

FEASIBILITY STUDY REPORT – Template and guidance

Introduction

Why?

The aim of EIT RawMaterials Upscaling Projects is to launch new products, services or processes (=solution) to the market.

Upscaling projects are innovation projects based on validated technologies that need additional step(s) for up-scaling, demonstration or implementation. The objective is to bring the technology to market, as a product, service or process. This implies paying attention not only to the technology but also to market, IP, value/customer proposition, competitors etc. that are important factors for the feasibility of the project.

The technology must be at Technology Readiness Level (TRL) of at least 5 at the beginning of the project, corresponding to a “technology validated in relevant environment”. If the upscaling is a service or process, the readiness should be similarly validated in terms of distance to market.

At the end of the Upscaling Project, the technology is expected to have reached a TRL of at least 7, corresponding to a “system prototype demonstration in operational environment”. Upscaling projects must aim for market introduction and/or a commercial use within 3 years (or less) after the end of project.

What?

These specific guidelines are offered for Innovation Projects' leaders and participants by posing the key questions that need to be tackled from the very beginning of the projects to:

- Initially assess the feasibility of the Upscaling Project and based on these findings develop a Go-To-Market Strategy
- Throughout the Upscaling project implement and, when needed, update the Go-To-Market Strategy.

The Go-To-Market Strategy is the plan how to close the “readiness level” gap between the initial TRL at the beginning of the project and the first commercial use, a point in time that can be as late as three years after the end of the Upscaling Project.

How?

The suggested approach for assessing the projects feasibility and developing a Go-To-Market Strategy is to engage with validators that can give first hand feed-back. This is done by interviewing the real stake holders such as decision makers, users, tech experts, partners etc. Min 8-12 good quality interviews with different types of stake holders is typically enough to get a data basis that can be used to draw conclusions upon. The preparations before the

interviews are crucial and don't miss the opportunity not only ask questions about your technology, but also if the interviewed knows some other stake holder that could help.

Market data from industry analysts is another source of information that can be very useful. However, remember that these types of broad-brush data can be very valuable in the beginning, but detailed data from the validators are often very useful when developing a Go-To-Market Strategy.

Instructions

The "Feasibility Assessment Work Package Questionnaire" is composed of a total of three sections:

- The first section consists of questions that help you describe the technology and its current status.
- The second section uses the interview results and collected data from section 1 and this is where you will provide several concise analyses that form the basis for the plan presented in the section three.
- The third section will describe of your plans for how to reach the market and provide the basis for the choices.

The Feasibility Assessment Report shall include all the information demanded in this present document.

Feasibility Assessment Work Package Questionnaire for Upscaling Projects

This section describes why using the PANORAMA deliverables is essential for decision makers in Member States, the EU and indeed global powerful entities.

SECTION 1 –DESCRIPTION OF THE SOLUTION

This report will continuously refer to PANORAMA deliverables. In annex A, a visual overview is given.

Another way to describe the solution is to list the deliverables: a set of Environmentally Extended Input-Output tables for over 40 major individual economies in the world and all other countries in the world. These tables describe the origin of critical raw materials and their use along the macroeconomic supply chain. They allow any researcher to model the metals, industrial minerals, biomass and land used by the global economy. Apart from the data, the harmonization algorithms and ways to extend time-series in the future are part of the deliverables, using official Eurostat data such as Structural Business Statistics, ComEXT trade data or PRODCOM. But this listing of PANORAMA deliverables is **not** the description we use to explore the ways to go-to-market with Panorama deliverables.

We describe the solution as follows. A successful delivered PANORAMA project plan will provide decision makers with the best possible publicly available information about the use of global natural resources. This information, especially its credibility and detail level, is needed to identify issues that EU economies and all other economies might face when leading our societies into a sustainable future. Examples of these issues are the need to source raw materials responsibly (no overexploitation, unacceptable working conditions etc.), adherence to regulation on substances such as REACH, dealing with geopolitical issues in foreign policies or the need to prove the relevance of a circular economy in decreasing a carbon footprint as fast as economic and technically feasible.

The consortium contains institutes that are world leading in providing environmentally extended macroeconomic information. It is estimated that outside of the consortium, about twenty to forty institutes in the world (mostly universities) operate at the quality level of the PANORAMA consortium. The deliverables can (and are expected to be merged) with the existing EXIOBASE forum that has proven to be a viable source of information for years as a standalone product. The open-source nature of EXIOBASE and explicit use of public data only illustrates that this project is different from other KIC projects in terms of Intellectual Property (IP). As this go-to-market report will illustrate, the challenge is to make the market aware of the existence and the benefits of the PANORAMA deliverables. This is done by (almost exclusively) providing the deliverables for free in an open-source environment.

1.1 Benefits

One of the cornerstones of the PANORAMA proposal is the political power that macro-economic models have in predicting economic growth in the short term. Many of these macro-economic models are based around the concepts of an SNA (see textbox next page). Policymakers can appreciate the capacity of models to explain the consequences of major changes in a particular sector in relation to the economy as a whole. Policymakers of global institutions emphasize the importance of a transition towards a global sustainable economy and to assess the impact of steps in this transition using macroeconomic concepts¹. These statements lead to the expectation that SNA-based models are a vital tool for assessing opportunities and barriers that multinationals and political leaders might encounter towards a sustainable future. Yet the available data and corresponding models are not mature enough to estimate the impact on economic growth, job growth and global competitiveness in a way that is robust enough for political leaders to build their message. It is necessary to establish a causal link between sustainable consumption and production and the economic activity that is created as a result.

In most case parameters in the models estimated on timeseries based on the SNA and in other cases derived from theory and models are thereafter calibrated to deliver plausible and usable outcomes. To make meaningful scenarios and forecasts, the modeller should, for instance, have the costs of component recycling, better use of industrial waste, reparability, possibility to communicate through the web or compare transport costs. Long story short, the empirical evidence, predominantly in the shape of data, is scarcely available to do this. An example can be taken from the current Exiobase version 3.3. For instance, to currently execute a research project into circular strategies requires available data for the repair, lease, waste and recycling sectors that needs to be verified with further field surveys. This is a costly time-consuming exercise. The PANORAMA project will improve this data by verification and increasing the level of detail.

