



# Study to support the monitoring and evaluation of the Framework Programme for research and innovation along Key Impact Pathways

*Baseline and Benchmark Report*

Independent  
Expert  
Report



Research and  
Innovation

## Study to support the monitoring and evaluation of the Framework Programme for research and innovation along Key Impact Pathways - Baseline and Benchmark Report

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# **Study to support the monitoring and evaluation of the Framework Programme for research and innovation along Key Impact Pathways**

## **Baseline and Benchmark Report**

Edited by James Nixon

# TABLE OF CONTENTS

<b>1. INTRODUCTION.....</b>	<b>3</b>
<b>2. OVERVIEW OF HE BASELINES AND BENCHMARKS.....</b>	<b>4</b>
<b>2.1 OVERALL DEFINITION OF HORIZON EUROPE BASELINES, BENCHMARKS AND REFERENCE POINTS.....</b>	<b>4</b>
2.1.1. HE baselines: overall definition .....	4
2.1.2. HE benchmarks: overall definition .....	5
2.1.3. Methodology used to collect data for the baselines and benchmarks .....	6
2.1.4. Selected list of baselines and benchmarks .....	7
<b>2.2. BASELINES AND BENCHMARKS FOR KIPs 1-3.....</b>	<b>12</b>
2.2.1. Overview of proposed baselines for KIPs 1-3 .....	12
2.2.2. Overview of proposed benchmarks for KIPs 1-3 .....	16
<b>2.3. BASELINES AND BENCHMARKS FOR KIPs 4-6.....</b>	<b>19</b>
2.3.1. Overview of proposed baselines for KIPs 4-6 .....	19
2.3.2. Overview of proposed benchmarks for KIPs 4-6 .....	22
<b>2.4. BASELINES AND BENCHMARKS FOR KIPs 7-9.....</b>	<b>26</b>
2.4.1. Overview of proposed baselines for KIPs 7-9 .....	26
2.4.2. Overview of proposed benchmarks for KIPs 7-9 .....	30
<b>3. LIST OF DATA SOURCES USED.....</b>	<b>33</b>



# 1. INTRODUCTION

This report constitutes a **Baseline and benchmark report** (Deliverable 4 of the study). The terms of reference (ToR) provide that the contractor shall analyse the **baseline situation** before the start of Horizon Europe (HE), and support the Commission services in computing the baseline values for all indicators. These baselines will provide a framework with which to measure the progress of Horizon Europe over time.

The main deliverable of this task is a set of baseline values and their analysis for each of the Key Impact Pathway indicators. The baseline assessment was based on qualitative and quantitative methods, including desk research, interviews/meetings and seven data pilots described in section 2.1.3 of the report.

This task also includes the identification of possible **benchmarks** to compare the performance of Horizon Europe. It was agreed that a typical benchmark value will be the performance of Horizon 2020 during the last year for which full data are available. To his end, the study first identified benchmark values for relevant indicators in existing sources. In cases where the benchmark values were not available or outdated, the study team calculated them via the seven data pilots.

Although the Baseline and benchmark report is a standalone deliverable in this study, it supplements the Indicator and Metadata Handbook (Deliverable 5 of the study) which, among other elements, provides baseline definitions and their values for each indicator under the Key Impact Pathways framework.

The contents of the report are as follows:

- Sections 2.1 and 2.2 provide an outline of the overall definitions used to describe HE baselines and benchmarks. In addition to these definitions, we describe in detail the methodology used to arrive at the baseline and benchmark values.
- Sections 2.3 to 2.5 summarise the results of our analysis of the Key Impact Pathways falling under the categories of Scientific Impact, Societal Impact and Economic Impact. In some cases, baseline/benchmark values are not easy to obtain, in which case the best available approximations have been used to define the values. The rationale behind some of the choices made are further explained in these sections of the report.

The report was delivered by a team consisting of PPMI, UNU-MERIT, Athena-RIC, Seureco-Erasme and Ontotext.

## 2. OVERVIEW OF HE BASELINES AND BENCHMARKS

### 2.1. OVERALL DEFINITION OF HORIZON EUROPE BASELINES, BENCHMARKS AND REFERENCE POINTS

#### 2.1.1. HE baselines: overall definition

We understand a baseline to be a snapshot against which future changes in the values of indicators will be measured. Baselines include contextual evidence on the situation that enables a better understand of changes in a specific area over time. In the context of EU Framework Programmes (FPs), a **baseline is the expected value of the indicator in the absence of an intervention**. It is thus the value one can reasonably expect in the general research environment outside Horizon Europe.

Two types of baseline data were used in this study. The first includes baselines that capture the **overall research performance at global or EU-27 level**. Whenever data were available for the EU-27, the study team used these values as they more closely capture the values/levels performance that might be expected outside EU FPs. In practice, the EU-27 and world level data are closely interlinked. A good example of this is the Field-Weighted Citation Impact (FWCI) index, which is used to quantify the medium-term indicator value for KIP 1. The estimated value of the FWCI for the EU is around 1.2, which suggests that the average European publication was cited roughly 20% more often than an average publication in the same fields at global level. However, Europe's FWCI is increasingly affected by changing dynamics in other regions of the world – notably China, whose share of global scientific output and FWCI scores have been growing rapidly. To maintain a similar FWCI score in the future, the EU's FWCI score should increase at similar rates to other fast-growing regions.

We also note that measurements of overall research performance at a global or EU-27 level also normally include the contribution of previous EU FPs (unless this contribution can be estimated and deducted, as is the case in certain areas such as the number of researchers). This is an important limitation, but even so, our assumption is that any impact from FP7 or Horizon 2020 would not be large enough to affect these measurements in such a way that it would make them not relevant or valid as baselines.

The second type of data includes baselines that look at the performance of **non-funded entities in the control groups**. This is the case in particular in KIPs 7-8, where growth in the turnover of and employment by firms not funded by FPs were used to calculate baseline values. The main reason behind this choice is that there is a strong element of self-selection

among applicants who participate in EU FPs. One cannot simply compare the performance of FP firms to all European firms that otherwise share many of the same propensities (i.e. country, sector, age, etc.). FP firms are mostly R&D-intensive, while the average European firm with the same observed characteristics is less so. As a result, the study team has used the performance of non-funded FP applicants to calculate baseline values.

An important detail to mention is that a number of baselines will be equal to zero. This is mostly the case for many short-term indicators that are cumulative and provide a count/sum value. This logic makes sense because, for example, no peer-reviewed publications would have been produced, or no FP researchers upskilled if there had been no FP intervention in the first place.

This does not mean that the baselines will be equal to zero for all short-term indicators. For example, the baseline for one short-term indicator in KIP 3, Publications, is defined as the share of publications that are open-access (OA). That is, the indicator is proportional and not cumulative. This means that the share of publications in OA would not be zero in the absence of FP funding, but would instead be around the same as the EU average.

The H-index, used to calculate the medium-term indicator for KIP 2, is a specific case. To calculate the baseline value for this indicator, one needs to capture the H-index value for each researcher as the projects begins under HE, and to compare this with the H-index values for non-funded researchers. These values can only be captured once HE projects have actually started. For this reason, it was not feasible to provide a benchmark for H-index under the HE programme at the time when this report was written (mid-2021).

Further details on the definitions used for HE benchmarks are outlined below.

### **2.1.2. HE benchmarks: overall definition**

There are two general approaches to benchmarking:

- Internal benchmarking involves benchmarking within an intervention, and compares the intervention's performance against that during a previous time period (e.g., the previous quarter, the same quarter last year, during the last-generation programme, etc.);
- External benchmarking compares benchmark performance or processes with those of analogous programmes or interventions.

Following discussions with the EC, it was decided to apply internal benchmarking consistently across all Key Impact Pathways and indicators. This means that a typical benchmark value will project the performance of Horizon 2020 during the last year for which full data are available.

This approach is applied consistently across all KIPs and indicators, except for several areas in which data for H2020 are not readily available and/or require sophisticated long-term studies to calculate their values. Notably, this is the case in KIP 9, where the direct leverage effect of EU FPs would need to be calculated using counterfactual and survey data or another

sophisticated research design. To the extent possible, data from macro econometric modelling and studies covering the previous FP7 programme<sup>1</sup> are used to compensate for the shortage of evidence.

In cases such as these, best available estimates are provided as the value for EU FPs' reasonable expected performance. Conceptually, these are not actual benchmark values, but rather reference points that provide useful context.

### **2.1.3. Methodology used to collect data for the baselines and benchmarks**

The baseline study carried out two main strands of work to collect data for HE baselines and benchmarks. The first strand included an extensive review of the literature, including various studies, evaluations and impact assessments on the performance of EU FPs and other national and international researcher funders. Following this review, a target collection of around 30 most relevant studies was identified. The full list is outlined in Section 3 of the report. These studies range from the EC's own monitoring efforts (SRIP reports, H2020 Flash Monitoring Reports, the MORE4 survey), to overarching evaluations and impact assessments of EU FPs (e.g. the Interim Evaluation of H2020 and the supporting studies; the Impact Assessment of Horizon Europe), as well as various studies looking at the performance of national and international research funders (e.g. MoRRI, international comparative performance of the UK Research Base 2019 report and others).

