# CIRCULAR PUBLIC PROCUREMENT TOOLBOX

## Managerial guidelines for circular procurement practitioners


### Abstract

This managerial toolbox is a key document elaborated within the Vinnova funded project PROCEED. It contains an innovative roadmap for public procurers to guide them in their circular public procurement activities by focusing on and leveraging on measuring circularity with specific product circularity indicators elaborated by RISE Research Institutes of Sweden AB – Division Built Environment. The goal is for the public sector to influence the market for a higher uptake of circular offering and ultimately becoming a key player to accelerate a transition to a circular economy.



Emanuela Vanacore, Robert Boyer & Mats Williander

RISE Research Institutes of Sweden AB

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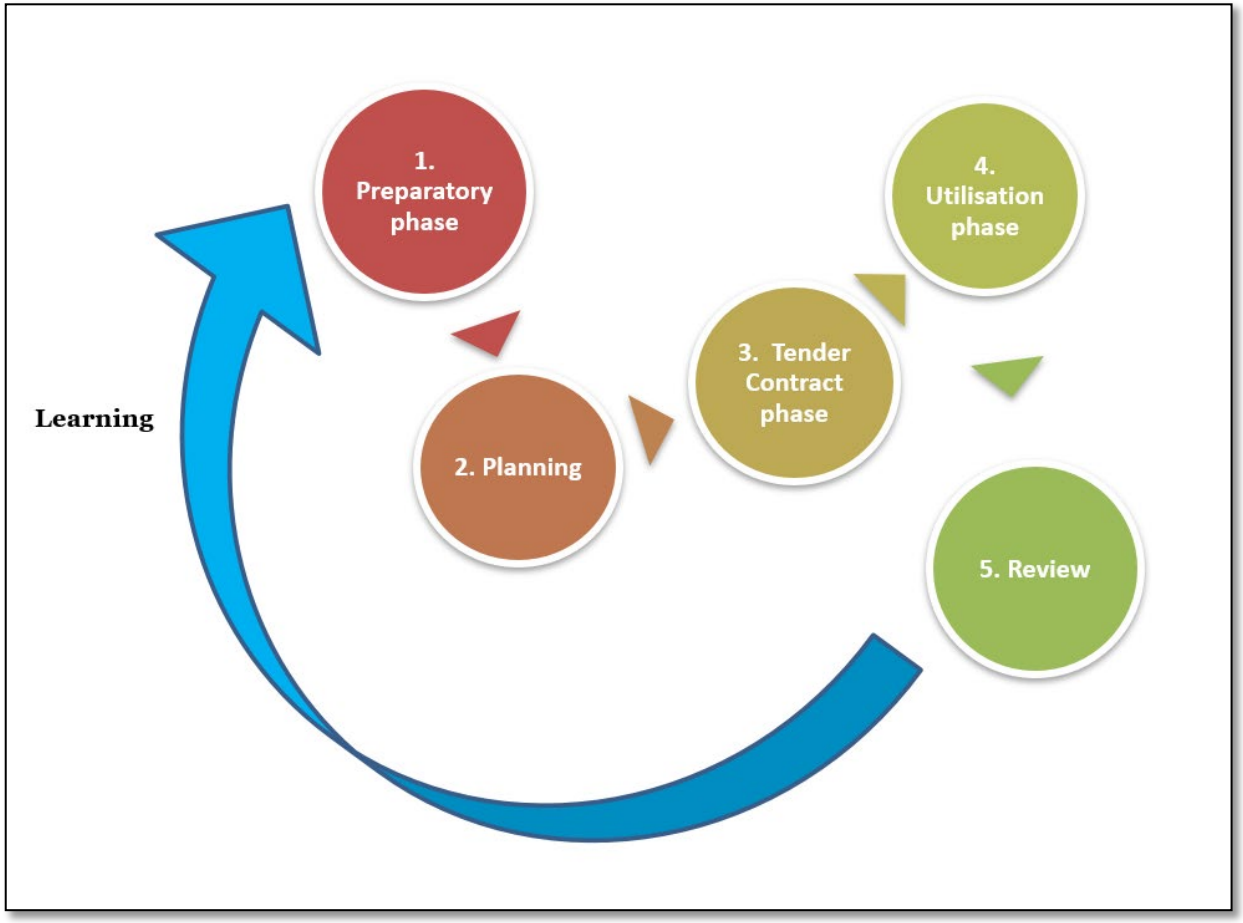



*Figure 1. Overview of the Toolbox steps (Source: elaborated by RISE AB).*

## 0. Introduction: Fundamentals

Sustainability is about consuming in ways that do not harm or over-use other stakeholders, where the environment is one of those stakeholders, although "without a voice". Sustainability is often discussed in three aspects: environmental, social and economic sustainability, sometimes referred to as "the triple bottom line" (Hubbard, 2009). All three aspects have to be taken into consideration for any person or organisation making sustainability claims and are, of course, required in any sustainable society. Some give equal weight to the three aspects, while others claim that there is an order of priority. Environmental sustainability comes first because a healthy environment is crucial for mankind to exist. After that comes social sustainability because a healthy, fair and equal social system is an essential prerequisite for a well-functioning economic system. Economic sustainability is fundamental for any person or organisation to prosper over time in a society based on trade and comparative advantages (Ivanko & Kivirist, 2009).

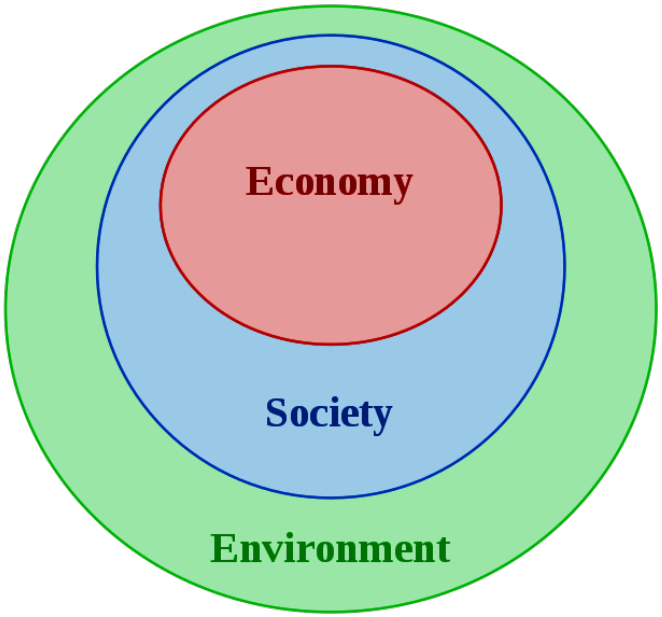



*Figure 2. The 3 pillars of sustainability*

Substantial work has been done by others to define and develop what sustainable procurement is (Brammer & Walker, 2011). An ISO standard, ISO 20400, has recently been developed and released for sustainable procurement, where sustainable procurement is defined as (ISO, 2017:3(5)):

*Sustainable procurement is the process of making purchasing decisions that meet an organisation's needs for goods and services in a way that benefits not only the organisation but society as a whole, while minimizing its impact on the environment. This is achieved by ensuring that the working conditions of its suppliers' employees are decent, the products or services purchased are sustainable, where possible, and that socioeconomic issues, such as inequality and poverty, are addressed.*

Our toolbox for circular public procurement focuses on improving *environmental sustainability* without causing negative economic effects for any stakeholder, i.e. it focuses on one part of what is required for a procurement to be sustainable.

The **toolbox** is therefore not supposed to replace any **existing purchasing criteria** but to **complement** them with one that ensures a continuous environmental sustainability improvement by getting more consumer utility out of a given set of material resources. Our position is hence to contribute to environmental sustainability by introducing an economic value-based circularity metric and include the economic aspect (making it "restorative by design") of the circular economy in the definition of what circular procurement has to be. We also offer a shortlist of other relevant product- and firm-level circularity metrics that have been developed in the past decade. They can be used to evaluate the same problem through multiple lenses. By complementing any existing purchasing process with what this toolbox provides, your organisation will become more environmentally sustainable, motivate suppliers to improve the environmental sustainability of their value-chain, and hence contribute to the shift of society to the highly needed circular economy.

