



## D7.5 – Interim report on the stakeholder platform activities



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## Executive Summary

The main objective of the activities presented in this report is to engage stakeholders to gather useful input for the development of policy recommendations related to Critical Raw Materials (CRM) and their use in the photovoltaic (PV) and battery industries.

The activities carried out so far include the organisation of two stakeholder workshops and the promotion of an online questionnaire. Two workshops were organized: 1) “Circular Solutions in the PV Industry” and 2) “Securing CRMs for the PV and Battery Industry”, they discussed challenges and opportunities related to circularity, sustainable exploitation, and deficiencies of supply chains. The online questionnaire gathered specific input on the sustainable exploitation of silicon in the PV value chain.

The main preliminary results from these activities highlight Europe's dependence on CRM imports, the challenges for domestic production (high energy costs, complex permits), and the crucial role of circularity and recycling for independence and resilience. The report also emphasises the need for rapid implementation of existing policies and the development of strategies that enhance end-of-life materials and the use of alternative materials.

RESiLEX is finalising an online policy platform to facilitate stakeholder engagement and facilitate the spreading of valuable knowledge. In the next year of activities, the project will continue stakeholder engagement, promoting the platform, organising a third workshop, and publishing RESiLEX's final policy recommendations. This report provides a summary of the activities carried out to date, while the full results are expected in the final report (D7.6).

## Introduction

This document provides a first overview of specific activities carried out by RESILEX partners in the context of WP7, specifically dealing with stakeholder engagement and policy aspects.

Starting in M12, WP7 partners have been active in reaching out to stakeholders of various kinds through the organization of several activities, which will be described in the subsequent chapters. The aim of these engagement activities is to gather the widest and most detailed set of information and inputs that can help RESILEX partners to deliver, towards the end of the project, to draft a series of policy recommendations regarding the sourcing, exploitation and use of Critical Raw Materials and their application in the PV and battery industry.

At the time of writing this report, one year of activities is left to the project, in this timeframe, the bulk of the results will be available, and this will also allow partners to organize new activities encompassing the stakeholder engagement aspects as well. As outlined in the second chapter, activities carried out so far have allowed the project to gather relevant external inputs that we are condensed in this deliverable. The final version of this Deliverable (D7.6) due at the end of the project, will include the outcomes of all future activities, this will constitute the bedrock of the policy recommendations that shall be published in the final months of the project.

The recommendations will take the shape of a position paper, published on the RESILEX website and shared across all the project's online and physical channels. The final chapter of this document includes information about the setting of the online page supporting the activities of the stakeholder platform developed by RESILEX. This is also followed by a prospect of future activities to implemented in the next 12 months from the submission of this deliverable.

## Activities performed

In this chapter, the activities carried out until M36 and their related outputs and takeaways are presented. Essentially, RESILEX partners carried out two stakeholder events and one online survey, which are presented below.

### 1. Workshop “Circular solutions in the PV industry”

On the 23rd of May 2024, RESILEX and the EVERPV project organized a highly participatory workshop in Brussels. Several speakers discussed the challenges and opportunities for advancing circular technologies and value chains relevant for the PV industry.



*Figure 1 Group picture of the workshop in 2024*

#### Main takeaways of the workshop

**Stakeholder engagement:** engaging the right stakeholders is crucial to bridge the gap between research and industry, and to identify synergies across sectors. This is essential due to the limited number of companies in Europe capable of taking recovered materials, especially Silicon.

**Cost and profitability:** the high costs of the recycling process, managing small quantities of certain materials (Indium and Gallium), and ensuring sufficient waste flows need to be addressed, to enhance the sector’s profitability.

Standardisation and policy: standardisation should be implemented at multiple stages, including with eco-design rules to make it easier to recycle PV modules and exclude certain materials, such as fluoropolymers. Recycling processes across the industry should be harmonised. Policy support can help increase the sustainability of the PV industry.

## Panel discussion on Critical Raw Materials and PV circularity

### Speakers:

Nouha Gazbour, PV Sustainability Manager, Commissariat à l'énergie atomique et aux énergies alternatives (CEA)

Francisco J. Luque, Senior Project Manager, Iberian Sustainable Mining Cluster

Emma Dominici, Policy Advisor on Supply Chains, SolarPower Europe

The event started with input presentations from the speakers. Nouha Gazbour, from CEA, presented the EVERPV project, its expected outcomes, objectives, added value and the different technologies being developed. Francisco J. Luque, coordinator of the RESILEX project, presented the project's objectives and progresses, especially focusing on silicon recycling.

