisations had more pressing concerns especially during COVID-19 (e.g. notably with the Italian business organisations).

The number of non-governmental stakeholders was lower than that of other groups from the outset despite outreach efforts. Furthermore, although a number of partners from business and industry were foreseen and approached, their participation was not as strong during the project.

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Table 5. Overview of participation levels from different stakeholder groups

		Number of stakeholders				
		Initial outreach	Workshop 1	Workshop 2	Workshop 3	Workshop 4
Stakeholder group	International/ EU policy	17	4	9	3	5
	National/Local policy	14	10	7	12	7
	Business and industry	17	7	3	4	1
	Non-governmental /Research	7	3	4	2	2
	Total	55	24	23	21	15
	Gender (%) M/F	n/a	75/25	65/35	62/38	73/27

The focus of the project was on selecting stakeholders to represent a particular organisation, not on the selection of individual persons. Unfortunately, this approach led to a clear underrepresentation of female participants; only a quarter of participants at the first workshop were women with little change in the subsequent workshops and a considerable drop in the last (see above). Where possible, consideration was given to gender balance, such as in the feedback panel at the end of the first workshop (1 female, 2 male) and in the organisation of breakout groups. Although none were able to participate, female stakeholders were also approached for interview to contribute to the final review of the project. Other personal characteristics such as race and disability were not monitored at all. In this way, although the project may have strived for 'representation' at an organisational level, ignoring individual characteristics is likely to mean that the overall balance of stakeholder voices is skewed towards a particular type of participant.

The interviews with stakeholders also drew out some useful insights in relation to stakeholder involvement more broadly. Paco Heras of the Spanish Office for Climate Change (OECC) noted that it is usually one person in each organization who attends a project workshop, and this person (in this case himself!) can end up becoming a bottleneck for information. Indeed, a number of the initially foreseen stakeholders did not participate in the project as the COACCH team had been reliant on a single personal contact who had then moved office. Furthermore, stakeholders highlighted that there is a missed opportunity that the lessons from the project do not reach other people in their organisations. Jonathan Beynon of the UK Foreign, Commonwealth and Development Office (FCDO) flagged that research is reliant on those who attend workshops being able to bring the right expertise and to be able to convey the views of the wider group of stakeholders or organisations they are representing. For this reason, it was noted, it is important that information is circulated in advance. This allows the questions to be discussed with colleagues more widely before coming to the workshop and allows the research to be shaped by inputs from a greater pool of expertise and interests.

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c) Lessons learned

- Much greater success was found - in terms of collaboration and especially use of the COACCH results - when a deep engagement process was followed.
- However, the distinction between types of stakeholders ('working group' or 'deep engagement') may cause unnecessary confusion as well as leading to heterogenous experiences of project engagement (i.e. for those not selected).
- While it is possible to identify a group of representative stakeholders, maintaining and holding onto a balanced and representative group is something that needs to be actively monitored and managed.
- For a truly 'representative' group, it is important to target specific people as well as an organisation.
- Engaging with multiple people from an organisation can increase the extent and impact of knowledge co-production as well as minimising the risk of stakeholder 'bottlenecks' or drop-out.

Principle 2. Research needs and uses

Identify user needs and the potential uses of COACCH information for decisions.

a) Activities

The potential user needs, and the potential use of COACCH research in decisions, were discussed throughout the project. The early focus of these activities was in the initial months (1-7) of the project. This included surveys and short conversations between relationship managers (RM) and their designated stakeholders. RMs filled a template with information on stakeholders' interests in *inter alia*: current and future risks; decision-making under climate change and research topics e.g. scenarios, extreme events, slow onset change, tipping points.

At the first workshop, a detailed co-design exercise was conducted to understand the areas of most relevance for the stakeholders. COACCH consortium members presented proposals for research topics relating to climate impacts, tipping points and policy responses. Stakeholders were encouraged to add further research topics of interest. The topics were then prioritised in a voting exercise, resulting in a ranking of the research topics to be addressed by the project (see Image 1).

Stakeholders were also asked to outline relevant decision-making processes and opportunities to use the COACCH results in their organisation – with the timing of these clearly articulated so that it could be related to the time period of COACCH – this allowed consideration of whether early synthesis results might be relevant – or later detailed results were possible (e.g. if the upcoming policy window was in a couple of years time). Understanding stakeholder interests and information needs allowed the team to feed results into important windows of opportunity for decision-making such as the review of the EU Climate Adaptation Strategy.

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As highlighted earlier, the deep engagement process was found to have the greatest impact in leading to the uptake and use of COACCH results. This reflects the greater resources dedicated to engagement and the use of case study work to tailor general COACCH results to a particular user and end-use. However, this takes more time and resources, and thus is difficult to do this for a large number of stakeholders.

b) Feedback

Jonathan Beynon (FCDO) noted that the way stakeholders and researchers identified and prioritised research areas together in the first workshop was a good way to implement co-design. The 29 participants who responded to the first evaluation survey were unanimous in their positive response to the presented COACCH co-design approach, with a majority (n=25) stating that they had plenty of opportunities to express their interest and needs for research on the economic costs of climate change during the first workshop. However, Paco Heras (OECC) commented that it can be difficult for the project to respond to such a wide range of different needs and interests.

Furthermore, the process of asking for users' needs may unnecessarily raise expectations among stakeholders of what the project is capable of producing. As Shouro Dasgupta, sector lead on energy, infrastructure and services noted, some research suggestions just could not be taken up: "there can be a mismatch between the stakeholder point of view and what the models can produce. Reconciling this is critical." Ramiro Parrado (Lead on macroeconomic assessment) as well as other interviewees from the project team also emphasised that the amount of leeway that researchers have to respond to stakeholder interests is restricted by the parameters set out in the proposal (i.e. the models and operating partners chosen) and the subsequent grant agreement with the European Commission.

> *"We didn't change what we had planned hugely. Because the models had already been chosen, there were a lot of things we just couldn't do, despite stakeholder interest. That was a bit frustrating."*
>
> Alistair Hunt, Sector lead for biodiversity

> *"The project was not so different from what we had planned. The major change was to improve the way we communicated the results e.g. adjustments to the web-based tool"*
>
> Ramiro Parrado, Lead for macroeconomic assessment

Stakeholders were asked to highlight processes for COACCH results to feed into. Some members of the consortium took these up in an active way, adapting policy briefs with nationally specific information (e.g. Spain and UK). These happened where there was close bilateral engagement with deep-engagement stakeholders, and outputs were able to feed directly into these processes. For other processes, there was less clear follow up and again, for those who were not engaged in bilateral exchanges, there may have been a lack of transparency about how COACCH results were feeding into different decision-making processes.

Paco Heras (OECC) suggested that identifying stakeholders with similar needs (for example, water authorities) might help outputs be aligned with a greater range of stakeholders' needs. Indeed, this was borne out by a smaller policy workshop in March 2021 (addressing climate

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change in European supply chains). This more specialised topic allowed for a greater depth of discussion leading to co-production of knowledge outputs that meet user needs. In the post-workshop reflections, the COACCH team noted how rich and useful it had been to have such a targeted discussion and that more such events should be supported.

c) Lessons learned

- The co-creation process is challenging within the current EC RTD approach, because of the requirements of the proposal and grant agreements, with very defined budget, work programmes and deliverables. This limits what can be changed. While it might be possible to build in more flexibility for co-creation, this would only be possible within each partner activity and budget, as it is very unlikely partners would agree to changes in budget allocation from themselves to others once work had started.

- There may be a need to think about exchanging with stakeholders at the proposal stage to ensure that models and consortium is able to respond to user needs and that stakeholders are made aware of the limitations. However, this is difficult due to a lack of budget resources (e.g. for workshops) and the fact that proposals may not subsequently get funded. This might suggest a potential role for RTD in greater co-creation for research proposal calls.

- Close bilateral interactions (and deep engagement) with stakeholders helps to provide targeted information within the right timeframe, so that it can be used in strategies and policy processes e.g. EU Adaptation Strategy. This leads to greater impact of the project, through the more direct use of COACCH results in decisions and in policy documents.

- Integrating focused workshops (e.g. sectoral or risk-specific) could be more conducive to effective co-design and co-production of research.