There are several reports on circular procurement, more specifically on circular public procurement (see for example Alhola, Salmenperä, Ryding & Busch, 2017). While these are very valuable, there is a lack of sufficient stringency on how to define circular procurement so that it encourages a shift away from the current linear and resource-flow based economy (as it will be defined and explained below) and into a circular economy that is "restorative by design" (as it will be defined and explained below). It is here that the **toolbox will contribute the most by providing a stringent financially grounded definition along with an economic value-based circularity metric**. This makes it **possible to set clear circularity targets and follow up on circularity both over time and throughout a value chain**.

We encourage the reader of this toolbox document to read through the references we give as a background material, especially if your organisation does not follow any of the existing guides (Green procurement, Sustainable procurement or Circular procurement).

Also, this toolbox is **complemented by an Action Plan** document that aims to guide the reader on understanding to focus on key areas and how to operationalise the steps suggested in the toolbox.

## 0.1 Why circular procurement and why by the public sector?

Today, humanity uses 1,5 times the natural resources that the planet can supply in a single year. In other words, humanity's current resource consumption and waste production requires the services of 1,5 "earths" per year, and each year that we sustain consumption over a factor of 1,0 humanity descends further and further into ecological "debt". If everyone on earth lived like an average Swede, it would require 4,2 "earths" (2018). Any use over the factor of 1 is unsustainable. **Before 2030**, about 3 billion people are improving their standard of living up to our level, which means that the share of people with roughly our standard of living will grow from 1,8 billion to 4,8 billion. With the current linear and resource-flow based economy, as explained later on, mankind's level of unsustainability will worsen considerably only within the coming 11 years. **At least a five-fold resource productivity improvement is needed to "absorb" the growing global middle class**, but it may need to be 8-fold depending on the rate of economic growth in the already wealthy part of the world.

In a **circular economy**, **material resources are repeatedly reused by creating circular material flows**. This can be done on different levels of material value.

**Recycling** is the most outer loop where a product's value is destroyed when its various material content is transformed into raw material again. **Remanufacturing** is a circular flow where a product is restored to its original specification with only a fraction of the cost of producing a new one. i.e. most of the product's original value is restored in the process of getting it "as new".
**Reuse** is the circular flow where a product, after providing utility for one consumer, can continue to provide utility for another consumer, i.e. its ability to continue deliver utility is retained at almost no additional cost (except for some logistics)

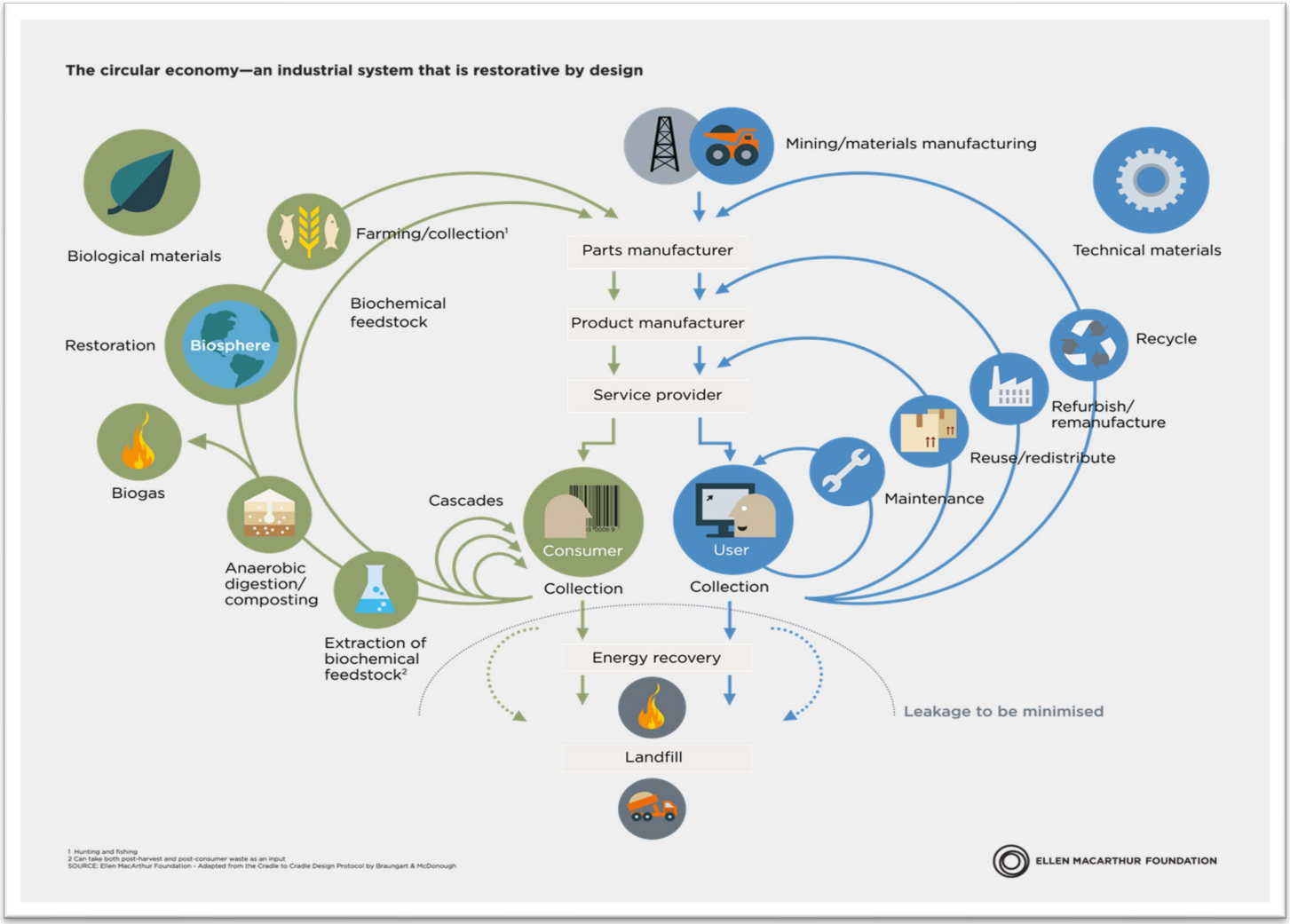
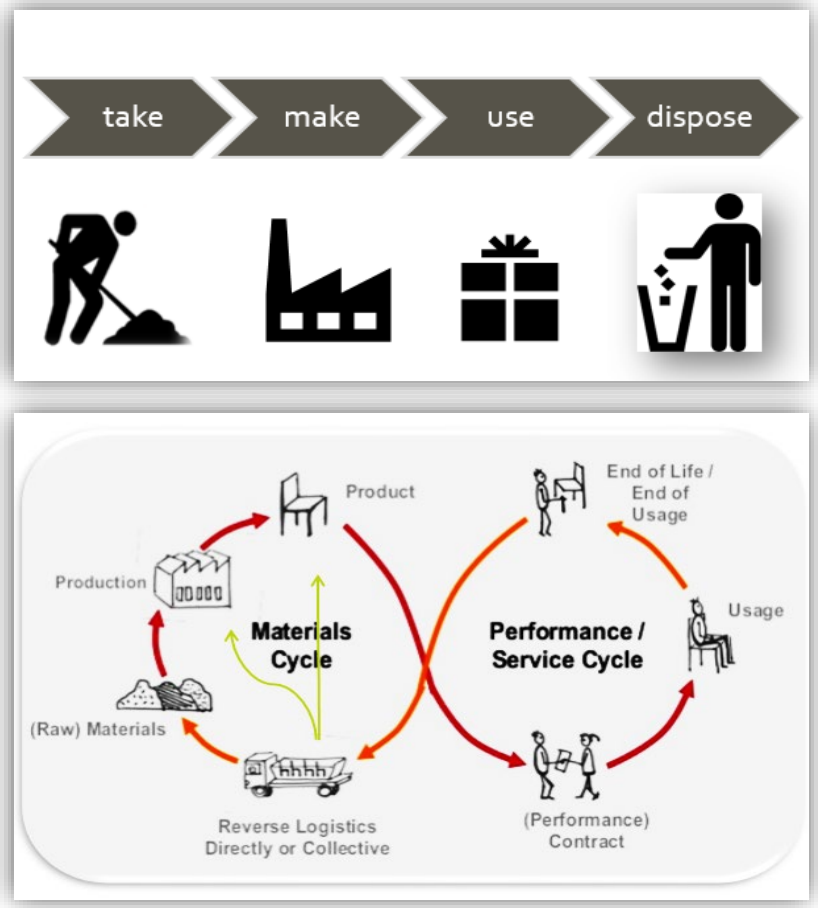



*Figure 3. A representation of the Circular Economy: the Butterfly Diagram (Source: Ellen MacArthur Foundation, 2012).*




A fundamental difference between a linear economy and a circular one is the logic behind making profit. In the linear economy, a manufacturer makes money by selling products – a product-flow based logic. The higher margin the better, and the more products that are sold the better. This incentivises the manufacturer to develop and produce products that are cheap to produce but looks expensive and make products with a limited useful life length.

