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Key Challenges for Transformations Towards a Circular Economy – The Status Quo in Germany

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Abstract

Facing an ever-increasing global consumption of natural resources and related environmental as well as socio-economic challenges, the transition towards a circular economy will be of crucial importance. The issue is high on the political agenda, especially since the European Commission published its Circular Economy Action Plan in December 2015. Apparently different stakeholders have very different perceptions of the concept as well as different expectations for its implementation. During a workshop series by the Friedrich Ebert Stiftung, experts from policy, science, administration, industry and unions discussed key issues for the circular economy: What´s the status quo in Germany? How can the circular economy be implemented in a comprehensive and efficient way? Which instruments are available? Is the legal framework on EU and national level sufficient for the evolvement of a circular economy? What is the role of the consumer? What are the economic potentials especially with regard to job creation? How can research and innovation policy contribute to this process? This paper aims to summarise the different discussions.

Keywords: Circular economy; Status quo; Instruments

Introduction

Facing an ever-increasing global consumption of natural resources and related environmental as well as socio-economic challenges, the transition towards a circular economy will be of crucial importance. The issue is high on the political agenda, especially since the European Commission published its Circular Economy Action Plan in December 2015. Apparently different stakeholders have very different perceptions of the concept as well as different expectations for its implementation. During a workshop series by the Friedrich Ebert Foundation [1] experts from policy, science, administration, industry and unions discussed key issues for the circular economy: What´s the status quo in Germany? How can the circular economy be implemented in a comprehensive and efficient way? Which instruments are available? Is the legal framework on EU and national level sufficient for the evolvement of a circular economy? What is the role of the consumer? What are the economic potentials especially with regard to job creation? How can research and innovation policy contribute to this process? This paper aims to summarise the different discussions.

Chapter 2 presents the discussions around the concept of circular economy in its different facets. Chapter 3 intends to assess the status quo of Germany on the way towards such a circular economy and outlines specific implementation approaches. The final chapter draws first conclusions of this dynamic debate and outlines further need for research.

The circular economy concept

The central starting point for the current discussion of the circular economy concept is the critical question, whether the production of waste really represents a necessary evil of our mode of production. Alternative approaches, such as circular economy, zero waste, closed-cycle, resource efficiency, waste avoidance, reuse, and recycling pursue the idea of responsible treatment of resources, materials, products and the environment. Although they have gained increasing traction in recent years, a "world without waste" can only be achieved with a holistic concept. That means taking account of approaches such as avoidance, reuse and recycling of both materials and energy at every stage of the product life cycle to ensure environmental product design from the outset – with recycling at the end.

The fundamental idea of the circular economy has given rise to various currents and variants featuring smaller or larger differences in concept, approach and scope. These include the circular economy of the Ellen MacArthur Foundation, the blue economy concept, cradle-to-cradle, and zero waste, that significantly differ regarding the perspectives on bio-based cycles [2,3]. Figure 1 sets these individual elements into the context of a comprehensive circular economy.

Benefits of circular economy

The transformation to circular economy is associated with high expectations concerning ecological and economic benefits: "Moving to more circular economic models promises a much brighter future for the European economy, by helping to decouple economic growth from resource use and its impacts, it offers the prospect of sustainable growth that will last" [4]. Studies increasingly emphasise these benefits on four levels: resource utilisation, the environment, the economy, and social benefits including the creation of new jobs.

Resource availability benefits: improving resource security and reducing import dependency

The circular economy has the potential to improve efficiency of primary raw material use both in Europe and at the global level. If materials are preserved in high-quality products or waste is returned to industry as high-quality secondary raw materials, the circular economy can reduce European industry's demand for primary raw materials. Lower demand for primary raw materials will in turn help to reduce dependency on imports, making value chains in many sectors