As implied earlier in this chapter, the abovementioned arguments are usually **not** mentioned in the way the PANORAMA project is presented to non-experts. At the same time, it is imperative that one observing the project has insights in the use of SNA based models and the technical solutions provided by the PANORAMA project to overcome them. Moreover, the consortium has the expertise and the intention to commit to explain why this type of information is essential in our global political and business society. Starting by presenting the remainder of chapter 1.

¹ <https://www.imf.org/en/News/Articles/2019/05/07/sp050719-how-to-ensure-the-effective-and-sustainable-financing-of-international-development>

System of national accounts (SNA)

The last concept we want to mention is not only a concept, but a set of methodologies and tools, developed in the 1930s and 1940s to measure how national economies operate and how they respond to centralized interventions. One of the most frequently used elements of an SNA is an input-output (IO) table. It creates the opportunity for a region (i.e., nation) or a set of regions to assess the annual flow of products, as well as how they are used by sectors as intermediate products and by consumers as final products. An environmentally extended input-output table (EEIO) can link environmental effects such as GHG-emissions or toxicity to specific products and specific sectors in certain regions.

The power of SNA and IO tables can also be illustrated by what they can describe, such as the flow of iron ore to China and from there in all products containing iron (more than a few!) from China to the world, or the environmental interventions (e.g., emissions) associated with oil-seed operations in Malaysia when chemical products are produced in Italy, or the final consumption of niobium from Brazil used in a chassis factory in Canada.

The disadvantage of using an SNA lies in the “homogeneity assumption”, which by default treats large parts of the economy as completely similar. This **lack of detail** limits its analytical strength when assessing specific products, sectors or regions. Another disadvantage of making IO tables into EEIO is when proportionality between monetary and physical flows is assumed. This is a shortcoming met by the PANORAMA proposal.

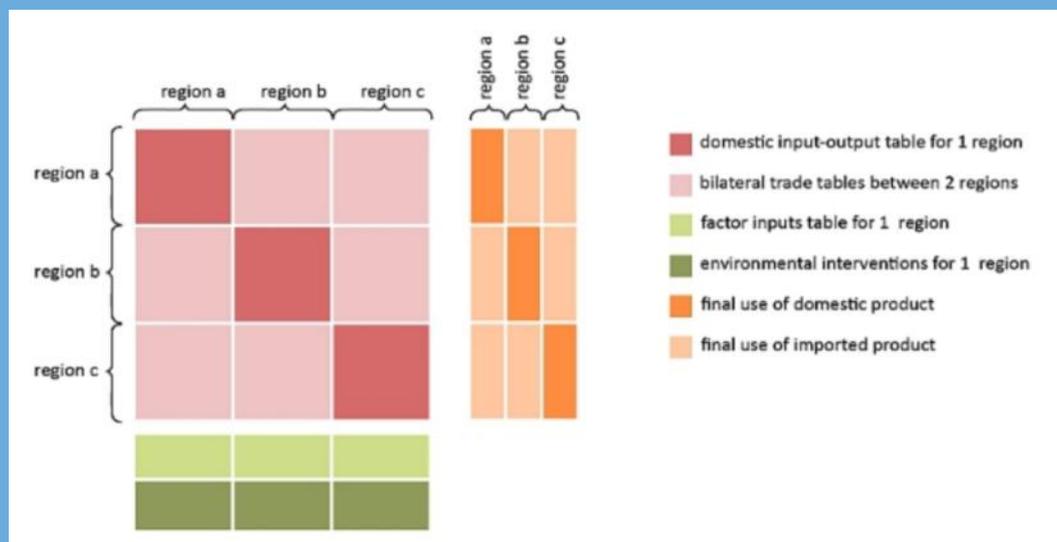


Figure 1 Basic representation of a multi-regional IO table

1.1.1 Validation

The circles (Figure 2) show an overview of the affiliation of the interviewed stakeholders over 2019. These interviews gave the clearest validation of the market strategy of PANORAMA as described in this report.