Emma Dominici from SolarPower Europe delivered a comprehensive overview of the Critical Raw Materials Act, emphasizing its practical implementation and relevance for the solar sector. She delved into the topic of recycling, discussing EU targets, strategic projects and the role of polysilicon in the PV industry.

## Workshop discussions

Workshop attendees were divided into groups to discuss how the projects can contribute to EU policy objectives. The audience was divided in 3 topical groups: (1) scaling up the technology, (2) closed loop recycling (within the PV industry), (3) open loop recycling (with other industries).

### Topic 1 Scaling up the technology

#### Discussion questions:

- What are the challenges in scaling up the technologies developed in EVERPV and ReSiLex and other EU-funded projects?

- How to ensure synergies between different HE-funded projects?

### *Economic challenges*

The lack of incentives for upcycling is diminishing the sector's profitability and introducing potential risks. Engaging with the right stakeholders and identifying synergies between industries are crucial steps. Implementing a targeted tax on downcycling could enhance sector profitability, provided the secondary materials are of high quality.

Upscaling technologies developed in Horizon Europe projects requires highly skilled employees. Establishing specific education programmes would help address this need.

### *Technological challenges*

Several technical aspects need to be addressed, notably regarding specific components, such as backsheet. The creation of a "material passport" would contribute to solving this issue. The lack of standard for PV panel design is another challenge. Though financing, banks can introduce standards.

Legal and regulatory challenges.

Collection rules for e-waste are not the same in each EU Member State. Unclear definitions and restrictive rules for the circulation of waste to research purposes is another challenge to test and develop recycling technologies within EU-funded projects.

Developing recycling processes for technologies which are not yet on the market is another challenge, as PV technology is evolving rapidly. Excluding certain materials with eco-design rules would contribute to scaling up technologies developed at R&I project level.

## Topic 2: Closed loop recycling (within the PV industry)

Discussion questions:

- What are the challenges to using recovered materials in the PV industry ?
- How to ensure the use of recovered materials in the PV industry?

### *Material challenges*

Reaching high levels of purity with the current recycling processes is challenging, especially for Si. Recycled materials might also have low levels of performance. Damaged materials also pose a challenge for recycling. Especially for glass damaged during handling. Material degradation, notably of polymers, is another challenge. Some materials are challenging to recover, especially fluoropolymers.

The complexity of the PV supply chain is a challenge for closed-loop recycling. Another challenge is the fact that a low number of companies are available to take back the material in Europe, with little manufacturers present on the continent. Other challenges.

Another challenge is the high cost associated with reuse and recycling, compounded by the lack of harmonisation of recycling processes at the EU level. The high carbon footprint of recycling processes poses a significant issue. The rapid pace of innovation in the PV sector means that recycling processes must continually adapt to evolving technologies.

### *Opportunities*

Standardization and robust legal frameworks are crucial for enabling the closed-loop recycling of PV systems. Standardization efforts should include comprehensive data access to facilitate efficient recycling processes.

Implementing incentives and deterrent measures can significantly enhance recycling efforts. For instance, adopting a polluter-pays system with landfill fees can discourage waste disposal and promote recycling. Additionally, creating incentives for on-site recycling facilities can further encourage sustainable practices within the industry. Increasing public awareness of the PV industry's efforts to reduce its environmental footprint is essential. Highlighting and supporting recycling initiatives will increase social acceptance and support for PV.

Optimizing recycling processes will contribute to the domestic sourcing of secondary materials in Europe, reducing dependency on external sources and promoting a circular economy. Recycling initiatives should also target niche markets beyond standard PV systems to ensure comprehensive and effective recycling solutions across the entire industry.

Topic 3: Open loop recycling (with other industries)

Discussion questions:

- What are the challenges to using recovered materials from PV in other industries?
- How to ensure the use of recovered materials from PV in other industries?

