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Annual Monitoring Report 2019

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[1] DG GROW: EIP monitoring and evaluation scheme, see: https://ec.europa.eu/growth/sectors/raw-materials/eip/monitoring-evaluation_en

Contents

Acronyms

AMR	Annual Monitoring Report
CfC	Call for Commitments
EIP	European Innovation Partnership
EIP-RM	European Innovation Partnership on Raw Materials
EIT	European Institute of Innovation and Technology
EU	European Union
KIC	Knowledge and Innovation Community
MoU	Memorandum of Understanding
MEP	Member of European Parliament
RMC	Raw Material Commitment
SIP	Strategic Implementation Plan
SME	Small and medium-sized enterprise
UN	United Nations
WEEE	Waste electrical and electronic equipment

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Contribution statement

The AMR survey was set up based on earlier survey editions by D. Wittmer with support from C. Latunussa and C. Veeh. The survey was managed by D. Wittmer, including the support to survey participants and quality control of survey inputs.

D. Wittmer analysed the data on partnership, coverage of SIP themes, financial input, and future plans, and drafted the related chapters of the report manuscript plus the introduction and executive summary (chapters 1 to 3.1, chapter 3.4, annex). C. Latunussa analysed the data on research, dissemination and coordination activities and the Commitment outputs (chapters 3.2 to 3.3).

C. Veeh is responsible in DG GROW for the EIP-RM monitoring and support of this EIP Annual Monitoring Report. She guided this AMR activity to ensure its usefulness for the EIP on Raw Materials community and its policy relevance. This included feedback on the survey and on the report at each stage of development.

D. Pennington coordinated the overall EIP Monitoring support activities in JRC, being involved in reviews at every stage of development of this AMR.

Executive Summary

The European Innovation Partnership on Raw Materials (EIP-RM) is a stakeholder platform that brings together representatives from industry, public services, academia and NGOs. Its mission is to provide high-level guidance to the European Commission, Member States and private actors on innovative approaches to the challenges related to raw materials. The Strategic Implementation Plan (SIP) of the EIP-RM sets specific objectives and targets, to be achieved through a range of proposed actions including research and innovation coordination, technologies for raw materials production, substitution, framework conditions, knowledge and skills and international cooperation. To implement these actions – which cannot be done by the European Union (EU) institutions alone – the European Commission launched Calls for Commitments. Commitments are joint voluntary undertakings by several partners, who commit themselves to carrying out activities that contribute to achieving actions and targets of the EIP-RM. This Annual Monitoring Report (AMR) report provides an overview on the state-of-play of these Commitments for 2019.

KEY DATA ON THE COMMITMENTS ACTIVE IN 2019

Since the beginning of the EIP-RM, it is under continuous development. To date **the EIP-RM counts around 400 unique partners**, including 20 partners from non-EU countries. Overall, Spain remains the best represented country in EIP Commitments with 70 unique partner organisations, followed by Italy and Belgium with each about half the number of unique partners.

In early-2019, the EIP-RM counted 50 Commitments, 23 from the 2013 Call for Commitments, and 27 from the 2015 Call for Commitments. For several years, **the Commitments had covered all Priority Areas of the EIP-RM in a relatively balanced way**, even though the 2015 Call for Commitments attracted very little Commitments on framework conditions for waste management. However, the completion of several Commitments, and also disqualifications[2], progressively led to smaller number of active Commitments, and thus to an imbalance of priority areas and themes. For example, in 2017 the number of active Commitments on ´Raw materials research and innovation coordination' and on ´Improving Europe's raw materials framework conditions' decreased significantly. In 2018 the decrease in the number of active Commitments slowed down. Nevertheless, the last Commitment related to Priority Area ´Raw materials research and innovation coordination' already ended, and only a single Commitment continues on theme ´Deep Sea Mining´. In 2019, the number of active Commitments on Biotic materials dropped by three and thus almost halved.

Taken together, the Commitments have reported a **total cumulative budget** of **€1979 million** (referring to both active and non-active Commitments).

FUNDING

The progress of the EIP-RM correlates with the **funding secured**. New funding therefore enhances the potential impact in relation to the SIP targets. **After several successful years regarding funding, the Commitments increased further the cumulative secured budget, although modestly, reaching a level of €683 million.** Accordingly, the share of budget secured in the total indicative budget reached **35% in 2019** (see Table 1). EU funding is the largest source of funding secured (€311 million), mostly through

[2] Commitments are disqualified after two consecutive years without responding to the AMR surveys. Subsequently, these Commitments are not anymore considered active and thus not invited to the surveys.

Horizon 2020, while the growth of its share further slowed down. **Alternative EU funding sources** such as the European Investment Bank, the European Development Fund and Cohesion Policy Funds account for a **very small fraction** of funding to the Commitments. Since 2014 the RMCs have received from public and regional funding **€122 million from 25 different countries**[3]. There was no country funding for the first time in 2019. Three RMCs secured **private funding of more than €11 million** in 2019, increasing the cumulative total to €135 million. 62 Commitments received private funding since 2014.

ACTIVITIES

With few exceptions, Commitments reported to have undertaken activities towards their objectives since 2014. Activities mainly relate to the categories **knowledge sharing/dissemination of information and best practices** followed by **international cooperation.**

OUTPUTS

A large number of Commitments have continued to deliver tangible outputs in 2019. The outputs are in various forms, which address one or several EIP targets. They include patent applications, policy recommendations, roadmaps, research agendas, events/workshops, websites etc.

Similar to 2018, most outputs contributed to **Target 3: Framework conditions for primary raw materials** (34%) followed by **Target 4: Framework conditions for materials efficiency and waste management** (22%), and **Target 1: Innovative pilot actions** (22%). Many of the RMCs that responded to the AMR Survey delivered outputs in more than one output category. Similar to 2017 and 2018, prominent examples of outputs delivered by the Commitments are **knowledge sharing outputs** (publications, events, websites etc.), **innovative actions or pilots** (technological processes, new business models, new products etc.), and **international cooperation** (sharing/dissemination of information and best practices, participation in joint collaboration projects, event/workshop/conference organisation, technology exchange, etc.).

[3] 24 member states (Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom), plus Norway.

Table 1 provides an overview of the report's **key performance indicators.**

Table 1: Key performance indicators (December 2019) for Raw Material Commitments (RMC)

Key performance indicator	2013 Call for Commit-ments	2015 Update on RMCs from 2013	2015 Call for Commit-ments	2016 Update	2017 Update	2018 Update	2019 Update	Total at beginning of 2020
				on RMCs from 2013 /2015				
Number of commitments	80	- 4	+ 47	-24	-37	-12	-15	35
Number of unique partners	699	+ 56	+ 223	-125	-210	-92	-167	384
Total indicative budget	€1744 million	- €58.4 million	+ €294 million	n.a.	n.a.	n.a.	n.a.	€1979 million
Budget secured[4]	€268 million	+ €123 million	n.a.	+ €113 million	+ €71 million	+ €61 million	+ €48 million	€683 million
Share of indicative budget secured	15%	23%	n.a.	n.a.	25%	29%	32%	35%
Outputs, cumulative	ca. 200	ca. 500	n.a.	ca. 900	ca. 1300	ca. 500	ca. 800	n.a.

Source: JRC analysis

[4] The "Budget secured" in the table included approximately €115 million of EU funding that RMCs had already secured at the time of the 2013 Call for Commitments (cf. EIP-RM Annual Monitoring Report 2014, p.8). Values shown are rounded, therefore the total can deviate from the sum of the annual values.

1 Introduction

1.1 The European Innovation Partnership on Raw Materials

The European Innovation Partnership on Raw Materials (EIP-RM) is a stakeholder platform that brings together representatives from industry, public services, academia and NGOs. Its mission is to provide high-level guidance to the European Commission, Member States and private actors on innovative approaches to the **challenges related to raw materials**.

The **Strategic Implementation Plan** (SIP)[5] of the EIP-RM sets specific objectives and targets, to be achieved through a range of proposed actions including research and innovation coordination, technologies for raw materials production, substitution, framework conditions, knowledge and skills and international cooperation.

To implement these actions – which cannot be done by the European Union (EU) institutions alone – the European Commission launched two **Calls for Commitments**[6] to Member States, industry, academia and other relevant stakeholders in October 2013 and December 2015. A third **Call for Commitments** ran from late spring 2018 to summer 2020.

The **'Raw Material Commitments'** (RMCs) are joint undertakings by several partners, who commit themselves to carrying out activities that will contribute to achieving the actions and targets of the EIP within the period 2014-2020. In some cases, commitments are specific projects, or project proposals. But, in general, commitments are a range of activities, including projects of different sizes, nature, project run times, and project teams. Such projects can be funded by various project schemes (Horizon 2020, Horizon Europe, LIFE, COST etc.) and thus have different characteristics.

The impact of specific projects may be estimated but is not in the scope of the EIP monitoring, as the EIP monitoring relates to commitments and not projects.

1.2 The EIP Annual Monitoring Report

The purpose of the Annual Monitoring Report (AMR) is to provide an overview on the **state-of-play of the Commitments**, based on indicators that measure the RMCs' inputs and outputs. As the EIP-RM is a multi-annual activity, this annual monitoring report reflects a snapshot for the year 2019, which will be updated further in 2020. The data used come from the information provided during the Calls for Commitments and from the annual AMR surveys.

While participation in the AMR survey is mandatory – every second year – to maintain their status as recognised active Commitments, the quality and utility of the responses vary across the Commitments´ contributions. There are no sanctions imposed in case of disqualification, as there is no direct linkage between a commitment and project funding.

The results of this monitoring exercise feed into the SIP Implementation Document and the Strategic Evaluation Report[7].

[5] https://ec.europa.eu/growth/sectors/raw-materials/eip/strategic-implementation-plan_en

[6] https://ec.europa.eu/growth/sectors/raw-materials/eip/commitments_en

[7] See the EIP Monitoring and Evaluation scheme: https://ec.europa.eu/growth/sectors/raw-materials/eip/monitoring-evaluation_en

Together with DG GROW, the Joint Research Centre (JRC) runs the EIP Annual Monitoring Report Surveys and authors the AMRs. In line with its neutral role, JRC is not involved actively in any commitment and participates only in very few of the related projects.

The AMR aims to inform policy makers in the field of inorganic non-energy raw materials at EU and member state levels, as well as the community of RMC leaders or other stakeholders interested in the overall development of the RMCs.

2 Overview of the Commitments

The EIP-RM organised **two Calls for Commitments**, in **2013** and **2015.** A third and last **Call for Commitments** ran from late spring 2018 to summer 2020. From the 2013 Call for Commitments the EIP Sherpa Group accepted **80** Commitments, while the 2015 Call led to **47** additional Commitments. The third, continuous call did not result in new Commitments.

Commitments that do not fill in the annual monitoring survey or respond to the invitation email for two consecutive years lose their recognition as a Raw Materials Commitment. In 2019 this was the case for nine Commitments[8]. Moreover, six Commitments finished their mission[9] and/or activities in 2019, bringing the total of completed Commitments to 21. This way the EIP counts **35 Commitments** at the beginning of 2020. This means that the annual decrease reached 15 in 2019, after 12 in 2018, 22 in 2017 and 45 in 2016.

This section presents an overview on the coverage of the SIP, the Commitment partners and their indicative budgets.

Further details on all the endorsed Commitments can be found on the EIP website:

https://ec.europa.eu/growth/sectors/raw-materials/eip/commitments_en

2.1 Commitments and coverage of the Strategic Implementation Plan

>> The coverage of the different Priority Areas is partly out of balance

Table 2 displays the coverage of the SIP Priority Areas, attributing each RMC to one Priority Area.

From the beginning of the EIP-RM, all Priority Areas were relatively well covered, considering that some Priority Areas (e.g., Priority Area I.C on substitution) are more specific than others. The 2015 Call for Commitments attracted very few Commitments on framework conditions for waste management (Priority Area II.B), while there were quite a lot of new Commitments covering biotic materials. The successive cessation of numerous Commitments has caused significant drops in the total number of recognised Commitments. In the AMR 2019 Survey, 34 RMCs responded by filling the AMR 2019 Survey online or indicating the status of the Commitment; this results in a response rate of 68%. This is about the same response rate as last year, and one and a half times the response rate of the AMR 2017 Survey. However, for certain analyses only a subset of Commitments (26; 52%) was available, as the remaining Commitments (8; 16%) include those ones merely reported in 2019 to be finished or idle, respectively.