Principle 3. Agree on the process

Develop a process for co-production to be discussed and agreed with stakeholders.

a) Activities

The process of implementing co-design, co-production and co-delivery was given detailed consideration, with a full Work Package in the project dedicated to this task. This began with the aforementioned literature review, which took in the state of the art on co-creation in the context of climate change research. This fed into the development of the nine principles to be implemented by the project and which were outlined earlier in this report. The idea of co-designed research was presented at the first workshop and the planned process of engagement and work plan were outlined (see Annex 2: Oveview of collaborative work process). Small group discussions were held on roles and responsibilities with a final list of 'roles and rules' for engagement gathered collectively. As highlighted earlier, a letter was sent out to stakeholders that set out the potential benefits of participation, but also highlighted the time requirements and inputs needed. Within the project team, there was also an allocation of roles and responsibilities, particularly with the overall knowledge broker role (shared between PWA and

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Ecologic) and the roles and responsibilities of the stakeholder relationship managers. The latter helped spread the considerable time involved in maintaining contact with a large group of 30 stakeholder organisations. However, the delivery of this role varied considerably between partners. Some were active, while others did not invest sufficient effort, and in these cases, relationships with stakeholders did decline significantly over the project duration.

b) Feedback

The 29 participants who responded to the evaluation survey at the first workshop (2018) were unanimous in their positive response to the presented COACCH co-design approach, with a majority (n=19) finding it to be "excellent and highly engaging". In the evaluation survey at the third workshop (2020), respondents who had participated in previous COACCH workshops (n=14) continued to rate the co-design process positively with a majority (n=10) rating it as 'very good' or 'excellent'.

The process for engagement and the roles and responsibilities were discussed and agreed upon by the stakeholders and research team at the first workshop (see Table 6). During an interview, Kit England (Sniffer/Climate Ready Clyde) noted that it would have been worth thinking a bit more about the co-design approach in the first workshop: "it felt like we talked about it, but only a little, and then just did it, rather than talking about it in a bit more detail". Furthermore, once the roles and rules had been agreed, they were not actively re-visited and there may have been an assumption that these were 'internalised' within the logic of engagement.

Table 6. Feedback on roles and rules for collaboration in COACCH

What?	Who?
Regular communication between workshops	Research team
Clear communication about engagement and inputs needed	Research team
Flexibility, space and advance notice of needs for inputs	Research team
Act as clearing house to provide research team with contacts and data	Stakeholders
Shared information about ongoing decision-making processes and milestones	Research team and Stakeholders

As can be seen in the Table, communication and information-sharing in both directions were at the core of the recommendations for collaborative engagement. At the first workshop, a draft synthesis of knowledge and gaps was presented (see first policy brief outlined earlier). It had not been circulated in advance as there had been considerable time-pressure to make it available for the meeting and furthermore its draft form meant that it was not desirable for the costs of the impacts to be shared in wider circles. However, stakeholders made strong requests that information be circulated in advance of workshops rather than being presented with a lot of information in a short space of time and asked to react.

For the second workshop, efforts were made to provide information ahead of time. Yet this was still perhaps insufficient for stakeholders to be able to confer with colleagues, thus improving the insights they could bring to the workshop (see also the findings and lessons from Principle 1). Verbal feedback at the second meeting suggested that the short presentations during the workshop were too condensed. Following this feedback, the policy brief for the third (online) workshop was circulated a week ahead of time, with a physical copy posted on request. One

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stakeholder who had made the request for earlier circulation of background reports noted their appreciation in the online chat on the first day: "THANKS for sending paper round in advance!"

Although there was no discussion with stakeholders about the use of online formats for collaborative engagement during the Covid-19 pandemic, like many other event organisers, the team took the decision to move the third workshop online. While the feedback on the COACCH execution of the online event was positive, face-to-face meetings were seen as preferable by all who were interviewed and necessary for detailed discussions.

> *"The sessions we had were good and there was a nice informal and conducive atmosphere. I really liked the activities to keep the participants engaged. There is a downside though to these online events – they have to be kept shorter to reduce screen time, but then you can't cover so much ground."*
>
> *Jonathan Beynon, UK Foreign, Commonwealth and Development Office (COACCH working group stakeholder)*

c) Lessons learned

- The focus on process, and the identification of roles and responsibilities was extremely useful, and helped to manage the co-creation activities.

- Related to this, the use of knowledge brokers was critical to the success of the co-creation process, keeping things move between workshops as well as at events. The designation of a wider group of relationship managers helped to spread the work involved with managing a large number of stakeholders, although the effectiveness of various partners in delivering this role varied considerably.

- Greater attention could have been paid in the initial phase to discussing the co-design and co-production process with stakeholders themselves, and to revisit roles during regular follow-ups.

- There may be a gap in the approach taken towards roles and rules of engagement; these may need to be re-visited. Rather than just checking if stakeholders are 'satisfied' there may be a need to provide space for more detailed discussion on the process from both research team and stakeholder points of view.

- The decision to move online was taken without consultation as there were few alternatives. However, it might have been appropriate to have consulted with stakeholders about preferred length and structure of the meetings.

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Principle 4. Joint outputs

Identify a set of joint products (outputs) for the project to work towards

a) Activities

The early stages of the project focused on setting the foundational elements of the co-production protocol in place. At the first workshop the project team and the stakeholders to co-designed research questions, scenarios and agreed on how the research should be delivered. This, as well as subsequent workshops, provided the opportunity to discuss joint outputs and how these could be designed to directly address stakeholder needs. At subsequent workshops, these products – such as the scenario explorer tool, the policy simulator, and the various synthesis materials – were presented to stakeholders in order to gather feedback to refine the outputs.

While it was initially anticipated that stakeholders would be more involved in joint knowledge production as the project progressed, this was made difficult by the COVID pandemic, and workshop sessions were shortened and focused on interactive discussion about early results and how to improve communication of these.

Nevertheless, at the final workshop, a session was held to discuss how to make the final outputs most relevant for end users and for wider dissemination. This identified useful ways of communicating the results (i.e. short bullet point policy briefs for busy policy makers) as well as specific suggestions (e.g. to present results in terms of benefit to cost ratios).

There were also some cases where COACCH results were directly incorporated in stakeholder policy documents (see earlier sections, and examples from Glasgow and UK CCC), which was a further way of joint production that had not been anticipated at the start of the project.

b) Feedback

COACCH takes a brokered and instrumental approach to the co-design and co-production of knowledge (see Figure 2). This means that while the first workshop reflected a more open format between researchers and stakeholders, subsequent workshops may have been less so. After the first meeting, more time was dedicated to presentation of results and gaining feedback, rather than perhaps an opportunity to genuinely shape the work. Paco Heras (Spanish Climate Change Office) for example felt that while the first workshop offered a greater opportunity to contribute, to share and convey ideas, the second and third workshops had more of a transmission character (one-way communication). Esther Boere, Sector lead for agriculture, forestry and fisheries agreed “We mainly presented results and received comments – we used the feedback to refine rather than really shape the research”. Nevertheless, stakeholder inputs were valued and many sector leads commented on the important role their views had played in co-designing the outputs.

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"The first Brussels workshop was particularly useful … the stakeholders' comments were definitely echoing in my mind while doing the work."

Alistair Hunt, Sector lead for biodiversity

"It helped me to think about my own work, as well as messaging. The comments on intermediate results during meetings were very helpful to shape the deliverable."

Esther Boere, Sector lead for agriculture, forestry and fisheries

The regular surveys with relationship managers have also demonstrated that they see stakeholders' inputs as useful for shared research products (see Figure 5).

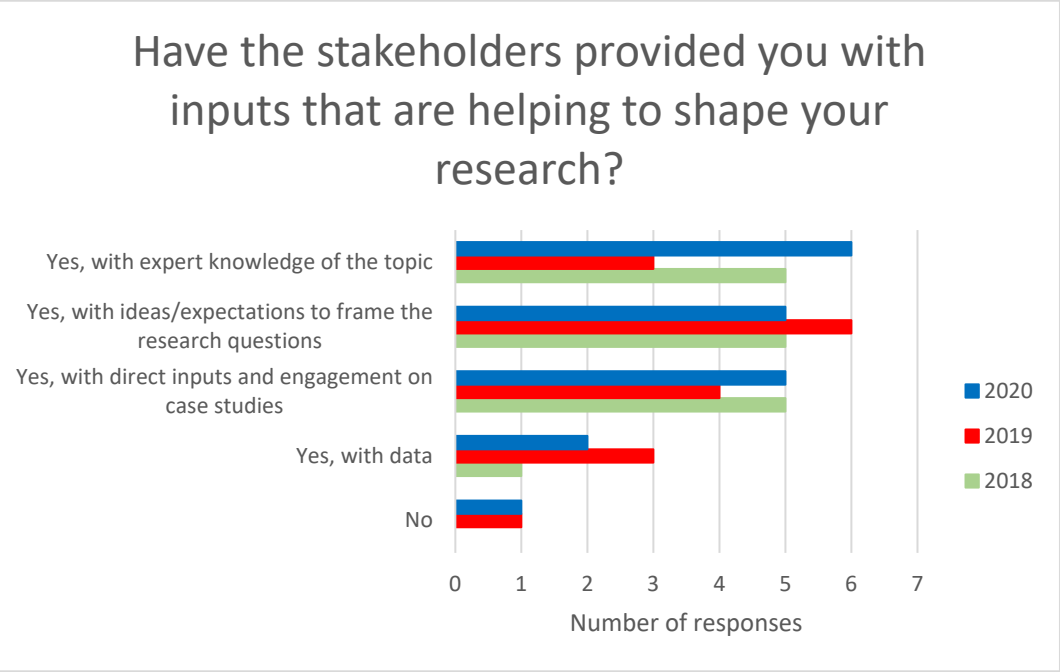

Figure 5. Annual surveys with relationship managers on usefulness of stakeholder inputs to research

