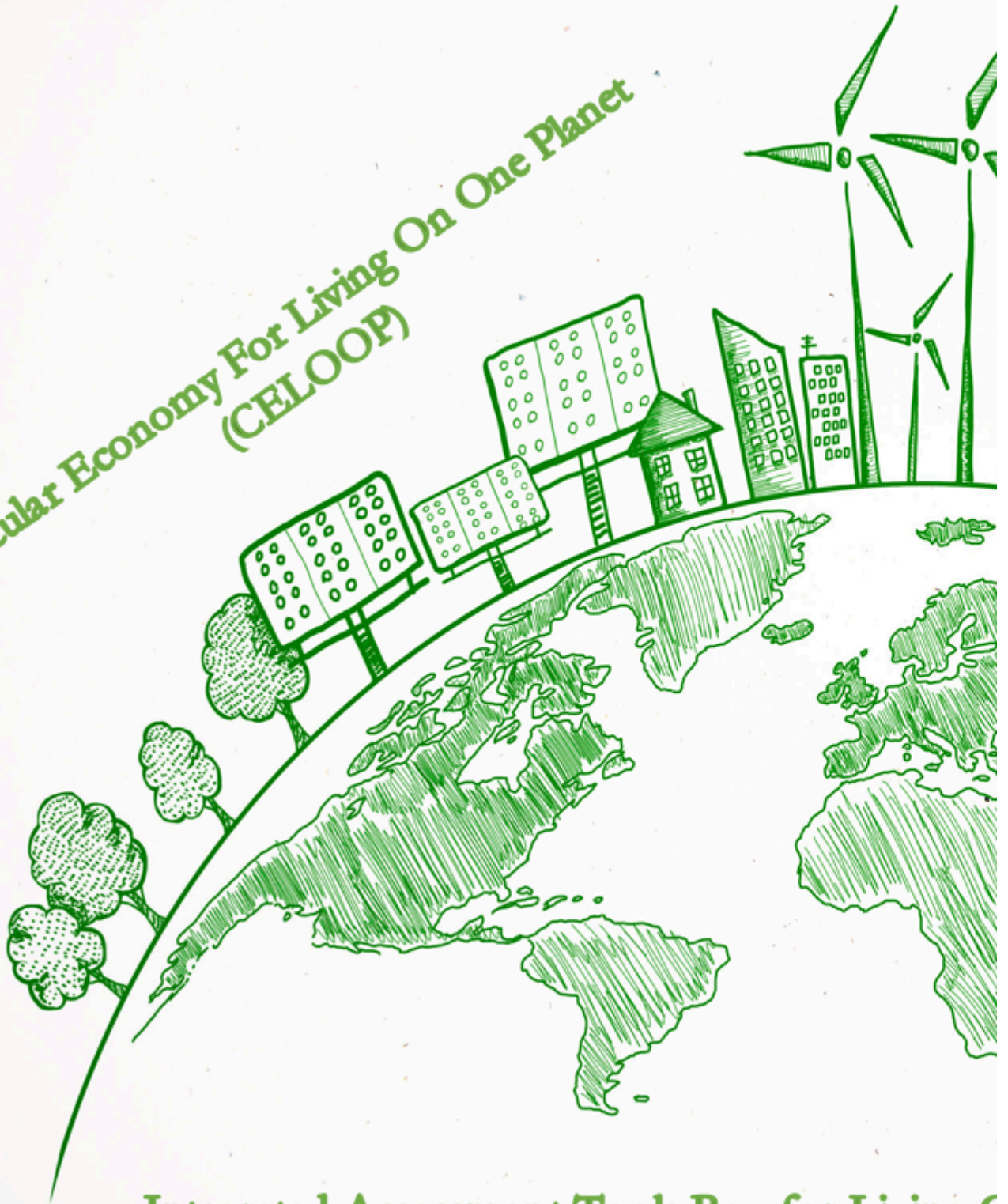


# LOOP MODELS

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# LOOP MC

Circular Economy For Living On One Planet  
(CELOOP)



Integrated Assessment Tools Box for Living C

Date

Du 01 octobre 2020 au 30 juin 2024

LOOP MODELS (modèles pour vivre sur une planète)

constituent une réponse apportée par différentes

institutions internationales (ERASME, Millennium Institute, Western University of Sydney, ICS, CERDI, HVL) à la question du fonctionnement des systèmes complexes.

