Discussion note #1. Advanced materials priorities – EU gaps and dependencies in value chains

Contribution from the Portuguese Representatives

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Q1 - How can the criticality of advanced materials be best assessed for value chains, anticipating also the related risks?

The EU should assess advanced-material criticality through a value-chain approach, rather than through a static list of material names. The relevant unit of analysis is a material-function-value-chain combination: the specific material, its technical role, the stage at which it is produced or processed, the strategic application it serves, and the geographic exposure of that chain. The same approach should be followed when implementing the risk assessment exercises foreseen.

1. Assessment approach

Drawing on the concept of FMEA (Failure Modes and Effects Analysis), it is important to identify across the portfolio of Advanced Materials Value Chains (AMVCs):

1) Failure Mode within the AMVC – how it might fail
2) Failure Effect on the AMVC – the consequences of the failure
3) Root Cause within the AMVC – the underlying causes of the failure

To assess and evaluate the risks affecting the AMVCs, the following approach is proposed, combining three main dimensions:

(S) – Severity (1-10 | 1 - low impact; 10 – catastrophic):
- Strategic importance (1-4)
- Exposure to dependency (1-3)
- Disruption sensitivity (1-3)

Severity could be determined using a simple logic:

Severity = *Strategic importance + Exposure to dependency + Disruption sensitivity*

(P) – Probability (1-10| 1 - low likelihood; 10 – extremely likely):
- Likelihood of a disruption of occurring in the value chain

(R) – Resilience (1-10| 1 – low resilience 10 – high resilience):
- Capability to rapidly detect failure, absorb and mitigate supply disruptions

Criticality Risk Number (CRN) of the Advanced Material Value Chain = S x P / R

1.1. Strategic importance
Measure whether the material is essential for strategic sectors such as clean tech, digital infrastructure,

electronics, health, biotech, aerospace, construction, mobility, or defence. Assess whether it delivers performance that is hard to replace and whether switching to alternatives would require lengthy requalification.

1.2. Exposure to dependency

Assess import reliance at each stage of the chain, concentration of supply by country, company, and facility, dependency on critical raw materials, reliance on foreign processing know-how or equipment, and dependence on a limited number of downstream buyers or standards.

1.3. Disruption sensitivity

Measure how vulnerable the chain is to shocks: long lead times, low inventories, difficult scale-up, sensivity of production yields, logistics bottlenecks, energy intensity, water stress, or regulatory delays. This captures how quickly a disruption would translate into industrial damage.

1.4. Resilience and mitigation capacity

Evaluate EU production capacity, near-term expansion projects, substitution options, stockpiling, purchase commitments, recycling and reuse potential, and the possibility to recover the material from waste streams or end-of-life products.

2. Core principle

Each advanced material should be classified into one of four groups:

- *Critical now*: high importance, high dependency, low resilience
- *Strategic emerging*: not yet critical, but likely to become so as demand scales
- *Watchlist*: some vulnerabilities, but manageable today
- *Non-critical*: low strategic impact or adequate resilience

3. Priority action trigger

A material should be flagged for intervention when it combines high strategic relevance with two or more of the following:

- strong import reliance
- no meaningful EU production or processing base
- high concentration in one country or site
- long qualification or switching times
- dependency on critical raw material inputs
- low circularity or weak substitution options

4. Policy implication

The EU should establish a monitoring mechanism with quarterly updates, annual reassessment, and scenario stress tests. This would help identify where action is needed: domestic scale-up, diversification, circularity investment, substitution R&D, qualification infrastructure, or strategic partnerships. It is also fundamental to monitor the outcomes of EU-funded projects and to implement mechanisms that support the scaling-up of advanced materials production. This should include fostering the adoption of emerging production lines and the uptake of new manufacturing technologies, to accelerate market deployment and reduce time-to-industrialisation.

5. <u>Example</u> of scoring template for the criticality assessment of advanced materials

The indicators below may be used to support the scoring of Severity (S) and Resilience (R).

A. *Strategic importance*

- Importance for strategic sectors
- Contribution to green, digital, or defence objectives

- Technical indispensability
- Time and cost to requalify substitutes

A score - average of 4 items

B. *Exposure*

- Import reliance at relevant stage
- Country concentration
- Company/facility concentration
- Dependency on critical raw materials
- Reliance on foreign equipment/IP/process know-how

B score - average of 5 items

C. *Disruption sensitivity*

- Lead times
- Low stock levels
- Scale-up and sensitivity of production yields
- Transport bottlenecks
- Energy/water/regulatory vulnerability

C score - average of 5 items

D. *Resilience*

- Existing EU production capacity
- Pipeline of EU projects
- Substitution availability
- Recycling/reuse potential
- Stockpiling, purchase commitments, or contractual security

D score - average of 5 items

For the purposes of the CRN methodology, S may be calculated as the sum of A, B and C, while D can inform the assessment of R. P should be scored separately on the basis of the likelihood of disruption.