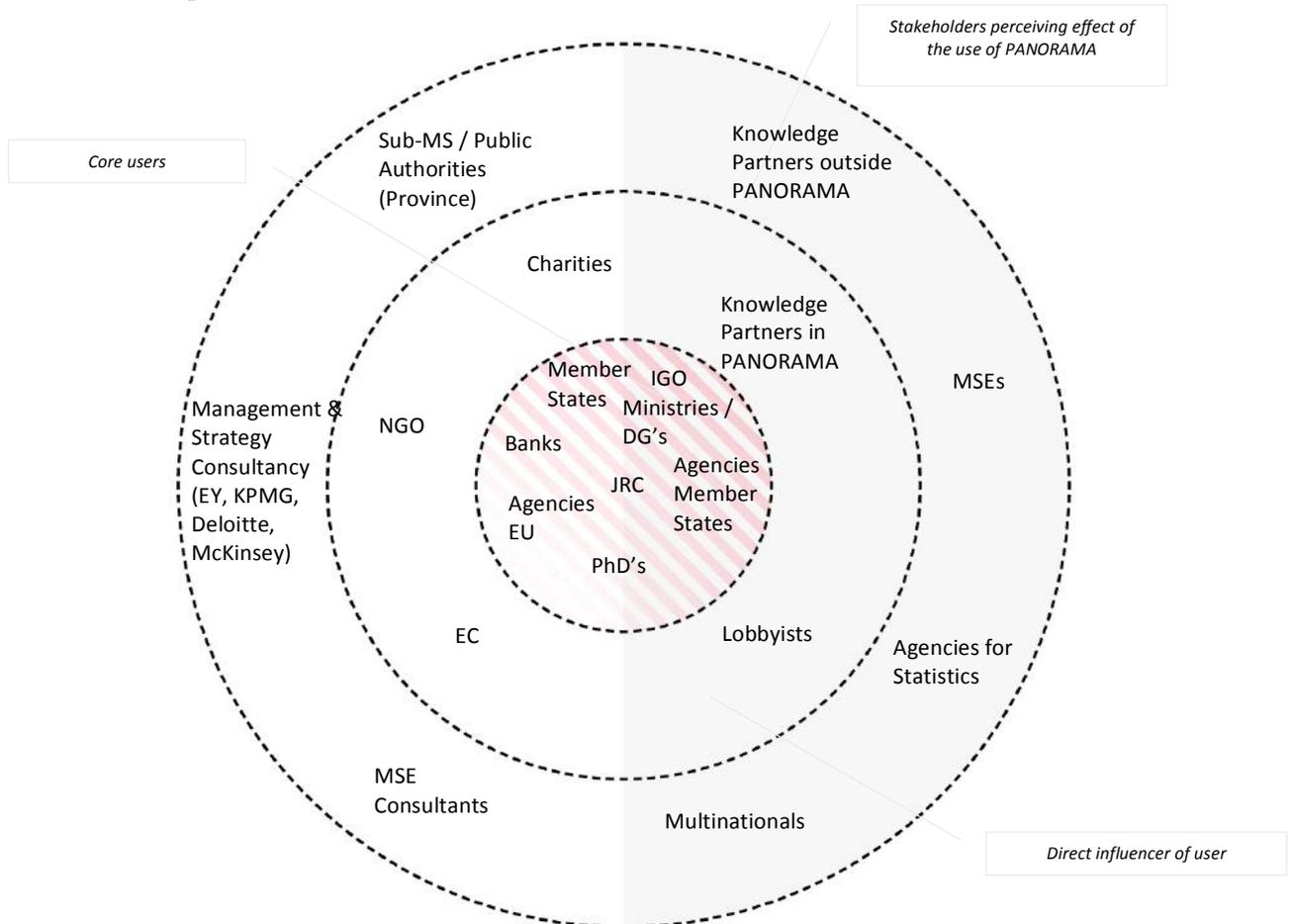


Figure 2: overview of three stakeholder involvements into PANORAMA

Evidence that the PANORAMA deliverables are expected to fit into a state-of-the-art database, is provided by a review from the OECD². This report states that the framework of EXIOBASE, even before PANORAMA will add more detail about critical raw materials, is arguably the best available in the world.

² https://www.oecd-ilibrary.org/fr/environment/the-macroeconomics-of-the-circular-economy-transition_af983f9a-en

The following listing in more detail of potential users provide additional insights in the stakeholders. As the overview shows, we selected our interviews partners by their place in the value chain, their geographic scope (global, regional etc.) and a balanced representation of public and private stakeholders.

- JRC: RMIS 2.0 roadmap, the aspiration of RMSA 2015 and how to get it into RMIS “X.0”
- Academia: EXIOBASE X.X, input for H2020/EIT Raw Material projects
- UN/EC policy makers: UNstat, ECO-invent, ECHA, Product Environmental Footprint (PEF), EU Ecolabel, REACH
- Branch organisations: like ACEA, Eurometaux, European Battery Alliance, WEEE forum, RE-source platform
- (Sub-)national governments: smart individuals who can combine MS or local political realities with EU-scoped information about raw material activities
- Enterprises/SMEs: support their PR message, using abovementioned circular strategies (servitisation, repair business, refurbishers and recyclers) and OEM’s delivering servitisation

Perhaps the most clear result of all the interview activities was the clear disincentive of any organization to pay for PANORAMA deliverable. Suggested payment schemes included pay-as-you-go downloads as well as license fees. This puts the go-to-market strategy of PANORAMA in a different light. Although there is a clear market for several parts of the PANORAMA deliverables, this market can’t be considered a regular commercial market.

1.1.2 Requirements

The technical requirements needed to disseminate the PANORAMA deliverables are clear and modest.

It was repeatedly stated by civil servants, business representations and researchers that easy downloads and input for material would ensure continued use for coming years.

Not mentioned spontaneously or confirmed as interested were readymade tool to link PANORAMA to responsible sourcing reporting obligations. This is also true for informative supply chain mapping (“for presentation purposes”). It is therefore not advised that PANORAMA would invest in those features.

Platforms such as Ramascene³ provide evidence that the technical expertise to deliver the project deliverables is in house and operational. Another example would be the PROSUM website: the Urban Mine Platform⁴.

³ <https://www.ramascene.eu/>

⁴ <http://www.prosumproject.eu/>

1.2 Development status

In this sub-section, we describe in a succinct manner the status of the PANORAMA deliverables in terms of its readiness to be utilized by a customer.

There is a sort of prototype available on the PROSUM website. During the interviews, we don't (yet) use this prototype extensively since the scope and presentation of PANORAMA are expected to be better by late 2020. An example that we use is the RMIS 2.0 website of the JRC.

At the end of the project (late 2021), the PANORAMA deliverables will be put online in a similar fashion as is done for the PROSUM and ORAMA projects. These projects use on-line resources that have been tested and proven reliable for several years now. We expect the deliverables to be meaningful enough to be included in the next RMIS version. This would mean that the Joint Research Center Directorate D would cover any maintenance costs. This is not a certainty, so backup plans to disseminate the deliverables on-line by consortium partners are being developed.

The stakeholder interviews with civil servants and researchers in particular are highly based on the interviewees experience with open-source downloads. Their feedback is therefore highly reliable, as open-source download are used for over twenty years in the field of natural resources and critical raw materials. The challenges and opportunities described in chapter 2 reflect these experiences, both positive and negative.

1.3 IP status

The nature of PANORAMA makes the IP status relatively irrelevant. Throughout the project, public data is used and applied by consortium members who will present their work in academic papers and online free downloads.

Expenses for professional IP mapping services are will therefore be counterintuitive thinking about the PANORAMA objectives.⁵

1.4 Competition

One of the key-users (JRC directorate D) sets the standards when it comes to on-line publication, granularity and transparency of data sources. This is not so much a competitor, as it is the quality level that should be aspired to in this project.

In general, we can think of only a handful of similar initiatives of this kind. See Annex B for a complete overview of the competing organisations providing similar data and assessment tools that the PANORAMA deliverables provide.

⁵ The opposite is also true: expenditures and involvement of experts in the field of communication and graphic design might be conceivable. See also section 3.1.