### *Challenges per materials*

- Challenges for Si applications: purity. To re-use the recovered Si in batteries, the Si needs to be 99.8% pure. Metal industries require less purity of Si, can use alloy AlSi. Another challenge is the fact that a low number of companies are available to take back the material in Europe and the amount of recovered material is still low. A solution would be to upscale the technologies developed in R&I projects and bridge the R&I and industrial upscaling gap through pilots and investments.
- Indium and Gallium: too small quantities in PV.
- Glass: presence of antimony in PV glass not compatible with the flat glass process. Alternative use of recovered glass can be found in road applications, however this will not represent a viable output in the future due to a too high quantity of glass. The EVERPV project is working on defining the maximum acceptable level of antimony for the recovered glass to be reused in flat glass application. A regulatory solution and a change of mind of consumers would allow for glass and other recovered materials to be re-used.
- Backsheet: lack of output.
- Cables, junction box and metals do not represent an issue for open loop recycling.
- Overall, using less components in PV panels would make them easier to recycle. Research should promote eco-conception of panels to be put in place at policy level.

### *R&I and industry gap.*

- A significant challenge is the lack of connection with industry, which hinders the identification of customers for newly developed technologies and recovered materials. Additionally, finding investors is challenging due to the extended timelines for return on investment.
- Another issue is the absence of a coherent project pipeline across various European Commission funding programs, which results in missed opportunities for project exploitation once initial funding phases are completed. This gap

prevents continuous development and commercialisation of innovative solutions, stalling progress and economic benefits.

## 2. Workshop “Securing CRMs for the PV and battery industry”



Figure 2 A snapshot of the venue during the workshop in 2025

On the 30th of April 2025, the RESILEX project organized a panel discussion in Brussels to discuss a series of topics relevant to the future of Europe. Key stakeholders were invited to engage in an active discussion on the sustainable exploitation and supply of Critical Raw Materials (CRMs) for the PV and battery industries.

Setting the stage, high-level introduction

Roman Stiftner from the European Raw Materials platform – EUMICON, set the foundation for the discussion by touching very critical points.

It was emphasized that Europe’s green transition hinges on critical raw materials like lithium and rare earths, nearly all of which are imported, often from single, politically sensitive sources, and that global demand will increase significantly (e.g., x12 for Lithium, x6 for Rare Earths). Despite the geological availability of raw materials, processing capacity in Europe is scarce and the outsourcing of mining, refining, and recycling has created a strategic vulnerability, leaving the EU dependent on countries with lower environmental and labor standards.

The Critical Raw Materials Act (CRM Act) is a step forward, setting 2030 targets and identifying strategic projects, but lacks the capital and speed needed to compete globally. One goal is for 10% of raw materials to come from European mining, but this faces practical difficulties, particularly due to bottlenecks in permitting that can take up to 10 years.

Europe must adopt a three-pronged strategy: responsibly mine locally, build trusted international supply partnerships, and treat recycling as a core industrial asset. Then the following points were also listed:

- Balancing security and sustainability is crucial.
- The European mining industry is committed to sustainability and strict environmental rules.
- Energy is a crucial issue, as metal industries are energy-intensive and costs in Europe are high. Therefore, very urgent measures to provide cheap energy are largely needed by the industry.
- Policy must now translate into action, with faster permitting, real investment, and alignment across industry, government, and research to secure Europe's clean-tech future.

#### Panel 1: Building resilient CRM supply chains for the PV and battery industries



Figure 3 picture of Panel 1

This panel, moderated by Claire Morin from SolarPower Europe, included speakers such as Pia Alina Lange (Trina Solar), Roman Stiftnner (EUMICON), and Kinga Timaru-Kast (Recharge). Topics covered included the diversification and securing of CRM supplies, geopolitical risk management, and policy measures.

Challenges in supply chains were discussed. For raw materials production taking place in Europe, the main urgencies are energy prices, regulation (permits), financing, and trade barriers. Kinga Timaru-Kast commented that for batteries, there are challenges related to the geographical concentration of extraction (Africa, South America, Australia) and processing (China).

The facilitation of permits is viewed positively but requires concrete implementation. Diversification of supplies, both primary and secondary, is considered fundamental. In the solar sector, Pia Alina Lange underlined that the focus is on “strategic” materials (not necessarily scarce), and costs are a key factor when considering primary or secondary sources given the lower costs for non-scarce materials.

Corporate sustainability for PV is reinforced by consumer expectations and regulatory aspects; carbon footprint is a good indicator. On circularity, European companies face competitiveness issues, especially with China, which has high recycled content due to available waste volumes. Trina Solar has developed fully recycled PV modules, although obtaining recycled content is not easy given the long lifetime of solar modules.