Annex 1 further provides an overview of the coverage of the EIP's Action Areas, based on Commitments' selection of up to 5 relevant Action Areas.

At the AMR2019 Survey, the following additional information have been gained on the status of Commitments:

- six Commitments reported to have finished its mission and/or activities: BioMOre, IMPACT, MINSPIRE, RESET, TailingsDamScavenger, WeCARE;
- seven Commitments reported no advancements were undertaken in 2019.

[8] EUROASSET, EUROPEM, ENCRAM, Reclaim, SUBST-EXTREME, WEEE 2020, Effiwood, EHIA, GENTLE.

[9] Finished in 2019: BioMOre.

Table 2: Number of RMCs covering each Priority Area in 2019. The Commitments that responded to the AMR2019 Survey are put in bold, those that finished in 2019 and/or lost their recognition are in *italics* (number indicated in brackets), and those that responded to the AMR2019 Survey and finished are in bold and italics.

Priority Area or theme	Relevant Raw Materials Commitments	Number of RMCs
Priority Area I.A. 'Raw materials research and innovation coordination'	none	0 *(0)*
Priority Area I.B. 'Technologies for primary and secondary raw materials production' >> Land mining (exploration/mining)	*BioMOre*, *EUROASSET*, **ExECRoMe**, **NEXT**, **SIMS**, **SmartExploration**, **SOcRATES**, **SOLSA**	8 *(2)*
>> Deep sea mining (exploration/mining)	**Blue Nodules**	1 *(0)*
>> Processing	BioAlMinore, **CuBES**, *EUROPEM*, INCOMES, **MetGrow**, **Mud2Metal**, **PolymetOre**	7 *(1)*
>> Waste management	**C&D-WRAM**, **EARTH 2020**, *ENCRAM*, EURELCO, **ITERAMS**, pHMine, *Reclaim*, ***TailingsDamScavenger***, ***WeCARE***, **ZeroWaste-NoI**	10 *(4)*
Priority Area I.C. 'Substitution of raw materials'	**EQUATOR**, EU-NARS-G, ***RESET***, *SUBST-EXTREME*	4 *(2)*
Priority Area II.A. 'Improving Europe's raw materials framework conditions'	**BioDIMA**, **EMD**, **ENSQM**, **Mineland[10]**, **MIREU[10]**, SUMAN2000, SUSMINE	7 *(0)*
Priority Area II.B. 'Improving Europe's waste management framework conditions and excellence'	***IMPACT***	1 *(1)*
Priority Area II.C. 'Knowledge, skills and raw materials flows'	**EUMINET**, *WEEE 2020*	2 *(1)*
Priority Area III. 'International cooperation'	**IMAGINe**, **INTERMIN**, ***MINSPIRE***	3 *(1)*
Biotic materials	*Effiwood*, *EHIA*, *GENTLE*, **NOWMOB**, **RUBB-ENDURE**, **RUBBERTOMARKET**, **WRING**	7 *(3)*

Source: JRC analysis

[10] Mineland and MIREU are RMCs active in 2018 and 2019, in contrast to the information shown in AMR2017.

2.2 Partners

>> Since 2015 the EIP on Raw Materials lost more than half of its partners counting about 400 at the end of 2019

In 2013, about 700 partners[11] related to 80 commitments belonged to the EIP-RM[12]. Between 2013 and 2015, one third of these RMCs reported through the AMR 2015 Survey an evolution of their partnership. Despite the disqualification of four RMCs and the consequential loss of 27 partners, the update by the AMR 2015 Survey showed a net increase by 56 new partners of the EIP-RM. Moreover, the 2015 Call for Commitments attracted another 223 partners, related to 47 commitments, bringing the overall EIP partnership to a peak of about 980 partners.

Since then, no new Commitments entered the EIP-RM, but many left due to reaching their goals or lifetime, or disqualification. This evolution is attended by an annual decrease also in the number of partnerships of the remaining RMCs. The **overall EIP partnership** thus decreased to about 850 partners in 2016, 650 partners in 2017, and 550 partners by the end of 2018.

Like the precedent year, the cessation of RMCs continued at a slow rate in 2019 with the disqualification of nine RMCs; six Commitments reported to have finished their mission and/or activities in this period. This results in a drop overall by 30% to 35 active RMCs at the end of 2019. In terms of partnership, the number lessened by about 150 partners to about **400 partners** by the end of 2019 (Table 1). In summary, the **overall EIP partnership** lessened between 2016 and 2019 by almost 600 partners[13], meaning a loss of about 60%.

>> Unevenness in Member State participation increased

Figure 1 presents the distribution of the **unique partners per Member State**. Overall, **Spain** remains further the best represented in the EIP Commitments (with 70 different partner organisations). Spain is followed by **Italy** and **Belgium** with 34 and 32 unique partner organisations, respectively. Especially for Italy, the number dropped significantly by more than 40%. Further countries with good representation in the RMCs are Sweden, France, Portugal and Germany with 20 to 30 unique partner organisations. The number of unique partners in average decreased for EU countries by 30%, which is double the rate of the year before. With a lower average number per country, its relative decrease varies significantly, up to almost 50%. The number of **partners from non-EU countries**[14] **decreased by 26%, now counting 20 partners**.

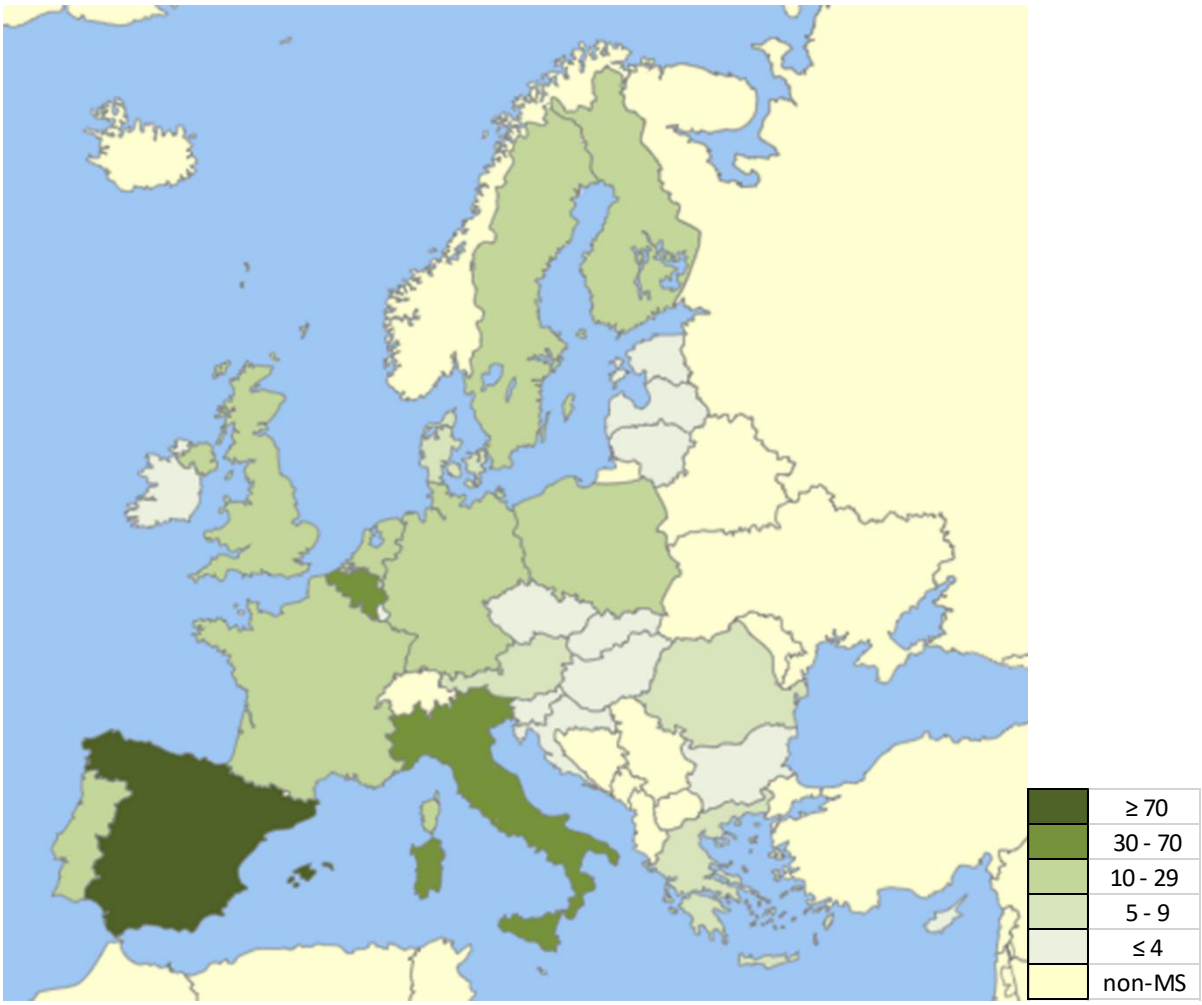
[11] The analysis distinguishes between the sum of "partners" and of "unique partners", in order to exclude double counting of partners participating in more than one Commitment. This report refers always to "unique partners", but for the reason of readability, the term "partners" is used throughout the report.

[12] The 80 commitments are the ones accepted after the 2013 Call for Commitments.

[13] minus 125 in 2016, minus 210 in 2017, minus 100 in 2018, minus 150 in 2019 (approximate values)

[14] The participation by non-EU countries is increasingly concentrated by few countries, led by Norway (4) and Chile (3). Further countries with various unique partners include Switzerland, the United States, Serbia, and Turkey.

Figure 1: RMC partner coverage, total number by Member State, 2019.



Source: JRC analysis

Spain (6), Italy (5), Finland (6) are well represented in **RMC leadership**[15], with pan-European organisations (9) also leading a significant number of RMCs. France, however, left this group as its leadership dropped from five to one.

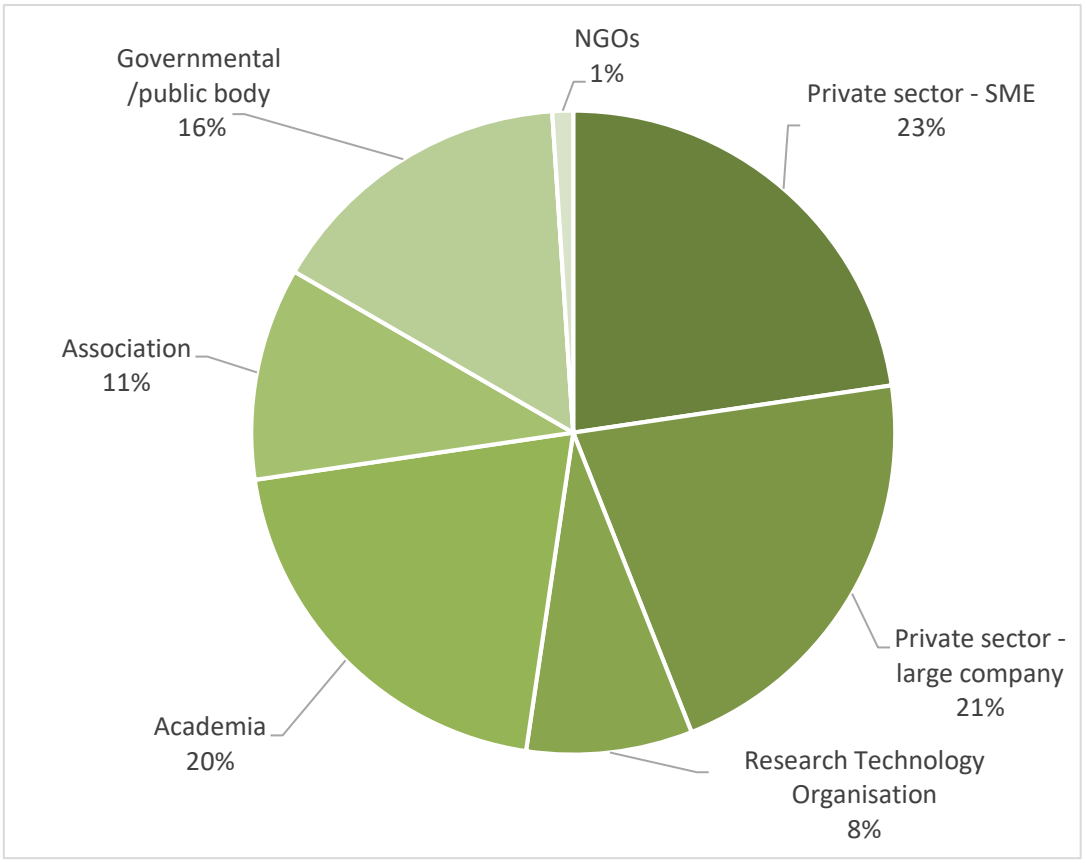
>> There is a balanced participation of organisations from the public and the private sector, yet NGOs are relatively under-represented

Figure 2 presents that, in terms of RMC partners, **participation in the EIP is still relatively evenly balanced between the public and private sectors**, despite the decreasing numbers. Since last year, a slight shift (< 5%) is reported from the private sector to public bodies, and associations. As a result, almost half (44%) of the organisations that participate in Commitments come from the private sector, both large companies, and small and medium-sized enterprises (SMEs); the latter representing over one quarter (23%) of all organisations that participate in Commitments. In addition, associations representing the private and non-private sector make account for 11%. Participation by NGOs were underrepresented from the beginning.

