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Circular economy — Vocabulary, principles and guidance for implementation

Économie circulaire — Vocabulaire, principes et recommandations pour la mise en œuvre

Norme Marocaine homologuée

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Correspondance

La présente norme est identique à l'ISO/FDIS 59004:2024.

Institut Marocain de Normalisation (IMANOR)
Angle Avenue Kamal Zebdi et Rue Dadi Secteur 21 Hay Riad - Rabat
Tél : 05 37 57 19 48/49/51/52 - Fax : 05 37 71 17 73
Email : imanor@imanor.gov.ma

Avant-Propos National

L'Institut Marocain de Normalisation (IMANOR) est l'Organisme National de Normalisation. Il a été créé par la Loi N° 12-06 relative à la normalisation, à la certification et à l'accréditation sous forme d'un Etablissement Public sous tutelle du Ministère chargé de l'Industrie et du Commerce.

Les normes marocaines sont élaborées et homologuées conformément aux dispositions de la Loi N° 12-06 susmentionnée.

La présente norme marocaine NM ISO/FDIS 59004 a été examinée et adoptée par la commission de normalisation de l'économie durable (137).

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 323, *Circular economy*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 Background

The global economy is "linear" as it is mainly based on extraction, production, use and disposal. This linear economy leads to resource depletion, biodiversity loss, waste and harmful losses and releases, all of which collectively are causing serious damage to the capacity of the planet to continue to provide for the needs of future generations.[28] Moreover, several planetary boundaries have already been reached or exceeded.

There is an increased understanding that a transition towards an economy that is more circular, based on a circular use of resources, can contribute to meeting current and future human needs (welfare, housing, nutrition, healthcare, mobility, etc.). Transitioning towards a circular economy can also contribute to the creation and sharing of more value within society and interested parties, while natural resources are managed to be replenished and renewed and in a sustainable way, securing the quality and resilience of ecosystems.

Organizations recognize many potential reasons to engage in a circular economy (e.g. delivering more ambitious and sustainable solutions; improved relationships with interested parties; more effective and efficient ways to fulfil voluntary commitments or legal requirements; engaging in climate change mitigation or adaptation; managing resource scarcity risks, increasing resilience in the environmental, social and economic systems), while contributing to satisfying human needs.

The ISO 59000 family of standards (see Figure 1) is designed to harmonize the understanding of the circular economy and to support its implementation and measurement. It also considers organizations, such as government, industry and non-profit, in contributing to the achievement of the United Nations (UN) Agenda 2030 for Sustainable Development[29].

ISO 59004, *Circular economy — Vocabulary, principles and guidance for implementation*

ISO 59010	**ISO 59020**	**ISO 59040**	**ISO 59014**
Circular economy — Guidance on the transition of business models and value networks	*Circular economy — Measuring and assessing circularity performance*	*Circular economy — Product circularity data sheet*	*Environmental management and circular economy — Sustainability and traceability of the recovery of secondary materials — Principles and requirements*

ISO/TR 59031, *Circular economy — Performance-based approach — Analysis of case studies*
ISO/TR 59032, *Circular economy — Review of existing value networks*

Figure 1 — ISO 59000 family of standards

0.2 Relationship between this document, ISO 59010 and ISO 59020

This document, ISO 59010[1)] and ISO 59020[2)] are interconnected, as shown in Figure 2, and support organizations in implementing a transition towards a circular economy.

1) Under preparation.

2) Under preparation.

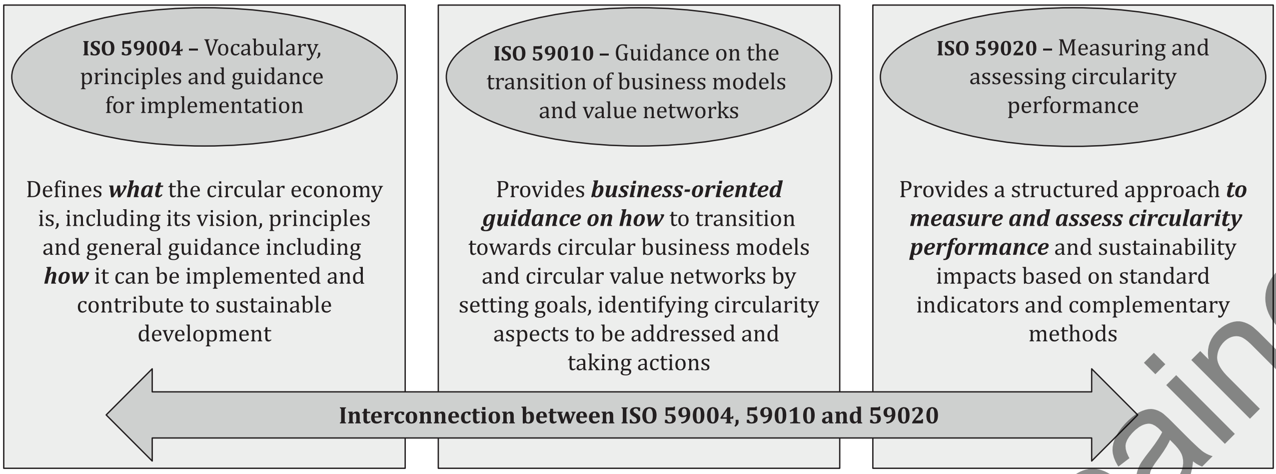

Figure 2 — Relationship between this document, ISO 59010 and ISO 59020

0.3 Purpose and the outline of this document

This document gives guidance for any kind of organization. It describes the main terms and definitions (see Clause 3), a circular economy vision (see Clause 4), the circular economy principles (see Clause 5), provides practical guidance on actions that contribute to a circular economy (see Clause 6) and guidance to implement a circular economy in any kind of organization (see Clause 7).

Circular economy — Vocabulary, principles and guidance for implementation

1 Scope

This document defines key terms, establishes a vision and principles for a circular economy, and gives guidance, including possible actions, for an organization to implement.

It is applicable to organizations seeking to understand and commit or contribute to a circular economy while contributing to sustainable development. These organizations can be either private or public, acting individually or collectively, regardless of type or size, and located in any jurisdiction, or position within a specific value chain or value network.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Terms related to a circular economy

3.1.1
circular economy
economic system (3.1.2) that uses a systemic approach to maintain a *circular flow of resources* (3.1.6), by recovering, retaining or adding to their *value* (3.1.7), while contributing to *sustainable development* (3.1.11)

Note 1 to entry: *Resources* (3.1.5) can be considered concerning both stocks and flows.

Note 2 to entry: The inflow of *virgin resources* (3.3.2) is kept as low as possible, and the circular flow of resources is kept as closed as possible to minimize *waste* (3.3.6), *losses* (3.3.7) and *releases* (3.3.8) from the economic system.

3.1.2
economic system
system (3.1.22) by which a society organizes and allocates *resources* (3.1.5)

Note 1 to entry: The economic system can vary depending upon the geographic region or governmental jurisdiction.

Note 2 to entry: This can include the regulation of resources and the production, use and disposal of these resources.

3.1.3
social system
system (3.1.22) by which human beings are expected to undertake different types of tasks in order to achieve common goals within a society

3.1.4
environmental system
systems (3.1.22) of the natural environment that interact, encompassing biotic and abiotic components

Note 1 to entry: In particular, this includes the atmosphere, *biosphere* (3.1.19), hydrosphere, cryosphere, pedosphere and lithosphere.

3.1.5
resource
asset from which a *solution* (3.2.1) is created or implemented

Note 1 to entry: Depending on the context, reference to “resource” includes “raw material”, “feedstock”, “material” or “component”.

Note 2 to entry: For the purpose of this document, asset refers to physical resources such as *natural resources* (3.3.1), *virgin resources* (3.3.2), *recoverable resources* (3.3.3) and *recovered resources* (3.3.5).

Note 3 to entry: Resource includes any energy type (e.g. the energy content or energy potential of materials).

Note 4 to entry: Resources can be considered concerning both stocks and flows.

3.1.6
circular flow of resources
systematic cycling of the provision and use of *resources* (3.1.5) within multiple *technical* (3.1.20) or *biological cycles* (3.1.21)

Note 1 to entry: The biological and technical cycles represent loops into the complex *system* (3.1.22) of resource flows in the economy.

3.1.7
value
gain(s) or benefit(s) from satisfying needs and expectations, in relation to the use and conservation of *resources* (3.1.5)

EXAMPLE Revenue, savings, productivity, sustainability, satisfaction, empowerment, engagement, experience, public health, trust.

Note 1 to entry: Value is relative to, and determined by the perception of, those *interested party(ies)* (3.4.2) able to capture it.

Note 2 to entry: Value can be financial or non-financial, e.g. social, environmental, other gains or benefits.

Note 3 to entry: Value is dynamic over time.

[SOURCE: ISO 56000:2020, 3.7.6, modified — “gain(s) or benefit(s)” replaced “gains” and “use and the conservation of resources” replaced “resources used” in the definition. “public health” added to the example. “those interested party(ies) able to capture it” replaced “the organization and interested parties” in Note 1 to entry. Example added in Note 2 to entry. Notes 3 to 5 to entry deleted. New Note 3 to entry added.]

3.1.8
recover value
process (3.5.5) to recuperate the *value* (3.1.7) of the object of consideration

3.1.9
retain value
process (3.5.5) to maintain the *value* (3.1.7) of the object of consideration

3.1.10
add value
process (3.5.5) to increase the *value* (3.1.7) of the object of consideration

3.1.11
sustainable development
development that meets the environmental, social and economic needs of the present without compromising the ability of future generations to meet their own needs

Note 1 to entry: Derived from the Brundtland Report[28].

[SOURCE: ISO Guide 82:2019, 3.2]

3.1.12
resilience
ability to endure, resist, adapt to or recover from disruptive events or conditions, whether natural or anthropogenic

Note 1 to entry: Resilience of an *ecosystem* (3.1.17) relates to its ability to resist or rebuild itself after some form of disruption without shifting into a qualitatively different state.

3.1.13
principle
fundamental basis for decision-making or behaviour

[SOURCE: ISO 26000:2010, 2.14]

3.1.14
circular
aligned with the *principles* (3.1.13) for a *circular economy* (3.1.1)

Note 1 to entry: Objectives and goals for a circular economy can be defined with respect to the principles for a circular economy.

3.1.15
circularity
degree of alignment with the *principles* (3.1.13) for a *circular economy* (3.1.1)

3.1.16
environment
surroundings in which an *organization* (3.4.1) operates, including air, water, land, *natural resources* (3.3.1), flora, fauna, humans, and their interrelationships

Note 1 to entry: Surroundings can be described in terms of biodiversity, *ecosystems* (3.1.17), climate or other characteristics.

[SOURCE: ISO 14001:2015, 3.2.1 modified — Note 1 to entry deleted and Note 2 to entry renumbered accordingly.]

3.1.17
ecosystem
dynamic complex of communities of plants, animals and microorganisms and their non-living *environment* (3.1.16), interacting as a functional entity

[SOURCE: ISO 14050:2020, 3.2.3]

3.1.18
technosphere
sphere or realm of human technological activity which results in a technologically modified *environment* (3.1.16)

[SOURCE: ISO 21930:2017, 3.8.4, modified — Note 1 to entry deleted.]

3.1.19
biosphere
part of the *environmental system* (3.1.4) that is capable of supporting life

[SOURCE: BSI 8001:2017, 2.7, modified — "environmental system" added and "in which living organisms exist" deleted.]

3.1.20
technical cycle
cycle(s) within the *social system* (3.1.3) through which *resources* (3.1.5) are used, recovered, restored and utilized within existing or new *solutions* (3.2.1)

Note 1 to entry: Resources flow into and within a technical cycle, which involves activities such as sharing, maintenance, *reuse* (3.5.17), *repair* (3.5.16), *remanufacturing* (3.5.21) and *recycling* (3.5.24).

3.1.21
biological cycle
cycle(s) through which biological nutrients are utilized by living organisms and subsequently restored into or within the *biosphere* (3.1.19) in a way that rebuilds *ecosystem* (3.1.17) *resilience* (3.1.12) and natural capital and enables the regrowth of *renewable resources* (3.3.10)

Note 1 to entry: Such cycles can involve, at various stages, *cascading* (3.3.15), *composting* (3.3.18), *anaerobic digestion* (3.3.17) or the extraction of bio-chemicals.

Note 2 to entry: Natural capital refers to the renewable and *non-renewable* (3.3.7) *natural resources* (3.3.1) (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people, including various ecosystem services such as producing oxygen, capturing carbon dioxide, purifying water, nutrient cycling, etc.

3.1.22
system
set of interrelated or interacting elements

[SOURCE: ISO 9000:2015, 3.5.1]

3.1.23
system in focus
system (3.1.22) that is defined by selected system boundaries and is the subject of a *circularity measurement* (3.6.4) and a *circularity assessment* (3.6.5)

Note 1 to entry: Four system levels are being used for measuring and assessing *circularity performance* (3.6.3): regional, interorganizational, organizational and product level.

3.2 Terms related to solutions

3.2.1
solution
product (3.2.2) or *service* (3.2.3), or a combination thereof, that fulfils a need of an *interested party* (3.4.2)

3.2.2
product
physical-based object designed for or utilized with a purpose

Note 1 to entry: A product can be, for example:

— goods of any type;

— hardware (e.g. engine mechanical part, spare parts, consumables);

— electrical or electronic hardware devices or components (e.g. computers, communication equipment and sensors);

— processed materials (e.g. lubricant, cement).

3.2.3
service
activity designed or executed with a purpose

Note 1 to entry: Services have intangible elements. Provision of a service can involve, for example:

— an activity performed on a tangible *product* (3.2.2) supplied to a *customer* (3.4.3) (e.g. automobile to be repaired; the income statement needed to prepare a tax return);

— the creation of ambience for the customer (e.g. in hotels and restaurants).