## ***IAM LOOP (Integrated Assessment Model For Living On One Planet)***

*World Models have been designed in the late 1960s and became popular in the early 1970s through the book World's Dynamics (J.J Forrester) and the report Limits to Growth (LG) for the Club of Rome. They have generated a vast literature and many controversies, the most famous is the criticism from William Nordhaus (1973) against the World Dynamics model (Forrester, 1972). In his article entitled "World Dynamics Measurement Without Data", Nordhaus (1973) highlighted six critical points: "What is the overall impression after a careful reading of World Dynamics? First, the dynamic theory put forward in the work represents no advance over earlier work... Second, the economic theory put forth in World Dynamics is a major retrogression from current research in economic growth theory... Third, Forrester has made no effort in World Dynamics to identify any relationship between his model and the real world... Fourth, the methodology of modelling in World Dynamics differs significantly from other studies of economic systems... Fifth, the predictions of the world's future are highly sensitive to the specification of the model... Sixth, there is a lack of humility toward predicting the future" (1973, p. 1183). Beyond the controversy, World model have raised a series of questions that, over time, increasingly challenged the community of complex system modellers.*

*(1) Is system dynamics an appropriate method for modelling socio-economic phenomena? (Sterman, 2000). How does system dynamics differ from the economists' toolbox (econometrics, general equilibrium model) (Meadows, 1976). What are the advantages and disadvantages of System Dynamics Method? (Pruyt, 2008). What other methodologies or tools can be associated with System Dynamics and provide a new perspective on modelling practices? (Videira, 2017). These questions seem particularly relevant in the french context because system dynamics is totally absent from economic curricula).*

*(2) While systems dynamics seems relevant to map complex systems, may we extend the World Model to National scale? Regional Scale or City Scale? Changes about the structure and the calibration of the model are necessary but not sufficient, data collection is also an issue.*

*(3) How systems dynamics modelling may tackle society's challenges (climate mitigation and adaptation, food security, transition to renewable energy, ecological footprint, circular economy...) and produce useful and relevant scenarios for central and local governments, companies and civil organizations.*

*(4) How participatory systems dynamics modelling may improve the quality of the model and develop feedback loops reconnecting top-down and bottom-up strategies.*

*(5) How system dynamics modelling and more generally integrated assessment models may be helpful to implement SDGs' targets for developed and developing countries, and how to extend these achievements to the scale of a territory or a city.*

***The overhall objective of IAM – LOOP project is to develop the structure and the calibration of System Dynamic Models at the national level for a developed country (France, Germany) and a developing country (Burkina Faso). We will use the iSDG model from Millennium Institute (MI, Washington). The iSDG model is a System Dynamics based tool that has been designed to support national development planning. The model provides policy makers and other users with an estimate of the consequences to be expected from current and alternative choices. The iSDG model is especially well suited to analyze the interactions among policies directed to achieve the SDGs.***

## ***CE-LOOP (Circular Economy for Living On One Planet)***

*The circular economy (CE) can enable “a greener, more resource efficient and climate resilient economy” whilst supporting EU commitments to the United Nations Sustainable Development Goals. It can potentially bring transformative change through a holistic and interdisciplinary approach. To date, researchers and practitioners have been developing and testing various concepts from “green the economy” to “new economic paradigms” (e.g., the concepts Factor 4, 4R, 9R, resource decoupling, urban and industrial symbioses, 8R from Degrowth, Economy of Functionality, Social and Solidarity Economy, and the Collaborative Economy, etc.). These separate pilots give valuable insights, but they do not yet present a sufficiently complete picture to garner public understanding and support, or to generate transformative social impact. By comparison, the CE agenda has the potential to deliver a paradigm shift in the way our future economies and societies could be organised and managed. Precisely how such a transformation will be enacted is not yet clear. The project CE LOOP is intended to clarify this issue. Building on the work of Rees (1992), Wackernagel and Rees (1996), Rockstrom & al. (2009) and Richardson & al. (2015) which introduced the concepts of ecological footprint and planetary boundaries, CE-LOOP project considers that the economy is embedded in the social; itself embedded in the environment.*