SECTION 2: ANALYSIS

The findings described in this chapter are found by processing the series of interviews held with individuals from the consortium network. This was done in five sessions, deploying TNO strategists Marije Stelwage, Ton Bastein, Frank Berkers and Elmer Rietveld. Ancillary information was searched and found by analysing EIT KIC raw materials documents describing activities in 2019 related to market and research questions.

Interviews were held with individuals from Coolrec, IHC, Granta, Umicore, Tata, Nyrstar) and B. Dijkstra. Also with Norsk Hydro, a company that is not a KIC EIT RM partner.

Product group foci could be inspired by lighthouse themes (CIRCuIT - CIRcular Cities Transition needs, ECOS - E-mobility cost study, Micro-EC - Micro-Wave Technology for Eco-Efficient Comminution and Extraction

The reliability of the outcome of the interviews is perceived as enough. It is necessary to obtain the same number of interviews in 2020 to further verify the needs of businesses related to the EIT KIC and in general.

Apart from the interviews, the other major investment of the budget of the WP0 of the PANORAMA project was in a three-legged working session within the project team.

The reliability of the outcomes of the interviews is perceived as fair. The experience of the consortium partners and the expertise of in-house consultants about the use of the PANORAMA deliverables is such, that we place a high degree of confidence in our findings.

2.1 Potential commercial markets

In Table 1 below, we describe the most important markets for the PANORAMA deliverables.

Table 1: Overview of markets for PANORAMA and the Decision Makers (DM)

	Market #1: DM in branch organisations and strategic parts of multinationals	Market #2: DM at Inter Governemental Organisations, EU and nation states	Market #3: researchers
Market name	Government	Business	Research
Market description Briefly describe the market, its composition, structure, size, balance of supplier and buyer power, and the types of buyers and end users.	In 2018, in the EU alone, the annual budget of research in to the use of natural resources by the economy	The investment in to supply-chains, CSR and R&D specifically aimed to change material use is expected to be	Within the EU, over 40.000 PhD students and over 100.000 master students are expected to use the type of data

	amounted to over 67 billion EUR ⁶	large. Frost & Sullivan estimates the consolidated market opportunity to be over €235 billion by 2025. ⁷	provided by PANORAMA
<p>Potential benefits Briefly recount the ‘pains’ suffered by this market and the benefits of the technology that provide resolution of those pains and that are believed to be important to this market.</p>	Improving political understanding. Currently, lack of overview and data, too much room for disinformation and unawareness of ignorance is frustrating policy development.	There is an unclear relation between corporate responsibilities and negative impacts. Business ask for clarity and guidance here, as they are commercially constrained to act independently.	Current research suffers from lack or research resources and unnecessary delay and work effort into natural resource use data. This situation will be improved.
<p>Market interest Describe the level of interest you found in your interviews in this market, and recount the reasoning that was used by interviewees to describe why they are or are not interested in the technology.</p> <p>Discuss what seem to be the most compelling benefits for this market, and any newly identified benefits.</p>	Providing solutions to societal challenges, such as security of supply, inclusive job growth, internal market coherence, political support for European sustainability standards.	Efficient starting point for decisions and enquiries made by companies themselves.	Better research questions and more time available for finding qualitative and/or tacit information.
<p>Market requirements Describe the market requirements that you uncovered in your research and interviews, addressing particularly the points:</p> <ul style="list-style-type: none"> Preferred pricing 	Reliable, updated and accessible data. Comprehensible and politically relevant interpretation of these data.	Providing a level playing field in terms of information among enterprises (SME and multinationals alike) and between business and policy	Data accompanied with contact information on how to process the data.

⁶ https://ec.europa.eu/budget/graphs/revenue_expenditure.html

⁷ https://www.csreurope.org/sites/default/files/FS_WP_Sustainable%20Development%20Goals_05112017_RD_0.pdf

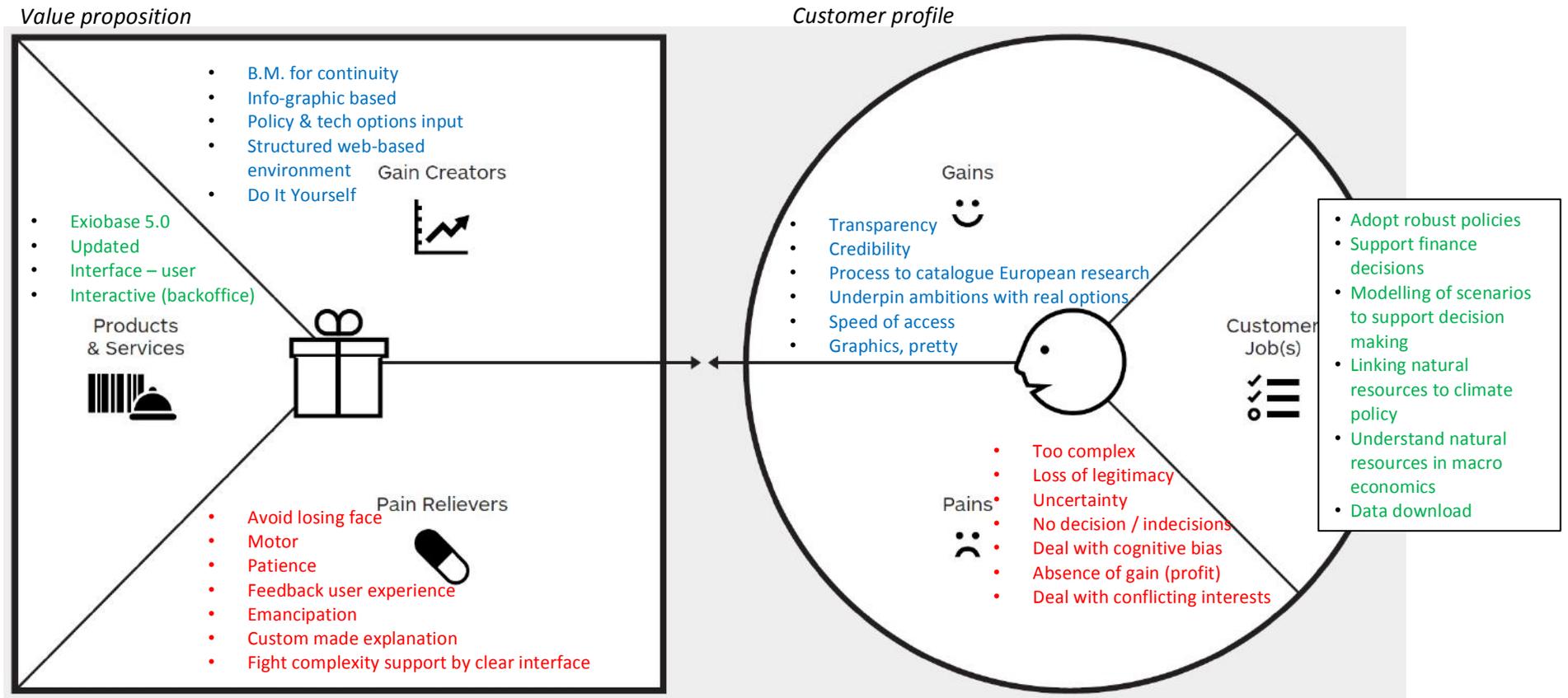
<p>models and levels</p> <ul style="list-style-type: none"> • Key purchasing factors • Customary order quantities and frequency • Expected product characteristics • Delivery expectations • Certification expectations • Post-sale support expectations 		<p>makers. Open-source access requested to preserve some sort of level playing field and the ability to verify or disclaim the reliability of the data.</p>	
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2.2 Potential challenges