Note 2 to entry: Knowledge transfer and financial management as well as digital software tools or programs and databases are considered as services.

3.2.4
life cycle
consecutive and interlinked stages in the life of a *solution* (3.2.1)

Note 1 to entry: The interlinked stages can include acquisition of *natural resources* (3.3.1), design, production, transportation or delivery, use, *reuse* (3.5.17), *remanufacturing* (3.5.21) and *recycling* (3.5.24).

Note 2 to entry: Within a *circular economy* (3.1.1), traditional linear life cycle understanding is transformed by the thinking that a life cycle can consist of several *end of use* (3.5.29) (e.g. multiple use cycles) and eventually ends at the *end of life* (3.5.30, 3.5.31).

3.2.5
life cycle perspective
life cycle thinking
consideration of the *circularity aspects* (3.6.1) relevant to a *solution* (3.2.1) during its *life cycle* (3.2.4) which includes consideration of the relevant environmental, social and economic impacts

Note 1 to entry: The main idea in applying a life cycle perspective is to improve the *circularity performance* (3.6.3) of a solution by considering its use of *resources* (3.1.5) and related emissions in relation to relevant environmental, social and economic impacts. This can facilitate links between the economic, social and environmental dimensions within an *organization* (3.4.1) and through its entire *value chain* (3.5.2).

Note 2 to entry: In measuring and assessing the circularity performance of a *system* (3.1.22), a life cycle perspective should be applied.

Note 3 to entry: This perspective should include all stages of *technical* (3.1.20) or *biological cycles* (3.1.21) over appropriate timescales that are related to that system.

3.3 Terms related to resources

3.3.1
natural resource
resource (3.1.5) occurring in nature

Note 1 to entry: Natural resources usually have not been subjected to any human-related processing or modification.

Note 2 to entry: Natural resources are acquired or extracted from the *environment* (3.1.16) or nature (the geosphere or *biosphere* (3.1.19)) into the *technosphere* (3.1.18) and emissions to air, water or land are released from the technosphere into the environment.

3.3.2
virgin resource
primary resource
natural resource (3.3.1) or energy that is used as a *resource* (3.1.5) for the first time as input in a *process* (3.5.5) or for creating a *solution* (3.2.1)

Note 1 to entry: Virgin resources can be either a *renewable resource* (3.3.10) or *non-renewable resource* (3.3.11).

Note 2 to entry: Using virgin resources to produce a material does not result in that material being considered a virgin resource when first used, notwithstanding other terminology used, depending on the context, i.e. “virgin material” or “primary material”.

3.3.3
recoverable resource
resource (3.1.5) that can be recovered and used again after it has already been processed or used

Note 1 to entry: Recovery can be undertaken to *recover* (3.1.8), *retain* (3.1.9) or *add value* (3.1.10).

Note 2 to entry: A recoverable resource can provide no *value* (3.1.7) and be considered *waste* (3.3.6).

3.3.4
non-recoverable resource
resource (3.1.5) that cannot be recovered and used again after it has been processed or used

Note 1 to entry: Resources can be non-recoverable at time due to technological, economical, environmental, social or regulatory infeasibility.

3.3.5
recovered resource
secondary resource
resource (3.1.5) that is obtained from one that has already been processed or used

Note 1 to entry: Recovery can be undertaken to *recover* (3.1.8), *retain* (3.1.9) or *add value* (3.1.10).

Note 2 to entry: A recovered resource may provide no *value* (3.1.7) to the *holder* (3.4.5) and be considered *waste* (3.3.6).

Note 3 to entry: Other terminology used, depending on the context, includes “secondary material.”

3.3.6
waste
resource (3.1.5) that is no longer considered to be an asset as it, at the time, provides insufficient *value* (3.1.7) to the *holder* (3.4.5)

Note 1 to entry: The holder can choose to retain, discard or transfer the waste.

Note 2 to entry: Value can be assigned to waste as a result of a need from another *interested party* (3.4.2), at which point the resource is no longer considered waste.

Note 3 to entry: The assignment of value to waste as a resource is linked, in part, to the available technology (e.g. landfill mining).

Note 4 to entry: Some regulations require the holder to dispose of certain types of waste, while others assign value to waste.

Note 5 to entry: Because resources include the energy content or energy potential of materials, such energy, when liberated during a *process* (3.5.5) and not recovered for another use, can be considered a waste.

3.3.7
losses
unmanaged outflows of a *resource* (3.1.5) from the *system in focus* (3.1.23) that are not recovered

Note 1 to entry: For the purpose of measuring *circularity performance* (3.6.3), losses can be estimated.

Note 2 to entry: Losses can happen at any stage of the *life cycle* (3.2.4), such as wear and tear in the use stage (e.g. tire abrasion, microplastic).

3.3.8
releases
managed emissions to air and discharges to water or land from the *system in focus* (3.1.23)

Note 1 to entry: Releases can be solid, liquid or gaseous.

Note 2 to entry: For the purpose of measuring *circularity performance* (3.6.3), releases are quantifiable but are not recovered at the time of emission or discharge.

Note 3 to entry: Releases can happen at any stage of the *life cycle* (3.2.4) (e.g. car emissions).

3.3.9
renewable energy
energy from a *renewable resource* (3.3.10)

3.3.10
renewable resource
resource (3.1.5) that can be naturally or artificially grown or replenished within a foreseeable time frame by processes found in nature

Note 1 to entry: Some renewable resources are inexhaustible (e.g. the sun) while others are capable of being exhausted but can be regrown or replenished indefinitely with proper stewardship in line with *sustainable development* (3.3.11).

3.3.11
non-renewable resource
resource (3.1.5) that exists in a finite or limited amount that cannot be naturally replenished within a foreseeable time frame

Note 1 to entry: Resources that are derived from activities that occur only in the *technosphere* (3.1.18) such as *recycling* (3.5.24) are not considered *renewable resources* (3.3.10).

[SOURCE: ISO 21930:2017, 3.6.3, modified — "finite or limited" replaced "fixed" and "within a foreseeable time frame" replaced "or cleansed on a human time scale" in the definition. "Resources that are derived from" added and "renewable resources" replaced "natural replenishment or cleansing" in Note 1 to entry. Notes 2 and 3 to entry deleted.]

3.3.12
biobased
bio-based
derived from *biomass* (3.3.14)

[SOURCE: ISO 16559:2022, 3.23, modified — "biobased" added as the preferred term.]

3.3.13
biobased resource
resource (3.1.5) derived from *biomass* (3.3.14)

Note 1 to entry: Biobased resources exclude any material embedded in geological formations or transformed to fossilized material.

Note 2 to entry: Biobased resources include, for example, trees, crops, grasses, tree litter, algae, microorganisms, animals and *wastes* (3.3.6) of biological origin, e.g. manure.

Note 3 to entry: Biobased resource focuses on the source of the material and not the ability of the resource to cycle through the *technical* (3.1.20) or *biological cycles* (3.1.21).

3.3.14
biomass
material of biological origin, excluding material embedded in geological formations or transformed to fossilized material

Note 1 to entry: This includes organic material (both living and dead) from above and below ground, e.g. trees, crops, grasses, tree litter, algae, animals, and *waste* (3.3.6) of biological origin, e.g. manure.

[SOURCE: ISO 14021:2016, 3.1.1, modified — "and excluding peat" deleted in the definition.]

3.3.15
cascading
repeated use of a *resource* (3.1.5) usually starting at a level of high *value* (3.1.7) with decreasing quantity and quality at each subsequent stage or cycle, depending on the *processes* (3.5.5) used

3.3.16
energy recovery
generation of useful energy through direct and controlled transformation of *recovered resources* (3.3.5)

Note 1 to entry: Forms of useful energy include usable heat and electricity.

Note 2 to entry: Energy recovery is often the final option for use of recovered resources.

Note 3 to entry: In the context of the *circular economy* (3.1.1), the generation of energy from *virgin resources* (3.3.2) is not a form of "energy recovery".

3.3.17
anaerobic digestion
controlled biological process where microorganisms break down organic material without oxygen, producing biogas, carbon dioxide and, normally, nutrient-rich digestate

3.3.18
composting
aerobic biological process usually carried out under controlled conditions, which converts organic material into a normally nutrient-rich, humus-like, material

3.4 Terms related to organizations and other interested parties

3.4.1
organization
person or group of people that has its own functions with responsibilities, authorities, and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private (e.g. foundation, union, association, agency, municipality, region, country, intergovernmental agencies).

Note 2 to entry: A group of organizations can also be considered as an organization that has, alone or collectively, their own objectives.

[SOURCE: ISO 14001:2015, 3.1.4, modified — Examples in Note 1 to entry added. Note 2 to entry added.]

3.4.2
interested party
stakeholder
person or *organization* (3.4.1) that can affect, be affected by, or perceive itself to be affected by a decision or activity

Note 1 to entry: To "perceive itself to be affected" means the perception has been made known to the organization.

[SOURCE: ISO 14001:2015, 3.1.6, modified — Admitted term "stakeholder" added. Example deleted.]

3.4.3
customer
organization (3.4.1) or individual member of the general public purchasing a *solution* (3.2.1) for commercial, private or public purposes

[SOURCE: ISO 26000:2010, 2.3, modified — "a solution" replaced "property, products or services".]

3.4.4
user
organization (3.4.1) or individual member of the general public using a *solution* (3.2.1) for commercial, private or public purposes

[SOURCE: ISO 26000:2010, 2.3, modified — "user" replaced "customer" as the preferred term. "using a solution" replaced "purchasing property, products or services".]

3.4.5
holder
organization (3.4.1), *customer* (3.4.3) or some other type of individual that possesses, carries or legally owns the object of consideration

3.5 Terms related to value creation models and design and development

3.5.1
value creation model
business model
organization's (3.4.1) chosen *system* (3.1.22) of interconnected and interdependent decisions and activities that determines how it creates, delivers and captures *value* (3.1.7)

Note 1 to entry: A value creation model involves external *processes* (3.5.5) (e.g. transportation, take back) beyond those of the organization's processes (e.g. education, financing) and the *solutions* (3.2.1) it provides.

Note 2 to entry: The value creation model can have a focus on the short, medium or long term, or some combination thereof.

[SOURCE: BSI 8001:2017, 2.8, modified — Admitted term "business model" added. "'short, medium and long term" deleted in the definition. Note 1 to entry replaced by Notes 1 and 2 to entry.]

3.5.2
value chain
set of *organizations* (3.4.1) that provide a *solution* (3.2.1) that results in *value* (3.1.7) for them

3.5.3
value network
network of interlinked *value chains* (3.5.2) and *interested parties* (3.4.2)

3.5.4
sphere of influence
range or extent of political, contractual, economic or other relationships through which an *organization* (3.4.1) has the ability to affect the decisions or activities of other individuals or organizations

Note 1 to entry: The ability to influence does not, in itself, imply a responsibility to exercise influence.

[SOURCE: ISO 14006:2020, 3.1.8, modified — "other" added in the definition. Note 2 to entry deleted.]

3.5.5
process
set of interrelated or interacting activities that transforms inputs into outputs

[SOURCE: ISO 14044: 2006, 3.11]

3.5.6
framework
structure of *processes* (3.5.5) and specifications designed to support the accomplishment of a specific task

3.5.7
requirement
need or expectation that is stated, generally implied or mandatory

Note 1 to entry: "Generally implied" means that it is custom or common practice for the *organization* (3.4.1) and *interested parties* (3.4.2) that the need or expectation under consideration is implied.

Note 2 to entry: A specified requirement is one that is stated, for example in documented information.

[SOURCE: ISO 14001:2015, 3.2.8, modified — "mandatory" replaced "obligatory". Note 3 to entry deleted.]

3.5.8
trade-off
decision-making actions that balance opposing *requirements* (3.5.7) and alternative *solutions* (3.2.1) on the basis of net benefit to *organizations* (3.4.1), *interested parties* (3.4.2), *ecosystems* (3.1.17) or society

[SOURCE: ISO 14006:2020, 3.4.11, modified — "balance opposing" replaced "select from various", and "organizations", "ecosystems" and "society" have been added.]

3.5.9
design and development
process (3.5.5) that transforms *requirements* (3.5.7) into a *solution* (3.2.1)

Note 1 to entry: Design and development usually follows a series of steps, i.e. starting with an initial idea, transforming the idea into a formal specification, through to the creation of a solution, its potential redesign and consideration of *end of life* (3.5.30, 3.5.31).

Note 2 to entry: Design and development can include taking a solution idea from planning to provision and review of the solution. It can include considerations on business strategies, marketing, research methods and design aspects that are used. It includes improvements or modifications of existing solutions.

[SOURCE: ISO 14006:2020, 3.2.1, modified — "solution" replaced all uses of "product" in the definition and Notes to entry.]

3.5.10
linear economy
economic system (3.1.2) where *resources* (3.1.5) typically follow the pattern of extraction, production, use and disposal

3.5.11
ecodesign
environmentally conscious design
ECD
design for environment
DfE
green design
environmentally sustainable design
design and development (3.5.9) based on a *life cycle perspective* (3.2.5) aimed at supporting *sustainable development* (3.1.11)

3.5.12
design for circularity
DfC
design and development (3.5.9) based on the *circular economy* (3.1.1) *principles* (3.1.13)

Note 1 to entry: This field of design builds on and is related to *ecodesign* (3.5.11).

3.5.13
procurement
process (3.5.5) relating to the provision or sourcing of a *resource* (3.1.5) or *solution* (3.2.1)

Note 1 to entry: Sourcing is a part of the procurement process and includes planning, defining specifications and selecting suppliers.

3.5.14
reverse logistics
process (3.5.5) of managing, collecting and moving *products* (3.2.2) from their current location after the *end of use* (3.5.29) for the purpose of *recovering* (3.1.8) or *retaining value* (3.1.9) through proper handling

Note 1 to entry: Only activities needed for the proper handling are included, e.g. logistics needed to bring a used product to a new *customer* (3.4.3) are not included.