A circular economy builds on another profit-making logic, the one of making profit from an asset stock. The manufacturer retains ownership over the products, which becomes her asset to create profit from. The manufacturer offers different forms of access to the products so the consumers can consume the products' utility This profit-making logic has two implications; One is that the manufacturer is incentivised to make products that are attractive over a long period of time and the other is that the manufacturer is incentivised to deliver utility continuously (since it is utility provision she gets paid for, and not the product itself). Such a circular economy becomes radically more resource efficient because less resources are required for a given amount of utility[1], and products will be kept attractive for longer time[2]. A factor 5 or more utility per unit of virgin resource consumed can be expected after some years.

*Figure 4. Linear economy V Stock-based economy*

[1] Today, with private car ownership, a car is normally used less than 5% of the time. Mostly, it is parked. That can be improved through car sharing and mobility-as-a-service by at least a factor of 4-8 (Loose, 2010:74).

[2] Through "future-adaptable design", products can be made attractive for substantially longer time periods than now (https://www.ri.se/sites/default/files/2019-12/White-paper%20FAD%2020190612.pdf). There is no reason why a car, that today is designed to last about 250 000 km, can't last as long as a truck, designed for 1 600 000 km. It is a matter of manufacturers' will rather than technology limitations.

The situation today is that the knowledge what needs to be done to make society and its industry circular is quite well developed, but there is a lack of market demand for circular offerings. This makes industry hesitant to start the journey to a circular economy by themselves. What if customers don't follow and accept purchasing product utility rather than product ownership?

Since the public sector represent a very big share of the annual consumption of goods and services in most developed countries (in Sweden the total value of purchase covered by public procurement regulations is estimated (2017) at 706 billion SEK which equates to nearly 18% share of GDP at fixed price (Konkurrensverket, 2019)), the public sector can play a very important role in kick-starting the shift to a more circular economy by circular public procurement. Since there is no reason why a circular offering should be more costly in the long run (in fact it should be less costly), and there is no primary value for the public sector to own products for the sake of owning, taking a lead in developing a market and kick-start the shift through circular public procurement is probably among the easiest and less time-consuming ways for a country to "go circular".

## 0.2 What is circular public procurement?

Basically, we define a circular procurement as one where **the economic value of recirculated material as share of total economic value of a product is specified and continuously increased for each new procurement round**. By introducing an economic value-based circularity metric, it becomes possible for procuring organisations to specify what degree of circularity and what improvement rate that it wishes from the supplier. The metric is also a useful tool for the supplier when creating offerings for the market, designing products, and choosing materials to use.

It is worth mentioning that the value-based circularity metric measures *only* rates of material recirculation and not other factors commonly associated with sustainability (e.g. toxic material, rare earth metals, water, or any other substance). A more detailed understanding of environmental consequences may require other complementary metrics. This toolbox with its circularity indicator is hence a complement to already existing requirements your organisation use in its procurement processes and specifications.

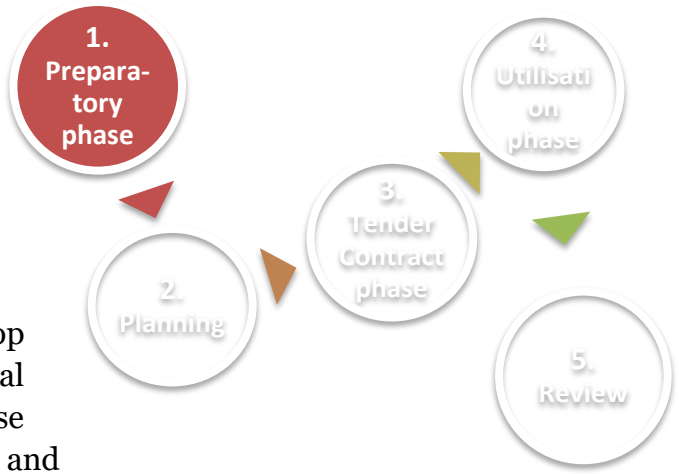
## 0.3 Some challenges to expect

One aim with circular public procurement is to become not only more sustainable in organisational operations, but also to help society shift to a more circular economy. By creating and increasing the demand for circular offerings, you as the purchasing organisation will trigger value chains of suppliers to become more circular. Since no circular economy yet exists, nobody knows for sure what can be achieved easily and what is on the border of being impossible when shifting. So, the path to higher circularity in a specific business sector is not known beforehand but will unfold during the purchasing period and beyond. Because of that there is a need for involved actors to collaborate, be flexible, yet stick to certain non-negotiable circular principles. The need for collaboration and flexibility must also be designed so that it does not violate the public procurement law (LOU – for some key facts on LOU please, see Annex 1).

One non-negotiable topic is to implement and use the circularity metric discussed in this document. Specific levels of circularity will remain a topic open for discussion– these will probably vary for different sectors. Another topic, the circularity improvement rate, can also be quite challenging. In order to meet global resource efficiency improvement needs, there is a general need for about 14% annual improvement in circularity. Since that is not the case for every raw material used in a product, it can therefore stimulate discussions about on what ground such demands are stated. The non-negotiable need is to increase consumer utility per product "consumed" (i.e. reached end-of-life) by 14% per year the coming 11 years, i.e. in total a five-fold resource efficiency improvement.

A shift from something known to something unknown is much easier if participating actors **share the vision and interest** in shifting because that lays the foundation for **trust**. All actors in a value chain must be able to trust that each of them will do their part willingly and with a genuine interest in succeeding. At the same time, such ambitions and the creation of such an environment must not go against the rules and intent of the public procurement law.

## 1. Preparatory phase




This is an initial phase to set up the conditions for the planning phase.

As explained in the introductory section, our current linear production and consumption economic model is unsustainable and our communities struggle to find more (and finite) resources while trying to dispose waste and emissions and cope with megatrends such as population growth, climate change and urbanisation (ICLEI, 2017).

We are in urgent need of decoupling and that is the ability of an economy to develop without corresponding increases in energy and resource use and in environmental pressure (sink limits). Governments, societies and businesses are beginning to realise that change is unavoidable in order to avoid the point of "no-return" (Wijkman and Skånberg, 2015). Actions for change at the both macro- and micro-levels can be observed, they develop at different pace and are rapidly growing in number in both existing and new organisations. Examples include: the EU Action Plan for the Circular Economy (COM/2015/0614final); the "Circular Netherlands 2050-Dutch Roadmap to Circular Economy 2016-20150", the Swedish car manufacturer Volvo (with its remanufacturing programme).

Moreover, evidence shows that sustainable and specifically, circular public procurement seems to be largely determined by endogenous variables and far less by exogenous variables. That means that in order to effectively support and implement circular practices while improving circular performance, organisational strategic choices and commitment by top management together with the efforts made by the administration are needed (ISO 20400, 2018; Testa et al., 2016).

Once top management, procurement management and staff have confirmed their commitment and clarified internal accountability, it is important to establish that "golden thread" between organisational policy and procurement strategy. This consists of aligning circular procurement with organisational vision, objectives and goals by adopting circular principles and practices. In other words, an organisation must identify its key circular procurement priorities and the related specific, measurable, achievable, realistic, timely (= SMART) objectives that can fully support the overall organisational vision and goals.

Also, in this phase it is important to carry out a Need Analysis to investigate what alternative options are available to deliver the same outcome more efficiently while ensuring a higher degree of circularity long-term. As suggested by ISO 20400 and the European Commission, this entails investigating the following:

- Possibility to eliminate the demand by reviewing the need;
- Decreasing the frequency of use / consumption;
- Identifying alternative methods to satisfy demand, e.g. renting rather than owning (service Vs product) with a take-back system in place where the supplier retains ownership of products, offers accessibility and related services and ensures to take the products back to then repurpose them;
- In case of service, what service?
- Aggregating and / or consolidating the demand;
- Sharing use between divisions, departments or organisations;
- Considering a circular procurement hierarchy, e.g. encouraging repairing, reusing or repurposing of older goods or recycling materials (e.g. What products? Recycled? Maybe services? What services? etc.).

