Theme 3: Economy: Economic perspectives in the circular bio-based society

Session 1-10

Submit your abstract here:

Circular@WUR - Author profile

3S1

Circular fashion

Paulien Harmsen, WUR/WFBR , paulien.harmsen@wur.nl, Harriette Bos, WUR/WFBR, harriette.bos@wur.nl, Dieuwertje de Wagenaar, WUR/CVC dieuwertje.dewagenaar@wur.nl, Michiel Scheffer, WUR/AFSG, michiel.scheffer@wur.nl

The Ellen MacArthur foundation has developed a roadmap towards a circular textiles and clothing industry. Their vision is based on two pillars: Increasing circularity following a hierarchy of circular solutions and moving away from non-renewable feedstock for any virgin material input. Several circularity strategies exist to reduce the consumption of natural resources and materials and minimize the production of waste. They can be ordered for priority according to their levels of circularity, i.e. the 10R-strategy. The hierarchy of circular solutions relevant for the textiles and clothing market segments can be based on the 10R-strategy, where Rethink stands for "Smarter product use and manufacture", Reuse stands for "Extend lifespan of product and its parts" and Recycle and Recover stands for "Useful application of materials". Ideally, waste is prevented by e.g. changing consumer buying behavior, wearing clothes for a longer period, implementing other business models in the fashion industry such as textile rental, or by applying design for longevity principles (Rethink). When a garment is disposed of, ideally it is reused by another customer through the 2nd hand market. When the garment is no longer wearable, it can be converted into a product of lower value such as wiping rags (Reuse). When the fabric is no longer usable as such, recycling techniques come into play. Here a distinction can be made between fibre, polymer or monomer recycling (Recycle). When recycling is also no longer possible, recovery of energy (Recover) or even landfilling are the final options. The second pillar deals with the options of phasing out non-renewable feedstock for any virgin material input. Although it is known that the fashion industry relies heavily on non-renewable feedstock, the options for fossil-free fashion are limited and seldom elaborated on.

In this session we would like to explore the options for replacing non-renewable feedstock in the textile industry by using more biomass-based feedstock and recycled content. Highlight the need to rethink the way we clothe ourselves. Also consider the boundaries of fossil-free fashion.

3S2

Optimizing circularity: Measuring social, environmental and economic performance of supply chains

Francesco Razza, Novamont, francesco.razza@novamont.com, Koen Boone, WER/TSC koen.boone@wur.nl

Decision makers within supply chains need to find the right balance between social, environmental and economic performance. Many methodologies have been developed that measure either social, economic or environmental performance of companies and supply chains but for decision making all three need to be integrated. For real circular solutions, performance should not be optimized only for individual firms but for full supply chains including the many loops. Also difficult to measure sustainability themes like biodiversity, inclusiveness and soil quality should be integrated. For some of these sustainability dimensions (like poverty, biodiversity, healthiness) the supply chain might not be the right level to optimize but a regional/jurisdictional or personal diet approach is needed. In the end all these individual indicators should ideally be integrated for decision making (e.g. by weighting into an overall score using planetary boundaries or monetization). Because of all these issues, solutions that do integrate all three dimensions, tend to end up with hundreds of indicators and become so complex that use in practice is hardly possible. Data assembling costs become too high and supply chains partners might not be willing to share the relevant data because of worries of misuse for economic reasons (like price negotiations). On the other hand new data assembling technologies (digitalization, blockchain, satellite technologies, artificial intelligence) might decrease costs and make new data easily available. Integration of all the different dimensions in a relatively simple way might be preferred to not taking them into account at all but over simplification should be prevented. Sustainability measurement also gets more and more integrated into the traditional management reporting systems, like with integrated reporting where companies produce one integrated report combining the traditional financial report with the sustainability report. In this way, it becomes more clear how sustainability is integrated within all parts of the company and how sustainability influences financial results. Preferably reporting would integrate more forward looking information on opportunities and threats of sustainability trends using e.g. scenario analysis (like proposed by the Taskforce on Climate Disclosures TFCD). For example they could implement aggregated methodologies for corporate reporting linking their purpose with innovative performance measurements. Indeed the research of exhaustive, scientific-based and clear ways able to catch the essence of a business is much sought after by stakeholders. Such a "simplified" communication would increase the effectiveness of integrated reporting contributing to boost the transition towards more sustainable production and consumption patterns. In this session, we would like to discuss methodologies and applications to measure supply chains circularity and sustainability in social, environmental and economic dimensions and that help supply chain partners to find the right optimum without creating too much complexity and an

