Example

Inclusion of Circular economy and Climate considerations in an I-RMOA

A Cobalt Metal RMOA

This example presents a short summary of some aspects of a project carried out by the consulting firm eftec (www.eftec.co.uk) for the Cobalt Institute. The objective of this project was to carry out an independent risk management option analysis (RMOA) in anticipation of potential EU regulatory action on cobalt metal, classified as carcinogen 1B, and identified by the EU as a Critical Raw Material among other reasons due the role cobalt substances play in the Green Economy.
A qualitative RMOA considered ten different risk management options (RMOs) and could establish how they could address a possible risk, whilst enabling the benefits of continued use of cobalt metal as well as recycling and re-use. It helped the Cobalt Institute members to identify the most appropriate and efficient RMOs as well as the additional information/data that may be gathered and provided to regulators to enhance the robustness of their assessment of potential regulatory options.

As sketched out in Table 1, **the RMOA prepared on cobalt metal included the typical phases of an RMOA,** as well as key elements deemed needed to have a meaningful discussion of and inclusion of the circular economy and climate dimensions (or pillars) in the analysis.
Be aware that this is an illustrative example, not a scientific paper (document has been simplified and references removed) nor an advocacy paper.

Table 1: Overview of RMOA phases and aspects of relevance in this example

I-RMOA phases presented in this example	*Task of the RMOA phase*	*Aspects summarized in this example*
Risk identification (1)	Understanding potential risks through volumes and exposures per use throughout the life cycle	Mass material flow
Analysis of Risk Management Options (2)	Consideration of the chemicals management, circular economy and climate dimensions	Pillar II – circular economy dimension **(2.a)** Pillar III – climate dimension **(2.b)**
	Proportionality analysis	Human health and environment criteria **(2.c)**
Synthesis (3)	Comparison of RMOs and conclusion in terms of the most adequate RMO	Synthesis table where scoring outcome of all RMOs are compared, considering the three pillars

1. RISK IDENTIFICATION

The lifecycle of a substance can be considered through a mapping of the materials flow through the supply chain. This is described in the I-RMOA guidance (Pillar 1: Chemicals management – 2. Understanding potential risks through uses, volumes and exposures throughout the life cycle).

GUIDANCE CHECK-LIST:

1. ***Uses***

2. ***Volumes*** *(tonnages per Use)*

   1) ***Material flows***
   2) ***Specific*** *aspects related to the* ***nature/fate of the substance***
   3) ***Physical form of the substance, and how it may change at each step of the life cycle***
   4) *Check if the substance doesn't change* ***speciation*** *during its uses or some of its uses*
   5) *Production of* ***articles***
   6) ***End-of-Life.***

3. ***Exposure***

   7) *Identification of* ***(potential) exposures/risks****.*
   8) ***Risk characterisation for the different exposure scenarios*** *(Registration dossier).*

