WM&R

Waste Management & Research
2016, Vol. 34(2) 93–95

DOI: 10.1177/0734242X15626015
wmr.sagepub.com
SAGE

Circular economy: European policy on shaky ground

In July 2014, the European Commission published its Communication, *Towards a Circular Economy: A Zero Waste Programme for Europe*. The Commission withdrew their 'waste package' in February 2015, in spite of fierce criticism from a majority of the European Parliament. In December 2015, a new policy was proposed, entitled *Circular Economy Closing the Loop* (European Commission, 2015). Again, 'circular economy' is presented as a promising alternative to the traditional 'linear economy':

> "The European Commission is supporting the EU's transition to a Circular Economy … New jobs will be created in innovative design and business models, research, recycling, re-manufacturing and product development … Long-term targets and measures to optimise waste management will boost recycling and reduce landfill."

We like to draw the reader's attention to two questions: Is the politically attractive message of a 'circular economy' that promises to enable continued economic growth while radically reducing the level of waste production scientifically correct? And does the Commission actually do what it promises in the 'circular economy package'?

Let us start with the first question: Optimal design of closed material loops would not only result in a radical reduction of waste, but also in an increased creation of economic value. This promise is based on two feel-good assumptions: That 'circular' solutions will necessarily lead to sustainable outcomes; and that, as a rule, 'circular' solutions are available that can be realised in practice. Unfortunately, both assumptions are wrong.

The basic idea of a 'circular economy' is that all industrial processes can be designed in a way that the associated material flows are fully consistent with natural cycles. In that case, they are either fully closed or designed in a way that all material flows into the environment consist of naturally occurring 'nutrients'. If that is the case, there will be no reason to minimise throughput and no reason to reduce waste or other emissions that we call pollution. The most radical version of this approach is found in the 'cradle-to-cradle' (c2c) philosophy (Braungart and McDonough, 2009), which can be summarised by two design principles: (1) 'waste equals food', and (2) 'use current solar income'. In this vision, material flows should (and always can) be designed in a way that all materials will either be used in the economic process or dispersed as natural nutrients into the environment. There is no waste, only 'food' (which is not used in the literal sense here). Moreover, all energy used in the economy should come from 'solar income'. If such a system can be realised, there will be neither a waste problem nor an energy (or man-made climate) problem.

Fundamental problems

But can a circular economy be realised in this way? It may be realised in some special cases, but there are three fundamental problems.

1. The first problem is that, in reality, waste is almost never 'food'. All production processes lead to downgrading materials (in the form of waste, mixed materials, etc.) and to create value from downgraded materials, we always need energy. To create a waste-free economy would cost gigantic quantities of energy. Creating endless material cycles without continuously adding energy would be counter to the Second Law of Thermodynamics. Complete recycling is therefore a thermodynamic impossibility: It will cost infinite quantities of energy and infinite time. In practice, the energy needed will be generally higher than the thermodynamic optimum.
2. The second fundamental problem is the assumption that natural nutrients can be fed into the ecosphere without any problems, regardless of their quantity. This cannot be guaranteed. There are scale problems even with natural nutrients (Reijnders, 2008).
3. A third fundamental problem comes with the progress of scientific information: Our knowledge about more or less harmful effects of substance flows on the environment is growing continuously. In the recent past and likely into the future as well, the production of beneficial consumer products almost always resulted in the generation of industrial wastes and used products or materials that turned out to be hazardous, necessitating treatment and disposal of unexpected waste flows (e.g. petroleum waste, nano-particles).

On this basis we conclude that the assumption that 'circular' solutions necessarily lead to sustainable outcomes is wrong. Such an outcome cannot be guaranteed. 'Circular' solutions can and do have negative ecological impacts and they may even be worse than so-called 'linear' solutions, especially with respect to energy use and in cases of risks coming up with certain compounds entering raw material chains. The sustainability guarantee of 'circular' solutions is an illusion.

Practical problems

But apart from those severe fundamental problems, there are huge practical problems to be considered. Optimising production systems to completely close material loops requires a rigid coupling of diverse processes of material conversion, not only within one company, but also between processes in different companies and countries. This tends to create rigidities and dependencies that are difficult to establish and manage in a market economy, where not only quantities processed and products produced continuously vary with market demand, but also companies appear and disappear regularly. Moreover, optimisation of material flows creates dependencies between decisions now and in the (far) future, when products will reach their end of life. Dealing with such complexities and dependencies limits the availability of practical options for optimising material cycles in the economy.

Experiences with implementing 'circular economy' strategies – especially in the context of cradle-to-cradle projects – are still limited. They consistently show that implementation is difficult and that their outcomes are modest in comparison with original expectations. Examples of relatively successful implementations all refer to simple products close to original materials and biological cycles. Examples are cradle-to-cradle designs of seeds and flower trays made from Algae material, carpets using recycled yarn, waste bins, bags, and tableware made from recycled plastics. Successful examples for the design of complex high-tech products are difficult to find. Experience shows that products designed on the basis of circular economy principles are not necessarily leading to minimum environmental impact. Where they manage to close material cycles, life cycle assessments show that their overall environmental impact is often higher than the non-circular design (Bjorn and Strandesen, 2011). Not surprisingly, studies on electronic consumer products have shown that recovering all materials present in a certain product in their original grade is not possible without creating substantial additional environmental impacts.