unrealistic data burden for supply chain partners. We welcome papers both on company level and supply chain/product level and both for internal management purposes and for external reporting.

3S3

Macroeconomic impacts of the circular economy

Hans van Meijl, WUR/SSG, hans.vanmeijl@wur.nl, Geert Woltjer, WUR/WER, hans.vanmeijl@wur.nl

To what extent is a circular economy consistent with economy growth? We need to rethink economics that ensures prosperity for all within the boundaries of our planet. Economic development is measured by the narrow metric of economic growth (GDP) and new metrics of welfare, happiness or wellbeing are needed. A circular economy could decouple economic growth from environmental degradation. However, can an inclusive and sustainable economy be achieved with continuous economic growth or do we need degrowth? This requires a new economic framework and within this framework the new circular bio-based society asks for drastic changes in our economy. We have to overhaul or get a new macro-economic engine of growth. Overhaul means decoupling economic growth from material use and emissions based on non-polluting energy and selling non-material services. To decouple economic growth from resource use is needed but it is very difficult in case of growth as current efforts show that the GHG emissions still increase despite all efforts. For many agricultural emissions decoupling is only partly possible. Are there alternatives? A new engine of growth might mean the challenge of a stable slow or non-growing economy in the long run. This needs change in behaviour of consumers and producers and the governance structure. Can we change lifestyle from consuming more and more individually, driven by novelty and status, towards a different lifestyle in which we care for 'Mother Earth' our 'common home', other people, including future generations and "less is more". From a macro-economic perspective avenues to explore might be opening the black box of consumer preferences, rebalancing work and leisure, shifts from private to public investment, private to public ownership, short-term to long-term investment focus based also on non-economic criteria, and a focus from labour-saving tech change to tech change directed. In this session we invite paper on the specification and measurement of new economic growth or wellbeing indicators. Furthermore we invite theoretical economic growth papers dealing with a circular economy and economic growth or degrowth.

3S4

Circular transition: Finding ways to understand and steer circular consumer behaviour

Marleen Onwezen, WUR/WER, marleen.onwezen@wur.nl

Current society is developed to trigger consuming more and more and more. Consumers are triggered to buy more products, use products as fast-moving products, and throw products away when they are no longer perfect. Due to the current high consumption patterns we are facing alarming global issues regarding the environment. For example visible in decreasing biodiversity and climate change (Buchmann-Duck & Beazley, 2020). This calls for rethinking the way we organize our economy and society by placing higher value on resources and changing our economy from linear to circular. Circular economy entails a system of closed loops in which raw materials lose value as little as possible. Circular consumer behavior is making different choices in choosing products, buying less, re-use of products or re-use of food waste (Korhonen et al., 2018). More specifically circular consumption means choosing for products that contribute to reduction of emissions and pollution, more respect for food, animal welfare, fair price for farmers, reduction of externalities, better use of raw materials, conservation of fish stocks, knowing the origin of foods, more attention for the position of farmers in the food chain, less consumption and improving biodiversity. This does not only entail behaviour of farmers, producers, or retails, but als behaviour of consumers (Antikainen et al., 2015). However, little is known about consumers' willingness to participate in circular economy (Borello et al., 2017). Circular@WUR welcomes submissions that give scientific insights in the change from linear to circular consumer behavior. Submissions that highlight how this behaviour differs from more traditional sustainable behaviours and how behaviour change among consumers can be supported are highly welcomed. Moreover, submissions that include novel methodologies or strategies to explore these types of consumer behaviours, or that include multiple stakeholders or a food system approach are also highly welcomed.

