



ASSESSING THE IMPACT PATHWAYS OF IA/RIA SC5 PROJECTS THROUGH THE USE OF PORTFOLIO ANALYSIS

**D1.2: Indicators for the evaluation of SC5 RIAs and IAs**

<b>Project acronym</b>	IMPACT-SC5
<b>Title</b>	Assessing the Impact Pathways of IA/RIA SC5 Projects through the Use of Portfolio Analysis
<b>Agreement number</b>	869746
<b>Deliverable</b>	D1.2
<b>Document title</b>	List of Indicators
<b>Document type</b>	R
<b>Due date of deliverable</b>	01-02-2020
<b>Actual submission date</b>	31-01-2020
<b>Reference</b>	IMPACT-SC5
<b>Dissemination level</b>	PU
<b>Version</b>	Final
<b>Date</b>	31-01-2020
<b>Project start date</b>	1 November 2019
<b>Duration</b>	12 months
<b>Date of issue of this report</b>	

## Table of contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>4</b>
1.1	Background and scope .....	4
1.2	Methodology .....	4
1.3	Proposed indicators.....	6
<b>2</b>	<b>STUDIES AND INDICATORS ASSESSED .....</b>	<b>15</b>
	<b>ANNEXES.....</b>	<b>23</b>
	ANNEX 1 : FP7 EX-POST EVALUATION .....	23
	ANNEX 2: HORIZON 2020 INDICATORS .....	31
	ANNEX 3: INTERIM EVALUATION OF HORIZON 2020 -SOCIETAL CHALLENGE 5 .....	38
	ANNEX 4: MONITORING THE IMPACT OF EU FRAMEWORK PROGRAMMES .....	42
	ANNEX 5: HORIZON EUROPE KEY IMPACT PATHWAY INDICATORS .....	43
	ANNEX 6: MID-TERM EVALUATION OF THE LIFE PROGRAMME .....	46

## Figures

Figure 1: Impact Pathways- evolution .....	43
--	----

## Tables

Table 1: Definitions of impact pathway steps and indicators .....	5
Table 2: List of proposed indicators .....	7
Table 3: Consolidated set of indicators from sources reviewed .....	16
Table 4: FP7 ex-post evaluation indicators.....	24
Table 5: Indicators related to Societal Challenges .....	32
Table 6: Indicators for monitoring cross-cutting issues .....	33
Table 7: Interim Evaluation of Horizon 2020 – Societal Challenge 5 .....	38
Table 8: Horizon Europe -scientific impact pathway indicators.....	44
Table 9: Horizon Europe -societal impact pathway indicators.....	44
Table 10: Horizon Europe - Economic/innovation impact pathway indicators.....	45

## 1 Introduction

### 1.1 Background and scope

This document represents the deliverable **D1.2 “List of Indicators”** of the project “Assessing the impact Pathways of RIA and IA SC5 projects using portfolio analysis” (IMPACT SC-5 project). The document presents the first step in the development of indicators that the Consortium will use for measuring the performance and effectiveness of the selected projects, in line with the Evaluation Guidebook presented in deliverable D1.1. The development of indicators is Task 1.2 of Work Package 1: Preparation of the evaluation of SC5 RIAs and IAs. The novelty of the work is that the indicators present the R&I pathways from short-term project outputs (deliverables) to longer-term expected scientific, societal and economic impact.

The indicators comply with the agreed scope of the work, which is to:

- Assess the impacts of all the RIAs and IAs of SC 5 under the 2014-2015 WP through in-depth quantitative and qualitative analysis-87 projects in total.
- Measure and better understand the progress made by and achievements of these projects.
- Compare the projects' impacts with the expected impact statements in the Work Programme for each of the relevant topics.

The section below describes the methodology applied in coming to the proposed set of indicators in section 1.3. Chapter 2 provides an overview of sources used to identify suitable and realistic indicators. Where relevant, a summary of findings is presented in the Annexed Chapters.

### 1.2 Methodology

The Guidebook already described the challenges related to evaluating R&I policy, specifically on the definition of the right and the right number of indicators to measure the performance of R&I activities. The literature review carried out as part of this task demonstrated all these challenges, and makes clear that developing a relevant, measurable, attainable, scalable and consistent set of indicators is an evolutionary task. As the extensive work done by Peter van den Besselaar, Ramon Flecha & Alfred Radauer (Monitoring the Impact of EU Framework Programmes) shows, this is not unique for the European Commission but also for countries within and outside the European Union (EU). Most "tried and tested" are indicators to assess (short to medium term) scientific performance as well as management and implementation of programmes. The authors of the report caution against over-reliance on indicators and note that some funding agencies do not use (quantitative) indicators at all.

Based on the review, we have developed a set of indicators that as much as possible follows the rules of SMART (Specific, Measurable, Achievable and Attributable, Relevant and Timely) and PATHS (Proximity, Attribution, Traceability, Holism, Stability). The objective is to assess performance and effectiveness over the short to longer term, and the indicators therefore address all analysis concepts from the intervention logic. In line with the intervention logic, the indicators have been built in three dimensions:

- Scientific impact:
  - Creating high quality new knowledge: reducing knowledge gaps.
  - Strengthening human capital in R&I.
  - Development and adoption of innovative technological solutions.
  - Partnerships and international openness.
- Societal impact:
  - Addressing EU policy priorities.

- Strengthening the uptake of innovation in society.
- Economic impact: refers to innovation activities, including breakthrough and improved solutions, and their market deployment and diffusion.
  - Generating innovation-based growth.
  - Creating more and better jobs.
  - Leveraging investments in R&I.

The indicators address the "level 1" evaluation questions where quantitative data is (likely to be) available, i.e. the questions that evaluate the extent to which the project (project portfolio) has achieved the expected scientific, societal and economic impact. The questions about what factors have played a role and what actions have been undertaken by the project partners is more likely to be qualitative data coming from the survey and/or the interviews.

In our work we have tried to be comprehensive, but also to provide as much as possible consistency between the different Framework Programmes (from FP7 through Horizon 2020 to Horizon Europe). The table below is from the Guidebook for the Evaluation, with added definitions for Key Performance Indicator, Metric and Skills.

Table 1: Definitions of impact pathway steps<sup>1</sup> and indicators

Step	Definition
<b>Needs</b>	Those contextual factors explaining the rationale for the policy intervention or the initial policy problems the intervention aims to solve
<b>Objectives</b>	The aim of the policy intervention
<b>Inputs</b>	Resources mobilised for the implementation of a policy intervention including funding, personnel, infrastructure as well as natural resources
<b>Activities</b>	The activities carried-out during the implementation period of the policy intervention including technical work, coordination and management, and dissemination and communication activities.
<b>Outputs</b>	Expected deliverables of the intervention i.e. what is directly produced or supplied. Outputs generally occur within the short to medium term and are intended to lead to results and contribute to intended long-term impacts.
<b>Outcomes</b>	Results of policy intervention contributing to achieving overall policy objectives, capturing short to medium term changes that initially motivated policy intervention
<b>Impacts</b>	Wider societal, economic or environmental cumulative changes over a longer period of time.

<sup>1</sup> European Commission (2019) Better regulation toolbox – Tool 46 DESIGNING THE EVALUATION. Available: [https://ec.europa.eu/info/sites/info/files/file\\_import/better-regulation-toolbox-46\\_en\\_0.pdf](https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-46_en_0.pdf) and [European Commission \(2015\) H2020 indicators: Assessing the results and impacts of H2020.](#)

<b>Key performance indicator</b>	A financial or non-financial metric used to help an organisation define and measure progress towards its goals <sup>2</sup> .
<b>Metric</b>	A measure for something; a means of deriving a quantitative measurement or approximation for otherwise qualitative phenomena <sup>3</sup> .
<b>Skills<sup>4</sup></b>	The expertise or talent to do a job or task. Examples are: communication, working under pressure to deadlines, project management, computing, writing (proposal, scientific or policy paper), presentation (creating a presentation to speaking in public), analytical / critical thinking.

### 1.3 Proposed indicators

Against the backdrop of the above, the following provides the set of feasible and potential indicators which will be taken forward in Task 1.3: Identification of data sources, and thereafter the implementation of the project.

The analysis of the different sources shows an evolution in the development of indicators, from looking at inputs (budget, number of participants, etc.) and immediate outputs (reports and publications) to the relationship between inputs, outputs, outcomes (or results) and impacts and from single indicators to impact pathways. The resulting set of indicators is a 'fusion' between those used in FP7 and Horizon 2020 and those proposed for Horizon Europe, taking into consideration also the analysis and proposals set forth in the Expert report 'Monitoring the Impact of EU Framework Programmes' by Peter van den Besselaar, Ramon Flecha and Alfred Radauer. Even though (automated) tracking of impacts on these three dimensions (scientific, societal, economic) is in its early stages, the results of IMPACT-SC5 will help validate the approach and deliver data to evaluate Horizon 2020 Societal Challenge 5 (SC5) as well as support the evolution to Horizon Europe (which will incorporate the impact pathways methodology in a structured way).

The indicators show that two aspects are important to assess the programme's performance: time and audience reach (or the sphere of influence). In addition to time (what happens during and directly following the action and the uptake over a longer period of time), there is the aspect of reach (whom it affects during and directly following the action and over a longer period of time) with ideally a ripple effect of diffusion – reaching more and more people, becoming more and more pervasive to the point where a transition has taken place.

---

<sup>2</sup> From: [https://en.wiktionary.org/wiki/key\\_performance\\_indicator#English](https://en.wiktionary.org/wiki/key_performance_indicator#English)

<sup>3</sup> Source: <https://en.wiktionary.org/wiki/metric>

<sup>4</sup> <https://examples.yourdictionary.com/examples-of-skills.html>

Table 2: List of proposed indicators

Dimension	Subject of evaluation	Short-term impact pathways (outputs)	Medium-term impact pathways (outcomes)	Long-term impact pathways (impacts)
<b>Towards scientific impact</b>	1. Creating high quality new knowledge; reducing knowledge gaps	<p>S.1.1 Publications – in peer reviewed high impact journals in the area of SC5:</p> <ul style="list-style-type: none"> <li>- S.1.a Number of peer reviewed publications produced per project (or: per call topic / action);</li> <li>- S.1.b Number of publications published in the top 10% impact ranked journals by SC5 subject category (such as: water, waste, resource efficiency, climate action).</li> </ul>	<p>M.1.1 Number of top cited SC5 project publications (the share of top cited papers acknowledging the publication or Horizon 2020). Highly cited papers indicate high quality research output.</p>	<p>L.1.1 Number and share of peer reviewed publications from FP projects that are a core contribution to the SC5 scientific fields (attributable and traceable to the publications and citations, the researchers involved or through direct references to the project).</p> <p><i>(A core contribution is considered a body of knowledge that leads to a scientific breakthrough in a SC5 domain.)</i></p>
		<p>S.1.2 Number of projects that have identified further research needs (evidence of gaps).</p>	<p>M.1.2 Number of follow up calls or research agendas developed, addressing the research gap identified in SC5 projects (this can be taken as evidence that research projects identify where critical new knowledge is needed).</p>	<p>L.1.2.a Number of projects with evidence (e.g. at portfolio / topic level) that their outcomes contribute to better science in priority (urgent) or promising fields.</p> <p><i>(Evidence is for example (inter) national recognition e.g. through science / innovation awards, invitation as keynote speaker, significant additional funding or even a Nobel Prize.)</i></p>