[15] The term RMC leadership is the location where the coordinating organisation of the Commitment is registered.

In essence, the distribution by type of RMC partners continues to be very stable, while a starting shift has been reported from the private sector (SMEs) towards governmental and public bodies.

Figure 2: Type of RMC partners, in %, 2019



Source: JRC analysis

The indicative budget remained constant at €1979 million since 2015.

3 Monitoring Progress of Commitments

This chapter presents **the progress made by the Commitments** of both the 2013 and the 2015 Call for Commitments that are recognised at the beginning of 2019. Like at the AMR 2018 Survey, almost 70% of these Commitments responded to the AMR 2019 Survey.

Indicators for monitoring, measuring and mapping the state-of-play of the ongoing EIP-RM Commitments are presented in three sections:

(1) inputs (human resources, funding, etc.);

(2) activities undertaken in the year;

(3) outputs (pilot actions, documents, meetings, etc.).

3.1 Inputs

The purpose of this section is to analyse the overall state-of-play of the adopted Commitments with respect to total funding secured, and to identify the proportion of projects that are on track versus those at risk, e.g., those lacking funds.

Overview

>> On average the RMCs have now secured more than a third (35%) of their total indicative budgets

Prior to the Annual Monitoring Report 2019 Survey, RMCs had reported the securing of €628 million[16]. **At the time of the Annual Monitoring Report 2019 Survey, the RMCs reported to have further secured €48 million**. This means that the EIP Commitments have now secured approximately **€683 million** out of the updated total indicative budget of €1979 million, or **35%** of their total indicative budgets (compared to 15% in 2014, 23% in 2015, 25% in 2016, and 29% in 2017, and 32% in 2018).

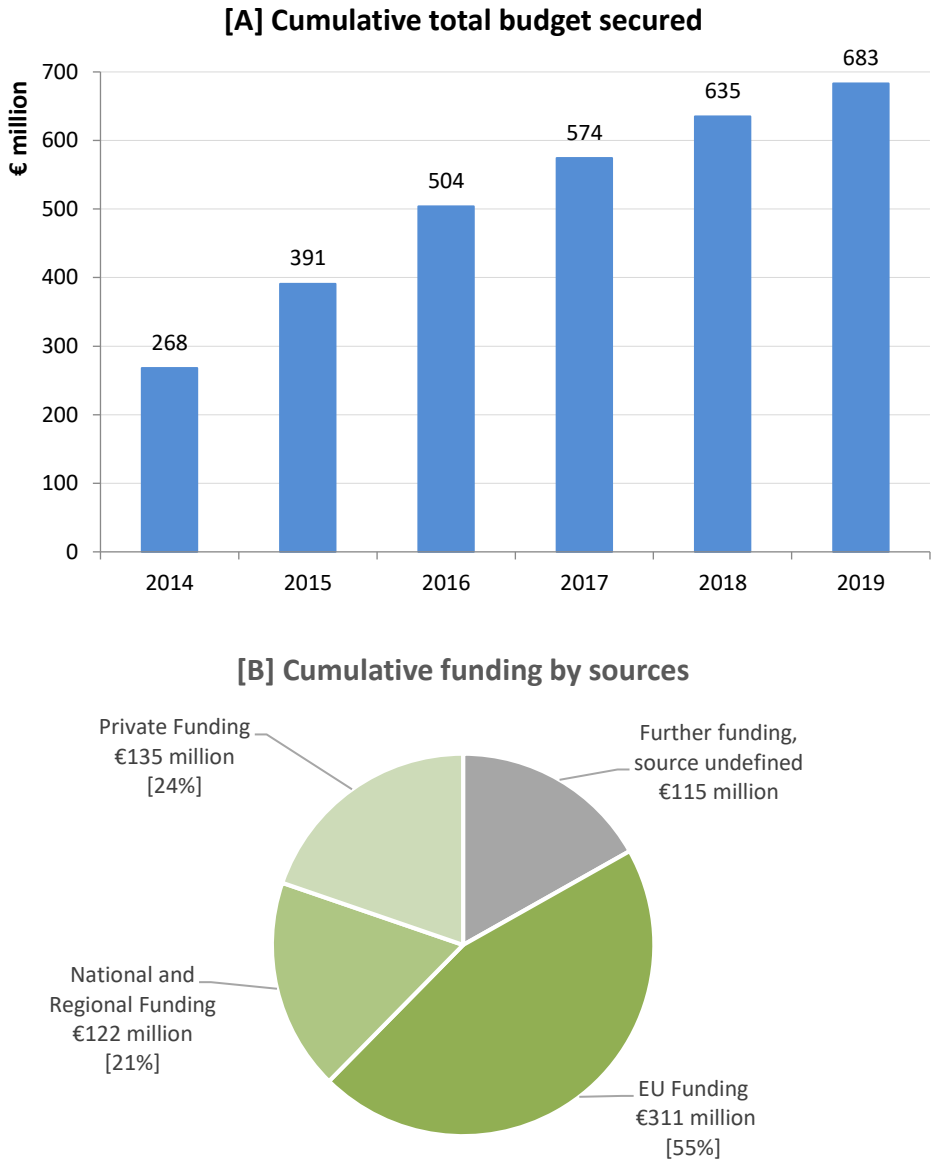
The **trend of the total budget secured**, cumulative for the years 2014-2019, is summarised in **Figure 4A**, while the reported budget secured for the period 2014-2019 is shown by type of resources in **Figure 4B**.

The **cumulative total budget secured grew rather evenly** over the period 2014-2019, starting from a total budget of €268 million and reaching now €676 million. The absolute annual increase continues to slow down significantly, with a marked drop in both absolute and relative terms in 2017.

Since 2014, the largest proportion of funding comes from the EU (Figure 4B); for the period 2014-2019 the cumulative EU funding amounts to more than half of the total (55%), equivalent to €311 million. Private funding of €135 million represents about a quarter (24%) of the total funding secured since 2014. Funding from public national and regional sources is more than €122 million over the same period, representing about a fifth (22%).

[16] This includes the budget indicated by the 2013 Call for Commitments.

Figure 4: Secured funding for EIP Commitments: [A] Cumulative total budget secured in the period 2014 to 2019, in €; [B] Cumulative budget secured split by type of sources since 2014, in € million[17] and % (disregarding "Further funding" category). Budgets are in nominal values.



Source: JRC analysis

In contrast to these cumulative shares, the shares of **annual** funding sources vary significantly. After four years of continuous drop down of both absolute volumes of annual private funding, and its relative share, the private funding exceeded in 2019 €11 million and thus reached again the pre-2016 level regarding the relative share (23%).

[17] The "Cumulative budget secured" in Figure 4B excludes approximately €115 million of EU funding that RMCs had already secured at the time of the 2013 Call for Commitments.

The share of the annual public national and regional funding continued to fluctuate strongly. Following its high in 2018 with more than 35% of the total annual budget secured, it almost halved in 2019 to 20%.

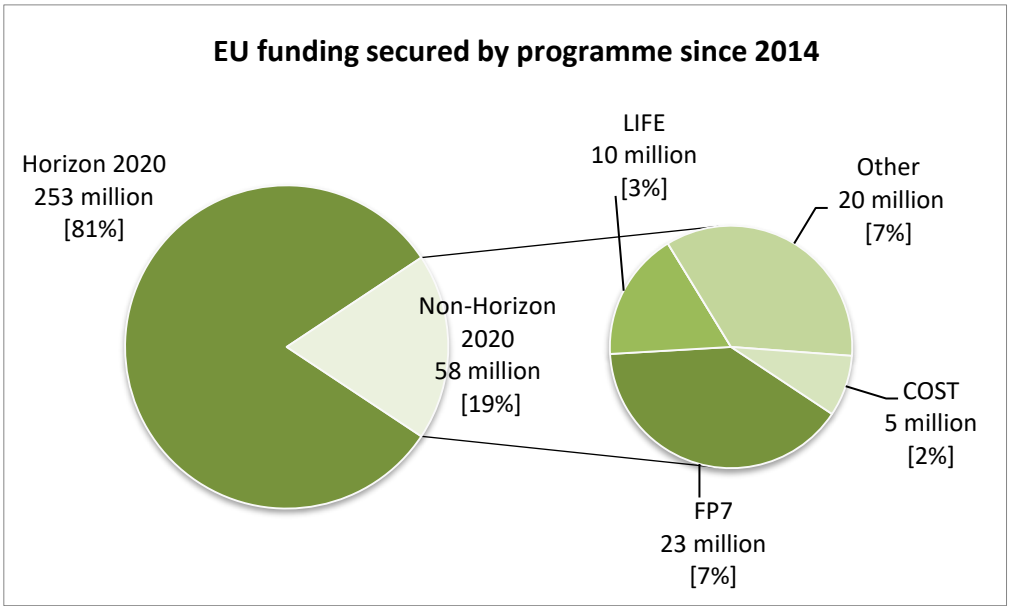
EU Funding

>> The Horizon 2020 programme clearly stays the biggest source of EU funding for RMCs, worth €247 million

Since 2015, the Horizon 2020 programme has become the biggest source of EU funding. **In 2019, 7 RMCs reported securing about €27 million of additional EU funding**. This brings EU funding to €311 million since 2014.

The **Horizon 2020** research and innovation funding programme clearly stays the **biggest source of EU funding** that Commitments received. For the period from 2015 on, Horizon 2020 extended its dominance of cumulative funding also in 2019, in absolute and relative terms, reaching 81% (Figure 5). The **FP7** research and innovation funding programme stopped to increase. Cumulatively, it stays the second largest EU funding source for EIP Commitments since 2014, with 7% of the total, followed by **LIFE with** 3% of the total.

Figure 5: Type of EU funding[18] received by EIP Commitments since 2014, in € million and %. Budget from the EIT Raw Materials is included in the Horizon 2020 category



Source: JRC analysis

>> Alternative EU funding sources account for a minor fraction of funding to the EIP Commitments, while the EIT Raw Materials has become a significant growing source of EU funding

As of 2019, the **EIT on Raw Materials** appears as a steadily growing source of funds. The cumulative contribution now amounts to approximately €23 million (compared to €17

[18] Other funding comprises funding from European Regional Development Fund, Cohesion Policy Funds and further unspecified funding.

million in 2018, €15 million in 2017, 13 million in 2016 and €0.75 million in 2015) in RMCs including the BioFlex, SolvoFlex, Electroflex, Pyroflex, Residuflex, Preflex, SSIC, ERMAT, GATEWAY and Metnet, PilotMet KAVA Networks of Infrastructures, AMCO, SUPRIM, Mineral products from Petrit-T sidestream, HARSHWORK, Circular TP, SUPRIM, and newly also for projects Blue Harvesting, and CIRCuIT.

It is notable that no EU funding has been secured from the **European Investment Bank** or the **European Development Fund**; and that only limited funding has so far been received from **Cohesion Policy Funds**.