***The overall objective of CE-LOOP is to map and analyse the current state of transition towards the circular economy at global and European levels through a systematic and uniquely integrated approach — accounting for ecological, economic, political and cultural perspectives equally. The goal is to co-develop practical tools and guidelines with current and potential stakeholders of circular economy actions to enable transformative change.*** CE-LOOP will reflect this holism with a range of different case studies. We will (i) Take an industry sector approach, examining value chains of the following sectors: energy, the car industry (for tyres with Michelin Cie, the rubber compounds are made up of elastomers, reinforcing fillers, plasticizers and others chemicals elements), food, public waste, plastics, construction, second-hand goods (furniture, small appliances & clothes), textiles and health ; (ii) Use macroeconomic analysis (physical and financial input-output tables; environmental satellite accounts; multi-regional CGE) to bring a national and international focus; (iii) Conduct a ‘deep dive’ with sophisticated mixed-method to establish the potential for CE transition within ‘nested’ (urban and rural) communities, municipalities and functional economic areas (city-region) within a region subject to economic challenge and multi-level and fragmented governance. The eight specific objectives are as follows:

*1° Build and analyse a comprehensive inventory of circular economy practices, discourses and public meanings at the global and European levels.*

*2° Investigate the policies, discourses and regulatory frameworks (norms, prices, quotas, convention, contracts...) for establishing circular economies at varied spatial scales.*

*3° Expand the assessment frameworks “Circles of sustainability” and the “Circular Triangle” towards understanding value chains in selected economic sectors.*

*4° Co-assess and co-reflect the assessment frameworks “Circles of sustainability” and “Circular Triangle” in selected cases.*

*5° Investigate the entire value chain of selected sectors through in-depth case studies to provide deeper insights into impacts, benefits and trade-offs.*

*6° Assess the potential for CE transformation (opportunities, barriers) within targeted communities, municipalities and city-regions, considering the nature, attitude and importance of ‘embedded’ and ‘mobile’ actors (e.g. multinational firms); mapping relationships; assessing social capital; overlaying political, cultural, and economic factors.*

7. Assess and develop tools for complex multilateral negotiations for establishing circularity pathways, joint value across the different actors and potentially emergent governance mechanisms.

8. Design evidence-supported and quantitative narratives of deep transformation, investigate the near- and mid-term scenario space, and develop policy guidelines for transformative change.

***The CE-LOOP project has been designed in conceptual framework, assessment framework, tools box and models to challenge the European Green Deal and H2021-H2027 Understanding the transition to a circular economy and its implications on the environment, economy, and society.***

## **IATB LOOP (Integrated Assessment Tools Box for Living On One Planet)**

Since 2015, cities play a key role in the Sustainable Development Goals of the Agenda 2030 (UN, 2015), represented by its own goal, SDG 11. The targets of SDG 11 “Sustainable cities and communities” represent universal rights (Al-Zu’bi, Radovic, 2018) and duties (ensuring access for all to housing, accessible and safe transport systems; reducing our environmental footprints; caring for people vulnerable to natural disasters; assisting developing countries in their urban transition), others address the field of social innovations, developing responses to new or poorly met needs under current market and social policy conditions. We focus namely on the following targets: 11.3 - strengthen inclusive and sustainable urbanization for all and capacities for participatory planning and management; 11.4 strengthen efforts to protect and preserve the world's cultural and natural heritage; 11.7a Promote positive economic, social and environmental linkages between urban, peri-urban and rural areas by strengthening national and regional development planning; and 11.7b Significantly increase the number of cities and human settlements that adopt and implement integrated policies and action plans for inclusion, resource efficiency, climate change adaptation and mitigation, and disaster resilience.

