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CIRCULAR ECONOMY TAXONOMY WHITE PAPER FOR WORKING GROUP

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Planned activity (short-term):

Reflecting upcoming ISO standard, reflecting input from kick-off.

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Abstract:

The CircularPSP project aims to develop a circular economy taxonomy (i.e. set of terms, data sources and standards) in an open working group. The aim is to reduce friction, empower AI and drive regulation. The results will be free to use and of direct benefit for multiple AI-solutions to be financed and tested through the CircularPSP project.

Keywords:

standardisation, taxonomy, regulatory framework, white paper, circular economy, pcp



REVISION HISTORY

Version	Date	Changes	Contributor
0.1	September 2023	First version white paper	Drafted by RISE, empirica, CircularPSP
0.2	September 2024	Full update of terminology and term; Added detail about EU legislation, updated data source information from Working Group Contributions with new (Supplier) additions	empirica, CircularPSP

Update 1 (Sep24): After the release of the ISO-Standard, the CircularPSP consortium integrated and revised the entire terms set to identify all relevant circular strategies for cities. A hierarchy for primary sources was introduced – the full result is now part of chapter 4. The data source set had been continuously updated almost doubling in the number of sources for an AI or any organisation attempting to conduct research on the implementation of the CE.

Statement of originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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ABBREVIATIONS

Abbreviation	Definition
CE	Circular Economy
CEAP	Circular Economy Action Plan
CPR	Construction Products Regulation
CRD	Consumer Rights Directive
DCAT	Data Catalogue Vocabulary
EPD	Environmental Product Declaration
ESPR	Ecodesign for Sustainable Products Regulation
MS	Member States of the EU
NLP	Natural Language Processing
UCDP	Unfair Commercial Practices Directive

MISSION STATEMENT

CircularPSP aims to solve the common challenge of municipalities to transition towards a circular economy (CE). Through CircularPSP, eight leading CE-cities and regions launched a competitive tender for technical solutions aiming to overcome organisational, informational and operational barriers. However, multiple standards and taxonomy-related issues are universal and should not be solved in parallel. Instead, CircularPSP seeks to involve key stakeholders, leading companies, and academics to tackle the following issues together:

- **Define core terminology** (i.e. taxonomy) to ensure different AIs are not adding to the confusion over circular economy but lead to more clarity.
- **Identify a set of core data sources** for AIs to ensure that the learning does cover all relevant circularity areas in a city instead of being dominated by the most advanced value chain or region etc.
- **Document a core set of data standards and protocols** to ensure the intended scalable solutions are fit for purpose to operate in a field with diverse IT and legacy systems.

Having advanced on these aspects will directly help municipalities in coordinating their effort and improve the solutions to be developed by suppliers. Based on this initial result and experience gathered during CircularPSP, we will further seek to advance on easily applicable and transferable indicators and benchmarks.

Focus are the challenges of municipalities (or procuring organisation) - including their inexperienced staff - in contrast to efforts aiming to standardise business value chains. Though these viewpoints are not mutually exclusive, the needs of the 'demand side' are currently not sufficiently covered.

Format: The work will be conducted as an open working group. Any interested party is welcome to join and contribute at events and at any time in a living document which is to evolve over time with initial push coming from CircularPSP or voluntary contributors. Permanent members will be the CircularPSP consortium and all selected suppliers. The online "living" file will be maintained and versioned by the CircularPSP consortium which will take ongoing efforts on the European data strategy into account. Versions will trigger follow-up events (2-4 per year) to update on developments and resolve contradictions etc.

- The first meeting is to lay out the white paper and cooperatively set out the interesting terminology and data sources for municipalities and where contributions are required due to gaps in existing relevant taxonomy.
- The initial phase will focus on 'collection and definition' of terms and data sources to cover circular economy, enabling AI holistically in the context of municipalities. One source will be the offers of suppliers tendering for the CircularPSP solution.
- Over time, the taxonomy will be validated with (selected) classifications used the EU taxonomy in upcoming standards to support and enable further regulation by clearly identifying the remaining gaps.
- Where possible benchmarks - going beyond minimum requirements or boundaries - will be added as complementary information.

Starting and end point: This white paper lays the ground for the working group describing the overall challenge, status quo, principles that should be followed and issues which can and should be tackled within CircularPSP regarding taxonomy, standards and data sources.

Validation during CircularPSP project: The results of the working group will be applied and tested by all Suppliers of the CircularPSP solution, in particular through their AI. The CircularPSP tender was released in January '24 and open to all parties. For Phase I, five Suppliers have been selected to solve the common challenge of CircularPSP. Insights from Suppliers and testing by procurers have been fed back into iterations of the CE Taxonomy.

Free use of results: Further, all parties are free to use working group results during ongoing and upcoming standardisation efforts and to contribute to the dialogue on circular economy. In such case, a reference and notification (or tagging) of the project is appreciated.

1. Background

1.1 Circular economy

The broader ambition of CE is to extend the life cycle of products as a way of reducing waste to a minimum. This starts with CE strategies as refuse, reduce and rethink. As a model for production, it emphasises strategies like, reusing, sharing, repairing, refurbishing and recycling existing materials to the degree possible, to keep them within the economy (see Table 2 for a full overview of CE strategies). Maximising the total value of the product breaks with the linear economy logic, and especially with planned obsolescence, designing products with a limited time span of effective use.