3S5

Monitoring transition from linear to circular production chain in the bio-economy

Berien Elbersen, WUR/WER, berien.elbersen@wur.nl

Regeneration of the natural system is central to the concept of circularity and is also an objective that the EC links to the transition to a biobased economy. However, whether this will happen per definition in a transition to a bioeconomy is a question. A recent assessment of the status and potentials of the circular economy in the EU (EEA 2019)

concludes that potential synergies between circular material use, climate change mitigation and the halting of biodiversity loss are increasingly recognised, but that such synergies require further integration within and between climate-neutral, bio- and circular economy policies. The report also concludes that the monitoring of progress needs further investment because many relevant data are not readily available in established information systems (e.g. statistical systems) that support such policies. The transition from a linear to a circular production in the bioeconomy needs effort in all segments of the economy and society from local, regional, national and supranational level. Circularity needs to be introduced in production and consumption systems.

Beside the overarching sustainability principle there are aspects that define circularity and that need to be addressed when monitoring it. The first aspect links to efficient use of resources. The second aspect is based on the coupling of the circular economy concept to a low carbon growth as is proclaimed in the EC Circular Economy Package (EC, 2015), The Bioeconomy vision, the EEA view on circularity and the Dutch 2050 circular economy vision. The third building block is related to the principle that circular systems can only be effective if socio-economic and environmental sustainability is increased (Giantolli et al., 2020 and Robert et al., 2020).

In this conference session we therefore want to review on what aspects the circular bioeconomy needs to be monitored, how this can best be done, what indicators are most relevant to develop, what methods are useful in this respect, what data are available and which are missing and how can we fill these data gaps and on what levels do we need to monitor circular bioeconomy transitions and impacts. Contributions to this session should focus on these questions.

3S6

Financing the circular bio-based economy

Erik Mathijs, KU Leuven, erik.mathijs@kuleuven.be

The implementation of circular business models requires "getting the economics right" as put forward by the European Commission in its 2020 Circular Economy Action Plan, as products generated in a circular way must compete with products generated in a 'linear way'. This requires a combination of appropriate policy instruments and business strategies. Policy instruments may refer to economic instruments such as taxes and subsidies, but also to standards or even outright bans of the use of some inputs. Business strategies may refer to price premiums obtained through successful product differentiation that are sufficient to cover the higher cost of circularity. The EU Emissions Trading System is an example of a cap and trade system that created a significant carbon market able to induce income streams for those that generate negative carbon emissions. Carbon credits thus become an essential element in sustainable business models. This sessions welcomes contributions that address the following questions: What

is the business case for the circular economy, such as for the recycling of nutrients? Is a business case possible without government intervention (e.g., fertilizer tax or nitrogen standards)? How can supply chain based solutions be developed to make a business case for circular approaches?

3S7

Techno-economic and sustainability assessment of biobased and circular economy innovations

John Posada,TU Delft, J.A.PosadaDuque@tudelft.nl, Steven van Passel, Universiteit Antwerpen, Steven.VanPassel@uantwerpen.be

A techno-economic assessment (TEA) combines process modeling and engineering design with an economic evaluation at early stages of technology development. Technological parameters are directly translated into economic (and environmental) indicators. A TEA can provide an ex-ante or prospective assessment with clear linkages to the (early) stages of technology development. A large increase in the number of TEA studies can be observed from 2010 onwards, especially in the domains of energy fuels, engineering & chemistry, and biotechnology. Expanding the scope of TEAs in more scientific domains (including water and food sciences) is needed. Also, further methodological improvements to make TEAs more dynamic, include stakeholder involvement, make them geographically explicit and to move to a more systemic level, are necessary. A third challenge is to integrate techno-economic assessments in a sustainability toolbox. Environmental and social impacts can be merged with the economic indicators of TEAs taking into account spatial and temporal considerations and using a wide range of integration methods. We welcome all contributions with a clear focus on techno-economic and/or sustainability assessment of biobased and circular production. The contribution can focus on a project, technology and/or innovation or a more systemic level.