Roman Stieftner added that the issue of materials “dispersion” outside of Europe emerged strongly. A lot of scrap leaves the EU. Keeping materials in Europe is considered fundamental for independence and resilience. The idea of banning exports of scrap materials was suggested as a measure to tackle this aspect.

To prevent material leakage, a quality definition for end-of-life waste is also considered important. Competing with China on costs is extremely difficult, but Europe can compete on innovation and sustainability criteria. To unlock needed investments, local content requirements (like “Made in EU”) are important to ensure investment in Europe.

Following a question about the actual permitting facilitation granted by the CRM act, EUMICON commented that a lot of projects are moving on and an overall evaluation is not yet possible, however, in some occasions, there are conflicts arising between EU, National and Regional legislation that intervene.

## Panel 2: Scaling up circularity solutions for the PV and batteries industry



Figure 4 picture of Panel 2

Moderated by Giulio Poggiaroni from ETA Florence, this panel explored advancements in recycling and recovery techniques, reducing reliance on extraction, and policies supporting circularity. Speakers included Hamid Oubaha (University of Liege), Rana Pant (European Commission), Pierre Fiasse (Groupe Comet), and Manfred Spiesberger (Centre for Social Innovation-ZSI).

The discussion opened with Rana Pant referencing to the CRM Act and especially the Batteries Regulation, which covers the entire lifecycle, including end-of-life and recycled content. The related draft Delegated Act concerning recycled content is under scrutiny, seeking a balance between ambitious targets and methodology.

For end-of-life PV panels (EoL PV), a large quantity of material is expected in the coming years. The main challenge is not so much the quantity of material to manage

(as this will improve the profitability), but the purification of recovered materials. Purification is key for Recycling and recycling contributes to EU independence.

Shredding technology is widely used and capable of handling large quantities, with profitability within reach. Other technologies like delamination, for example, that of the PHOTORAMA project which uses water jets and chemical treatments, are not yet as mature as shredding. Still, these are certainly very promising, as they allow for recovery of high-quality and high purity secondary raw materials (e.g. Si, Ag) which was recognized by the EUSEW Innovation Award 2024, commented Manfred Spiesberger.

Back on purification, Pierre Fiasse noted that glass in Chinese PV panels contains antimony which requires a special treatment. A list of materials to be in ecodesign could help in recycling.

For batteries, collection and cross-border shipments inside the EU represent a challenge, with administrative burdens, thus making more difficult to reach targets on recycled content. On this matter, it is important to prevent EV batteries from leaving the EU to be able to recover the materials within them.

Hamid Oubaha commented that valorizing end-of-life (EoL) products, such as PV panels and lithium-ion batteries (LIBs), is fundamental for establishing a domestic supply chain for strategic and critical raw materials. Integrating these recovered materials into new devices offers a promising and sustainable pathway for upcycling and reducing reliance on imported materials.

He explained that the RESiLEX Project, is focusing on the recovery and recycling of silicon as strategic material for the PV sector. In other hand, silicon is viewed as a valuable resource to substitute graphite anode materials in LIBs. Hamid OUBAHA provides details on how RESiLEX Project is integrating recycled Silicon from EoL PV Panels into a LIBs as anode active materials.

Finally, He raised the question of the increasing interest in Lithium Iron Phosphate (LFP), to reduce dependence on critical raw materials (CRMs) like cobalt and nickel. This shift could significantly impact the strategies of the LIBs recycling industry.

## Main takeaways

- **Dependence and Strategic Vulnerability:** Europe faces significant strategic vulnerability due to its near-total dependence on critical raw material (CRM) imports, which are indispensable for the green transition and have rapidly growing global demand.
- **Internal Supply Obstacles:** The main challenges to increasing internal European production (extraction, refining, recycling) are high energy costs and excessively long and complex permitting procedures.
- **The Crucial Importance of Circularity:** Keeping materials and waste within Europe through recycling is considered fundamental for independence and resilience, overcoming challenges related to purification and administrative burdens for collection.
- **Need for Rapid Policy Implementation:** Despite legislative acts like the CRM Act and Battery Regulation being positive steps, the biggest challenge is their effective and rapid practical implementation, concretely accelerating permits and ensuring real investment to translate goals into reality and compete globally.
- **End-of-Life Value and Alternative Materials:** Strategies such as the use of alternative materials (e.g., LFP in batteries to reduce critical CRMs) and innovative recycling of end-of-life materials (e.g., PV silicon for battery anodes, RESiLEX project) are considered crucial for reducing dependence on imported CRMs.