From an environmental perspective a CE logic has benefits. One of the clearest and easiest to measure is decreased greenhouse gas emissions. Other benefits of a more efficient use of existing products are a reduced use of scarce or harmful resources. Covid-19 became an important reminder of risks inherent to global value chain as well as price volatility. Inefficient use of materials is an increasing concern as European countries are dependent on imports. Dependence of raw materials from countries such as China and Russia create an additional layer of complexity and can and has become a security concern. Thinking circular from the start has great and measurable impact, as roughly eighty percent of negative impact of products are determined during its design.

1.2 The EU and circularity

The EU has adopted numerous regulations, directives, strategies etc. in the CE domain. This section includes a selection of the most important legislation for CircularPSP.

1.2.1 Circular Economy Action Plan (CEAP)

While increasing circularity is important, shifting to a circular economy built within and around a circular logic is challenging. One apparent constraint relates to procurement based on the lowest price, which benefits low-cost products rather those that benefit the buyer over the life cycle. To mitigate these challenges and to accelerate change, the European Commission launched the **Circular Economy Action Plan** (CEAP) in March 2020. The plan initially is one of the main building blocks of the European Green Deal and focuses on resource intensive sectors, including ICT, batteries and vehicles, packaging and plastics, textiles, and construction.

The CEAP is a broad package of different measures to foster the circularity transition. At the core of the CEAP is the **Ecodesign for Sustainable Products Regulation** (ESPR). This regulation entered into force in July 2024 and sets performance and information conditions (such as product durability and reusability, recycled content) for almost all physical goods.

To monitor progress towards circularity, the EU has adopted the **Circular Economy monitoring framework** in 2018, and revised in May 2023. This framework includes indicators that are consistent with **8th Environment Action Programme**, the **zero-pollution monitoring and outlook**, the **EU SDG indicators** and the **EU resilience dashboard**.

Consumer-related initiatives

The CEAP has included multiple initiatives that aim to reinforce consumer rights and ban greenwashing:

- Directive on repair of goods
 - Entered into force on 31 July 2024. Promotes repairing and reusing of goods both within and outside the legal guarantee.
- Empowering Consumers Proposal
 - Strengths the Unfair Commercial Practices Directive (UCPD) and the Consumer Rights Directive (CRD), and fighting greenwashing practices by prohibiting specific greenwashing practices in a blacklist of unfair commercial practices. The amendments of both directives entered into force in February 2024 and shall be transposed by March 2026 by the Member States (MS).
- Green Claims Directive
 - Proposal published in March 2023, not in force yet. Complements the UCPD by setting specific rules on the substantiation, verification and communication of voluntary environmental.

Sectoral initiatives

The CEAP further includes several sectoral initiatives:

- EU Strategy for Sustainable and Circular Textiles
 - Adopted in March 2022, envisions for example that all textile products on the EU market are durable, repairable and recyclable.
- Revision of the Construction Products Regulation (CRP).
 - Proposal published in March 2022, not in force yet. One of the two objectives is that the CRP contributes to the objectives of the green and digital transition, particularly the modern, resource-efficient and competitive economy

In addition, several complementary sectoral rules on batteries, chemicals, packaging have been adopted.

1.3 Circular economic decision making and data

While circularity can seem straightforward, not all circular choices will be as easy to make. There are several reasons why it may be hard to make CE decisions as well as to prioritise between different potential choices. Some of such factors are collected in Table 1.

Table 1. Factors influencing CE decision making.

External	Internal
Legislation	Utilities
Culture and norms	Funding
National, local, and regional conditions	Perceptions
Stakeholders	Abilities
Available resources	Systems and routines
Sourcing and infrastructure	Strategy and objectives

From the perspective of a municipality, these factors can be divided into:

Framework conditions

On a societal level, formal institutional conditions such as legislation will partially define what can and what should be complied with and measured. Informal institutional conditions such as culture and norms will define what desirable objectives and outcomes are, reflected in the preferences of stakeholders in society. Of specific importance is the preferences of the constituents, towards which a municipality is accountable. This has the additional implications that policymakers have to balance the long-term ambitions of CE with often short-term preferences of voters. Available resources and sourcing, such as the availability of inputs in the region and/or within reasonable distance, and infrastructure, including roads as well as industrial production and recycling facilities will also shape circular decision making.

Challenges within the organisation

Within the municipal organisation, a core question is to understand which utility a municipality wants to achieve. How utility is understood and what will create utility will depend on the prior mentioned external factors as well as internal factors of the municipality. Of key importance becomes available resources. Policymakers must always balance value today, for example constituent preferences, with long-term resilience. Additionally, what can and should be prioritised is dependent on staff perceptions and abilities, as well as the routines and systems in place. Even in cases where, for example, re-shaping procurement has clear and measurable impact, long-term skills and routines may make a desirable reform impossible. Such a transformation is affected by legal constraints and internal systems. Most procurements are based on lowest cost rather than value for money. This can partially be understood from a legal perspective, where transparency is key. This need for transparency promotes the most transparent benchmark, i.e. numbers, but is also due to deeply rooted routines.