				<p>L.1.2.b Evidence of creation and consolidation of large integrated research communities (European Schools of Thought) that focus on grand societal challenges with high level research.</p> <p><i>(Evidence is for example visibility of level and degree of organisation, such as COST networks, European Institute for Innovation and Technology Knowledge &amp; Innovation Community, Joint Programming Initiatives or other forms of public or private partnerships (the article 185 partnership PRIMA for Research and Innovation in the Mediterranean Area can be considered to be such a successful integrated research community)).</i></p>
	<p>2. Strengthening human capital in R&amp;I</p>	<p>S.2.1 Number of projects that have recruited early stage researchers, PhDs, post-docs for the project (i.e. number of temporary jobs created as a result of the project, giving young researchers their first experience in gaining work experience, particularly in international collaborative projects).</p>	<p>M.2.1 Career advancement: Number of participant organisations that have retained researchers hired for the project (continuation of employment beyond the life of the project, increasing the overall number of researchers in the specific SC5 domain).</p>	<p>L.2.1 Number of FP researchers having progressed in their position in the organisation (seniority, management) or with improved working conditions (research facilities, research assistants).</p>



		<p>S.2.2 Number of researchers that have benefited from active skills development as part of the project (such as skills in leadership and management; professionalism; organisational; team building; analytical; life skills<sup>1</sup>) through formal or on-the-job training, working in teams and working with experienced researchers.</p>	<p>M.2.2 Number of researchers that have gained visibility as result of participating in the project and the skills / experience gained.</p> <p>M2.2.a Visibility through having co-authored publication(s)</p> <p>M.2.2.b Skills / experience by having obtained their degree during / as result of the project;</p>	<p>L.2.2 Number of researchers attracted to or staying in the research domain (over a period of years).</p>
		<p>S.2.3 Number of women participants (in total, in all functions).</p>	<p>M.2.3 Number of female project coordinators (as indication that participating in European cooperative projects provides the skills and paves the way for taking a coordinating / leadership role, i.e. becoming established in the area of expertise and recognised as such by the own and partner organisations).</p>	<p>L.2.3 Number of women project participants / coordinators taking place in European Commission advisory groups, evaluation panels, expert panels, etc.</p>
	<p>3. Development and adoption of innovative technological solutions</p>	<p>S.3.1 Number of (IA) projects where the golden funding ratio has been applied in the budget allocation, which is: 50% RES, 30% SME, 20% large enterprise <i>[although perhaps more an input or enabler metric of public-private collaboration]</i>.</p>	<p>M.3.1.a Number of joint public-private publications.</p> <p>or</p> <p>M.3.1.b Number of joint public-private technology demonstrators.</p>	<p>L.3.1 Number of SC5 participants benefiting from innovations deployed by generating economic benefits (in terms of sales in euro) or having become more resource efficient (achieving savings in terms of euro or percentage).</p>

	4. Fostering diffusion of knowledge and open data	<p>S.4.1 Number of open access articles published in peer-reviewed journals and/or the share (in percentage) of SC5 output available in the open access domain.</p> <p><i>(The availability of FP output to other researchers should improve and accelerate the uptake.)</i></p>	<p>M.4.1 Number of open access project research outputs cited, and the share of outputs cited compared to the publications / citations indicator (to determine if there is a noticeable difference in greater use of open access outputs).</p>	<p>L.4.1 Number of datasets and infrastructures created and made available by SC5 projects that have been used (in terms of identifiable downloads, access accounts created, visits to portals) beyond the initial project's outreach, for example into a crossover domain or outside the science community.</p>
		<p>S.4.2 Number of projects that have made (or will be able to make) scientific data and / or datasets made accessible and reusable.</p>	<p>M.4.2 Number of projects that have engaged in an active transfer of knowledge through dissemination and training activities.</p>	<p>L.4.2 Number and share of SC5 project beneficiaries having developed new transdisciplinary / trans-sectoral collaborations with users of their open FP R&amp;I outputs (use of open data).</p> <p><i>(The question this seeks to answer is if participation in FP projects with end users creates new partnerships, increasing the uptake of R&amp;I data.)</i></p>
		<p>S.4.3 Number of projects that have trialled open research standards or infrastructure.</p>	<p>M.4.3 Number of projects that have provided (improved) access to infrastructures and databases (accessible, compatible, interoperable) beyond the project beneficiaries.</p>	<p>L.4.3 Number of projects showing evidence that project data contributes to or has become part of larger data networks.</p>
	5. Partnerships and international openness	<p>S.5.1 Number of participations (distribution across type of beneficiary and country) to establish the extent to which</p>	<p>M.5.1 Number of FP participants that have developed new and lasting partnerships (e.g. go on to</p>	<p>L.5.1 Internationalisation of research beyond European Union –European Economic Area boundaries such as SC5 results contributing to international (or</p>

		SC5 projects develop cross-country and cross-disciplinary collaboration.	form PPP, P2P platforms or initiatives).	global) science and research (climate, Earth observation); EU researchers taking up leading research positions outside the EU or renowned researchers from outside the EU taking up positions here.
		S.5.2 Share of participants and amount of EU financial contribution by EU member state, associated and third country (€ millions).	M.5.2 Number of joint development of solutions for inter- / transnational environmental challenges.	L.5.2 Share of SC5 projects that have continued research (through different FPs and/or (inter) national programmes).
<b>Towards societal impact</b>	6. Addressing EU policy priorities	<p>S.6.1 Number of projects with outputs aimed at addressing specific EU policy priorities, cluster (waste, raw materials, water.) challenges or Sustainable Development Goals (SDGs).</p> <p><i>(Outputs can either be the number and share of articles published in peer review journals in relation to the policy priorities, challenges or SDGs or the number and share of innovations produced (such as prototypes, products, goods or services, processes, distribution methods, organisational or marketing</i></p>	<p>M.6.1 Number and share of Innovations and scientific results from the projects that address specific EU policy priorities, cluster (waste, raw materials, water.) challenges or SDGs. This is determined by:</p> <p>M.6.1.a share of SC5 projects with technology transfers, total number of technology transfers, share of transfers per project.</p> <p>M.6.1.b number and share of knowledge transfers and adoptions by diverse stakeholders,</p> <p>M.6.1.c number and share of changes in professional standards, protocols, practices and services on stakeholder's activity and</p>	<p>L.6.1 Aggregated estimated effects from use of FP-funded results, on tackling specific EU policy priorities, cluster (waste, raw materials, water.) challenges or SDGs including contribution to the policy and law-making cycle. This is determined through:</p> <p>L.6.1.a number and share of evidence of improvements in relation to the previous situation,</p> <p>L.6.1.b number and share of evidence of replicability of those improvements,</p> <p>L.6.1.c number and share of evidence of sustainability of the improvement achieved.</p> <p>OR</p>

		<i>methods, databases or infrastructures).</i>	organisations (including beneficiaries and other stakeholders).	<p>L.6.2 Number of policy documents citing SC5 project findings (either from individual projects or topics / project portfolios).</p> <p>(This refers to policies that have been influenced by the results of the SC5 projects.)</p> <p><i>(Policy documents include a variety of official documents developed by governments or institutions, including for instance regulations, directives, decisions, treaties, protocols, plans of action, programmes, conventions or agreements.)</i></p>
7. Strengthening the uptake of innovation in society	<p>S.7.1 Number and share of projects where EU citizens and end-users contribute to the co-creation of R&amp;I content (co-creation with Non-governmental Organisations / Civil Society Organisations as core partner in the design of the project), determined through:</p> <p>S.7.1.a Number of science fairs and exhibitions organised.</p>	<p>M.7.1 Number and share of project beneficiary entities with citizen and end-user engagement mechanisms after the FP project (lasting engagement).</p> <p><i>(Rather than only involvement during the project, this indicator looks at mechanisms developed to create lasting engagement for example through social media channels.)</i></p>	<p>L.7.1 Uptake and outreach of project co-created scientific results and innovative solutions (societal R&amp;I uptake), e.g. through green public procurement. Determined through:</p> <p>L.7.1.a Number of activities / programmes / products which are based on SC5 (scientific) results that have been implemented by citizens and civil society organisations,</p> <p>L.7.1.b Percentage of SC5 (scientific) results and innovative solutions by number of end-users reached.</p>	

		<p>S.7.1.b Number of articles and interviews in popular media.</p> <p><i>(Co-creation of knowledge is considered to increase societal impact of research through aligning research and social needs.)</i></p>		
<b>Towards economic / innovation impact</b>	8. Generating innovation-based growth	<p>S.8.1 Funding of innovation, determined through:</p> <p>S.8.1.a Total number of projects and share of EU financial contribution allocated to Innovation.</p> <p>S.8.1.b Within the Innovation Actions specifically, share of EU financial contribution focused on demonstration and first-of-a-kind activities.</p>	M.8.1 Number of innovations from the projects (by type of innovation) including from awarded IPRs (including trademarks).	L.8.1 Creation, growth and market shares of companies having brought new products or services from the project to the market.
		<p>S.8.2 Number of Innovative products, processes or methods developed (prototype feasibility) &amp;</p>		

<sup>5</sup> 'Market replication' means to support the first application or market deployment of an innovation which, though already demonstrated, has not yet been applied or deployed on the market, owing to market failure or other barriers, <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/support/faq/1016>.

		Intellectual Property Rights (IPR) applications per € 10 million funding.	(prototypes successfully tested and demonstrated).	
		S.8.3. Number of projects contributing to harmonisation or standard development.	M.8.3 Number of projects having established new standards committees or enhancing / strengthening work of existing committees.	L.8.3 Number of industrial standards that can set the tone and be adopted at global level <sup>2</sup> .
	9. Creating more and better jobs	S.9.1 Number of full-time equivalent (FTE) jobs created through SC5 support, by type of job (low, medium, high) and contract duration (short term – long term); particularly in participating SMEs.	M.9.2 Number of full-time equivalent (FTE) jobs maintained or increased in SC5 beneficiary entities following the project, by type of job (low, medium, high); particularly in participating SMEs.	L.9.1 Number of direct and indirect jobs created or maintained due to diffusion of the project's results, by type of job (low, medium, high); particularly in SMEs.
	10. Leveraging investment in R&I	S.10.1 Amount of public & private investment mobilised with the initial project investment (within the project).	M.10.1 Amount of public & private investment mobilised to exploit or scale-up the project's results.	L.10.1 Amount of public & private investment mobilised to extend the impact of the project's results.
		S.10.2 Investor attractiveness: changes in Technology Readiness Level (TRL) from start to end of the project.	M.10.2 Investor readiness: investment for market testing / industrial demo (e.g. European Investment Bank / European Investment Fund, European Investment Project Portal (EIPP), business angels).	L.10.2 From funding / investment to turnover: first customer(s) secured (from companies involved in the project or spin-offs).

## 2 Studies and indicators assessed

We have developed this set of indicators to measure the performance of the 87 SC5 projects through a thorough screening of existing indicators and indicator sets. In this way, the Consortium ensures that the indicator development provides continuity and consistency by building on existing monitoring and evaluation indicators from comparable sources. As far as possible they incorporate the idea of impact pathways i.e. create traceable links between project short-term results and medium- and long-term impacts. The following is the list of sources we have reviewed. Relevant information about indicator use or development is summarised in the Annexes to this document.