Suggested interpretation

- >12: Critical now
- 8–12: Strategic emerging
- 5–8: Watchlist
- <5: Lower priority

6. Additional risk assessment

For each material, a stress test should be carried out against the following scenarios:

- export restriction
- shipping disruption
- major plant outage
- demand surge
- energy price spike
- delay in an EU scale-up project

For each scenario, rate:

- probability
- impact
- time to disruption
- time to recovery

This provides a visual risk matrix highlighting the most significant vulnerabilities.

Q2 - Could you share examples of measures taken into your country on how to address identified dependencies on advanced materials?

The short answer is: yes, Portugal already has several examples. The strongest ones are:

- battery value-chain build-out,
- microelectronics capacity-building,
- additive-manufacturing/advanced-materials scale-up,
- circularity and recycling agendas, and
- interface and cluster institutions that connect firms, labs and public support.

1. Batteries: trying to anchor more of the value chain in Portugal

This is probably Portugal's strongest and most explicit response to strategic dependency. Since 2021, the government has framed the "cadeia de valor das baterias sustentáveis" as a national opportunity tied to materials, industrialisation and energy storage. Under that umbrella, Portugal has backed the NGS – New Generation Storage agenda, which covers the battery chain from components and packs to end-of-life management and recycling. In parallel, the government has promoted major industrial projects in Sines, Estarreja and Boticas, including a CALB (Chinese lithium-) battery factory, a lithium refinery project, spodumene production, and a cathode active materials plant. That is a textbook dependency-reduction strategy: move from importing finished battery inputs to hosting more steps of the chain domestically.

2. Microelectronics: building domestic capability in a dependency-prone sector

Portugal's National Semiconductor Strategy (RCM No. 12/2024), approved in January 2024, aims to position the country as a relevant player in the European semiconductor ecosystem by focusing on chip design, advanced packaging (backend), and specialised training. It foresees an investment of €121 million until 2027 (through FCT and ANI), with the potential to leverage additional European funding.

Portugal has also used the RRP to support the *Agenda da Microeletrónica*, explicitly presented as a way to strengthen national productive and innovation capacity in semiconductors and microelectronics, with the aim of positioning Portugal in the management, production, distribution and recycling of semiconductors. Given that semiconductors are one of Europe's best-known strategic dependencies, this is another good example of Portugal addressing an identified weak point through targeted industrial policy.

3. Additive manufacturing and advanced production: reducing dependence by localising know-how and manufacturing flexibility

Portugal is also investing in INOV.AM, a RRP mobilising agenda focused on additive manufacturing. Its own project description says it was created to develop new materials, advanced manufacturing processes and post-production capabilities. That matters for dependencies because additive manufacturing can shorten supply chains, reduce tooling dependence, localise production of complex parts, and help industry qualify alternatives faster. This is reinforced by current COMPETE 2030 and STEP calls, which explicitly support advanced products/materials and technologies that help reduce or prevent strategic dependencies in the EU.

4. Circularity and recycling: reducing virgin-material dependence

Portugal is not only trying to produce more; it is also trying to need less material. A good example is the SUSTAINABLE PLASTICS mobilising agenda, designed to move the plastics sector toward a circular economy through material design, circularity, recycling and lower-emission production. Within it, the **Recicla+** project has already built a national collection model and a pilot recycling line for post-consumer coffee capsules and coffee grounds. This is relevant to advanced-material dependencies because it creates domestic recovery loops and secondary material streams instead of relying only on imported virgin inputs.

5. Demand-side measures: using public procurement to support alternative materials
Portugal has also acted on the demand side. Under the ECO360 green public procurement strategy and action plan, ecological criteria became mandatory for certain public contracts, including the integration of ecological criteria for specified products and services; Portugal's circular-economy policy framework also highlights support for bio-based products and recycled-content use. This is less visible than a factory announcement, but it matters: public procurement can help create an early market for lower-dependency materials such as recycled, circular, or bio-based substitutes.

