



**HAL**  
open science

# From waste to urban mines: a historical perspective on the circular economy

Franck Aggeri

## ► To cite this version:

Franck Aggeri. From waste to urban mines: a historical perspective on the circular economy. Field Actions Science Reports, 2021, Industry and Waste: toward a Circular Economy, 23, pp.10-13. <hal-03503289>

**HAL Id: hal-03503289**

**<https://minesparis-psl.hal.science/hal-03503289v1>**

Submitted on 27 Dec 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

## From waste to urban mines: a historical perspective on the circular economy

Franck Aggeri

---

**Electronic version**

URL: <https://journals.openedition.org/factsreports/6530>

ISSN: 1867-8521

**Publisher**

Institut Veolia

**Printed version**

Date of publication: 23 November 2021

Number of pages: 10-13

ISSN: 1867-139X

Brought to you by Bibliothèque de MINES ParisTech

**Electronic reference**

Franck Aggeri, "From waste to urban mines: a historical perspective on the circular economy", *Field Actions Science Reports* [Online], Special Issue 23 | 2021, Online since 23 November 2021, connection on 27 December 2021. URL: <http://journals.openedition.org/factsreports/6530>

---



*Field ACTions Science Reports* est mise à disposition selon les termes de la Licence Creative Commons Attribution 4.0 International.

# FROM WASTE TO URBAN MINES: a historical perspective on the circular economy

Franck Aggeri  
Professor at MINES ParisTech



Le Chiffon deviendra Papier.

Ragpicker in the 19<sup>th</sup> century

Franck Aggeri is a professor of management at MINES ParisTech, PSL University and researcher at CGS-i3, UMR 9217. He is co-director of the Mines Urbaines chair on the circular economy and head of the PhD program in management at MINES ParisTech. His research interests and teaching focus on the circular economy, CSR and the ecological transition in businesses. In May 2021, he co-organized a seminar at Cerisy on the theme of the circular economy. He has published books about the circular economy and several research papers, especially in the *Journal of Cleaner Production* and the review *Gérer & Comprendre*. He is also a columnist for the French magazine *Alternatives économiques*.

Contrary to a commonly held belief, the circular economy was the dominant economic model for a long period. Nothing was lost or discarded, everything was systematically recovered and reused. At the end of the 19<sup>th</sup> century, it was superseded by the linear economic model, based on extracting new raw materials and disposing of waste in landfills, that accompanied the industrial revolution and rise of the hygienist movement followed by the growth of the consumer society. The present-day challenge is to develop a new approach to the circular economy that meets expectations in terms of quality and traceability as well as exploring new economic models that are less resource-intensive. But while innovations are certainly needed, in recycling, for example, as a strategy it is not a magic bullet. This is because recycling corresponds to a weak circularity model that fails to challenge how we produce and consume. For a strong and less resource-intensive circularity model to emerge, we need to explore services-based strategies that seek to extend product lives via repair, reuse or rental, all of which require upstream efforts in terms of eco-designing products to improve their repairability and durability.

## INTRODUCTION

Over the past decade or so, the circular economy has become a hot topic among policymakers, the media, social and economic actors, and the public in general. The narrative surrounding the circular economy is summed up in this short promotional film released by the European Union.<sup>1</sup> Every European consumes a growing quantity of products that contain raw materials (14 metric tons per person in Europe) and generate a growing amount of waste (5 metric tons per person in Europe). But products, raw materials and waste could equally be repaired, reused or recycled. This is the circular economy principle. The film explains that this ever-expanding material footprint is the result of the linear economic model founded on the idea that we live in a world of infinite resources we can limitlessly exploit to transform into products which we then consume then dispose of in landfill. Conversely, the circular economy model seeks to create looped flows of materials and energy that circulate through the economy. Several strategies are possible within this model: reduce the quantities of energy and materials used to produce goods; share, repair and reuse products to extend their lifespans, and recycle component materials at the end of a product's useful life, forming an endless cycle.

The film emphasizes the dominant messaging surrounding the circular economy: it is presented in utopian terms, promising that a new, less resource-intensive growth model rooted in the circulation of products and materials

<sup>1</sup> <https://www.europarl.europa.eu/news/en/headlines/priorities/circular-economy/20151201STO05603/circular-economy-definition-importance-and-benefits>

is possible and compatible with an ecologically sustainable model of society.