A complementary analysis needs to focus on understanding what kind of circular procurement principles and practice make most sense in a specific context as well as considering impact, risk and opportunities that may arise at both the organisational and external level (suppliers). For example, the request of certain circular specifications for a product that might require the supplier to reconsider the product design or perhaps hire some specialists.

| Circular issues / Purchase category | **Issue 1** (e.g. Climate change) | **Issue 2** (e.g. Waste management) | **Issue 3** (e.g. Health & Safety) | **Issue n** |
|---|---|---|---|---|
| **Category 1** (e.g. Furniture) | | | | |
| **Category 2** (Building construction) | | | | |
| **Category 3** (e.g. Packages) | | | | |
| **Category n** | | | | |

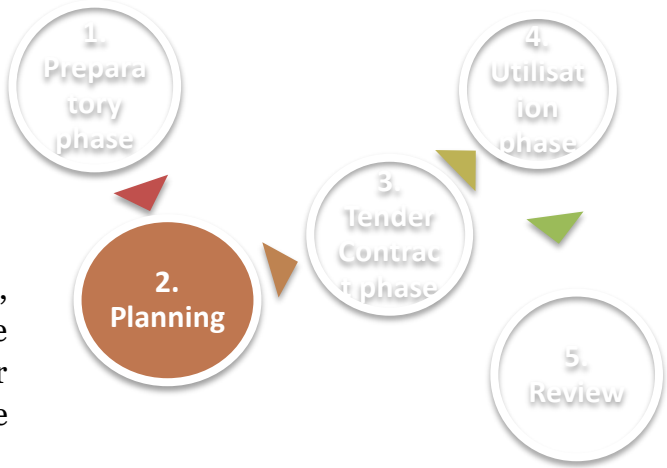
*Figure 5. Example of sustainability issues per category and their level of impact (Source: ISO 20400, 2018; p.22)*

**Summary:**

- **Ascertain commitment + accountability of top management, procurement management and staff.**
- **Identify organisational vision, mission, strategy and policy.**
- **Set sustainability issues, objectives and prioritise them.**
- **Identify organisational needs (What product? Maybe a service? What services? Etc.).**
- **Conduct a risk / opportunity analysis based of the selected needs.**

## 2. Planning phase

This phase establishes circular requirements and associated CPIs for the Tender Contract phase and comprises of two focused sub-phases:




### 2.1 Enablers.

In order to effectively plan, deliver and assess a circular procurement process it is important that all the parties (both internal and external) understand motivation, objectives, procedures and contribution to each procurement activity. This will increase the chances of resulting in all the parties' value alignment and matching circular solution that will ultimately steer the market to a higher degree of circularity (see Value Case Methodology (van Dijk and Dittrich, 2013)).

***Internal*** – The organisation must ascertain that the right staff with the necessary skills and experience are available. A simple three-step process can be used and includes: 1.) Mapping the key objectives, tasks and competences required will help identify the necessary profiles and possible gaps; 2) Evaluation of the ability to implement if the skill set is available; 3) Decision making depending on the magnitude of the gaps and ability to implement. The possible actions therefore include (from the least costly to the most expensive one): moving staff around, internal training or recruiting.

***External*** – This refers mainly to stakeholder engagement. A different *modus operandi* also entails different dynamics among and with the suppliers.

It is therefore desirable to open up for closer and transparent collaboration (Witjes and Lozano, 2016) and hold / jointly participate for instance to market consultations, trade shows, liaising with universities to get guidance on potential suppliers, industry, searching on the internet for supplier directories, etc. These initiatives can be also coupled with surveys and online

forums. The resulting interaction should aim at achieving a good match between an organisation's requirements, the options available on the market or innovative new circular offering that can be developed.

**When engaging with potential suppliers one can address a number of questions as listed below** (MVO, 2017). It is worth noting that these questions are suitable at all level of the search for supplier, at a small-scale purchase and can be performed even without an overall revision of the organisational (circularity) goals:

- Assess the status of circular applications within your sector and within your company. Try to estimate the impact of the applications, for instance by asking yourself: is this happening too slowly?
- Further to the previous question: Can you illustrate how you contribute to the circular economy in terms of:
  - the product design of your offering
  - the production process of your offering
  - how traceability is performed and managed
  - extending of the lifespan or useful life of your offering (e.g. maintenance/repair)
  - highest-value re-use of your offering, in relation to both technical and biological materials
- It is a principle of the circular economy that products have a residual value after their initial phase of use, thanks to recycling of the product and/or the used components or materials. What opportunities do you envisage to extend the benefit of this residual value (in part) to the user?
- How do you currently measure the level of circularity of your products?
- What forms of contract can you offer to apply circular models in our procurement project? Do you have any examples?

- What risks do you envisage, and how do you respond to them? What risks related to finance, production, sourcing, legal compliance, etc. can you/ would you wish to run: how great can the risks be?

## 2.2 Specifications: Identification & Integration of CE requirements

This phase is about identifying and setting the criteria for CPP which have to be fully integrated within the overall procurement processes. Therefore, this phase can be part of the broader Environmental prioritisation (see the Leverage model by Fracchia et al., 2012) with an obvious focus on CE. It derives that Environmental Performance Indicators (EPIs) and Circular Performance indicators (CPIs) can be used in a complementary way.

It is crucial to take into consideration that the circularity indicator "C" and the setting of the related performance improvement targets are NOT NEGOTIABLE criteria. However, it is important to contemplate a "tolerance range" for C that might occur as clarified below in the paragraph "**Introducing circularity indicators"**.

### 2.2.1 Procurement Need Specifications

It is important to remember that product specifications have to be **realistic** (= achievable vision, market and budget), **objective** (= the specified behaviour does not vary depending on the agent that performs it) and **verifiable** (= measurable through indicators). Also, when designing tender specifications, one must consider technical aspects and / or functional aspects.

A technical approach defines the contract to the market and describes measurable criteria against which tenders will be assessed, including the minimum compliance requirements.

A functional / output-performance based approach defines both the desirable result and expected outputs (e.g. quality, quantity, reliability, etc.).

Whether the latter allows a greater degree of flexibility in the procedure by giving the market scope to innovate and offer the most effective solution (for instance in terms of reduced resource use and costs), the former ensures a greater level of normativity by setting specific circular improvement targets.

A more comprehensive approach combining the aforementioned two approaches would include the following aspects specifications:

- Product design
- Production process
- Operational phase
- End-of-life management

There are three typical circular procurement scenario contracts:

1. Pay-per-Use. Under this model also known as Product Service System (PSS), the supplier keeps the ownership of the products and the user pays-per-use or based on performance.

2. Purchase and Buy-back agreement. The supplier commits to buy back products at the end of their lifecycle under specific terms agreed in advance. This helps secure optimum value retention via reuse.

3. Purchase and resale agreement. This agreement can either establish that a third party will recoup the product after use, typically for reusing lower-value materials or recycling; or that other contracts can be introduced with specific clauses on reuse.

### 2.2.2 Sourcing Strategy (including how to measure circularity)

In order to corroborate the product specification a complementary "Sourcing Strategy" must be performed. This includes the following:

**Assessing circular risks / opportunities** – In this step each organisation should make, assess and prioritise important considerations on technical aspects, compliance culture, sourcing locations, supply chain structures (and particularly, suppliers below tier 1), taking into account the directions set by the organisation's procurement strategy and policy. The identification of circular risks and opportunities is best performed with a multidisciplinary approach that entails gathering knowledge from technical / circular experts (who can advise on how goods and services are manufactured, processed and delivered), sustainability experts (who can advise environmental management, legal issues, health and safety, etc.), user experience experts (who can advise on how products and services are used by the organisation).

It is essential to realise that in a circular setting that aims to maximise and increase the utility per product consumed, the responsibility of the market must be shared between the buyer organisation and the supplier as follows:

- The Buyer organisation has to expect, accept and demand used / upgraded products;
- The Supplier has to commit to produce products with a logic of tighter loops (this refers to the so-called "power of the inner circle' that is about minimising comparative material usage vis-à-vis the linear production system (Tomellini and Alming, 2019)).

**Conducting complementary Life Cycle Assessment Analysis & Life Cycle Costing (LCC) Analysis** – The previous step can be complemented by a Life Cycle Approach to assess the impact that a product can have from a sustainability viewpoint during its entire lifespan, i.e. from cradle to grave or perhaps from cradle to cradle (for circular products). An LCC analysis is a methodology that identifies all the costs associated to a product or a service throughout their lifetime. As such, this approach makes sound economic sense and should foster circularity.