Note 2 to entry: The proper handling can include *remanufacturing* (3.5.21), *repair* (3.5.16) or *recycling* (3.5.24) or other treatment.

3.5.15
closed loop system
system (3.1.22) by which *products* (3.2.2) or *resources* (3.1.5) are used and then recovered and turned into new products or *recovered resources* (3.3.5), without losing their inherent properties

3.5.16
repair, verb
restore a *product* (3.2.2) to a condition needed for the product to function according to its intended purpose

Note 1 to entry: Actions can include renewal or replacement of worn, damaged or degraded parts of the product.

3.5.17
reuse, noun
use of a *product* (3.2.2) or its component parts after their initial use, for the same purpose for which they were originally designed

Note 1 to entry: Utilization intended by the original design can involve either single-use or multiple-uses by the initial *user* (3.4.4) or *customer* (3.4.3) over time.

Note 2 to entry: Minor treatment (e.g. cleaning) of the product can be needed by the user to allow for reuse.

Note 3 to entry: In some cases, *resources* (3.1.5), such as water, are considered as a product, in which case, the purpose of “original design” is not applicable.

3.5.18
refurbish, verb
recondition
restore an item, during its expected service life, to a useful condition for the same purpose with at least similar quality and performance characteristics

3.5.19
refurbishing, noun
refurbishment
reconditioning
process (3.5.5) by which an item, during its expected service life, is restored to a useful condition for the same purpose and with at least similar quality and performance characteristics

Note 1 to entry: Refurbishing does not include restoration after the expected service life.

Note 2 to entry: Refurbishing can include activities such as *repair* (3.5.16), rework, replacement of worn parts and update of software or hardware but does not include activities that result in significant changes of *product* (3.2.2) performances.

3.5.20
remanufacture, verb
return an item to a like-new condition from both a quality and performance perspective using an industrial *process* (3.5.5)

Note 1 to entry: From the performance perspective, the functionality of the item is an important consideration as it relates to the fulfilment of a particular need.

3.5.21
remanufacturing, noun
industrial *process* (3.5.5) by which an item is returned to a like-new condition from both a quality and performance perspective

Note 1 to entry: The item can be previously sold, leased, used, worn, *remanufactured* (3.5.20) or a non-functional *product* (3.2.2) or part.

Note 2 to entry: A like-new condition can also be described as "same-as-when-new" or "better-than-when-new".

[SOURCE: ANSI/RIC001.2-2021, modified — "like-new" replaced "original" in the definition. Note 2 to entry revised accordingly.]

3.5.22
repurpose
adapt a *product* (3.2.2) or its component parts for use in a different function than it was originally intended for, without making major modifications to its physical, chemical or mechanical structure

3.5.23
repurposing
process (3.5.5) by which a *product* (3.2.2) or its component parts are adapted for use in a different function than it was originally intended for without making major modifications to its physical or chemical structure

3.5.24
recycling
activities to obtain *recovered resources* (3.3.5) for use in a *process* (3.5.5) or a *product* (3.2.2), excluding *energy recovery* (3.3.16)

Note 1 to entry: Activities to obtain recovered resources include recovery, collection, transport, sorting, cleaning and re-processing.

Note 2 to entry: Recycling does not include *reuse* (3.5.17).

3.5.25
destructive
characteristic of a *process* (3.5.5) to obtain *recoverable resources* (3.3.3) without any intent of preserving the functionality or form of the original object

EXAMPLE Crushing, shredding, milling, grinding, melting, sawing, mining, other extraction activities.

3.5.26
non-destructive
characteristic of a *process* (3.5.5) to obtain *recoverable resources* (3.3.3) with the intent of preserving the entire functionality or form of the original object to the extent possible

Note 1 to entry: Non-destructive processing is usually applied for the purpose of obtaining *resources* (3.1.5) for *reuse* (3.5.17) or *recycling* (3.5.24).

3.5.27
regenerate
improve or restore a degraded *ecosystem* (3.1.17)

3.5.28
regenerative practice
activity that improves or restores degraded *ecosystems* (3.1.17)

3.5.29
end of use
point in time at which a *product* (3.2.2) or *resource* (3.1.5) is transferred by the *holder* (3.4.5) to some other holder

Note 1 to entry: The holder may transfer the product or resource internally within their own *organization* (3.4.1).

3.5.30
end of life
<product> point in time when a *product* (3.2.2) is taken out of use and its *resources* (3.1.5) are either recovered for processing or it is disposed of

Note 1 to entry: “Taken out of use” refers to when the product is no longer usable or ceases to exist in its current form.

Note 2 to entry: Disposal can be by incineration, deposit to landfill or the natural environment, or a combination thereof.

3.5.31
end of life
<resource> point in time when a *resource* (3.1.5) is taken out of use and is disposed of

Note 1 to entry: “Taken out of use” refers to when the resource is no longer usable.

Note 2 to entry: Disposal can be by incineration, deposit to landfill or the natural environment, or a combination thereof.

3.6 Terms related to measurement and assessment

3.6.1
circularity aspect
element of an *organization’s* (3.4.1) activities or *solutions* (3.2.1) that interacts with the *circular economy* (3.1.1)

EXAMPLE Durability, recyclability, reusability, repairability, recoverability.

Note 1 to entry: Circularity aspects should be considered in relation to the *principles* (3.1.13), as well as the organization’s objectives, goals and actions, for the implementation of a circular economy.

3.6.2
circularity impact
change to *economic* (3.1.2), *social* (3.1.3) and *environmental systems* (3.1.4), whether adverse or beneficial, including possible consequences, wholly or partially resulting from an *organization’s* (3.4.1) *circularity aspects* (3.6.1)

3.6.3
circularity performance
degree to which a set of *circularity aspects* (3.6.1) align with the objectives and *principles* (3.1.13) for a *circular economy* (3.1.1)

3.6.4
circularity measurement
process (3.5.5) to help determine the *circularity performance* (3.6.3) through collection, calculation or compilation of data or information

3.6.5
circularity assessment
evaluation and interpretation of results and impacts from a *circularity measurement* (3.6.4)

Note 1 to entry: Assessment includes consideration of the sustainability aspects and can apply complementary methods such as *life cycle assessment* (3.6.8).

3.6.6
circularity indicator
metric used to measure one or more *circularity aspects* (3.6.1)

Note 1 to entry: A circularity indicator can represent a measurable aspect or combination of aspects of a *resource* (3.1.5), a *solution* (3.2.1), *process* (3.5.5) or action.

3.6.7
externality
external effect
consequence of an activity that affects *interested parties* (3.4.2) other than the *organization* (3.4.1) undertaking the activity, for which the organization is neither compensated nor penalized through markets or regulatory mechanisms

[SOURCE: ISO 14050:2020, 3.12.12]

3.6.8
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and potential *environmental impacts* (3.6.10) of a product system throughout its *life cycle* (3.2.4)

[SOURCE: ISO 14040:2006, 3.2]

3.6.9
traceability
ability to trace the history, application and location of that which is under consideration

Note 1 to entry: When considering a *solution* (3.2.1), traceability can relate to:

— the origin of *products* (3.2.2);

— the *process* (3.5.5) and *service* (3.2.3) history;

— the distribution and location of the product;

— the product composition.

Note 2 to entry: When considering a *resource* (3.1.5), traceability can relate to:

— the origin of the resource (e.g. whether it is a *virgin* (3.3.2) or *recovered resource* (3.3.5));

— the process history;

— the distribution and location of the resource.

[SOURCE: ISO 9000:2015, 3.6.13, modified — "and location of that which is under consideration" replaced "or location of an object". Note 1 to entry revised. Note 2 to entry replaced.]

3.6.10
environmental impact
change to the *environment* (3.1.16), whether adverse or beneficial, wholly or partially resulting from an *organization's* (3.4.1) environmental aspects

Note 1 to entry: Environmental aspects are any element of an organization's activities or *products* (3.2.2) or *services* (3.2.3) that interacts or can interact with the environment (see ISO 14001:2015, 3.2.2).

[SOURCE: ISO 14001:2015, 3.2.4, modified — Note 1 to entry added.]

4 Circular economy vision

Human activities have increased to such an extent that the effects today, such as climate change and biodiversity loss, threaten the resilience and sustainability of the Earth's systems. With respect to countering this trend, Annex A contains a list of drivers for implementing a circular economy. The circular economy uses observations of how natural systems function as a basis for developing relevant aspects and metrics to maintain and guide human well-being, progress and preserve the natural environment.

The long-term vision of a circular economy is, by design, to provide appropriate solutions for the reduced, efficient and effective use of resources, and to prevent harmful releases, losses and environmental degradation when meeting societal needs.

Under this vision, social and economic growth are decoupled from resource consumption. This is done by reducing waste, extending the productive life of resources, maximizing recovered resources, maintaining them at their highest value and keeping the inflow of virgin resources as low as possible, in particular non-renewable resources. Natural resources are managed sustainably in a way that protects and contributes to the regeneration of ecosystems.

The six principles described in Clause 5 should be integrated into organizational strategies and objectives to support continual progress towards increasing circularity. Systems thinking should be applied to circular economy activities, which supports progress towards sustainable development.

5 Circular economy principles

5.1 General

In understanding the circular economy principles, it is important that the organization considers environmental, social and economic systems, and their interactions, see Figure 3. The economic system is understood as embedded into the social system, and both are relying on and embedded into the environmental system.

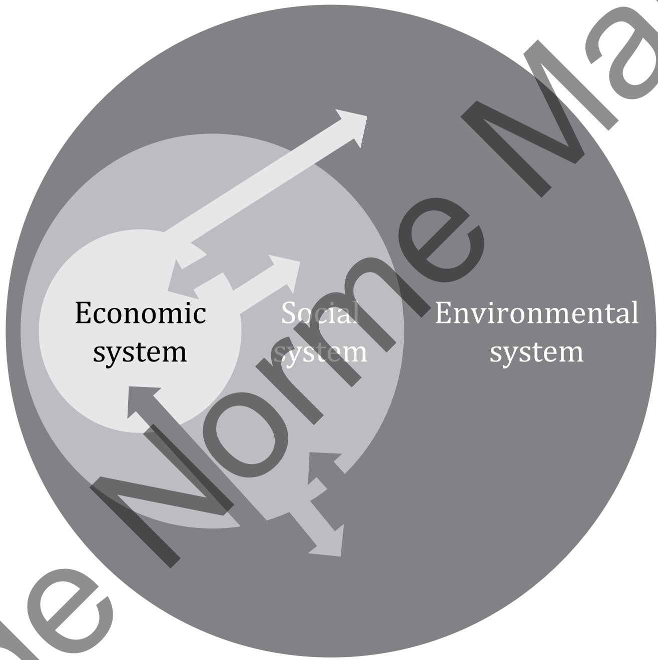

Figure 3 — Illustration of the interactions between the environmental, social and economic systems

Enabling a circular economy requires a transition in thinking from linear to circular regarding the management of stocks and the movement of resources within and through multiple series of technical or biological cycles and resource flows.

Implementing a circular economy involves applying several approaches relating to resource management (e.g. connecting linear flows, using fewer resources, extending the life of a solution, designing for durability and longevity, minimizing resource degradation), in order to reduce the use and loss of resources when engaging in value creation and sharing.

NOTE This can be referred to as closing, narrowing or slowing resource flows.

The set of principles given in 5.2, which are interlinked and complementary, should be considered by an organization to transition towards a circular economy.

5.2 Principles

5.2.1 Systems thinking

Organizations take a life cycle perspective and apply a long-term approach when considering their impacts on environmental, social and economic systems.

5.2.2 Value creation

Organizations recover, retain or add value by providing effective solutions that contribute to socio-economic and environmental value, and use resources in an efficient way.

5.2.3 Value sharing

Organizations collaborate with interested parties along the value chain or value network in an inclusive and equitable way, for the benefit and well-being of society, by sharing the value created with the provision of a solution.

5.2.4 Resource stewardship

Organizations manage stocks and flows in a sustainable way including by closing, slowing and narrowing resource flows to contribute to resource accessibility and continued availability for present and future generations and to reduce risks associated with dependence on virgin resources.

5.2.5 Resource traceability

Organizations collect and maintain data to enable tracking of resources through their value chains and are accountable for sharing relevant information with interested parties.

5.2.6 Ecosystem resilience

Organizations develop and implement practices and strategies that protect and contribute to the resilience and regeneration of ecosystems and their biodiversity, including preventing harmful losses and releases and taking into account planetary boundaries.

5.3 Considerations of adopting the principles

5.3.1 General

This subclause discusses the implications for an organization related to the adoption of circular economy principles and provides examples that an organization can consider when developing circular solutions.

5.3.2 Design and development

Circular economy principles should be considered in the early stages of design and development of a solution so that it is designed to create the highest possible value relative to resource use and to minimizing waste, losses and releases (including energy dissipation) associated with all processes during its life cycle. Designing for the reduction of resource use is one form of decoupling resource use and consumption from social and economic development. Considering the integration of all the circular economy principles is important, as focusing on only one or two principles can undermine the achievements that would otherwise occur if all the principles were considered.

Applying a systemic approach together with life cycle perspective is important for the design phase. Systems thinking covers interdependencies and cumulative impacts in the systems that the organization or its solutions interact with and helps the organization in understanding how individual decisions and activities interact and can cause impacts within those wider systems.

For more examples of applications of a circular economy to design and development, see ISO 59010.

5.3.3 Collaboration for management of information and resources

Organizations should collaborate to improve transparency when monitoring resource stocks and flows on an ongoing basis. The organization should identify opportunities to add value, retain value, recover value, track and manage resources when working in collaboration with other partners in related or alternative value chains. When identifying opportunities, the principles involving resource stewardship and traceability are useful. For example, application of the principles can help identify opportunities for more effective and efficient management and use of resources that ensure high-value creation through multiple use cycles. Another example is the use of open information systems and sharing that facilitate cooperation along the value network and over time. Cooperation in the sharing of information and resources takes place within the value network. This can be between organizations within a nearby geographic location or between distant ones.