3S8

How can the economic value of biobased value chains be reflected in policy?

Calliope Panoutsou, Imperial College London, c.panoutsou@imperial.ac.uk, Robert M`Barek, European Commission, robert.m'barek@ec.europa.eu

Policy and industry decision-makers place a high priority on biomass as a significant resource for the emerging low carbon, circular bioeconomy. Biobased value chains can offer opportunities to reduce the use of petrochemicals, mitigate climate change and contribute to local economic growth including the creation of skilled employment opportunities. Worldwide, decision-makers are nowadays increasingly exploring varied, innovative value chains that can supply and use biomass sustainably and cost-efficiently. The diversity of resources and products together with the complex interactions and interrelations among the biobased sectors restricts the efficiency of providing valid, up-to-date evidence for their economic value to policy makers. Modelling and unit-cost approaches across value chain stages are useful and in addition to the economic value they can also assess the contribution to economic recovery and effects on societal welfare. In biobased value chains this facilitates grouping of budgets costs, transfers, and externalities, in each biomass supply and value chain stage and identification of respective physical and economic parameters. This session aims to build on existing knowledge and modelling platforms and further define challenges within the biobased value chain stages, discuss appropriate methods and indicators that can interpret performance for relevant competitive advantages and as such foster the development of resource efficient and sustainable circular bioeconomy.

3S9

Modelling the circular economy with sectoral and macro-economic models

Hans van Meijl, WUR/SSG, hans.vanmeijl@wur.nl

The transition from a linear (i.e., produce, use, discard) towards a circular economy has to be mirrored by a transition in modelling. Existing (economic) almost completely ignore material cycles and recycling, as well as co- and by-production of products and materials. An improved representation of physical material cycles (material flows) in models helps to increase their policy support relevance with regards to biomass availability, sustainability of bioenergy as well as reduction of food losses and waste. Key challenges are the explicit modelling of waste and by-products, waste management sector, secondary production sectors, and the explicit modelling of a product lifetime by, for example, dynamic stocks of materials and products. Principles of the circular economy

require the modelling of waste and reuse of materials to create value added in for example partial and general equilibrium models. Sound material flow data in physical and monetary are essential. A more detailed representation of new and emerging bioeconomy sectors, such as biobased materials and chemicals is needed. Furthermore, the process of technological change has to be endogenized for the circular and bioeconomy. Quantitative macro-economic models (e.g. general equilibrium models) focus on money flows and ecological variables, resource use and emissions are not taken very well into account. Can we create macroeconomic models for sustainability that include material and energy flows, emissions and resource use in both biophysical and monetary terms? How can we include producer and consumer behaviour necessary for a circular economy within the economic models? The key challenge is how can we improve existing economic models to better address circularity.

3S10

Circular food packaging; current options and limitations

Ulphard Thoden van Velze, WUR/WFBR, ulphard.thodenvanvelzen@wur.nl, Judith van Leeuwen, WUR/ESG, judith.vanleeuwen@wur.nl, Sanne Stroosnijder, WUR/WFBR, sanne.stroosnijder@wur.nl

Food companies and retailers strive towards a more circular economy for food packages and want to act quickly and meaningful. During the last five years, these companies have become increasingly aware of the environmental impacts caused by mis-managed packaging waste and experience a mounting pressure from consumers and governments to reduce these impacts. With ten thousands of products, complex supply chains, contracts, large investments, multiple strategies, various pitfalls and undesired side-effects, this is, however, an enormous challenge. This scientific session will focus on how the combination of technical limitations, legal constraints & business incentives is limiting the options to progress directly towards a more circular economy for food packages. The aim of the session is to identify the limitations of all strategies (reduce, reuse, recycle, recover) and seeks to identify critical improvement points (legal, technical, behavioural) to overcome these limitations. And hence progress towards a more circular economy for food packaging, without generating more food waste, endangering food safety, causing more greenhouse gas emissions elsewhere, etc.