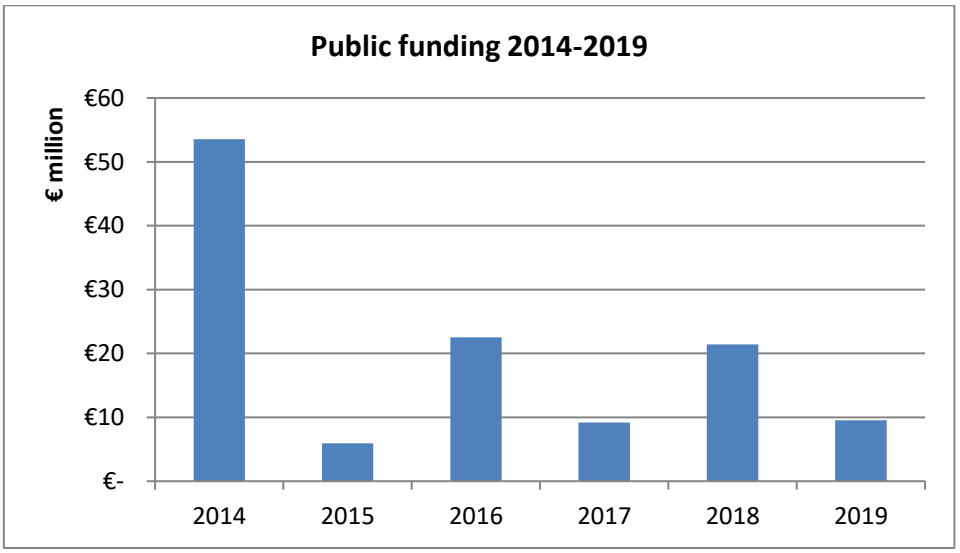
Public National/Regional Funding

>> Since 2014 the RMCs have received more than €122 million; the reported volumes of national or regional funding follow a significant annual up and down

In 2019, **3 RMCs received direct funding or in-kind contributions from public or regional bodies** across Europe and internationally (compared to 6 RMCs in 2018). The volume of the annual national or regional funding more than halved to **€10 million from 11 countries.** Austria, Belgium, Germany, Finland, France, Portugal, Sweden, Slovenia, Spain as well as United Kingdom, each of them showing a share of about €1.0 million. Italy, however, shows a contribution that is minor compared with the other countries (€0.1 million).

In comparison to private funding and EU funding, national/regional funding appears to be more fluctuating, see Figure 6**.**

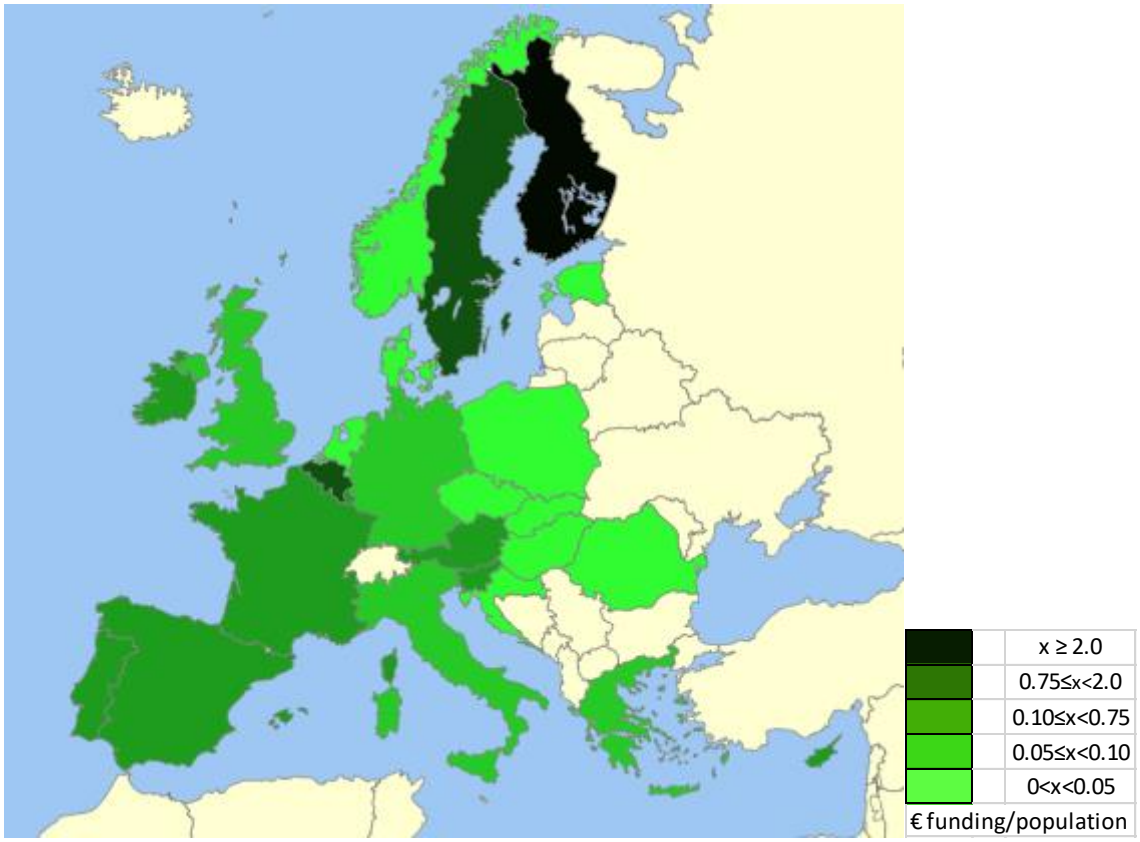
Figure 6: Trend of National or Regional Funding received by EIP Commitments since 2014, in € million



Source: JRC analysis

Since 2014, **35 EIP Commitments** received direct funding or in-kind contributions from public and regional bodies across Europe and internationally totalling over **€122 million from 25 different countries** (Figure 7). No regional funding was reported in 2019. As expected, most countries providing funding are member states, complemented by few non-EU countries (Europe and overseas).

Figure 7: Sources of national or regional funding for EIP Commitments since 2014[19]. Population reference year is 2019.



Source: JRC analysis

From 2016 to 2018 Finland and Belgium were the member states showing the largest funding volumes, while they were only slightly surpassed by Spain in 2019. The cumulative funding since 2014 is highest for Sweden (€19 million) due to its lead at the initial phase.

According to the reporting on the EIP monitoring survey, **4 Member States appear to have not provided any public or regional funding** to the EIP Commitments since 2014. **Outside the EU**, about **€3 million** of financial contributions to EIP Commitments were provided by **Gabon, Norway, Turkey, South Africa and Argentina**.

Private Funding

>> Since 2014 more than every second Commitment (56%) received private funding, worth together €135 million.

In 2019, 3 RMCs reported to have secured private funding, after 4 RMCs in each of the two preceding years**. The private funding received in 2019 was more than €11 million**, following €2 million in 2018. The cumulative funding for the 2014-2019 period was **€135 million**.

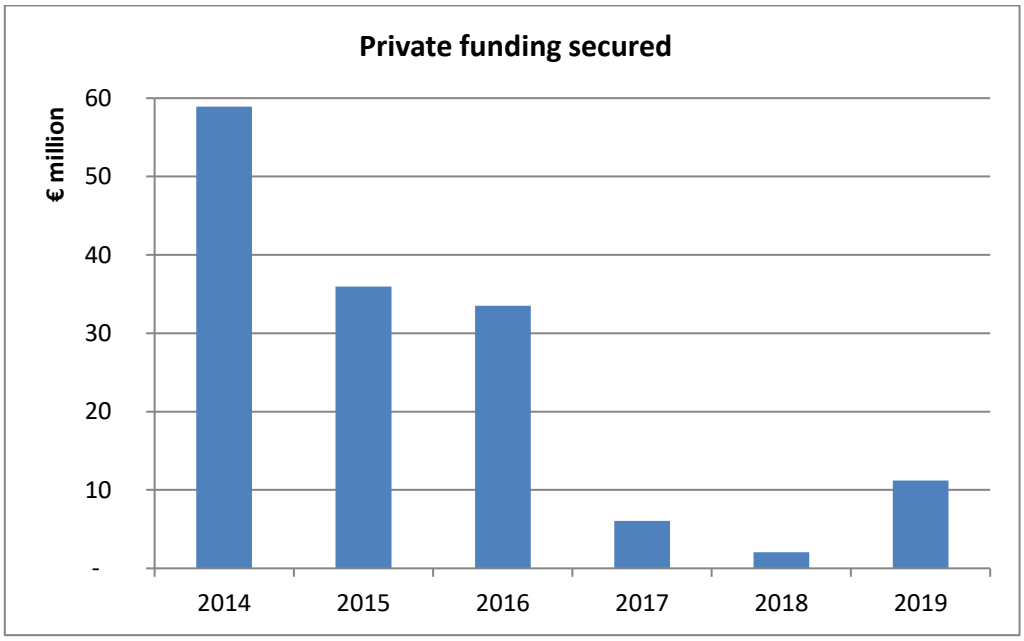
After a continuous decrease in the annual volume of private funding from 2014 to 2018, the annual volume increases for the first time in 2019 (Figure 8). Further exploration is required to understand to what degree this result is influenced by fluctuations in response

[19] In the map, the colour-scheme for Member States has been scaled to show funding relative to population figures of the reference year 2019.

rates, the incidence of the final phase of the European Innovation Partnership, or other factors.

The number of RMCs that secured private funding since 2014 increased to **62** (**adding** in 2019 **RMC RUBBERTOMARKET**)**.** Out of the 62 RMCs that secured private funding, the funding volumes of the upper 32%, i.e. those 20 RMCs securing over €1 million each from private sources, add up to €126 million (94% of the total private funding).

Figure 8: Trend of Private funding received by EIP Commitments since 2014, in € million



Source: JRC analysis

3.2 Research, dissemination and coordination activities

Most of the Commitments responding to the AMR2019 Survey (almost 89%) reported progress towards the planned activities, defined by documentation of outputs. Commonly reported activities belong to **knowledge sharing/dissemination of information and best practices** and **international cooperation.**

Seven Commitments[20] reported to have not achieved any further outputs since 2018. In 2019, three more RMCs reported to have no significant production of outputs due to the ending of the related project in 2018 and lack of resources and temporal availability.

The following sub-sections highlight a selection of research, dissemination, and coordination activities undertaken by Commitments in 2019.

3.2.1 Research activities

Research activities performed by the Commitments can be grouped into several thematic fields, namely primary resources, recycling, substitutes, and harmonisation and modelling of raw materials stocks and flows.

Key achievements of the commitments, sorted by topic, include the following:

Primary resources

[20] These commitments are the following ones: RMC EQUATOR, RMC SOcRATES, RMC BioDIMA, RMC IMAGINe, RMC SOLSA, RMC ZeroWaste-NoI, RMC ExECRoMe.

- RMC Blue Nodules conducted research activities for the subsea harvesting equipment. RMC Blue Nodules delivered a report concerning national and international regulations regarding endangered species and protected areas. In this context, RMC Blue Nodules also participated in several international capacity-building conferences.
- RMC SOLSA[21], dealing with on drilling technologies, has published the results from testing of combined mineralogical and chemical analyses of drill cores on different surfaces in scientific journals. RMC SOLSA implemented an expert system that integrates quantitative data on chemistry, mineralogy and texture of drill cores, which is expected to significantly speed up the drilling stage. This RMC has also constructed an open-access database library for specific instruments, allowing the determination of mineralogical and chemical analysis of the cores in real time. In addition, RMC SOLSA also applied a patent of the prototypes they developed.
- RMC PolymetOre conducted research activities in developing sustainable and efficient technological solutions to benefit polymetallic, complex, and low-grade ores from diverse mines located in Spain, Portugal, Poland and Serbia. The activities of th RMC aimed at increasing the leaching efficiency at an already existing industrial plant with atmospheric leaching.
- RMC NEXT[22] develop exploration technologies and data analysis methods expected to be more cost-effective, environmentally safe and potentially more socially accepted. In doing so, RMC Next brought together mining industry, service providers and research institutions.
- RMC SIMS[23] continued to conduct research and development activities in underground mining technology. This action aims to test and exhibit relevant technologies for a sustainable intelligent mining system. RMC SIMS produced several outputs in underground mining technology under the category new products.

Recycling

- RMC C&D-WRAM has developed recovery and recycling solutions towards near-zero waste for construction and demolition waste.

Substitutes

- RMC EQUATOR continued working on a substitution material for antimony as fire retardant.

  The developed material is made from inertized fly ash of different origins, such as municipal solid waste incineration and silica waste residues.

Harmonisation and modelling of raw materials stocks and flows

In this category, RMC EUMINET published two relevant reports:

- Data management plan behind the European raw-materials knowledge base platform, Mintell4EU.