5.3.4 Risk and opportunity management

Implementation of circular economy principles can support an organization in evaluating risks and opportunities related to resource management over different time periods. One goal of applying circular economy principles is to support assessments that help organizations continually reduce detrimental effects and generate opportunities for better solutions (e.g. those that can tackle climate change, social inequities, biodiversity loss and waste). For detailed information on assessments, see ISO 59020. These new solutions can reduce loss of value and improve resource stock and flow management ("close the loop").

A circular economy should not harm the health of people, wildlife or the environment. Therefore, a risk-based approach should be used to avoid exposure to hazardous substances. When possible, organizations should avoid their use.

5.3.5 Relationship between value creation and resource use

Circular economy principles focus on ways to transition towards sustainable and effective solutions that meet societal needs. Organizations seek, design or offer solutions that focus on optimizing and balancing all kinds of value creation, not only economic but also social and environmental, relative to resource use. The focus is on the functions provided by solutions rather than on the products or services themselves. Organizations should consider what approach is optimal in relation to provided value and resource use. When considering the resource use, organizations should not only consider the ones used in solutions but also the full effects of the system generating and supporting the solutions (e.g. energy and materials).

5.3.6 Awareness of stocks and flows

Circular economy principles include the need for organizations to understand the stocks and flows relevant to any solutions developed or activities performed by the organization. This includes managing trade-offs between economic, environmental and social aspects. For this reason, it is important to consider all aspects in order to make better informed decisions.

To efficiently manage the resource utilization in a circular way, the organization can identify and measure the use of all types of resources (virgin or recovered, non-renewable or renewable) and trace the mass and value over time, while resource substitution, resource recovery and recycling are carried out and improved. There is inevitably loss of resources (e.g. material and energy) over time that should be monitored in terms of type, final disposition and effects. Closing resource flows involves establishing systems and processes that enable resource recovery. Slowing resource flows involves keeping resources in use for as long as technically and economically possible (e.g. extending the life of products or if that is not possible, extending the life of its components or materials). Narrowing resource flows involves constraining the inflow of resources (e.g. doing more with less). For more examples of applications of a circular economy to measuring stocks and flows, see ISO 59020.

Organizations should also manage resources sustainably, including minimizing negative circularity impacts associated with their resource use, which can include detrimental losses or releases (e.g. dissipation of energy) that are harmful to ecosystems.

6 Actions that contribute to a circular economy

6.1 General

This clause presents actions that an organization should consider and can implement, following the guidance described in Clause 7. These actions are applicable across the entire value chain or value network and can contribute to narrowing, slowing or closing resource flows. They can be related to several circularity aspects.

The actions are not exhaustive, nor necessarily independent and mutually exclusive. They can be implemented individually or combined in any configuration which helps to enable the organization's circular economy value creation models (see ISO 59010) in accordance with the circular economy principles (see 5.2).

Innovative approaches (see 6.6.3) are important for an organization in transitioning towards a circular economy. Prior to implementing any of the identified actions in this clause, an organization should have an understanding of where their solutions fit in the value chain.

Organizations should consider refuse and rethink as preliminary actions.

Refusing refers to re-evaluating resource use patterns to ensure that organizations pursue sufficiency and are set up to prevent overusing resources. Refusing can make a solution(s) redundant by demonstrating to an organization that it is not required, or its function can be replaced by a solution with the same function or with a radically different solution.

Rethinking refers to a reconsideration of design and manufacturing decisions with a different mindset (e.g. making service use more intensive, sharing or by putting multi-functional products on the market).

NOTE Depending on the type of organization, some actions can be considered as enablers.

Annex B contains a list of examples that illustrate the actions.

Annex C provides illustrative questions to check how the sustainable development dimensions can be considered in the implementation of actions that contribute to a circular economy.

Some of the actions can impact resource management. Guidance is provided in 6.7.

6.2 Actions that create added value

6.2.1 General

Organizations should rethink solutions, especially at the design stage, and optimize production processes to enable product and resource circulation and prevent the creation of waste and harmful losses and releases. As a priority, organizations should consider the principle of resource stewardship (see 5.2.4). The design, development and production stages are of special importance in the transition towards a circular economy. These stages set the critical course as to whether and how the resources can be recovered or not. When such interventions take place early in the life cycle, their positive environmental impacts mainly materialize in the use stage and through recovery at the end of use or end of life, resulting in reduced use of virgin resources.

6.2.2 Design for circularity

Design for circularity is intended to:

— rethink solutions such that they can easily be repaired, maintained, refurbished, remanufactured, upgraded or reused;

— minimize resource use;

— prolong product lifetime.

This, in turn, allows for reuse as well as product and resource recovery at the end of a use cycle. Optimizing the number of loops and the value recovery process to avoid waste and harmful losses and releases through appropriate design is key in a circular economy.

A systems perspective is used to consider relevant aspects concerning appropriate resource choices. This can include:

— preventing the use or release of substances that can harm human health and ecosystem resilience (see 6.2.3);

— sustainability aspects throughout the life of the product (e.g. minimizing its negative impact and enhancing its positive impacts along the whole life cycle);

— exploring new relationships with customers, suppliers and partners for the purpose of designing a suitable value creation model.

Design for circularity is a design practice that integrates all the circular economy principles. It allows for the adoption of other actions along the life cycle of solutions aiming to increase, for example, durability or resource recovery. A difference between design for circularity and ecodesign is that design for circularity integrates a process of selection of resources that is consistent with the circular economy principles described in 5.2.

Important aspects of design for circularity are:

— design for product durability and long use;

— design for product and resource recovery;

— design to minimize resource use and losses;

— design for performance-based approaches.

6.2.3 Circular sourcing

The sourcing process, as understood in its broad life cycle approach from resource sourcing to recovery, should be considered throughout the organization when transitioning towards a circular economy, including research and development, and product design.

The sourcing process can also be understood as part of the procurement process, including sourcing of resources but also suppliers' development and management.

When implementing circular sourcing, organizations should minimize resource use and give preference to acquiring recovered and renewable resources while taking into consideration the life cycle impacts of these resources.

Important aspects of circular sourcing are:

— substitute virgin resources in technical and biological cycles;

— the sourcing of all virgin or secondary non-renewable and renewable resources should consider all aspects of sustainability related to the resource;

— substitute substances of concern;

— source with recovered or used resources and products while maintaining safety.

6.2.4 Circular procurement

Circular procurement, as part of the broader concept of sustainable procurement (see ISO 20400), encompasses actions at strategic, management and operational levels to embed aspects of circularity into procurement policies and processes.

EXAMPLE 1 Procurement guidelines, acquisition requirements, specifications, contracts, suppliers' assessment tools, sourcing strategy.

In this sense, circular procurement can play a key role in the transition towards a circular economy, engaging suppliers and its solution's value chains and value networks to enable the creation of new markets for organizations and support current markets in the transition from linear to circular.

EXAMPLE 2 Procurement teams assist sourcing and operations to make sure that scrap can be appropriately recovered and recycled to meet zero waste operations goals.

Circular procurement involves looking beyond short-term needs and expected benefits but considering the longer-term circularity impacts of each purchase. This includes questioning whether a purchase should be made at all. Often a service can fulfil the function needed.

The objective is to purchase products, services or solutions that seek to contribute to closed resource cycles within supply chains, while minimizing or avoiding negative societal and environmental impacts and enhancing the positive circularity impacts of the solution(s) across its whole life cycle.

To achieve this, changes in contractual methods should be considered and circular economy principles should be embedded into the requirements for suppliers.

Purchasing decisions made by the procurement department can demonstrate the organization's commitment to its circular economy strategy.

6.2.5 Process optimization

In production processes, as well as in supply chains for buildings or regions, large circularity impacts can be achieved by optimizing resource efficiency and changing processes to reduce or eliminate waste as well as harmful losses and emissions. The reduction of total resource and energy inflow as well as the sustainable use of water is cost saving and enhances the resilience of the organization.

6.2.6 Industrial, regional or urban symbiosis

Symbiosis describes a system that enables circular flows of resources, by engaging traditionally separate organizations in a collective approach to share inflows and outflows and optimize their value networks.

In industrial symbiosis, for example, separated industries or value chains engage to exchange (or share) resources, such as energy, water or by-products due to synergistic possibilities offered by geographical proximity.

In regional or urban symbiosis, multiple cities, regions and other subnational governmental organizations (as well as agencies) exchange or share resources, solutions, information and capabilities (infrastructure and knowledge).

There are additional opportunities for symbiosis (e.g. involving both government and industry).

This type of geospatial collaboration can create advantages and mutually beneficial value creation and provide resource productivity and innovative solutions, while reducing the overall adverse environmental, social and economic impacts from their activities.

6.3 Actions that contribute to value retention

6.3.1 General

Organizations should invest in activities to retain the value of the resources involved in creating a solution. This should be considered from the design stage of the solution. Activities presented in this clause, such as reuse, leasing, sharing or maintaining, refurbishing and remanufacturing, are meant to help preserve the function of a solution or preserve the product itself through strategies to increase lifetime and use intensity. These activities are strongly dependent on corresponding value creation models (see ISO 59010).

Organizations should review the actions for resource management to select the most appropriate and viable actions, as suggested in 6.7.

6.3.2 Reduce, reuse and repurpose

Reducing demand for a product helps in lowering the associated resource use. This strategy can also include reduction with the intent to increase efficiency in product manufacturing or by consuming fewer natural resources.

Reusing products or components that a user no longer needs for the same function for which they were originally used over multiple usage cycles is an important measure for reducing resource use and losses and increasing value capture from existing products. To reuse products and components, it is important to provide a method for the non-destructive collection and redistribution of used products and components. Reuse often retains the greatest value in embedded costs such as material, labour, energy and capital, as well as greatest savings in external costs such as greenhouse gas (GHG) emissions, water consumption, etc.

Alternatively, strategies to repurpose can be pursued, where a discarded product or its parts are used in a new product with a different function.

When the negative impact(s) in the use stage exceeds the benefits from new replacement products, the retention value can become insignificant. In this instance, it can be better to replace the product.

6.3.3 Maintenance and repair

If a product malfunctions or breaks it cannot be suitable for (re)use and risks being discarded. To avoid that, preventive or predictive maintenance is necessary. To enable maintenance and repair, the availability of spare parts, maintenance and repair instructions as well as services are essential.

Performance of products can be extended or restored with repair and maintenance services to permit the original functions to continue instead of being discarded. These actions can also lead to job creation through needed service providers.

6.3.4 Performance-based approaches

Performance-based actions and their associated value creation models are acknowledged as relevant to decouple revenues from the use of resources and make organizations less dependent on the quantity of products delivered.

With the transition to a circular economy, ownership of products can be supplanted by the option to purchase services that focus on the function provided by the product. Ownership of a product then remains with the supplier, but customers are loaned access to the product as part of delivering a service, as an overall solution.

The organization carrying out the service activity retains ownership and responsibility for the upkeep, maintenance and end-of-life management of the product while the user gets access via leasing, pay-per-use, subscription or deposit return schemes. The value creation model should enable these strategies. It is important to ensure that the service is managed in a sustainable way and that higher resource efficiency is achieved by increasing intensity of use, extending the life of products and limiting the amount of non-recoverable resources after end of use. Moreover, resource efficiency improvements are achieved by avoiding the need for each potential user to buy and own a product (see ISO/TR 59031[3]).

6.3.5 Sharing to intensify use

Sharing durable assets or products can increase their use over time and reduces the number of products that need to be produced by avoiding the need for each potential user to buy and own a product. Digital technologies such as platforms can help to reduce the organizational effort and create a positive experience for the user.

EXAMPLE Software as a service (also referred to as "SaaS"), a clothing borrowing programme, and on-demand transportation service.

This approach is more commonly known as the "sharing economy" (see ISO 42500).

Tools, models and digital platforms created for sharing to intensify the use should include consideration of the overall net resource savings and impact reductions on a life cycle basis (e.g. overall reduction in the pressure on natural resources and non-renewable energy) compared to a new solution. Organizations should focus efforts on promoting the life extension of the product or asset and should not compromise the ability to recover or recycle the product, part, asset or material at the end of a life cycle. Services and sharing platforms should also seek to benefit local workers and communities, whenever possible.

6.3.6 Refurbishing

Refurbishing can include activities such as repair, rework, replacement of worn parts, and update of software or hardware, but does not include activities that result in the need for a new product certification and a legal manufacturer status of the refurbisher. Refurbishing does not include restoration after the expected lifetime.

Once immovable assets (e.g. buildings, infrastructure, machines) reach the end of use or their use becomes redundant, refurbishing or repurposing can prolong their use possibilities. Such activities help to put back the assets to their original use, possibly with extended functionalities, or to a state that provides for adaptive repurposing and retrofitting.

6.3.7 Remanufacturing

Remanufacturing is performed on products resulting in a new expected service life, new or modified specifications, intended use(s) or legal claims.

By remanufacturing products, components or parts, a company contributes to the circular economy by extending the lifetime of those elements and thus creates additional value for the organization, the customer, the workers and the environment. Remanufactured products or parts can often come with a warranty equivalent to the warranty the product received when new.

6.4 Actions that contribute to value recovery

6.4.1 General

With the activities listed in this clause, it is possible to recover the value of products, product components and materials with the goal to reintroduce them into new products or processes. These activities are key to closing the loop and preserving resource value.

The value of a recovered resource or product can be determined with the assistance of product information, such as material data sheets, trade information, quantity, quality and composition of the product. Product circularity data sheets (PCDS) can provide additional guidance to the purchaser and assist in identifying an appropriate value for the recovered product, component or material (see ISO 59040[4]). Efficient management

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and sharing of this information, in alignment with the circular economy principle of resource traceability (see 5.2.5), can facilitate the process to recover value.

Product collection, sorting and recovery should be implemented efficiently so that existing product value can be extended and resources are recovered in high quality, biological or technical cycles, or both.