If and to what extent different economic, environmental, and social outcomes can be prioritized will depend on an interplay between framework and organisational conditions. The ability to forge a strategy, define priorities, set objectives, and implement will hinge on access and ability to use data.

While data and information are commonly emphasized as being crucial for informed decision making and organisational change, the terms are often used interchangeably. One way to define the boundaries is how the system theorist Russell Ackoff¹ classified the human mind into five categories:

1. Data: symbols
2. Information: Data that are processed to be useful
3. Knowledge: Application of data and information ("who", "what", "where", and "when")
4. Understanding: The "why"
5. Wisdom: evaluated understanding. Learning

One conclusion could be to prioritise measures that create “the right utility”, as data must be processed into information and transformed into knowledge (and ideally understanding and wisdom). While data is increasingly available, and technology lowers thresholds for use, challenges

¹ For basic information on these perspectives the following [link](#) can be helpful

remain. Challenges will furthermore be context specific, which creates additional complexity in promoting a general transformation towards circularity. Finally, data is available from a myriad of sources and is organized in vastly different ways. This affects the ability to use and combine data.

1.4 Data, principles, and taxonomies

The above categories are fairly intuitive, on a daily basis we process data into information to make more or less well-informed decisions. But what has happened in the last decades is that the access to data has exploded. In its wake, innovation and technical progress has followed. The wide public access and use of Large Language Models has potentially changed the conditions for analytics and may have far-reaching implications for how society becomes organized. From the perspective of a municipality, the increasing access to data does not answer the question on how to access data. If data is findable, the question is how data from one or often several sources can be structured to become information and crucially lead to knowledge and thus better-informed decision.

To bridge such gaps, several frameworks which define principles that allows organisations to make data operable have been introduced. **Principles** commonly relate to making data **findable** and **accessible** so they can be used, **interoperable** so that data from sources can be combined and **reusable** so that sufficient information exists to strategically use data for an analysis fit-for-purpose in the specific context. Of great importance is also that data can be analysed with minimum needs for humans to facilitate the process, that data is **machine actionable** and is defined by **data interoperability – i.e. standardised and documented so that** datasets can effectively be combined (by computers and/or humans) in analysis.

A cornerstone to effectively use data, and thus complying with the principles – are (standardised) **taxonomies**. Taxonomies are widely used in different scientific fields and can be understood as classification systems. A set of classes of concepts that are organised in a hierarchy, usually depicted as a tree turned upside down. The further one moves and more specific one becomes; the number of shared features decreases. As a consequence, upper classes possess all the features of the lower classes, unlike the other way around. From a data perspective, (or information that can be turned into usable data) information is made available with its relationship to other data in the taxonomy. Organising data in such a hierarchy makes it easier to use, reuse, analyse etc. The possibly most known, is the Linnaean taxonomy where one level is the class (for example mammals) which at the below level, has the order (for example primate) which is more specific.

Taxonomies are a cornerstone for how data is organised and processed. All data crucially has a hierarchy. The opportunity created by following common principles with an ever-increasing amount of data sources is that we can create tangible value. This is why principles are emphasised by the EU. But to take full advantage, interoperability is crucial which is why principles for how data can be combined is as important. A key process currently is Data Catalogue Vocabulary (DCAT). DCAT provides classes and properties to allow datasets and data services to be described and included in a catalogue in a standardised way (for example combining statistical data with geographical data). This makes it easier to discover datasets and data services and to make a search that can lead to a combination of datasets from multiple sites. And as the it goes from a global root to a branch in each country data from different countries can be combined (for example DCAP-AP-SE). With vocabularies the ability to use data beyond borders are also increasing.

A hypothetical circular economy case

Combining taxonomies, with principles of interoperability, creates ample opportunities. One example would be to use procurement data. European procurements are codified using the CPV taxonomy, through EU Ted it is possible to get access to current and historic calls for tender. A hypothetical case would be that a city wants to understand how European cities understand circularity. By collecting all historic procurements that are deemed circular (for example by using vocabularies to scan all procurement that apply the language of circularity) and comparing which tenders were chosen, it could be possible to find patterns among procurement professionals. The analysis could be used to develop a training on circularity to nudge behaviour. Based on interoperability (using DCAP as a short-cut), it would be possible to combine data (for example datasets) of cities' environmental performance. One possible analysis would then be to try to pinpoint if, and to what extent city recycling is affected by circular procurements. This analysis could be used to change how a city operates.

The EU – principles, data, taxonomies, and resources

The EU has become an important proponent of better and more effective use of data for analysis. By providing a common framework that encompasses how data 1) should be structured in taxonomies from the global to national levels in many fields, 2) should be made interoperable, to a higher degree findable, accessible, as a machine actionable and be able to combine interoperable datasets effectively in analysis.

Understanding principles and taxonomies

One way to understand taxonomies and why they are so important for data is to think of a language. To be able to communicate in for example Swedish, we can communicate by using words in accordance with the Swedish language taxonomy. The more precise we are (by referring to a cabriolet rather than a car) the better we can communicate. How we communicate will also depend on the syntax (how words are organised into a sentence) where a question follows another order than a statement. But we will not be able to communicate with someone from Greece without knowing the language or with a tool that allows to interact. To overcome this barrier, for example, a dictionary increases our interoperability to a certain degree, tools such as Google Translate increase interoperability further. Word-by-word translation, however, has its downsides typically not able to recognise contextual meaning which follows along the words listed in a dictionary. Humans, however, are able to utilise the extended taxonomies of context and (meta-)data from classifications etc..