- Ex-Post Evaluation of FP7 Cooperation Programme Theme: “Environment (including Climate Change)”. Report to the European Commission, by the Group of Experts (2014)
- Horizon 2020 Indicators. Assessing the results and impact of Horizon 2020 (2015)
- Interim Evaluation of H2020 – Societal Challenge 5. Contribution of Societal Challenge 5 to the overall Interim Evaluation of Horizon 2020 (2017)
- Peter van den Besselaar, Ramon Flecha & Alfred Radauer 2018. Monitoring the Impact of EU Framework Programmes. Expert Report. Available: <https://op.europa.eu/en/publication-detail/-/publication/cbb7ce39-d66d-11e8-9424-01aa75ed71a1>
- Horizon Europe proposal (COM(2019) 435 final), Annex V - Key impact pathway indicators (2018)
- European RTD evaluation network (representatives from member states, est. 1997). The network aims to enhance cooperation between national ministries and agencies, academics and experts, and Commission services working in the area of evaluation methodology, use of research indicators and measurement of research impact: [https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/evaluation-impact-assessment-and-monitoring/euevalnet\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/evaluation-impact-assessment-and-monitoring/euevalnet_en)
- Support for an external and independent LIFE Mid Term Evaluation Report, Final Report by Ecorys for the European Commission Directorate-General for Environment, March 2017. ISBN 978-92-79-67817-2
- Final Evaluation of the Entrepreneurship and Innovation Programme (EIP), part of the Competitiveness and Innovation Programme, Final Report (2011)
- Evaluations of the Competitiveness and Innovation Framework Programme (CIP) 2007-2013; Final evaluations of CIP and its programmes, 2013: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52013DC0002>
- European Innovation Scoreboard, the 2019 edition of the scoreboard: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52013DC0002>
- Roadmap to a Resource Efficient Europe COM(2011) 571 final. The Roadmap contains resource efficiency indicators. The SC5 work programme 2014-15 mentions (under the Waste call) that activities should contribute to this Roadmap’s objectives: [https://ec.europa.eu/environment/resource\\_efficiency/targets\\_indicators/roadmap/index\\_en.htm](https://ec.europa.eu/environment/resource_efficiency/targets_indicators/roadmap/index_en.htm)
- Innovation Radar. Innovation metrics: [www.innoradar.eu](http://www.innoradar.eu).
- European Investment Project Portal. Platform to match those seeking and those offering investment: <https://ec.europa.eu/eipp/desktop/en/index.html>

Table 3: Consolidated set of indicators from sources reviewed

H2020 objectives	SC5	Indicator Evaluation questions	Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
Scientific	FP7		Participation (rates). Correlation between participation rates of research organisations and national level of R&D funding. Continuity of research (follow on topic / partners from previous projects or programmes). Access of researchers from smaller EU member states (particularly those joined post 2004) to become involved in larger projects.	Publication outcome <sup>3</sup> . Open access to publications. Improved the nature (quality) and scale (quantity) of European research system.	The impact the project has had on the individual researcher as well as the scientific community within a research area. Open access to information and results. Share of budget allocated towards effective knowledge transfer, including dissemination and targeted dissemination of results. Critical mass through sustained collaboration between researchers (European Schools of Thought).
	H2020	Publications in peer-reviewed high impact journals in the SC5 area Patent applications and patents	Horizon 2020 performance is measured on the one hand through management (input) indicators and on the other	% of publications published in the top 10% impact ranked by subject category	



H2020 objectives	SC5	Indicator Evaluation questions	Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
		awarded in the area of SC5	through direct project deliverables.	# of patent applications; number of awarded patents (IPR) by SC5 topic	
	Horizon Europe	Creating high-quality knowledge	<u>Publications</u> - Number of FP peer reviewed scientific publications	<u>Citations</u> - Field-Weighted Citation Index of FP peer reviewed publications	<u>World-class science</u> - Number and share of peer reviewed publications from FP projects that are core contribution to scientific fields
		Strengthening human capital in R&I	<u>Skills</u> - Number of researchers having benefitted from upskilling activities in FP projects (through training, mentoring/coaching, mobility and access to R&I infrastructures)	<u>Careers</u> - Number and share of upskilled FP researchers with more influence in their R&I field	<u>Working conditions</u> - Number and share of upskilled FP researchers with improved working conditions
		Fostering diffusion of knowledge and Open Science	<u>Shared knowledge</u> - Share of FP research outputs (open data/ publication/ software etc.) shared through open knowledge infrastructures	<u>Knowledge diffusion</u> - Share of open access FP research outputs actively used/cited	<u>New collaborations</u> - Share of FP beneficiaries having developed new transdisciplinary/ trans-sectoral collaborations with users of their open FP R&I outputs
<b>Societal</b>	FP7		Qualitative and quantitative policy-based	Contribution to the policy cycle, through	Design, implementation, evaluation and transnational coordination of globally

H2020 objectives	SC5	Indicator Evaluation questions	/ Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
			research with output policy briefs, evidence gap maps or syntheses. Organisation of national policy dialogues within partner countries or at EU level. Websites, portals. Inclusion of NGO / CSO as core partners in the design of the project.	dissemination of policy briefs, tools such as evidence gap maps etc to policy makers. Collaborative initiatives between policymakers and researchers in developing strategies. Transient communication and dissemination (newsletters, workshops, social media).	relevant, public, evidence-informed policies. Indirect: use of “knowledge brokers” (JRC, EEA, consultants) to derive policy inputs from research results. Interim review and active involvement of EC project officers (e.g. in meetings). Specialist communication and dissemination partner and evidence of sustained communication strategy beyond lifetime of the project.
	Horizon Europe	Addressing EU policy priorities through R&I	<u>Outputs</u> - Number and share of outputs aimed at addressing specific EU policy priorities	<u>Solutions</u> - Number and share of innovations and scientific results addressing specific EU policy priorities	<u>Benefits</u> - Aggregated estimated effects from use of FP-funded results, on tackling specific EU policy priorities, including contribution to the policy and law-making cycle
		Delivering benefits and impact through R&I missions	<u>R&amp;I mission outputs</u> - Outputs in specific R&I missions	<u>R&amp;I mission results</u> - Results in specific R&I missions	<u>R&amp;I mission targets met</u> - Targets achieved in specific R&I missions

H2020 objectives	SC5	Indicator Evaluation questions	Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
		Strengthening the uptake of innovation in society	<p><u>Co-creation</u> - Number and share of FP projects where EU citizens and end-users contribute to the co-creation of R&amp;I content</p>	<p><u>Engagement</u> - Number and share of FP beneficiary entities with citizen and end-users engagement mechanisms after FP project</p>	<p><u>Societal R&amp;I uptake</u> - Uptake and outreach of FP co-created scientific results and innovative solutions</p>
<b>Economic</b>	FP7		<p>Participation (including mix of academic partners, SMEs and large enterprises.</p> <p>Golden funding ratio: budget allocation (50% RES, 30% SME, 20% large enterprise).</p>	<p>TRL achieved, type and nature of innovations, budget allocated, commercialisation data, factors of success, further investments obtained.</p> <p>IPR applications (patents, trademarks, registered design).</p> <p>Create an understanding of innovation for the benefit of innovation management in H2020.</p> <p>Improved the nature (quality) and scale (quantity) of European innovation system.</p>	<p>Economic (sales) and resource efficiency (savings) impacts of the innovations.</p> <p>Involvement of financial investors.</p> <p>Technology-transfer, spin-off and brokerage activities.</p>

H2020 objectives	SC5	Indicator Evaluation questions	Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
	H2020	<p>Prototypes and testing activities</p> <p>Joint public-private publications</p> <p>New products, processes and methods launched into the market</p>	<p>Horizon 2020 performance is measured on the one hand through management (input) indicators and on the other through direct project deliverables.</p>	<p># of prototypes, testing (feasibility / demo) activities in the area of SC5</p> <p># and % of joint public-private publications out of all relevant publications</p> <p># of projects with new innovative products, services and methods (project count)</p>	
	Horizon Europe	<p>Generating innovation-based growth</p>	<p><u>Innovative outputs</u> - Number of innovative products, processes or methods from FP (by type of innovation) &amp; Intellectual Property Rights (IPR) applications</p>	<p><u>Innovations</u> - Number of innovations from FP projects (by type of innovation) including from awarded IPRs</p>	<p><u>Economic growth</u> - Creation, growth &amp; market shares of companies having developed FP innovations</p>
		<p>Creating more and better jobs</p>	<p><u>Supported employment</u> - Number of FTE jobs created, and jobs maintained in beneficiary</p>	<p><u>Sustained employment</u> - Increase of FTE jobs in beneficiary entities following FP project (by type of job)</p>	<p><u>Total employment</u> - Number of direct &amp; indirect jobs created or maintained due to diffusion of FP results (by type of job)</p>

H2020 objectives	SC5	Indicator Evaluation questions	/ Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
			entities for the FP project (by type of job)		
		Leveraging investments in R&I	<u>Co-investment</u> - Amount of public & private investment mobilised with the initial FP investment	<u>Scaling-up</u> - Amount of public & private investment mobilised to exploit or scale-up FP results	<u>Contribution to '3% target'</u> - EU progress towards 3% GDP target due to FP
	Cross-cutting issues (from FP7, check if elements of these should be integrated in the 3 objectives above)		Gender balance in project work force composition (total and leading positions). Male/female PhD students. Involvement of early stage researchers, PhDs, post-docs. Researcher inter-organisational mobility. Science with and for society.	Research implication on gender. Gender (equality) action plan. Continuity of research (cumulative process of knowledge creation). Transfer of knowledge through dissemination and training.	OA: facilitate or enable adoption of OA principles (e.g. harmonisation and opening up of databases, definition of criteria for sharing infrastructures, etc.). Internationalisation of research (incl beyond EU-EEA boundaries); ensuring continuity of R&D

H2020 objectives	SC5	Indicator Evaluation questions	/ Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
			OA: dissemination of produced knowledge and data; OA publications. Internationalisation.		
	European added-value (from FP7, check if elements of these should be integrated in the 3 objectives above)		Access to infrastructures and databases (compatibility, interoperability). Joint collaboration for solutions to shared problems. Score 1-5 (or 7) of projects on Likert scale <sup>4</sup> .	Capacity building and development of critical mass. Potential to leverage additional resources.	Industrial standards that can set the tone and be adopted at the global level. Uptake of research results, e.g. adoption of harmonised measurement procedures or tools, integration of recommendations into relevant policies.

## ANNEXES

### 1 Annex 1 : FP7 ex-post evaluation

The FP-7 Cooperation priority area Environment was designed to fund collaborative, trans-national research to promote the sustainable management of both the man-made and natural environments and associated resources. The FP7-Environment work programme was specifically designed to support the refinement of the EU's environment policies, thus further contributing to the development of said policies in a research-informed manner. The ex-post evaluation focused on the impacts that research funded by FP7-Environment had on:

- scientific excellence,
- environmental innovation,
- evidence-based policy making,
- cross-cutting issues of relevance to the European Research Area (ERA), and on
- European added value (EAV).

During and post FP-7, a shift took place from scientific research excellence to innovation (influenced by the financial and economic crises starting in 2007) to boost economic growth and jobs but also to tackle major societal challenges such as climate change.