The literature review carried out by the team yielded baseline and benchmark values for a number of indicators. At the same time, in many areas the data were not available, or the indicators needed to be updated using the most recent sets of data. For this reason, the baseline study team carried out seven additional small-scale studies in order to obtain the missing data:

- Pilot 1: a bibliometric analysis of H2020 publications. This pilot tested the methodology for the indicators for KIP 1. Among other activities in this pilot, the study team matched a set of 160,000 H2020 publications against Scopus and extracted data on the total number of publications produced in Europe for each year, starting with 2014.
- Pilot 2: in addition, the baseline study team carried out an analysis of author data reported in H2020 outputs, using Scival API/Scopus data. As the new (Horizon Europe) data architecture takes shape, including an in-house version of the Elsevier Scopus SQL database, it is clear that the 'static' Scival H-Index metrics as first envisaged are obsolete and will be replaced by H-Index metrics calculated from the in-house SQL on a continuous basis, including historical trends, which can be generated using time-stamped and author-specific data already in the in-house SQL.
- Pilot 3: analysis of OA uptake in publications, datasets and software. This analysis was carried out by consortium partner Athena-RIC, which used OpenAIRE's capacities to calculate OA shares and uptake, as well as several novel indicators on open

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<sup>1</sup> i.e. the EAV study, which analysed the leverage effect in FP7.



collaborations. Overall, this pilot contributed to the calculation of baseline and benchmark values for short-, medium- and long-term indicators for KIP 3

- Pilot 4: analysis of the H-Index data of FP authors was carried out using MAG data. For the purposes of the baseline study, PPMI researchers matched over 160,000 H2020 publications to the MAG database. In doing so, they identified a) 97,000 authors of these publications, among whom just over 28,000 were also affiliated with one of the organisations participating in H2020 projects; b) 69,000 authors who were not affiliated with one of the organisations participating in H2020 projects. The first set of authors was used to calculate the benchmark value for H2020, while the second set were used to calculate the baseline value.
- Pilot 5: analysis of patent data; namely, a sample of 2,073 IPR Items reported under H2020. Consortium partner UNU-MERIT cleaned the data, matched it to PATSTAT, and calculated a series of metrics that aim to capture the technological value of patents. Of particular importance is the metric use to measure the number of forward citations received; this data feeds into the estimate for the medium-term indicator for KIP 7. In addition, PPMI inspected the full PATSTAT database to produce data on the total number of patents granted by the European Patent Office (EPO) between 2014 and 2020.
- Pilot 6: a micro-econometric analysis was carried out on KIPs 7 and 8 with a treatment group of some 6,400 FP firms and 7,300 H2020 applicant firms that had never received funding under the programme. PPMI analysed turnover and employment growth as the two key indicators. In addition to testing the methodology for the related indicators, the analysis derived some approximations for the baseline and benchmark values for the two KIPs.
- Pilot 7: a new round of macro-econometric analysis was carried by consortium partner Seureco-Erasme for KIPs 7-9. Compared to the analysis performed for the Interim Evaluation of Horizon 2020 and the Impact Assessment of Horizon Europe, the new analysis assesses the aggregate economic effects, by year, for EU FPs under the Horizon Europe programme. This novel approach provides a more precise way of revealing the full economic effects of FP funding in a given year. In previous assignments, the economic effects of different programmes were modelled in isolation.

Further details of the analyses carried out by the study team are provided in the Operationalisation plan for IT systems, as well as in the Indicator Handbook.

#### **2.1.4. Selected list of baselines and benchmarks**

The table below provides a full list of the baselines and benchmarks selected for analysis in this study. In the proposed definitions, the baselines typically refer to an observed indicator value without FP intervention, while the benchmarks capture the performance of H2020 according to the proposed indicators. Before proceeding to the indicator values in Sections 2.2 to 2.4, it is worth emphasising several points:

- Based on guidance provided by the EC, the goal of the study and this report was to propose one key baseline per indicator and its corresponding benchmark. As a result, even though some KIPs/levels have more than one indicator (e.g. the short-term indicator

for KIP 7, which has IPR outputs and innovative products, processes, or methods from FP), a single baseline indicator was proposed (e.g. IPR outputs for the said KIP 7 indicator).

- For many short-term indicators that are based on the count of specific types of outputs, I proposed baselines will be equal. To give an example, the baseline for the short-term indicator for KIP 1, Publications, is defined as the number of scientific publications produced without FP intervention. The resulting baseline is zero – i.e. there would be no FP publications produced if there were no FP funding. The same applies to KIP 8 (there would be no FTE jobs supported without FP funding), and so on.
- For some indicators it was only possible to calculate partial baseline/benchmark values. The specific cases are:
  - Short-term indicator for KIP 2 (Skills): the main challenge was to obtain a benchmark value, e.g. the number of researchers involved in H2020 projects. This type of data was not directly collected for H2020. An estimate was obtained in a 2017 study on the EAV and the economic impact of EU FPs; however, this was based on survey data. In Horizon Europe, data on the researchers involved will be collected via dedicated tables in the reporting templates. Due to this very different methodology, the estimates reported in this report should be used as approximations and best estimates for the future assessment of Horizon Europe's performance.
  - Long-term indicator for KIP 2 (Working conditions): based on the latest MORE survey data, our team derived the shares of researchers with full-time, permanent contracts. This is one of the core results reported by the MORE survey. However, it was not possible at the time of the baseline study to turn these shares into total numbers/numbers of researchers as the indicator stipulates. The reason for this is that the MORE survey only reported percentage shares, and not the total estimated numbers of researchers. As a result, we have chosen to base this indicator on shares rather than also quoting absolute numbers.
  - Medium-term indicator for KIP 7 (Innovations): this indicator is defined as the number of innovations from FP projects (by type of innovation), including from awarded IPRs. This covers the analysis of granted and validated foreground patent inventions, but also other types of innovation and valorisation. Numerous discussions took place with regard to the inclusion and coverage of other types of innovations in the analysis for this indicator; however, this would involve the use of sophisticated analysis techniques (including web scraping, natural language processing and others), which would be very challenging for the EC to internalise. As a result, a decision was made to focus the analysis for this indicator on patents and to extend the analysis of other types of innovation through future dedicated studies and evaluations of the economic impacts of the EU FPs.
  - Short- and medium-term indicators for KIP 8 require a breakdown of the jobs supported and maintained, by job type. While the total figures are possible to calculate from EC monitoring data (for the short-term indicator) and beneficiary entities (i.e. medium-term), it was not possible to break down the jobs supported/maintained by type. This is because the EC monitoring data and Orbis (the data source used to analyse job creation in beneficiary companies) do not provide data on job types/profiles. This type of data is, however, estimated in the long-term indicator,

where estimates are made of the number of research jobs created as well as all other jobs, classified by skill level (see visualisations for KIP 8).

- Medium-term indicator for KIP 9 (Scaling Up): data on the R&D&I investment attracted are scarce, and only best available estimates could be obtained for the related benchmark value. Specifically, our team reported on the leverage created by EU FPs using data from a 2017 study on the EAV and economic impact of EU FPs. The estimate was derived from survey data using a counterfactual design. The team also explored alternative data sources throughout the study (e.g. Dealroom and Crunchbase data), but its coverage proved too low for this analysis. It should be noted that these two data sources should not be used at all – they are somewhat specialist/niche sources for specific programmes targeting start-ups and scale-ups (e.g. the EIC). Other data sources that were considered include Orbis Zephyr, the premium product from BvD/Moody's; however, the study team did not have access to this very expensive product.

*Table 1. List of baseline and benchmark definitions for indicators for KIPs 1-9*

INDICATOR	BASELINE DEFINITION	BENCHMARK DEFINITION
<b>KIP 1 short-term: Publications</b> Number of peer reviewed scientific publications resulting from the Programme	Number of scientific publications produced without FP intervention	Number of H2020 publications published in peer-reviewed journals and conference proceedings
<b>KIP 1 medium-term: Citations</b> Citation Index of peer-reviewed publications resulting from the Programme.	FWCI score of the EU's publications	FWCI score of H2020 publications
<b>KIP 1 long-term: World-class science:</b> Number and share of peer-reviewed publications resulting from the Projects funded by the programme.that are core contributors to scientific fields	The EU's share of the top 1% of most-cited publications	Share of the top 1% of most-cited publications in H2020-funded research.
<b>KIP 2 short-term: Skills</b> Number of researchers involved in upskilling activities (training, mentoring/coaching, mobility and access to R&I infrastructures) activities in projects funded by the Programme.	Number of researchers upskilled without FP intervention	Number of researchers involved in H2020 projects
<b>KIP 2 medium-term: Careers</b> Number and share of upskilled researchers involved in the Programme with increased individual impact in their R&I field.	Annual increase in the H-index of researchers who are similar to FP researchers	Annual increase of the H-index of H2020 researchers 3 years after the start of their projects
<b>KIP 2 long-term: Working conditions</b> Number and share of upskilled researchers involved in the Programme with improved working conditions, including researchers' salaries.	Share of European researchers on full-time, permanent contracts	Share of FP researchers on full-time, permanent contracts

INDICATOR	BASELINE DEFINITION	BENCHMARK DEFINITION
<p><b>KIP 3 short-term: Shared knowledge</b> Share of research outputs (open data/publication/software etc.) resulting from the Programme that are shared through open knowledge infrastructures.</p>	Share of the EU's publications in OA	Share of H2020 publications in OA
<p><b>KIP 3 medium-term: Knowledge diffusion</b> Share of open access research outputs resulting from the Programme actively used/cited.</p>	Average FWCI score of H2020 non-OA publications	Average FWCI score of H2020 OA publications
<p><b>KIP 3 long-term: New collaborations</b> Share of Programme beneficiaries who have developed new transdisciplinary/ trans-sectoral collaborations with users of their open-access research outputs that have resulted from the Programme.</p>	Collaborative index (CI) of non-OA publications in H2020	Collaborative index (CI) of OA publications in H2020
<p><b>KIP 4 short-term: Results</b> Number and share of results aimed at addressing identified Union policy priorities and global challenges (including SDGs) (multidimensional: for each identified priority). These include the number and share of climate-relevant results aimed at delivering on the Union's commitment under the Paris Agreement.</p>	Top 3 SDGs by share of total publication output for the EU (excluding the UK) in 2015-2020 that potentially contribute to them	<p>Top 3 SDGs by share of H2020 projects that potentially contribute to them</p> <p>Top 3 SDGs by share of H2020 investment that potentially contributes to them</p> <p>Share of H2020 projects that potentially contribute to Union policy priorities</p> <p>Top 3 SDGs by share of UKRI funding in 2011-2020 that potentially contribute to them</p>
<p><b>KIP 4 medium-term: Solutions</b> Number and share of innovations and research outcomes that address identified Union policy priorities and global challenges (including SDGs) (multidimensional: for each identified priority). These include the number and share of climate-relevant innovations and research outcomes that deliver on the Union's commitment under the Paris Agreement.</p>	Top 3 SDGs by share of patent applications for the EU (excluding the UK) in 2015-2020 that potentially contribute to them	Top 3 SDGs by the share of H2020 funded publications that potentially contribute to them
<p><b>KIP 5 short-term: R&amp;I mission outputs</b> Results in specific R&amp;I missions</p>	Relevant baselines defined under other KIPs	Relevant benchmarks defined under other KIPs
<p><b>KIP 5 medium-term: R&amp;I mission outcomes</b> Outcomes in specific R&amp;I missions (multidimensional: for each identified mission).</p>	Relevant baselines defined under other KIPs	Relevant benchmarks defined under other KIPs
<p><b>KIP 6 short-term: Co-creation</b> Number and share of projects funded by the Programme where Union</p>	Number of projects in which Union citizens and end users contribute to the co-creation of	Share of H2020 projects in which Union citizens and end users contribute to the co-creation of R&I content