In this sub-section we will describe the challenges of delivering the PANORAMA project to the market. The identified challenges in the value proposition have one thing in common: they indicate that a traditional commercial model will probably not be feasible when disseminating PANORAMA deliverables. We will seek a written statement from EIT-RM that they accept our decision as soon it is clear that not-for-profit dissemination is indeed the way to go.

A visual support for both the potential challenges as well as the potential opportunities is given in Figure 3.

Figure 3: Value proposition and customer profile of PANORAMA, to support the identified potential challenges and opportunities



2.2.1 Technical challenges

The following technical challenges related to the PANORAM deliverables were mentioned:

- Macro-economic data, models, interdependencies between economic and ecologic systems are simply too complex. It remains to be seen if PANORAMA can shed a light here by offering visually attractive representations. It would be acceptable if the “classic” way to show information is the only feasible way to publish PANORAMA deliverables.
- Uncertainty in certain critical raw material data, given the absence of such data in previous projects such as the 2nd and 3rd revision of the critical raw material list of the EU.

2.2.2 Proprietary/distribution challenges

The following proprietary challenges related to the PANORAM deliverables were mentioned:

- Absence of direct gain (profit) of using the deliverables.
- Deal with conflicting interests within organisations; businesses have to deal with this challenge more directly than public authorities.

2.2.3 Social and economic challenges

The following technical challenges related to the PANORAM deliverables were mentioned:

- Loss of legitimacy if PANORAMA deliverables are not certified to be congruent with official statistics like EUROSTAT.
- Indecision, due to the increasingly heated (2019) political decision-making process around sustainability.
- Dealing with “cognitive bias”: decision makers don’t think raw material supply will ever be a problem since they have never experienced such issues at scale in their career.

2.3 Potential opportunities

The interviews uncovered clear opportunities that relate to the PANORAMA deliverables. There is a clear need from individual companies to contribute as a sector to the societal environmental challenges. In order for them to provide evidence that they’re outperforming the competition, they need data like the PANORAMA deliverables to benchmark themselves.

2.3.1 Material/Technical opportunities

The observed gaps that existing data have in terms of technology are expressed by the following questions asked during interviews:

- What is the quality and locations of the deposits? What by-products can be expected?
- What are inhibiting factors and risks to a mining venture?
- What are trends in raw materials consumption?
- To what extent can recycling of secondary raw materials fulfil future supply?

- What is the volume and composition of available waste flows?
- What is the volume and composition of societal stocks (from which such future waste flows can be derived), ideally geographically specified?
- In relation, what is the product composition, use time and life time, and historical marketed volume of products per annum (derived from production and trade statistics, both of intermediate and final products)?

2.3.2 Proprietary/distribution opportunities

The observed gaps that existing data have in terms of manufacturing knowledge and R&D are expressed by the following questions asked during interviews:

- What global supply chains am I part of, and what stakeholders are involved?
- Do I deal with a critical raw material? How can this criticality be assessed?
- How can supply chains be made transparent (e.g. in case of conflict minerals)?
- Are there other critical nodes in my supply chain, in terms of a limited number of independent companies or limited number of geographical regions producing a relevant intermediate product?
- What are the characteristics of recycling technologies and their economics of scale?
- What alternative materials and intermediate components are available for me? Do these have criticality problems too?

2.3.3 Social and economic opportunities

The observed gaps that existing data have in terms of socio-economic or financial information are expressed by the following questions asked during interviews:

- What are financing options for new mining activities?
- What are the costs and when will be a certain resource be profitable to extract from a specific mining deposit?
- Who provides raw material extraction permits and under what conditions for exploiting how much of primary resources?
- Overview of greenfield/brownfield exploration projects and key characteristics
- Applicable EU regulations and duration of licensing procedures
- Social acceptance and vicinity of liabilities (e.g. high value nature areas, etc.)
- Capital demand for operations (both primary mining as secondary mining)
- Availability and economic costs of production factors
- Forecasts of demand/supply scenarios, commodity prices and uncertainties therein
- What are the current and future most important sectors in terms of jobs and value added?
- To what extent does my MS or other region depend on critical raw materials or intermediate products?

- To what extent can secondary raw materials contribute to the Circular Economy Package objectives?

2.4 Value chain analyses

One of the major promises of PANORAMA is to offer analytic opportunities to assess critical raw material supply and use of natural resources over the value chain. It is important to remember that this is done at a macroeconomic level of detail. This means that explicit raw materials (like Cobalt, Tungsten etc.) are explicitly present, but that sectors are described at a generally course level such as “machinery”, “transport equipment other than automotive” or “base metal”. It is unlikely that this granularity will suffice as a clear description of a value chain. We see no reason to act upon this potential technical challenge as interviews have indicated that users will be satisfied with this general detail level and will not use PANORAMA deliverables expecting that it will map out their own particular supply chain in detail. It takes tens of thousands of EUR to perform a proper value chain mapping for an individual company or specific sector, so this level of detail can’t be expected from PANORAMA.