2. Practical challenges to be tackled

Common standards, taxonomies, and the ability to share, use and re-use data create great opportunities. Notwithstanding the ability to seize the opportunities will depend on several factors. Even if the data is structured in accordance with the principles and taxonomies and principles, some remaining challenges include:

- The degree “the right data” is actually findable and accessible.

- The ability to understand what is “the right data”.
- The ability to convert the “the right data” into information that allows the organisation to address the specific problem, given the external conditions within which the organisation operates and the internal constraints of the organisation.

From a CE perspective, if the “the right data” is **findable and accessible** is a question of point of departure. From one perspective, there is ample access to data that relates to aspects of circularity. Still accessible data will probably be insufficient to be deemed the right data for many cities, different countries have progressed at different paces in making data available. But even in a scenario where data would be available, the core challenge remains, the concept of CE is still unclear to many and perspectives diverge between individuals, organisations, within and between countries. While there are attempts to consolidate the concept of CE and to codify it in taxonomies, there is still not a commonly accepted benchmark.

Additionally, even if a common benchmark defines circular missions, planning activities, and measures progress, it is inherently dependent on combining circular data with other types of data. A case in point is to choose to refurbish or reuse rather than to buy new computers. To assess the relative value of reusing rather than recycling and buying new equipment, will depend on factors such as local infrastructure, the development of programmes and performance, portfolio of task, energy consumption etc. Reusing in the case that performance requirements change, or if new models have better energy consumption, may turn out to be less efficient and thus creates the risks of unforeseen externalities. Knowing **which data is the right data** to combine, is often less obvious than it seems. Depending on context, recycling (e.g. of certain fabrics in clothing) may be more harmful than buying new using other fabrics. The question of data is also related to time. Certain circular choices can only be made in the design phase. There are ample examples of time and data, not least the prior example of fabrics, where the circular impact is inherent to design phase.

Finally, circularity is an important priority, but it is competing with other potential sustainable choices. Additionally, there are competing interests related to efficiency and local economy development that may override the impetus for circularity. Conflicting sustainability priorities could arise when locally sourced goods guarantee employment opportunities, but provide a segment of the population with few other opportunities or where the right materials cannot be sourced. The question that follows then is whether the “right data” on circularity would be **the right data in a specific context**. A similar challenge relates to preferences in the organisation, capacities to use data or routines in key departments. One or several of these aspects may imply that the circular intent does not translate into a circular action.

3. CircularPSP Challenge in context of Taxonomy

Reminder: The issue of CE Taxonomy is an important and underlying problem of the CircularPSP Challenge but it does not constitute the entire challenge as published in the [Challenge Brief](#). Below description, summarises aspects in which the use of one common CE Taxonomy will help to achieve a more efficient and higher-quality result.

Underlying imperatives of the CircularPSP project allow cities to take decisions and make priorities that can feasibly and long-term move strategy and operations towards a circular path. This requires

finding a balance between the circular objectives and possibilities, challenges, and opportunities at city level with the common objective of moving Europe towards circularity. To allow cities to find the circular opportunity, the intention is to:

- **Contribute to the consolidation of a European framework for circularity:** Specifically, to collect data and reflections on current frameworks, and their relevance to the operational realities of European cities. This will provide a common inspirational mission that also provides a measurable and timebound framework can capture an ideal as well as a minimum requirement for city circularity.
- **Provide cities with tools to access, understand and convert the “the right data”:** a core challenge is to know what the right data is. Based on the missions of cities, AI and Natural Language Processing (NLP), it is possible to connect data sources that are interoperable with the challenge defined so that cities can combine relevant data sources to the circular mission or process. The contribution of the project will be to provide the ability to measure circularity progress in balance with city specific priorities and constraints.
- **Provide cities with tools to forge relevant and traceable indicators:** This will emphasise the operationalisation including through tracking progress, success and trigger motivation.
- **Provide cities with a scalable solution:** At the core of CircularPSP is to develop a platform solution that is firmly built on the principles for sharing and re-using data and datasets from different sources from strategy and operative decision making. While certain datasets will be common, others will be possibly to foresee and add to the solution at city level. Moving a city towards circularity will demand flexibility in accessing and combining the right data during analysis, so the right conclusions can be drawn as external and internal factors change and new opportunities emerge. A key contribution of CircularPSP is that the solution will be built based on an open structure, in accordance with the European data strategy. This will mean that as new datasets emerge or possibilities to combine data from different sources emerge, those can be accessed by the cities. Additionally, a priority will be to use AI, to suggest new and better ways to measure circularity and consequently develop actions that are fit for purpose. A final benefit of that as the state-of-the-art progresses, the framework used to measure circularity can be developed. This would provide analytics both for analysis, goal setting and measurement.
 - The above is transformed in the **CircularPSP Challenge Brief** as follows: The CE-solution must decode, understand, sort and display data and offer inspiration, information and advice to users following CE principles. The Challenge for Suppliers is that they must commit to use and apply the most recent version of the CE Taxonomy in their CE-solution (including terms, data sets and standards) and participate in CE Taxonomy Working Group sessions.