INDICATOR	BASELINE DEFINITION	BENCHMARK DEFINITION
citizens and end-users contribute to the co-creation of R&I content.	R&I content without Programme intervention	
<b>KIP 6 medium-term: Engagement</b> Number and share of participating legal entities which have citizen and end-user engagement mechanisms in place after the end of projects funded by the Programme.	Share of research-performing organisations in the EU that had mechanisms in place for public engagement	Share of research-performing organisations in the EU that had mechanisms in place for public engagement
<b>KIP 7 short-term: Innovative results</b> Number of innovative products, processes or methods resulting from the Programme (by type of innovation) and intellectual property rights (IPR) applications.	Total number of patent applications without FP intervention	Number of IPR outputs reported by H2020 beneficiaries, including patent applications at peak productivity in H2020 (year analysed: 2018)
<b>KIP 7 medium-term: Innovations</b> Number of innovations resulting from projects funded by the Programme (by type of innovation), including from awarded IPRs.	Number of validated patent families without FP intervention Additional reference data: Average number of forward patent citations of patents in the control group (i.e. patents that are similar to FP-funded patents)	Total number of verified patent families with priority date exceeding project start date (i.e. foreground patents) in H2020  Average number of forward patent citations received by H2020 patents
<b>KIP 7 long-term: Economic growth</b> Creation, growth and market shares of companies having developed innovations in the Programme.	Average growth in annual turnover of companies in the control group (i.e. firms that are similar to FP-funded firms) (compound annual growth rate)	Average growth in annual turnover of H2020 companies (compound annual growth rate)
<b>KIP 8 short-term: Supported employment</b> Number of full time equivalent (FTE) jobs created, and jobs maintained in participating legal entities for the project funded by the Programme (by type of job).	Number of FTE jobs created or maintained without FP intervention	Number of FTE jobs created or maintained in H2020
<b>KIP 8 medium-term: Sustained employment</b> Increase of FTE jobs in participating legal entities following the project funded by the Programme (by type of job).	Average employment growth in companies in the control group (i.e. firms that are similar to FP-funded firms) (compound annual growth rate)	Average annual employment growth in H2020 companies (compound annual growth rate)
<b>KIP 8 long-term: total employment</b> Number of direct & indirect jobs created or maintained due to diffusion of results from the Programme (by type of job).	Total employment effect induced by FP funding under the continuation scenario	Total estimated employment effect induced by H2020 funding
<b>KIP 9 short-term: Co-investment</b> Amount of public and private investment mobilised with the initial investment from the Programme.	Amount of public and private investment mobilised by the beneficiaries without the intervention	Amount of own funds contributed to H2020 projects
<b>KIP 9 medium-term: Scaling up</b> Amount of public and private investment mobilised to exploit or	Amount of public and private investment mobilised to exploit	Estimated amount of funding directly leveraged by H2020 funding

INDICATOR	BASELINE DEFINITION	BENCHMARK DEFINITION
scale up FP results from the Programme (including foreign direct investments).	or scale up FP results without the intervention	
<b>KIP 9 long-term: Contribution to the 3% target</b> Union progress towards 3 % GDP target due to the Programme.	R&D intensity in the EU in 2019 without FP investment	Total estimated leverage effect induced by H2020 funding

## 2.2. BASELINES AND BENCHMARKS FOR KIPs 1-3

### 2.2.1. Overview of proposed baselines for KIPs 1-3

#### *Key Impact Pathway 1:*

This section presents an overview of the proposed baselines for Key Impact Pathways 1-3. The baseline for the **short-term indicator for KIP 1, Publications**, is defined as the number of peer-reviewed scientific publications resulting from the Programme without FP funding, i.e. without the intervention. The baseline value for the KIP 1 short-term indicator can thus be regarded as **zero**, based on a plausible assumption that **no publication output funded by the FP would be produced in the absence of FP**.

In addition to the baseline value, it is useful to look at reference data on the EU's total publication output. Based on the data provided in the 2020 SRIP report, the EU produced 21% of global scientific output in 2018. The EU's share of output has remained largely stable since the early 2000s, although it can be expected that its share will start to decline slightly due to growing productivity levels in other regions of the world, especially China. Hence, when setting targets/expectations, a situation in which Europe's results remained stable over the next few years should be considered a positive achievement. The same logic applies to the medium-term and long-term indicators for KIP 1.

The baseline for the **medium-term indicator for KIP 1, Citations**, is defined as the average field-weighted citation impact (FWCI) score for the EU's publications. Based on the estimates provided by the Internationalisation of EU Research Organisations study (2019), the Study for the ITRE Committee (2017), and the International Comparative Performance of the UK Research Base 2019 report, the overall/baseline FWCI for the EU-27 was **around 1.2, and remained stable** between 2007 and 2017. According to the Internationalisation of EU Research Organisations study (2019), the three best-performing countries were Luxembourg, Denmark, and the Netherlands (each with FWCI scores of 1.9 between 2007-2017). These were followed by Italy, Germany and France, each with a score of 1.4. The FWCI score for the US between 2007 and 2017 was around 1.5.

The baseline for **World-class science** was defined as the EU's share of the top 1% of most-cited publications. This share was equal to 1.2%, and has remained largely stable since 2010.

Overall, a slight downward trend is expected for the FWCI and top 1% indicator values due to the fast-improving performance of China.

### *Key Impact Pathway 2:*

To calculate the baseline value for the **short-term indicator, Skills**, one needs to estimate the number of researchers that would have been upskilled under the programme without intervention. The **baseline value is thus zero**, i.e. no researchers would be upskilled in the programmes if there were no FP funding.

While setting potential targets for the short-term indicator under KIP 2, the EC could consider the following reference data and information. Our study team identified two relevant estimates on the number of researchers supported by FP funding. Both of these are derived from a study carried out for the interim evaluation of Horizon 2020 (namely, the *Assessment of the Union Added Value and the Economic Impact of the EU Framework Programmes*, 2017).

- First, the study estimated that 78,000 full-time research jobs were directly dependent on EU funding, or 4.2% of the EU's research workforce. The same study also estimated that research teams funded by EU FPs grew, on average, 11.8% faster than teams in the control group. Aggregated for the whole programme, this difference amounted to some 53,000 additional research jobs created under FP7. EU FPs contributed 15% of the total increase in research jobs across Europe during the period 2007-2015, through around 10% of the total research funding in the EU. There are, , no equivalent estimates for Horizon 2020 at the micro/team level.
- A second estimate was derived via the NEMESIS model for the interim evaluation of Horizon 2020, which estimated that between 110,000 and 179,000 additional FTEs would be created by 2030, including between 29,000 and 35,000 jobs in research.
- Taking into account several caveats involved in the EAV study, our best estimate is that between 50,000 and 100,000 research jobs depend on FP funding in the EU.

The baseline value estimated for **the medium-term indicator, Careers, is 0.29**. This estimate represents an average annual change in the H-index value of researchers who are similar to FP researchers. It is based on an analysis of author data from 107,000 H2020 publications matched with the MAG database, from which our team identified 97,000 authors who produced 7.2 million publications that received a total of 27 million citations. Just over 69,000 of these authors were not affiliated with organisations participating in FP-funded projects. These authors may be considered similar to FP-funded authors, as they co-authored FP publications with FP-funded authors. The average H-index of these similar authors was calculated to be 6.98 for 2015 (i.e. the first year in which more substantial numbers of H2020 publications were published). This figure increased to 7.43 in 2016, 7.61 in 2017, and 7.86 in 2018. Using these data, the baseline study team deduced that the average annual increase in H-index value during this period was around 0.29.

The **long-term indicator, Working conditions**, looks at the number and share of upskilled FP researchers with improved working conditions. According to the MORE4 survey (2020), **79.8% of European researchers were on permanent contracts, and 91% were on full-time contracts**. The share of researchers on permanent and full-time contracts was some 8 percentage points higher in 2020 compared with 2012.

### Key Impact Pathway 3:

The short-term indicator for **Key Impact Pathway 3, Shared knowledge**, is defined as the share of FP research outputs that are open-access. The baseline indicator is then defined as the **share of the EU’s publications that are OA**. Data provided in the Open Science Monitor and OpenAIRE’s calculations under the baseline study suggest that 42-46% of the EU’s publications were open-access during the period 2017-2019. A slight upward trend has been observed, with the share of publications in OA having been 35-38% at the start of Horizon 2020 period. This upward trend is expected to accelerate in the future, due to major policy initiatives launched by the EC (notably the 3Os, EOSC), as well as numerous community-based initiatives that will provide a further boost to the uptake of OA and Open Science practices.

The **medium-term indicator for KIP 3** looks at the share of open-access FP research outputs that are actively used/cited. As in KIP 1, a field-weighted citation impact (FWCI) indicator is used. The baseline is defined as the **FWCI score of H2020 non-OA publications**.