An LCC Analysis comprises of two components:

1. Total Cost of Ownership (TCO) including:
    1.1. Buying price and all associated costs (e.g. delivery, installation, insurance, labour costs)
    1.2. Operating costs (e.g. maintenance for a product that might be purchased as a service, spare parts, energy, fuel and water use)
    1.3. End-of-Life costs (e.g. disposal, decommissioning)

2. Monetisable positive or negative externalities including:

   At the organisational level: the evaluation of costs related to benefits of risks and / or mitigation and benefit realisation

   At the societal level: the cost of both environmental and societal externalities (e.g. greenhouse gases; job creation).

It is advisable that each supplier company encourages its supply chain to perform an LCA Analysis and an LCC Analysis as the extension of such methodologies across the supply chain (particularly when based around end-of-life approaches) are instrumental for quantifying the environmental benefits of material efficiency and circular economy strategies at the ecosystem level (Walker et al., 2018).

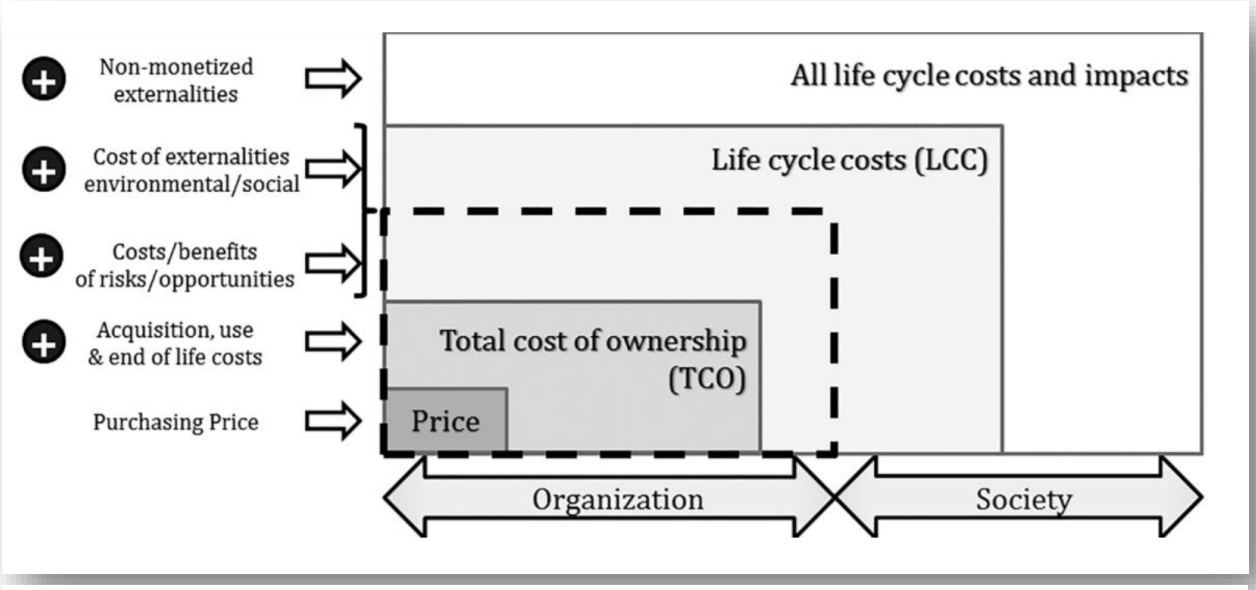



*Figure 6. Overview of LCC (Source: ISO 20400, 2017-p.28).*

It is worth noting that where different budgets for upfront cost of purchase and long-term energy and maintenance costs are required, then collaboration between department is vital (EC, 2017).

**Analysing the market and potential challenges –** This step aims at understanding the current and future ability / capacity of the market to fulfil circular procurement needs. It is a way for an organisation to realise whether circular criteria can lower or rise both the organisation's buying power and the level of competition in the market.

By engaging with potential suppliers in early stages of a procurement process, an organisation can gauge whether business requirements can be met or even exceeded based on new technologies, new goods and services, new suppliers, advances in circular business practices, new circular business models, pioneering buyer/supplier relationship, use of specific and appropriate environmental/sustainability standards (e.g. ISO 14001) and labels (e.g. FSC, C2C).

When analysing the market and the potential challenges one can address the following questions (MVO, 2017):

- Is there sufficient capacity in the market?
- Does the market have a solution to the functional requirement as formulated?
- What chances do market players see to meet the minimum requirements despite a smaller available budget?
- Are there alternative routes to circular solutions?
- Can the market satisfy the requirements set, and if not, why not?

**Introducing circularity indicators –** "What gets measured, gets done!". There are a series of various sustainability indicators that can be set and used in a procurement process. Also, when it comes to measuring circularity, there are many ways to measure it and at different levels in society (Linder et al., 2017; Pauliuk, 2017). For example, the European Commission has adopted guidelines to help its member countries transition to a circular economy. These guidelines are different from the goals and guidelines set by cities, for example, the City of Amsterdam, which hopes to be a fully-circular city with zero landfill waste and zero virgin material consumption by the year 2050. Circularity principles have also been adopted by individual firms to help reduce the resource consumption, waste production, and per-unit profitability of their operations. In all of these contexts, some kind of indicator is necessary to measure progress, although different contexts will use different indicators.

**Definition of the Circularity Metric**

For the purposes of the circularity metric, product level circularity is defined as:

*the fraction of a product that comes from retired products.*

We define *fraction of a product* in terms of **economic value**. This is different from fraction in terms of mass. Economic value is calculated using **market prices** or **cost estimations** (for proprietary parts). Because the metric is focused on economic value, there is often no need to break down the analysis to the level of raw materials. A reused component can be entered in the calculation as it is, without considering the materials it is made from.

The circularity metric ranges between 0 and 1 (or 0% to 100% recirculated parts).

The definition can be operationalised as follows
(C referring to product circularity):

$$C = \frac{economic\ value\ of\ recirculated\ parts}{economic\ value\ of\ all\ parts}$$

*Figure 7. Definition of the Circularity Metric "C" as elaborated by RISE AB – Division Built Environment - Sustainable Business*

This report proposes an indicator called "C". C is designed specifically to measure the circularity of individual products. C is equal to the percentage of a product's economic value that comes from recirculated (recycled, remanufactured, reused, et) material. A product whose economic value is composed of relatively more recycled, refurbished, or reused material is considered *more circular*. It can be argued that there are several benefits to considering the economic value as the basic unit for aggregating products parts for measuring product circularity as it:

- Promotes re-entering of material (it rewards tighter loops);

- Promotes value-preservation;
- Focuses on valuable and scarce materials rather than on the material weight. This is because prices are "neutral" conveyors of key information on materials, i.e. they are sensitive to relative scarcity; they reveal the presence of a new item on the market.

The definition of "C" is contained in fig.6. Further information can be found in annex 1 ("Guidelines for implementing circularity metric & related environmental indicators").

### Other product- and firm- level circularity metrics

As discussed above, scholars and government agencies have proposed multiple ways of measuring circularity at the national-, local-, firm-, and product-scale. The C metric is one product-level metric that offers the advantage of being expressed as a single digit that can be calculated with relatively simple arithmetic. Several other product- and firm-level circularity metrics have also been developed in the past decade. Each metric offers advantages and disadvantages to firms interested in pursuing circularity. Several of these metrics are described below.

*The Circular Economy Toolkit (CET).* The CET is an organisation-level circularity metric developed by scholars Jamie Evans and Nancy Bocken at the Cambridge Institute for Manufacturing in 2013. It is designed to help organisations identify broad strategies for accessing the benefits of the circular economy. The CET assessment tool asks questions in seven different operational categories, including 1) design, manufacture, and distribute, 2) usage, 3) maintain/repair, 4) reuse/redistribute, 5) refurbish/remanufacture, 6) recycle, and 7) products as a service. There are 33 questions total, and each question is answered on a 3-point scale. The results of the assessment tool identify either high, medium, or low *improvement potential* in these seven realms, offering decision makers guidance about where and how to focus attention on efforts to improve circularity in their organisation. The metric can be accessed free of charge, as an online questionnaire at www.circulareconomytoolkit.org. This tool is useful for establishing an overview of an organisation's potential for circularity. In the case of evaluating suppliers for public procurement, it may be useful as a tool for determining baseline qualifications of firms. It is not, however, designed to assess the circularity of specific products. The assessment tool score is also qualitative by design, so a side-by-side comparison of different suppliers may be challenging.