Minerals Inventory Report, a report that describes the process of refining the minerals inventory database in Mintell4EU (previously known as Minerals4EU database). The process included identification of data gaps in spatial coverage, quality control and assurance, establishing connections with other relevant projects.

3.2.2 Dissemination activities

Among the most relevant dissemination activities are those activities addressing knowledge, skills and raw material flows as well as waste. Some commitments organized specific dissemination events such as conferences, workshops, and meetings during 2019.

[21] Sonic On-Line Sampling Analysis - Automated mineralogy and chemistry Analysis

[22] New EXploration Technologies

[23] Sustainable Intelligent Mining Systems

Waste area

- RMC ZeroWaste-NoI's activities focused on valorisation of complex, low grade primary and secondary raw materials resources. Following 2018's activities, RMC ZeroWaste-NoI conducted a dissemination activity with the launch of a website in 2019.
- RMC C&D WRAM[24] with its FISSAC[25] project held some webinars to inform about their projects. Other than that, the project also created a software platform to facilitate information exchange, involving stakeholders at all levels of the construction and demolition waste value chain.
- RMC NOWMOB communicated the results from the WoodCircus project on good practices and cross-border transfer on wood side stream utilization and wood waste management on the project website[26]. The main goal of the project is to promote wood-based value chains as a key part of a circular bioeconomy in Europe.
- RMC RUBBERTOMARKET, whose work focused on waste tyres valorisation issued several articles available to public, for example a book, a technical manual, new products a catalogue, a scientific article and industry standards. RMC RUBBERTOMARKET was also active in communicating the results from the research activities at several conferences.
- RMC Metgrow published several scientific articles. One of the articles was related to the valorisation of construction and demolition (C&D) and industrial wastes. Over the years, RMC MetGrow has focused on developing innovative metallurgical technologies to extract the following metals: nickel, copper, zinc, cobalt, indium, gallium, germanium in a cost-effective way.

Knowledge, skills and raw materials flows

RMC TAURUS has organized several collaboration events among the Commitment partners, resulting in project proposals at national and European level. More than 10 scientific papers on the evaluation of mineral resources by means of an exergy-based methodology were published.

Events: conferences, workshops, and meetings

Most of the RMCs who responded to the AMR 2019 Survey reported to have taken part in dissemination activities in conferences, workshops, and meetings. Many of these activities were at international level. Prominent examples are the following RMCs:

- RMC C&D WRAM with the FISSAC project including the "Living labs FISSAC" in several sites in Europe,
- RMC EMD held EMD open days in September 2019, joined by 109 participants, mainly EU operations (and few sites in Brazil, USA and Russia),
- RMC Mineland, RMC SIMS, RMC MIREU, RMC NOWMOB and RMC RUBBERTOMARKET organized at least one event in the reported year.

3.2.3 Coordination activities and proposals

After 2018, the following commitments continued their coordination activities and proposals:

- RMC RUBB-ENDURE has set up a new consortium and submitted a H2020 proposal on recycling of raw materials from end-of-life products. RMC RUBB-ENDURE has been working on developing raw materials for elastomer from the End-of-Life Tires (ELT).

[24] Towards a new model of C&DW management for a circular supply chain integrating innovative solutions for a better recovery of Raw Materials

[25] Fostering Industrial Symbiosis for a Sustainable Resource Intensive Industry across the extended Construction Value Chain

[26] https://woodcircus.eu/

- RMC C&D-WRAM proposed an innovative concept for recycling WEEE and batteries, which materialised in a H2020 project proposal.

3.2.4 International cooperation

- RMC SmartExploration signed a MoU with Metal Earth Canada with the objective to establish an exchange of knowledge and ways to collaborate. Following this MoU, Smart Exploration participated in MERC-Metal earth conference in Canada. In early 2020, RMC Smart Exploration also started a joint-collaboration project in exploration technology with INFACT[27] project with non-EU partners. The exploration project was created to address the challenges surrounding the exploration of mineral resources within the EU.
- RMC IMAGINe[28] participated in a partnership with seven Latin American countries as part of the Mineral Exploration Trade Show (METS) and Mineral Development Network Platform (MDNP). The objective of the partnership is to facilitate dialogue between the relevant global stakeholders through the creation of a network of focal points in the Asia-Pacific region.
- Other RMCs involved in joint collaboration projects at international level during the reporting period were RMC NOWMOB, RMC MINSPIRE, RMC NowMob, and RMC NEXT.

3.2.5 Other activities

Some Commitments reported to have **improved their operational structures** (governance meetings of potential consortium partners, workshops, website development, and work package definition and proposal writing) in order to act more efficiently and **secure funding**.

RMC RUBBERTOMARKET project partners have collaborated to prepare European proposals for the development of new applications for ELT materials. Each commitment partner also developed R&D projects in collaboration with key stakeholders. RMC CuBES reported to have secured an EU funding for copper Redox Flow battery concepts, aiming to substitute vanadium, a critical raw material.

In previous AMR surveys, several Commitments reported to have made **a contribution to the EIT Raw Materials**. In 2019, RMC Minspire has provided support to the EIT Raw Materials education programmes, Cross-KIC (RM-Climate) activities, and other technology-related projects.

3.3 Outputs

This subchapter monitors the achievements produced by the Commitments in 2019. As in the past editions of the Annual Monitoring Report, the emergence of outputs reported by the Commitments were analysed (subchapter 3.3.1). The outputs concern various types of achievements, which address one or several EIP targets. They comprise of, amongst others, patent applications, policy recommendations, roadmaps, research agendas, events/workshops, websites etc. In addition, the Technology Readiness Level (TRL) achieved by the individual Commitments is discussed per selected categories (see subchapter 3.3.2). The outputs reported by the Commitments have been verified to the extent possible.

[27] The Innovative, Non-invasive and Fully Acceptable Exploration Technologies

[28] The Industrial Minerals Associations' Global Innovative Network

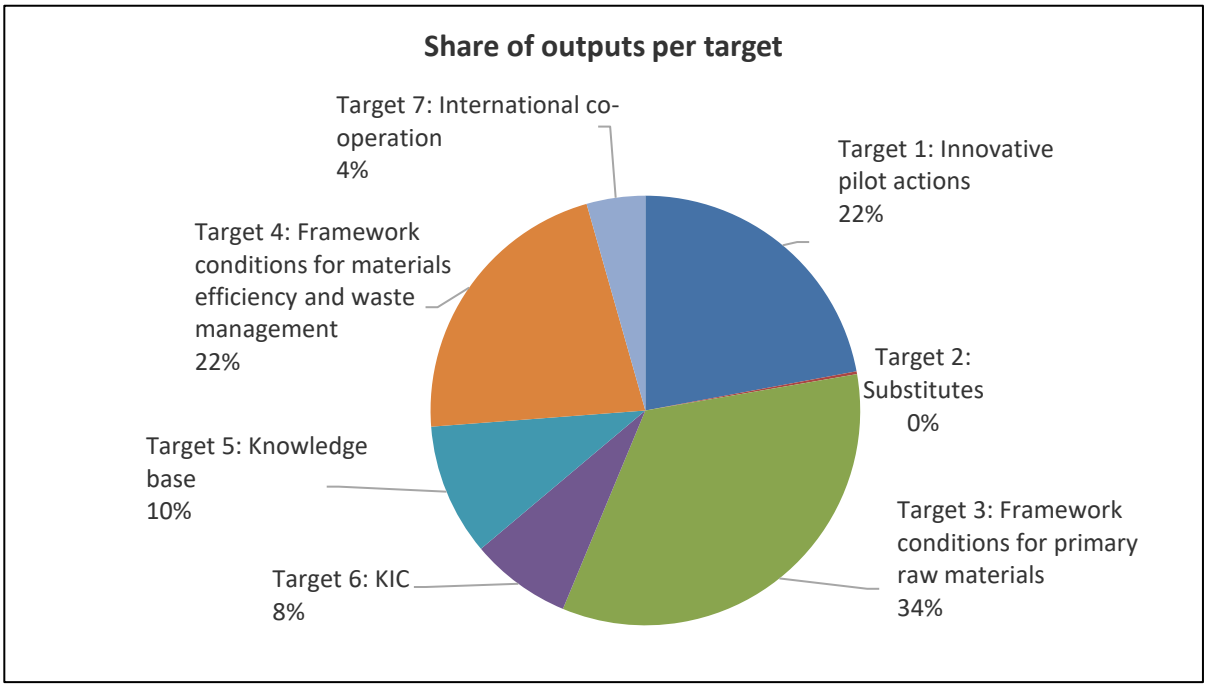
3.3.1 Emergence of Outputs

>> Many Commitments are delivering tangible outputs, of which the largest shares contribute to Target 3 Framework conditions for primary raw materials

This section focuses on outputs delivered by Commitments. **As many as 26 EIP-RM Commitments** out of the 47 respondents of the 2019 annual survey **achieved at least one output in 2019.** Seven Commitments who responded to the survey communicated that all the outputs had been achieved in 2018 and therefore there were no outputs in 2019.

Figure 9 presents an overview of **how these outputs in 2019 relate to the EIP targets**. Most commitments contributed to Target 3: Framework conditions for primary raw materials (34%), Target 4: Framework conditions for materials efficiency and waste management (22%), and Target 1: Innovative pilot actions (22%). The picture is different compared to the AMR 2018 where most of the commitments contributed to Target 4: Framework conditions for materials efficiency and waste management (27%), Target 3: Framework conditions for primary raw materials (22%), and Target 6: KIC (17%). Outputs related to Target 7: international co-operation and Target 2: Substitution remained relatively low. There was a decrease in the outputs from Target 5: knowledge base, from 16% in 2018 to 10% in 2019.

Figure 9: Contribution to the EIP targets by the outputs delivered by EIP-RM Commitments reported for 2019[29]



Source: JRC analysis

>> Commitments continued to achieve outputs in innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials

Most outputs from category innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials came from the production of new outputs in sub-categories **new technology/process/concept** and **other outputs**.

[29] The number of targets (here shown as %) is weighted by the number of targets quoted per RMC.

The Commitments that have produced relevant outputs in **new technological processes** are the followings:

- RMC MetGrow has developed various pre-treatment, metal extraction, metal recovery and residue valorization methods from laterites, jarosite, Cr-rich sludges, and Zn-rich sludges. Moreover, METGROW+ project has produced an online toolbox that gathered all the information from Metgrow decision support framework. The toolbox allows finding the best combination of processes for a selected low-grade resource based on certain environmental, techno-economic, and risk assessment criteria.
- As reported in AMR2018, RMC Blue Nodules has developed the nodule cracker tool for deep-sea mining application. This tool was designed and constructed in order to determine key mechanical properties of submerged and pressurized polymetallic nodules.
- In exploration technologies and data analysis methods, RMC NEXT has produced several key outputs such as a prototype for ground and aerial- measurement devices and mapping tool. RMC NEXT expected to produce a cost-effective, environmentally safe and potentially more socially accepted technology in exploration.
- In the field of C&DW (Construction and Demolition Waste), one of the main projects of RMC C&D-WRAM was the FISSAC[30] project. The project involved stakeholders at all levels of C&DW value chain to develop a methodology and software platform to facilitate information exchange that can support industrial symbiosis networks and replicate pilot schemes at local and regional levels. RMC C&D-WRAM developed a model of C&DW management for a circular supply chain. The model intended to integrate innovative solutions for a better recovery of raw materials. The RMC also published a demo of case studies in the Paperchain Project[31] to demonstrate the valorisation of the pulp and paper industry waste streams whose current fate is mainly landfilling.
- RMC SIMS developed an automated scheduling support and automatic production reporting system from unit operations to be implemented and used in production sites.

In the sub-category **new products**, the following RMCs succeeded in launching outputs:

- RMC SIMS produced, among others, the following mining technologies: a high precision localization system for underground mine applications, a charging robot that can charge a full tunnel face, and robotized unmanned aerial vehicles for inspection tasks in mining environments.
- In the field of secondary raw materials, RMC RUBBERTOMARKET developed a self-sustaining and market-driven tyre recycling sector that integrates within the European Circular Economy Strategy. This RMC generated a mixture of tyre rubber and plastic, reportedly to be usable for commercial outlets. It also developed products made of recycled rubber from end-of-life tyres.