SECTION 3: MARKET PLAN

This section will describe how PANORAMA deliverables will be offered and what conditions need to be put in place by investing in resources.

3.1 Go-To-Market Strategy

The market for using PANORAMA deliverables can easily be described in general terms. Our method to explore the market needs was therefore a combination of general modus operandi (individual interviews) combined with a clear focus on details (the Value Case Methodology) on how to put the PANORAMA deliverables to market, both as a product (“unparalleled data about critical raw materials in the global economy”) and auxiliary services around that product.

The Value Case Methodology (see Figure 4) enables us to help to map all the values of the consortium members in a comprehensive, independent and objective manner, and use these to align your objectives. This allows us to reach a widely accepted investment decision in a joint project. The method has four steps. After each step, you can move forward and take a decision. Once the consortium and the KIC delegates are convinced by a certain decision, you should proceed to the next step.

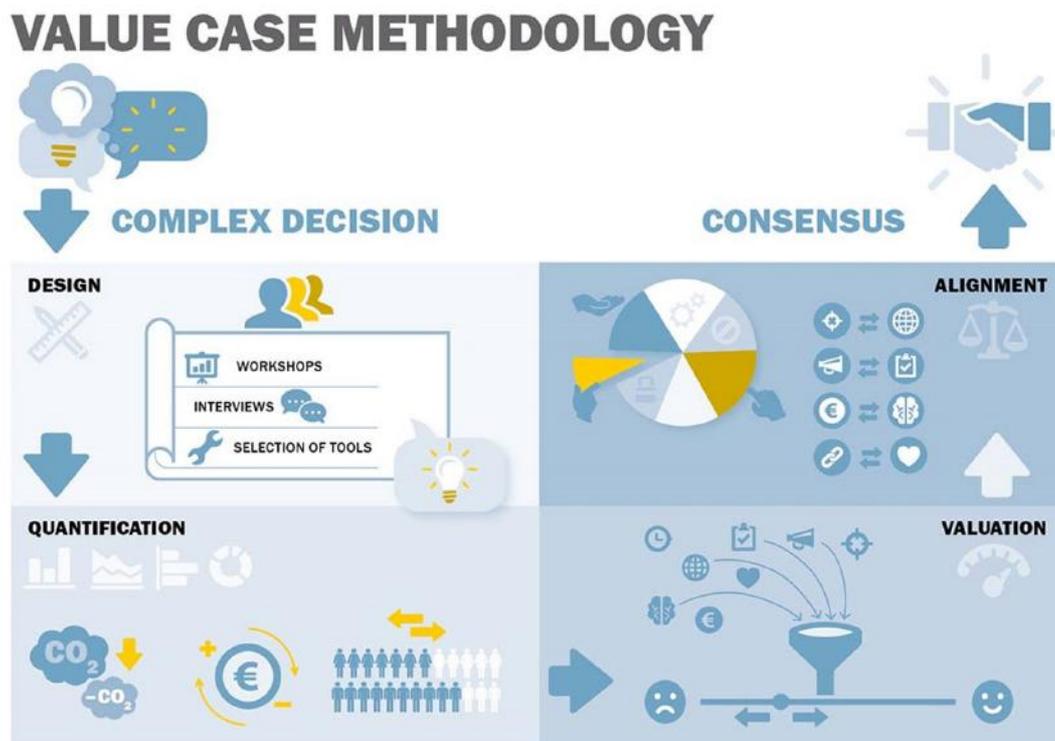


Figure 4: four steps of the Value Case Methodology

Step one is Design. Suppose stakeholders are considering investing in a responsible sourcing information system. What are the actions that need to be taken and by whom, which party takes what part of the costs and benefits, and who carries the risk? Communication about these types of questions offers clarity about the objective of the investment both for the consortium and for the other parties involved.

The second step is Quantification. We plan to offer insight in the values that can be gained relative to your objectives to the best of our knowledge at that particular time in the project. In this step we help to quantify the impact of the decision against objective measures: From financial and social effects to environmental impact.

Step three is Valuation. Suppose that an industrial stakeholder wants to reduce the CO₂ emissions or retain the control over product flows in a global region. Both will lead to costs. How do you trade off what is important? The subjectivity of the answer is likely to complicate matters. An electronics manufacturing sector has different wishes and deems other aspects important than, for example, an extraction site owner. The Value Case Methodology allows us to extract objectives from stakeholders and transform these into a single combined value for each party, the so-called economic utility.

Negotiation is the fourth and final step. The design step establishes how the costs and benefits are divided among the parties in a society. A decision-maker may decide in step two or three that the trajectory contributes insufficiently to the objectives. For example, because it becomes too expensive, the environmental benefits are too little, or independence is at stake. In the fourth step we support you with the exchange of values in the negotiation process and to reach a plan that is favorable for all parties.

We expect relatively limited feedback during the project from applying the Value Case Methodology. The project duration, project organization, deliverables and budget will certainly not be affected by the results of the go-to-market strategy. The main factor that can be influenced is the list of partners. The continuous search for societal relevance and therefore viable markets for PANORAMA deliverables can result in the inclusion of subcontracted partners during the project. We expect these partners to come from the KIC membership network and to offer expertise other than already present in the consortium. We envisage branch organizations to be involved on a permanent bases, or possibly additional knowledge & skills to be included such as sales, communication, public relations and graphic design.

