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SERIES L: ENVIRONMENT AND ICTS, CLIMATE
CHANGE, E-WASTE, ENERGY EFFICIENCY;
CONSTRUCTION, INSTALLATION AND PROTECTION
OF CABLES AND OTHER ELEMENTS OF OUTSIDE
PLANT

Circular and sustainable cities and communities

Development framework for bioeconomy in cities and communities

Recommendation ITU-T L.1604

ITU-T L-SERIES RECOMMENDATIONS

ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

OPTICAL FIBRE CABLES	
Cable structure and characteristics	L.100–L.124
Cable evaluation	L.125–L.149
Guidance and installation technique	L.150–L.199
OPTICAL INFRASTRUCTURES	
Infrastructure including node elements (except cables)	L.200–L.249
General aspects and network design	L.250–L.299
MAINTENANCE AND OPERATION	
Optical fibre cable maintenance	L.300–L.329
Infrastructure maintenance	L.330–L.349
Operation support and infrastructure management	L.350–L.379
Disaster management	L.380–L.399
PASSIVE OPTICAL DEVICES	L.400–L.429
MARINIZED TERRESTRIAL CABLES	L.430–L.449
E-WASTE AND CIRCULAR ECONOMY	L.1000–L.1199
POWER FEEDING AND ENERGY STORAGE	L.1200–L.1299
ENERGY EFFICIENCY, SMART ENERGY AND GREEN DATA CENTRES	L.1300–L.1399
ASSESSMENT METHODOLOGIES OF ICTS AND CO2 TRAJECTORIES	L.1400–L.1499
ADAPTATION TO CLIMATE CHANGE	L.1500–L.1599
CIRCULAR AND SUSTAINABLE CITIES AND COMMUNITIES	L.1600–L.1699
LOW COST SUSTAINABLE INFRASTRUCTURE	L.1700–L.1799

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T L.1604

Development framework for bioeconomy in cities and communities

Summary

Bioeconomy concerns both sustainability and circularity and covers all biological resources. The aim of this Recommendation is to provide cities with a framework for the development of the bioeconomy, especially under the lens of circularity and sustainability.

The main elements examined in this Recommendation are:

- The definition and role of bioeconomy in cities, with a focus on circularity and sustainability.
- The determination of factors and key performance indicators (KPIs) that affect bioeconomy development in cities.
- The definition of a generic implementation framework for bioeconomy in cities.

History

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Table of Contents

	Page
1 Scope	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere	1
3.2 Terms defined in this Recommendation.....	1
4 Abbreviations and acronyms	2
5 Conventions	2
6 Bioeconomy in the urban ecosystem	2
6.1 Definition of bioeconomy.....	2
6.2 Bioeconomy in cities	3
6.3 A development framework for bioeconomy in cities	4
6.4 Factors and KPIs for bioeconomy development in cities.....	15
Bibliography.....	20

Introduction

In the last decade, interest in bioeconomy has increased due to the adoption of policies for the emergence of biotechnology for new product and market development and for the utilization of biomass [b-Birch]. The continuous effort of governments to mitigate the post-petroleum economy has led to the definition of several national strategies for bioeconomy. However, the migration to bioeconomy is an expensive and slow process, which engages all industries and social living.

Bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, biobased products, energy and services [b-EC-4].

A definition for bioeconomy given by the European Commission concerns the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, biobased products and bioenergy. Its sectors and industries have strong innovation potential due to their use of a wide range of sciences, enabling and industrial technologies, along with local and tacit knowledge [b-EC-3], b-UNECE].

As such, bioeconomy deals with both sustainability and circularity. Regardless of the fact that cities can become circular bioeconomy hubs and of existing strategic approaches and action planning (e.g., in Europe) limited attention has been given to urban bioeconomy and only some pilot cases can be identified [b-EC-1], [b-EC-2].