Several other RMCs were involved in the **improvement of existing technologies**, such as:

- RMC Blue Nodules developed an automated and technologically sustainable deep-sea mining system, including the submerged technology and the mineral processing technology.
- During 2019, RMC RUBBERTOMARKET developed R&D projects to improve existing technologies in waste tyre treatment, such as optimization of the design conditions of rubberized bituminous mixtures that are manufactured by the dry process and the production of warm mix asphalt with crumb rubber from end-of-life tyres.
- RMC SIMS reported to have made improvement of technologies in the mining system. This commitment developed a novel blasting system, boundary

[30] Fostering Industrial Symbiosis for a Sustainable Resource Intensive Industry across the extended Construction Value Chain

[31] Paper Chain project https://www.paperchain.eu/

layer/material detection system, roof crack detection on moving machineries and generic Virtual Reality platform for mining operations.

The following RMCs have produced **new services** activities:

- RMC SIMS provided training modules for operators and mine workers as well as educational modules for students.
- RMC SmartExploration formed a joint commercial project among mining companies in the Nordic countries that are RMC partners. This RMC issued new license lease for geophysical system prototypes, mostly new instruments related to electromagnetic and seismic equipment, and includes airborne, UAV, surface-based, in-mine and downhole systems, as well as other aspects such as geological and geochemical target vectoring and generations.

Under the **Joint R&D category through pooling of competences/resources** category, the following RMCs communicated outputs from their activity:

- The consortium of RMC ITERAMS engaged competences from industry, universities, and member states. The main activity of RMC ITERAMS is developing methods for closing the water cycle and for geo-polymerization
- Similarly, RMC Blue Nodules obtained competences or resources from its project partners, composed by 14 leading industry and research partners from 9 countries in Europe.

In the **other output sub-category,**RMC RUBBERTOMARKET project partners have collaborated to prepare European proposals for the development of new applications for end-of-life tyres (ELT) materials. All partners also participated in the funding of ERASSTRI (European Risk Assessment Study on Synthetic Turf Rubber Infill), which runs from 2017-2020.

>> Several Commitments developed alternative solution for critical raw materials

In the sub-category **substitution** for critical raw materials:

- RMC CuBES[32] developed a substitution of critical raw materials notably vanadium in Redox Flow batteries.
- RMC RUBBERTOMARKET: The use of rubber granulates or powder from ELT in rubber composites (rubber matrix and thermoplastic elastomer) for the rubber industry can replace raw materials such as rubber and reinforcing fillers, both usually sourced from petrol or primary natural resources.

Under the sub-category **new product design**, RMC Blue Nodules published deliverables in the field of submerged technology, mineral processing technology, logistics, and ship-to-ship transfer.

>> Commitments published increasingly strategic documents supporting implementation measures

For the category Strategic document, the highest number of outputs comes from the sub-category **guidelines/reference document**, followed by **industry standard**. Most of the outputs from this category addressed Target 3: Framework conditions for primary raw materials and Target 4: Framework conditions for materials efficiency and waste management.

In the sub-category **guidelines/reference document**, The RMC RUBBERTOMARKET finalized several standards on recycled rubber and its application, such as:

[32] Copper Based Electrochemical Solutions

- A book about the experience concerning real works, the efficiency and improvements of certain features that crumb rubber from end-of-life tyres lends to bituminous mixtures
- A technical manual "Warm mix asphalt with crumb rubber from end-of-life tyres" aiming to provide the road sector with technical information to promote the application of warm mix asphalt technology with crumb rubber in full-scale projects.
- Sustainability White paper that outlined several models to support good practice in material recycling.

RMC Mineland published guidelines in mineral resource extraction and land-use, which are available on their project website.

In the sub-category **industry standard**, all partners of RMC RUBBERTOMARKET participated in the standardization committee of "Materials obtained from end-of-life tyres (ELT)". The scope of this technical committee is the standardization of the materials produced from end-of-life tyre treatment (e.g., cuts, shreds, chips, granulates, powders, steels, textiles). During the period 2018-2019 this RMC published several European EN standards and technical specifications related to the end-of-life tyre treatment. This Commitment intended to encourage the application of used tyres for different purposes and to help to explore new market opportunities.

In terms of sub-category **research agenda**, RMC EARTH2020[33] has foreseen the delivery of a Strategic Research and Innovation Agenda for Circular Economy at the end of September 2020. This Commitment worked on the development of flexible and modular combined metallurgy technologies adaptable to multiple End-of-Life (EoL) complex products, with focus on WEEE.

In the sub-category **methodology**, RMC WRING[34] formulated best practices and criteria for the individuation of wood management methodologies for designing circular products.

In the sub-category **labelling/certification**, SDAB as a project partner of RMC RUBBERTOMARKET, pre-launched the CERUB label, a sustainability label for responsibly recycled tyres. The label will support a wider use of recycled material in a variety of applications. CERUB is a co-operation between Sweden, Norway, Finland and the Netherlands, however, it aims to become a pan-European label.

>> Almost two thirds of Commitments conducted knowledge sharing/dissemination activities

In the category **knowledge sharing/dissemination of information and best practices**, most Commitments participated to an **event/workshop/conference.** Fewer commitments published **scientific publications**. The knowledge sharing activities that took place covered all EIP targets.

In the sub-category **event/workshop/conference**, the following RMCs were among the examples of those who were involved in organizing events, workshops, or conferences.

- RMC C&D WRAM with the FISSAC project organized the "Living labs FISSAC" in several sites in Europe. These living labs engage actors from the construction industry value chain to identify appropriate challenges related to industrial symbiosis in their regions. Moreover, RMC C&D WRAM also held several FISSAC webinars to communicate their projects. RMC EMD held EMD open days in September 2019, joined by 109 participants, mainly EU operations (and few sites

[33] The Environmentally sound Advanced Recycling Technologies for Hi Tech products: An innovative technology framework for the development of advanced recycling systems of critical and precious raw materials from hi-tech products.

[34] WRING: Wood woRking INdustry RecycliNG

in Brazil, USA and Russia). RMC EMD also organized 128 further activities across Europe, which covered the various sectors involved 68% of the activities and open site events related to the minerals sector; 13% to aggregate companies; 8% by mineral companies; 6% to the cement industry, and 6 % to other types of EMD partners. RMC EMD, together with RMC MIREU and EUMICON[35] co-organised the event 'Raw Materials meeting societal needs' in November 2019 in Brussels.

- RMC Mineland held its Final Conference and Clustering Event in November 2019. A pre-meeting was also held beforehand to share the project results and outcomes and discuss the progress and achievements made by Mineland.
- RMC MIREU organized several events, for example a high-level policy workshop on "Governance and Policy within Mining and Metallurgy Regions" in Spain in January 2019. Another example of the participation of RMC MIREU in event organization was the 3rd OECD Meeting of Mining Regions and Cities in Sweden in June 2019. The meeting included a special focus on the regional development in the Arctic and on enhancing the quality of life and well-being for regions with a specialization in mining.
- RMC NOWMOB arranged several practical and scientific dissemination conferences.
- RMC PolymetOre held a Clustering Conference organized by the INTMET project, "Fostering Innovation in the Iberian Pyrite Belt" in Seville in January 2019.
- The project partners of RMC RUBBERTOMARKET organized a congress on rubberized asphalt mixtures.
- RMC SIMS held an annual project conference in 2019.

In the sub-category **scientific publications**, the following RMCs delivered relevant outputs:

RMC MetGrow, RMC NOWMOB, RMC RUBBERTOMARKET and RMC Blue nodules, RMC RESET and RMC WeCARE published articles in scientific journals and conferences.

RMC Mineland and RMC Euminet developed outputs in the sub-category **Information infrastructure/data base (including harmonisation and improvement).**

- RMC Mineland published a database, which displays all the policies, case studies and best practices collected regarding land use planning. By the end of December 2019, this database became accessible on the project website[36].
- RMC Euminet published a report that describes the Data Management Plan (DMP) for the Mintell4EU project. The purpose of the plan is to ensure that research data generated in the projects will be findable, accessible, interoperable, and reusable (FAIR). This Commitment also published the Minerals Inventory Report, a report that describes the process of refining the Minerals Inventory database. Both reports are available at the project website[37].

Several RMCs, for example RMC Mud2metal, RMC Blue Nodules, RMC ENSQM, RMC MIREU, RMC PolymetOre, RMC NOWMOB, RMC Mineland, and RMC SIMS, conducted knowledge sharing and/or dissemination of information. There is a range of knowledge sharing activities, from launching a **website** to systematic exploitation via the EU Knowledge Base hosted by the EC Raw Material Information System developed by JRC**.**

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RMC NOWMOB, RMC MIREU, RMC Mud2metal communicated outputs in the sub-category **study/analysis**.

- RMC Mud2metal; as part of the EU research project RemovAL, the European Aluminium organised a workshop focusing on the EU regulatory framework

[35] European Mineral Resources Confederation, a joint platform of stakeholders from public authorities, the raw materials industry and science.

[36] The Minland project – Mineral resources in sustainable land-use planning – Database section https://www.minland.eu/database/

[37] Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe - Geoera project: see https://geoera.eu

addressing residues and slags from the metal industry. This workshop, held in November 2019 in Brussels, gathered more than 50 experts from the European commission, metal industries such as aluminium, steel, copper, and ferro-alloy industries, and from the RemovAL consortium. Experts discussed the opportunities and challenges encountered by the various metal sectors to identify more promising regulatory options for the future, especially for bauxite residues.

- RMC NOWMOB published up to 30 practical analysis reports and project papers in European and national forums, presentations and posters in dissemination conferences. The members of RMC NOWMOB also participated in consultancy and advisory works with industries.

RMC PolymetOre provided consultancy in metallurgical test-work for a private mining company while RMC WRING offered new circular approaches for SMEs aiming for higher quality of eco-sustainable wood-based products. Both Commitments' outputs belong to the sub-category **consultancy services.**

Several RMCs were involved in **education and training activities**:

- RMC Blue Nodules organized courses and lectures, for academic institutions and a private company.
- RMC EMD organized the annual European Minerals Day - Open Days (September 2019). The event was held with decision-makers to increase visibility and enhanced understanding about the essential role of mineral raw materials for an innovating, competitive and sustainable EU economy.
- RMC NOWMOB held several short courses, training events and published education and dissemination materials based on the related project achievements. White papers and policy briefs were formulated for decision makers. RMC NOWMOD also had an active participation and contribution to funding applications training for researchers (Innovawood, national funding and development bodies).
- RMC RUBBERTOMARKET held various relevant education and training activities, such as:
    - Participation in the safe pedestrian and bicycle pavement solution with recycled tyre rubber content part;
    - Financing of a PhD student under supervision of SDAB and RISE (The Swedish Research Institute);
    - With the aim of raising awareness among children and young people, publication and dissemination of the children's book "The Incredible Journey of Neuman Tikin".
    - Participation in a percussion performance that transforms waste (tires, plastic bottles) into musical instruments;
    - Involvement in the Ambientech Program, i.e., an educational portal for students in secondary education, high school and other training cycles;
    - Lectures on the activity of tyre recycling to provide a complete overview of the sector, in collaboration with the Autonomous University of Madrid (Spain) in the master's degree programme in Waste Management and Treatment
    - Supporting an annual scholarship in collaboration with the EFE agency for the training of young journalists in the environmental field.
- RMC SmartExploration received visits by students from Wits and a post-doc from Laurentian University;
- RMC WeCARE held a PhD course at Politecnico di Torino;
- RMC WRING provided technical content in the wood-furniture sector covering different fields, for example information on products, processes, technologies, and marketing.

Moreover, the following RMCs have been actively engaged in **stakeholder platform/institutionalized interaction/cooperation between different stakeholders, broader than the partners:**

- RMC Blue Nodules participated in the yearly International Seabed Authority (ISA) conference in Jamaica;

- In 2019, RMC ENSQM (European Network for Sustainable Quarrying and Mining) reported to NEEIP (Non-Energy Extractive Industry Panel) partners on the RMC activities;
- RMC MIREU collaborated with OECD Mining regions and cities project. RMC MIREU also organised the third Social License to Operate (SLO) workshop, at which international SLO Panel members attended;
- RMC Mineland: A stakeholders' network was established under the MinLand project. It is envisaged to be maintained after the project ends through the annual meetings of the EuroGeoSurveys Mineral Resources Expert Group;
- RMC NOWMOB established the Research, Technological Development and Innovation (RTDI). RTDI networks in different projects, for example in ROSEWOOD, WoodCircus, EFFORTE, SUSTREE. These networks cover all Triple Helix groups at European and national levels;
- RMC WeCARE: Participation in the PROMETIA association, an international non-profit association promoting innovation in mineral processing and extractive metallurgy for mining and recycling of raw materials.