Once actions that contribute to value retention have been prioritized, the anthropogenic stocks (e.g. incineration ashes, post-consumer products, sludge sewage, landfill) can be exploited to provide recovered resources. Decommissioning and resource mining can also provide resources for future uses.

Organizations should review the actions for resource management to select the most appropriate and viable actions as suggested in 6.7

6.4.2 Reverse logistics

Reverse logistics is key to enable a circular flow of resources and products as well as for value recovery. Reverse logistics transports post-use, undesired (in their current location) or unsold products, components or materials back into the same or another value chain or network for further use cycle management. Effective reverse logistics is key to enabling a supply of high-quality recovered resources to circular activities such as reuse, remanufacturing or recycling.

Organizations should consider developing effective and efficient logistics schemes that enable collection or take-back processes and contribute to products or parts or materials being properly brought back in the same or another value chain or network (after processing or not) with an appropriate value.

6.4.3 Cascading of resources

6.4.3.1 General

Cascading also enables the circular flow of resources. Cascades provide an opportunity for an output to be an input usually starting with the highest value use and decreasing quality and quantity in subsequent cycles. Cascading is a way to use resources more efficiently and for as long as possible. Energy recovery is part of the cascade. Economic value can decrease or increase depending on the context.

Cascading can result in expanded or new value networks. Downcycling (recycling activities that obtain recovered resources with a lower value) can be an element of cascading, although priority should be given to cases where the flow will result in a solution with increased value. The two situations can happen in technical cascades and biobased material cascades, and some products have a material profile that allows inclusion in both cycles. Material information should stay with the products throughout the cascade to define resource quality for the subsequent steps.

The identification and management of contaminants is important for value retention along the cascade due to resources that can no longer be used for their intended purpose or become a hazard or a waste. Managing risks from exposure to harmful substances enables safer disposal or managed release into the environment and enables the use of resources for various applications. Waste that remains at the end of the cascade should be evaluated to limit any harm to humans or the environment. Energy recovery should be considered when the resource is no longer suitable for inclusion in solutions.

6.4.3.2 Cascading in technical cycles

In technical cycles, the sequential use of resources for different purposes usually consists of multiple resource cycles before energy recovery operations. The key drivers structuring cascades are economic, regulatory and opportunity driven. Absence of markets for cascaded resources is a key obstacle to sustaining resource cycles and can require establishing new marketplaces or, as a last resort, energy recovery. Re-mining can ultimately be part of technical cascades if the resources are stored in a way that can be recovered when the economic conditions become favourable.

6.4.3.3 Cascading of biobased resources

Cascade utilization can provide an opportunity to use biomass more efficiently as an extended carbon storage strategy to create more value with the same amount of biomass, thereby limiting impacts to the environment or competition with food or feed supply. Cascading biobased resources implies subsequent uses for the resource (e.g. bio-chemicals or bio-materials) followed by final energy recovery or other forms of recovery if the resources are compostable or biodegradable.

Providing a dedicated collection infrastructure can facilitate further flows, allowing the cascade to use the biomass more efficiently. Having a dedicated collection system with adequate design makes it easier to prevent contamination. Efficiency of the system is also important. Non-contamination and compliance with qualifying conditions for composting or biodegradation (see ISO 59020:—, A.3.5) allow for the final cascaded resources to be returned safely to the biosphere to help restore soil fertility.

Anaerobic digestion (with energy production) or aerobic process (composting) with or without nutrient or biochemical extraction are forms of value creation in the cascade.

6.4.4 Recycling

Through recycling, the resource remains in use and the creation of wastes is reduced. Recycling can involve a mechanical, physical, chemical process or biological processes, or a combination of these processes. When considering recycling processes, it is important to assess whether the quality of the resource is maintained (e.g. it can be used for same purpose again) or if it will be cycled to a lower quality during the process. Also, consideration should be given to how much energy is used for the recycling process.

Not all resources should be recycled though, as hazardous substances can accumulate during successive cycles, increasing net toxicity. Successive use of resources within cascades can also be appropriate for technical materials or components, which sometimes provide new opportunities for inputs to support new circular resource flows.

6.4.5 Waste management

In a circular economy, waste is minimized by intention. However, waste will still be created throughout the transition towards a circular economy and needs proper management and treatment.

NOTE Waste management, when it complies with national and international laws and treaties, aims to reduce emissions into air, water and soil to minimize adverse impacts on human health and the environment.

Within the circular economy, products or components that have insufficient value for the holder are given a temporary waste status in some countries because of regulatory requirements. Nevertheless, they can become a recovered resource if there is an active recovery process in place. Otherwise, they can be intentionally removed from the system through landfilling or incineration. In the case of incineration with energy recovery, resources are effectively removed from the system but their energy content is recovered, see 6.4.7.

Wherever possible, because of the nature of the recovery options, biodegradable and non-biodegradable resources should be kept as separate as possible or designed for separate recovery at the end of use or end of life, for treatment in appropriate facilities. When biodegradable and non-biodegradable resources cannot be separated, best practice is to ensure their treatment in appropriate facilities that focus on limiting contamination.

6.4.6 Material recovery

Material recovery is the method of recapturing and reutilizing recoverable resources specifically for reuse, refurbishing, remanufacturing, recycling or other methods that add or retain value of a resource.

Resources once considered waste can be valuable in resource recovery. For instance, resources can be extracted from landfills or reclaimed from anthropogenic sources, such as unused assets (e.g. abandoned infrastructure). This process adds value to dormant resources.

Accurate information facilitates material recovery. Information that can support material recovery includes data on the quantity and ease of access to the resource, detailed resource specifications and any related product certifications. It's also crucial to understand recovery limitations, including the available methods for resource recovery, logistical challenges in resource collection and any legal, regulatory or technological barriers. Organizations should assess the trade-offs before deciding to recover a specific resource. This evaluation is essential to ensure that the recovery process is not only feasible but also beneficial for the organization and the environment.

6.4.7 Energy recovery

Energy recovery is most effective when coupled with an end-of-life resource recovery process, such as anaerobic digestion, which creates conditions to capture nutrients and produce an agricultural input while generating energy. Other energy recovery processes, such as combined heat and power, can produce ash or sludge as a by-product that can be used as an input for yet another recovery process. A residual material input that feeds into the creation of a new fossil-based fuel is also primarily an energy recovery practice.

Organizations should seek to apply actions with the most favourable environmental outcome from a life cycle perspective. Therefore, energy recovery efforts deployed without having considered a material's place in the circular flow and the broader environmental impact when compared to other actions are not considered circular. Energy recovery should be optimized, and the energy should be usefully employed to displace non-renewable alternatives.

Furthermore, in order to support the cascade of biobased materials through to the energy recovery stage, by-products of energy recovery should not be detrimental to the ecosystems to which they are introduced.

6.5 Actions to regenerate ecosystems

To align with the principle of ecosystem resilience, regeneration of degraded ecosystems can encompass removal of harmful substances and remediation of soil and water bodies, mitigation and adaptation to climate change impacts, and protection of biodiversity. These actions should ultimately lead to the conservation and continuous renewal of natural resources, improvements in water, soil and air quality, and prevention of land degradation. These activities help to ensure the long-term provision of critical ecosystem services such as food provision, water purification, flood control, carbon sequestration, disease control and nutrient cycling.

Production using regenerative practices that an organization can perform includes agroecology, regenerative agriculture, restorative aquaculture, reforestation and permaculture. Regenerative practices provide food and materials as well as create positive outcomes for the biosphere.

Creating engagement through participation in projects helps people to embrace environmental problems that occur in their region and feel part of the environment that surrounds them. This allows for a better understanding and appreciation of environmental quality and the success of regenerative practices, as well as a better understanding that reducing negative anthropogenic impacts on the environment is central to human survival.

6.6 Actions to support a circular economy transition

6.6.1 General

The transition towards a circular economy is currently at different stages in different countries. The activities of organizations are influenced by the systems that have been developed for linear production and consumption systems. To improve conditions, relevant actors should participate to enable a systems change towards a circular economy. This also means that subsystems (e.g. education, research, political, legal, economic and financial systems) should be reformed, and support should be provided for the evolution of cultural values and norms.

Depending on the type of organizations, these actions can be considered as enablers.

6.6.2 Education and research

Moving from a linear to a circular economy implies that individuals, organizations and interested parties need to learn and implement new types of knowledge and mindsets, and this should include developing an understanding of the differences between a linear and circular economy, the limits of a linear economy and the benefits of the circular economy.

It is important for organizations to take part in initiatives to educate their customers and other interested parties on how they can support the transition from a linear economy towards a circular economy. In many cases, this implies that customer behaviour needs to be changed and become more responsible. This is often called “responsible use and consumption”.

The education, training and research system ensures professional qualifications and lays the foundation for innovations through its research activities.

6.6.3 Innovation

Transitioning from a linear economy towards a circular economy can involve a multitude of innovations on different levels. These innovations can be technological (e.g. recycling technologies or product redesign), organizational (e.g. value creation models), institutional (e.g. recycling quotas) or social (e.g. repair cafés, where the do-it-yourself repair of products is promoted).

Relevant actors include schools, vocational training institutions, colleges, universities, non-university research and industry. The success of innovation systems is closely linked to the transfer of knowledge between organizations, universities and research institutions through various channels such as joint research projects.

An important starting point for innovation processes are resource flows. Not only is the transfer of knowledge important at this point, but also the relationships between actors at different stages of the value chain who jointly process these flows (see ISO 56002).

6.6.4 Collaboration and networks

Collaboration is key to achieve a circular economy, as highlighted in the principle of value sharing. Successful collaboration can create competitive advantages for all partners and improve circularity performance. It is an essential enabling condition. The design of circular systems, especially, needs the collaboration of different actors within one organization and the development of partnerships between organizations.

Formal and informal networks are important structural elements of innovation systems. The transfer of knowledge within innovation networks and the input of external knowledge are of great importance. The creation of multi-stakeholder initiatives helps to accelerate the transition to a circular economy by providing support at the local, regional and national levels.

6.6.5 Helping users change their behaviour

Users play an important role in the success of innovation processes through purchasing decisions, use behaviour and intensity, maintenance, repair, reuse or the choice of disposal route. New use models should be offered such as collaborative use, sharing or take-back systems with easy access for users so that users have alternatives to buying a product. Digital technology such as apps or platforms provide the user with relevant and transparent information about the environmental impact of products and services, the average product life and associated reparability. Social innovations can help to establish more sustainable lifestyles and motivate different societal stakeholders to take an active role.

6.6.6 Policy and legal system

A re-examination of the political and legal frameworks can be needed to assist the transition towards a circular economy. Changes in these arenas can influence actions by identifying goals, incentivizing innovation and guiding public procurement. Other legal requirements can set limits and identify organizations responsible for carrying out actions. Of main importance are measures for waste prevention and waste management that ensure the protection of people and the environment in the generation and management of waste, in particular, non-recoverable resources. The specific obligations should also be clarified in this case by means of legal ordinances.

Product responsibility policies have been implemented in some countries by means of corresponding ordinances. These regulations often include sections on labelling, take back, recovery and financing obligations.

Circular public procurement recognizes the role public authorities can play in supporting the transition towards a circular economy as a driver for innovation.

6.6.7 Financial services

All organizations need a mechanism to finance their operations. Engaging the financial services to consider the risks of linear value creation models and value circular value creation models can lead to increased capital for circular strategies, including direct or indirect investment from investors, both private and public.

An investment is an allocation of financial means (e.g. buying shares, bonds or property to make profits or gain advantages). Transition towards a circular economy can involve investments with a long-term perspective and embracing a life cycle perspective in new value creation models, production, technologies, techniques, infrastructure, etc. Through their investments, organizations can facilitate their own transition to a circular economy and influence other interested parties.

Traditional and non-traditional investors can also play a role in funding start-up operations, scaling up operations or de-risking new technologies from a resource intensive linear model to a resource productive circular economy. Engaging insurance agencies can also result in benefits related to the circular economy.

Regulatory systems are increasingly prescribing sustainable finance classification systems, which rank investments by merit. Investors are having to evaluate their portfolios of investment against specific sustainability and circular economy criteria, which can impact eligibility for grants, tax benefit or other programmes.

6.6.8 Digitalization

Organizations can use digital technology, for example, to share information along the value chain, enhance product design and processes, improve recycling methods, understand resource flows and develop circular value creation models.

As outlined in standards such as ISO 59040 and ISO 59014[5)], transparent and timely documentation facilitates actions that contribute to a circular economy.

6.7 Guidance for resource management actions

This resource management guidance is intended to help organizations prioritize actions to increase circularity performance. A life cycle perspective should guide the organization in the identification of the best action for their value creation model and to avoid unwanted trade-offs.

The guidance (see Table 1) suggests organizations can begin by determining if there is a need to be satisfied and if the need can be met without additional resource use (refuse). If a solution is needed, the guidance suggests that organizations begin with a systemic approach, re-evaluating the concept from the earliest possible stages by designing solutions that use fewer resources (rethink, reduce) and prioritizing the use of recovered resources and sustainably produced renewable resources (source).

Organizations should seek to extend the life of solutions by design and by maintaining the solution in use for as long as possible (repair, reuse, refurbish, remanufacture, repurpose) while continuing to provide value.

Finally, organizations should look to use resources in multiple cycles (cascade, recycle), recover the energy if the resource cannot be used again (energy recovery) or source resources from landfills (re-mine).

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In general, products should be repaired before they are remanufactured, and remanufactured before they are recycled. However, in cases where applying this guidance does not lead to the best outcome, organizations should consider applying a life cycle perspective to determine the best action.

Organizations can apply this guidance at any stage in their value network.

Organizations with solutions that are currently in the market can use this guidance to increase the circularity of their solutions. Consideration of actions included in this resource management guidance should help organizations build business value creation models consistent with the circular economy principles (see Clause 5) and accelerate the transition towards a circular economy.