Feedback and ideas to shape the scenario explorer web tool and policy assessments were gathered in a general way at the first meeting; these outputs were shared during the project's lifespan and so stakeholders could share early feedback on their content and design. Nevertheless, while it may be more obvious to the research team how stakeholder feedback has been incorporated, the message of how the outputs have been jointly shaped and co-produced could still be communicated (back to stakeholders) in a more explicit way.

Regarding the outputs that have been produced, stakeholder feedback has generally been very positive. A majority have found the information in the policy briefs useful and at the right level of detail, while the draft versions of the scenario explorer have been met with interest.

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c) Lessons learned

- Joint knowledge products do offer the opportunity for closer collaboration around defined outputs, and can help ensure outputs are presented in a way that makes them most suitable for end-users (e.g. policy makers). There were some cases where COACCH results were directly incorporated in stakeholder policy documents, which was a further example of joint production that had not been anticipated at the start of the project.

- It is useful and important to ensure that initial workshops provide space for stakeholders to engage in shaping the research, its direction and outputs. However, follow-up workshops need to be designed in such a way that stakeholders feel that they are being given sufficient opportunities to shape the outputs.

- Equally, it was found sometimes the case that researchers need to be pushed to take stakeholder suggestions on board and to adapt their work to produce useable and shared outputs.

- It may be necessary to communicate more clearly about how stakeholder contributions are shaping the research to ensure that the outputs are understood as the product of a collaborative process and not simply a consultation with researchers.

Principle 5. Time for engagement

Allow sufficient time for the co-production process, and seek to build opportunities for continued engagement through the project

a) Activities

A key feature of the collaborative process in COACCH was the ongoing and iterative nature of engagement (see also Principle 7. 'Iteration'). Within the regular stakeholder workshops (four workshops over the course of the project), time was divided between the project team presenting the current state of their research and results, and opportunities for stakeholders to engage and discuss. Outside of the workshops, researchers and stakeholders were encouraged to hold bilateral exchanges at a frequency that suited both parties. The most successful relationships were those which built on existing connections and where the relationship managers were able to harness the project results to meet specific stakeholder needs.

b) Feedback

In the organisation of the workshops, there was often a tension between wanting to allocate enough time to sharing the results of the research team while also making time for stakeholders to participate. On the one hand, the organising project team felt that the events should not be too long or too frequent so as to ensure attendance. At the same time, once people had signed up and made the effort to attend, they sometimes appeared to feel short-changed by the amount of time available for discussion. Kit England (Sniffer / Climate Ready Clyde) for example, felt that the workshops could have been longer; although he recognised that with so many high-level participants it can be difficult to get them to commit to more than one day. This is perhaps

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indicative of different understandings of the type of co-design that was being implemented. It may be that there were greater expectations of participation than the research team were able to allow for, given the bounded nature of the project and the fact that the models to be used had already been determined.

In a survey of participants at the first workshop 86% said they had plenty of opportunities to express their interest and needs for research on the economic costs of climate change. Kit England remarked that "although we had to get to some outcomes at the first meeting, the path was not too fixed and that worked with people." However, by the second workshop, there was a distinct difference in that only 44% of the participants stated that they had "plenty" of opportunity to express their interests and needs for research on policies; although a further 50% said they had "some" opportunity. A general comment made by Paco Heras (OECC) about workshops (not only in COACCH) was that often a lot of the time is devoted to providing background information and then little time remains for discussion and inputs from stakeholders. When the workshops moved to a virtual format (as a result of the COVI-19 pandemic), the organising team felt the need to keep these short to avoid screen fatigue. However, this unfortunately meant that there was even less time available for stakeholder contributions than in the face-to-face format.

The actual stakeholder meetings used a wide variety of meeting mechanisms to stimulate engagement and keep participants interested, i.e. using a combination of presentations, group work, world café sessions (rotating tables) and 'meet an expert' (allowing participants to move around a room and dive into the detail in areas of interest.

The interviews with both stakeholders and research team suggested that the interactive and informal elements of the face-to-face workshops been important to support the co-production of research. Stakeholders had enjoyed the freedom to move around the room to talk to researchers about the findings in more depth on a one-to-one basis. Both researchers and stakeholders used the opportunity of the lunch and breaks to have bilateral follow-ups on specific aspects of the work.

> *"It was great to be able to have deeper conversations with the researchers and build our understanding as a stakeholders – I'd be interested to know if the academics got as much out of it as we did."*
>
> *Kit England, Sniffer / Climate Ready Clyde (COACCH deep-engagement stakeholder)*

> *"The one-to-one interactions were very effective - lunch time talks and coffee chats are important for going into detail about why stakeholders need certain types of information or in time for a particular process or report they are working on."*
>
> Daniel Lincke, Sector lead for sea-level rise and coastal flooding

By the time the second workshop took place, 16 months had elapsed since the research team and stakeholders had met as a whole group. When asked whether they had had additional contact with COACCH researchers outside of the workshop, just under half (n=8) of participants completing the evaluation survey (n=18) answered positively. Although low, these numbers are

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in part due to the fact that not all had committed to participate as 'deep engagement' stakeholders. While these DES were being kept abreast of project developments, those in the broader WGS category would have experienced a particularly long period with little opportunity to interact. This poses the question from above (Principle 1. 'Stakeholders') whether there is any value to be gained from asymmetrical forms of engagement, or whether this leads to very heterogeneous experiences of collaboration.

c) Lessons learned

- Spaces for open discussion and informal one-to-one interactions at project meetings were appreciated by both stakeholders and consortium members and led to greater understanding between researchers and end-users.

- Shorter sessions with less space for discussion e.g. the online sessions that were held during the pandemic (discussion at the third workshop), led to lower levels of satisfaction from the stakeholders but not necessarily for the consortium.

- Opportunities for continued engagement between meetings did take place, but very much relied upon the proactive initiative of individuals seeking contact with one another. These processes could perhaps have been further supported through check-ins and reporting.

Principle 6. Resources

Allocate sufficient financial and staff resources to the co-production process and use a facilitated process for engagement.

a) Activities

In order to ensure an effective co-production process, a significant amount of staff time was allocated to the implementation. The Work Package covering the co-production tasks received 10% of the overall project budget and importantly every project partner allocated resources to dedicate to these tasks. This allocation of staff time guaranteed that sufficient resources were able to organise, prepare, and manage the various co-production activities. As the stakeholder engagement and co-production Work Package ran throughout the duration of the project, this amount of staff resources was necessary to ensure sustained communication and exchange with stakeholders.

These staff resources included dedicated event planning staff, whose extensive experience in facilitating stakeholder workshops ensured that these events ran smoothly for everyone involved. Furthermore, the project budget set aside adequate financial resources for event spaces and facilities, meals, and coffee breaks. Finally, an external moderator was brought in to increase the impact and user-experience of both of the in-person workshops.

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b) Feedback

Overall, the amount of financial and staff resources dedicated to the co-production process was sufficient to organise effective co-production activities and processes. During the evaluation process, and in informal exchanges with partners and stakeholders, the general perspective of the co-production activities, the organisation of the workshops, and the available resources was positive. Nevertheless, there may have been a slight difference between the project partners who part of the core co-design team (PWA and EI) and other partners who were responsible for providing contributions. Surveys with relationship managers suggested that they found co-design to be resource intensive and the interactions with stakeholders to take up more time than expected.

Having sufficient resources, the project was able to make use of an external moderator at the first and second workshops. While this brought in a level of professional expertise in terms of room management and time keeping, it was not necessarily always in alignment with the nuances of the discussions. The third and fourth workshops were moderated by COACCH team members but were briefer in length and online making it difficult to make a direct comparison as to their relative impact and effectiveness.