**Objective of the ex-post evaluation:** to conduct an assessment at project level (micro level) and on that basis develop an evaluation at strategic level (macro level). The scope covered the whole of FP7 duration (2007-2013) and included examination of a subset of 90 completed projects.

The analytical framework of this *ex-post* evaluation was based on the rationale and objectives of FP7-Environment. It distinguishes between inputs, outputs, outcomes and impacts of the programme, with a particular focus on impacts. The analysis of outputs and impacts is subdivided into the areas: *scientific excellence; support to policy; innovation; cross-cutting issues; and European added-value*.

The evaluation was led by a group of five independent experts (GoE). This GoE was supported by a group of 25 Monitors, who carried out the individual assessments of the projects. The final projects' reports were the primary source for this in-depth project analysis, supplemented by interviews with projects' coordinators and partners.

The table below summarises the objectives and indicators. The GoE used the objectives and indicators to determine outputs, outcomes and impacts from the 90 projects. Some of these indicators were mentioned explicitly, but most often we derived them from the descriptions. The report was not always clear in the distinction between performance/outputs, outcomes/results or impacts and in these cases, we have assigned them to the category we felt was most fitting based on the definitions used:

- Outputs: Publications, discoveries, and patents.
- Outcomes: when outputs inform policy guidelines, are used to build competencies, or add to the knowledgebase for a particular discipline.
- Impacts: the development of these outcomes into enhanced environmental and economic status, balanced with sustainable development, improved health and/or wellbeing, enhanced state of knowledge within a field, reduced waste etc.

The GoE considered participation as an output; publications, discoveries, patents as outcomes, and the remainder as impacts.

Table 4: FP7 ex-post evaluation indicators

Objectives		Outputs (short-term pathways)	Outcomes (medium-term impact pathways)	Impacts (long-term impact pathways)
<b>Scientific</b>	<p>Creating high quality new knowledge: reducing knowledge gaps.</p> <p>Strengthening human capital in R&amp;I.</p> <p>Development and adoption of innovative technological solutions.</p> <p>Fostering diffusion of knowledge and open data.</p> <p>Partnerships and international openness.</p>	<p>Participation (rates).</p> <p>Correlation between participation rates of research organisations and national level of R&amp;D funding.</p> <p>Continuity of research (follow on topic / partners from previous projects or programmes).</p> <p>Access of researchers from smaller EU member states (particularly those joined post 2004) to become involved in larger projects.</p>	<p>Publication outcome <sup>6</sup>. Open access to publications.</p> <p>Improved the nature (quality) and scale (quantity) of European research system.</p>	<p>The impact the project has had on the individual researcher as well as the scientific community within a research area.</p> <p>Open access to information and results.</p> <p>Share of budget allocated towards effective knowledge transfer, including dissemination and targeted dissemination of results.</p> <p>Critical mass through sustained collaboration between researchers (European Schools of Thought).</p>
	<b>Societal</b>	<p>Addressing EU policy priorities.</p> <p>Strengthening the uptake of innovation in society.</p>	<p>Qualitative and quantitative policy-based research with output policy briefs, evidence gap maps or syntheses.</p> <p>Organisation of national policy dialogues within</p>	<p>Contribution to the policy cycle, through dissemination of policy briefs, tools such as evidence gap maps etc to policy makers.</p> <p>Collaborative initiatives between policymakers</p>

<sup>6</sup> Compared to other Cooperation themes in FP7. Measured are: total number of publications; average number of publications per project; percentage of publications in high ranked journals as defined by the SJR index. The source of information was the EC's Respir database. Also measured are the publications within FP7-Environment per topic (e.g. climate change or management of natural resources) and the number of publications per EUR 10 million of FP7-Environment funding.



		<p>partner countries or at EU level.</p> <p>Websites, portals (as mechanism to share results).</p> <p>Inclusion of NGO / CSO as core partners in the design of the project.</p>	<p>and researchers in developing strategies.</p> <p>Transient communication and dissemination (newsletters, workshops, social media).</p>	<p>Indirect: use of “knowledge brokers” (JRC, EEA, consultants) to derive policy inputs from research results.</p> <p>Interim review and active involvement of EC project officers (e.g. in meetings).</p> <p>Specialist communication and dissemination partner and evidence of sustained communication strategy beyond lifetime of the project.</p>
<b>Economic</b>	<p>Generating innovation-based growth.</p> <p>Creating more and better jobs.</p> <p>Leveraging investments in R&amp;I.</p>	<p>Participation (including mix of academic partners, SMEs and large enterprises).</p> <p>Golden funding ratio: budget allocation (50% RES, 30% SME, 20% large enterprise).</p>	<p>TRL achieved, type and nature of innovations, budget allocated, commercialisation data, factors of success, further investments obtained.</p> <p>IPR applications (patents, trademarks, registered design).</p> <p>Create an understanding of innovation for the benefit of innovation management in H2020.</p> <p>Improved the nature (quality) and scale (quantity) of European innovation system.</p>	<p>Economic (sales) and resource efficiency (savings) impacts of the innovations.</p> <p>Involvement of financial investors.</p> <p>Technology-transfer, spin-off and brokerage activities.</p>
	Cross-cutting issues	<p>Gender balance in project work force composition (total and leading positions).</p> <p>Male/female PhD students.</p> <p>Involvement of early stage researchers, PhDs, post-docs.</p>	<p>Research implication on gender.</p> <p>Gender (equality) action plan.</p> <p>Continuity of research (cumulative process of knowledge creation).</p>	<p>OA: facilitate or enable adoption of OA principles (e.g. harmonisation and opening up of databases, definition of criteria for sharing infrastructures, etc.).</p>

		<p>Researcher inter-organisational mobility.</p> <p>Science with and for society.</p> <p>OA: dissemination of produced knowledge and data; OA publications.</p> <p>Internationalisation.</p>	<p>Transfer of knowledge through dissemination and training.</p>	<p>Internationalisation of research (including beyond EU-EEA boundaries); ensuring continuity of R&amp;D</p>
	European added-value	<p>Access to infrastructures and databases (compatibility, interoperability).</p> <p>Joint collaboration for solutions to shared problems.</p> <p>Score 1-5 (or 7) of projects on Likert scale<sup>7</sup>.</p>	<p>Capacity building and development of critical mass.</p> <p>Potential to leverage additional resources.</p>	<p>Industrial standards that can set the tone and be adopted at the global level.</p> <p>Uptake of research results, e.g. adoption of harmonised measurement procedures or tools, integration of recommendations into relevant policies.</p>

The following sections provide a summary of the overall recommendations as well as the findings per programme objective.

### 1.1 Summary of recommendations

The FP7 Environment ex-post evaluation included a set of recommendations for its successor, Horizon 2020 Societal Challenge 5 (SC5): Climate Action, Environment, Resource Efficiency and Raw Materials. Those related to impact monitoring and indicators are repeated here:

- The Commission should develop an enhanced monitoring and follow-up system to assess and increase the impact of projects. The Commission should develop methodologies and reporting tools allowing a close follow-up of the content of projects, in order to play a more pro-active role towards ensuring societal impact.
- To increase its impact in terms of innovation, SC5 should strengthen the links with industrial partners who are active in R&D, involving both large companies – with the capacity to integrate technologies at a large scale – and innovative SMEs. A further involvement of NGOs and CSOs would also strengthen the links between the research and innovation communities and society, contributing to the potential increase in impacts of projects.

The sections below describe the methods to assess the performance in terms of scientific excellence; innovation; support to policy; cross-cutting issues; and European added-value.

<sup>7</sup> Survey scale, 5 or 7-point scale that ranges from one extreme attitude to another, like “extremely likely” to “not at all likely”. Typically they include a moderate or neutral midpoint.

## 1.2 Scientific excellence

### 1.2.1 Scientific outcome

- Publications by FP7 Cooperation programme theme: # of processed projects; % of projects without reported publications; # of publications; average # of publications by project; # of publications in high-impact journals; % of publications in high-impact journals.
- Publications by FP-7 Environment priority area: # of projects with a processed final report; # of projects with at least one publication; total # of publications; # of publications in high-impact peer reviewed journals; % of publications in high-impact peer reviewed journals; average # of publications per project; # of projects by € 10M; # of publications in high-impact peer-reviewed journals by € 10M.
  - Analysis of journal rankings.
  - Statistical analysis: variables for the publication outcomes.
- Average publications per project, by instrument.

### 1.2.2 Scientific impact

- Impact on scientific excellence of individual participants: usually measured by the h-factor and/or by the impact factor of the journal chosen for publication. Also mentioned are the recruitment of early career researcher combined with a system of staff exchanges and joint training efforts (with the pull of excellent researchers).
- Impact on scientific excellence and maturity of the scientific community of a particular research area: measured by interaction with and impact on international and interdisciplinary communities (such as IPCC) for example influence on international research agenda.

Structuring scientific impacts, creating critical mass: selection of projects based on excellence and impact created a critical mass of good research (rather than creating a singular leading excellence in a particular field).

Recommendations on research excellence were:

- Indicator and monitoring system to evaluate the impact of financed projects on improving scientific excellence at the level of individual researchers, and at the level of scientific communities: comparing the publications record of beneficiaries in a dynamic way, during/after and before funding.
- Through Horizon 2020, create and consolidate large integrated research communities (European Schools of Thought) that focus on grand societal challenges with high level research.
- Integrate scientific excellence (publication in high ranked journals) with procedures for high-level support to policy (i.e. not separate research activities from policy support activities).
- EC to collect reliable data on R&D performance of national research programmes including from third countries (eg US, Japan, BRIC) to benchmark cost-efficiency of FPs.

## 1.3 Innovation

FP-7 was reoriented to (also) support industrial and social innovation, which needed:

- New methodology for allocation resources;
- Different players (e.g. industrial participants and commitment);
- Innovation-oriented specific tools and expertise.

The assessment of innovation impact was determined through a survey (as no indicators or criteria were developed as part of FP-7 and therefore no reporting data was available).

#### 1.4 Innovation outcome

Measurements of innovation outcomes include:

- IPR / Patent applications per € 10M of FP7-environment investment (as a proxy of innovation).
- Number and type of innovations that have been exploited (either commercialised, internal to the firm or other such as in the public domain): new processes, new products, new services, new (organisational) methods.
- Innovation definition: core innovation; adjacent innovation; transformational innovation and amount (and % of total) budget spent on each.
- Technology Readiness Level.
- Data on actual turnover resultant from exploited innovations, size of the market, possible market share and number of years needed to reach it.
- Cost-savings in energy and raw materials.
- Export within and beyond the EU.
- Estimation of economic and societal impact of the innovations supported by FP7-Environment: *potential* total market size (sales) and *potential* total resources savings of surveyed projects.

#### 1.5 Innovation - outputs and impacts on growth and jobs

As FP7 was designed as a research (and not innovation) programme, no indicators were developed to measure results and impacts from the projects. The GoE mentions for example the rate of industrial and innovative SME participation and use of R&I portfolio management models as proven by and used in industry as means to monitor the innovation potential of projects. In order to increase the potential to have impact, they recommend for H2020 SC5: a) strengthened links with R&D intensive industrial organisations and a good balance between innovative SMEs and large enterprise; b) include in the evaluation process targeted objectives, a clear allocation of resources, commitment of partners for follow-up investments and project legacy, with clear procedures for the protection of sensitive information; c) involve NGOs and CSOs; d) involve financial organisations; e) reliable sectoral data on (potential) markets so that innovation priorities can be linked with an analysis of economic and societal impacts of technologies and other innovations promoted by the calls; f) coordination between H2020 and regional funding so that solutions in the fields of water or waste management or recycling can be deployed through regional funding.