Table 1 — Guidance for resource management actions

Action	Description
Refuse	Make solutions redundant by abandoning its function or by offering the same function with a radically different solution.
Rethink	Reconsider design and manufacturing decisions. Make service use more intensive (e.g. through sharing or by putting multi-functional products on the market).
Source	Select recovered or renewable, sustainably sourced or produced resources. Use resources that can be easily recycled or returned to the biosphere. Reconsider formulations.
Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials.
Repair	Restore a defective or damaged product so that it can be used in its original function.
Re-use	Re-use a discarded product which is still in working condition and fulfils its original function.
Refurbish	Restore to a useful condition during expected service life with similar quality and performance characteristics.
Remanufacture	Return an item, through an industrial process, to a like-new condition from both a quality and performance perspective.
Repurpose	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	Shift recovered materials from one loop to another to optimize feedstock flows through additional cycles, often with decreasing quality and quantity. When adopting for biobased material, cascading implies repeated use of renewable resources at decreasing quality, with final treatments such as composting, energy recovery or biodegradation, and safe return of the material to the environment.
Recycle	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 energy	Generate useful energy from recovered resources.
Re-mine	Mining or extraction from landfills and waste plants can be possible in some cases if mining or extraction activities are sustainably managed.

7 Implementation guidance

7.1 Overview

7.1.1 Implementation process

The transition towards a circular economy within an organization is complex and evolutionary.

This guidance is flexible to permit adaptation to the specific circumstances and requirements of the organization during the process of transitioning towards a circular economy.

The implementation process should be based on an understanding of the circular economy, its principles (see Clause 5), and how it can be adapted to the specific needs of the organization and the context in which it operates.

Implementing a circular economy involves:

— an understanding of the circularity in current operations, value creation models and related risks;

— identification of areas of opportunity to increase circularity (see Clause 6);

— leverage points and interactions along the value chain or value network and across different sectors and spheres of influence.

Implementation also implies assessment of the requirements, drivers (see Annex A) and barriers that can be derived from an existing or upcoming legislative and economic framework, and user (or societal) and market considerations.

Challenges an organization can face in implementing circular economy strategies include, but are not limited to:

— lack of attractive incentives in transitioning to a circular economy;

— unsupportive regulations or lack of regulations to the implementation of a circular economy;

— resistance from interested parties to the disruption that can be caused by a circular economy value creation model;

— lack of commitment of leadership or other members of the organization.

Implementation of a circular economy is facilitated by incorporating circular economy principles into organizational policies, actions and procedures.

7.1.2 Incorporating circular economy principles in the implementation process

The implementation process of the circular economy for an organization should consider the principles of the circular economy as described in 5.2. These principles provide a fundamental basis that guides action in each of the stages of circular economy implementation, as described in 7.1.4 and Figure 4. Steps undertaken in each stage should be aligned with the circular economy principles. To ensure alignment, the circular economy principles should be considered before deciding on a specific strategy to better understand how the steps chosen within each stage align with the principles and to identify any possible gaps or conflicts that can arise.

7.1.3 Levels of implementation

This guidance is applicable to organizations operating at all system levels, as follows:

— Global, regional, country, local level: covers, but is not limited to, international agencies, countries, states, provinces, cities and municipalities.

— Interorganizational level: covers inter-industry and inter-firm networks, including trade associations, as well as private-public or public-public networks.

— Organizational level: covers any type of organization (e.g. government agency, private, public or nongovernmental organization).

ISO 59020 covers these three levels and also includes a system level focusing on products. This fourth system level is indirectly covered in this document by the goals, strategies and activities of the organizations that provide products.

Organizations that interact or operate across more than one system level should consider the relationships and interactions within and between the other system levels to achieve a circular economy.

7.1.4 Structure of the guidance for implementation

The guidance is structured to allow for an iterative process. The stages of implementation can be altered and adapted to reflect changing circumstances of the organization. Figure 4 illustrates the stages, which are underpinned by the circular economy principles.

The proposed stages that an organization can undertake in order to implement a circular economy are discussed in 7.2 to 7.6.

NOTE The sequence of stages can differ and can also occur at the same time or in parallel.

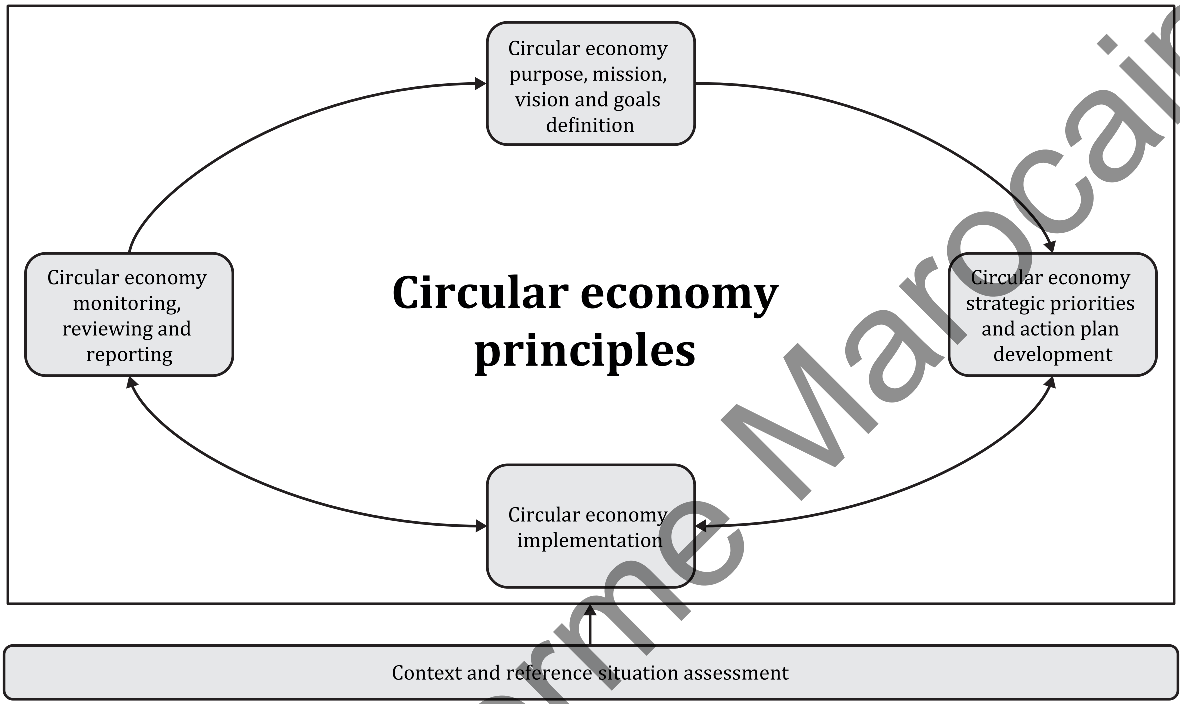

Figure 4 — Guidance for circular economy implementation

7.2 Context and reference situation assessment

7.2.1 Overview

The transition towards a circular economy in an organization is influenced by its socio-economic, geographical, institutional and regulatory environment, among others. Assessing the context is key to identifying areas of opportunity and risk associated with an organization's actions and determining the relevance of creating circular systems for operations, processes or solutions, considering the value network(s). The context is dynamic and therefore it is important to re-evaluate conditions throughout the implementation process to better understand the different interactions with the context in defining what and how a circular economy can be applied within the organization.

The primary outcomes expected from this stage are:

a) to identify how contextual parameters can influence how a circular economy is applied by the organization;

b) to understand risks and opportunities associated with the circular economy;

c) to determine a baseline from which the organization begins its transition.

The context evaluation stage can involve a number of different steps as given in 7.2.2 to 7.2.5.

7.2.2 Assess the reference situation

As an initial step, the organization should determine their reference situation with regards to a circular economy. This may encompass, but is not limited to:

— identifying current resource management practices in the organization and its value chain(s) or value network(s);

— assessing the flow of resources used by the organization;

— assessing the current organizational practices and understanding how they align with the circular economy principles;

— identifying sections of the organization with greater levels of circularity and opportunities to increase circular flow of resources;

— analysing circularity impacts of current operations on the use of resources and energy requirements, and if the activities or processes are designed for circularity (see ISO 59020 for methods to analyse circularity impacts);

— assessing key environmental impacts (e.g. GHG emissions, land use, impacts on biodiversity) as well as social implications, such as possible human rights infringements (see ISO 26000);

— exploring options to use energy and resources from sustainable sources and assessing opportunities to substitute virgin resources with recycled resources, informed by life cycle perspective;

— identifying and reviewing existing initiatives (e.g. circular processes, solutions) within the organization;

NOTE 1 In partnership with interested parties in the value network or established between the organization and other partners, organizations can identify projects of relevance to a circular economy.

— assessing regulatory and legal requirements that can influence the action plan;

— considering recommendations from relevant interested parties.

As part of the reference situation assessment, the selected circularity indicators should be calculated and a baseline circularity assessment performed. A baseline can assist the organization when setting targets for a circular transition, assessing progress, evaluating the effectiveness of actions introduced, and making improvements, as needed.

NOTE 2 More information on how to identify appropriate circularity indicators can be found in ISO 59020.

7.2.3 Assess the importance of a circular economy for the organization

The organization should develop an understanding of how a circular economy can be relevant to it and its interested parties. Analysing the different potential actions will also help identify circular opportunities for addressing current or future risks (see Clause 6 for more details about potential actions). This can involve the combination of circular approaches and identification of additional value creation models in becoming more circular. In this stage, the organization can also identify how its implementation of a circular economy can contribute to the social and environmental goals, such as targets set in relation to GHG emissions and impacts on biodiversity, among others.

7.2.4 Assess the system conditions for transitioning towards a circular economy

The current system conditions within and around organizations are not always conducive towards a circular economy. Therefore, the organization can consider the changes required, which can be directly influenced by itself, and can be addressed at wider institutional levels, taking into account the relationship with all relevant interested parties. It is important to understand the system or systems in which the organization operates, while identifying the interconnectedness of the organization with other systems needed for the transition to a circular economy.

This understanding includes acknowledging how the organization creates value and how the organization interacts with other systems to become more circular. Solutions should consider the whole system (e.g. resource origin, production processes, reuse phases, full life cycle impacts).

A systems thinking approach is recommended in this step to help organizations manage the transition towards a circular economy more effectively and appreciate trade-offs when assessing alternatives.

NOTE 1 More information about systems thinking can be found in ISO Guide 84:2020, Annex A.

It is recommended to:

— determine system boundaries, including upstream and downstream activities;

  NOTE 2 Further details on system boundaries and practical examples can be found in ISO 59020.

— map the system using relevant system thinking tools and techniques;

— identify root causes or core demand drivers;

— identify relevant interested parties;

  — map their relationship to the organization, including partnerships, collaborations and participation;

  — clarify interested party interest and vision about the system and a circular economy;

— identify points in the system, under direct control of the organization, where processes will need to be changed or interrupted in order to adopt a circular economy.

7.2.5 Identify the risks and opportunities of a circular economy for the organization

Based on the assessment of the reference situation, the organization should identify and analyse potential risks and key areas of opportunity. This can include:

— exploring alternative or new ways to create value and interact with the value network through resource reduction or a more circular flow of resources when reduction is not possible;

— identify interested parties' knowledge about the circular economy;

— determining which resources are important to the existence and resilience of the organization based on current use and identifying whether these resources should continue to be used, if there is a risk or opportunity associated, and possible negative environmental or social implications;

— exploring if there is an opportunity to use other resources or solutions that can better secure the future of the organization;

— identifying key dependencies and their changes on other areas such as future preferences, market conditions, regulations, resource scarcity, and other trends that can impact the transition towards a circular economy in the organization.

The analyses of possible actions (see Clause 6) can also help to identify risks and opportunities.

7.3 Circular economy purpose, mission, vision and goals definition

7.3.1 Create a purpose, mission and a vision that align with the circular economy principles

Organizations should develop their purpose, mission and vision for a circular economy in alignment with the circular economy principles (see 5.2). The vision should inspire change and provide a clear direction for the organization to transition towards a circular economy.

The vision should include a commitment from the organization to guide its actions for a transitioning towards a circular economy. The organization should involve relevant interested parties that are needed for the transition and explain what their role will be and how they can contribute and capitalize by realizing the vision. Further, the organization should communicate the underlying assumptions that support their transition towards a circular economy, so that shifts in norms, ideas, customs and behaviour of relevant interested parties can be realized.

7.3.2 Establish circular economy goals aligned with the organization's purpose, mission and vision

The organization should develop goals with an aim to create structured and lasting change and identify pathways and key actions to achieve their vision for a circular economy. Intermediate targets should be established to allow for circularity assessments of progress from the reference situation towards the longer-term goals.

NOTE Details on how to measure the achievement of defined goals can be found in ISO 59020.

7.4 Circular economy strategic priorities and action plan development

7.4.1 Overview

The organization should determine strategic priorities and develop an action plan. The action plan should aim to address all principles of the circular economy. Clause 6 and ISO 59010 provide additional information for developing a strategy.

7.4.2 Generate ideas and prioritize actions

The organization should perform an exercise to develop ideas about how to achieve the goals.

Based on the ideas generated, the organization should develop a list of actions and elaborate on those ideas having the highest potential to:

a) contribute to the transition towards a circular economy;

b) be implemented within a specific time frame and by using available capabilities;

c) be synergistic;

d) enable more opportunities of the organizational transition.

Actions should align with the organization's goals and targets (see 7.3.2).

The actions (see Clause 6 and Annex B) should aim to address all principles of the circular economy and can cover a range of issues that simultaneously affect the technological, organizational, social, legal, cultural and behavioural levels. The organization should allow for adaptive management and occasional adjustment of the actions.

7.4.3 Establish a circular economy strategy

An organization's strategy should link its mission, vision, goals, priorities, targets and respective actions or projects followed by a measuring framework. This should also include the establishment of a set of circularity indicators that allows for monitoring the strategic priorities and action plan implementation and goals achievement, as well as the outcomes of the different actions applied (see ISO 59020).