Having sufficient resources to have full day workshops allowed for valuable 'conversation space' to be allocated in the breaks for additional discussions to take place between the research team and stakeholders as mentioned above (Principle 5. 'Time for engagement'). Informal and interested conversations took place between COACCH team members and stakeholders throughout each of the days. The dinners held on the evening prior to the first and second workshops appeared to be appreciated by those present and the events opened with a positive atmosphere.

> *"These processes were quite fundamental and creating spaces around the event are as important as the workshop itself. It is important to build trust between the researchers and the stakeholders as a foundation for co-design."*
>
> Kit England, Sniffer / Climate Ready Clyde (COACCH deep engagement stakeholder)

c) Lessons learned

- While the co-design and co-production approach was found to have large benefits, co-design was found to involve considerably more resources and time compared to a normal research project, particularly at the start of the project, but also later on to ensure user interests were delivered. In COACCH, 10% of the project budget was allocated to co-creation activities (including event costs).

- While resource level was sufficient to drive the overall process, surveys with relationship managers from the project team suggested they found co-design to be resource intensive and the interactions with stakeholders to take up more time than expected.

- There are positive and negative aspects to consider when bringing in an external moderator to a closely collaborative process. It may be more conducive to the process

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to choose a moderator from within the project if they have adequate facilitation experience.

- The face-to-face meetings were valued by many for the space they provided for informal interactions. The dinners, coffee breaks and other unmoderated exchanges were missed by many after the workshops moved online.

Principle 7. Iteration

Adopt an iterative approach, providing opportunities to adjust the goals, method and outcomes as the project progresses, and identify checkpoints for discussion.

a) Activities

Iteration was one of the key principles informing the project's collaborative approach. To implement this, a range of reporting activities and opportunities for feedback were incorporated in the collaborative process. At the stakeholder workshops, participants identified relevant decision-making processes which COACCH could feed its results into. The first inputs from 2018 were updated at the 2nd stakeholder workshop. Unfortunately, the exercise could not be accommodated in the schedule of the shorter virtual workshops.

The co-design of COACCH research topics at the first stakeholder workshop has been described above under Principle 2. 'Research needs and uses'. At the consortium project meeting in July 2018 the research team discussed the feasibility of covering stakeholder research priorities in practice (see Figure 6). Following the discussion, it was decided that 83% of the topics of high interest to stakeholders could be taken forward for research. In addition to the topics put forward by the COACCH consortium, stakeholders also proposed several new topics for research. Of these suggestions, 40% were taken up by the project. While this is not a large percentage, it nevertheless demonstrates an important openness to new ideas on the part of the scientific staff and a willingness to take stakeholder suggestions seriously.

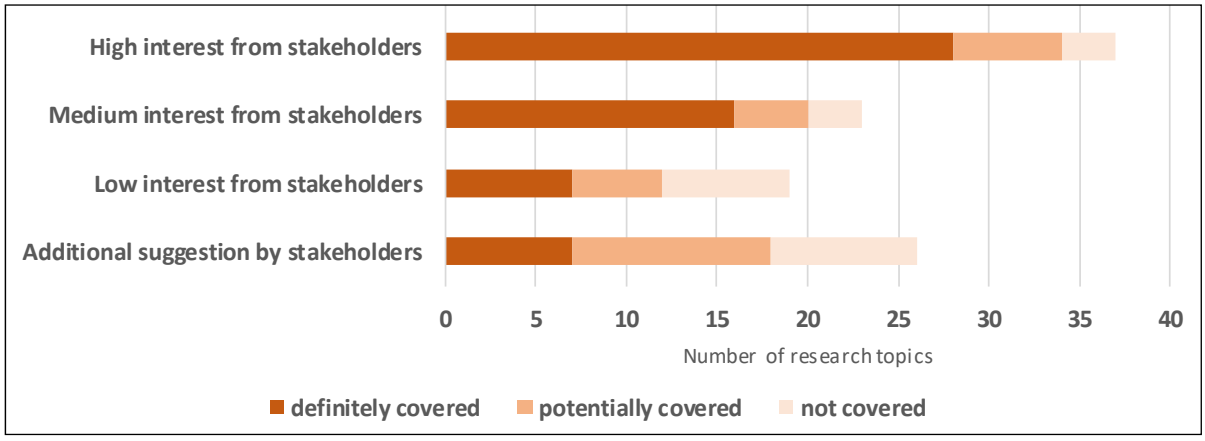

Figure 6. Summary on discussion of research topics during project meeting July 2018

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By the next consortium project meeting in May 2019, preliminary results were already available for 16 research topics (21% of all topics) (see Figure 7). This included seven research topics identified as being of high interest to the stakeholders and two research topics, which were additional suggestions by stakeholders. For an additional 20 research topics (26%) work was ongoing.

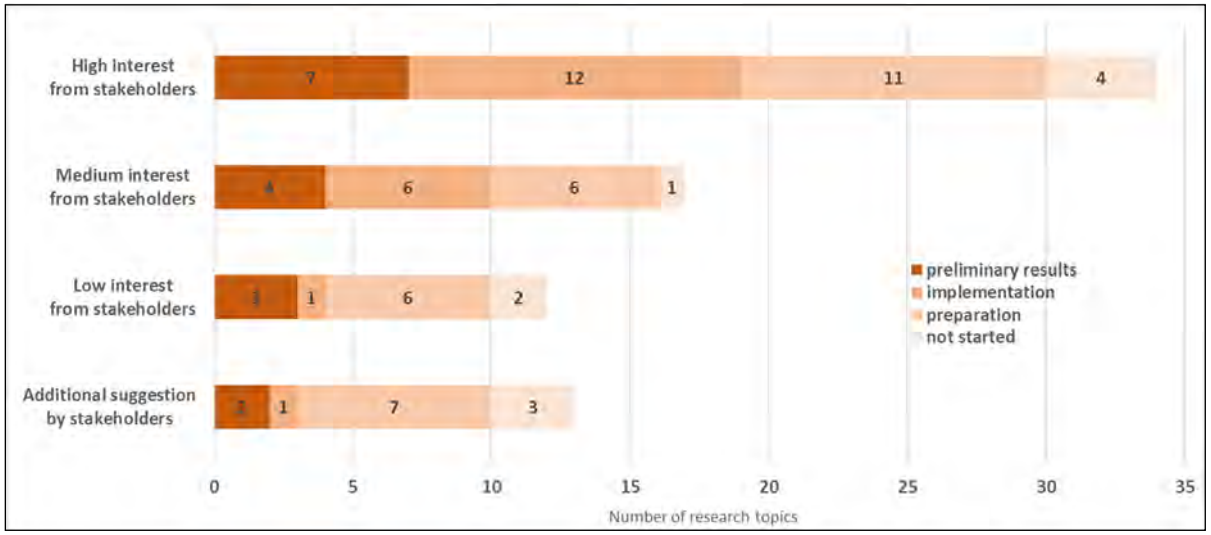

Figure 7. Progress on research topics in May 2019

The figures above were presented to participants at the second workshop. The aim of presenting this information was to demonstrate how stakeholder inputs were being considered and to promote transparency and accountability as suggested by the common features of successful co-design.

Some further iterative discussions were recurring elements at the workshops, e.g. a brainstorming on relevant tipping points was held at the first workshop, with the progress and results of the tipping point assessment presented at the second and third workshops. Joint products e.g. the COACCH scenario explorer, were discussed at several meetings, progress on tool development was presented and comments were gathered at various stages.

b) Feedback

Much of the core work was presented in stages across the stakeholder meetings and stakeholders were able to contribute across several iterations. The move to virtual events and the resulting time constraints were challenging in this regard. For example, the detailed discussions on policy processes at the third workshop would have been expanded upon and stakeholders given the opportunity to feedback on different case studies they had been working on. However, the team decided to keep the online format shorter to avoid 'screen fatigue' and the discussions in the third workshop had to be shortened considerably. Furthermore, at times, work had not reached completion e.g. the tipping point assessments before the third workshop, which limited the depth of discussions at that stage.

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Kit England (Sniffer / Climate Ready Clyde) noted that it can be difficult to keep a handle on everything that is going on in large projects such as COACCH. He would have found a central organising concept e.g. macro-economic assessment a helpful aid in this regard.

c) Lessons learned

- The time schedule of the project activities (and outputs) should ideally be aligned with the engagement process. However, often research packages were designed around the research time needs and so did not exactly line up. It could be useful to identify check-in points for different work streams to address this.