*Circular Economy Indicator Prototype (CEIP).* The CEIP is a product-level assessment tool developed by scholars Steven Cayzer, Percey Griffiths, and Valentina Beghetto. It extends and modifies many of the features of the CET (above) but involves more objective

evaluation criteria and its results are displayed in a dashboard that allows for quantitative comparison of different products. The tool involves answering 15 questions across five categories: 1)design/redesign, 2)manufacturing, 3)commercialisation, 4) in use, and 5) end of use. Answers are rewarded a certain number of points based on their correspondence with circularity principles. For example, a product with relatively more reused material is rewarded more points. The outcome of the CEIP assessment is a final score ranging from 0%-100%. Such a test is most useful for assessing and comparing the circularity of specific products, and requires relatively basic knowledge about the firm and manufacturing process. CEIP is freely available as a Microsoft Excel spreadsheet.

*Material Circularity Index (MCI)*. The MCI is a product-level circularity metric developed by consultancy Granta and the Ellen MacArthur Foundation. It is very widely used by industry and academia, and offers a multidimensional circularity assessment for individual products. The tool is can be accessed as a Microsoft Excel spreadsheet and very simple to use, but its final output involves relatively complex mathematics that integrate data about 1) how much recirculated material *goes in* to the product, 2) how much of the product is reused, recycled, or refurbished in its next life, 3) how long the product is projected to last as compared to "the average" product, and 3) how many times the product will be used over the course of its functional life as compared to "the average" product. While the MCI arguably offers the most comprehensive assessment of circularity because it integrates data about material recirculation, length of use, and intensity of use (e.g. all three dimensions of product-level circularity), it also requires some guessing about the future: how much of the product will be recirculated? How long a product will last? How often will a product be used? The answers to these questions can vary tremendously from user to user. The MCI is available as a free Microsoft Excel spreadsheet tool, and the Ellen MacArthur Foundation has published a very detailed handbook describing the tool's methodology.

*The Longevity Indicator*. This indicator was developed by Elizabeth Franklin-Johnson, Frank Figge, and Louise Canning. It measures a product's circularity in time units, like months or years. It is best suited for comparing an entire product line rather than a single product, and uses data about rates of reuse, refurbishment, and recycling to estimate the amount of *time* that recirculation processes add to the lifespan of an average product. The tool is conceptually very easy to understand and rewards long lifecycles and recirculation streams. However, to date this metric has not been adapted into either an online tool or spreadsheet model. It is also very new, so there limited accounts of it being applied in practice. Applying such a tool correctly would also involve a data that might be challenging to obtain from a single firm, for example, *what percentage of a product line is reused and for how long?*

## How to choose the 'best' metric

No metric is perfect. Each metric has advantages and disadvantages that one should consider before investing time in applying it. An important feature of metrics, generally, is *objectivity*. An objective metric is one that can be applied multiple times by different individuals and offer the same results, every time. In other words, the results of an objective metric rely *as little as possible* upon a single person's interpretation of the facts. The C-metric is an example of a metric with high objectivity. Applying the C-metric involves using data about the economic value of different product components. Although there are different ways to assess economic value, once this has been determined calculating C involves relatively little interpretation. Two people following similar instructions about calculating C should arrive at the same answer about a product's C-score.

Alternatively, a *subjective* metric requires that the person applying the metric use their judgement or a "good guess" to complete an evaluation. The CET is an example of a metric that poses some risk for subjective decisions. For example, the CET assessment tool requires users to rate—on a three-point scale—whether products are made with "scarce materials." It also asks whether products are made with "eco-efficient" materials. The assessment tool does not specify, however, what counts as "scarce" or "eco-efficient" material. The meaning of these terms can vary dramatically from place to place, from year to year, and upon different interpretations of the words *scarcity* and *efficiency*. In other words, the answers to the CET assessment tool can be subject to the interpretation of the individual filling out the assessment tool at any particular time. The MCI involves some elements that are objective (e.g. rates of recycling for existing products) but also involves elements that can be subjective (e.g. the estimate lifespan of a product, which can vary tremendously from user to user).

Good metrics also ought to be *simple* and cost-effective to use. Applying metrics that require complex mathematical procedures, proprietary data, or data from multiple sources may present insurmountable challenges to users. Ideally, a metric's methodology is easy to understand and easy to apply. In this case, CET and CEIP are good examples of a *simple* metrics. Both can be completed by individuals with relatively little expertise, in part because they involve data that can be collected from one or a small number of sources. For both of these metrics, completing an assessment involves using simple interactive icons on a website or a spreadsheet tool. On the other hand, metrics like the C-metric or the Longevity Indicator are relatively *demanding* metrics. Firstly, neither of them has developed a web-based tool to facilitate calculation, although these may emerge in the future. Secondly, both involve data inputs that can be hard to access or that remain concealed by companies that have no obligation to share information about component costs. The MCI has developed a convenient spreadsheet tool, but is based upon formulae that may be hard for non-experts to interpret.

Figure 8 compares different metrics on competing scales of objectivity and simplicity (As it happens, this is a highly subjective interpretation!). Ideally, circularity metrics would be both objective and simple to apply. At this point, however, users must often strike a balance between these two characteristics. Highly objective metrics tend to be the most demanding to apply, while very simple metrics tend to be the most subjective.

One suggestion to help overcome this dilemma is to apply more than one metric to the same problem. Each metric focuses on different characteristics of products and/or organisations. It may make sense to view the same problem through multiple lenses. It is also important to choose metrics that best fit the problem an organisation is trying to solve. As discussed above, the CET is an appropriate metric for establishing a baseline understanding of an organisation's capabilities and areas in which it can improve, but not about the circularity of an individual product. The C-metric is better for understanding rates of recirculation for individual products, but is probably unsuitable for understanding circularity of entire systems or products with thousands of components (like cars). The MCI offers a very holistic picture of product circularity, but can involve some guessing about product lifespan and use intensity.