MASS MATERIAL FLOW

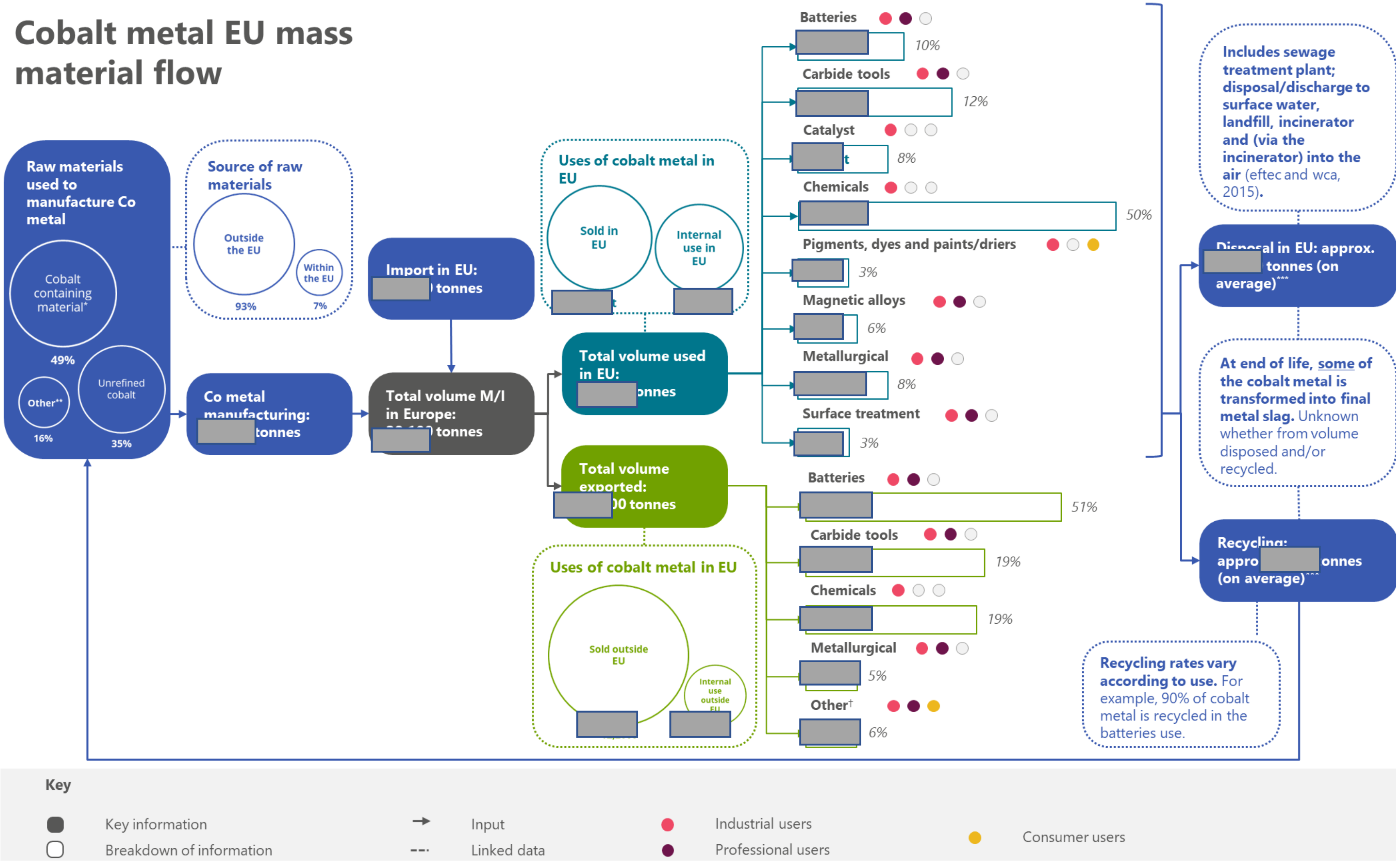
As an important step in the understanding of the uses of cobalt, a mass material flow (

Figure 1) was established (figures hidden for reasons of confidentiality). It describes where the cobalt comes from and where it is used, as well as its end-of-life situation (such as what is recycled or what may be lost to the environment).

The material mass flow is essential for the discussion of the circular economy (Pillar II) and climate (Pillar III) dimensions. The information provided in the material flow allowed to understand and determine:

- Which uses of cobalt contribute to addressing climate change and their relative importance in terms of volume of the cobalt metal placed on the EU market and related exposures, and
- The necessity to promote circular uses of cobalt metal in the EU (end-of-life); in particular, vis-à-vis the fact that 93% of the raw materials from which cobalt is refined are sourced outside the EU.

Figure 1: EU cobalt mass material flow



2. ANALYSIS OF THE RISK MANAGEMENT OPTIONS

The I-RMOA approach as developed in the Guidance proposes to cover ground beyond the regulatory scope of a regulatory management scenario, sensu stricto, as there is, with the Green Deal, a need for integrating the manifold of green priorities into the risk management measure discussions to achieve a holistic and effective approach for metals and inorganics.

The I-RMOA Guidance presents this as a three-pillar exercise consisting of:

- ***Pillar 1:** The I-RMO analysis in the **chemicals management** sphere which can be split between a reactive exercise (responding to a regulatory management options analysis initiative) and a more holistic approach (pro-active or even strategy-oriented)*
- ***Pillar 2:** When relevant, the **Circular Economy** dimension is considered, and the risk management options considered under pillar I will be put to the test of circular economy priorities.*
- ***Pillar 3:** Also, when relevant, the **Climate Change** dimension will be considered and the risk management options under pillar I will be looked at from the Climate policy perspective.*

This example elaborates on Pillars II and III of the RMOA on cobalt metal.

2.a FOCUS ON PILLAR II: CIRCULAR ECONOMY

Preparing the assessment of Pillar II 'Circular Economy' through the description of cobalt's contribution to EU circular economy

EU circular economy plan

One of the main building blocks of the EU Green Deal is the Circular Economy Action Plan, which aims for a cleaner and more competitive European economy. A steppingstone to achieve this ambition is to lay out initiatives along the entire product life cycle to incentivise the production of more sustainable products that last longer. The Circular Economy Action Plan presents measures to (EC, 2020d):

- Make sustainable products the norm in the EU
- Empower consumers and public buyers
- Ensure less waste
- Make circularity work for people, regions, and cities; and
- Lead global efforts on the circular economy.