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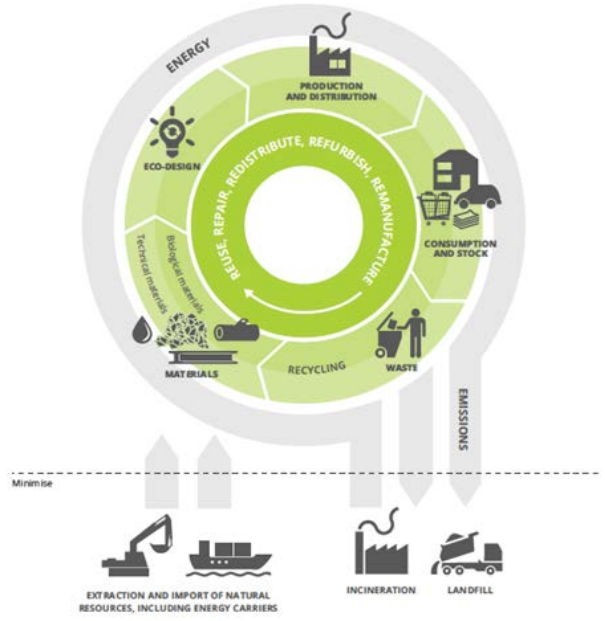

Figure 1: The concept of circular economy [11].

of industry less vulnerable to price fluctuations in the international commodity markets and to insecurity of supply caused by scarcity and/or geopolitical factors. Current estimates suggest that 6 to 12 percent of total material consumption (including fossil fuels) could already be saved or avoided through recycling, waste avoidance and eco-design strategies; the maximum potential on the basis of existing technologies is estimated at up to 17 percent [5].

Ecological benefits: fewer environmental impacts

The absolute decoupling of economic growth and quality of life from consumption of resources and energy (and the associated environmental impacts) is the principal objective of the EU's resource efficiency policy. Circular economy strategies contribute concretely to that goal in various ways, including by prioritising waste avoidance and reuse under the waste hierarchy. According to an impact assessment in connection with the EU's waste targets the complete closure of landfill sites in combination with elevated recycling targets could generate an additional annual reduction in greenhouse gas emissions of approximately 440 million tonnes between 2014 and 2030 [4]. And in a circular economy waste avoidance, eco-design, reuse and similar measures can also contribute to climate protection: they are already responsible for avoidance of 2 to 4 percent of Europe's total annual greenhouse gas emissions [6].

Economic benefits: opportunities for economic growth and innovation

Turning away from linear modes of production and consumption based on "take, make, use and dispose" can also offer considerable opportunities to improve competitiveness in various sectors of European industry. The circular economy offers important cost savings for various industries. According to estimates by the Ellen Mac-Arthur Foundation, improving circulation in the manufacturing of complex consumer durables with medium lifespans could produce savings in material costs of up to $630 billion in the EU alone [7]. Beyond this, the circular economy can also offer a platform for innovative approaches, technologies and business models that create economic added value from limited natural resources. This can support European industry in becoming more resilient to external shocks and improving its global competitiveness.

Social benefits: sustainable consumer behaviour and employment possibilities

From a social perspective, too, Europe can profit from the transition to a circular economy. Social innovations associated with waste avoidance, reuse, recycling, eco-design, a sharing economy and other developments offer opportunities to establish more sustainable patterns of consumer behaviour and thus to contribute to human health and consumer safety. In particular, the circular economy can generate new employment opportunities in Europe. According to the European Commission's impact assessment for waste targets, simplified legislation, improved monitoring and dissemination of best practices alone could create more than 180,000 new jobs by 2030 [4].

Limits of the concept

However, it is conspicuous that certain questions have to date received little or no systematic consideration in the circular economy debate. Not only are the hopes to completely close materials cycles still a remote utopia in practice; even in theory they contradict the fundamental laws of thermodynamics, as certain quantitative or qualitative losses are practically unavoidable. In any event, energy is also required to recycle waste. While this is normally less than needed for extracting and processing primary raw materials, it remains impossible to circulate unlimited quantities of material without coming into conflict with climate targets [8]. Fundamentally the transformation to the circular economy will not obviate the necessity to substantially reduce the consumption of natural resources in the interests of sustainable development.