Food systems, waste and sewage processing, green terraces, recycling and others are only some of the urban systems that are benefit from bioeconomy and in this respect this Recommendation will be useful for city policy makers and corresponding industries.

On the other hand, urban innovation has emerged due to continuous urbanism and environmental degradation, phenomena that have highlighted the importance for cities' transformation to sustainability, resilience and climate neutrality. Information and communication technologies (ICT) have resulted in recent trends for smart, circular and green cities, which highlight the central role of cities in adopting policies and in initiating actions against challenges such as climate change. The urban metabolism framework, which synthesizes a roadmap for city circularity and depicts the crucial role of bioeconomy for urban innovation (technological, climate, governance and social innovation), can be considered one of these actions.

Recommendation ITU T L.1604

Development framework for bioeconomy in cities and communities

1 Scope

This Recommendation defines a framework for the development of the bioeconomy development, which will help identify the scope, priorities, objectives (i.e., ensuring food and nutrition security; managing natural resources sustainably; reducing dependence on non-renewable energy sources; climate change mitigation; new jobs' creation, etc.) and key performance indicators (KPIs) for its development, especially under the lens for improving sustainability and circularity and achieving Sustainable Development Goal 11 and related targets, and the climate objectives of the Paris Agreement.

The main elements examined in this Recommendation are:

- The definition and role of bioeconomy in cities, with a focus on circularity and sustainability.
- The determination of factors and KPIs that affect bioeconomy development in cities.
- The definition of a generic implementation framework for bioeconomy in cities.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 circular bioeconomy [b-Kardung]: Applying the principles of circular economy in bioeconomy.

3.1.2 smart sustainable city [b-ITU-T Y.4900]: A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental, as well as cultural aspects.

NOTE – City competitiveness refers to policies, institutions, strategies and processes that determine the city's sustainable productivity.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 bioeconomy: The production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, biobased products and bioenergy.

NOTE 1 – Three main interpretations of the term coexist, one referring to the entropic narrative of the economic process, a second referring to the industrial promises offered by the biotechnology revolution, and a third referring to the biobased carbon economy.

NOTE 2 – Based on [b-EC-3] and [b-Giampetro].

3.2.2 circular economy: An economy closing the loop between different life cycles through design and corporate actions/practices that enable recycling and reuse in order to use raw materials, goods and waste in a more efficient way.

NOTE 1 – The circular economy concept distinguishes between technical and biological cycles, the circular economy is a continuous, positive development cycle. It preserves and enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and renewable flows, while reducing waste streams.

NOTE 2 – Definition adapted from [b-ITU-T L.1022] and [b-ITU-T L.1020].

3.2.3 urban metabolism [b-Lucertini]: The process of supplying material, energy and food to a hypothetical city, as well as the resulting waste products.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

EU	European Union
IoT	Internet of Things
LCA	Life Cycle Analysis
R&I	Research and Innovation
SME	Small and Medium Enterprise
UM	Urban Metabolism

5 Conventions

None.

6 Bioeconomy in the urban ecosystem

6.1 Definition of bioeconomy

There is no commonly adopted definition of bioeconomy; some of the existing ones are summarized as follows in [b-Giampetro]:

1. 2020: The bioeconomy comprises those parts of the economy that use renewable biological resources from land and sea – such as crops, forest, fish, animals and micro-organisms – to produce food, materials and energy.
2. 2019: The co-existence of three main interpretations of the term: one referring to the *entropic narrative of the economic process*, a second referring to *the industrial promises offered by the biotechnology revolution*, and a third referring to *the biobased carbon economy*.
3. 2009: All industrial and economic sectors and their associated services which produce process or in any way use biological resources (plants, animals, micro-organisms). These sectors include: agriculture and forestry, the food industry, fisheries, aquaculture, parts of the chemical, pharmaceutical, cosmetic, paper and textile industries, as well as the energy industry.