Multiple strategies needed

It is necessary to include all three basic strategies for creating sustainable production systems: Efficiency strategies (doing more with less), consistency strategies (feeding back materials, in a way that is optimally consistent with natural substance flows), and sufficiency strategies (reducing the need for products and services). The contribution of the c2c approach based on the consistency strategy is necessarily limited.

Effective solutions to reduce the ecological footprint of our economy will not be possible without considering other strategies. In the first place, we need to continue our efforts to increase energy and material efficiency in order to further decouple growth in waste generation, energy use, and pollution from growth in economic activities. However, we cannot overlook that we may have to question the need for certain products and services in order to keep the ecological footprint of the economy within acceptable limits.

There is no reason to believe that a 'circular economy' will make efficiency and sufficiency strategies obsolete. It is an illusion to assume that material flows in the economy can be completely closed and that the energy requirements for such a 'circular economy' can be solved by trusting on the use of 'solar income'. It is an illusion based on a complete neglect of both physical realities and practical barriers to implementation.

A European policy based on 'circular economy ideas' creates expectations that will never be realised. It conveys the wrong and misleading message that there exists an easy path to creating a growing economy with an ever decreasing ecological footprint. It may also create the expectation that this can be done on the basis of market forces and voluntary actions only. It neglects the unsolved energy, waste, and pollution issues that result from its implementation. It may weaken the necessary attention to regulatory issues.

Sustainable resource management is necessary

Now let us turn to question 2 and illuminate the amendments proposed by the Commission. The new 10% landfill target for 2030 or 2035 (depending on the member states (MS)) goes beyond the targets of the 1999 directive – but many MS did, or do, not meet neither the 50% nor the 35% target without consequences drawn by the Commission. New instruments for enforcement besides better reporting by the MS are not proposed in the 'package'. So, we will not achieve the defined targets and it is doubtful, if a more stringent target will be achieved ten years later. It is certainly a step forward that the Commission accepts that recycling strategies have to be linked to product design, but the amendments for the waste electric and electronic equipment directive (WEEE) and the Battery Directive do not explicitly include such regulations. Uniform definitions for 'municipal waste' and for recycling targets, as have been proposed by the Commission, are an important contribution to European waste management, but dedicated targets for valuable or scarce resources are still lacking.

Sustainable resource management will start from an integrated concept covering waste policy, resource management, energy efficiency, and climate protection. In every single case, an optimal solution has to be selected on the basis of economic and ecological priorities. European policy should focus on instruments that can effectively influence the market, with the aim to reduce consumption of scarce materials and to increase the level of material and energy recovery.

- The most successful tool against wasting resources – as has been proven in some MS – is a deadline for landfilling organic waste fractions in the relatively short term. This would be an enormous contribution to climate protection, because recovery of material and energy are the only alternatives. The Commission might also encourage the transport of residual waste from countries still relying on landfills for waste disposal to countries with best available disposal technology like waste to energy (WtE) (Newman, 2015).

- Economic incentives like establishment of extended warranty periods would contribute to enhance the longevity of products (‘design for repair’).
- Rules for the design of specific products, especially those including priority materials, would foster recovery operations (‘design for recycling’).
- More transparency about the materials used, especially in the case of complex long-living goods (buildings, electric devices, etc.), is necessary to facilitate methodical deconstruction of products to enhance material recycling opportunities.

Only if it includes a mix of strategies and instruments that are optimally geared to provide specific solutions in specific situations, will a policy on materials, product design, and waste be effective. A clear decision to stop landfilling organic waste in Europe would be a good foundation for further actions. Basing policy one-sidedly on one selected strategy – such as ‘circular economy’ and ‘zero waste’ – may sound attractive as a political rhetoric, but its real contribution to sustainable development is highly questionable.

References

Bjorn A and Strandesen M (2011) The cradle to cradle concept – is it always sustainable? In: Poster session presented at The Life Cycle Management (LCM) Conference, *Towards life cycle sustainability management*, Berlin, 28–31 August. Available at: http://orbit.dtu.dk/files/6443333/Bjoern-The_Cradle_to_Cradle_concept-773_ax%5B1%5D.pdf (accessed 2 December 2015).

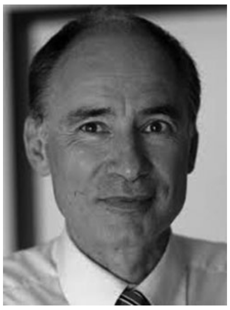
Braungart M and McDonough W (2009) *Die nächste industrielle Revolution*. [The cradle to cradle community]. EVA Verlag, Hamburg.

European Commission (2015) *Circular Economy Closing the Loop*. Available at: http://europa.eu/rapid/press-release_IP-15-6203_en.htm (accessed 2 December 2015).

Newman D (2015) Challenges for the waste industry in the EU. *Waste Management World* 9/10: 19–25.

Reijnders L (2008) Are emissions or wastes consisting of biological nutrients good or healthy? *Journal of Cleaner Production* 16: 1138–1141.

Reinier de Man
Sustainable Business Development,
Rivierforel 45, NL-2318 MG
Leiden, The Netherlands.
Email: reinier.de.man@rdeman.nl



Henning Friege
N³ Thinking Ahead,
Scholtenbusch 11. D-46562
Voerde, Germany.
Email: Friege@N-hoch-drei.de