The Horizon 2020 Impact Assessment report calculates that across all Member States every euro of funding from the programme will lead to an increase in industry added value of €13<sup>8</sup>. This return of investment should be confirmed ex post starting with the economic impact of FP7.

<sup>8</sup> Commission Staff Working Paper Impact Assessment accompanying the Communication from the Commission “Horizon 2020 – The Framework Programme for Research and Innovation”, COM(2011) 808 final, in: [http://ec.europa.eu/research/horizon2020/pdf/proposals/horizon\\_2020\\_impact\\_assessment\\_report.pdf](http://ec.europa.eu/research/horizon2020/pdf/proposals/horizon_2020_impact_assessment_report.pdf)

## 1.6 Cross-cutting issues

As well as the direct research and innovation objectives, FP-7 projects should have a broader impact on the European Research Area (ERA): gender, mobility, international cooperation, open access, early stage or senior researchers and “science with and for society”.

**Gender:** includes both the composition of the project team (including distribution of leadership positions) and the implication of the research on gender issues or impacts (measured at project level as well as FP7-Environment and FP7 as a whole). Indicators to determine addressing gender issues used are: # of projects with specific Gender Equality Actions; Design and implement an equal opportunity policy; Set targets to achieve a gender balance in the workforce; Organise conference and workshops on gender; Actions to improve work-life balance; # of projects where gender dimension was associated with the research content.

**Early stage and senior researchers:** # of early stage researchers, PhD, post-doc researchers involved in / hired for projects.

**Researcher mobility:** mobility between academic or research institutions or between sectors (from academia to industry), training, summer school etc.

**Continuity of research:** collaboration of individuals or organisations beyond project duration; development of new projects to build on previous; joint exploitation of results.

**Science with and for society:** awareness raising actions (science fairs and exhibitions, articles and interviews in popular media, summaries of project results in plain language available on websites and widely distributed), training (such as guidelines on what to do in emergency situations, visits and presentations to schools and other education institutions and / or development of curricula), empowerment of social stakeholders (measured through the inclusion of CSO/NGO as core partner).

**Open access and transfer of scientific knowledge:** output level: dissemination of project results; OA of publications. Impact level: content of research directed to facilitate or enable adoption of OA principles such as harmonisation and opening up of databases, definition of criteria for sharing infrastructures, etc.

**Internationalisation:** benefits from international collaboration for competitiveness, scientific excellence and addressing specific problems on the basis of mutual interest and mutual benefit.

## 1.7 Support to EU policies

Influence of research output on policy requires engagement with a mix of stakeholders (e.g. industry, NGOs, scientists and policy makers) in flexible modes of interaction and dialogue. The GoE concluded there is no exact way to measure the way scientific output improved policy but deemed that this would require collaborative initiatives between policymakers and researchers in developing strategies to support evidence-informed policy addressed through the FP7-Environment calls.

As project outputs they looked at deliverables: policy briefs, evidence gap maps and syntheses suitable for policy makers.

For project outcome/impact they considered: dissemination, national policy dialogues or output directly relating to policy objectives.

The recommendations on policy from the FP7 ex-post evaluation are repeated here, because of their specific reference to Horizon 2020.

*Recommendations on policy from the Ex-Post Evaluation of FP7 Cooperation Programme Theme: Environment (including Climate change)*

- Identify the needs for further research (the evidence gaps) to improve the scientific underpinning for the implementation of existing and future EU Directives and policies and global obligations.
- Develop processes and increase support mechanisms to extract the knowledge and outputs from research activities, analyse and synthesise them, and make them widely accessible (per descriptor, criteria, indicator, pressures and impacts). This support to the production of relevant, reliable, accessible and timely syntheses of research into policy briefs, targeted towards policy makers will involve:
  - Support to the establishment of clearing houses for research syntheses and policy relevant research;
  - Horizon 2020 funded projects to be obliged to support a substantially improved EU research synthesis and dissemination strategy, encompassing easy and open access to the results of publicly funded European research, including commitment to supporting the legacy of the project.
  -
- Specific attention in Horizon 2020 to the elaboration of how policy relevant instruments will be used to support the development of science-policy interfaces.
  - Engage with policy makers from the earliest stages of the project, so that the two-way dialogue can inform the researchers of the needs and expectations of the policy maker; such deliberative fora would involve civil society and the general public, supporting access to and use of research evidence.
  - Establish domain specific science-policy interface platforms, (with involvement of several projects) to share and validate good practices, bringing together the relevant stakeholders, towards supporting the implementation of environmental Directives and policies.
  - Develop rapid response mechanisms to meet policymakers' needs for research evidence within short time frames. Projects should include strategies to monitor the evolving policy environment and adapt accordingly.
  - Mechanisms for more direct involvement of Project Officers in policy projects, as well as potential beneficiaries, including other DGs, in a project's "policy profile" aspect.
  - Conduct regular interim reviews to support fine-tuning of call expectations with reality of limitations of research activities, thus enhancing impact.

## 1.8 European Added Value

The GoE states that European Added Value (EAV) is analysed through establishing 1) the need for public intervention; 2) the need for intervention at European level. Dimensions of added value (with contribution at project level assessed on a Likert scale) are:

1. Access to infrastructures and databases (accessible, compatible, interoperable).
2. Joint development of solutions for inter- / transnational environmental challenges.
3. Geographical or research domain building of capacity and critical mass.
4. Potential for leveraging additional resources from the private sector.

## 2 Annex 2: Horizon 2020 Indicators

In 2015, the Commission published a set of indicators that would allow the assessment of results and impacts of Horizon 2020. Previous assessments and evaluations measured the performance based on a combination of input indicators (number and type of participant organisation, country, budget, etc.) and outputs from the projects (reports, tools, briefs, conferences and workshops, publications). For the first time, Horizon 2020 has a set of Key Performance Indicators<sup>9</sup> that are: 1) identified prior to the start of the programme and 2) aim to measure results (or outcomes) and impacts of the programme.

As well as inputs and direct project outputs, the indicators therefore aim to capture the extent to which the programme resulted in changes in the short to medium term as well wider societal, economic or environmental cumulative changes in the longer term.

Output indicators: specific deliverables of the intervention.  
 Result indicators: immediate effects of the measure concerned and its direct addressees.  
 Impact indicators: successful outcome in terms of impact on economy / society beyond those directly affected by the intervention.

The indicators show that two aspects are important to assess the programme's performance: time and audience reach (or the sphere of influence). In addition to time (what happens during and directly following the action and the uptake over a longer period of time), there is the aspect of reach (whom it affects during and directly following the action and over a longer period of time). The H2020 indicators were developed to analyse the nature and scale of impact on the:

- European research and innovation system
- Contribution to building a society and an economy based on knowledge and innovation across the Union by leveraging additional research, development and innovation funding.

Data through which to measure each Horizon 2020 Key Performance Indicator has been defined. To measure change and monitor progress, the baseline and target have also been determined. It was expected that the information would become available through periodic and final reports (i.e. only in the later stages or upon completion of Horizon 2020) although some could become available through ex ante assessments at proposal evaluation stage. Indicators are organised along the lines of the three pillars of Horizon 2020: Excellent Science, Industrial Leadership and Societal Challenges. A separate set of indicators was developed to monitor the 14 cross-cutting issues. The indicators related to the Societal Challenges (and therefore SC5) are the following.

Effective performance management, including evaluation and monitoring, requires development of specific performance indicators which can be measured over time, which are realistic and reflect the logic of the intervention, and which are relevant to the appropriate hierarchy of objectives and activities. Appropriate coordination mechanisms should be put in place between the implementation and monitoring of Horizon 2020 and the monitoring of progress, achievements and functioning of the ERA.

*Horizon 2020 – Regulation of the European Parliament and of the Council (no. 1291/2013)*

Table 5: Indicators related to Societal Challenges

KPI	Definition	Type of data required	Baseline (start)	Target (end)
<b>Publications in peer-reviewed high impact journals in the area of the different societal challenges</b>	The percentage of publications published in the top 10% impact ranked journals by subject category	Publications from relevant funded projects (DOI: Digital Object Identifiers); Journal impact benchmark (ranking) data to be collected by commercially available bibliometric databases	[new approach under Horizon 2020]	[On average, 20 publications per €10 million funding (for all societal challenges)]
<b>Patent applications and patents awarded in the area of the different societal challenges</b>	Number of patent applications by theme; Number of awarded patents by theme	Patent application number	[new approach under Horizon 2020]	On average, 2 per €10 million funding (2014-2020)
<b>Prototypes and testing activities</b>	Number of prototypes, testing (feasibility / demo) activities, clinical trials	Reports on prototypes, and testing activities, clinical trials	[new approach under Horizon 2020]	[to be developed on the basis of first Horizon 2020 results]
<b>Joint public-private publications</b>	Number and percentage of joint public-private publications out of all relevant publications	Properly flagged publications data (DOI) from relevant funded projects	[new approach under Horizon 2020]	[to be developed on the basis of first Horizon 2020 results]
<b>New products, processes and methods launched into the market</b>	Number of projects with new innovative products, processes and methods	Project count and drop-down list allowing to choose the type of processes, products and methods	[new approach under Horizon 2020]	[to be developed on the basis of first Horizon 2020 results]

The Horizon 2020 legal basis includes 14 cross-cutting issues contributing to the various policy objectives to which the programme should contribute. For these, separate indicators have been developed and to be reported on annually. The table below lists the cross-cutting issue, the definition of the indicator and the type of data required. A new column has been added where we indicate the application to IMPACT-SC5 (if and where applicable).