The notion is undeniably meeting with success, as witnessed by the adoption of countless laws and plans for the circular economy in Europe and Asia, and the number of businesses converting to the model. In 2000, Japan became the first country to adopt a framework law based on principles close to the circular economy, the Basic Act for Establishing a Sound Material-Cycle Society. The aim was to reduce the amount of waste generated by products, use the waste generated as a resource in appropriate ways (reuse and recycle), and properly dispose of waste that could not be reused in any form. In 2008, China enacted a framework law to promote the circular economy. The European Union adopted a circular economy action plan in 2016, and France passed its law on the circular economy and combatting waste (AGEC) in 2020.

## THE CIRCULAR ECONOMY: A TRULY NEW MODEL?

The circular economy model is presented as being something new, but is this true? Conceptually, there is nothing new about the idea of circularity. It was outlined in 1966 in a book by Kenneth Boulding,<sup>2</sup> who stated that humanity must find its place in a cyclical ecological system which is capable of continuous reproduction of material forms. The concept of the circular economy itself was explicitly cited for the first time in a 1989 book on the environmental economy.<sup>3</sup>

Contemporary problematization of the circular economy borrows heavily from industrial ecology and cradle-to-cradle<sup>4</sup> approaches based on looping flows of materials and energy, with symbioses from the natural world as their model.

In terms of practices, the circular economy model is an ancient one, as shown in the works of many historians. It is reasonable to state that it was the dominant model until the end of the 19<sup>th</sup> century. The term waste was little employed at the time. Everything was either reused or left to decay naturally. An entire parallel economy, based on rag-pickers and other actors, retrieved all the material available. Rags were reused to make paper, manure and sewage became fertilizer, animal bones had numerous uses, in glues and smelling salts or for whitening beet

*In terms of practices, the circular economy model is an ancient one, as shown in the works of many historians. It is reasonable to state that it was the dominant model until the end of the 19<sup>th</sup> century*

sugar, fats were used in candle making, and so on. Sabine Barles<sup>5</sup> emphasizes that materials circulated spontaneously between city, industry and agriculture until around 1870.

## CIRCULAR ECONOMY MODELS: FROM MODE 1 TO MODE 2

The historical circular economy model, or mode 1,<sup>6</sup> disappeared progressively in response to three major shifts. The first was the emergence of the industrial revolution and coal-fired steam engines, making it possible to generate cheap energy and stimulating the development of new forms of locomotion (trains and boats). The cost of extracting raw materials fell dramatically, while the second industrial revolution, particularly with the development of chemicals and electrification, led to the spread of new synthetic materials, such as chemical fertilizers and cellulose paper pulp, which supplanted previously recovered materials.

A second major shift proved fatal to recovered products and materials: the rise of the hygienist movement in the wake of the pasteurization revolution of the late 19<sup>th</sup> century. The hygienist movement stigmatized the circulation of waste and organic matter, claiming it to be the primary cause of epidemics. Eugène Poubelle was the Prefect of the Seine region of France in 1884 when, in a famous decree, he ordered landlords to provide tenants with recipients for their household waste, in the process giving French the word poubelle (waste bin). This ushered in an era of waste containment inventions that led to the rise of landfill as the 20<sup>th</sup> century's dominant waste processing solution.

The third major shift began in the 1930s: the growth of the consumer society, i.e. a lifestyle where modern people began to live their lives in terms of objects consumed or owned, a shift that led to a society of plenty.

## REINVENTING THE WASTE MANAGEMENT MODEL

The linear economy model is primarily the one that developed in the 30 years following the Second World War, an era when rapidly expanding economies led to huge increases in the consumption of raw materials and resources and the amount of resultant waste. Landfill was the dominant waste processing solution at the time, followed by the massive development of incineration from the 1970s to recover energy from organic waste. As landfill sites filled up and public opposition to the construction of new sites and incinerators grew, the model faced a crisis caused

2 Boulding, K.E. (1966). *The Economics of the Coming Spaceship Earth*, in: H. Jarrett (ed.) 1966. *Environmental Quality in a Growing Economy*, pp. 3-14. Baltimore, MD: Resources for the Future/Johns Hopkins University Press.

3 Pearce, D.W. and Turner, R.K. (1989). *Economics of Natural Resources and the Environment*, John Hopkins University Press.