- In our view, the performance of non-OA H2020 publications constitutes a good basis for calculating the baseline, as the sample of the publications approximates that which would be achieved by the same authors if no OA mandate were included in EU FPs.
- One might ask why the same approach was not used to calculate the baseline for KIP 1. The answer is that the researchers who participated in projects under H2020 are not known. Hence, it is not possible to precisely analyse the performance of their non-FP-funded publications.
- This type of analysis will be possible under Horizon Europe, where the researchers involved in the projects will be identified.

Analysis carried out by OpenAIRE under the baseline study established an average **FWCI score of 2.2 for non-OA H2020 publications published in 2017** (i.e. three years before the time of analysis in the baseline study). Looking ahead, a slight downward trend is expected in the evolution of the FWCI score due to the growing performance of China’s R&I system.

OpenAIRE also calculated baseline data for the **long-term indicator, New collaborations**, which measures the development new transdisciplinary/trans-sectoral/international collaborations. Specifically, OpenAIRE calculated a **Collaborative index (CI) value of 3.8 for non-OA publications in H2020**. Further details of the CI index are provided in the IT operationalisation plan for KIP 3.

*Table 2. List of baseline values for indicators for KIPs 1-3*

INDICATOR FOR HE PROGRAMME	BASELINE DEFINITION	BASELINE VALUE	BASELINE TREND	SOURCE
<b>KIP 1 short-term: Publications</b> Number of peer reviewed scientific publications	Number of scientific publications produced without FP intervention	0	N/A	N/A



INDICATOR FOR HE PROGRAMME	BASELINE DEFINITION	BASELINE VALUE	BASELINE TREND	SOURCE
resulting from the Programme	Reference data: the EU's share of global scientific output	21% in 2018 (239,000 publications produced in the EU-27 in 2018 versus 2.6 million in the world)	So far: stable Expected: stable or slight downward trend	SRIP 2020 report
<b>KIP 1 medium-term: Citations</b> Citation Index of peer-reviewed publications resulting from the Programme.	FWCI score of the EU's publications	1.2 between 2007 and 2017	So far: stable Expected: slight downward trend	Internationalisation of EU Research Organisations study (2019) Study for the ITRE Committee (2017) International Comparative Performance of the UK Research Base 2019 report
<b>KIP 1 long-term: World-class science:</b> Number and share of peer-reviewed publications resulting from the Projects funded by the programme that are core contributors to scientific fields	The EU's share of the top 1% most-cited publications	1.2% between 2007 and 2017	So far: stable Expected: stable or slight downward trend	Internationalisation of EU Research Organisations study (2019)  International Comparative Performance of the UK Research Base 2019 report
<b>KIP 2 short-term: Skills</b> Number of researchers involved in upskilling activities (training, mentoring/coaching, mobility and access to R&I infrastructures) activities in projects funded by the Programme.	Number of upskilled researchers without FP intervention	0	N/A	Calculations under the Baseline study (2021)
	Reference data: number of researchers employed in the EU-27	2.9 million researchers in 2019	So far: upward trend Expected: N/A	Eurostat, R&D personnel data (2019)
	Reference data: share of EU researchers currently employed in another country	13% in 2018	N/A	SRIP 2020 report (2020)
<b>KIP 2 medium-term: Careers</b> Number and share of upskilled researchers involved in the Programme with increased individual impact in their R&I field	Annual increase of the H-index of researchers who are similar to FP researchers	Increase of 0.29/year during the period 2015-2018	So far: N/A (by design, H-index grows over time) Expected: N/A	PPMI calculations under the baseline study (2021)

INDICATOR FOR HE PROGRAMME	BASELINE DEFINITION	BASELINE VALUE	BASELINE TREND	SOURCE
<b>KIP 2 long-term: Working conditions</b> Number and share of upskilled researchers involved in the Programme with improved working conditions, including researchers' salaries.	Share of European researchers on full-time, permanent contracts	79.8% of European researchers on permanent contracts in 2020 91% of European researchers on full-time contracts in 2020	So far: upward trend Expected: N/A	MORE4 survey (2020)
<b>KIP 3 short-term: Shared knowledge</b> Share of research outputs (open data/publication/software etc.) resulting from the Programme that are shared through open knowledge infrastructures.	Share of the EU's publications in OA	42-46% between 2016 and 2018	So far: slight upward trend Expected: accelerated upward trend	Open Science Monitor (2018) OpenAIRE's calculations for the baseline study (2021)
<b>KIP 3 medium-term: Knowledge diffusion</b> Share of open access research outputs resulting from the Programme actively used/cited.	Average FWCI score of H2020 non-OA publications	2.2 for H2020 non-OA outputs published in 2017	So far: N/A Expected: slight downward trend	OpenAIRE's calculations for the baseline study (2021)
<b>KIP 3 long-term: New collaborations</b> Share of Programme beneficiaries who have developed new transdisciplinary/ trans-sectoral collaborations with users of their open-access research outputs that have resulted from the Programme.	Collaborative index (CI) of non-OA publications in H2020	2.0 for H2020 non-OA pubs in 2019	So far: N/A Expected: N/A	OpenAIRE's calculations for the baseline study (2021)

### 2.2.2. Overview of proposed benchmarks for KIPs 1-3

The table below presents an overview of the proposed benchmark indicators for KIPs 1-3, and their estimated values. The overall logic for the benchmark values is that they capture the performance of Horizon 2020 in the last year for which full data are available. This means, for example, that the benchmark value for the medium-term indicator for KIP 1, Citations, is the FWCI score of H2020 publications.

Data for the benchmarks were derived from desk research and literature review, as well as from several pilots carried out under the study. The exact benchmark values and their

sources are provided in the table below. As with baseline values, shortages of data and various methodological caveats meant that certain decisions were made with regard to several of the indicators. These are listed below:

- **KIP 1 short-term, Publications (H2020 publications as a share of the EU's total production, at peak productivity in H2020):** FP investment is top-heavy, while outputs come later and continue to be produced even after a project has ended. The baseline should therefore be calculated by considering data over many years. Thus, for the H2020 period, one would have to consider the 2014-2015 calls, when all/most projects had ended and some time had passed since their end.
- **KIP 2, short-term (Number of researchers involved in H2020 projects):** one major issue with this benchmark is that the researchers involved in H2020 projects were not tracked under the programme. Analysis of researcher data is a major novelty in Horizon Europe. As a result, it was not possible to calculate benchmark data for the short-term indicator for KIP 2. Instead, a best available estimate was used from a study on the Union Added Value and Economic Impact of the EU FPs (2017), which fed into the interim evaluation of Horizon 2020. The study found that in 2015, around 350,000 researchers were working in units funded under the EU FP7 Cooperation theme. Around 78,000 of these full-time research jobs were directly dependent on EU funding. EU research funding contributed to the activities of around 1 in 24 researchers across Europe.
- **KIP 2, medium-term (Annual increase of the H-index of H2020 researchers from the start of the projects):** the estimated value for this benchmark is 0.25. This estimate represents the average annual change in the H-index value of H2020. It is based on the analysis of author data from 107,000 H2020 publications matched with the MAG database, from which the research team identified 97,000 authors who produced 7.2 million publications, that received nearly 27 million citations. Around 28,000 of these authors were affiliated with organisations participating in FP-funded projects. The average H-index of these authors was calculated to be 7.21 in the year when their projects began, increasing in year N+1 to 7.53, followed by 7.76 in year N+2, and 7.97 in year N+3. From this data, our team deduced that the average annual increase in the H-index value was around 0.25 during this three-year period.
- **KIP 2, long-term (Share of FP researchers on full-time, permanent contracts):** our team used data from the latest MORE4 survey to calculate the share of FP researchers on full-time and permanent contracts. We thus established that 87.7% of FP researchers were on permanent contracts, and that 93.7% had full-time contracts. However, while these data should closely approximate the performance of H2020, it is not possible to fully isolate H2020 researchers in the survey data, as no distinction was made in the MORE4 survey questionnaire as to the exact source of funding/programme in H2020 and FP7. As a result, these values should be treated as a best available estimate for the benchmark data.

Table 3. List of benchmark values for KIPs 1-3

INDICATOR	BENCHMARK DEFINITION	VALUE	SOURCE
<b>KIP 1 short-term: Publications</b> Number of peer reviewed scientific publications resulting from the Programme	Number of H2020 publications published in peer-reviewed journals and conference proceedings	101,000	Analysis of Scopus data under the baseline study (2021)
<b>KIP 1 medium-term: Citations</b> Citation Index of peer-reviewed publications resulting from the Programme.	FWCI score of H2020 publications	1.9 for the H2020 publications analysed	Calculations from the baseline study (2021) using Scival data
<b>KIP 1 long-term: World-class science:</b> Number and share of peer-reviewed publications resulting from the Projects funded by the programme.that are core contributors to scientific fields	Share of publications resulting from H2020-funded research that are in the top 1% most-cited publications.	4% of H2020 publications	Calculations from the baseline study (2021) using Scival data.
<b>KIP 2 short-term: Skills</b> Number of researchers involved in upskilling activities (training, mentoring/coaching, mobility and access to R&I infrastructures) activities in projects funded by the Programme.	Number of researchers involved in H2020 projects	Best available estimate: 78,000 researchers, or roughly 4.2% of the research workforce	<i>Assessment of the Union Added Value and the Economic Impact of the EU Framework Programmes (2018)</i>
<b>KIP 2 medium-term: Careers</b> Number and share of upskilled researchers involved in the Programme with increased individual impact in their R&I field.	Annual increase in the H-index of H2020 researchers	H-index increase of 0.29/year since the start of the projects	PPMI calculations for the baseline study (2021)
<b>KIP 2 long-term: Working conditions</b> Number and share of upskilled researchers involved in the Programme with improved working conditions, including researchers' salaries.	Share of FP researchers on full-time, permanent contracts	87.7% of FP researchers on permanent contracts in 2020  93.7% of FP researchers on full-time contracts in 2020	MORE4 survey (2020)
<b>KIP 3 short-term: Shared knowledge</b> Share of research outputs (open data/publication/software etc.) resulting from the Programme that are shared through open knowledge infrastructures.	Share of H2020 publications in OA	84% for H2020 publications (all years analysed)	OpenAIRE's calculations for the baseline study (2021)
<b>KIP 3 medium-term: Knowledge diffusion</b>	Average FWCI score of H2020 OA publications	3.3 for publications published in 2017	OpenAIRE's calculations for the