Table 6: Indicators for monitoring cross-cutting issues

Cross-cutting issue	Definition of the indicator	Type of data required	Applicable to IMPACT-SC5 (if/where relevant)
<b>Contribution to the realisation of the European Research Area</b>	1.1 research positions advertised on Euraxess jobs	Number of research positions advertised in Euraxess jobs	yes
	1.2 national research infrastructures networked (in the sense of being made accessible to all researchers in Europe and beyond through support from Horizon 2020)	Number of national research infrastructures networked (in the sense of being made accessible to all researchers in Europe and beyond through support from Horizon 2020)	yes
	1.3 Open access articles published in peer-reviewed journals	Number and percentage of open access articles published in peer-reviewed journals	yes
	1.4 Scientific data and / or datasets made accessible and re-usable	Number of projects that make scientific data accessible and re-usable and number of scientific datasets made accessible and re-usable	yes
	1.5 Multiannual Implementation Plans adopted by Joint Programming initiatives	Number of Multiannual Implementation Plans adopted by Joint Programming initiatives	n/a
<b>Widening participation</b>	2.1 Total number of participations by EU-28 Member State	Nationality of Horizon 2020 applicants and beneficiaries	yes
	2.2 Total amount of EU financial contribution by EU-28 Member State (€ millions)	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	yes
<b>SME participation</b>	3.1 Percentage of EU financial contribution going to SMEs (Parts II and III of Horizon 2020)	Horizon 2020 beneficiaries flagged as SME; EU contribution to Horizon 2020 beneficiaries	yes
	3.2 EU financial contribution committed through the SME instrument (Parts II and III of Horizon 2020)	EU financial contribution committed through the SME instrument	n/a
<b>Social Sciences and Humanities</b>	4.1 Percentage of SSH partners in selected projects in all Horizon 2020 priorities and percentage of EU financial contribution allocated to them	Projects properly flagged (the SSH follow the Horizon 2020 definition)	Only if flagged

Cross-cutting issue	Definition of the indicator	Type of data required	Applicable to IMPACT-SC5 (if/where relevant)
<b>Science and Society (Responsible Research and Innovation)</b>	5.1 Percentage of projects where citizens, CSOs and other societal actors contribute to the co-creation of scientific agendas and scientific contents	CSOs identified in PDM / proposal submission; 'Other societal actors' identified in PDM as natural persons	yes
<b>Gender</b>	6.1 Percentage of women participants in Horizon 2020 projects	Gender of participants in Horizon 2020 Projects	yes
	6.2 Percentage of women project coordinators in Horizon 2020	Gender of MSCA fellows, ERC principal investigators and (scientific) coordinators in Horizon 2020 activities	yes
	6.3 Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of members of advisory groups, panels, etc.	n/a
	6.4 Percentage of projects taking into account the gender dimension in research and innovation content	Projects properly flagged	Only if flagged
<b>International cooperation</b>	7.1 Percentage of third country participants in Horizon 2020	Nationality of Horizon 2020 beneficiaries	yes
	7.2 Percentage of EU financial contribution attributed to third country participants	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	yes
	7.3 Percentage of budget of topics in the WP mentioning at least one third country or region	Budget figures by topic	yes
<b>Sustainable development and climate change, including information on the amount of climate</b>	8.1 Percentage of EU financial contribution that is climate-related in Horizon 2020 <sup>10</sup>	Budget figures by topic for top-down activities; for bottom-up topics: budget allocated to retained proposals <sup>11</sup>	yes

<sup>10</sup> calculated on the basis of the "RIO markers" methodology developed by OECD, distinguishing: expenditure-related outputs where climate is the principal (primary) objective to be counted as 100% climate related; expenditure-related outputs where climate is a significant, but not predominant, objective to be counted as 40% climate related; expenditure not targeted to climate objectives to be counted as 0% climate related

<sup>11</sup> "Top-down" topics are topics for which markers can be allocated on the basis of the Work Programme. "Bottom-up" topics are topics for which it is not possible to allocate a marker on a topic basis.

Cross-cutting issue	Definition of the indicator	Type of data required	Applicable to IMPACT-SC5 (if/where relevant)
<b>change related expenditure</b>	8.2 Percentage of EU financial contribution that is sustainability-related in Horizon 2020, calculated on the basis of the “RIO markers” methodology developed by OECD	Budget figures by topic for top-down activities; For “bottom-up” topics: budget allocated to retained proposals	yes
	8.3 Percentage of EU financial contribution that is biodiversity-related in Horizon 2020 (EUR), calculated on the basis of the “RIO markers” methodology developed by OECD	Budget figures by topic for top-down activities; For “bottom-up” topics: budget allocated to retained proposals	yes
<b>Bridging from discovery to market</b>	9.1 Percentage of projects and EU financial contribution allocated to innovation actions in Horizon 2020	Proposals and projects properly flagged; Topics properly flagged in the WP; follow-up at grant level	Only if flagged
	9.2 Within the innovation actions, percentage of EU financial contribution focused on demonstration and first-of-a-kind activities	Topics properly flagged in the WP; follow-up at grant level	Yes (Innovation Actions)
<b>Digital Agenda</b>	<p>10.1 Percentage of EU financial contribution that is ICT Research &amp; Innovation<sup>12</sup> related in Horizon 2020 (EUR), calculated on the basis of the “RIO markers” methodology developed by OECD:</p> <ul style="list-style-type: none"> <li>• Expenditure for topics/projects where ICT R&amp;I is the principal (primary) objective to be counted as 100% ICT related;</li> <li>• Expenditure for topics/projects where ICT R&amp;I is a significant (secondary), but not predominant objective to be counted as 40% ICT related;</li> </ul>	<ul style="list-style-type: none"> <li>• For “top-down” topics: budget figures by topic</li> <li>• For “bottom-up” topics: budget allocated to retained proposals</li> </ul>	?

<sup>12</sup> ICT Innovation is defined as “ICT and ICT-enabled new products, services or processes within and outside the ICT sector”

Cross-cutting issue	Definition of the indicator	Type of data required	Applicable to IMPACT-SC5 (if/where relevant)
	<ul style="list-style-type: none"> <li>Expenditure for topics/projects not targeted to ICT R&amp;I objectives to be counted as 0% ICT related.</li> </ul>		
<b>Private sector participation</b>	11.1 Percentage of Horizon 2020 beneficiaries from the private for profit sector	Horizon 2020 beneficiaries classified by type of activity and legal status	yes
	11.2 Percentage of EU financial contribution going to private for profit entities (Parts II and III of Horizon 2020)	Horizon 2020 beneficiaries classified by type of activity; corresponding EU contribution	yes
<b>Funding for PPPs and P2Ps</b>	12.1 EU financial contribution for PPP-P2Ps	EU contribution to PPP-P2Ps	n/a
	12.2 PPPs leverage: total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution	Total funding made by private actors involved in PPPs	n/a
	12.3 P2P leverage: total amount of funds leveraged through Art. 185 initiatives	Total public funds integrated in the Art. 185 initiative; total public funds in the specific sector	n/a
<b>Communication and dissemination</b>	13.1 Dissemination and outreach activities other than peer-reviewed publications (conferences, workshops, press releases, publications, flyers, exhibitions, trainings, social media, websites, communication campaign e.g. radio, tv)	A dropdown list allows the choice of the type of dissemination activity. Number of events, funding amounts and number of persons reached thanks to the dissemination activities	yes
<b>Participation patterns of independent experts</b>	14.1 Proposal evaluators by country	Nationality of proposal evaluators	n/a
	14.2 Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	n/a

The document concludes by noting that “indicators are in the end all based on data, either sourced from third parties or collected through programme monitoring or participant surveys”. The amount of data captured in Horizon 2020 has been expanded (largely via the CORDA database) to ensure its full exploitation and to measure the direct and indirect contribution of Horizon 2020 projects and initiatives to competitiveness and growth. The majority of data is collected from project beneficiaries.

IT systems used to support the Commission (and that are not available to the public) are:

- SEP for submitting proposals (including plans for the dissemination and use of research results), and for evaluating and ranking them.

- 
- CPM/SYGMA for monitoring funded projects during their entire life cycle, including capturing information and data on the dissemination and use of their results.
  - CPM/SESAM/RESPIR for reports, deliverables and data on dissemination and use of the results of research carried out under each concluded FP7 project. It has to be taken into account that data on results supplied by beneficiaries is not always perfect.
  - CORDA as the overall warehouse for structured data, tapping into the previous systems. CORDA is the internal data warehouse for Commission users. It is also used to inform Member States about their participation in the framework programmes through the related e-CORDA platform.

Systems that are open to the public are:

- CORDIS: the Commission's primary public repository and multilingual portal to disseminate information on all EU-funded research projects and their results.
- OpenAIRE: an open repository and portal for data and information related to research projects funded through a wide range of programmes. It stores millions of projects, research data sets and publications, and its coverage goes well beyond EU programmes.
- The EU Open Data Portal (operated by the Publications Office) makes accessible thousands of sets of data and information from the Commission and other EU institutions.

### 3 Annex 3: Interim Evaluation of Horizon 2020 -Societal Challenge 5

In March 2017, the European Commission published the interim evaluation of Horizon 2020 Societal Challenge 5 (carried out in 2016). It follows the structure and principles of the Better Regulation Guidelines: intervention logic, relevance, effectiveness, efficiency, consistency and EU added-value. The evaluation covered the first two work programmes of 2014-15 and 2016-17.

Considering or determining the 'Relevance' and 'Consistency' of SC5 is outside the scope of IMPACT-SC5 and therefore not included here. The other three evaluation principles, with a short description and the way they have been determined (indicators, metrics or otherwise) are the subject of the next table. The reports' authors note that at the time of evaluation most projects were ongoing or had just started, and outputs – let alone results and impacts - could not be expected at that point. Much of the evaluation is therefore related to the monitoring of the implementation based on inputs such as work programme topics, budget allocations and type/geography of beneficiaries.

Table 7: Interim Evaluation of Horizon 2020 – Societal Challenge 5

Evaluation principle	Short description	Short-term outputs (+ source)	Expected longer term results (+ source)
<b>Effectiveness</b>	From short-term programme outputs to (expected) longer term results and progress towards the SC5 specific and overall Horizon 2020 objectives.	IPR / Patents (Corda); Publications (Corda); Self-perceived benefits to organisation and/or environment (survey).	Scientific: publications and patents (extrapolated from and using FP7 indicators).  No data collection for innovation results and impacts.  Progress towards attaining the SC5 specific objectives <sup>13</sup> and overall Horizon 2020 objectives <sup>14</sup> .
<b>Efficiency</b>	The relationship between the resources used by an intervention and the changes it generates. Main element is	Project outputs (expected, as no data available).	Project outcomes and impacts (expected, as no data available).

<sup>13</sup> Fighting and adapting to climate change; Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems; Ensuring the sustainable supply of non-energy and non-agricultural raw materials; Enabling the transition towards a green economy and society through eco-innovation; Developing comprehensive and sustained global environmental observation systems; Cultural heritage; Specific implementation aspects.

<sup>14</sup> Promoting excellent science in scientific and technological research; Boosting innovation, industrial leadership, competitiveness and job creation; Addressing major societal challenges; Spreading excellence and widening participation; Science with and for society; Science for policy

Evaluation principle	Short description	Short-term outputs (+ source)	Expected longer term results (+ source)
	simplification of procedures and timings.		
<b>EU added-value</b>	Rationale for and demonstration of EU added value.	Scientific outputs and innovation results	Citation and CIS

*Other findings from the report of relevance to IMPACT-SC5*

### Effectiveness

The authors question why the Commission does not use the Community Innovation Survey (CIS), carried out by Eurostat, as tool for the assessment of innovation result and impact. They state that the CIS questionnaire includes a question that refers to funding from the Framework Programme.

Participation in the calls (including Innovation Actions) is still dominated by the traditional academic stakeholders, with "attempts to force excessive research activities through an IA, with different degrees of success". This is something to look out for in the evaluation (e.g. when looking at the participants in IAs).

Few data available on outputs as projects are still ongoing, but also due to inconsistencies in CORDA which mean the data are not reliable or easy to access. As result the report describes what *may* happen, rather than what has happened. For example, a higher societal impact is expected as result of large-scale demonstrations and pilots.

### Efficiency

Covers: Budgetary resources; Programme's attractiveness (mobilisation of – new – stakeholders, success rate, geographical dimension and cross-cutting issues); Cost-benefit analysis; The issue of 'agencification' (delegation of management and governance) falls outside the scope of IMPACT-SC5.