4 McDonough, W., & Braungart, M. (2005). *Cradle to Cradle*, McGraw-Hill Education; Ayres, R. U., & Ayres, L. (Eds.). (2002). *A Handbook of Industrial Ecology*, Edward Elgar Publishing.

5 Barles, S. (2005). *L'invention des déchets urbains: France, 1790-1870 (The Invention of Urban Waste: France, 1790-1870)*, Champ Vallon.

6 Aggeri, F. (2020). *The Circular Economy: Historical Perspective and Contemporary Issues*, in: Delchet-Cochet, K. (Ed.). (2020). *Circular Economy: From Waste Reduction to Value Creation*. John Wiley & Sons.

by its incompatibility with the precepts of sustainable development.

The popularity of the circular economy concept can be dated to the late 2000s, a time when three simultaneous events combined to create a favorable reception for the new concept: first was the steep rise in commodity prices, which increased fourfold between 2000 and 2010, serving as a reminder to policymakers and businesses of their economic dependency on natural resources; second was China's embargo on the rare earth metals vital to numerous high-tech applications, creating panic among politicians and businesses; third was the constant rise in alarming environmental indicators, underlining the urgency of the ecological catastrophe.

The narrative surrounding the circular economy, outlined in the introduction, was popularized by reports issued by the Ellen MacArthur Foundation and McKinsey.<sup>7</sup> It seemed a plausible response to the three-pronged crisis. The appeal of this narrative is not really about the originality of a concept that, as we have shown, is far from new. It lies more in clever storytelling that recycles various concepts within an integrating framework inspired by the analogy with natural symbioses. This storytelling is also rooted in mechanisms for constructing a utopia that appear to be realistic, rational even.

According to Jean-Louis Metzger, a rational utopia is constructed around three registers: an inspirational narrative that articulates both a critique of the current situation (e.g.: the linear economy) and a description of an ideal (e.g.: the circular economy); a set of powerful images designed to permeate collective beliefs (e.g.: the butterfly diagram with its looped strategies), and tools and models that guide collective action (e.g.: circularity indicators, norms and tools for managing the circular economy). A rational utopia, therefore, corresponds to the problematized narrative of an ideal society based on images that touch the imagination as well as on rational components (reasoning, modeling, calculations) that are meant to embed it in the domain of the deliverable. Rational utopias thus combine the inspirational properties of utopia with the reassuring properties of reason. This being the case, it is a matter of building collective promises that can pull together and mobilize a wide variety of different actors.

The spread of these rational utopias is all the stronger because they are produced in ways that are collective and anonymous, in line with the European Union's narrative. They appear to the public as neutral constructions,

depoliticized and open to multiple interpretations, i.e. free of references to ideologies or particular authors, and can be subject to wide variety of possible appropriations.

## TOWARD THE MODE 2 CIRCULAR ECONOMY

Modern-day issues with the circular economy clearly do not involve a return to the historical mode 1 model, but entail the invention of a new, less resource-intensive growth model that respects the need for traceability, hygiene and quality with lower environmental impacts.

Health and hygiene issues remain key, as evidenced in regulations like the European REACH directive that aim to trace substances that are potentially harmful to health and are found in chemical and household products. Ensuring that recycling and reuse comply with these regulations is a key challenge. Plastics with brominated flame retardants are a good illustration of the problem. These plastics, used extensively in electrical and electronic devices, perform an

important function as they are designed to prevent devices with batteries that can overheat from catching fire. But they come with a major drawback: they contain chromium, a heavy metal that is potentially harmful to health. This means that recovering them is forbidden and they have to be sent to landfill. But automated plastics sorting at modern waste processing centers is not 100% effective and certain brominated

plastic residues can end up mixed in with other plastics for recycling.

So, whether for repair, reuse or recycling, the modern circular economy depends on the development of a quality economy where strict respect for specifications and traceability standards must go hand-in-hand with actor upskilling and structuring new industrial and business ecosystems.

## TRANSFORMING WASTE INTO RESOURCES: NEW APPROACHES FOR A CIRCULAR ECONOMY

There is no reason for the transition to the circular economy to happen naturally. The consumer society is now deeply embedded in our behaviors, and the intensive pace of innovation drives businesses to accelerate their products' renewal rates so that they can retain a temporary advantage over their competitors. The combination of these two forces leads to endless expansion in the amount of materials consumed and waste generated.