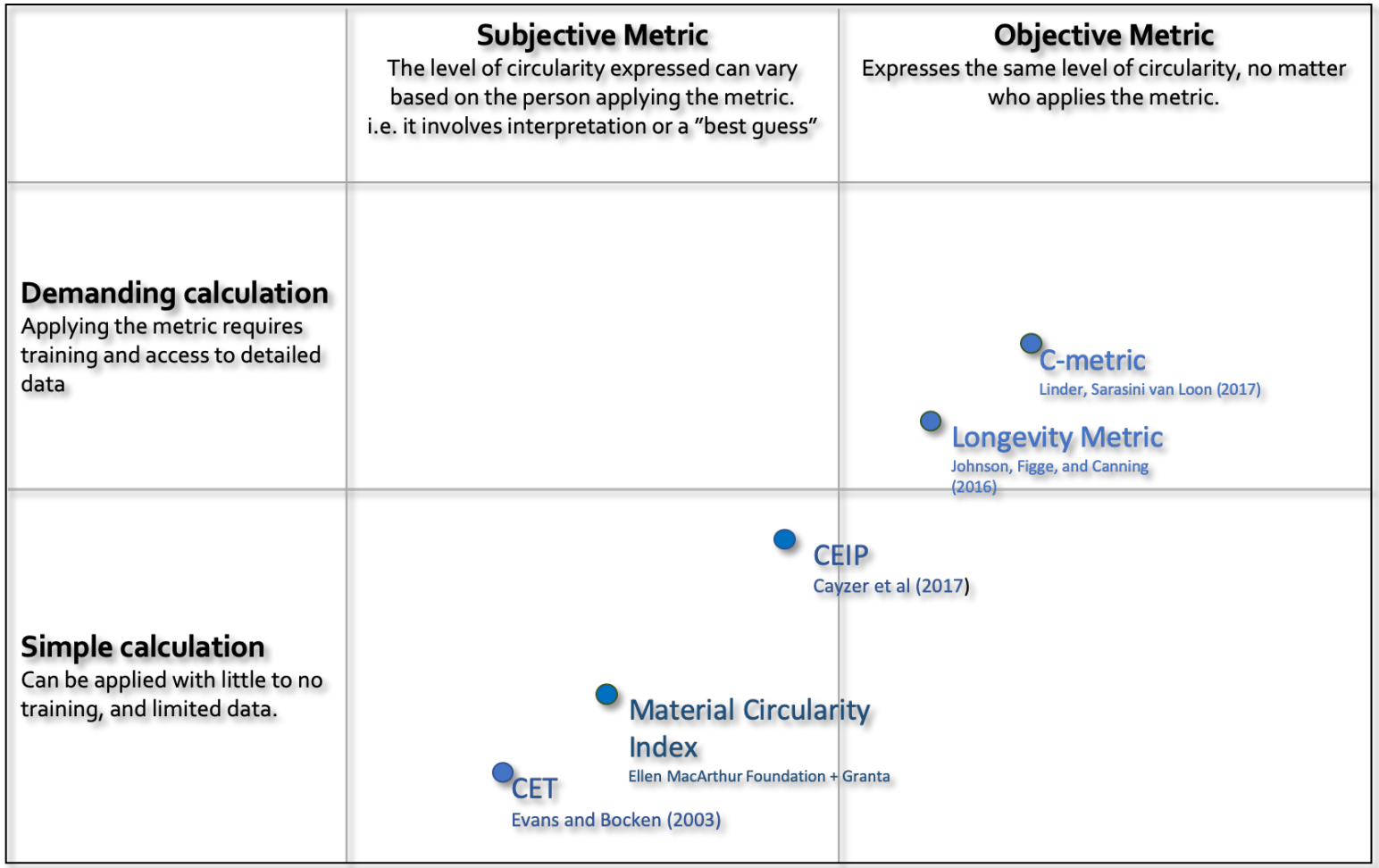



*Figure 8. A matrix for circularity metrics in terms of subjectivity and objectivity (Source: elaborated by RISE AB)*

NOTES ON THE INDICATOR "C"

The indicator C works rather well for measuring the degree of circularity for simple products that are put through significant activities before re-entering the market. For example, cases that include use of recycled materials in a product, remanufacturing, renovation and repurposing. As per the design, the indicator does not include the concepts of product life nor emissions during the use phase.

C is therefore unsuitable to assess the circular economy compatibility of so-called product-service systems and the sharing economy. It is also difficult to interpret for direct reuse, for instance second-hand sales.

According to preliminary studies, the indicator C is overall more suitable for comparing the circularity of products that utilise cycles such as "recycling" (reuse at material level), "re-manufacturing" / extensive renovation and upgrading / recycling (reuse at component level) than cycles as "reuse" (reuse at product level) (see final report of the RE:Source *Mätning av produktcirkularitet som ett sätt att öka resursproduktivitet* project by Linder et al., 2017).

*Table 1. Results from RE:Source Mätning av produktcirkularitet som ett sätt att öka resursproduktivitet project*

| "C" VALUE | LOOPS | INDUSTRY |
|---|---|---|
| 99% | Refurbishment | Consulting (Waste & IT) |
| 93-98% | Recycled materials | Hygiene & Health |
| 87% | Re-purposing | Waste recycling |
| 83% | Remanufacturing | Furniture |
| 67% | Re-purposing | Architecture & Urban Design |
| 65% | Update / Remanufacturing | Furniture |
| 65% | Update / Remanufacturing | Furniture |
| 64% | Recycled materials | Textile |
| 36% | Re-purposing | Lighting manufacturing |
| 32% | Recycled materials | Furniture |
| 18% | Recycled materials | Automotive |
| 12% | Recycled materials | Lighting manufacturing |
| 10% | Recycled materials | Lighting manufacturing |
| 0% | Biological materials | Textile |

In this phase it is fundamental to set a circularity target or continuous circularity improvement target over time.

- In essence, a circular economy needs metrics to ascertain that:
    1. We are on the right track towards a transition
    2. This is happening at a sufficient pace.

As stated earlier, the circularity indicator "C" and the setting of the related performance improvement targets are NOT negotiable criteria. However, it is important to contemplate a "tolerance range" for C that might occur. Specifically:

- If it is above the range, then it is a **bonus,** and this can even out years when C is below the range
- If it is below the range, then it **can still be accepted** at certain conditions such as:
    3. it does not result from bad practice of the supplier but only from external, not manageable conditions;
    4. there is an Action Plan in place to attempt to solve the problem within the supply chain;
    5. it shows improvement over the years anyway.

**Setting feedback mechanisms.**

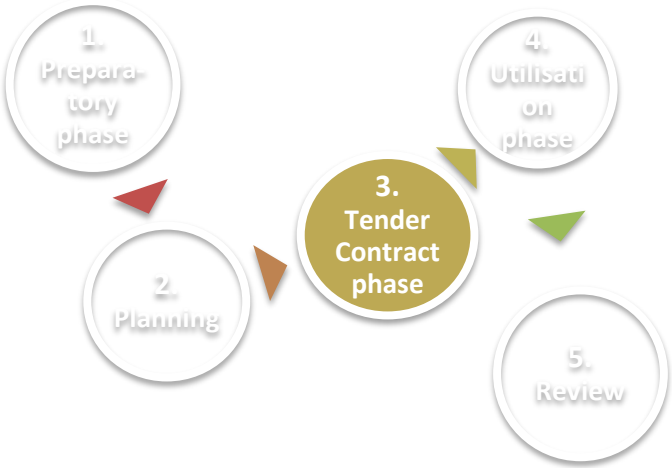
In the spirit of true collaboration and deep learning, the public authority should set up feedback mechanisms for the suppliers throughout the contract so that any comments should optimise the current and future procurement process in the medium term and drive the radically more efficient economy in the longer term. For example, both parties could select dedicated staff to perform periodic surveys, scheduled face to face meetings, audit to check procedures, quality levels, etc.

**Summary:**

**This phase establishes circular requirements and associated CPIs for the Tender Contract phase and comprises of two focused sub-phases (and related subphases):**

1. **Enablers: Internal and External**
2. **Specifications: Identification & Integration of CE requirements**
    - **Product need specifications**
    - **Sourcing Strategy:**
        - **Assessing circular risks / opportunities**
        - **Identifying circularity categories**
            - **Conducting complementary Life Cycle Analysis & Life Cycle Costing (LCC) Analysis**
        - **Introducing circularity indicators**
        - **Analysing the market and potential challenges**
        - **Setting feedback mechanisms.**

## 3.Tender Contract phase




This phase is about implementing and managing actions related to the contract of each specific tender.

It includes 1. Selecting suppliers according an evaluation process against the set criteria; 2. Signing contracts between the interested parties.

1. Selecting suppliers according an evaluation process against the set criteria. This process is overall regulated by the European Directive 2014/24/EU on procurement stating that contracts must be awarded according to the Most Economically Advantageous Tender (MEAT). Such an approach means that award criteria do not necessarily focus on the lowest price, but also on quality and sustainability. It derives that in a circular public procurement context, the award criteria include at least **price**, **quality** and **circularity** aspects (e.g. circularity indicator, life-cycle costs). Since the need to measure circularity in NOT NEGOTIABLE it is crucial to set a "threshold value" for circularity that is specific to each product. Then, other aspects can be weighted accordingly.
2. Signing contracts between the interested parties. For this step there is no specific recommendation other than referring to what the responsible and qualified individuals advise to do.

## 4. Utilisation phase


This phase is about delivering the product or service as well as monitoring that their use complies with the related agreement.

The aforementioned three typical circular procurement scenarios have to be managed and monitored according to their structure and dynamics. They include the following:

1. Pay-per-Use. Under this model also known as Product Service System (PSS), the supplier keeps the ownership of the products and the user pays-per-use or based on performance.

2. Purchase and Buy-back agreement. The supplier commits to buy back products at the end of their lifecycle under specific terms agreed in advance. This helps secure optimum value retention via reuse.

3. Purchase and resale agreement. This agreement can either establish that a third party will recoup the product after use, typically for reusing lower-value materials or recycling; or that other contracts can be introduced with specific clauses on reuse.

In all the three cases the public authority is responsible for a fair use of the products.

The buying organisation should monitor improvements and evaluate performance on a regular basis. It is therefore advisable to refer back to the evaluation system set and utilised for awarding the contract, with the tender as the baseline. (MVO, 2017).

## 5. Review & Learning phase

This phase is critical as it aims to ensure that all the work carried out collectively is properly evaluated so that key learning points can feed into the next procurement round and trigger a "virtuous circle of circularity". Also, plans should be made to replicate the proposed circular process by adopting it in similar procurement processes and broadening the take-up in new areas of procurement. The resulting impact of the new circular approach should enable the market and suppliers to develop and refine more resource efficient business models over time (i.e. from a flow-based to a stock-based logic) and therefore contribute to a scale-up (REBus, 2017).