## 3. The online questionnaire

In the second half of 2024, RESiLEX partners promoted an online questionnaire that focused on key aspects relevant to the sustainable exploitation of silicon as a raw material (with a particular emphasis on tracking and analyzing the use of silicon throughout the PV value chain), specifically addressing

- Social Responsibility
- Environmental Responsibility
- Competitiveness
- Innovation,

## Purpose

The questionnaire provides a platform to gather input from a range of stakeholders on addressing the identified challenges within the European PV supply chain for silicon-based modules. This input will play a pivotal role in defining policy recommendations aimed at addressing these challenges effectively.

## Questionnaire results

The questionnaire received 22 responses as of early May 2025.

The responses reveal a range of perspectives, particularly due to the varied backgrounds of the participating research and innovation institutions. Experience with critical raw materials (CRM) issues is mixed across respondents. Notably, only one-third of those surveyed indicated they are planning to implement specific measures to address geopolitical risks affecting CRM supply.

The limited presence of the CRM industry within Europe appears to be driven by multiple factors. These include high operational costs (OPEX), stringent environmental regulations, limited public acceptance, and the absence of strong secondary raw material supply chains or a comprehensive regulatory framework.

In terms of proposed measures to address CRM challenges, nearly half of respondents emphasized the importance of establishing standards to ensure a level playing field across the value chain. A significant portion also highlighted the need for improved protection against unfair competition, such as the introduction of certification standards or border adjustment taxes. Antitrust approaches were also cited as important mechanisms to promote fair competition.

Social dimensions of CRM policy were frequently noted. Enhancing transparency within supply chains and supporting local economic development in raw material source regions were identified as priority actions by 27% and 30% of respondents, respectively. In addition, 22% stressed the importance of promoting community engagement in CRM-related initiatives.

A recurring theme in the responses was the need for a comprehensive and integrated policy approach. Rather than relying on a single solution, respondents advocated for coordination between raw materials policies, secondary market incentives, and circular economy strategies.

Preliminary takeaways underscore the necessity of considering the interplay between environmental regulations, public acceptance, and policy coherence in shaping Europe's CRM market. External competitive pressures, particularly from monopolistic or unfair practices, remain a significant barrier. The RESILEX policy messages must therefore articulate a coherent and balanced policy narrative that addresses these challenges, especially in relation to the silicon supply chain.

The screenshot shows the 'Policy platform' section of the ReSiIlex website. It includes a navigation bar with 'About', 'Activities', 'Results', 'Updates', and 'Resilex Network'. The main heading is 'Policy platform' with the subtitle 'Your input for a policy improvement'. Three introductory paragraphs describe the questionnaire's purpose: gathering input on CRMs, providing feedback on challenges, and defining policy recommendations. The form fields include: 'Name', 'Organisation', 'E-mail', 'Stakeholder Type' (a dropdown menu with options: Silicon Manufacturer, Electronics Manufacturer, PV Manufacturer, Battery Manufacturer), 'Other (please specify):', 'Have you experienced CRMs (Critical Raw Materials) supply issues in the last 4 years?' (checkboxes for Yes, No, Not relevant), 'How are you sourcing CRMs?' (text input), 'Have you adopted/are you going to adopt/ measures that could mitigate geopolitical risks affecting the your supply of CRMs or PV/Battery components?' (checkboxes for Yes, No), 'If Yes, can you briefly describe them?' (text input), and 'Name the regulatory barriers in Europe (both national and EU level) that you think are limiting the adoption of Circular and more sustainable Value chains with regards to PV/Battery production' (text input). A 'Manage' button is visible on the right side of the form.