Batteries are a particular focus of the circular economy efforts due to their high potential for circularity. Improvements in battery life as well as the ability to recycle and re-use batteries are important steps in achieving the circular economy. As more than half of the cobalt production is used in battery applications (in 2022), the recycling of batteries in the context of circularity of cobalt can speak for a large portion of the cobalt volumes on the EU market.

The objectivity of the circularity analysis in the RMOA requires looking at both the possible assets and drawbacks of cobalt in terms of circular economy, also considering that this metal is on the Critical Raw Materials list of the EU and that as such the EU will in no way be able to survive on local sources of cobalt ever. The EU depends on imports of sources of cobalt which, once used and disposed of in the EU, should be retained in the EU to prevent or reduce the increase of this dependency on foreign sources.

Assets of cobalt: Recyclability

Infinite recyclability

Non-ferrous metals (and therefore cobalt) are **infinitely recyclable** due to the fact the structural integrity of cobalt does not diminish during the recycling process. With no performance loss and the ability to continually re-use cobalt, it reduces the need to mine for new raw materials. This is especially important for materials where there are concerns of availability and security of supply. Reducing the need for further natural resource extraction matches the goals of the EU circular economy programme and emphasises how compatible cobalt is with recyclability goals within this.

How is cobalt recovered?

Cobalt is recovered from End-of-life (EoL) scraps that arise from turbine blades, cutting tools, rechargeable batteries, magnets and spent catalysts. As cobalt is a scarce material, it possesses a high market price, which creates incentives to recover and re-use it. The high price also makes it economically feasible to recover cobalt rather than dispose of it.

Recycling rates are influenced by several factors, such as cost of technology and infrastructure. CRMs like cobalt are often used in long-life assets, therefore there is a time lag between manufacturing, use and scrapping. The rate of recycling for rechargeable batteries containing cobalt is high, at 90% within the EU. Although recycling rates vary by use-sector, the sectors that use cobalt report good levels of recycling efficiency, which will be high relative to other Critical Raw Materials (CRM). Despite cobalt's high recycling rate, it is still insufficient to meet expected demand for cobalt on its own (i.e., without contributions from primary sourcing of the metal).

The growing demand for cobalt, because of the transition to a circular economy, only reaffirms the importance of improving recycling rates of cobalt. **EU concerns around the stability of future cobalt supply can be mitigated in part by better recycling and reuse**.

Drawbacks in terms of circularity of cobalt: impacts on circular economy due to economic constraints and cobalt impurities

Barriers to recycling and ways to overcome them

- Metal recycling has a high cost and existing recycling infrastructure needs to be improved to enable recycling and re-use of cobalt across sectors.
- The circularity of any material is heavily influenced by which end-use application it is used in. Changes to recycling within sectors should be product-centric through design to ensure recyclability, recoverability, and re-usability.
- Any regulatory measure that would make the recycling and re-use cobalt-containing metals more complex and in some cases prohibitive (black-listing, restrictions, bans), would further increase the cost for recyclers, which ultimately reduces the ability of metals to be integrated back into the circular economy.

Cobalt impurities

- *Natural impurity:* Whilst cobalt metal is intentionally used in applications across several sectors, it is also **present as a natural impurity within other metals and their alloys**.

- *Final slags:* One major material in which cobalt metal can be found is within final slags. These are a by-product created by the metals sector during the smelting and metal recycling process. According to a 2018 eftec study "*the metal sector aims to recover as many materials as possible to close the materials loop, which is particularly eco-efficient for inorganics. However, these slags contain a lot of substances in minor fractions, including Co (metal and compounds) in low concentrations that cannot be technically and/or economically recovered*".

  Replacing the use of these slags in building and construction material because they contain impurities subject to given risk management options, with alternatives such as natural aggregates, would have both financial and environmental impacts which are contrary to the circular economy goals. For example, the cost of natural gravel is twice as high as the cost of slags per ton of material. Moreover, it would decrease the energy efficiency of the metals sector, increase the related CO_2 emissions, and waste generation, and increase the use of gravel mining in Europe, as well as the environmental footprint overall, drastically. This is a case where circularity and climate concerns can be addressed jointly. In this example, it was not addressed in separately in the climate dimension discussion.

- *Cross-metal dimension:*

  Copper: The production and recycling of copper is a stakeholder in any risk management option applied to cobalt. Cobalt metal is indeed intentionally added to some specific copper alloys to increase the strength of these alloys and is therefore present in processing and end-of-life scrap.