4. Working Group Contributions

4.1 CE Taxonomy Terminology (as of June 2024)

The core is to scope the terminology including the term, their definition and any useful categories (or classifications with using EU taxonomy) which can be applied. Initially, the focus is on scoping and the entire structure is considered free to grow (i.e. the working group identifies areas in which terms are needed).

The following categories should be commonly and universally used:

- Reference to standardised terminology
- Mandatory function-specific taxonomies
- CircularPSP harmonised terminology
 - User groups
 - CE Strategies (e.g. R-Strategies and any strategies missing within this set)
- Further classifications and categories to be agreed in the working group, including CircularPSP suppliers and procurers

The work has been conducted cooperatively in this MS WORD working file. Suppliers' additions have been incorporated after the tender offer. Suppliers for Phase II commit to use the content of CE Taxonomy on terminology consistently in the CE-solution (including during training and learning of AI) and commit to attempt to implement the content of CE Taxonomy on standards in the spirit of interoperability and in anticipation of emerging standards to the best possible degree.

4.1.1 Reference to standardised terminology (in order of preference)

Suppliers are advised to make use of the following standardised terminologies wherever necessary, useful and possible. The order represents the preference of the Buyers Group.

- ISO Standard 59000 Circular Economy, in particular 59004 – Vocabulary, principles and guidance for implementation.
- ISO Standard 20400 Sustainable Procurement – Guidance.
- Corporate Sustainability Reporting Directive (CSRD) - Directive (EU) 2022/2464.
- Development of standardization roadmap CE – German Institute for Standardization (DIN):
 - Standards research on the Circular Economy, CE standards clustered according to topics, based on the Circular Economy Action Plan. An Excel with more than 3000 data points is provided by DIN.
 - R-Strategy Framework – Circular Thinking in Standards, DIN identified CE standards and clustered them according to the R-Strategies. A total of 280 sets of rules with over 700,000 current references were examined.

4.1.2 Mandatory functional term/specific taxonomies

General purpose

The following taxonomies are to be applied wherever necessary data is available or would be useful to ensure the user and AI are considering the same subset of information:

- TED Data CPV – procurement
- NUTS classification - hierarchical system of territories
- NACE Rev. 2 - statistical classification of economic activities
- EU taxonomy for sustainable activities

National regulation

OPTIONAL DURING PHASE I – This needs to be implemented for Phase 2, version 1 testing.

Some states (or regions) define terminology which is already known by targeted users, used in practice and therefore likely to constitute language used in searches and prompts. Hence, the CE-solution must take these definitions into consideration and apply them at the location of the user. Suppliers are free to decide whether it is efficient and necessary to train the AI using each national term set and/or to map any given national set against another term set and/or apply other methods.

The mandatory definitions include:

- Germany – KrWG Art. 6 Waste hierarchy (i.e. grouping of R-hierarchies, see below)
- List to be extended.

4.1.3 CircularPSP harmonised terminology to be used by all suppliers

The following terms are to be used by the CE-solution to ensure results are complete and comparable. **Additional classifications and term sets are allowed** (please document in deliverable).

Users (in CircularPSP)

The Buyers Group preserves the right to fully moderate this section as it is closely linked to the Challenge Brief. This does not prevail adaptation of new user classifications or entirely new users. Personas in the Challenge Brief are complementary.

- **Intermediaries** are CE experts who drive the transition and Change towards CE across the City or within a department. They act as multipliers of knowledge and CE practice across the organisation.
- **Municipal staff** (part of a City²) conduct their day-to-day job and their action is to become more circular.
- **Champions** are a subset of municipal users who are highly motivated in advancing CE and are likely to become power users of CE-solution. They act as multipliers (i.e. inform, trigger and motivate) other users to use the CE-solution and/or act circular. (Champions can also exist in the Business user group).
- **Business users** work at all companies and entities in the local economy who use the business-tier of the platform. They may offer circular solutions or wish to act more circular. Many users will come from SMEs.

CE strategies

CE-strategies are key terminology to link case studies with experience of users and, for instance, upskilling material needed to enable any given user to implement a case study. An R-strategy in itself conveys information on how ambitious a CE case study is and what kind of impacts it can achieve.

Table 2 provides a collection of CE strategies based on UNEP circularity platform³ (see also Annex I), the ISO Standard 59004 wherever possible, law and additional strategies used in literature and case studies. The descriptions are **written from city-perspective** (we acknowledge that the definitions for large manufacturers and waste-stream stakeholders may differ). Each strategy is

² City/Cities are a generic term for public organisations, here municipalities as demonstration sites, including all its users from Buyers Group and other organisations on the demand side.

³ United Nations Environment Programme (2019), UNEP circularity platform. www.unenvironment.org/circularity

rated by an indicative R-level, in which higher R-levels imply higher circular impact⁴, a graphical representation of this ranking of R-strategies can be found in Annex II .