INDICATOR	BENCHMARK DEFINITION	VALUE	SOURCE
Share of open access research outputs resulting from the Programme actively used/cited.			baseline study (2021)
<b>KIP 3 long-term: New collaborations</b> Share of Programme beneficiaries who have developed new transdisciplinary/ trans-sectoral collaborations with users of their open-access research outputs that have resulted from the Programme.	Collaborative index (CI) of OA publications in H2020	3.8 for H2020 publications in 2019	OpenAIRE's calculations for the baseline study (2021)

## 2.3. BASELINES AND BENCHMARKS FOR KIPs 4-6

### 2.3.1. Overview of proposed baselines for KIPs 4-6

Relevant data for Key Impact Pathways 4-6 and their related indicators have not yet been measured in a systematic manner by any major international or national research and innovation funder. Hence, possibilities for establishing relevant baselines remain limited. For some indicators the baseline value is 0, indicating that Horizon Europe is embarking on a new type of R&I funding (such as funding EU missions or mainstreaming citizen and end-user engagement), for which no counterfactual situation exists.

Importantly, this document focuses on indicators for the programme as a whole. The proxies for KIP 4 proposed below may not be well suited to gauging the potential impact of R&I under selected pillars or components of the programme, and further effort would be required to define more appropriate indicators for such areas. In addition, while KPI 4 focuses on contributions to Union policy priorities, no valid baselines can be established for the current Union policy priorities. Despite this, in the next chapter on benchmarks, this document suggests a way to tentatively estimate an internal benchmark, based on the provided mapping of SDGs to Union policy priorities.

The closest proxy for a **KIP 4 short-term** indicator comes from the report *Contextualizing Sustainable Development Research* by Digital Science, May 2020 (<https://doi.org/10.6084/m9.figshare.12200081>). This report provides estimates of each country's total publication output in 2015-2020 by SDG. The excerpt from the report included below indicates wide variation with regard to which SDGs are the focus of research focuses, both globally but also among EU Member States. While the report does not provide precise numbers or shares, the graph indicates that among the EU Member States (excluding the UK) between 2015 and 2020, the top 3 SDGs (by share of total publication output that potentially contributes to them) were SDG 15 (around 20%), SDG 13 (around 18%) and SDG 12 (around 16%).

The baseline for **KIP 4's medium-term** indicator would require a similar attribution of SDGs to particular scientific results (such as patent applications or patents granted) or innovations; however, such estimates are not yet available, either globally or for the EU. The suggested baseline would be the top 3 SDGs by share of patent applications for the EU (excluding UK) in 2015-2020.

EU R&I missions come with a new framework for impact; therefore, no baselines are available globally or for the EU. At the same time, EU missions are well defined and self-standing parts of the Horizon Europe programme (as opposed to the Focus Areas under H2020), hence they would benefit from the baselines defined under other KIPs. The outputs (under **KIP 5 short-term**) and results (under **KIP 5 medium-term**) of specific EU missions could be gauged against the general baseline situation for the whole programme. In addition, the baseline value of KIP 5 short-term indicators could be considered to be 0 (zero), as this type of funding did not previously exist in the EU.

Figure 1. Distribution of research outputs by SDG within countries



A direct proxy can be identified for **KIP 6 short-term** indicator: while citizen science and the contributions and engagements of citizens and end users are areas of growing interest more generally among R&I funders, quantitative estimates in terms of citizens and end users contributing to the co-creation of R&I content are not yet available. A relevant baseline would be an estimate of the number of EU citizens who are involved in the co-creation of R&I content.

The closest proxy for the **KIP 6 medium-term** baseline comes from MoRRI estimations – namely, indicator PE5: Public engagement performance mechanisms at the level of research institutions. Its values are based on surveys of higher education institutions and public research organisations across EU Member States in the period 2014-2016. These data provide an estimate of the share of research-performing organisations in the EU that had mechanisms in place for public engagement. The estimated share increasing between 2014 and 2016 from 67% to 72% (*The evolution of Responsible Research and Innovation in Europe: The MoRRI indicators report*, p. 53).

*Table 4. List of baseline values for indicators for KIPs 4-6*

INDICATOR	BASELINE DEFINITION	VALUE	TREND	SOURCE
<b>KIP 4 short-term: Results</b> Number and share of results aimed at addressing identified Union policy priorities and global challenges (including SDGs) (multidimensional: for each identified priority). These include the number and share of climate-relevant results aimed at delivering on the Union's commitment under the Paris Agreement.	Top 3 SDGs by <b>share of total publication output for the EU (excl. UK) in 2015-2020</b> that potentially contribute to them	SDG15 (ca. 20%); SDG 13 (ca. 18%); and SDG 12 (ca. 16%)	N/A	Contextualizing Sustainable Development Research report (2020)
<b>KIP 4 medium-term: Solutions</b> Number and share of innovations and research outcomes that address identified Union policy priorities and global challenges (including SDGs) (multidimensional: for each identified priority). These include the number and share of climate-relevant innovations and research outcomes that deliver on the Union's commitment under the Paris Agreement.	Top 3 SDGs by <b>share of patent applications for the EU (excluding the UK) in 2015-2020</b> that potentially contribute to them	N/A	N/A	Does not exist yet, to be defined
<b>KIP 5 short-term: R&amp;I mission outputs</b> Results in specific R&I missions	Relevant baselines defined under other KIPs	Zero / as per relevant baseline	-	As per relevant baseline
<b>KIP 5 medium-term: R&amp;I mission outcomes</b> Outcomes in specific R&I missions (multidimensional: for each identified mission).	Relevant baselines defined under other KIPs	As per relevant baseline	-	As per relevant baseline

INDICATOR	BASELINE DEFINITION	VALUE	TREND	SOURCE
<b>KIP 6 short-term: Co-creation</b> Number and share of projects funded by the Programme where Union citizens and end-users contribute to the co-creation of R&I content.	Number of projects in which Union citizens and end-users contribute to the co-creation of R&I content without programme intervention	Zero	N/A	N/A
<b>KIP 6 medium-term: Engagement</b> Number and share of participating legal entities which have citizen and end-user engagement mechanisms in place after the end of projects funded by the Programme.	Share of research-performing organisations in the EU that had mechanisms in place for public engagement	72% (in 2016)	Increasing	MoRRI estimations based on HEI, PRO surveys

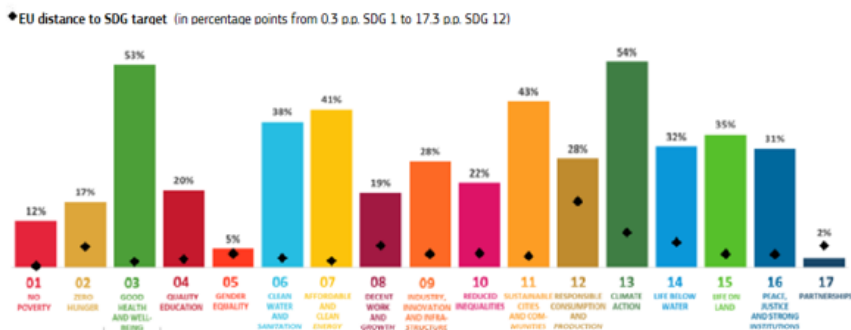
### 2.3.2. Overview of proposed benchmarks for KIPs 4-6

Opportunities for internal benchmarking remain limited, as data for the Key Impact Pathways 4 and 6 and related indicators have not been systemically collected for the Horizon 2020 programme. However, several proxy indicators and estimates could serve as a useful points for comparison.

The closest proxies for the **KIP 4 short-term** indicator are the estimated shares of H2020 projects and H2020 investment that potentially contribute to SDGs. These are estimates based on internal EC calculations (see the *Keeping our eyes on the Horizon* report, 2020). The cut-off date for these data is 1 July 2019; so the baseline values provided in the table below reflect the situation at that date, and may potentially be updated in the future as implementation of the programme progresses. The benchmark focuses on the three top SDGs, but estimates and data are available for all SDGs. Importantly, on average, a H2020 project is estimated to contribute to three SDGs (3.2, to be precise), therefore the indicated shares (of H2020 projects and H2020 investment) do not add up to 100%.

Interestingly, the report also maps the share of potential H2020 investment by SDG to EU distance to achieving a given SDG target (a black dot in the graph below):

Figure 2. Share of potential H2020 investment by SDG





As the KIP 4 short-term indicator focuses on the number and share of outputs aimed at addressing specific EU policy priorities, some proxy estimates may be derived on the basis of the data mentioned above. The factsheet *Delivering on the UN's Sustainable Development Goals*

([https://ec.europa.eu/info/sites/default/files/delivering\\_on\\_uns\\_sustainable\\_development\\_goals\\_factsheet\\_en.pdf](https://ec.europa.eu/info/sites/default/files/delivering_on_uns_sustainable_development_goals_factsheet_en.pdf)) lists the SDGs that are strongly associated each specific Commission political priority, while noting that most SDGs contribute, to varying degrees, to a number of different priorities:



Based on the estimated shares of H2020 projects and H2020 investment that potentially contribute to SDGs (*Keeping our eyes on the Horizon* report, 2020), the tentative estimated shares of H2020 projects that potentially contribute to Commission priorities are calculated as follows:

- A European Green Deal (EGD): 84%
- An economy that works for people (People): 35%
- A Europe fit for the digital age (Digital): 10%
- Promoting our European way of life (WoL): 30%
- A new push for European Democracy (ED): 11%

These estimates assume that each H2020 project contributes to an average of slightly more than three SDGs. This baseline is preliminary, and should be revised once more reliable data become available.