NOTE For more information on monitoring and reporting, see 7.6.

7.4.4 Explore a value creation model

The organization should align its actions with the strategy and address identified opportunities to create value and have a value creation model in place that is aligned with the circular economy.

When considering a value creation model based on circular practices, some elements that should be considered include:

— technically, socially and economically feasible circular economy practices that add value to the implementing organization, as well as to its key interested parties;

— transition pathways, from linear to circular.

NOTE There are many classifications and types of circular economy value creation models. For more information, see ISO 59010.

7.4.5 Assess feasibility

For all kinds of organizations, technological, socio-economic and financial feasibility considerations should be a part of any project and therefore actions also should be assessed in terms of their feasibility. This is a dynamic shaped by the context and therefore any assessment of feasibility should be considered in close linkage with the context evaluation (see 7.2), while also considering the sustainability implications of the strategic priorities and value creation models.

NOTE Annex C provides examples of questions to illustrate how to consider a sustainable development perspective in some actions, which are explored in Clause 6.

The assessment of feasibility should support an organization in evaluating expected economic, environmental and social impacts in interaction with their value creation model. It should include a mapping of the technical, organizational, financial, economic and other contextual factors that are associated with the circular economy strategic priorities and adopted actions.

To assess the feasibility of the adoption of a circular economy and its associated circular economy value creation models, actions should be assessed against the following dimensions:

— technical aspects: the extent to which a solution or process is designed and manufactured according to the circular economy principles and identification of potential technological innovation gaps, which the organization can tackle through innovation or collaboration with other organizations along the value network;

— organizational aspects: the degree to which the most important value chain partners are involved in the process and the extent to which the process can be changed and organized to facilitate circularity and circular use;

— financial and economic aspects: financial feasibility for the organization, as well as the way in which suppliers and partners strive to financially incentivize circularity;

— context aspects: regulatory frameworks, institutional settings and social norms that can create different contextual conditions and shape feasibility of alternative solutions;

— social aspects: the impact on social systems, including the social equity benefits to be achieved;

— environmental aspects: the environmental impacts considering the different scenarios where actions will be implemented.

7.4.6 Develop an action plan for the circular economy

Once the circular economy strategic priorities are established, the organization should develop an action plan for how the circular economy strategy will be implemented. This should include consideration of the scope and capabilities for the circular economy implementation.

The organization should determine responsibilities for the different steps and critical areas towards circularity.

If necessary, the organization should target behavioural changes and should ensure that its culture is aligned with the circular economy principles and pursuing goals related to the circular economy.

The action plan for a circular economy also should consider the capabilities allocated and timeline for implementation and should identify potential setbacks that can occur during the implementation phase, so that preventive measures, if necessary, can be adopted. Transitioning to a circular economy can affect many different aspects of the organization. Coordination and cooperation across different areas (e.g. marketing, specification, design, procurement, manufacturing, sales, finances) should be fundamental. This implies defining specific interventions to ensure that circular economy principles are understood, and the circular economy strategic priorities are embedded across the organization.

Organizations should determine the scope of the application and consider whether it aims to apply the strategic priorities to the whole organization or, alternatively, can consider pilot testing it in a part(s) or an area(s) of the organization (see 7.4.7).

Also, the organization should plan for continual re-evaluation of the circular economy strategic priorities and its implementation plan to ensure that the necessary course corrections can be made and that they can react to unintended consequences of the implementation (for more information on review, see 7.6).

7.4.7 Develop pilot projects

Prior to formal implementation some organizations can consider a preliminary pilot application of a specific circular economy practice or for a specific segment of the organization to ensure the application works as planned and any specific risk or barriers are addressed before wider implementation. This allows organizations to review practical viability and effectiveness of the proposed areas of strategies and actions, and alignment with the circular economy principles, and to prove effectiveness in achieving its goals.

Piloting tends to be carried at a smaller scale, and in some cases, it can be restricted to virtual simulation or laboratory trials rather than real-world situations.

Before, during and after the implementation of a pilot case, it is important to plan a monitoring and reporting process that enables the organization to evaluate the pilot experience and derive learnings for its mainstreaming and wider implementation (for more information, see 7.6). Based on the review, preliminary adjustments to the goals, strategy and value creation model can be introduced to improve effectiveness of the wider implementation.

7.5 Circular economy implementation

7.5.1 Overview

During the implementation phase, the strategic priorities and action plan for a circular economy are put into practice. In this stage, it is important to incorporate and integrate a circular economy into the organizational culture and activities.

Subclauses 7.5.2 to 7.5.4 highlight some key elements of the implementation stage.

7.5.2 Raise awareness and build capacity for action

To achieve a successful circular economy implementation, cooperation inside and outside the organization should be fostered by promoting communication and engagement. Interested parties should be aware of the relevance of a circular economy and its benefits, as well as the mission, vision, goals and plans of the organization for implementing a circular economy. Goals and targets for a circular economy should be recognized across different areas of the organization.

Communication with interested parties should be encouraged in order to:

— identify their perceived risks and barriers, expectations, and motivations for increased circularity and what they need for continuous engagement towards that goal;

— assess capacities to create shared value and to collaborate;

— communicate to them what a circular economy can mean for the organization and what their role can be, including benefits and opportunities.

The organization should also build up the capacity for action and provide coaching, training and skills development with a view to transitioning towards a circular economy. These actions should promote internal and external cooperation, and inclusion to achieve circular economy goals.

Communication, engagement and capacity building activities should highlight the culture of the organization and the change in behaviour within it. This can also have implications for interested parties outside the organization. The changes should include understanding of the interconnections between social and economic systems and their dependence on the biosphere. The organization should challenge linear thinking and discuss ways to adopt a more circular thinking (see Clause 4). Organizations should use this stage to look at their activities from a circular perspective to rethink habits, preconceived notions, behaviours and routines.

7.5.3 Test and iterate value creation model(s)

The implementation phase provides insights into how selected value creation models work in practice and the adjustments that can be needed across the different areas of the organization to ensure value is created and goals are being realized. Aspects related to the feasibility of some of the actions are likely to appear during the implementation phase and therefore a flexible approach is important to allow for gradual adjustments to incorporate new value creation models.

NOTE For more detail on value creation models and value networks, see ISO 59010.

7.5.4 Execute the action plan for a circular economy

While the strategic priorities development (see 7.4.) and, more specifically, the action plan (see 7.4.6) provide the roadmap for the implementation phase, more specific, short-term considerations should be evaluated by the organization when implementing the plan, including:

— short term requirements and capabilities should be budgeted to ensure effective and efficient implementation;

— the organization should identify any new risks that derive from the implementation as well as measures to overcome them or to introduce adjustments in the plan and strategy;

— during the implementation phase, new opportunities for more circular and efficient use of resources can emerge and warrant possible consideration;

— the organization should maintain communication across different areas of the organization and with external interested parties to maximize potential, reduce any problems, and keep them informed and engaged;

— the implementation should contribute to ensuring that the circular economy goals are understood and embedded in the overall organizational strategy and in the daily practices of the organization.

7.6 Circular economy monitoring, reviewing and reporting

As part of its action plan for a circular economy (see 7.1.4), the organization should choose circularity indicators to assess the effectiveness and efficiency of the interventions adopted and monitor the progress. The circularity indicators should be determined with the circular economy principles in mind, as well as the circularity goals and strategic priorities established by the organization. Guidance on how to measure and assess circularity performance is provided by ISO 59020.

The organization should often review these indicators and circularity performance. The review links the actions to the circular economy principles. It considers actions that are not feasible to undertake in the present moment and actions to develop in the future. The review is also an opportunity to identify the risks and opportunities (see 7.2.5) the organization is experiencing in transitioning towards a circular economy, and to identify new strategic priorities (e.g. products, technologies) that can be instrumental in achieving greater circularity. The review reflects the level of circular economy implementation and the wider implications for circularity.

Review of the circularity indicators and circularity performance should set the basis for continual improvement and, therefore, can include milestones and targets for the next period. These elements are confirmed by relevant interested parties, whose expectations are identified through enhanced dialogue and communication processes.

There are several elements that should be considered when monitoring, reviewing and reporting on the transition towards a circular economy:

— alignment with the significant circularity aspects resulting from the reference circularity assessment and any risks and opportunities identified;

— alignment with established goals and strategic priorities for the circular economy transition and respective measurement and assessment;

— adoption of appropriate system boundaries for the circularity measurement that support the circularity assessment;

— adoption of a systematic approach to have resource flows measured, actions monitored, and circularity and sustainability impacts of actions assessed;

— adoption of circularity assessment criteria that are relevant for the organization in accordance with its circularity aspects, goals and strategic priorities;

— selection of indicators for the assessment of circularity performance of the organization and its system, considering a whole life cycle perspective;

— identification of relevant sources of data for the calculation of the indicators;

— adoption of monitoring, reviewing, and reporting and documenting process to uphold the organization's circular economy strategy in line with interested parties' expectations;

— review of the results of the monitoring and reviewing process;

— adoption of an internal and external reporting and communication process considering relevant interested parties.

Annex A
(informative)

List of drivers

A.1 Overview

This annex is intended to assist an organization's management in identifying motivations to transition towards a circular economy.

The organization should analyse its position in the value chain or value networks to understand what internal and external drivers are relevant to consider from a circular economy perspective.

The list given in this annex contains internal and external drivers that are deliberately generic in order to emphasize their universality. This list is not exhaustive.

A.2 Drivers

A.2.1 Sustainable use of resources

Humans harvest and extract natural resources, use them to create solutions and dispose of them when they no longer serve a purpose. This model of economic growth assumes there is an infinite availability of natural resources and other inputs. For centuries, the ability to harvest or extract natural resources and convert them into products has helped people all over the world to live more comfortably and prosper more rapidly than each preceding generation.

While some economic and social gains have been achieved, some important negative environmental and social impacts have been identified.

Life cycle perspective can enable organizations to better engage in circular economy activities to reduce their pressure on natural ecosystems and alleviate resource scarcity.

A.2.2 Compliance with voluntary commitments or legal requirements

Compliance obligations can arise from an organization's environmental, social and economic aspects. These obligations can stem from mandatory obligations imposed by regulations or voluntary agreements and commitments that have been adopted by the organization.

Organizations should understand the obligations that can be fulfilled by adopting the circular economy principles.

A.2.3 Mitigation and adaptation to climate change

The human race is experiencing greater environmental threats and climate-related challenges, including natural disasters, drought, desertification, food shortages, water scarcity, wildfires, sea level rise and depletion of the oceans.

The rise in GHG emissions, which is the primary factor causing accelerated climate change, is partly a result of a linear take-make-waste economy that relies on fossil fuels and the poor management of resources.

Taking and implementing innovative measures in the way that solutions are produced, used and managed, by adopting the circular economy principles, can help in tackling climate change and its consequences.

A.2.4 Satisfaction of basic human needs

Adopting the circular economy principles can provide an organization with an opportunity to offer solutions that satisfy basic human needs while reducing pressure on ecosystems.

A.2.5 Improved interested party relations

Many customers, investors, shareholders, non-governmental organizations, citizens and others are more aware of the importance of improving the way organizations deal with circularity and sustainability issues. Organizations that adopt the circular economy principles can find it easier to be aligned with other organizations and interested parties who value the circular economy.

A.2.6 Development and improvement of solutions

Development and improvement of solutions is a way to strengthen the organization's fulfilment of its purpose. The adoption of the circular economy principles is a source of opportunity that can drive the organization towards the development and improvement of solutions for its interested parties.

A.2.7 Increasing resilience

Uncertainty, complexity and ambiguity have increased within society. The adoption of the circular economy principles is a way to help the organization improve its ability to anticipate, respond and adapt to the incremental changes, demands, risks and sudden disruptions.

Annex B
(informative)

Non-exhaustive list of examples of actions

B.1 Overview

This annex provides examples of actions that can be implemented by an organization depending on its objectives and context. Some examples can illustrate different actions. This is a way to see how the actions can be interlinked. The list is not exhaustive.

ISO 59010 presents guidance for organizations on adopting the actions listed in this annex and others to transform elements of their value creation models in a way that supports the organization in transitioning to a circular model.

B.2 Examples of actions that create added value

Actions that add value include:

— design and construction of assets (e.g. new buildings or infrastructure) for dismantling or reuse after a use phase;

— design and construction incorporating recovered resources;

— replace non-renewable resources by recovered resources;

— reduce energy intensity, and use renewable energy from sustainable sources;

— use renewable resources from sources involving regenerative practices or at least sustainably certified sources;

— develop technologies that significantly help to reduce the amount of resources needed and prevent the creation of waste (e.g. additive manufacturing);

— reuse and recycle (waste-)water in production, buildings, agriculture, etc.;

— develop participatory solutions between municipalities, local foundations and local users to improve water management practices;

— support conformance with standards that outline methods to increase supply chain traceability, such as PCDS (see ISO 59040);

— use low-waste technologies (e.g. use all parts of a plant);

— provide users with information about the environmental impact;

— when creating new products or services, use nature as an inspiration to solve human design challenges;

— switch from buying virgin resources to a take-back scheme to collect own products or materials for repurposing internally;

— develop active facilitation for the exploration, identification, development and operationalization of new resource effective synergies (e.g. through concentrated actions by industry consortia, external facilitation experts or public programmes);

— develop strategic planning for co-location of processes and organizations that can utilize or provide additional value to surrounding organizations;

— improve access to information regarding resource use and recovered resource production (e.g. through networking activities, formal flow databases, informal marketplaces).