AI-models are to classify case studies, knowledge nuggets and training materials etc. reliably. Below definitions are not final and must not be adhered to the letter if modifications achieve better results. For the training of an AI, it might be useful to select good examples to complement the description. Additional classifications are allowed.

The impact of each R-strategy for a specific case study (potentially changing the order of the indicative rank) is determined by applying the indicator framework suggested by the Supplier.

Table 2. CE strategies with approx. R-level (ISO used where suitable)

CE strategies	R-level (approx.)	Description
Refuse	0	Avoid consumption of natural resources, materials and services entirely or avoid any product with undesirable properties (e.g. hazardous substances, short life-cycle, difficult recycling)
Reduce	1	Lower consumption of natural resources, materials and services
Reduce by design	1	Refers to products and services which were designed so that they lower or avoid consumption of natural resources, materials and services during production and/or during the life-cycle
Rethink	1	Change a current material, product or service or configuration thereof to tackle specific concerns or to achieve a desired attribute.
Reuse	2	Re-use a discarded product which is still in working condition and fulfils its original function
Resell	2	Handing over a product or service to another user, most frequently without intermediary and with no modification of the product or service for the same purpose.
Redistribute ⁵	2	Change of the model of individual ownership to a model which distributes resources and materials more equally
Share ⁶	2	Multiple users coordinate to maximise the utilisation and minimise waste of products, resources, or services
Repair	3	Restore a defective or damaged product so that it can be used in its original function
Refurbish	4	Restore to a useful condition during expected service life with similar quality and performance characteristics
Remanufacture	5	Return an item, through an industrial process, to a like-new condition from both a quality and performance perspective.
Regenerate ⁷	5	Support natural processes and leave more room for nature to thrive.

⁴ Kurilova-Palisaitiene et al. (2023). Orienting around circular strategies (Rs): How to reach the longest and highest ride on the Retained Value Hill? Source: <https://doi.org/10.1016/j.jclepro.2023.138724>

⁵ Circle Economy. (2023). The Circularity GAP Report. Source: https://assets.website-files.com/5e185aa4d27bcf348400ed82/63c9411c827cc7b22366eade_CGR%202023%20-%20Report.pdf

⁶ Kane Curtis, S. Lehner, M. (2018). Defining the Sharing Economy for Sustainability. Source: <https://www.mdpi.com/2071-1050/11/3/567>

⁷ Ellen MacArthur Foundation. (n.d.). Regenerate nature. Source: <https://ellenmacarthurfoundation.org/regenerate-nature>

Repurpose	6	Adapt a product or its parts for use in a different function than it was originally intended without making major modifications to its physical or chemical structure.
Cascade	6	Shift recovered materials from one loop to another to optimise flows through additional cycles, often with decreasing quality and quantity.
Recycle	7	Recover and process material to obtain the same (high grade) or lower (low grade) quality through activities such as recovery, collection, transport, sorting, cleaning and re-processing.
Recover / reclaim (energy)	8	Recover of (embodied) minerals, energy, or scarce elements from wastes and residues
Re-circulate	8	Taking care of the material and information flow within a circular network.
Re-mine	9	Landfill re-mining, i.e. the retrieval of materials after the landfilling phase

4.2 CE Taxonomy Data Sources (as of June 2024)

Provided the CE-solution is consistent with the common European standardisation and interoperability framework, it will be possible to tap into existing and upcoming data sources with relevant information on the current state, practice and progress of CE transition. A core challenge will be the ability to make data informative for local users.

The work has been conducted cooperatively in this MS Excel working file. Suppliers' additions have been incorporated after the tender offer. Suppliers for Phase II commit to deploy the content of CE Taxonomy on data sets to the greatest possible degree presuming the data sets are and remain available for use and if this were not to be the case it requires documentation in the respective supplier deliverable.

4.2.1 Data categories

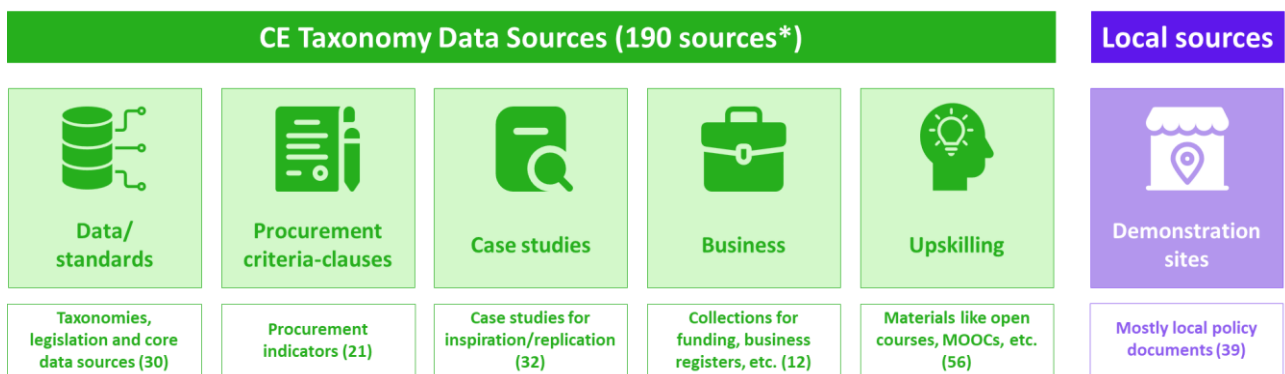
Data sources will be collected along the following categories:

- Relevant taxonomies (data/standards – 30 sources)
 - Contains relevant Taxonomies and core data sources for CE, like the [ISO 59000 series](#) and the [EU taxonomy for sustainable activities](#).
- Procurement criteria (procurement clauses/indicators – 21 sources)
 - Collection of maintained and validated procurement indicators (i.e. for actual tender - not for tracking overall CE progress) and includes for example [Green Public Procurement Criteria and Requirements](#) from DG ENV.
- Case studies (for inspiration/replication – 32 sources)
 - Collection of sources for CE case studies or best practices which could be replicated, includes for example [Ellen MacArthur Foundation - Case studies](#) and [Good Practices of the EU CE Stakeholder Platform](#).
- Business (collections for funding, registers, etc. – 12 sources)
 - Includes business-related collections, including data on funding, materials, classifications and business registers/classifications like digital Environmental Product Declaration (EPD) databases. Added as a new category in January 2024.
- Upskilling (e.g. open courses – 56 sources)

- Upskilling materials, open courses, MOOCs focusing on CE. Contains open university courses, webinars and e-learning modules both in English and local languages. Added as a new category in June 2024.
- Local sources from the demonstration sites (mostly policy documents – 39 sources)
 - Sources which might be relevant on local level for CE-solutions --- some might be "upgraded" to other categories over time.
- Further categories to be agreed in the working group, including CircularPSP suppliers and procurers

A graphical overview is depicted in Figure 1.

Figure 1. CE Taxonomy Data Sources



*Number of sources as of August 2024

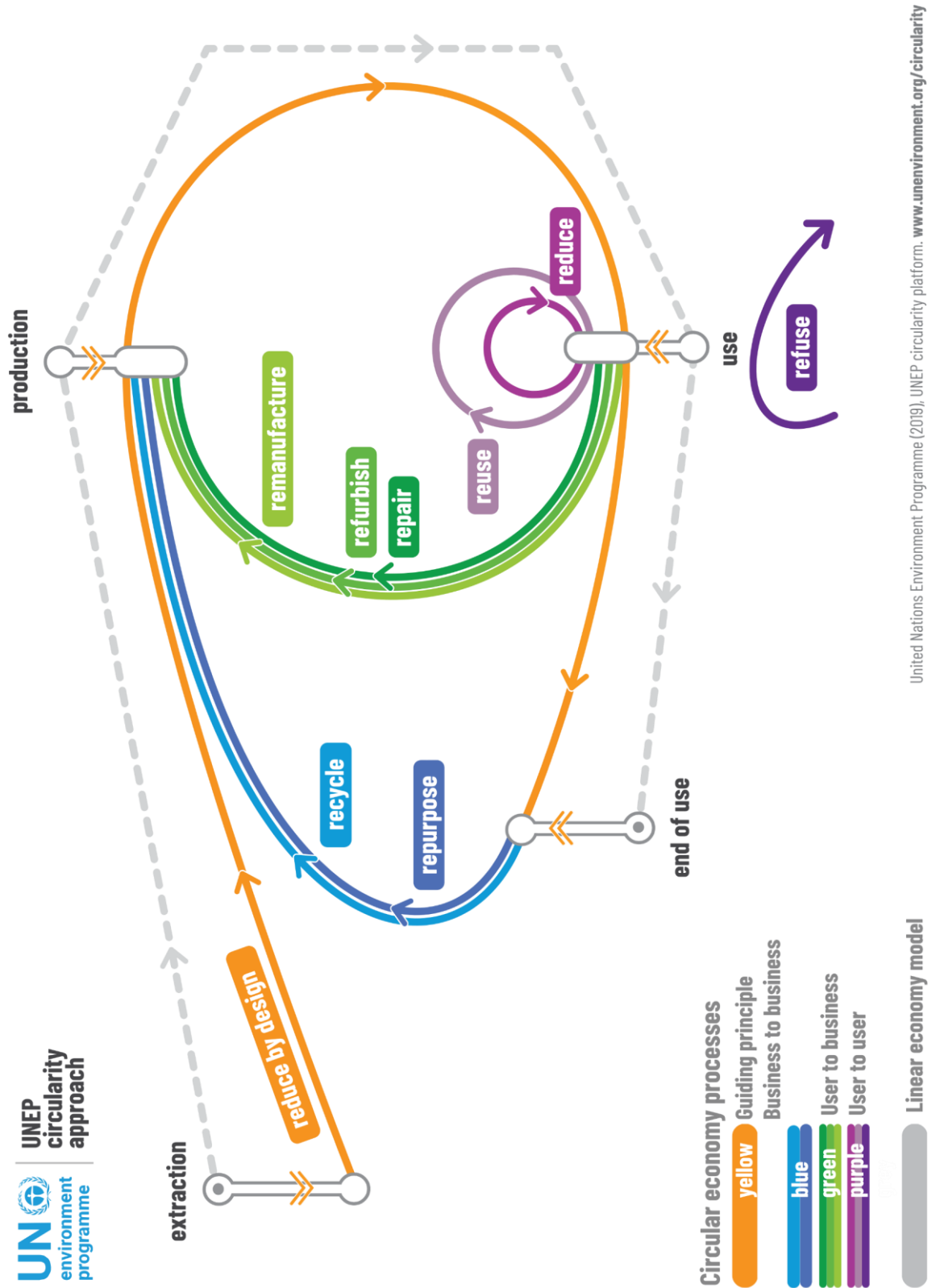
CircularPSP has continuously extended the MS Excel working file and aims to proceed like that. Where suitable, new categories will be added and at anytime new sources can be added by CircularPSP consortium members, Suppliers or guest contributors. The growth of data sources over time is depicted in Figure 2, the current number of sources is 190.