>> Almost half of the Commitments were active in international cooperation

A number of Commitments engaged in international cooperation in various forms, for example international joint-collaboration projects, workshops, knowledge sharing, capacity building and education and training. Most of these Commitments participated in the **organisation of events, workshops, and/or conferences**. Several other Commitments were involved in the activities related to **knowledge sharing/dissemination of information and best practices**.

RMC Blue Nodules, RMC MetGrow, RMC MIREU, RMC MINSPIRE, RMC NEXT, RMC NOWMOB, RMC SmartExploration, RMC WeCARE participated at least at one international **event/workshop** in 2019.

Knowledge sharing/dissemination of information and best practices:

- RMC Blue Nodules held a dissemination event through Dutch National television and some further events;
- RMC MIREU communicated the achievements of the related projects by the publication of a number of public deliverables;
- RMC NOWMOB: Dissemination actions and good practices sharing in the research projects and between Commitment members and miscellaneous stakeholders;
- RMC SmartExploration reported to have conducted knowledge sharing/dissemination of information with companies such as DeBeer, Anglo, Rio, BHP;
- RMC SIMS presented the results of the SIMS project in 2019 at more than ten international and national conferences and seminars, for example at the Raw Materials Weeks in Belgium, the Sweden-Brasil Innovation week in Stockholm, the Blasting and explosives conference EFEE in Helsinki, and the International Conference "Mines of the Future" in Aachen, Germany;
- RMC WeCARE presented the related project results mainly by the publication of journal articles;
- RMC WRING continued the collaboration among partners to keep the knowledge spreading and dissemination.

Several Commitments participated in **joint collaboration projects**, such as:

- RMC MINSPIRE contributed to several international seminars/events/workshops held in 2018 and 2019;
- RMC NOWMOB was active in the RTDI collaborative project across RMC members and collaborators. The activities included planning, execution and dissemination, project meetings, project reporting and exchange of data and methodology;

- Several partners of RMC NEXT participated in 2019 in other joint collaboration projects, for example: H2020 MIREU, H2020 ORAMA, H2020 Minland, H2020 ENeRAG, H2020 INFACT; and EIT-Raw Material MinExTarget, UpDeep, MAP;
- RMS SmartExploration: In early 2020, RMC SmartExploration started a joint collaboration project in exploration technology with the INFACT[38] project.

Several Commitments were engaged in **capacity building** activities, for example:

- RMC NOWMOB participated in capacity building by starting investments in research infrastructure, hiring new RDI staff and building a long-term RTDI collaboration between academia, research institutes and commercial sectors;
- Other Commitments conducted capacity building through their participation in several international events/workshops, for example RMC SmartExploration's participation in workshops at SAGA-Durban, at KEGS-Canada, and during an Exploitation tour in Canada and Australia. RMC MINSPIRE was involved in 2018-2019 in capacity building activities by its participation in various workshops on the Raw Materials Global Value Chain in Mexico.

Several Commitments conducted **education and training activities**, such as:

- RMC SmartExploration: Wits University, South Africa, and Laurantian University;
- RMC NOWMOB organized short courses at the member of the Commitment and Innovawood network's countries;
- RMC Blue Nodules organized several courses, such as the Royal IHC internal Offshore course, the Royal IHC General Dredging Course, the TU Delft Deep Sea Mining Geoscience lecture, and the HBO Avans Deep Sea Mining lecture;
- RMC Intermin held a conference in Ecuador in October 2019. The conference consisted of a series of educational activities, such as a visit to the training facilities and laboratories of the Faculty of Engineering of Earth Sciences of the High Polytechnics School of the Litoral (ESPOL), a visit to some artisanal and small-scale mines, and a visit to a processing plant.

3.3.2 Technology Readiness Level

To specify the maturity of technologies developed in the course of Commitments, or their related projects, the Technology Readiness Level (TRL) method is used. This basically allows discussion and comparison of technical maturity across different types of technologies, as they are developed in the various technology-related areas of the EIP-RM. The universal usage of TRL in EU policy was implemented by the H2020 framework program[39]. In this context, the Commitments reported the TRL of their outputs as a means for indicating the maturity of a technology they developed. Given the scope of the measure, it was applied in the AMR Survey for two selected output categories, i.e. "Innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials" and "Alternative solution for Critical Raw Materials". The Commitments self-assessed the TRL already achieved at the time of filling the survey (mid 2020) according to the nine levels of TRL:

- TRL 1 – Basic principles observed
- TRL 2 – Technology concept formulated
- TRL 3 – Experimental proof of concept
- TRL 4 – Technology validated in lab
- TRL 5 – Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – System prototype demonstration in operational environment
- TRL 8 – System complete and qualified

[38] The Innovative, Non-invasive and Fully Acceptable Exploration Technologies project

[39] Technology readiness levels (TRL). Extract from Part 19 - Commission Decision C(2014)4995

- TRL 9 – Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

The bigger part of the responses on TRL related to the to the category Innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials, which comprise new products/technology/processes.

New Product in innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials

- RMC SIMS developed several new products in the field of mining exploration, claimed to have contributed to the improvements of existing technologies. The products are the following:
    - Sustainable battery powered underground mining machinery;
    - A virtual mine 3D demonstrator presented to public including student in schools at all levels;
    - High precision localisation system based on UWB infrastructure and sensor data fusion for situational and safety awareness in underground mining application;
    - Cost effective positioning enabling mass localisation;
    - Charging robot that can charge a full tunnel face;
    - Robotized UAV.

  RMC-SIMS reported that the mentioned outputs have reached TRL 7.
- RMC RUBBERTOMARKET has developed a tyre rubber and plastic mixture, manufactured with 70% of tyre and just 30% of plastic. This mixture was shown to be perfectly usable for commercial outlets. The technological readiness level of this new product was TRL 7. Other outputs from this RMC contributed to the improvements of existing technologies in the treatment and valorisation of waste tyres. During 2018-2019, the R&D projects of RMC RUBBERTOMARKET developed an optimization of the design conditions of rubberized bituminous mixtures manufactured by the dry process and warm mix asphalt with crumb rubber from end-of-life tyres, both validated in lab (TRL 4).
- RMC SmartExploration produced and validated five prototypes in geophysical systems, achieving TRL level 6. The prototypes were the following: Unmanned Aerial Vehicle – UAV, Helicopter-based deep penetrating TEM – HTEM, Electric Seismic Source - e-vib, GPS time-system, and Slimhole modular-based digital seismic-magnetic-temperature system.

New technology/process/concept in innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials

- RMC MetGrow developed and tested a process of using of leach residues for the residue valorisation as supplementary cementitious materials (SCM) and the production of alkali activated inorganic polymers (AAIP), which may be used as binders in the construction sector or construction materials with various beneficial properties. Thus, this output corresponds to technology readiness level TRL 5.
- RMC Blue Nodules developed submerged technology, mineral processing technology, logistics, and ship-to-ship transfer, reported to be at TRL 5 or TRL 6. The outputs of RMC Blue Nodules belonged to the sub-category new technology/process/concept/product design as well as improvement of existing technologies.

- RMC NEXT has developed several instruments for mining exploration that have been validated in relevant environment (TRL 5), among them were the prototype of "Ground based electromagnetic measurement device and orthogonal vector magnetic system, field electrochemical probe prototype, Ground and aerial hybrid electromagnetic measurement device.
- RMC C&D-WRAM developed FISSAC methodology to facilitate information exchanges that can support industrial symbiosis networks and replicate pilot schemes at local and regional levels. RMC C&D-WRAM communicated that this methodology was at TRL 7.

In the output belonging to the category "Alternative solution for Critical Raw Materials", RMC CuBES, who worked on an alternative solution for Critical Raw Materials developed material substitution (notably vanadium) in Redox Flow batteries. The technological readiness level of this solution was TRL 3.

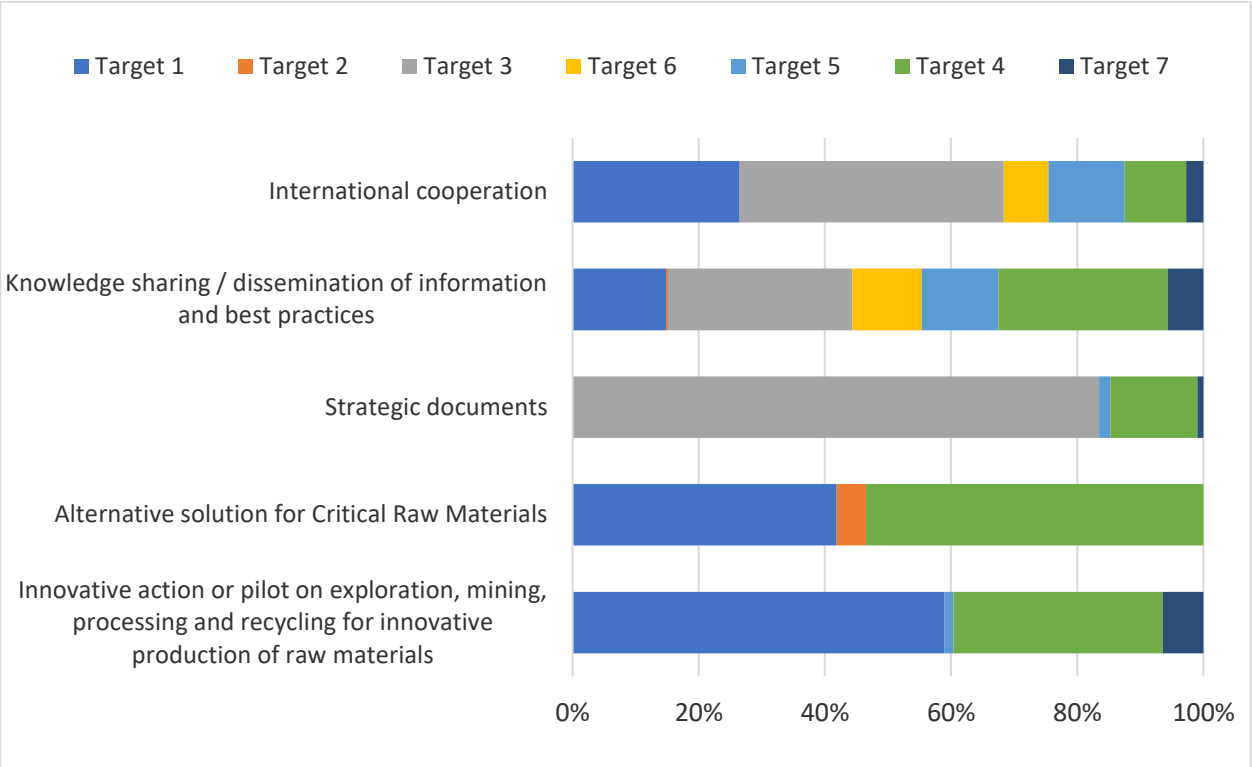
Additional material

Most of the outputs belonging to international cooperation, knowledge sharing/dissemination of information and best practices and strategic document were allocated to Target 3 Framework conditions for primary raw materials. Most of the outputs were in the form of organisation of event/workshop/conference.

The outputs in the category alternative solution for critical raw materials were dedicated to Target 4 Enhanced efficiency in material use and in waste prevention, re-use and recycling, with a specific focus on flows that are common to many product life-cycles and have potentially negative impact on the environment; and identified opportunities and new ideas for innovative raw materials and products with market potential, mainly by material substitution sub-category.

The outputs from category innovative action or pilot on exploration, mining, processing and recycling for innovative production of raw materials mostly aimed at Target 1 Up to 10 innovative pilot actions on exploration, mining, processing, and recycling for innovative production of raw materials; coming from the production of new technology/process/concept.

Figure 1: Target of Commitments by Category reported in the AMR 2019 survey[40]



3.4 Future Plans for 2019-2020

The Commitments have various future plans corresponding to the differing degrees of commitment maturity. Many of the Commitments have been entering or executing their implementation phase, accompanied by coordination or dissemination activities. The most common activities of the Commitments include the execution of funded projects, continuous support of commitment ideas and goals (with or without relation to funded projects), participation in thematic discourse and discussions, dissemination, and search for new funding opportunities, while research and development in the narrower sense is diminishing.