- A clear conceptual overview on inputs and outputs between different work streams and work packages could be helpful to present to stakeholders to show central research elements, interlinkages and main outputs of the project.

- There is a need to regularly highlight the stakeholder priorities within the project team discussions. A suitable tool / format to monitor and map planned and implemented project activities regarding stakeholder priorities should support the process. Sufficient time resources should be reserved for discussions within the project team, e.g. during project meetings.

Principle 8. Inclusion

Ensure an inclusive process that recognises and respects different views.

a) Activities

The original stakeholders approached were chosen primarily based on their expertise and institutional representation (see Principle 1. 'Stakeholders'), however a certain balance of geographical regions, type of organisation (business, policy, academia, NGOs) and gender was also considered.

During the stakeholder workshops and the bilateral meetings the stakeholders had room to express their questions and feedback. As described above, time, space and resources were dedicated to a range of formats for engagement. This included smaller groups and one-to-one discussions and some stakeholders chose to approach research team member bilaterally via email in follow-up. A mix of plenary and small group discussions were chosen to accommodate the exchange, e.g. at the second workshop a poster presentation incl. methods and results for sectoral impact assessments were held in an open "market place" setting.

Virtual engagement was necessary for the third and fourth workshops. This can have a democratising effect, with online chat functions and virtual whiteboards allowing for greater range of contributions. By the same token, it risks losing the perspectives of those who are unable or unwilling to engage in this way online. For the virtual meetings, break-out groups were used to split into smaller groups to hold more inclusive and focused discussions. The makeup of the groups was partially selected by the project facilitators, e.g. to hold discussions within the COACCH stakeholder groups (local / national policy, business, knowledge broker & NGOs).

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Stakeholders were often able to choose the discussion topic based on their preferences, e.g. for the virtual meetings topics for break-out rooms were selected based on preferences by the stakeholders, which were gathered during registration for the workshop. In this way stakeholders were provided with ample opportunity to engage on topics that they were interested in and comfortable speaking about.

b) Feedback

After the first stakeholder workshop, 86% of stakeholders indicated that they had "plenty of opportunities" to express their interests and research needs on economic costs of climate change. Following the second workshop, this decreased significantly, with 45% of respondents saying they had plenty of opportunity to express their research interests on (a) socio-economic tipping points and (b) policies. A further 52% stated that they had only "some opportunity." In the context of small group discussions at the third stakeholder workshop, 84% of participants said they had plenty of opportunities to contribute on the issues of tipping points and policy making. These results highlight the importance of smaller groups and adequate space for discussion for effective inclusion of a range of stakeholder perspectives.

As mentioned in Principle 1. 'Stakeholders', a number of NGOs and business partners were selected and approached to participate in advance of the first workshop. Unfortunately, these efforts were not very successful and both the aforementioned groups were under-represented in the project activities, and also declined in engagement over time. The limited availability and resources for participation in such a collaborative process were mentioned as main reasons. As is often the case with these types of longer research project, it was also difficult to keep all stakeholders actively engaged over the 4 years. However, the process remained open and new stakeholders were included throughout the project duration. Nevertheless, perhaps an opportunity was missed to follow up on stakeholders who had dropped out and to ask for more feedback from within the group about whose perspectives might not be represented. This leads to obvious gaps in the feedback received and the inclusion of these perspectives in the project.

c) Lessons learned

- The stakeholder engagement activities were all executed in a spirit of transparency and respect. The consortium was open to ideas and feedback from stakeholders.

- During a 4-year stakeholder engagement process it is natural that the activities of stakeholders vary and some stakeholders need to reduce their activities, change jobs, etc. Therefore, during the course of the entire project new stakeholders should be contacted to join the discussions. Attempts to gather relevant stakeholders or to reach a certain balance between groups should be a continuous process.

- It should be made clearer from the outset to the research team that the priorities and research needs formulated by stakeholders are of key importance and that the research activities will be monitored and evaluated according to their ability to meet stakeholder needs.

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Principle 9. Monitoring and evaluation

Ensure a continuous process of monitoring and evaluation, using this to inform the project as it progresses, and to provide lessons for future co-production at the end.

a) Activities

Evaluation was seen as an important component of the engagement process from the beginning. The COACCH approach included evaluation as a separate stage (see Figure 1). Five main evaluation inputs were used:

(1) **Frequent evaluations and monitoring of accomplishment of prioritised research topics:** During the first stakeholder workshop research topics were gathered and prioritised together with the stakeholders (See Principle 2. 'Research needs and uses' for further details). The implementation of these research topics was monitored during each of the project meetings organised on a yearly basis. During these exercises the status of the work was indicated by the project partners in a table format (see Section 4. 'Research team reviews' and Annex 1: Research topic table). The decision to not follow up on a number of research topics was also monitored with this exercise. The main reasons for not further implementing research topics were that data and suitable methods were unavailable or the extent of work needed exceeded the planned project workload. The final interviews with the project partners (see point 4 below) were also used to collect final feedback on the implementation of the research topics.

(2) **Evaluation questionnaire at each stakeholder workshop:** At each of the four stakeholder workshops an evaluation questionnaire was circulated (workshop 1 and 2 as printed copies, workshop 3 and 4 as online survey). It included questions on the usefulness of information provided within the different sessions, feedback to the co-design approach and general comments to the workshop. The first questionnaire contained a question on how the COACCH collaborative approach could be evaluated. Half of the participants indicated evaluation questionnaires as suitable tool. Other options, such as group discussions, online questionnaires or live polls, were also indicated as being beneficial.

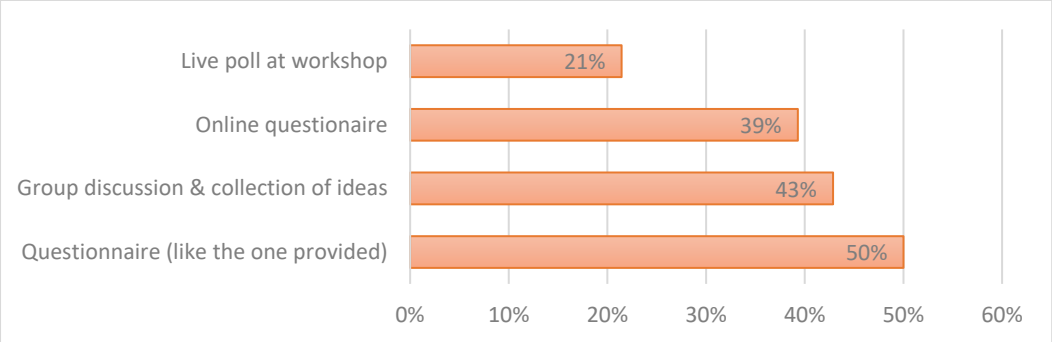

Figure 8: Results of evaluation questionnaire, first stakeholder workshop, May 2018

(3) **Evaluation panel at face-to-face workshops:** In addition to the evaluation questionnaire, talking heads had the possibility to reflect on the workshops. The panel was integrated at the end of the face-to-face workshops. At the first workshop a panel

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with three stakeholders discussed their impressions; at the second workshop two stakeholders and one project partner emphasised their reflections at the end of workshop.

(4) **Survey with relationship managers:** An online survey with the relationship managers was conducted on a yearly basis in Q1 of 2019, 2020, 2021. The survey had the objective to gather information on the interaction between project partners and stakeholders related to the bilateral engagement and to monitor the suitability and usefulness of the collaborative process from the perspective of the researchers. The survey included questions on the collaboration between researchers and stakeholders within the last year, the inputs of the stakeholders (e.g. delivering data) and the researchers' opinion on the main benefits of the collaboration.

(5) **Final evaluation interviews at the end of project as basis to prepare co-design guidelines (D5.8)**: At the end of the project, nine interviews were conducted. The interviews had the objective of gathering feedback on the collaborative process. These interviews also aimed to enrich the information which can be used to develop this document on guidance for collaborative research projects which summarises lessons learned and recommendations for future collaborative research projects.

b) Feedback

The regular discussions of the research topics were very beneficial to monitor the implementation progress of the research topics. Furthermore, the monitoring exercise was used as a tool to highlight the importance of considering stakeholder interests to project partners throughout the project. The research topic tables also enabled the project team to report back to the stakeholder in a transparent way how many of the research topics have been taken up and in which project outputs the results are published, e.g. project deliverables or scientific papers. The iterative monitoring and evaluation process has been fundamental to the production of this report and will support the production of the report on findings from thematic working groups and deep engagement case studies.