At the end of the PANORAMA Project, the technology is expected to have reached a TRL of at least 7. The mentioned references of Ramascene of PROSUM are at TRL 9

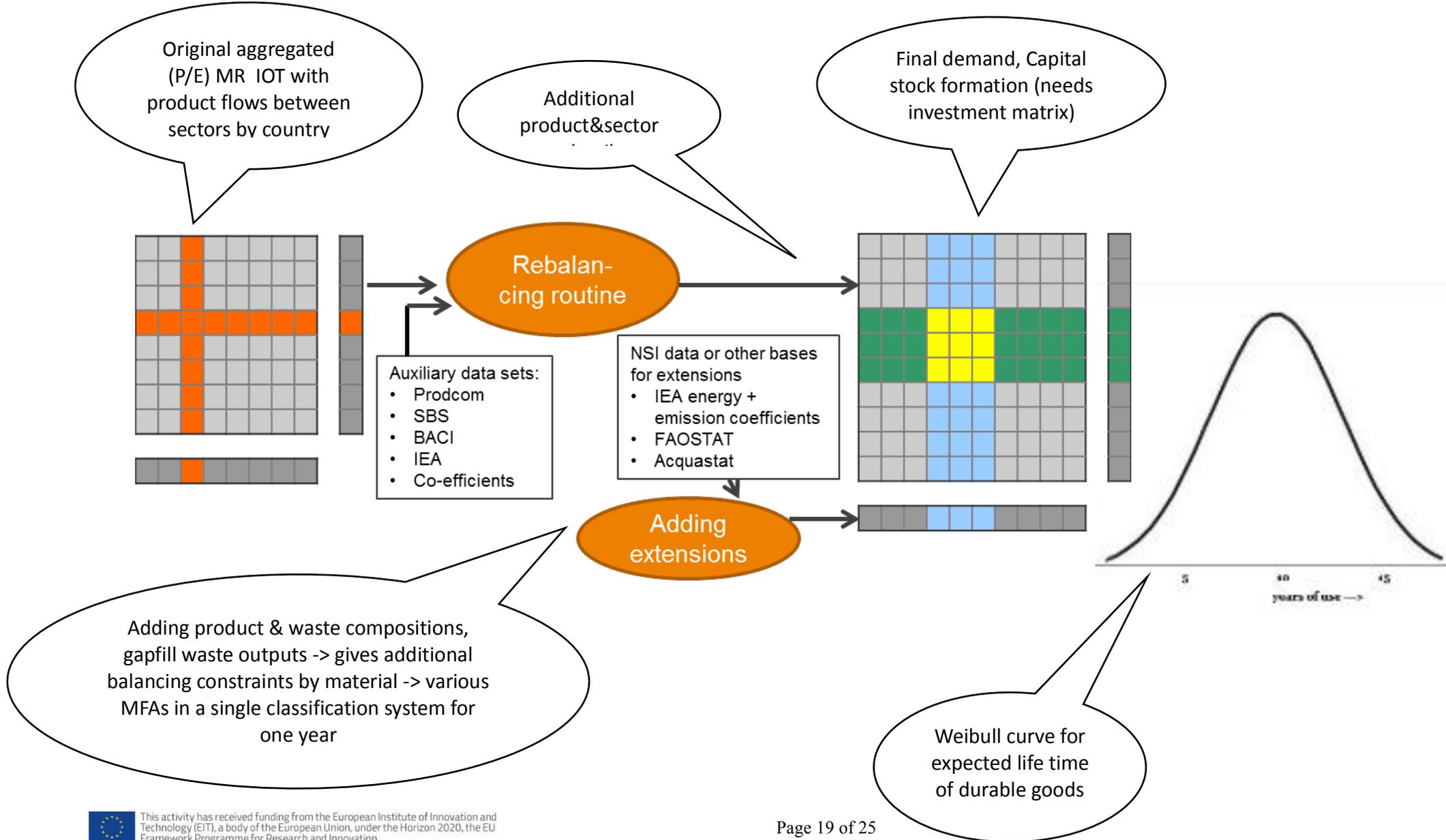
3.2 Investment needs and financial return

It is not strictly necessary to make additional investments in order for PANORAMA to deliver the market penetration envisaged in the proposal. Investments depend on the way the deliverables are offered on-line. The preferred option is to do this within RMIS and benefit from the funds made available for this system. The alternative options is to disseminate the PANORAMA deliverables within consortium partners mandate, for instance a website managed by BRGM. It is therefore conceivable that extra investments are made outside of the

project proposal. The additional investments needed to ensure a maximum market uptake for PANORAMA deliverables will be between 40.000 and 200.000 EUR. It is unlikely that these investments will be in the shape of out-of-pocket financial costs. It is more likely that in-kind contributions in the shape of labor and knowledge will be made to improve the dissemination options.

It is fair to be pessimistic about any commitments that can be made in terms of P&L (Profit and Loss) for the exploiting partner and ROI for EIT RawMaterials. We simply do not expect PANORAMA to gross any money during and after the project. Any additional calculations in that regard would be futile. As stated before, we will seek a written statement from EIT-RM that they accept our decision as soon it is clear that not-for-profit dissemination within the RMIS structure is indeed the way to go.

Annex A: visual overview of PANORAMA deliverables



Annex B: Overview of competing data and model providers

Model name and link	Organisation	Geographical coverage	Sectoral and other coverage	Modelling methodology	Special features
GEM-E3 http://ipts.jrc.ec.europa.eu/activities/energy-and-transport/gem-e3/	NTUA	EU28	59 NACE sectors, EuroStat data, GHG emissions	CGE model, recurse dynamic	Abatement curves, learning curves for technology diffusion, choice of transport modes, nested CES production function with KLE nest, different types of households with nested CES utility function, renewable energy and backstop technologies, linked with land-use model, linked with energy system model MARKAL, linked with micro-simulation model MACROMOD, effective labor supply, various skill types, wage bargaining and matching between vacancies and unemployed, semi-endogenous growth with human capital accumulation and R&D, detailed modelling of unemployment, investment decisions with Tobin's Q
GTAP, GTAP-E https://www.gtap.agecon.purdue.edu/models/current.asp	Purdue University	129 countries of the world	57 sectors, detailed agriculture commodities, GTAP database, GHG emissions	CGE model, recurse dynamic	Nested CES production function with KLE nest, land use, renewable energy, includes data on import tariffs
GEMINI, GEMINI-E3 family of models https://www.gtap.agecon.purdue.edu/models/current.asp	French Ministry of	28 world regions	18 sectors, GTAP database, GHG emissions	CGE model, recurse	Focus on energy and emissions, emissions trading schemes, nested CES production function with