Another associated aspect here is the fundamental availability of raw materials. Until recently the resource de-bate has been dominated by the so-called critical raw materials that are absolutely indispensable for particular processes or products {especially for green technologies such as solar and fuel cells} [9]. No suitable substitutes exist for these substances, and at the same time supplies are endangered because demand exceeds supply, the static range may be disturbingly small, or the known reserves are concentrated in a small number of countries that could exploit their monopoly position to their own advantage. The most widely dis-cussed example is the rare earths, without which no modern smartphone can be manufactured. China possesses 90 percent of the known reserves, and has in the past restricted exports. In view of rapidly growing demand, even a completely closed cycle would not suffice to supply industry. As these points illustrate, the circular economy still presents conceptual challenges where work remains to be done [10].

Discussion

German progress towards a circular economy

The waste management perspective: With respect to the waste management side of the circular economy, Germany has long been one of the absolute leaders. Largely technical regulations – for example on landfill, incinerator emissions and producer responsibility for packaging waste – have created a technical level of waste management infrastructure that remains the envy of the world. This is associated with impressive recycling rates for almost all relevant waste streams, holding steady over many years. For example, 86.9 percent of household waste

is recycled, while the European average in 2012 was just 37 percent [11]. Germany's overall recycling rate in 2013 was 79 percent [12].

Environmental problems associated with the generation and treatment of waste have been substantially reduced in Germany, and "security of disposal" has been broadly established as the objective of the waste management. Waste is in principle comprehensively collected and could be returned to the materials cycles. In fact, many actors now regard waste as a problem that has been "technically solved".

In addition to the ecological benefits, recycling also pays economically in Germany. Waste management is a major sector of the economy, employing almost 200,000 people in about 3,000 companies, with an annual turnover of about €40 billion [13]. Ambitious waste management strategies and strong environmental awareness have in particular brought forth technological innovations for separation and recycling. Globally there is strong demand for German high-tech solutions and German know-how [14].

The circular economy perspective: A very different picture appears, however, if we expand the perspective and examine the real circulation of waste. The German Association for Waste Management, for example, investigated what proportion of waste is actually "returned to production as secondary raw materials", and arrived at the sobering figure of just 38 percent for 2013 [15]. In other words, two-thirds of waste is not used as a resource. This fits with the finding that in 2010 only 14 percent of the raw materials used in Germany were gained from waste [16].

Recycling rates are therefore of only limited value as indicators of circular economy. Under current legislation a product such as a mobile phone can be classed as 100 percent recycled without reclaiming even a single milli-gram of the critical raw materials it contains, such as gold, palladium and indium. The reclamation rates for these substances – which are present only in minute quantities but represent a large proportion of the product's total resource use on account of the complexity of their mining and processing – still remain disappointingly small or tend to be zero due to lacking technology. Even for substances such as aluminium, steel and copper, where the recycling technologies are long-established, secondary raw materials still only account for 40 to 50 percent of respective production in Germany [17].

The inner cycles

The circular economy concept of maintaining the value of products and raw materials as long as possible implies a particular focus on activities such as preparation for reuse, repair and in general extension of the service life of products. Here we find that considerable development potential still exists in Germany. Durable, repairable and recyclable product design is one of the core elements of the circular economy. But the real developments in this area still remain extremely confused and opaque, as reflected for example in the discussion about "planned obsolescence". Critics argue that products are designed intentionally to fail sooner than necessary (in particular shortly after expiry of the guarantee), forcing consumers to purchase unnecessary replacements.

A recent study commissioned by the German Environment Agency found that consumers today are keeping newly purchased products less long than they used to. In comparison to 2004, the time until the first user purchased a replacement for domestic appliances such as washing machines, dryers, fridges and stoves in Germany fell from 14.1 years (2004) to 13.0 years (2012/2013) [18]. Although no clear trend is observable for other product groups such as notebooks, the "phasing out of waste" through product design is definitely not yet reality.