The results from the evaluation questionnaires (filled at the end of the workshops) were re-considered before the project team started the preparation of the next workshop. The evaluation was useful to gather major feedback on, e.g. time schedule & balance of presentations and discussions, general satisfaction with the selected topics. Partially it would have been nice to gather further detailed feedback, but as the number especially of open questions is limited within such a questionnaire it was not possible. In this context, the evaluation panel was an interesting method which enabled a further more detailed expression of feedback. Unfortunately, due to the moving to online-workshops with a shorter time schedule, the panels were not included for the last two workshops.

The online survey with relationship managers was beneficial for gathering feedback on the individual bilateral engagement processes. To increase transparency on the benefit of the bilateral engagement, the survey could have included more detailed information on the exchanges between stakeholders and project partners, e.g. main topics covered during the bilateral meetings or more details on challenges to engage with stakeholders. In hindsight, more could have been done to follow up on the results of these regular surveys to replace 'lost'

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stakeholders and to improve the balance of stakeholder types (especially in relation to non-governmental and business stakeholders).

c) Lessons learned

- The continuous engagement process, and regular stakeholder evaluation and surveys were extremely useful for the team in understanding stakeholder needs and improving the process and outputs.
- The use a mix of evaluation tools to gather general feedback from the whole group and detailed feedback from individuals worked well. The review of the feedback from the previous event, before the next, provided a useful way of ensuring feedback was incorporated.
- For comparability, it is better to use the same evaluation questions throughout the project to show possible developments and improvements at the end of project.

Conclusions

This section has evaluated the co-design, co-production and co-delivery activities as practically applied in the COACCH project. It has taken into consideration the feedback from stakeholders through surveys and interviews and it has taken into account the views of relationship managers who had closer connections with the stakeholders as well as sectoral impact leads who met with stakeholders at the three project workshops.

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Table 7 7 summarises the activities, feedback and lessons learned.

Communication was raised in the 'roles and rules' discussion with stakeholders at the first workshop and has been repeatedly emphasised during the project. Although efforts were made to keep channels open and to communicate results, feedback from interviews suggested that even more internal communication could have taken place to keep stakeholders abreast of interim progress. Jonathan Beynon (FCDO) for example was keen to see more proactive updates, news and contact around the project. "People need prompts to look at things. The newsletter was useful to point to more detailed reports, but it should also update with news and interesting things to keep momentum. The newsletter also seemed to get less frequent." It was intended that the social media platforms used by the project should provide this kind of update, but of course it is important to bear in mind that not all stakeholders are regular social media users. Nevertheless, Jonathan's point that having greater opportunities to engage more between results – which in theory was meant to happen – could have happened more to ensure that the co-design and co-production was more collaborative. The policy briefings were positively received and those interviewed found these to be clear, understandable and of high quality. Despite the clear importance of communication as a central thread, this was not included as a principle per se in the COACCH protocol. This leads us to want to consider whether communication may be so central to collaborative research processes that it should be added as a tenth principle.

The general findings of the evaluation in Section 5 suggest that the project and its approach have been appreciated and the results have been of interest to the stakeholders. At the same time, the way in which the engagement process was conducted is certainly open to further refinement. In the final section, we share some final reflections on collaboration in COACCH.

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Table 7. Evaluation of COACCH co-design protocol implementation

COACCH co-design principle	Activities	Findings and lessons learned
1. Identify a group of representative stakeholders	• Deliverable 1.1 Stakeholder Database. • Creation of two main types of stakeholder: WGS and DES. • Identification of other individuals of interest for dissemination purposes.	• While it is possible to identify a group of representative stakeholders, maintaining and holding onto a balanced and representative group is something that needs to be actively monitored and managed. • Much greater success was found - in terms of collaboration and use of the COACCH results - when a deep engagement process was followed. • However, the distinction between types of stakeholders ('working group' or 'deep engagement') may cause unnecessary confusion as well as leading to heterogenous experiences of project engagement (i.e. for those not selected). • For a truly 'representative' group, it is important to target specific people as well as an organisation. Engaging with multiple people from an organisation can increase the extent and impact of knowledge co-production as well as minimising the risk of stakeholder 'bottlenecks' or drop-out.
2. Identify user needs and the potential uses of COACCH information for decisions.	• Discussions between relationship managers and stakeholders prior to Workshop 1 - template with stakeholder needs • Co-design of research topics, tipping points and scenarios at Workshop 1 • Outline decision-making processes for use of COACCH results at Workshop 1. • Ongoing collaboration and communication throughout the project	• The co-creation process is challenging within the current EC RTD approach, because of the requirements of the proposal and grant agreements. This limits what can be changed. While it might be possible to build in more flexibility for co-creation, this would only be possible within each partner activity and budget, as it is very unlikely partners would agree to changes in budget allocation from themselves to others once work had started. • There may be a need to think about exchanging with stakeholders at the proposal stage to develop programmes that match user needs However, this is difficult due to a lack of budget resources (e.g. for workshops) and the fact that proposals may not subsequently get funded. This suggests a potential role for RTD in co-creation for research proposal calls. • Close bilateral interactions (and deep engagement) with stakeholders helps to provide targeted information within the right timeframe, so that it can be used in strategies and policy processes. This leads to greater impact of the project, through the more direct use of COACCH results in decisions and in policy documents. • Integrating focused workshops (e.g. sectoral or risk-specific) can be more conducive to effective co-design and co-production of research.

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3. Develop a process for co-production to be discussed and agreed with stakeholders.	• Dedication of full Work Package in the project to co-design process. • Literature review on state of the art for collaborative climate change research. • Development of COACCH protocol and nine principles • Presentation of proposed process at Workshop 1 • Establishing of 'roles and rules' for engagement.	• The focus on process, and the identification of roles and responsibilities was extremely useful and helped to manage the co-creation activities. • The use of knowledge brokers was critical to the success of the co-creation process, keeping things move between workshops as well as at events. The designation of a wider group of relationship managers helped to spread the work involved with managing a large number of stakeholders, although the effectiveness of various partners in delivering this role varied. • Greater attention could have been paid in the initial phase to discussing the co-design and co-production process with stakeholders, and to revisit roles during regular follow-ups. • Rather than just checking if stakeholders are 'satisfied' with the process, there may be a need to provide space for more detailed discussion on the process from both research team and stakeholder points of view.
4. Identify a set of joint products (outputs) for the project to work towards	• First workshop (Deliverable 1.3) • Second workshop (Deliverable 1.7) • Third workshop (Deliverable 1.8) • Fourth workshop (Deliverable 1.9)	• Joint knowledge products do offer the opportunity for closer collaboration around defined outputs, and can help ensure outputs are suitable for end-users (e.g. policy makers). There were cases where COACCH results were directly incorporated in stakeholder policy documents, which was a further example of joint production. • It is important to ensure that initial workshops provide space for stakeholders to engage in shaping the research, its direction and outputs. However, follow-up workshops need to be designed so give stakeholders sufficient opportunities to shape the outputs. • Sometimes researchers need to be pushed to take stakeholder suggestions on board and to adapt their work to produce useable and shared outputs. • It may be useful to communicate more clearly about how stakeholder contributions are shaping the research to ensure that the outputs are understood as the product of a collaborative process and not simply a consultation with researchers.
5. Allow sufficient time for the co-production process and build	4 workshops dedicated to co-design, co-production and co-delivery over project lifetime • Conversation spaces built into face-to-face workshops for informal exchange	• Spaces for open discussion and informal one-to-one interactions at project meetings were appreciated by both stakeholders and consortium members and led to greater understanding between researchers and end-users.