Figure 5 A snapshot on the appearance of the questionnaire

## Online platform and next steps

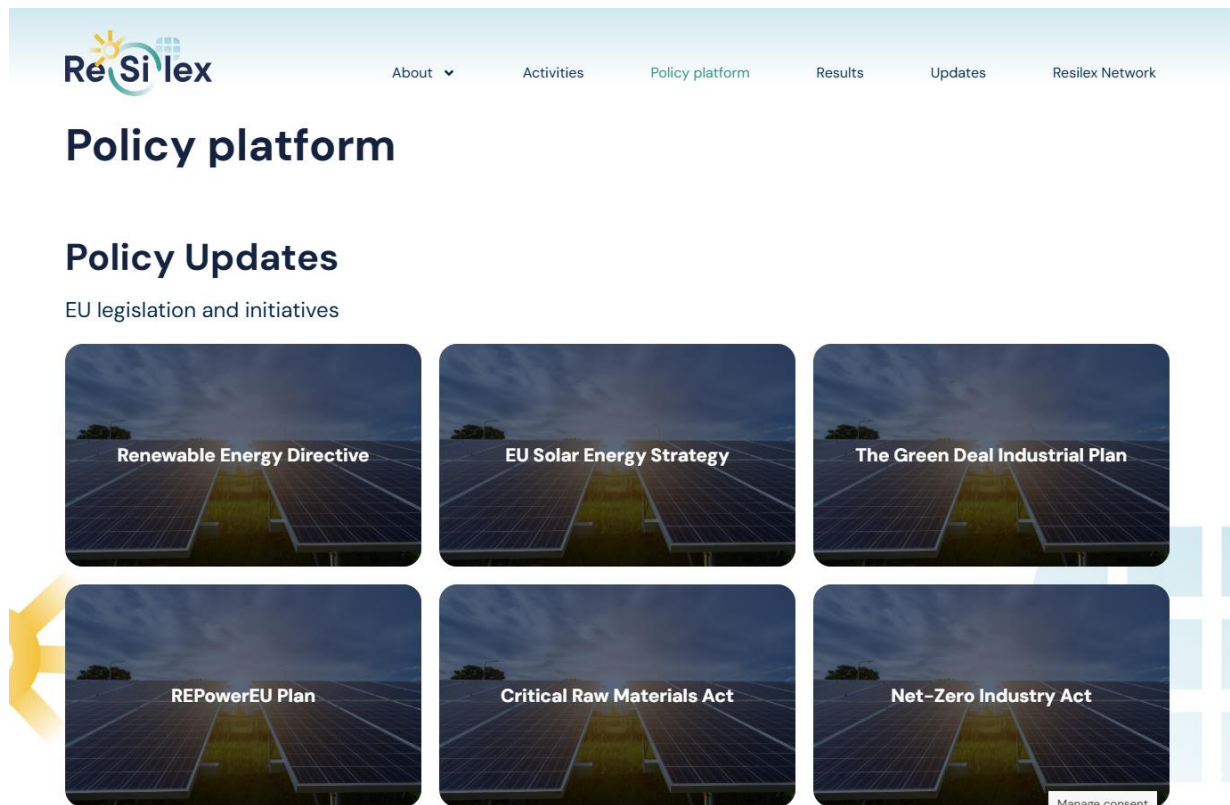
### The policy platform

The ReSiIlex Policy Platform, launched in its first version at Month 36, is an open, digital tool designed to support policy development and stakeholder engagement related to the sustainable sourcing of critical raw materials (CRMs). It is structured into three core sections:

- **Policy Updates:** This section provides stakeholders with the latest legislative and regulatory developments affecting the silicon value chain and CRM sectors at both EU and national levels.
- **Knowledge Hub:** A central repository offering access to research papers, best practices, technical reports, and case studies that support informed decision-making and knowledge exchange across the sector.
- **Stakeholder Engagement and Feedback:** A space for collecting input from various actors in the CRM value chain, enabling them to share challenges, insights, and policy recommendations through interactive tools such as surveys. This section includes the adapted questionnaire, described in pages 16–18, which will remain always available, providing (hopefully) new inputs from external stakeholders.

Together, these sections are designed to inform users, encourage collaboration, and gather stakeholder perspectives to help shape effective EU policy in the PV and battery industries.

*Figure 6 Screenshots of the updated Policy Platform*



### Next steps

With one year of activities still ahead, the RESILEX partners will keep active the stakeholder engagement effort, in order to gather more and new inputs from external subjects, in a similar way to what has been done so far.

Three main actions will characterize the activities of the next 12 months:

- 1) Promotion of the policy platform and of the questionnaire. This will increase the outreach of the page and its resources/functionalities, as well as letting more and more people know about the RESILEX activities and results. The reception of new inputs to the questionnaire will further provide insights for the drafting of policy recommendations.
- 2) Organization of a third stakeholder workshop. Following the success of the two previous workshops in 2024 and 2025, a new and larger one will be organized, aiming to attract more and new stakeholders and provide key inputs and insights.
- 3) Publication of the RESILEX policy recommendations. This document will gather all the relevant inputs gathered in three years of work, presenting all the elements gathered in a series of well-organized policy recommendations.





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