In terms of external benchmarking, the only proxy to benchmark the KIP 4 short-term indicator consists of recent estimates of the share of UK Research and Innovation funding (UKRI) from 2011 to 2020, by SDG (*How is UK Funding Allocated to Support Sustainability Research?* by Digital Science, May 2021; <https://www.digital-science.com/blog/2021/05/ukri-sustainability-funding>). This source provides estimates regarding how UKRI sustainability research funding (in GBP) was distributed across the 17 SDGs between 2011 and 2020. This allows the top 3 SDGs to be identified.

The **KIP 4 medium-term** indicator aims to measure innovations and scientific results that address specific EU policy priorities, including meeting the SDGs. The closest proxy would be the working estimates of the share of H2020 publications by SDG that have been developed as part of this project. These estimates were made on the basis of a sample of 11,500 H2020-funded publications. To ensure focus, the baseline provides values for the three top SDGs, but estimates and data are available for all SDGs. Importantly, because H2020 publications usually contribute to several SDGs, the shares indicated do not add up to 100%.

For the reasons explained above, when discussing baselines, there are no specific benchmarks for the outputs (under **KIP 5 short-term**) and results (under **KIP 5 medium-term**) to be produced under specific EU missions; however, their monitoring would still benefit from the benchmarks defined under other KIPs.

No direct proxies are available for **KIP 6 short-term** or **medium-term** internal benchmarks, as the engagement of citizens and citizen science under H2020 was mainly funded through a limited intervention under the ‘Science with and for Society’ part of Horizon 2020. The total number of citizen science and citizen engagement projects in Horizon 2020 (as of 15/07/2020) was 29. Due to the limited size of investment, there are no meaningful internal benchmarks for the KIP 6 short medium-term indicator. Qualitative insights can be derived from an analysis of the situation of the beneficiaries of the 29 H2020 projects mentioned in the report (European Commission, *Citizen Science and Citizen Engagement - Achievements in Horizon 2020 and recommendations on the way forward, 2020*; [https://ec.europa.eu/info/sites/default/files/research\\_and\\_innovation/research\\_by\\_area/documents/ec\\_rtd\\_swafs\\_report-citizen\\_science.pdf](https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/ec_rtd_swafs_report-citizen_science.pdf)). On the basis of the aforementioned baseline, one can also arrive at a benchmark of around 72% research-performing organisations in the EU having public engagement mechanisms in 2016.

*Table 5. List of benchmark values for KIPs 4-6*

INDICATOR	BENCHMARK DEFINITION	VALUE	TREND	SOURCE
<b>KIP 4 short-term: Results</b> Number and share of results aimed at addressing identified	Top 3 SDGs by <b>share of H2020 projects</b> that potentially contribute to them	SDG3 (45%), SDG11 (26%) and SDG7 (26%)	N/A	<i>Keeping our eyes on the Horizon report (2020)</i>

INDICATOR	BENCHMARK DEFINITION	VALUE	TREND	SOURCE
Union policy priorities and global challenges (including SDGs) (multidimensional: for each identified priority).	Top 3 SDGs by <b>share of H2020 investment</b> that potentially contribute to them	SDG13 (54%), SDG3 (53%), SDG11 (43%)	N/A	<i>Keeping our eyes on the Horizon</i> report (2020)
	<b>Share of H2020 projects</b> that potentially contribute to Union policy priorities	EGD 84%, People 35%, Digital 10%, WoL 30%, ED 11%		Internal estimates based on <i>Keeping our eyes on the Horizon</i> report (2020)
	Top 3 SDGs by <b>share of UKRI funding in 2011-2020</b> that potentially contribute to them	SDG7, SDG13, SDG3	N/A	Digital Science estimates, May 2021
<b>KIP 4 medium-term: Solutions</b> Number and share of innovations and research outcomes that address identified Union policy priorities and global challenges (including SDGs) (multidimensional: for each identified priority).	Top 3 SDGs by the <b>share of H2020-funded publications</b> that potentially contribute to them	SDG9 (26%), SDG3 (21%), SDG11 (7%)	N/A	Sample of 11,500 H2020 publications, OSDG.ai
<b>KIP 5 short-term: R&amp;I mission outputs</b> Results in specific R&I missions	Relevant benchmarks defined under other KIPs	As per relevant benchmark	-	As per relevant benchmark
<b>KIP 5 medium-term: R&amp;I mission outcomes</b> Outcomes in specific R&I missions (multidimensional: for each identified mission).	Relevant benchmarks defined under other KIPs	As per relevant benchmark	-	As per relevant benchmark

INDICATOR	BENCHMARK DEFINITION	VALUE	TREND	SOURCE
<b>KIP 6 short-term: Co-creation</b> Number and share of projects funded by the Programme where Union citizens and end-users contribute to the co-creation of R&I content.	Share of H2020 projects in which Union citizens and end users contribute to the co-creation of R&I content	No benchmark value is available for H2020; best available estimate – ca. 11% of H2020 projects declared the involvement of stakeholders	N/A	EC monitoring data (as of 15/07/2020)
<b>KIP 6 medium-term: Engagement</b> Number and share of participating legal entities which have citizen and end-user engagement mechanisms in place after the end of projects funded by the Programme.	Share of <b>research-performing organisations in the EU that had public engagement mechanisms in place</b>	72% (in 2016)	Increasing	MoRRI estimates based on HEI, PRO surveys

## 2.4. BASELINES AND BENCHMARKS FOR KIPs 7-9

### 2.4.1. Overview of proposed baselines for KIPs 7-9

#### *Key Impact Pathway 7*

This section presents an overview of the proposed baselines for Key Impact Pathways 7-9. The baseline for the **short-term indicator for KIP 7, Innovative results**, is defined as the **total number of FP-funded patent applications without FP intervention**. The baseline value is thus zero – there would be no FP patent applications without FP funding.

Analysis of reference data from PATSTAT (May 2020 release) suggests that 151,000 patents were granted by the EPO with a priority date in 2016. The overall trend in patenting activity was upward, with the total number of patents granted having grown from 126,000 in 2004, and 130,000 patents in 2010. Given these numbers, FP funding is expected to contribute less than 0.1% of the total patenting activity each year. As a result, when setting targets for Horizon Europe, the EC should take this fact into consideration – i.e. EU FP funding should not be expected to contribute significantly to observed changes in the baseline value.

The baseline for the **medium-term indicator for KIP 7, Innovations**, is defined as **the number FP-funded, validated patent families without FP intervention**. The value is zero – since without FP funding there would be no patents produced, and thus there would also be no validated patents. As additional reference data, this indicator also looks at the average

number of forward patent citations received by patents in the control group, i.e. patents that are similar to FP-funded patents. A patent analysis carried out in the baseline study estimated that an average patent in the control group received 1.1 forward citations.

- It should be noted that this estimate is preliminary, as the analysis carried out in the baseline study was based on a sample of H2020 patents, and the time window for analysis was at most three years for patents in the control group.
- If the EC were to perform an equivalent analysis on HE patents, the analysis would need to be carried out in 2027, i.e. about six years after the start of the programme, as was the case with the analysis carried out in the baseline study.

The baseline for the **long-term indicator, Economic growth**, was defined as the **average growth in annual turnover of companies in the control group**, i.e. non-funded firms that applied for FP funding in the same calls as the funded firms, but never received FP funding. Following analysis of company data in the baseline study, our team estimates the average growth in annual turnover to be around 1.8% for the non-funded companies analysed.

### *Key Impact Pathway 8*

The **short-term indicator for KIP 8, Supported employment**, measures the number of FTE jobs created and jobs maintained in beneficiary entities of FP projects. The indicator baseline is thus defined as the **number of FP-funded researchers employed in the EU-27 without FP intervention**. The **baseline value is thus zero** – there would be no FTEs supported by EU FPs without the intervention.

According to Eurostat data, there were 2.9 million R&D personnel employed<sup>2</sup> in the EU-27 in 2019. No exact figures are available on the number of researchers supported by the EU FPs; however, our best estimate is that between 50,000 and 100,000 research jobs were directly dependent on FP funding (see Section 2.2.1 for more details). The EC should consider this information when setting potential targets for the short-term indicator for KIP-8. At the same time, the value observed in this indicator will depend entirely on the amounts allocated to personnel costs in FP projects, and the amounts or person-months designated to fulfil the tasks.

The baseline for the medium-term indicator, **Sustained employment**, is defined as the **average growth in annual turnover of companies in the control group**, i.e. non-funded firms that applied for the same grants/under the same calls as FP firms and did not receive FP funding. An average annual **employment growth of 1.8%** was estimated for this group in the baseline study.

The **long-term indicator for KIP 8, Total employment**, measures total/long-term employment induced by EU FP funding. Its baseline was defined in the Impact assessment of Horizon Europe (2018), in which the Continuation scenario was used to estimate the total employment effect induced by FP funding. The study estimated that, under the Continuation scenario, up to 100,000 jobs are expected to be directly created in R&I activities by 2027.

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<sup>2</sup> As per the Eurostat definition, R&D personnel include all persons employed directly in R&D, plus persons supplying direct services to R&D, such as managers, administrative staff and office staff.

Indirectly, more than **200,000 additional jobs will be created by around 2035, including 80,000 high-skilled jobs.**

### Key Impact Pathway 9

The **baseline for the short-term indicator for KIP 9, Co-investment**, is defined as the total amount of co-investment mobilised without FP intervention. The **baseline value is thus zero** – there would be no co-investment by the beneficiaries without FP intervention.

According to Eurostat data, around EUR 306 billion were spent on R&D in the EU-27 in 2019<sup>3</sup>. The business enterprise sector spent 66% of this amount, followed by the higher education sector (22%), the government sector (11%), and the private non-profit sector (1%). The data provided in the Horizon Dashboard suggest that the total cost of H2020 projects (i.e. the EC’s contribution and participants’ own funds) that were funded in calls with a deadline in 2019 was EUR 14.1 billion, or around 17.5% of the total budget. The EC could consider this ratio as a useful reference data point when setting potential targets for this indicator.