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opportunities for continued engagement through the project.	• Ongoing bilateral engagement and communication to allow for ad-hoc engagement and feedback	• Shorter sessions with less space for discussion e.g. the online sessions that were held during the pandemic (discussion at the third workshop), led to lower levels of satisfaction from the stakeholders but not necessarily for the consortium. • Opportunities for continued engagement between meetings did take place, but very much relied upon the proactive initiative of individuals seeking contact with one another. These processes could perhaps have been further supported through check-ins and reporting.
6. Allocate sufficient financial and staff resources to the co-production process and use a facilitated process for engagement.	• Generous allocation of staff time guaranteed that sufficient resources were able to organise, prepare, and manage the various co-production activities. • Dedicated event planning staff, with extensive experience in facilitating stakeholder workshops. • Adequate financial resources for event spaces and facilities, meals, and coffee breaks. • External moderator to increase impact and user-experience at in-person workshops.	• Spaces for open discussion and informal one-to-one interactions at project meetings were appreciated by both stakeholders and consortium members and led to greater understanding between researchers and end-users. • Shorter sessions with less space for discussion e.g. the online sessions that were held during the pandemic (discussion at the third workshop), led to lower levels of satisfaction from the stakeholders but not necessarily for the consortium. • Opportunities for continued engagement between meetings did take place, but very much relied upon the proactive initiative of individuals seeking contact with one another. These processes could perhaps have been further supported through check-ins and reporting.
7. Adopt an iterative approach, providing opportunities to adjust the goals, method and outcomes as the project progresses, and identify check-points for discussion.	• Range of reporting activities and opportunities for feedback were incorporated in the collaborative process and revisited at several points over the project. • Annual review and feedback process on progress with consortium at project meetings • Reporting back to stakeholders at workshops and bilateral meetings.	• The time schedule of the project activities (and outputs) should ideally be aligned with the engagement process. However, often research packages were designed around the research time needs and did not exactly line up. It could be useful to identify check-in points for different work streams to address this. • A clear conceptual overview on inputs and outputs between different work streams and work packages could be helpful to present to stakeholders, to show central research elements, interlinkages and main outputs of the project. • There is a need to regularly highlight the stakeholder priorities within the project team discussions. A suitable tool / format to monitor and map planned and implemented project activities regarding stakeholder priorities could support the process. Sufficient time resources should be reserved for discussions within the project team, e.g. at meetings.

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8. Ensure an inclusive process that recognises and respects different views.	• First workshop (Deliverable 1.3) • Second workshop (Deliverable 1.7) • Third workshop (Deliverable 1.8) • Fourth workshop (Deliverable 1.9) • Bilateral interactions between deep engagement stakeholders and case study leads • Bilateral interactions between relationship managers and all stakeholders	• The stakeholder engagement activities were all executed in a spirit of transparency and respect. The consortium was open to ideas and feedback from stakeholders. • During a 4-year stakeholder engagement process it is natural that the activities of stakeholders vary and some stakeholders need to reduce their activities, change jobs, etc. Therefore, during the course of the entire project new stakeholders should be contacted to join the discussions. Attempts to gather relevant stakeholders or to reach a certain balance between groups should be a continuous process. • It should be made clearer from the outset to the research team that the priorities and research needs formulated by stakeholders are of key importance and that the research activities will be monitored and evaluated according to their ability to meet stakeholder needs. •
9. Ensure a continuous process of monitoring and evaluation, using this to inform the project as it progresses, and to provide lessons for future co-production at the end.	• Three annual reviews conducted with relationship managers in Q1 of 2019, 2020 and 2021. • Evaluation surveys after each workshop (Deliverable 1.3, 1.7, 1.8, 1.9) • Progress check with COACCH consortium via research topic tables at annual project meetings • Findings from thematic working groups and deep engagement case studies (Deliverable 1.10) • Guidelines for best practice (Deliverable 5.8)	• The continuous engagement process, and regular stakeholder evaluation and surveys were extremely useful for the team in understanding stakeholder needs and improving the process and outputs. • The use a mix of evaluation tools to gather general feedback from the whole group and detailed feedback from individuals worked well. The review of the feedback from the previous event, before the next, provided a useful way of ensuring feedback was incorporated. • For comparability , it is better to use the same evaluation questions throughout the project to show possible developments and improvements at the end of project.

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6. General reflections on the co-design process in COACCH

The COACCH project used a bounded form of co-design, focusing on generation of usable results of relevance to stakeholders, and using a brokered process. This worked well for this particular project (and the objectives of COACCH) but it is highlighted this is a 'light-touch' form of co-design.

The co-design and co-production did align the project towards user needs, although there are limits on what can be done given the fixed description of work and deliverables in RTD projects. Daniel Lincke, Sector lead on coastal flooding and sea-level rise for example remarked "Is what we did really 'co-design'? Or was it mainly just a bit of additional interaction?". Indeed, other consortium comments (see Principle 2. 'Research needs and uses') does indicate that COACCH researchers often pursued their own research agenda (in line with the DOW), but this is because a fixed project work plan and budgets and deliverables makes it challenging to adjust in a flexible manner as topics and budget were already allocated during proposal phase. Nonetheless, it is clear that researchers did do something different, not least because the majority of relationship managers (responding to the final survey) reported that they found the process to be resource intensive, and often challenging, conceptually and in practice.

The co-production process found that for a project like COACCH, which as a strong scientific alignment, there was much more interest from the policy stakeholders than in business and finance stakeholders. While the latter are interested in climate change impacts, risks and policies, they are often seeking for very operational and firm-specific insights to design their risk management strategies. Scenario information or macroeconomic assessments are less relevant. In practice, after an initial phase it was difficult to get the representatives of the business community involved, although these groups were particularly affected by COVID-19 and so priorities also changed.

In terms of engagement with stakeholders, the combination of periodic events, coupled with bi-lateral meetings and communication between events, was found to work well. An important key to the success of this process was to build relationships with stakeholders (individuals and organisations). The greatest level of co-design, and the greatest uptake of results in decisions, was found for the deep engagement stakeholders, which highlights that the more effort that is put into co-creation, the likely greater impact. As with previous studies, it was found that developing joint products was useful, whether reports or tools, to help build the engagement and co-production process. However, it is difficult to undertake deep engagement with a large number of stakeholders, and this suggests a need to focus on a few stakeholders with clear goals set for the collaboration (and awareness of benefits this will deliver, for both sides).

There is no doubt that the co-design process is enhanced by direct physical meetings. However, the COACCH project also found it was possible to successfully deliver the co-production tasks with stakeholders using a virtual format - though this might have proved more of a challenge for the initial co-design step. The COACCH workshops found that a mix of formats at stakeholder meetings worked well, i.e. using a combination of presentations, group work, world café

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sessions (rotating tables) and 'meet an expert' (allowing participants to move around a room and dive into the detail in areas of interest).

A list of potential benefits of co-design was compiled, and then stakeholders and COACCH researchers were surveyed to identify which of these were the most important. The results are shown below.

In terms of the key findings, the experience from the COACCH project is that co-design can deliver important co-benefits, as compared to a traditional research project. The most important benefits of co-design are the improved relevance of research outputs for uptake and use (in decisions), and the improvement in the dissemination and communication of research outputs

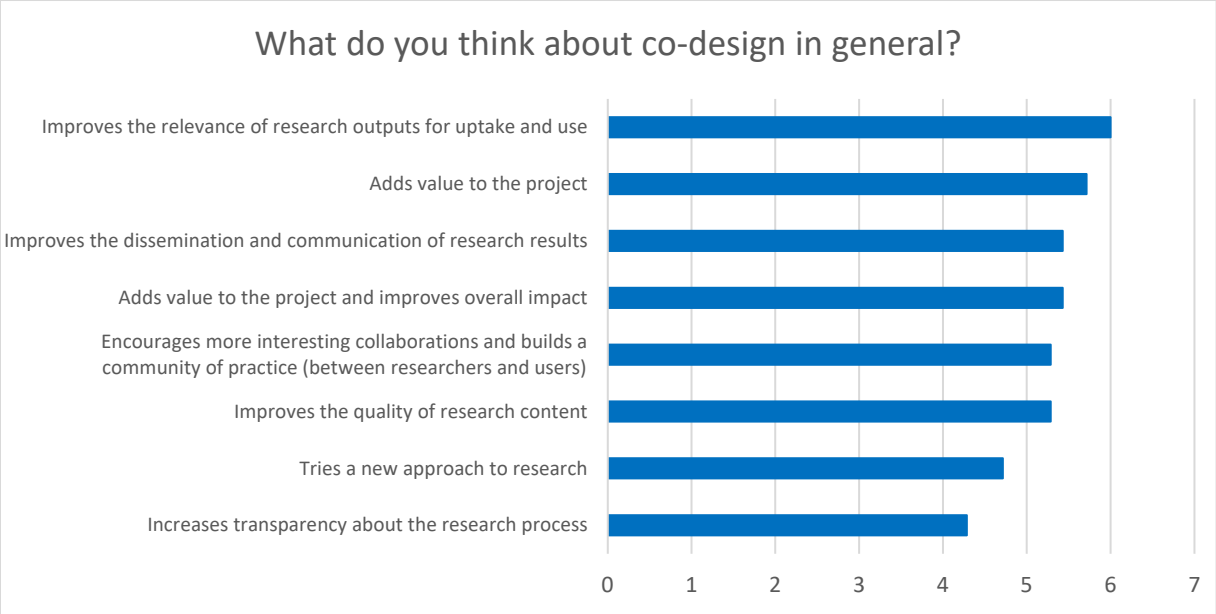

Figure 9. Survey (Q1 2021) with relationship managers on benefits of co-design

However, as highlighted above, compared to a normal research project, co-design was found to involve considerably more resources and time, particularly at the start of the project, but also later on to ensure user interests were delivered. In COACCH, 10% of the project budget was allocated to co-creation activities (including event costs).