Figure 2. Growth of data sources CE Taxonomy



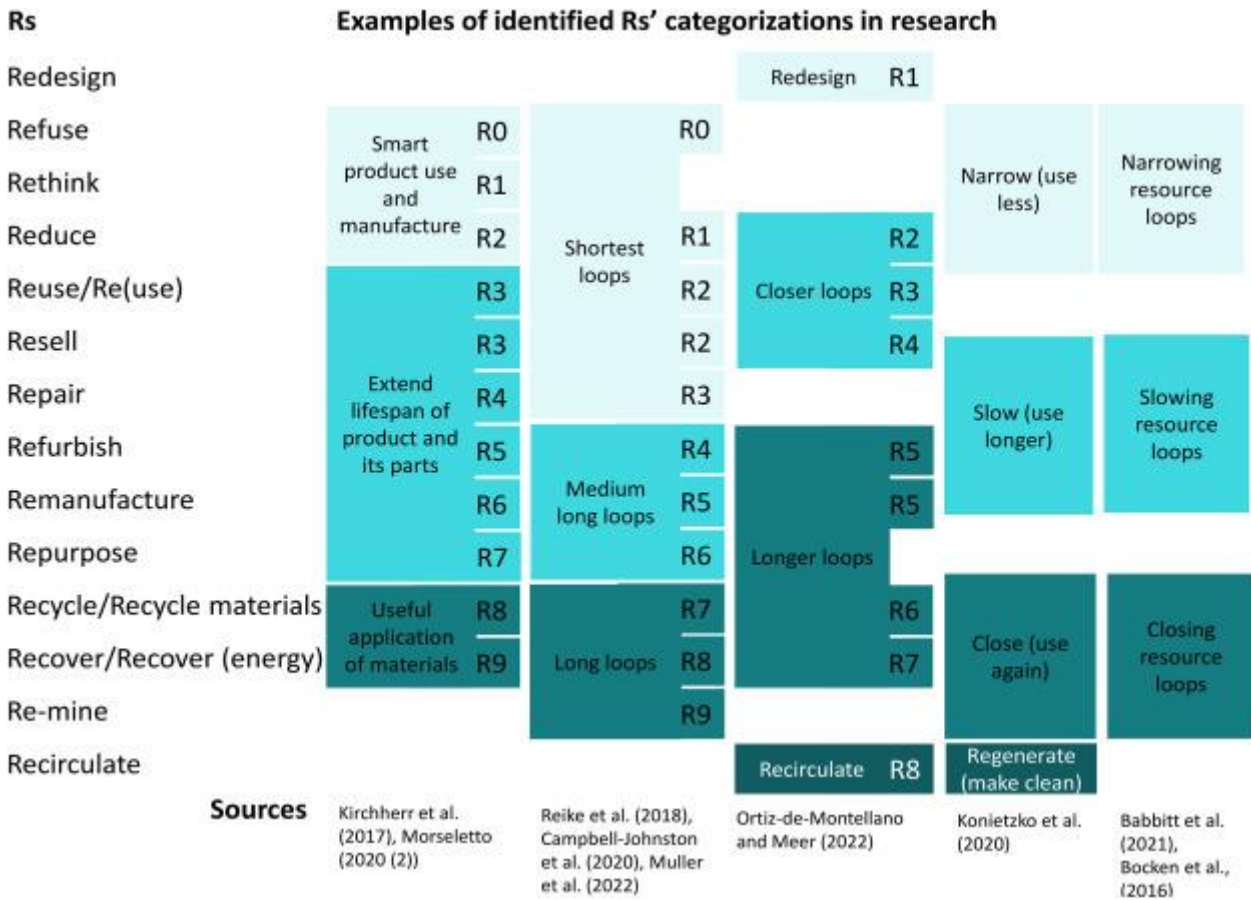
ANNEX I – UNEP CIRCULARITY DIAGRAM

Figure 3. UNEP Circularity Diagram



ANNEX II – RANKING OF R-STRATEGIES

Figure 4. Ranking of R-strategies⁸



R-strategies and their ranking according to circular strategy priority (R0 to R9), and grouping, according to length and speed of resource loops (marked with colour), prioritizing short and narrow resource loops (light blue) over long and closed ones (dark blue) in different sources.

⁸ Kurilova-Palasiene et al. (2023). Orienting around circular strategies (Rs): How to reach the longest and highest ride on the Retained Value Hill? Source: <https://doi.org/10.1016/j.jclepro.2023.138724>