6. Interface institutions: turning research into industrial capacity
Another important Portuguese measure is institutional rather than sectoral: the RRP's Missão Interface. Its purpose is to strengthen the scientific and technological support network and improve links between firms and academia so research gets translated into industrial innovation. This matters directly for advanced materials because Portugal is using it to fund entities such as CeNTI (advanced materials and nanotechnology), VG CoLAB (energy storage), and PIEP (polymers and plastics). In other words, Portugal is financing the intermediaries needed to move from lab capability to domestic scale-up.

7. Coordination platforms: cluster-building rather than isolated projects
Portugal has also leaned on ecosystem coordination. Battery Cluster Portugal was created to strengthen the national value chain and innovation ecosystem in batteries and energy storage materials, while the Portugal–Spain joint declaration of October 2024 commits both countries to joint value-chain assessments and to fostering Iberian clusters in strategic sectors including the electric vehicle chain, lithium for sustainable batteries, and microelectronics/semiconductors. That is relevant because dependencies are rarely solved by one plant alone; they usually require coordinated ecosystems.

In conclusion, Portugal has taken several measures to address identified dependencies on advanced materials. The main caveat is that Portugal is still acting through multiple instruments rather than through a single integrated national mechanism that says: "these are the advanced-material dependencies we identified, and these are the exact measures attached to each one." So there are real measures, but the governance is still more portfolio-based than fully dependency-mapped.

Q3 - Do you see a role for the Commission on the coordination? How could be the Technology Council involved?

In a nutshell, the Commission should own the framework and the monitoring, while the Technology Council should provide the strategic judgement and coordination needed to turn data into shared priorities.

1. Commission's role

1.1. Methodology and evidence
The Commission should define a common EU method for assessing advanced-material criticality and dependencies, so Member States are not using different criteria. It is already building pieces of that evidence base through the advanced-materials communication, the production-and-use analysis, and the substitution work supported by the JRC. It is also essential to ensure alignment across different EU-level monitoring and risk assessment exercises (e.g. advanced materials and semiconductor value chains), to build a coherent and consistent evidence base for decision-making.

1.2. Monitoring and early warning
A Commission-led mechanism could maintain the EU-wide dashboard: trade exposure, production

capacity, scale-up gaps, CRM dependencies, circularity potential, and disruption signals. That fits the Communication's governance logic and its emphasis on resilience, open strategic autonomy, and updating priorities over time.

1.3. Cross-instrument alignment
Only the Commission can really connect the different levers: Horizon Europe, industrial deployment support, IPCEI (Important Project of Common European Interest) discussions, standards work, skills initiatives, digital infrastructure, and internal-market tools. The current Communication explicitly groups these issues together, which is a sign that coordination cannot be left to one Directorate-General or one Member State alone.

1.4. Market-shaping and de-risking
The Commission is well placed to coordinate areas where fragmentation compromises scale-up: pilot infrastructure visibility, access conditions, common data standards, regulatory sandboxes, procurement approaches, and investor signalling.

1.5. External coordination
Because advanced-material vulnerabilities often sit outside the EU, the Commission should also coordinate international partnerships, economic-security screening, and consistency with other EU files such as critical raw materials, trade, and research cooperation. That is already built into both the Communication and the Council's formal tasks.

2. Technology Council role
Strategic coordination and validation, not for day-to-day administration.
In fact, that is already how it is evolving. The first meeting in November 2024 framed the Council as a forum for strategic dialogue and cooperation. The implementation page says it confirmed the four initial priority areas (mobility, electronics, energy, and construction) and created subgroups on health/medical devices and uptake and deployment. In June 2025, the Council endorsed both subgroup reports.
The most useful way to involve the Council would be as follows:

2.1. Validate the EU criticality methodology
The Commission and JRC could run the analytics; the Technology Council could test whether the criteria make sense in practice across sectors and Member States.

2.2. Prioritise sectors and bottlenecks
The Council should regularly decide which material-function-value chains deserve deep assessment, starting from strategic sectors and cross-cutting bottlenecks.

2.3. Run focused subgroups
The June 2025 subgroup on uptake and deployment is a good model: it identified barriers like scale-up, funding, regulation, pilot infrastructure, skills, energy costs and raw-material supply, and proposed follow-up actions. That kind of subgroup could also be used for criticality screening, circularity, substitution, and defence-relevant needs.

2.4. Translate diagnosis into action packages
For each high-risk value chain, the Council could recommend whether the answer is more R&I, pilot lines, standards, procurement, recycling capacity, substitution, skills, or financing — rather than treating every dependency as a trade problem.

2.5. Create a feedback loop with Member States.
Since the Council includes national ministries plus industry, academia and RTOs, it is well suited to compare national strategies, identify duplications or gaps, and align national and EU investments.