>> Funding opportunities

To sustain their commitment activities, the following RMCs intend to complete and submit funding applications in 2020 and/or 2021:

- at EU level (H2020): RMCs CuBES, RUBB-ENDURE, PolymetOre.

RMC Euminet can be further developed as new data and knowledge about EU raw materials is generated. It is planned to extend RMC Euminet within Horizon Europe and a proposed European Partnership on a Geological Service for Europe (EP-GSE) that is currently under consideration. Alternatively, it may be implemented as an expanded CSA. The funding as an EP-GSE would allow this RMC to continue developing until at least 2027.

RMC RUBB-ENDURE will continue its efforts to apply for funding, as it considers certain challenges regarding technology require concerted efforts to reach to reach a long-term

[40] Numbers correspond to responses to the AMR 2019 Survey, however, some commitments may have reported at this survey in addition for earlier year(s).

satisfactory level of high material valuation and minimal material functionality loss. Devulcanization is considered of key importance in this respect. The present high dependency on virgin rubber for tyres must be sought to be broken requiring fundamental research, in order to allow the European Tyre manufacturers to be world leaders, which prioritise sustainability high on the agenda.

RMC CuBES interacts with project CuBER, amongst others, to explore new funding avenues for the concepts developed at CuBES.

>> *Execution of funded projects*

The implementation of commitments depends on the availability of funding of projects related to these commitments. On this basis, the execution of the following projects has been planned for 2020 and 2021.

The implementation of **RMC Euminet** started in 2019 by several projects. In 2020 and 2021, this implementation will continue. The objectives of **RMC Euminet** are pursued by the *GeoERA project* (theme on raw materials) via the projects *FRAME*, *Mintell4EU*, *MINDeSEA*, and *EuroLithos*.

RMC Mud2Metal is developing large scale recycling options for Bauxite Residues produced in the alumina industry. Until end of 2021, the pilot scale demonstration in projects like *SCALE*, *ENSUREAL* and *REMOVAL* will verify lab results and provide technoeconomic data to evaluate the feasibility of the novel processing routes. The various technologies tested aim at direct recovery of critical raw materials (scandium in *SCALE*) and base metals (alumina in *ENSUREAL*, iron alloys in *REMOVAL*), as well as at the use of bauxite residues as raw material in the construction sector for existing or novel products (*REMOVAL*).

RMC INTERMIN aims to complete the INTERMIN Online Educational platform for the Network with a portal user manual, prepare the Sustainability Plan of the international Network, and the Action Plan to close skill gaps and enhance existing education and training programmes. Further, its plans include the elaboration of the joint training programmes for the raw materials sector, the signature of Cooperation agreements, the preparation of various communication materials and a Networking Map, and an enquire to push and populate the training centre database in the *INTERMIN* portal.

RMC Blue Nodules is implemented by the Horizon2020 project of the same name. The project develops a new highly-automated and technologically sustainable deep sea mining system for the harvesting and in-situ processing (sediment separation and sizing) and onboard process (dewatering and conditioning) of polymetallic nodules from the sea floor, with minimum environmental impacts (http://www.blue-nodules.eu/vision-and-objectives). The Commitment is extended by the project BLUE Harvesting (https://blueharvesting-project.eu), which advances the technology of a hydraulic nodule collectors, while minimizing its environmental footprint. The current activities are concluding the results of the exploration cruises in EU waters in 2018 and 2019. A test mining vehicle has been tested. The outcome of these tests gave input to further deliverables. Currently the report is being prepared for delivery before the end of the project in 2020 Several RMCs including ITERAMS, and NEXT, continue the execution the related research activities. RMC ITERAMS is implemented by the ITERAMS project (www.iterams.eu), which focuses on water recycling and geopolymerization validations (pilots) in the mine sites. The project runs until November 2020.

RMC PolymetOre ic closely related to the *Poly Metallurgical Refinery (PMR)* Project, the most important mining-metallurgical project under development in the Iberian Pyrite Belt, which is led by Cobre Las Cruces. *PMR* is still pending to receive legal permits from the authorities. Once permitted, the estimated start time of the project is mid-2021. *PMR* is described as a pioneer and thus unique in the world, leading the mine-to-metal concept to recover in situ the metals Cu, Zn, Pb and Ag as refined metals or added-value metals. In-situ leaching applies fluid-based metal dissolution on intact ore bodies. For the first time worldwide, PMR will install a poly-metallurgical refinery treating polymetallic bulk

concentrates. The Commitment shall support those new mining-metallurgical projects and disseminate their outcomes.

RMC C&D-WRAM continues to execute its activities within the projects *FISSAC*, *PAPERCHAIN*, *VEEP*, and *RE4*, to develop improved recovering and recycling solutions towards near-zero waste.

During 2020 the focus of **RMC NOWMOB** will be to initiate and launch RTDI consortia and project planning on roundwood mobilization, forest sector resilience, biodiversification, value chains, value add and digitalization (H2020, Horizon Europe, Interreg Europe and other regional programs).

RMC WRING will evolve definitions of best practices about reuse, recovery and recycling of wood at EU level, support the implementation of circular economy solutions for wood, and contribute to the identification of new business model based on circular approaches for furniture SMEs (i.e., leasing model for furniture). These activities will continue at least until the end of 2021 by the individual partners and be extended beyond in part in the framework of H2020 projects *WoodCircus* and *Ecobulk*, as well as within the innovation network *InnovaWood*.

>> *Thematic Discourse and Discussions*

Almost all the **network and co-ordination Commitments** plan to continue a range of activities through 2019, for example MIREU, NOWMOB, and PolymetOre. RMC EMDwill maintain the synergies created with RMC ENSQM and RMC MIREU. It will continue the organisation of the European Minerals Days but foresees EMD events also in other regions. For 2020, IMA-NA has planned to organise open days outside Europe.

A key objective of **RMC MIREU** stays to establish a network supporting regions to share knowledge and experiences when facing the challenges to establish and maintain an extractive industry. The MIREU H2020 project determines the framework conditions that are either conductive or hampering mining and metallurgical development in Europe, by reviewing the regulatory and policy conditions and adding suggestions for improvement and assessing the skill requirements and investment conditions. MIREU plans a series of stakeholder workshops in 2020 targeted to various aspects of the work programme to engage the regions in the implementation of the project. The feedback from the regions is used to formulate policy-guiding documents as deliverables of the MIREU project. The final meeting of the MIREU project in autumn 2020 is also the opening meeting of the Council of Mining and Metallurgy Regions of Europe (CoMMER).

RMC EARTH 2020 is going to continue to strengthen the integration of raw materials related initiatives to support the Circular Economy, including an extension of the scope to circular business models, and to develop activities related to Blue Economy (Bio Blue Technologies). It also intends to reinforce its activities on batteries (Battery Alliance).

RMC ENSQM discusses internally the extension of the Commitment beyond December 2020.

RMC NOWMOB will foster an university-industry-government interaction (so-called triple helix discussion), planning, scenario and policy making platforms for enhanced wood mobilization and innovative utilization in bio-circular economy. It will contribute actions for defining the target areas of Horizon Europe and the European Green Deal at the European Commission as well as contribute to the European Forest Strategy 2021 and the European Biodiversity Strategy 2030. NOWMOB members support and realize also national and regional project planning and adoption of good practices from different countries and regions. NOWMOB members participate actively to discussions with EC in order to bring out objective research-based arguments to the decision-making process from the viewpoint of wood-based industries and wood mobilization. At RMC NOWMOB, federation members organize industry-driven conferences as well as public dissemination and promotion events. RDI organisations prepare White papers and Policy briefs to impact EU and national decision makers on economic, rural, regulation, public support and research policies and incentives.

RMC CuBES has supported the *CuBER* project[41] yet. This shall be maintained and intensified by regular bi-monthly information exchange between participants. CuBES shall interact with *CuBER*, promoting its findings, and integrating its results into CuBES activities to allow their further development.

>> Dissemination and Promotion

The Commitments will use various events in 2020 and 2021 to strengthen the cooperation and dissemination.

RMC MetGrow has been foreseen to end when the *METGROW+* project finishes, in the beginning of 2020. *METGROW+* has contributed to the Commitment with several pilot campaigns. The main outcome of the project, the free public version of the METGROW+ toolbox (https://app.metgrowplus.eu), is developed and published in 2020.

For **RMC ENSQM**, advanced dissemination is also foreseen by further upgrading and updating the *ENSQM* project website. Moreover, a workshop in Romania has been foreseen in late 2020/early 2021.

RMC WRING will disseminate hitherto results and foster the assessment of public and industrial needs in the field of wood processing and recycling. To support this, it will organize key events, such as workshops, and focus groups, and involve actively European stakeholders through communication and dissemination activities.

To build increased trust and social acceptance for the mining industry, **RMC SIMS** will be communicating and visualizing the SIMS demonstration activities. To this end, the transparency of Sustainable Intelligent Mining Systems will be increased[42].

RMC RUBBERTOMARKET partners will attend to different conferences and workshops to share the best practices and disseminate the results obtained in their projects. Activities related to circular economy and the reuse of materials derived from ELT will be carried out. In addition, partners will continue working on activities related to the acceptance of the end-of-waste criteria for this kind of materials.

>> Research and Development

RMC PolymetOre plans to promote the application of developed technologies within EU projects, in particular it will continue to support the new Poly Metallic Refinery Project from Cobre Las Cruces, which is expected to extend its life of mine beyond 2030.

RMC NEXT is further advancing and consolidating various technologies and techniques related to the exploration and the analysis of diverse mineral deposit types. This comprises the development of a new lithogeochemical exploration technology applicable on ore deposits of critical metals. Further, the project develops hardware (drones) and software for modern drone exploration surveys. Amongst others, RMC NEXT shall also design a practical NEXT SLE Toolkit for exploration companies.

RMC SmartExploration intends to advance innovative mineral exploration solutions by an integrated approach. This comprises the use of geophysics methods, the development of prototypes as well as software. The Commitment was extended by one extra year for follow-up and life-beyond activities.

RMC RUBBERTOMARKET partners will participate in different R&D projects with the aim of developing new applications for materials from End-of-Life Tires (ELT). Particular effort will be put into specific projects and publications aimed at strengthening and demonstrating the advantages of the use of ELT-derived rubber granulate as filler for artificial turf in response to the potential threat of ECHA's restriction on microplastics intentionally added to products. Work will continue on Standardization (CEN/TC 366) to encourage the quality

[41] https://cordis.europa.eu/project/id/875605/es

[42] https://www.simsmining.eu/work-packages/

of materials from ELT. This includes the publication of reference documents and guidelines to promote the use of materials from ELT in different applications.

Annex 1. Number of Raw Material Commitments contributing to each Action Area[43]

Pillar	SIP Action Area	Coverage
Technology	I.1 Improving R&D&I coordination in the EU	26
	I.2: Exploration	14
	I.3: Innovative extraction of raw materials	30
	I.4: Processing and refining of raw materials	25
	I.5: Recycling raw materials from products, buildings	27
	I.6: Materials for green technologies	5
	I.7: Materials for electronic devices	3
	I.8: Materials under extreme conditions	6
	I.9: Applications using materials in large quantities	4
Non-Technology	II.1: Minerals Policy Framework	40
	II.2: Access to Mineral Potential in the EU	18
	II.3: Public Awareness, Acceptance and Trust	23
	II.4: Product design/optimised use/increased recycling	12
	II.5: Optimised waste flows for increased recycling	18
	II.6: Prevention of illegal shipments of waste	4
	II.7: Optimised material recovery	22
	II.8: EU Raw Materials Knowledge Base	17
	II.9: Possible EIT Knowledge & Innovation Community	4
	II.10: Optimised materials flows along value chains	22
International Cooperation	III.1: Technology	23
	III.2: Global Raw Materials Governance / Dialogues	5
	III.3: Health, Safety and Environment	12
	III.4: Skills, Education and Knowledge	14
	III.5: Investment activities	4

Source: JRC analysis

[43] This table summarises the results from the AMR Surveys 2015 to 2019. The colour coding relates to the coverage of the Action Areas divided into 3 tiers, from high coverage (dark green) to low coverage (light green). The table is not altered since the AMR2017 because no Commitments reported at the AMR2018 Survey or the AMR2019 Survey that did not report earlier.

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