  Ferrochrome: Cobalt being a naturally occurring element in chromium ores, it is found in the ferrochrome slags, a by-product of ferrochrome production. The RMOA provided calculated evidence of the advantages of using these slags in the construction sector compared to the use of natural resources (as an alternative).

  Stainless steel: Cobalt is also present in stainless steel, specifically in stainless steel scrap, as an impurity with functional benefits in terms of corrosion protection in concentrations below 0,7%. Due to their similar melting points, it is not possible to completely remove cobalt in an economical and efficient manner during the production of stainless steel or its primary alloying feed materials.

  Stainless steel scrap (process scrap and end-of-life articles) has a high value which makes collection and recycling economically attractive within the EU. It also possesses one of the highest recycling rates, with scrap accounting for 70% of material used to make new stainless steel, rather than using primary sources – chromium and nickel. This is important **as steel scrap recycling saves the equivalent of 57% of CO_2 emissions and 40% of energy consumption when compared with steel produced from virgin materials.** The production and recycling of stainless steel would be adversely impacted by any risk management option applied to cobalt.

2.b FOCUS ON PILLAR III: CLIMATE

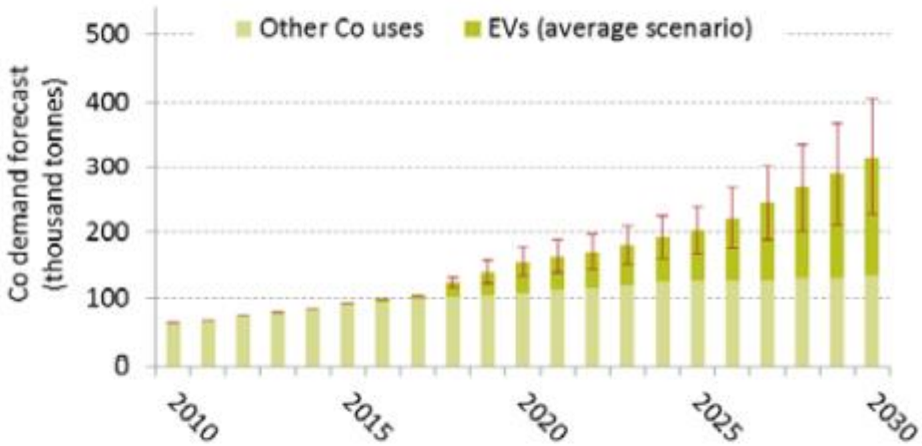
Contribution to EU climate targets and green growth

The specific details of the EU's green-house gas reduction targets are set out in the '2050 long term strategy', and in September 2020, the Commission proposed further reductions in green-house gas emissions, stating that levels should fall to 55% of those in the base year of 1990 by 2030.

The European Green Deal, first presented in December 2019, provides an action plan for cutting green-house gas emissions, outlining tools such as the development of cleaner forms of transportation.

The **transformation of the transport system in Europe** is seen as an essential target area. The move away from fossil fuel powered vehicles towards those powered by electricity is a crucial element. Cobalt is important in the production of batteries for electric vehicles, and a steady supply is required to meet the increasing demand for electric vehicles over the next decade. The International Energy Agency expects that there will be approximately 130 million electric vehicles worldwide by 2030, compared to the circa 3.2 million in circulation in 2017. Figure 2 below shows the growing global demand for cobalt alongside the increasing share of this demand that will be used to produce electric vehicles.

Figure 2: Projected future demand for cobalt (Source: EC (2018))



The use of cobalt is crucial in the EU's ability to transform the transportation system as laid out in the Green Deal. Without cobalt, the ambitions of the green agenda in increasing usage and production of electric cars will be difficult to achieve. With inadequate or disproportionate risk management of cobalt, it is a fundamental portion of the Green Transition desired by the EU which would be at stake.

2.c PROPORTIONALITY ANALYSIS

Once the possible ways to address the potential concerns identified (in ten RMOs) and the chemicals management, circular economy and climate dimensions integrated into the analysis, the analysis can proceed to the proportionality analysis of the RMOs.

The following proportionality attributes of each of the 10 RMOs have been assessed:

- Effectiveness
- Practicality
- Consistency
- Economic impacts
- Human health and the environment.

A set of criteria is used to assess each attribute and designed to aid the comparison of the ten RMOs included in this study, before scoring.

- Human health and the environment.

The human health and environment criterion takes a **more holistic view** on whether the RMO will lead to an overall improvement in human health and the environment considering, among others, impacts on the climate (e.g., energy consumption and emissions) and on the circular economy (e.g., on recycling and resource consumption). This goes beyond typical RMOAs and has the merit of likely increasing the overall efficiency and compatibility of the selected measure(s) with broad EU policy goals, not only with those related to the management of chemicals.