Efficiency of budgetary resources looks at the implementation of budget, i.e. has the money been spent (allocated) as expected or have there been deviations. The evaluators conclude that, apart from the SME instrument, budget has been spent as foreseen (breakdown of budget by instrument, type of beneficiary and country is presented in the section "Implementation" of the report). The report further concludes that the average contribution by the Commission to projects is €5.02 million compared to €3.5 million in FP7. The question is raised (but not answered) if this increase means projects are more ambitious (which in any case would be difficult to determine, since projects are not like-for-like) or if simplification measures are not leading to a more efficient use of resources. They do consider this a critical indicator to assess in the H2020 ex post evaluation. They also note that the work programmes publish the contribution the Commission deems reasonable for the call, thereby influencing the projects.

To assess the programme's attractiveness, the evaluators look at the extent to which stakeholders are mobilised – assessed through the success rate and the ability to attract new types of innovative stakeholders. The finding is that RIA and IA are implemented by industrially driven consortia, with participation from downstream and end-user partners. In terms of geographic dimension, the evaluators looked at the number of participations as main indicator where the number of stakeholders from EU13 (increasing), associated and candidate (decreasing) and third countries (decreasing) is compared to FP7-Environment.

In relation to cross-cutting issues, they note that SC5 performs well on expenditure on sustainable development and climate (as expected) but that, as result of the methodology and data collection, performance against gender issues, SSH and Digital Agenda is harder to assess under H2020. Despite the reasonable number of topics flagged as SSH relevant, SC5 is rather unsuccessful in mobilising the SSH community to participate.

Overall the evaluators note that the monitoring system remains weak, without reliable and user-friendly databases.

### EU added-value

EU added value answers the question if:

- A) the problem requires public intervention, and if yes
- B) this public intervention is preferable at European scale instead of at national or sub-national level.

Three criteria are typically used to assess the EU added-value:

1. Effectiveness: where EU action is the only way to get results to create missing links, avoid fragmentation and realise the potential of a border-free Europe.
2. Efficiency: where the EU offers better value for money, because externalities can be addressed, resources or expertise can be pooled, an action can be better coordinated.
3. Synergy: where EU action is necessary to complement, stimulate and leverage action to reduce disparities, raise standards and create synergies.

#1 is a qualitative assessment of objectives in relation to the Treaty on the Functioning of the EU (TFEU), Environment Action Plans and international organisations such as the IPCC. #2 and 3 are assessed on the basis of scientific outcomes and innovation results, where collaborative R&I produces greater benefits and synergies and mutual learning between beneficiaries from different countries, increasing the overall knowledge and expertise. This is demonstrated (measured) through citation impacts and the CIS 2018. Although too early to show EU added value, the evaluators selected two projects (from 2014-2015) that they consider promising: MASLOWATEN (IA) and AtlantOS (RIA).

### KPI / metric / indicator related summary

- **Large-scale demonstrations** (as part of the systemic approach) should have a greater societal and environmental impact than previous programmes.
- Deployment of **new technologies** combined with **business models** and greater **participation by businesses** should lead to better uptake of research results by industry – and thereby lead to a higher innovation impact.
- Increased coordination between Commission departments (e.g. Environmental Knowledge Community) should lead to a stronger policy impact (therefore only indirectly linked to projects).
- **Direct link** between raw material actions (e.g. RIA/IA) and EU raw materials policy / European Innovation Partnership on Raw Materials expected to lead to a positive contribution and help consolidate raw materials R&I community in Europe.

The evaluators expect SC5 to fail on some KPIs, such as publications and patents.

### Recommendations:

- Increase participation of non-EU countries – this should not be seen as an objective, rather as a tool for (and indicator of) R&I excellence.
- Develop a monitoring system to measure economic impacts (e.g. turnover) and environmental/resource efficiency impacts (e.g. energy or raw materials savings, reduction of emissions) of the large-scale demonstration projects.
- Improve communication to citizens to make them aware of the knowledge and innovation stemming from EU funded projects (to counter the criticism and challenging of European integration).
- Continue with innovative approaches (nature-based solutions, climate services, sustainable cities) and maintain the balance between 'core' R&I actions and conceptual development (new concepts and approaches).
- Develop and gather data on further indicators, such as innovation, policy impacts, researchers' and innovators' careers, and R&I results at the end of the projects. The evaluators consider the H2020



---

performance indicators "insufficient for proper monitoring and evaluation". They also recommend that the monitoring and evaluation system be set up to contribute to the SDGs.

- A further recommendation is to make the objectives more precise, quantifiable.

**Sources of data:**

The document does not provide a methodology (other than to state that the structure and principles established in the European Commission's Better Regulation Guidelines were followed) and data types and sources used. From the document we deduce that the evaluation is based on:

- Literature review
- CORDA database
- ORBIS database
- RESPIR database
- Eurostat (e.g. Community Innovation Survey).

---

## 4 Annex 4: Monitoring the Impact of EU Framework Programmes

Three Experts from the Expert Group on Evaluation Methodologies carried out an analysis on the monitoring of the impact of the EU Framework Programmes (FPs) for research and innovation. They based their findings on a literature review and lessons learned from relevant practices worldwide regarding tracking impact from research an innovation investment. The report informed the development of Horizon Europe and elaborated the concept of impact pathways. Three different experts carried out desk research and literature review of existing evaluation reports and methods for research performing organisations (RPO), research funding organisations (RFO) and research funding programmes (RFP), particularly the existence and use of indicators, following the three impact categories:

- Scientific impact: related to supporting the creation and diffusion of high-quality new knowledge, skills, technologies and solutions to global challenges;
- Societal impact: related to strengthening the impact of research and innovation in developing, supporting and implementing EU policies, and support the uptake of innovative solutions in industry and society to address global challenges;
- Economic impact: related to fostering all forms of innovation, including breakthrough innovation, and strengthening market deployment of innovative solutions.

For each of these categories, the document includes a review of the proposed Impact Pathways and related indicators, with comments on the comprehensiveness, relevance and feasibility of the Impact Pathways towards scientific, societal and economic impact. As the whole document pertains to impact pathways and indicators, it cannot be summarised here. The proposed indicators will be assessed for comprehensiveness, relevance and feasibility for the evaluation of the SC5 RIAs and IAs as part of IMPACT-SC5.

## 5 Annex 5: Horizon Europe Key impact pathway indicators

In June 2018, the European Commission published its proposal for Horizon Europe, the EU R&I programme 2021-2027 (COM(2019) 435 final). The planned Monitoring and Evaluation Framework has been designed as an evolution from the current system used under Horizon 2020. Nine Key Impact Pathways are foreseen as the basis to track progress towards scientific, societal and economic impacts (Annex V – Key impact pathway indicators). The Commission summarises the key principles informing this approach as PATHS.

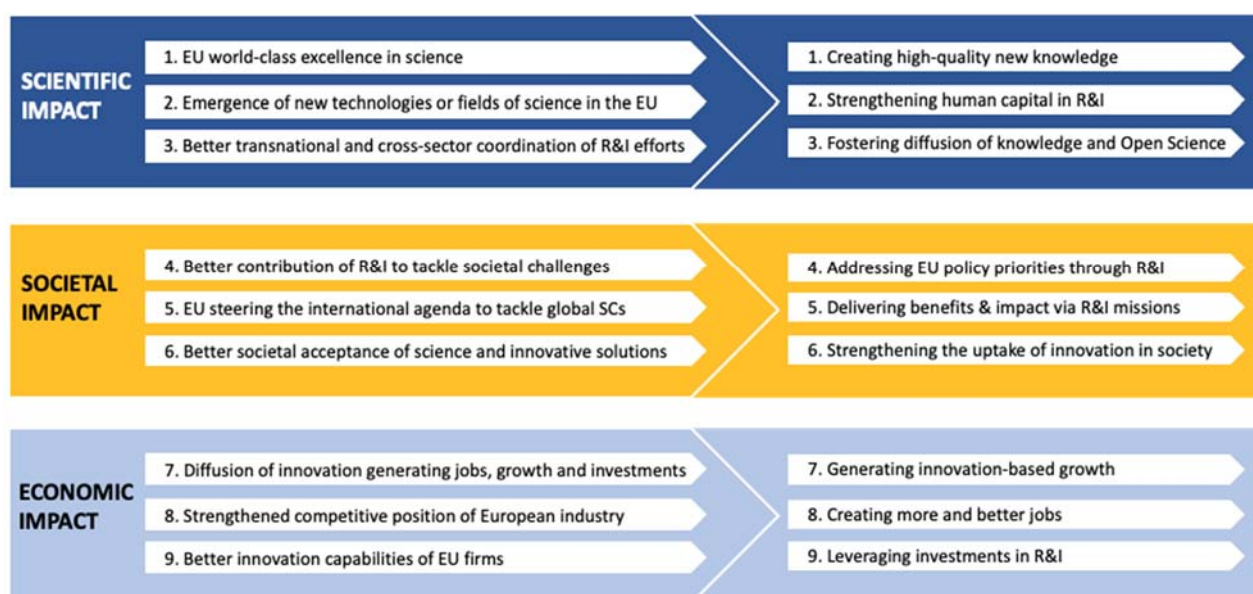
The 'PATHS' principles stand for:

<b>P</b> roximity	Knowing who the individual researchers and companies are, for example through unique identifiers such as VAT numbers, researchers' IDs, funder ID
<b>A</b> ttribution	Microdata collection supporting the identification of control groups for counterfactual analysis
<b>T</b> raceability	Minimised burden on beneficiaries through automatic data harvesting from existing databases; use of additional primary (including qualitative) data sources such as project evaluators and reviewers
<b>H</b> olism	Telling the story of the progress of the Programme as a whole according to the objectives, at any moment in time
<b>S</b> tability	Building on the current systems, piloting evolutions in Horizon 2020

The figure below shows the evolution of impact pathways from Horizon 2020 to Horizon Europe.

Figure 1: Impact Pathways- evolution

Impact Pathways – evolution Horizon 2020 to Horizon Europe



The Impact Pathways are expected to allow for a better capture and communication of the progress of Horizon Europe towards its objectives, including beyond the programme's lifetime, while allowing for a clearer identification of the many impacts that R&I investments have<sup>15</sup>. To track progress, key impact pathway indicators have been developed. The report says that "micro-data behind the key impact pathway indicators will be collected for all parts of the Programme and all delivery mechanisms in a centrally managed and harmonised way and at the appropriate level of granularity with minimal reporting burdens on the beneficiaries". The document goes on to say that progress will be monitored through **proxy indicators** along the following key impact pathways. These indicators are repeated below for scientific impact, societal impact and economic impact.