The suggested **baseline for the medium-term indicator, Scaling up**, is the same as that for the short-term indicator, and refers to the amount of public and private investment mobilised to exploit or scale up FP results without the intervention. Similarly, the baseline value is zero – that is, no additional public and private investment to scale up results would be mobilised if there were no intervention (hence, no FP results).

The **long term-indicator for KIP 9, Contribution to the 3% target**, measures EU progress towards the 3% GDP target due to FP. The baseline is thus defined as R&D intensity in the EU in 2019 without FP investment. According to Eurostat, the EU’s R&D intensity was 2.19% of GDP in 2019. Excluding FP investment (i.e. EUR 14.1 billion in 2019), this share would have been **2.09% of the EU’s GDP**.

*Table 6. List of baseline values for KIPs 7-9*

INDICATOR	BASELINE DEFINITION	VALUE	TREND	SOURCE
<b>KIP 7 short-term: Innovative results</b> Number of innovative products, processes or methods resulting from the Programme (by type of innovation) and intellectual property rights (IPR) applications.	Total number of patent applications without FP intervention	Zero	So far: N/A  Expected: N/A	Calculations for the baseline study (2021)
<b>KIP 7 medium-term: Innovations</b>	Number of FP-funded validated patent	Zero patents	So far: N/A	UNU-MERIT calculations under the

<sup>3</sup> For data sources, see the following Eurostat article: <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20201127-1>

INDICATOR	BASELINE DEFINITION	VALUE	TREND	SOURCE
Number of innovations resulting from projects funded by the Programme (by type of innovation), including from awarded IPRs.	families without FP intervention  Additional reference data: average number of forward citations of patents in the control group (i.e. patents that are similar to FP-funded patents)	1.1 forward citations/patents for the patents analysed in the control group	Expected: N/A	baseline study (2021)
<b>KIP 7 long-term: Economic growth</b> Creation, growth and market shares of companies having developed innovations in the Programme.)	Average annual growth in turnover of companies in the control group (i.e. firms that are similar to FP-funded firms) (compound annual growth rate)	1.8% between 2012 and 2018	So far: N/A  Expected: N/A	PPMI calculations under the baseline study (2021)  SME participation in Horizon 2020 study (2020)
<b>KIP 8 short-term: Supported employment</b> Number of full time equivalent (FTE) jobs created, and jobs maintained in participating legal entities for the project funded by the Programme (by type of job).	Number of FTE jobs created or maintained without FP intervention	Zero	So far: N/A  Expected: N/A	Eurostat, R&D personnel data (2019)
<b>KIP 8 medium-term: Sustained employment</b> Increase of FTE jobs in participating legal entities following the project funded by the Programme (by type of job).	Average employment growth in companies in the control group (i.e. firms that are similar to FP-funded firms) (compound annual growth rate)	1.8% between 2012 and 2018	N/A	PPMI calculations under the baseline study
<b>KIP 8 long-term: total employment</b> Number of direct & indirect jobs created or maintained due to diffusion of results from the Programme (by type of job).	Total employment effect induced by FP funding under the continuation scenario	200,000 additional jobs created by 2035, of which 80,000 are in research	So far: N/A  Expected: N/A	Impact assessment of Horizon Europe (2018)
<b>KIP 9 short-term: Co-investment</b> Amount of public and private investment	Amount of public and private investment mobilised by the	Zero	So far: N/A  Expected: N/A	PPMI calculations under the

INDICATOR	BASELINE DEFINITION	VALUE	TREND	SOURCE
mobilised with the initial investment from the Programme.	beneficiaries without the intervention			baseline study (2021)
<b>KIP 9 medium-term: Scaling up</b> Amount of public and private investment mobilised to exploit or scale up FP results from the Programme (including foreign direct investments).	Amount of public and private investment mobilised to exploit or scale up FP results without the intervention	Zero	So far: N/A  Expected: N/A	PPMI calculations under the baseline study (2021)
<b>KIP 9 long-term: Contribution to the 3% target</b> Union progress towards 3 % GDP target due to the Programme.	R&D intensity in the EU in 2019 without FP investment	2.09% of GDP in 2019	So far: N/A  Expected: N/A	Eurostat  Horizon Dashboard

## 2.4.2. Overview of proposed benchmarks for KIPs 7-9

The table below presents an overview of the proposed benchmark indicators and their estimated values for Key Impact Pathways 7-9. As is the case with the other KIPs, the overall logic is that the benchmark values capture the performance of Horizon 2020 in the last year for which full data are available.

Data for the benchmarks have been derived from desk research and literature review, as well as from several pilots carried out under the study, notably patent analysis, a micro-econometric analysis of company data, and macro-econometric modelling.

- **KIP 7 medium-term, Innovations:** the baseline study team analysed 2,073 IPR outputs reported by H2020 projects, following which the team: a) selected patents; b) matched these to PATSTAT and identified distinct patent families; and c) checked if patent families had a priority date that exceeded the start date of the projects. Following this analysis, 279 validated patent families were identified.
- An additional analysis was carried with these 279 patent families. Based on an analysis of patent data carried out in the baseline study, H2020 patents received, on average, 1.5 citations. It is important to mention that this analysis was carried out using a sample of H2020 patents that were filed during or before 2016 (i.e. during the first three years of the programme), and that analysis was carried out in early 2021 (i.e. roughly six years after the start of H2020). If this analysis were to be repeated for HE patents, similar timeframes should be used for the analysis to obtain comparable estimates.
- **KIP 7 Long-term, Economic growth; and KIP 8 medium-term, Sustained employment:** these two benchmark indicators provide estimates of the average annual growth of H2020 firms in terms of turnover and employment, respectively. These estimates range between 2% and 5%. A key issue affecting the accuracy of these estimates relates to interrupted time series data for many H2020 companies in the Orbis



database (a total of nearly 5,300 H2020 companies were analysed; see the IT operationalisation plan for more detail). With regard to employment, coverage rose from nearly 40% of firms in 2012 to 67-70% in the period 2017-2018. Coverage of turnover figures varied between 42% and 49%. As a result, these estimates should be interpreted with caution.

- **KIP 9 short term, Co-investment:** based on analysis of Cordis data (accessed 18 August 2021), the total project cost was 80.5 billion euros, of which the EC contributed 66.5 billion euros. Beneficiaries own funds totalled 14 billion euros, which represents a 17.5% share of the total budget of Horizon 2020 projects.
- **KIP 9 medium-term, Scaling up:** this was another indicator for which it proved challenging to obtain a benchmark value, due to data gaps. The EIC started reporting data on the private follow-up investment attracted by EIC Accelerator portfolio companies; however, equivalent Investment was not tracked in other H2020 programmes. As a reference data point, one can also use an estimate derived from the study *Assessment of the Union Added Value and the Economic Impact of the EU Framework Programmes* (2018), which found that an additional EUR 4.2 billion was leveraged by EU FP-funded teams. However, these two estimates of Investment attracted/mobilised are not directly comparable and should not be aggregated.

*Table 7. List of benchmark values for KIPs 7-9*

INDICATOR	BENCHMARK DEFINITION	VALUE	SOURCE
<b>KIP 7 short-term: Innovative results</b> Number of innovative products, processes or methods resulting from the Programme (by type of innovation) and intellectual property rights (IPR) applications.	Number of IPR outputs reported by H2020 beneficiaries, including patent applications at peak productivity in H2020 (year analysed: 2018)	609 IPR outputs (including 524 patent applications) in 2018	Horizon Dashboard (2021; site visited in September 2021)  UNU-MERIT calculations under the baseline study (2021)
<b>KIP 7 medium-term: Innovations</b> Number of innovations resulting from projects funded by the Programme (by type of innovation), including from awarded IPRs.	Total number of verified patent families with priority date exceeding project start date (i.e. foreground patents) in H2020  Average number of forward patent citations received by H2020 patents	279 verified patent families in H2020  Best available estimate: 1.5 forward citations per H2020 patent	UNU-MERIT calculations under the baseline study (2021)
<b>KIP 7 long-term: Economic growth</b> Creation, growth and market shares of companies having developed innovations in the Programme.	Average annual growth in turnover of H2020 companies (compound annual growth rate)	1.6% growth between 2014-2018	PPMI calculations under the baseline study (2021)  SME participation in Horizon 2020 study (2020)
<b>KIP 8 short-term: Supported employment</b> Number of full time equivalent (FTE) jobs created, and jobs	Number of FTE jobs created or maintained in H2020	234,796 jobs supported in H2020 projects by August 2021	PPMI calculations under the baseline study (2021)

INDICATOR	BENCHMARK DEFINITION	VALUE	SOURCE
maintained in participating legal entities for the project funded by the Programme (by type of job).			
<b>KIP 8 medium-term: Sustained employment</b> Increase of FTE jobs in participating legal entities following the project funded by the Programme (by type of job).	Average annual employment growth of H2020 companies (compound annual growth rate)	2% growth between 2014 and 2018	PPMI calculations under the baseline study (2021)
<b>KIP 8 long-term: total employment</b> Number of direct & indirect jobs created or maintained due to diffusion of results from the Programme (by type of job).	Total estimated employment effect induced by H2020 funding	137,000 jobs by 2030, of which 48,000 jobs are in research	Interim evaluation of Horizon 2020 (2018)  Impact Assessment of Horizon Europe (2018)
<b>KIP 9 short-term: Co-investment</b> Amount of public and private investment mobilised with the initial investment from the Programme.	Amount of participants' own funds contributed to H2020 projects	EUR 15.3 billion for H2020 projects signed between 2014 and 2020	Horizon Dashboard (accessed in September 2021)
<b>KIP 9 medium-term: Scaling up</b> Amount of public and private investment mobilised to exploit or scale up FP results from the Programme (including foreign direct investments).	Estimated amount of funding directly leveraged by H2020 funding	<u>Best available estimate:</u> an additional EUR 4.2 billion leveraged by EU FP-funded research teams  EUR 5.3 billion of total private follow-up investment attracted by EIC Accelerator portfolio companies	<i>Assessment of the Union Added Value and the Economic Impact of the EU Framework Programmes</i> (2018)  Deep Tech Europe EIC Impact Report (2020)
<b>KIP 9 long-term: Contribution to the 3% target</b> Union progress towards 3 % GDP target due to the Programme.	Total estimated leverage effect induced by H2020 funding	Estimated amount of additional leverage (direct and indirect) attracted to R&D (sum from 2014 to 2030): EUR <u>19.4 billion</u>  Estimated amount of additional leverage (direct and indirect) attracted to R&D per each euro spent in FP: EUR <u>0.28</u>	Interim evaluation of Horizon 2020 (2017)  Seureco's calculations under the baseline study (2021)