Cities serve as hubs for social innovation. Therefore, urban dynamics related to the efforts of actors, such as citizens, associations, businesses and local authorities, to develop strategies that put creativity, participation, co-construction and cooperation are of particular interest (Nedelciu, Diemer, 2020). While studies of urban dynamics have often been reduced to issues of housing, mobility and employment (Pumain, Reuillon, 2017; Yang & al., 2017), new challenges have emerged at this level. Namely, the management of resources (fossil fuels, minerals, biological resources, etc.), which the city takes from the environment, the waste produced by the transformation of natural resources into consumer goods and services, the damage caused by related production and consumption processes to the climate, air quality, soil and social aspects - gender equality, social equity, access and quality of education (Raworth, 2017). Cities have thus developed new strategies to address those challenges, which can be understood as paradigm shifts (Carta, 2017). One strategy is to apply the circular economy concept in its holistic dimension (Arnsperger, Bourg, 2016). While waste reduction remains a priority, it combines technological and industrial transformations with powerful levers for socio-economic transformation (Pla-Julian, Guevara, 2019). Thus the goal is to support this transition, which will be accompanied by social, economic, cultural, political and ideological change (Bag, Pretorius, 2020).

**The overhall objective of IATB LOOP is to develop a multicriteria toolbox to evaluate public policies for implementing circular economy. Four specific objectives have been designed:**

(1) **To analyse the transition of cities to circular economy** from the point of view of social representations, change of direction and radical mutations. Through a historical perspective, we describe the transition to the circular economy, the main obstacles and the actions undertaken by different actors. Here we develop the concept that each city ecosystem exudes certain behavior that locks them into specific behavior.

(2) **To identify the potential synergies but also trade-offs caused by the transition of cities to the circular economy from an industrial and technological (principles of industrial ecology), economic (business models) and social (employment, social protection, equity) perspective.** Through this, we understand how innovation is likely to create synergies with circular, social and solidarity economies, to define what is covered by the social dimension of the circular economy, and to analyse particular forms of organisation, in particular industrial symbioses.

(3) **To propose a circular economy toolbox enabling local authorities and other stakeholders to assess the current situation and to evaluate public action (indicators crossing several dimensions: technological, environmental, economic, social, cultural, political).** The assessment of resource usage and material flows through our partner ToileMaker (energy, water, raw materials, waste) make it possible to visualise the network of public and private actors to understand how to reduce our ecological footprint, but also the transformations necessary to change take place (new jobs, job relocation, site reconversion, lifelong training, etc.).

(4) Establish a set of potential scenarios to inform local authorities and their partners on possible trajectories for 2030 and 2050.

The toolbox will design an urban profile (circles of sustainability), map the ecosystem (Toile maker) and propose a System Dynamics-based model. Toile Maker is a software solution for visualizing and highlighting interactions and flows between stakeholders of an industrial park/municipality in a dynamic and interactive way. This interactive and visual mapping tool allows a better understanding and analysis of the local ecosystem. Additional functionalities in terms of the identification of industrial symbiosis are being developed using the semantical analysis to foster circular economy and regional development by identifying potential complementary industries (Troussier et al. 2017), (Brueel et al., 2018; Sirina et al, 2018). The integration of qualitative and quantitative assessment tools with a multicriteria perspective allows also a better understanding of flow metabolism and its analysis and qualification on the dimensions of embeddedness, autonomy and energetic, environmental and socio-economic footprints.

### **EMS LOOP (Energy-Mix System For Living On One Planet)**

EMS LOOP is the last project of the loop model. This project aims to model energy system at the global, national *and micro level to produce scenarios for 2030 and 2050. We analyze international scenarios, scenario for France and Algeria by using Systems Dynamics Modeling. These scenarios should help energy companies to engage themselves to the pathway of sustainability. A case study is concerning the company Sonatrach. Targets and objectives of the model will match the 17 SDGs.*

<https://erasme.uca.fr/version-francaise/recherche/iam-loop>(<https://erasme.uca.fr/version-francaise/recherche/iam-loop>)