While the German data on repair and preparation for reuse is also patchy, it is clear that the classical system of "produce–use–dispose" remains absolutely dominant. In the case of electronic devices, for example, the rate of reuse after disposal is just 1 percent in Germany. A comparison with other countries and regions such as Austria and Flanders reveals that considerable potential remains untapped, even with the current state of technology and the current design of products on the market. Reuse networks like Revital and Kringloop apply uniform quality standards and marketing concepts and enjoy political support and/or reduced VAT rates for repaired products – and achieve reuse rates that are in the case of certain products ten times better than Germany's [19]. While the annual volume of repair services in Germany is already about €2.8 billion [20] that is still considerably less than 1 percent of the market for new products.

Necessary framework and instruments

Even if, as outlined above, Germany still has a long way to go to achieving closed materials cycles (to an extent that makes sense) and implementing the circular economy, a number of discernible approaches and instruments could contribute to that goal. In the following a number of these are described, with their possible fields of application, strengths and weaknesses.

Product design

Improved and waste-avoiding product design will have to be one of the central levers for implementing the circular economy. Better design can help to make products longer-lived or easier to repair, refurbish or upgrade. It can assist recycling businesses when they dismantle products to reclaim valuable materials and components. Altogether, valuable resources can be saved in this way. Yet the current market signals appear inadequate for realising this possibility, especially because the interests of producers, consumers and recyclers are not aligned. It is therefore essential to launch initiatives for improving product design, while preserving the internal market, upholding competition and enabling innovation. Because products are generally not manufactured for individual national markets, this is an issue in particular for the European Commission.

In order to promote better product design, the Commission will emphasise aspects of circular economy in future regulations under the Eco design Directive, whose objective is to improve the efficiency and ecological performance of energy-related products. To date Eco design regulations have largely targeted energy efficiency; in future, questions such as reparability, durability, upgradeability, recyclability, and the identification of particular materials and substances will be systematically reviewed. As a first step the Commission has developed – in the scope of the Eco design Directive – obligatory product design and labelling standards, which will soon be presented to the member states. For example, the dismantling, reuse and recycling of electronic displays is to be made easier and safer [21].

In order to allow technical service life to be measured and compared in practice, progress is needed in the development of measuring norms and standards for components and devices. The framework for product reparability should also be improved, so that defective devices are more frequently repaired rather than replaced. This would include making spare parts and transparent repair information available to independent repair businesses (not tied to the manufacturer). The authors of a study on the influence of product life on environmental impact [22] also recommend expanding manufacturers' duty to supply information.

Support for new business models

Innovative business models based on closed cycles and resource

efficiency are one of the most powerful drivers of the circular economy. Where successfully established, such business models will have a direct and lasting impact on the economic system and at the same time advance the adaptation of the necessary framework. Here very different approaches exist [21]. The various service-orientated concepts of "using instead of owning", for example, seek to create economic incentives for long-lived product design with optimised return systems, and also to intensify customer relations. From the customer perspective they often produce significantly greater transparency concerning the overall life cycle costs of products and thus enable more rational purchase decisions [23]. Two examples of such approaches have already become classics: Xerox, as a supplier of copying services rather than photocopiers {where the service model already contributes almost 50 percent of company profits; [24]} and the jet engine division of Rolls-Royce, whose power-by-the-hour contracts already include servicing and repairs. Other approaches focus more strongly on collective use through sharing or leasing. Here the business models generally arise through the provision of online platforms for customer-to-customer exchange, whether private or commercial (B2B or C2C). One of the most successful models in the area of such a platform economy is probably AirBnB as meanwhile the largest provider of living space.

New financing models also play a crucial role. Whereas contracting is long-established in the field of energy efficiency, for example, similar models for circular economy concepts are frequently still in the early stages of development. The associated uncertainties and teething problems frequently make it difficult for innovative start-ups to gain the necessary access to capital markets. One fundamental problem affecting the aforementioned service-orientated concepts such as Xerox, and also Mud Jeans, for example, is that ownership remains with the manufacturer even in the use phase, and cash-flow is considerably delayed in comparison to linear business models. Such concepts could be supported by the new green bond market, although it is itself still in an early stage of development [25].