*So, whether for repair, reuse or recycling, the modern circular economy depends on the development of a quality economy where strict respect for specifications and traceability standards must go hand-in-hand with actor upskilling and the structuring of new industrial and business ecosystems*

<sup>7</sup> Ellen MacArthur Foundation. (2012). *Towards the Circular Economy*. Ellen MacArthur Foundation.

## WHAT SOLUTIONS ARE LIKELY TO REVERSE THIS TREND?

One of the first solutions lies in developing innovations, especially technological, for exploiting the potential value contained in recovered waste and end-of-life products. This is the challenge of what are known as urban mines, highlighting the fact that our waste contains potential value to exploit. For example, a metric ton of smartphones contains concentrations of gold two or three times greater than occurs naturally in a mine.

At present, the most frequently recovered metals are the most common ones (steel, aluminum, copper), as well as precious metals for which recycling technologies and industries have been developed that make possible recycling rates of 50% or more. However, effective recycling rates rarely exceed 50%. For all materials, the rate of circularity in Europe was just 11.7% in 2017 (source: Eurostat). For plastics, a recent study by the Ellen MacArthur Foundation claims that just 14% of plastics are recycled, 14% used for energy recovery, 40% go to landfill and 32% end up in the environment.<sup>8</sup> The development of closed loop recycling systems, i.e. for the same applications, is important for protecting value and is an innovation pathway of interest to manufacturers. For rare earth metals, used extensively in high-tech applications (electronic boards, wind turbines and batteries), the recycling rate is below 1%. Securing supplies of materials such as these by developing new recycling sectors is critical to reducing dependency on high-risk countries where these materials are extracted. The challenges are not just technological. They also involve structuring new industrial ecosystems and new regional mechanisms for collecting, sorting, processing and recycling waste so that it can be reused.

But recycling is not a magic bullet. It corresponds to a weak form of circularity that fails to significantly reduce environmental impacts. Even if we assume that technological progress will drive an improvement in recycling rates, it remains the case that the volume of new products consumed will continue to grow, meaning that recycling can only be a partial solution for reducing environmental impacts. Good quality recycling is also hampered by trafficking and illegal exports that represent the fourth largest source of income for organized crime, after narcotics, prostitution and gambling. Traffickers have a decisive advantage over legal operators because they do not have to pay the associated overheads, taxes and pollution clean-up costs. Trafficking is also a source of diffuse pollution, because traffickers only recover parts or materials that interest them, discarding other polluted parts in nature. Finally, from a technical standpoint, not all

materials can be recycled indefinitely. Certain materials, plastics for instance, lose their properties, meaning that only a limited number of cycles are possible.

## CONDITIONS NEEDED FOR A PARADIGM SHIFT

Not all circularity strategies are equally promising from the environmental perspective and in terms of their potential for creating jobs. Apart from recycling, how can we promote a strong circularity model that is less intensive in terms of materials and resources? Circularity strategies focusing on reusing and repairing, or the functional economy, as ways to promote extended product lifespans and durability are promising avenues to explore when seeking to reduce the material footprint of our economic activities, but also for creating locally based jobs. For businesses, these services-based strategies require upstream work on eco-designing products to improve their ease of disassembly and product durability, and a downstream network with new skills able to roll out services-based solutions across an entire region. These are new business models that have to be invented and lastingly embedded, supplanting models centered on selling products. Consumer behavior must change if this is to happen. Consumers need to be happy with repaired, second-life or rented products rather than constantly

buying new. Recent changes seem to suggest this shift may happen, particularly among younger generations who seem less attached to the concept of owning things.<sup>9</sup> The rise of digital platforms like Back Market, specializing in selling refurbished products, is further evidence of this change in behavior. In this regard, the introduction of new incentive mechanisms, such as France's law on the circular economy and combatting waste, may help accelerate these transitions both by making it easier to access information on reparability performance and by encouraging people to purchase repaired or second-life products. These new strategies for strong circularity (repair, reuse and the functional economy) herald sweeping changes to business models and lifestyles.

*These new strategies for strong circularity (repair, reuse and the functional economy) herald sweeping changes to business models and lifestyles*

8 Ellen MacArthur Foundation (2016). *The New Plastics Economy: Rethinking the Future of Plastics & Catalysing Action*.

9 Guillard V. (2019). *Du gaspillage à la sobriété: avoir moins et vivre mieux? (From Waste to Sobriety: Having Less and Living Better?)*, De Boeck Supérieur.