The following criteria are used based on the aspects most relevant, as covered in the Commission's 2015 Better Regulation "Toolbox":

- **Improves in working conditions for affected population** (e.g., avoids need for RPE)
- **Contributes to tackling climate change** (e.g., CO_2 emissions or energy consumption)
- **Improves resource efficiency** (e.g., durability of productions or recycling of materials at end of life)
- **Preserves the quality of natural resources / reducing pollution** (e.g., reduced air pollution or need for use of raw virgin materials)
- **Reduces waste and improves/facilitates their management** (e.g., reduces materials sent to landfill or increased re-use)

The criteria were discussed with a quick answer requested (yes, no or maybe) on the basis of a rationale, as illustrated in Table 2.

Table 2: Assessment of human health and environment criteria

Criteria	Quick answer (Yes, No, Maybe)	Rationale
Improves working conditions for affected population		*Discussion of impacts of RMO in terms of workplace conditions (increased automation) and working conditions (changes in personal protective equipment)*
Contributes to tackling climate change		*Discussion of impact of RMO on use of Co-containing steel scrap in the EU.* *This is important as steel scrap recycling saves the equivalent of 57% of CO_2 emissions and 40% of energy consumption when compared with steel produced from virgin materials.*
Improves resource efficiency		*Discussion of impacts of RMO on the re-use and recycling of cobalt-containing products. Will it induce an increase in the use of primary sources rather than recycling from end of life, which goes against the circular economy goals?*
Preserves the quality of natural resources / reducing pollution		*Discussion of climate consequences of RMO on use of virgin raw material (e.g., aggregates like sand and stone) rather than slag.*
Reduces waste and improves/facilitates their management		*Discussion of impact of RMO on re-use/recycling vs. landfilling*

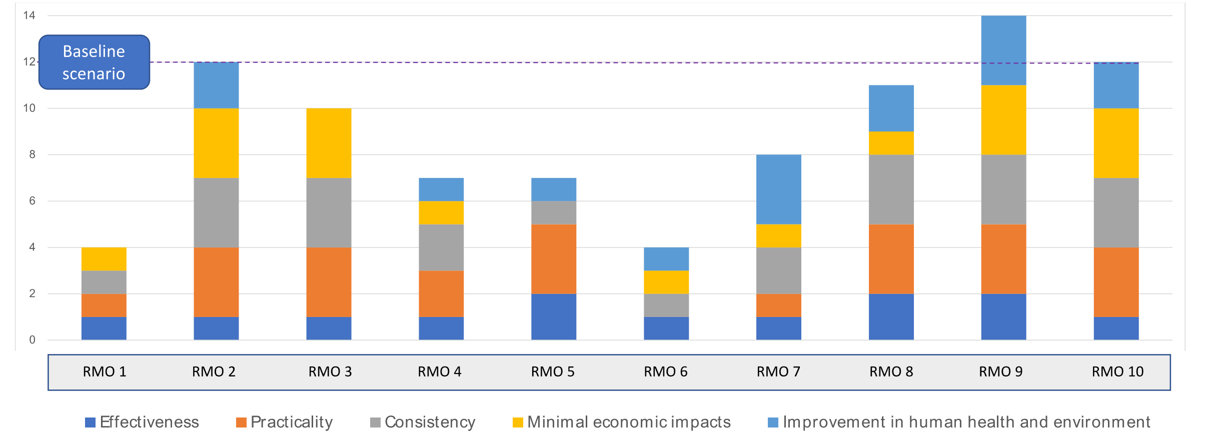
3. SYNTHESIS OF THE I-RMOA

Conclusion table

A qualitative assessment allows for the development of an initial understanding of the most suitable and efficient RMOs in a way that is less resource-intensive than a quantitative assessment. However, the interpretation of the outcome of a qualitative assessment of RMOs will always, to some extent, be subjective. The study developed a simple 'scoring' system of the attributes discussed above with the purpose of introducing more transparency to the ranking of the ten RMOs.

The scores of the RMOs assessed was compared with the baseline scenario which reflects the evolution of the situation in the absence of further regulatory action (also called a business-as-usual scenario) and presented as in Figure 3.

Figure 3: Comparison of scores for all 10 RMOs assessed



The study's conclusion was that, compared to the baseline scenario, RMOs 2, 9 and 10 would provide the most benefits, especially when focusing on the improvement of the human health and the environment in the broader context of circular economy and climate dimensions discussed above.