Conclusion

Comparison of the potential benefits of the circular economy with the steps thus far undertaken to implement it underlines that Germany has yet to make full use of the opportunities on offer (as the Ellen MacArthur study concludes for Germany): "Comparatively few German companies or regions use the circular economy principle as a differentiating feature; resource management continues to focus on observance of limits and management of energy efficiency" {translated from McKinsey [26]}. On the basis of this study and the FES's series of discussions, four main conclusions can be drawn.

The circular economy is more than improved waste management

One of the central conclusions, also backed by the findings of the FES discussions, is that the circular economy debate in Germany still concentrates too strongly on the topic of waste management. There continues to be an excessive focus on measures that only take effect at the end of a product's life cycle, such as optimised separation of recyclable materials from residual waste or reclamation of metals from incinerator ash. In fact, technical optimisation measures can also expand the economic and ecological potential – although in comparison to the possibilities of a real circular economy these appear rather marginal. One central challenge will consist in communicating that circular economy means much more than better waste separation and technically optimised waste management.

The circular economy must bring new actors on board

Technical innovations will also play a central role in the circular economy. This is especially necessary in relation to the design of products, which need to be long-lived, repairable, and 100 percent recyclable. Yet the technical aspects of the circular economy are probably in fact the easier part of the challenge of switching an entire economic system from linear to circular. Especially in comparison to waste management, a whole new realm of cooperation and coordination will be required in order to make this model viable right along the entire value chain. Resource producers, product designers, merchants, consumers and not least waste management actors will have to work together on optimised solutions, rather than continuing to concentrate solely on "their" elements of the chain (optimised resource extraction, process optimisation, improved recycling rates etc.). For example, repairable products can only be sensibly developed if users also possess the necessary skills.

The circular economy will not emerge on its own

With respect to the different interests and expectations of the various actors, it thus becomes clear that the circu-lar economy also requires a clear regulatory framework. The discussion about possible economic savings and market potential sometimes threatens to obscure the fact that many actors also profit very well from the existing linear system. Many of those involved understandably wonder about the future of their business model if there is no longer to be any waste. The transformation to the circular economy will certainly not come about automatically, and even the frequently-invoked new business models will only be able to fulfil their role as drivers of the circular economy if they are given the appropriate framework.

The circular economy requires a new mix of instruments

Shaping the framework that could support a circular economy will require new policy instruments that extend far beyond existing waste legislation. As outlined above, such instruments should operate in particular where the cycles intersect: product design to enable recycling; business models that minimise waste, etc.

The big challenge will be to integrate these instruments in a new policy mix:

- In which the individual elements are complementary and ideally mutually reinforcing. On account of the often unclear objectives for the future of the circular economy, relevant policy in Germany still often appears inconsistent and too many existing arrangements are still designed for a classical linear system – for example for the disposal of construction and demolition waste that could be used as a resource elsewhere.
- That brings together in sensible framework responsibilities that are distributed over a wide range of political levels and ministries. This also includes the question of the responsibility of local authorities and private-sector waste operators, which needs to be considered more strongly from the perspective of a long-term circular economy and less in terms of short-term market share.

Only a policy mix of that type can in the long term create the necessary stable and credible framework within which businesses will invest in innovative circular-capable production processes and consumers will be able to enjoy the advantages of such a sustainable economic model.

A necessary precondition will, however, be, that prices for natural

resources better reflect the "ecological truth": the environmental costs of resource extraction are frequently externalised and unloaded on the populations of mining regions or in the case of climate change, on future generations. Even in economic theory, such price dis-tortions lead to lead to deadweight losses; reducing environmentally harmful subsidies and pricing in the envi-ronmental costs of raw materials (for example through a resource tax or differential VAT rates [27] will represent a necessary element of an effective circular economy policy in Germany.

In conclusion, the expert talks have illustrated the recent dynamic of this issue and clearly shown that, in spite of foreseeable significant ecologic and economic potentials, especially the implementation still shows substantial challenges.

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