### 3. LIST OF DATA SOURCES USED

Table 8. List of key data sources used

SOURCE NUMBER	RELEVANT KIPS	URL LINK (IF PUBLISHED)
0. Horizon 2020 Monitoring Flash	Various KIPs	<a href="https://ec.europa.eu/info/publications/horizon-2020-monitoring-flash_en">https://ec.europa.eu/info/publications/horizon-2020-monitoring-flash_en</a>
1. Interim evaluation of H2020 (key documents)	Various KIPs	<a href="https://ec.europa.eu/info/publications/interim-evaluation-horizon-2020_en">https://ec.europa.eu/info/publications/interim-evaluation-horizon-2020_en</a>
2. Horizon Europe impact assessment – Staff Working Document	Various KIPs	<a href="https://ec.europa.eu/info/publications/horizon-europe-impact-assessment-staff-working-document_en">https://ec.europa.eu/info/publications/horizon-europe-impact-assessment-staff-working-document_en</a>
3. <i>Assessment of the Union Added Value and the Economic Impact of the EU Framework Programmes</i>	Various KIPs	<a href="https://op.europa.eu/en/publication-detail/-/publication/af103c38-250d-11e9-8d04-01aa75ed71a1/language-en">https://op.europa.eu/en/publication-detail/-/publication/af103c38-250d-11e9-8d04-01aa75ed71a1/language-en</a>
4. Provision and analysis of key indicators in research and innovation study	Various KIPs	Data feeding into the Innovation Union Scoreboard
5. Horizon Dashboard	KIPs 1, 3, 7	<a href="https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-dashboard">https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-dashboard</a>
6. Open Science Monitor	KIPs 1, 3	<a href="https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor_en">https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor_en</a>
7. OpenAIRE Monitor	KIPs 1, 3	<a href="https://beta.monitor.openaire.eu/dashboard/ec/input">https://beta.monitor.openaire.eu/dashboard/ec/input</a>
8. Analysis of publications and patents of ICT research in FP7	KIPs 1, 7	<a href="https://op.europa.eu/en/publication-detail/-/publication/2f800262-ea80-11e5-a2a7-01aa75ed71a1/language-en">https://op.europa.eu/en/publication-detail/-/publication/2f800262-ea80-11e5-a2a7-01aa75ed71a1/language-en</a>
9. Dynamic network analysis of the EU R&I Framework Programme	KIPs 1, 3	<a href="https://op.europa.eu/en/publication-detail/-/publication/0323a3e3-fdc2-11e8-a96d-01aa75ed71a1/language-en/format-PDF/source-82692556">https://op.europa.eu/en/publication-detail/-/publication/0323a3e3-fdc2-11e8-a96d-01aa75ed71a1/language-en/format-PDF/source-82692556</a>
10. Studies on OA/OS update	KIP 3	Results of the study on open access to publications and research data management and sharing within ERC projects are only partially available at: <a href="https://zenodo.org/communities/erc-study-on-oa-and-rdm/?page=1&amp;size=20">https://zenodo.org/communities/erc-study-on-oa-and-rdm/?page=1&amp;size=20</a>  'Do authors comply when funders enforce open access to research?' Article in <i>Nature</i> . <a href="https://www.nature.com/articles/d41586-018-07101-w">https://www.nature.com/articles/d41586-018-07101-w</a> <a href="https://www.more-4.eu/">https://www.more-4.eu/</a>
11. MORE3/MORE4 studies	KIP 2	<a href="https://www.more-4.eu/">https://www.more-4.eu/</a>
12. FP7 Human research capacity study	KIP 2	<a href="https://www.evropskyvyzkum.cz/files/fp-hrc-study-final-report.pdf">https://www.evropskyvyzkum.cz/files/fp-hrc-study-final-report.pdf</a>
13. Study on Career Impacts of ERC funding	KIP 2	Final results are not public: <a href="https://research.utwente.nl/en/publications/revised-inception-report-study-on-career-impacts-of-erc-funding">https://research.utwente.nl/en/publications/revised-inception-report-study-on-career-impacts-of-erc-funding</a>
14. SDG-related data sources	KIP 4	Keeping our eyes on the Horizon report: <a href="https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/f164fa95-fed4-11ea-b44f-01aa75ed71a1">https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/f164fa95-fed4-11ea-b44f-01aa75ed71a1</a>

SOURCE NUMBER	RELEVANT KIPS	URL LINK (IF PUBLISHED)
		Data from the Aurora project: <a href="https://aurora-network.global/project/sdg-analysis-bibliometrics-relevance/">https://aurora-network.global/project/sdg-analysis-bibliometrics-relevance/</a> OSDG: <a href="https://github.com/TechNote-ai/osdg">https://github.com/TechNote-ai/osdg</a>
15. MORRI and SuperMORRI studies	KIP 6	<a href="http://morri-project.eu/">http://morri-project.eu/</a> ; <a href="https://www.super-morri.eu/super-morri/index.php">https://www.super-morri.eu/super-morri/index.php</a>
16. Impact Assessment of Horizon Europe (Annex 5)	KIPs 7-9	<a href="https://ec.europa.eu/info/sites/info/files/swd_2018_307_f1_impact_assessment_en_v6_p2_977548.pdf">https://ec.europa.eu/info/sites/info/files/swd_2018_307_f1_impact_assessment_en_v6_p2_977548.pdf</a>
17. Performance of SMEs in FP7 study	KIPs 7-9	<a href="https://www.kmuforschung.ac.at/wp-content/uploads/2018/01/Volume-I-SMEs-in-FP7-Final-May-2014-EC-Format.pdf">https://www.kmuforschung.ac.at/wp-content/uploads/2018/01/Volume-I-SMEs-in-FP7-Final-May-2014-EC-Format.pdf</a>
18. Study on the tracking of research results	Various KIPs	No public link to the project
19. NIH assessments	Various KIPs	Public R&D Investments and Private-sector Patenting: Evidence from NIH Funding Rules <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6818650/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6818650/</a>
20. DG REGIO evaluations	KIPs 7-9	<a href="https://ec.europa.eu/regional_policy/en/policy/evaluations/ec/">https://ec.europa.eu/regional_policy/en/policy/evaluations/ec/</a> (in particular, the 2011-2012 studies on the performance of SME grants)
21. Various FWCI studies	KIP 1	Internationalisation of EU research organisations study (2019), <a href="https://www.europarl.europa.eu/RegData/etudes/STUD/2019/634444/EPRS_STU(2019)634444_EN.pdf">https://www.europarl.europa.eu/RegData/etudes/STUD/2019/634444/EPRS_STU(2019)634444_EN.pdf</a> Overall output of select geographical group comparators and related FP7-and H2020-funded publication output; <a href="https://op.europa.eu/en/publication-detail/-/publication/16c3e2c1-2523-11e9-8d04-01aa75ed71a1/language-en">https://op.europa.eu/en/publication-detail/-/publication/16c3e2c1-2523-11e9-8d04-01aa75ed71a1/language-en</a> H2020 Monitoring Flash: <a href="https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/h2020_monitoring_flash_092018.pdf">https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/h2020_monitoring_flash_092018.pdf</a> Study for the ITRE Committee: <a href="https://www.europarl.europa.eu/RegData/etudes/STUD/2019/631062/IPOL_STU(2019)631062_EN.pdf">https://www.europarl.europa.eu/RegData/etudes/STUD/2019/631062/IPOL_STU(2019)631062_EN.pdf</a> International comparative performance of the UK Research Base 2016 report <a href="https://www.elsevier.com/research-intelligence?a=507321">https://www.elsevier.com/research-intelligence?a=507321</a> International comparative performance of the UK Research Base 2019 report
22. Studies on H-index	KIP 2	The <i>Carbon<sub>h</sub></i> -Factor: Predicting Individuals' Research Impact at Early Stages of Their Career <a href="https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0028770">https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0028770</a>  Making Research Count: Analyzing Canadian Academic Publishing Cultures <a href="https://www.researchgate.net/publication/235676852_Making_Research_Count_Analyzing_Canadian_Academic_Publishing_Cultures">https://www.researchgate.net/publication/235676852_Making_Research_Count_Analyzing_Canadian_Academic_Publishing_Cultures</a>
23. SME participation to Horizon 2020 study	KIPs 7-9	Ongoing study/not public; relevant results will be presented in the overviews for KIPs 7-9

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The Baseline and benchmark report is one of the deliverable of the study to support the monitoring and evaluation of the Framework Programme for research and innovation along Key Impact Pathways – RTD/2019/SC/016

It is based on the work performed under Task 3, which was about defining, calculating and analysing the baseline and identifying benchmarks for each of the nine Key Impact Pathways.

The report includes baseline values for all Key Impact Pathway indicators to assess Horizon Europe progress over time, as well as relevant benchmarks. The assessment of baselines and benchmarks was based on desk research and multiple data computations performed by the study team.

The information and views set out in this report are those of the author(s) and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for the use which may be made of the information contained therein.

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