There were also challenges is maintaining participation in the view of time constraints and busy agenda of stakeholders. As highlighted above, there was most success in deep engagement with policy makers. This may mean that other approaches are needed to find a direct, clear and beneficial approach for deep engagement with business and industry stakeholders. This may mean more direct interaction and focus on relevant outputs, as without these direct benefits, business stakeholder participation is motivated just by personal good will or curiosity.

The role of knowledge brokers was critical, not just at the workshops (or at the beginning), but throughout the project to continually drive the engagement and user-focus and ensure the anticipated uptake of results in decision making. The closer collaboration with deep engagement

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stakeholders and the use of collaborative case studies was also important. It was also found that for researchers with less experience in stakeholder engagement - and especially co-design and co-production - it would be good to identify a minimum of activities for the engagement process and possible questions and advice to give some guidance.

Looking back, it is clear that this was an ambitious project, even without the collaborative element. However, attempting to co-design and co-produce knowledge that is based on highly technical models of climate change and economic impacts is challenging. Nevertheless, there has been a spirit of collaboration and openness to greater stakeholder involvement that has marked a step-change for many consortium members in the way that may have otherwise approached their work.

"I have been involved in other co-design projects – but in COACCH we got more 'bang for our buck'. The team seemed to know each other so engagement was really well managed. The project had real world application and I really liked the models and policy tools. It was a good project that has achieved a lot and we have been able to use the results to inform the Glasgow city region adaptation strategy."

Kit England, Sniffer/Climate Ready Clyde (COACCH deep engagement stakeholder

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Annex 1: Research topic table example

This annex contains an example of the co-designed research topics (for river flooding) and how progress towards their implementation was monitored at different check-in points over the course of the project.

Progress:	
0 = Not started	3 = Preliminary results
1 = Early preparation (e.g. background research, work planning)	4 = Intermediate results
2 = Implementation (e.g. preliminary model runs, stakeholder interviews)	5 = Completed

Research topic – River flooding			**Prague**		**Amsterdam**		**2021**	
Topic and level of stakeholder interest at Brussels workshop	**COACCH team discussion results**	**How? (method/ model)**	**Progress (0-3)**	**Activities undertaken and results**	**Progress (0-5)**	**Activities undertaken and results**	**Progress (0-5)**	**Activities undertaken and results**
High interest								
1) Improved, more accurate assessment of total flood costs (direct + indirect + intangible) to underpin flood risk policy	Definitely covered	LISFLOOD, GLOFRIS	3		4	Direct costs completed, indirect costs going on	4	Direct damage costs are published (open access) In touch with CMCC to feed results into macro model (meeting pending, TBD if it happens)
2) Showcasing the role of critical infrastructures (e.g. transport networks) in avoiding flood-related socio-economic tipping points	Definitely covered	New: OSdaMage	2	Baseline finished, now connecting with CC scenarios	4	Direct finished (including CC), First results of network analysis comparison Belgium - Austria	4.5	Percolation network analysis nearly complete, working on final publication (poss 1 year to publication). Results for nearly all European countries.
Medium interest								

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3) Discuss mismatch between bottom-up and top-down EU river flood models based on local case studies and validate top-down EU river flood models	Can potentially cover, Deltares will follow Flood Directive		0	Results not yet available				One case study covered in research paper, however little else available. → Research gap, could be a nice co-design study (road practitioners etc) Improvement of model work flow with higher spatial resolution (continental and local scale assessment)
Low interest								
4) Improvement of assessment of multi-flood hazards current top-down EU river flood models	Not covered	-	-	-				No pan-European dataset of compound events Exploring w/JRC related to coastal floods
5) Improve integration of socio-economic developments in flood risk studies	Definitely covered		3	Local data on flood protection standards (current & optimal)			5	Same situation as before
Additional stakeholder suggestions								
6) Include robust decision analysis into flood adaptation assessments	Definitely covered		1	Analysis done for Netherlands			4	JRC paper in context of PESETA, results are summarized briefly in D4.2. DELTARES/VU paper submitted on flood risk case study Rotterdam
7) Increase knowledge on cost-benefit analysis comparison between green and grey infrastructures	Can potentially cover Deltares/VU to discuss in context of WP 4					VU: We do not really research this for COACCH.		JRC paper in context of PESETA, results are summarized briefly in D4.2 But no comparison of green-grey

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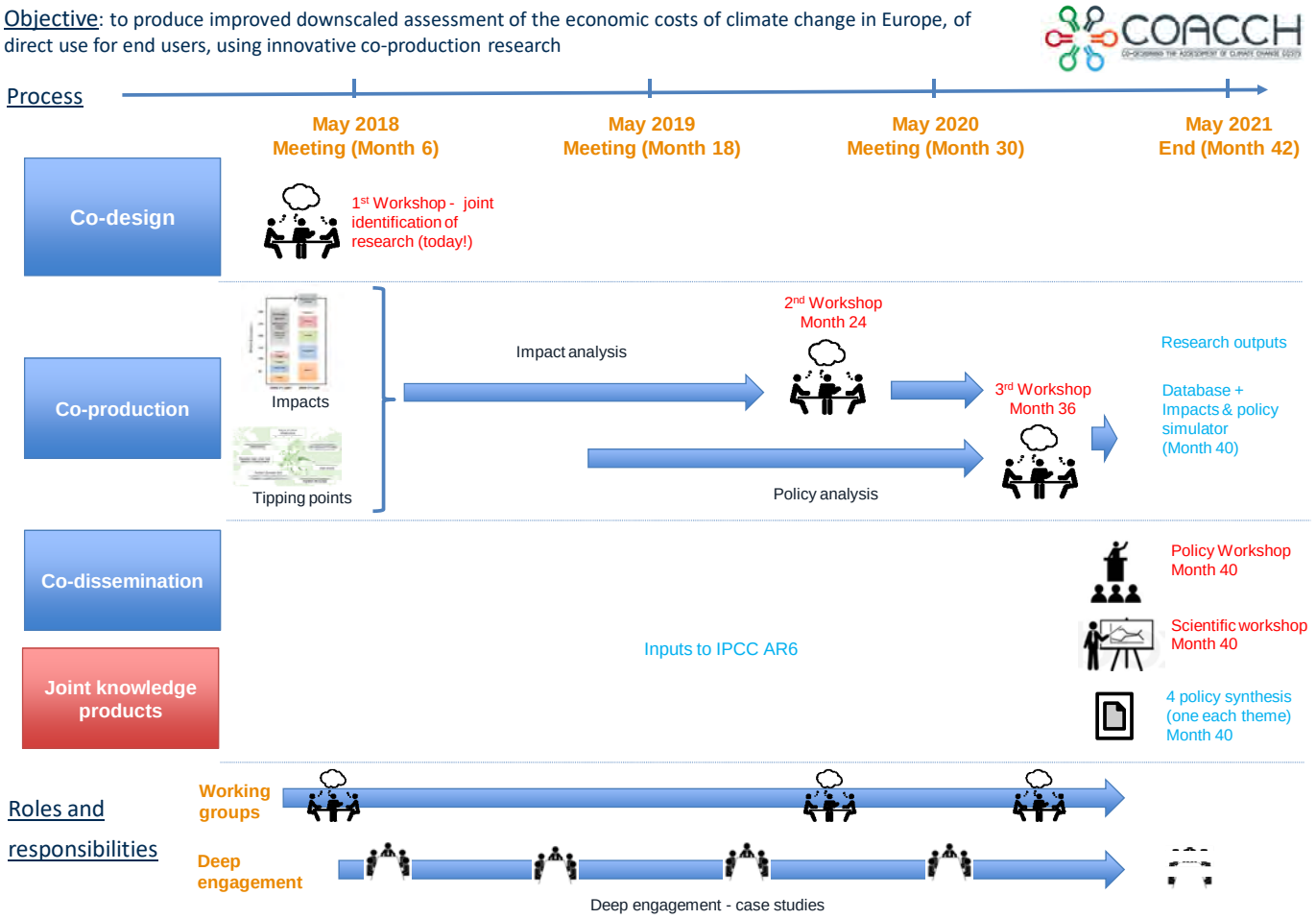
Annex 2: Oveview of collaborative work process

The image below provides an overview of how the engagement with stakeholders was foreseen at the project outset.



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