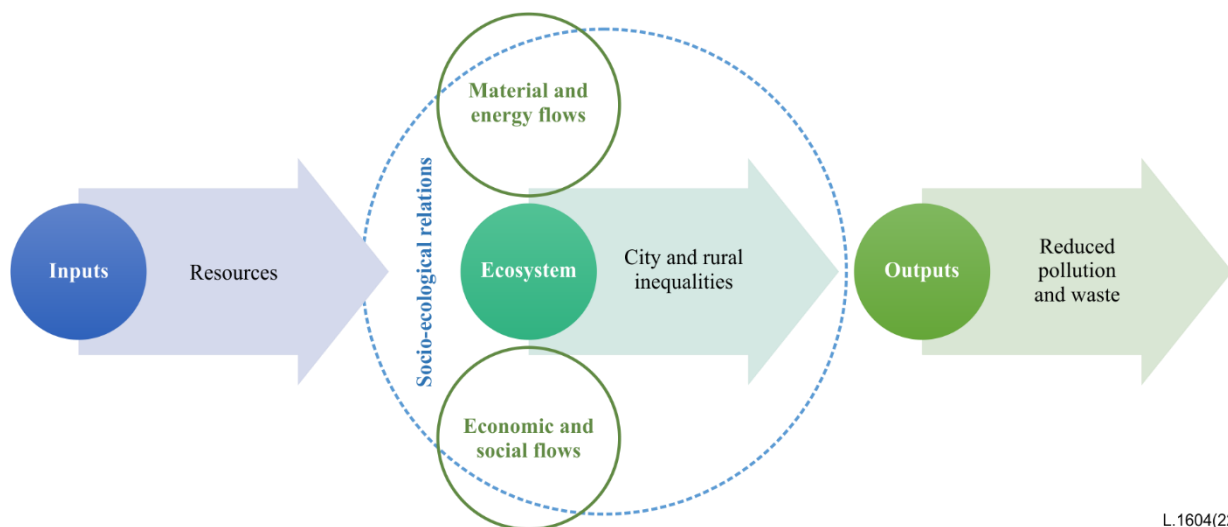
4. 1970: A term intended to highlight the biological origin of the economic process and thus spotlight the problem of humankind's existence with a limited store of accessible resources unevenly located and unequally appropriated.
5. 1954: The combination of the terms 'bio' and 'economy' to indicate: (i) the economic return on investment (typical of the economic narrative) – information relevant for the economic system of control; and (ii) the risk of reducing the long-term productivity of the economic activity (an ecological problem) –information referring to the biophysical processes taking place in the environment.

It could be also considered the combination of what should be done (the circular economy) and how it can be done (bioeconomy) into a single package, labelled "circular bioeconomy" [b-Giampetro]. To stimulate the economic growth of developed economies can be considered a good solution combining a desirable 'what' (circular economy) with a feasible, viable and desirable 'how' (bioeconomy).

Moreover, since the existing definitions of circular economy focus on controlling flows in the "technosphere" (products, components and materials) and do not explain how these flows can be recycled without using ecological processes from the "biosphere" (energy, water, land, biomass, minerals); the role of bioeconomy appears to be promising.

6.2 Bioeconomy in cities

Since bioeconomy has been justified as an emerging trend that is being coined with circular economy, how and why it can be seen in cities must be justified. Thus, the urban metabolism (UM) concept (Figure 1) is utilized, which shows resources that enter the boundaries or interaction space of a city. This space considers flows of materials and energy and economic and social flows embodied in urban-rural interactions [b-Lucertini].



L.1604(22)

Figure 1 – The urban metabolism concept
(Figure based on [b-Lucertini])

Urban systems are becoming more complex, cities are growing and levels of production, consumption and waste are increasing, which make UM and circular economy very promising concepts. The circular UM framework (Figure 2) is the result of the circular economy concept applied in a UM context (see also [b-Lucertini]). The circular UM framework can help planners and policymakers to rethink urban activities (e.g., transport or food production), within the urban-rural space and through time.