Specifically, this phase includes the following steps:

- Checking the understanding of and evaluating the implementation of the circular procurement process at the organisation level;
- Benchmarking the process versus a linear option in terms of costs/benefits and risks/opportunities based on policy, financial, functional metrics with particular consideration on the use of the product circularity metric "C";
- Assessing the monitoring mechanisms and with feedback opportunities for suppliers;
- Evaluating the learning at the supplier level and then at the whole business eco-system level (since all the players should learn how to increase circularity continuously);
- Consolidating and documenting both the internal and external learning as "lessons learnt" with the view of informing and rolling-out new procurement processes over specific timescales. It is important to consider that each new procurement strategy should draw on the lessons learnt from the previous one (ISO 20400, 2017; REBus, 2017).

## Conclusions

With the current linear and resource-flow based economy mankind's level of unsustainability will considerably worsen only within the coming 11 years. There is therefore a need to shift to a more radically resource efficient economic model for instance by adopting circular principles and practices. In order to ensure a transition to a functioning CE regime, a systemic multi-level change, including technological innovation, business model innovation and stakeholder collaboration is required (Wjties and Lozano, 2016)

Since the public sector represents a very big share of the annual consumption of goods and services in most developed countries (Sweden included), it can clearly play a very important role in kick-starting the shift to a more circular economy by circular public procurement.

This toolbox for circular public procurement focuses on improving *environmental sustainability* without causing negative economic effects for any stakeholder, i.e. it focuses on one part of what is required for a procurement to be sustainable.

The toolbox is therefore supposed to complement existing purchasing criteria to ensure a continuous environmental sustainability improvement by getting more consumer utility out of a given set of material resources. In order to contribute to achieve a desirable environmental sustainability level, an economic value-based circularity metric is introduced. The "C" metric includes the economic aspect (making it "restorative by design") of the circular economy in the definition of what circular procurement has to be. By complementing any existing purchasing process with what this toolbox provides, your organisation will become more environmentally sustainable, affect the value-chain of suppliers to become more environmentally sustainable, and hence contribute to the shift of society to the highly needed circular economy.

## References


Alhola, K., Salmenperä, H., Ryding, S.-O., & Busch, N. J. (2017). *Circular Public Procurement in the Nordic Countries*. http://doi.org/10.6027/TN2017-512.

Brammer, S., and Walker, H. (2011). Sustainable procurement in the public sector: an international comparative study. *International Journal of Operations & Production Management*, *31*(4), 452–476. http://doi.org/10.1108/01443571111119551.

EMF (2015). Delivering The Circular Economy: A Toolkit for Policymakers. Cowes: Ellen MacArthur Foundation. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_PolicymakerToolkit.pdf, Accessed 07/03/2019.

Fracchia, M., Carlsson, R., Steckler P., Oberhauser, A. and Leitao, N. (2012). Enhance the Environmental Performance of Railway Infrastructure. *Social and Behavioral Sciences, 48*(2012) , 1047-1057.

Hubbard, G. (2009). Measuring organizational performance: beyond the triple bottom line. *Business Strategy and the Environment*, *18*(3), 177–191. http://doi.org/10.1002/bse.564

ICLEI (2017). Public Procurement for a Circular Economy. Good practice and guidance. Brussels: European Commission. http://ec.europa.eu/environment/gpp/pdf/Public_procurement_circular_economy_brochure.pdf

ISO (2017). *ISO 20400:2017. Sustainable Procurement – Guidance*. Geneva: International Organization for Standardization.

ISO (2017). *Sustainable Procurement*. https://www.iso.org/files/live/sites/isoorg/files/store/en/ISO%2020400_Sustainable_procur.pdf, Accessed 07/03/2019.

Ivanko, J. and Kivirist, L. (2008). *ECOpreneuring: putting Purpose and the Planet before Profits*. Gabriola Island: New Society Publishers.

Konkurrensverket (2019). The number of tenders in public procurement is increasing. http://www.konkurrensverket.se/en/news/the-number-of-tenders-in-public-procurements-is-increasing/. Accessed 13/01/2020.

Loose, W. (2010). *The state of European Car-Sharing*. *Final Report D 2.4 Work Package 2*. http://carsharing.de/images/stories/pdf_dateien/wp2_report__englisch_final_2.pdf . Accessed 07/03/2019.

MVO (2019). *Circular Procurement Guide*. https://mvonederland.nl/circular-procurement-guide. Accessed 06/03/2019.

REBus (2017). *Guide for Circular procurement REBMs*, http://www.rebus.eu.com/implementing-a-rebm/guide-for-circular-procurement-rebms/. Accessed 06/03/2019.

Tomellini, R. and Alming, A. (2019). *Some thinking around a close-loop approach for material use and management*. https://ec.europa.eu/research/industrial_technologies/pdf/circular-economy_en.pdf. Accessed 07/03/2019.

van Dijk, W. and Dittrich, K. (2013). The Value Case Methodology. A Methodology Aligning Financial and Non-Financial Values in Large Multi-Stakeholder Innovation Projects. Delft: TNO. DOI: 10.13140/2.1.3043.4247

Walker, S., Coleman, N., Hodgson, P. Collins, N., and Brimacombe, L. (2018). Evaluating the environmental dimension of material efficiency strategies relating to the circular economy. *Sustainability (Switzerland), 10(3) 666*, 1-14. DOI: 10.3390/su10030666

Wijkman, A. and Skånberg, K. (2015). *The Circular Economy and Benefits for Society*. *Swedish Case Study Shows Jobs and Climate as Clear Winners*. The Club of Rome and MAVA Foundation.

Witjes, S. and Lozano, R. (2016). Towards a more Circular Economy: Proposing a framework linking sustainable public procurement and sustainable business models. *Resources, Conservations and Recycling*, *112*(2016), 37-44. http://dx.doi.org/10.1016/j.resconrec.2016.04.015.

# Annexes

## Annex 1. Key facts on Public Procurement in Sweden (LOU).

### What is Public Procurement?

Public procurement consists of a contracting authority that buys, hires or otherwise acquires goods, services or construction contracts on the market

### Official website for information

https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/lag-20161145-om-offentlig-upphandling_sfs-2016-1145

**Five basic principles**

- Equal treatment
- Transparency (the principle of transparency)
- Proportionality
- Non-discrimination
- The principle of mutual recognition

**Procurement Laws typologies:**

- LOU: Procurement of goods, services and construction works
- LUF: Procurement in the supply sectors
- LUFS: Procurement in the Defence and Security area
- CLOSE: Procurement of concessions (construction, services)
- Law: Act on Freedom of Choice Systems

**Statistics on Public Procurement**

Overview

- 18,300 announced contracts per year
- 7% of the procurement is reviewed.
- 4,000 contracting authorities and entities
- 1,300 of these announced a procurement
- The largest contracting PP / UE in 2016 was the Swedish Transport Administration, SLL and the Swedish Migration Board (in kronor).
- 217,000 suppliers
- 54% of the service companies never bid for public procurement.
- Swedish companies are poor performers on the European market.

Percentages of announced contracts

- 69% of municipalities or municipal companies
- 10% county councils / regions
- 18% government agencies / works
- 2% others

**Law (2016: 1145) on Public Procurement**

Chapter 1. The law's content, scope and definitions

Chapter 2. Mixed procurement

Chapter 3. Exceptions from the law's scope

Chapter 4. General provisions

Chapter 5. Thresholds

Chapter 6. Procurement procedures

Chapter 7. Framework agreement, purchasing centres and other coordinated procurement

Chapter 8. Electronic methods for procurement

Chapter 9. Technical requirements

Chapter 10. Announcement of procurement and invitation to tenderer

Chapter 11. Deadlines for applications for tenders and tenders

Chapter 12. Communication, information to suppliers and documentation

Chapter 13. Exclusion of suppliers

Chapter 14. Qualification

Chapter 15. Own assurance and investigation of suppliers

Chapter 16. Evaluation of tenders and award of contract

Chapter 17. Completion of contract

Chapter 18. Project competitions

Chapter 19. Procurement under the thresholds and procurement of services according to Appendix 2 and Appendix 2a

Chapter 20. Contract block, review and damages

Chapter 21. Procurement damage fee

## Annex 2. Guidelines for implementing circularity metric & related environmental indicators

1. Guidelines for implementing C.pdf