B.3 Examples of actions that contribute to value retention

Actions that contribute to value retention include:

— design for longer life or an intensity dematerialization while keeping the adequate performance of the product or service, and ease the life extension;

— deliver product access rather than the product itself through a combination of product and services;

— provide (local) services such as repair to extend the product life;

— sell spare parts and upgrades for outdated technologies to make them compatible with new technology systems;

— provide a product and agree to repurchase the product after a certain amount of time;

— enable an increased utilization rate via a sharing platform;

— purchase and sell second-hand products;

— expand or retrofit manufacturing facilities, ancillary equipment and technology for refurbishing and remanufacturing purposes;

— establish small-scale businesses or not-for profit organizations for the reuse and repair of customer products (e.g. clothing, furniture, bicycles, household appliances);

— construct building that enables easy disassembly, repairing and material reuse or recycling;

— technology development for harvesting rainwater as well as recycling and reuse of greywater for water supply in buildings;

— develop concepts for sharing to better engage with users.

B.4 Examples of actions that contribute to value recovery

Actions that contribute to value recovery include:

— establish industrial symbiosis;

— collaborate with manufacturers on designing the collection, sorting and treatment phase;

— develop reverse logistics for high-value actions such as reuse, remanufacturing and recycling;

— support infrastructure for waste collection, transport and temporary storage;

— support or build open logistics platforms, joint collection and sorting facilities;

— establish dual logistics (integrating forward and return logistic);

— ensure proper collection: separate collection of materials, appropriate collection schemes;

— innovate and invest in new recycling and recovery solutions and facilities;

— support or build secondary material and product trading platforms;

— incentivize user engagement for closing the cycles (e.g. through take-back schemes);

— define final waste and waste for disposal management routes;

— build wastewater treatment plants;

— establish recovery and recycling schemes for biowaste and used biomass;

— selectively deconstruct building components, sort and refine construction and demolition waste to facilitate recycling;

— identify process technologies for the extraction of biobased products and feedstocks from bio-waste and residual biomass, wastewater and sludge from organic origin;

— invest in research and development to extract valuable nutrients as fertilizers from wastewater.

B.5 Examples of actions to support a circular economy transition

Actions to support a circular economy transition include:

- education and research:
  - facilitate training of relevant actors (such as suppliers, logistics and architects);
  - establish do-it-yourself and community repair initiatives that transfer knowledge;
  - offer circular economy training programmes to foster awareness in users, employees and others;
- collaboration and networks:
  - change structures and management procedures to enable collaboration;
  - leverage investments for joint innovation projects;
  - foster cultural change towards collaboration and learning for circularity;
  - provide workshops and other platforms for the transparent sharing of knowledge, information and capabilities;
  - involve suppliers into the process of design for circularity, and build supply chain collaborations;
- helping users change their behaviour:
  - guide customers or purchasers in making better decisions by identifying credible certification programmes;
  - help customers or purchasers adopt more responsible consumption habits;
  - provide educational workshops or public service announcements that assist customers and purchasers with evaluating new services by offering hands-on experiences;
  - offer consumer and purchaser information for how to engage in resale and secondary market platforms;
- policy and legal system:
  - segregate the collection of recyclable solid construction waste;
  - offer financial support for new reverse logistics schemes between several municipalities.

B.6 Illustrated tabulated example of possible interlinkages between actions

Table B.1 shows how an example can be used to illustrate different actions. Not all the examples of actions listed in this annex are included in the table; the selected ones are just examples.

Organizations can develop a table as shown below with their considered actions in order to identify the interlinkages they have with other actions. Elaborating such a table helps organizations to recognize the range of circularity impacts they can provide and serves as possible basis in the communication process with interested parties.

Table B.1 — Examples of actions and their possible interlinkages

Example	Actions that contribute to a circular economy																								
	Create added value					Contribute to value retention						Contribute to value recovery						Regenerate ecosystems	Support a circular economy transition						
	DfC	CS	CP	PO	S	RR	MR	PA	SU	RF	RM	RL	CM	R	WM	MR	ER	RE	EH	I	CN	CB	PL	FS	D
Design and construction incorporating secondary materials	x	x	x											x										x	
Establish small-scale businesses or not-for profit organizations for the reuse and repair of customer products						x	x														x	x			
Establish industrial symbiosis	x				x								x	x	x			x			x			x	
Circular economy training programmes to foster awareness in users, employees and others																			x			x			x

Key

DfC: design for circularity; CS: circular sourcing; CP: circular procurement; PO: process optimization; S: industrial, regional or urban symbiosis; RR: reduce, reuse, repurpose; MR: maintenance and repair; PA: performance-based approaches; SU: sharing to intensify use; RF: refurbishing; RM: remanufacturing; RL: reverse logistics; CM: cascading of materials; R: recycling; WM: waste management; MR: material recovery; ER: energy recovery; RE: regeneration of ecosystems; ER: education and research; I: innovation; CN: collaboration and networks; CB: helping customers change their behaviour; PL: policy and legal system; FS: financial services; D: digitalization

Annex C
(informative)

Considering a sustainable development perspective in actions

C.1 General

This annex is intended to assist the organization's management team in considering a sustainable development perspective while implementing actions that contribute to a circular economy. To qualify as substantially contributing to the circular economy, the activities chosen and implemented by the organization should show improvements towards sustainable development and towards circularity.

Using the following questions can help the organization to review the application of this broader perspective:

— Are different kinds of environmental impacts evaluated? Including climate change, ozone depletion, respiratory inorganics, photochemical ozone formation, acidification, water depletion, land use, resource consumption, eutrophication, cumulative energy demand, human toxicity (carcinogenic and non-carcinogenic) and ecotoxicity (freshwater, marine, terrestrial)?

— Are all the life cycle stages of the solution considered in its circularity impact assessment?

— Are both adverse and beneficial environmental impacts considered?

— Are all the impacted interested parties considered?

— Are there ways to implement the action considering the positive circularity impact on underserved communities?

— Are there ways to promote local development?

— Are there ways to promote social inclusion?

— Are there ways to promote human rights and labour rights?

— Are the needs and expectations of all the interested parties considered?

— Are the costs of externalities considered in the economic feasibility studies (e.g. cost of the climate change impact)?

— Are the risks of corruption considered?

The questions given in Clauses C.2 to C.6 are illustrative for some actions described in Clause 6.

C.2 Actions that create added value (see 6.2)

C.2.1 Design for circularity

— Does the design create a positive environmental impact or reduce negative environmental externalities that can be damaging to the environment from a life cycle perspective?

— Does the design eliminate or reduce hazardous substances?

— Do you consider the logistics of resources and products when using new materials and components that are more durable, reparable and modular?

— Does the design create a positive or less negative impact on inhabitants, users or workers?

— How many non-renewable or renewable resources can be saved by extending product lifetime?

— How can the value created through new circular value creation models be equitably distributed among the interested parties in a value chain such that new approaches are sustainable?

C.2.2 Circular sourcing

— To what extent can the organization replace the virgin materials they use at present with alternatives that are extracted or produced using more sustainable methods?

— How can the organization replace the use of resources, the extraction of which has a negative effect on workers' health?

— How can the products' embedded material become a valuable asset over time and allow cheaper credits and easier financing?

— Are the resources managed considering the human rights risks?

C.2.3 Circular procurement

— How can procurement reduce the use of resources and minimize negative environmental impacts during the life cycle of solutions?

— How can procurement favour products with recycled or renewable content?

— How can procurement add local economic value and create local jobs?

— How can procurement favour local suppliers and products or services that respect human rights?

— How can the raw material capital be maximized to ensure the long-term sustainability of supply?

C.2.4 Process optimization

— How are the process or value chains optimized to reduce losses and releases (including energy dissipation)?

— In relation to development of processes that create societal value, who are the local treatment operators who will have control of wastes, by-products or products for reuse?

— How can changes in mass manufacturing evolve to encompass higher degrees of customization?

— Can the resource use from manufacturing be minimized through keeping the products in use for a longer time?

C.2.5 Industrial, regional or urban symbiosis

— Can the outflows of an organization or a group of organizations (e.g. wastes and by-products) substitute inputs for another organization (locally, regionally)?

— Are input substitutions replacing conventional virgin materials and energy sources?

— Are outflow resources sufficiently decontaminated or treated to ensure the outflow meets the desired quality specifications and is properly managed from a reuse perspective?

— How can the quality and traceability of synergy flows be secured for the downstream organization?

— How can the broader benefits and costs be fairly distributed and allocated among involved organizations?

— Can the outflows of a city, county or region substitute as inputs for other cities, counties or regions?

— Can urban and suburban communities share costs and benefits of a regional transit system, regional power generation and distribution system, or regional water and wastewater treatment system?

C.3 Actions that contribute to value retention (see 6.3)

C.3.1 General

— Valorization of alternatives: Are there different alternatives of transforming used products? How many virgin resources (materials and energy) are required as input in each alternative? What is the environmental impact of each one?

— Does the organization achieve significant overall net resource savings and impact reductions on a life cycle basis compared to a new product?

— Does the organization implement strategies to put products back to their original use?

— Are efforts made so that the promotion of life extension does not affect the ability to recover or recycle the product, part and material?

C.3.2 Reduce, reuse and repurpose

— How many non-renewable or renewable resources can be saved by extending product lifetime?

— Are environmental and social impacts of the preparation of the solution for reuse considered?

— Can the obsolete product be used in a different way or for another function? What is the circularity impact of the substituted product? What are the advantages?

C.3.3 Maintenance and repair

— How many non-renewable or renewable resources can be saved by extending product lifetime?

— Can the organization encompass less sales driven profit towards service profit?

C.3.4 Performance-based approaches

— Does the transition to a “service” offer bring an overall reduction (rebound effect neutralized) in the pressure on the stock and flow of natural resources, materials and energy?

— How can changes in the “sell them cheap” value creation models evolve to a focus on extended value?

— Can the organization encompass less sales driven profit towards service profit?

— What duration of use of products and equipment is needed in order to sell an integrated solution based on the sale of usage?

C.3.5 Sharing to intensify use

— Do sharing-oriented initiatives help create social cohesion?

— Can the investment costs for assets and infrastructure be lowered through sharing?

C.3.6 Refurbishing

— How many non-renewable or renewable resources can be saved by extending the product lifetime?

C.3.7 Remanufacturing

— How can changes be developed in design models towards incorporating modular design elements that facilitate the easy reuse of parts?

— How many non-renewable or renewable resources can be saved by extending the product lifetime?

C.4 Actions that contribute to value recovery (see 6.4)

C.4.1 General

— Valorization of alternatives: are there different alternatives of transforming used products? How many virgin resources (materials and energy) are required as input in each alternative? What is the environmental impact of each one? Is the environmental impact of transformed used products greater than the production of a new product from raw materials?

C.4.2 Reverse logistics

— Are the reverse logistic operations designed considering the environmental impacts, including climate change?

— Are the reverse logistic operations managed considering the human rights risks?

— Will lifetime extension bring logistic changes in operation and supply changes?

— How can the organization ensure that its products effectively go to the appropriate collection route?

C.4.3 Cascading of materials

— In what ways does cascading of materials encourage innovation and combat climate change?

— How can cascading materials help to reduce poverty and inequality in a region?

C.4.4 Recycling

— In relation to creation or consolidation of management routes, what is the financial gain associated with recycling and other recovery solutions?

— What is the share of recyclable or recoverable products in the waste?

— To what extent can the resources within the products be separated and what solutions other than material recycling can be considered?

C.4.5 Waste management

— Who are the local treatment operators who will have control of waste or by-products to take in charge of the end-of-life products?

— Does the organization ensure the proper collection and separate transportation of waste, redundant parts and materials to enable the recovery of high-quality resources?

— Are hazardous substances or wastes traced and collected separately with proper disposal in the country where they are produced?

— Does the organization collect biodegradable materials separately to ensure the safe return of nutrients and carbon into the soils?

C.5 Actions to regenerate ecosystems (see 6.5)

— Are there treatments that interfere with natural decomposition, composting or use of organic material as feedstock?

— Does the organization take measures to actively protect and regenerate natural ecosystems?

— Does the organization contribute to the protection of unique and fragile ecosystems and landscapes and take actions to protect rare, threatened and endangered species and their habitats?

— Does the organization finance conservation initiatives that directly result in the protection of natural ecosystems locally (e.g. helping to establish one or more protected areas, assisting funding for protected area management), and restoration activities to restore natural ecosystems and enhance biodiversity?

— Is the process of regenerating the ecosystem considering the human rights risks?

C.6 Actions to support a circular economy transition (see 6.6)

C.6.1 General

Depending on the type of organization, these actions can be seen as enablers.

C.6.2 Education and research

— Does the education on the circular economy initiative consider its contribution to sustainable development with explicit analysis of its environmental, social and economic dimensions?

— Is the education initiative considering the different needs from different interested parties?

— Is the education initiative considering the importance of behavioural change?

— Do the education programmes include customers and the wider population?

C.6.3 Innovation

— How can the quality and traceability of input substitutions be ensured for downstream organization?

— Are the outflow resources valorized and used in new applications?

— Is there a creation of new competitive advantages through the synergies (e.g. new products and processes)?

— Is it possible to include start-ups in the process?

C.6.4 Collaboration and networks

— Do the activities performed create new social networks enabling innovation and collaboration around further issues?

— Does the development of new synergies create additional jobs or increase collaboration between organizations?

— What are the costs and benefits (to individual organizations and to the broader economy) of substituting or sharing services or products?

— Are there any neighbouring organizations that use the same machines at a sufficiently low frequency to consider a sharing arrangement?

C.6.5 Helping users change their behaviour

— Issues related to pro-environmental behaviour: how does the organization foster pro-environmental behaviours in its community? Is there a study about people's perceptions and willingness to perform new behaviours?

— Would pricing models drive change from user behaviour?

C.6.6 Policy and legal system

— Are the policies and regulations designed considering their environmental, social and economic implications?

— Are the side-effects (or unintended consequences) of the implementation of a policy or regulation analysed during the design phase?

C.6.7 Financial services

— Does the investment decision-making process consider social and environmental impacts going beyond the economic return?

— Are the investments managed considering the mitigation of negative social and environmental risks?

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