Table 8: Horizon Europe -scientific impact pathway indicators

Towards scientific impact	Short-term	Medium-term	Longer-term
<b>Creating high-quality new knowledge</b>	<u>Publications</u> - Number of FP peer reviewed scientific publications	<u>Citations</u> - Field-Weighted Citation Index of FP peer reviewed publications	<u>World-class science</u> - Number and share of peer reviewed publications from FP projects that are core contribution to scientific fields
<b>Strengthening human capital in R&amp;I</b>	<u>Skills</u> - Number of researchers having benefitted from upskilling activities in FP projects (through training, mentoring/coaching, mobility and access to R&I infrastructures)	<u>Careers</u> - Number and share of upskilled FP researchers with more influence in their R&I field	<u>Working conditions</u> - Number and share of upskilled FP researchers with improved working conditions
<b>Fostering diffusion of knowledge and Open Science</b>	<u>Shared knowledge</u> - Share of FP research outputs (open data/ publication/ software etc.) shared through open knowledge infrastructures	<u>Knowledge diffusion</u> - Share of open access FP research outputs actively used/cited	<u>New collaborations</u> - Share of FP beneficiaries having developed new transdisciplinary/ trans-sectoral collaborations with users of their open FP R&I outputs

Table 9: Horizon Europe -societal impact pathway indicators

Towards societal impact	Short-term	Medium-term	Longer-term
<b>Addressing EU policy priorities through R&amp;I</b>	<u>Outputs</u> - Number and share of outputs aimed at	<u>Solutions</u> - Number and share of innovations and	<u>Benefits</u> - Aggregated estimated effects from

<sup>15</sup> Source: [https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/evaluation-impact-assessment-and-monitoring/euevalnet\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/evaluation-impact-assessment-and-monitoring/euevalnet_en) Meeting of the European RTD evaluation network, 7 November 2018, Vienna, Austria

	addressing specific EU policy priorities	scientific results addressing specific EU policy priorities	use of FP-funded results, on tackling specific EU policy priorities, including contribution to the policy and law-making cycle
<b>Delivering benefits and impact through R&amp;I missions</b>	<u>R&amp;I mission outputs</u> - Outputs in specific R&I missions	<u>R&amp;I mission results</u> - Results in specific R&I missions	<u>R&amp;I mission targets met</u> - Targets achieved in specific R&I missions
<b>Strengthening the uptake of innovation in society</b>	<u>Co-creation</u> - Number and share of FP projects where EU citizens and end-users contribute to the co-creation of R&I content	<u>Engagement</u> - Number and share of FP beneficiary entities with citizen and end-users engagement mechanisms after FP project	<u>Societal R&amp;I uptake</u> - Uptake and outreach of FP co-created scientific results and innovative solutions

Table 10: Horizon Europe - Economic/innovation impact pathway indicators

Towards economic / innovation impact	Short-term	Medium-term	Longer-term
<b>Generating innovation-based growth</b>	<u>Innovative outputs</u> - Number of innovative products, processes or methods from FP (by type of innovation) & Intellectual Property Rights (IPR) applications	<u>Innovations</u> - Number of innovations from FP projects (by type of innovation) including from awarded IPRs	<u>Economic growth</u> - Creation, growth & market shares of companies having developed FP innovations
<b>Creating more and better jobs</b>	<u>Supported employment</u> - Number of FTE jobs created, and jobs maintained in beneficiary entities for the FP project (by type of job)	<u>Sustained employment</u> - Increase of FTE jobs in beneficiary entities following FP project (by type of job)	<u>Total employment</u> - Number of direct & indirect jobs created or maintained due to diffusion of FP results (by type of job)
<b>Leveraging investments in R&amp;I</b>	<u>Co-investment</u> - Amount of public & private investment mobilised with the initial FP investment	<u>Scaling-up</u> - Amount of public & private investment mobilised to exploit or scale-up FP results	<u>Contribution to '3% target'</u> - EU progress towards 3% GDP target due to FP

## 6 Annex 6: Mid-Term Evaluation of the LIFE Programme

In March 2017 the European Commission published the Mid Term Evaluation Report of the LIFE programme, based on a study led by Ecorys. The report's conclusions were derived from 96 questions addressing effectiveness, efficiency, coherence, relevance, EU added value, sustainability, impact, and other specific aspects of the programme. To answer the evaluation questions, a combination of document review, quantitative analysis of LIFE/LOFE+ monitoring indicators, interview, a public consultation and stakeholder surveys were used. The study assessed the LIFE programme in terms of interventions (input), its implementation (management) and its results (outputs, outcomes and impacts) from the first three years (2014-2016).

The evaluation analysed the quantitative and qualitative impact of the programme's contribution to the conservation status of habitats and species listed under Directives 92/43/EEC and 2009/147/EC. The quantitative assessment of effectiveness, efficiency, impact and sustainability was carried out using the Commission's indicator database, eProposal and Butler as the main resources. Other sources are the LIFE projects database (publicly available) and the procurement database of spending financed through the LIFE programme. A qualitative assessment was carried out into relevance, coherence, EU added value, action grants, procurement and financial instruments using desk research, multiple surveys, interviews and site visits as the main methods.

For the purposes of IMPACT-SC5, we have drawn on the evaluation of effectiveness, efficiency, sustainability and impact and particularly any indicators used in the assessment of these criteria.

The data for the LIFE indicators come from the project beneficiaries, which is then validated by the administrators of the database. These consist of a mandatory key indicators and complementary indicators. The set of indicators replicated below are interesting and could be applicable to SC5 projects in determining real environmental or sustainable progress. The limiting factor for application is that the H2020 beneficiaries have not been asked to report against these indicators and likely the data will not be available. Investigating the relevance and application to Horizon 2020 projects would be very interesting (and could provide stronger synergies / avoiding overlap between programmes) but is outside the scope and means of IMPACT-SC5.

### Effectiveness against the objectives:

1. Nature: LIFE(+), Nature and Biodiversity;
2. Environment: LIFE, Environment and Resource Efficiency and LIFE+, Environment and Governance;
3. Climate action;
4. Information, Governance and Awareness raising;
5. EU2020 objectives.

### Efficiency:

1. Costs for the management of the Programme;
2. Benefits of the interventions of the Programme: direct benefits (jobs and economic growth) and indirect benefits (societal gains through habitat conservation and CO2 emissions reduction);
3. Balancing the distribution of LIFE projects across thematic priorities and across member states and regions;
4. Private sector participation.

The complete set of key indicators and parameters<sup>16</sup> are listed below. The indicators, on which all applicants or beneficiaries have to report, at least by indicating 'not applicable' ('N/A'), are written in bold and are underlined. Moreover, at least one of the key indicators under points 2 to 12 have to be chosen as the main priority area or sector the project focuses on, for which all detailed descriptors and values have to be provided. Furthermore, at least one other key indicator under points 2 to 12 must be chosen as a complementary key indicator for which the applicant will need to provide as much detailed information as is readily available.

- |           |   |
|-----------|---|
| 1.        | Basic project data and Context  |
| <b>A.</b> | <b><u>1.1 Basic information</u></b>   |
|           | <b><u>1.1.1 Level/Size of legal entity</u></b>                                      |
|           | <b><u>1.1.2 Timeframe for the project and the (estimated) ex post situation</u></b> |
| <b>B.</b> | <b><u>1.1 Priority area/sector on which the project focuses</u></b>                 |
| <b>C.</b> | <b><u>1.2 Ecosystem service(s)</u></b>  |
| <b>C.</b> | <b><u>1.3 Interrelationship with other EU policies and funds</u></b>                |
|           | <b><u>1.4 Overarching geographic context</u></b>                                    |
|           | <b><u>1.4.1 Biogeographic region(s)</u></b>   |
|           | <b><u>1.4.2 Territorial extent - NUTS</u></b>                                       |
|           | <b><u>1.4.3 Water body/bodies</u></b>   |
|           | <b><u>1.4.4 Ecosystem(s)</u></b>  |
|           | <b><u>1.4.5 Natura 2000 sites</u></b>   |
|           | <b><u>1.5 Project area/length</u></b>   |
|           | <b><u>1.6 Humans (to be) influenced by the project</u></b>                          |
| <b>D.</b> | <b><u>Types of environmental and climate action outcomes</u></b>                    |
| <b>E.</b> | <b><u>Societal outcomes</u></b>   |
| <b>F.</b> | <b><u>Economic outcomes</u></b>   |
| 2.        | Water (including the marine environment)  |
| 2.1       | Terrestrial extent affected by the pressure or risk addressed                       |
| 2.2       | Aquatic extent affected by the pressure or risk addressed                           |
| 2.3       | Pressure(s) or risk(s) addressed  |
| 2.3.1     | Physical alteration of channel/bed/riparian area/shore of water body                |
| 2.3.2     | Dams, barriers and locks  |
| 2.3.3     | Hydrological alteration   |

16

[https://ec.europa.eu/environment/archives/life/toolkit/pmttools/life2014\\_2020/documents/160215\\_LIFEproject\\_level\\_outcome\\_indicators.pdf](https://ec.europa.eu/environment/archives/life/toolkit/pmttools/life2014_2020/documents/160215_LIFEproject_level_outcome_indicators.pdf)

2.3.4	Flood risk
2.3.5	Resource efficiency – water
2.3.5.1	Drought risk/water scarcity
2.3.5.2	Water abstraction/diversion
2.3.5.3	Water consumption for production
2.3.6	Point source pollution
2.3.7	Diffuse source pollution
2.4	Environmental status - marine, coastal or transitional waters
3.	Waste
3.1	Waste management
3.2	Marine litter
4.	Resource efficiency (including soil, forests and green and circular economy)
4.1	Resource efficiency - energy
4.1.1	Consumption
4.1.2	Intensity
4.1.3	Renewables production
4.2	Resource efficiency - Forest
4.2.1	Sustainable Forest Management
4.2.2	Provision of forest datasets to the European Data Centre
4.3	Resource efficiency - soil
4.4	Resource efficiency - circular economy
5.	Environment and health (including chemicals and noise)
5.1	Chemicals
5.1.1	Chemicals released
5.1.2	Chemicals substitution
5.2	Noise
5.2.1	Noise level/frequency - terrestrial
5.2.2	Noise level/frequency – underwater noise
6.	Air
6.1	Air - emissions
6.2	Air - quality
6.3	Air - deposition
7.	Nature and Biodiversity



- 7.1 Ecosystem assessment
- 7.2 Ecosystem services assessment
- 7.3 Natural and semi-natural habitats
- 7.4 Wildlife species
- 7.5 Threats - Invasive alien species (IAS) or other threats
  - 7.5.1 Invasive Alien Species
  - 7.5.2 Other threats
- 8. Climate Change Mitigation
  - 8.1 Greenhouse gas emissions
    - 8.1.1 CO<sub>2</sub>
    - 8.1.2 Other greenhouse gases
  - 8.2 Carbon capture and sequestration
- 9. Climate Change Adaptation
  - 9.1 Adaptation area
  - 9.2 Particularly vulnerable areas
  - 9.3 Infrastructures targeted for climate resilience
- 10. Governance
  - 10.1 Compliance/enforcement
    - 10.1.1 Duty holders covered
    - 10.1.2 Supervisory/enforcement bodies involved
    - 10.1.3 Risk-based compliance/enforcement system put in place/completed
  - 10.2 Effect/impact of involving non-governmental organisations (NGOs) and other stakeholders in project activities
- 11. Information and awareness raising of the general public
  - 11.1 Website (mandatory)
  - 11.2 Other tools for reaching/raising awareness of the general public
  - 11.3 Surveys carried out regarding awareness of the environmental/climate problem addressed (only mandatory for information and awareness projects)
- 12. Capacity building
  - 12.1 Networking (mandatory)
  - 12.2 Professional training or education
- 13. Jobs
- 14. Contribution to Economic growth
  - 14.1 Total project related expenditure during the project period

- 14.2.1 Capital expenditure expected in case of continuation/replication/transfer after the project end
- 14.2.2 Operating expenses expected in case of continuation/replication/transfer after the project end
- 14.2.3 Revenue expected in case of continuation/replication/transfer after the project end
- 14.2.4 Cost reduction expected in case of continuation/replication/transfer after the project end

14.3 Future funding

14.4 Continuation/replication/transfer scope

- 14.4.1 Entry into new entities/projects
- 14.4.2 Entry into new sectors
- 14.4.3 Entry into new geographical areas