econ.purdue.edu/resources/download/6006.pdf	Equipment, Transport and Housing		emissions	dynamic	different types of energy, abatement cost curves
EPPA model http://globalchange.mit.edu/files/document/MITJPSPGC_Rpt125.pdf	MIT	16 world regions	About 25 sectors with specific details for energy sectors	CGE model, recursive dynamic	Abatement curves, learning curves for technology diffusion, choice of transport modes and detailed representation of transport technology, different nested CES production function for each sector, different types of households with nested CES utility function, renewable energy and backstop technologies, endogenous technological progress, separate modelling of trade in natural resources, energy taxes, technology regulation, tradable permits
GREEN model http://www.oecd-ilibrary.org/docserver/download/51gsjhvj7dvd.pdf?expires=1393861062&id=id&accname=guest&checksum=5FAC550BCE4FA6F826A0C16FFFEE75C	OECD	12 world regions	8 sectors with 5 energy backstop technologies	CGE model, recursive dynamic	Focus on energy and emissions, emissions trading schemes, nested CES production function with different types of energy, abatement cost curves, backstop technologies

<p>E3ME model, E3MG global is upcoming http://www.camecon.com/EnergyEnvironment/EnergyEnvironmentEurope/ModellingCapability/E3ME.aspx http://www.camecon.com/EnergyEnvironment/EnergyEnvironmentEurope/ModellingCapability/E3ME/licensing_e3me.aspx</p>	<p>Cambridge econometrics</p>	<p>EU28</p>	<p>59 NACE sectors, EuroStat data, GHG emissions</p>	<p>combination of IO table and macro-econometric modelling</p>	<p>E3ME combines the features of an annual short and medium-term sectoral model estimated by formal econometric methods with the detail and some of the methods of the CGE models, providing analysis of the movement of the long-term outcomes for key E3 indicators in response to policy changes. Includes 33 econometrically estimated equations per country. Focus is on energy and GHG emissions.</p>
<p>GINFORS model http://www.gws-os.com/de/content/view/173/109/</p>	<p>GWS</p>	<p>53 countries</p>	<p>41 sectors</p>	<p>combination of IO table and macro-econometric modelling</p>	<p>combines energy model with trade model, macro model and IO model, mostly uses ad-hoc methodology with some conflicting results between the modules</p>
<p>PRIMES model http://ec.europa.eu/energy/energy2020/roadmap/doc/sec_2011_1569_2_prime_model.pdf</p>	<p>NTUA</p>	<p>EU28</p>	<p>IEA database</p>	<p>energy systems model, partial equilibrium</p>	<p>detailed representation of energy technologies of industry and households, backstop technologies, detailed modelling of energy supply and demand, integrated REMOVE transport model, steam and hot water, biomass, gas supply, hydrogen, GHG emissions, energy balances, various types of dwellings and appliances</p>

<p>POLES model http://ipts.jrc.ec.europa.eu/activities/energy-and-transport/documents/POLESdescription.pdf</p>	<p>Enerdata</p>	<p>47 world regions</p>	<p>IEA database, - Final Energy Demand by main sectors - New and Renewable Energy technologies - Electricity and conventional energy and Transformation System - Primary Energy Supply</p>	<p>energy systems model, partial equilibrium</p>	<p>abatement costs, emissions trading, global energy markets and prices, modelling of reserves, global supply and demand for energy, detailed representation of technologies, renewable energy, hydrogen, biomass, waste, transport and buildings, land-use</p>
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Annex C: Value Case Methodology in more detail

	Value Case Methodology as main methodological framework	VCM 1: Orchestrating Innovation	VCM 2: InnoCentre	VCM 3: ASAP Aligning Sustainability impact Assessment of Purchasing decisions
Input	Innovation, Actors, Distribution of inputs/activities	Idea for an innovation program in context of a societal challenge	Idea for an innovation program in context of a societal challenge	compact fact sheet (1-2 A4) containing key information about the investment project
Transformation	Process that guides quantification, sensitivity analysis, adapting the innovation and/or additional measures or exchanges to achieve 'collective action'	Process to get commitments, set up the organisation, attract ecosystem players, execute innovation projects and ensure impact. These innovations typically require SBMIs	Design of an organisation and corresponding business model that aims to address the societal challenge by means of multiple (coherent) innovations	project is assigned either 0, 1, or 2 points on 5 criteria, resulting in score 0-10 Individuals in the DMU first do this individually, then discuss the scores aim is to ensure that energy efficiency is discussed as soon as possible (ASAP)
Output	Distribution and quantification of effects. Commitment to 'collective action'	An operating innovation centre	Design of an organisation ((digital) innovation hub) and corresponding business model that "generates" (coherent) innovations	Insight in the relevance of the investment for energy efficiency
Problem	General willingness of actors to consider collective action, yet uncertain about the exact distribution.	Multi-actor innovations in scope of societal challenges requires knowledge of technology & innovation management, public and business administration as well as networking. This multi-disciplinarity is typically insufficiently available	Addressing societal challenges requires multiple coherent innovations and business models.	How can we ensure that energy efficiency is included as standard / consciously as a criterion in CAPEX decision-making, as early as possible in the discussion?
Target group	Multiple innovation stakeholders (~	Stakeholders in innovation programs in scope of societal	Typically, regional stakeholders, such as Regional Development	Boardroom/Decision Making Unit

	DMU)	challenges.	Funds, governments, corporates	(DMU)
Identification of actors	Input	Following ecosystem mapping and stakeholder management	Following the actors in an innovation ecosystem	You want to be at the table with the people who influence decision making. Typical C-level people: CEO, CFO, CTO, other roles depending on the organization
Impacts on actors	Yes, by means of quantification	This is not supported with a model	This is not supported with a model	Use of the tool has the following behavioral effects: Rationalizes and structures decision making The topic of energy efficiency comes up early Group decisions are of better quality if the input of each individual is first made explicit. After all, every DMU member has his / her own perspective
Position in time	Decision support based on quantification of the effects of an innovation (and business model)	Provides a process for organising the context in which SBMIs are required.	Provides the organisations of a context for SBMI. SBMI actors are expected to be identified in the ecosystem mapping of the Innovation Centre.	Contributes to innovation adoption through intervention on systemic drivers / barriers at the intra-organizational level.