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Chapter 14

The Normative and Social Dimensions of the Transition Towards a Responsible, Circular Bio-Based Economy

Vincent Blok

Introduction

If we take into consideration the Anthropocene and the critics of our current relationship with the environment, as well as the necessary change in approach and mindset they promote, we also need to think of new conceptual foundations for our economic activities. Current developments in new product development based on renewable energy in general and biomass valorisation in particular are promising, and can be seen as the motor behind the transition to the circular bio-based economy (CBE). Although the concept and definition is contested in academic literature (Kirchherr et al. 2017; Birch and Tyfield 2013; Goven and Pavone 2015; Zwier et al. 2015), we adopt a common definition that is provided by the Ellen MacArthur Foundation (2010: 7). They define the CBE as:

an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models.

Despite this, a transition to the CBE is yet to take place. Recent studies in the CBE indicate that it is a promising way forward, although its actual practices are still marginal (Jonker et al. 2017). This may be explained by the chasm between innov- ators and early adopters and the majority of producers and consumers. Even where economic actors adopt CBE practices, it is often a side event and not part of the core business of the company. In the sustainability transition literature, it is argued that we are currently between the phase of pre-development, in which only small changes in the system take place that are not (yet) visible, and the phase of take-off, in which these structural changes gain momentum (Bosman and Rotmans 2016).

Normally, the explanation of why the transition to the CBE has not taken off yet is found in the complexity of system transitions. The transition to the CBE is a

complex process of co-evolution of economic, technological and institutional developments at multiple levels and at a long-time scale (Grin et al. 2010). From a multilevel perspective, at the micro level new innovation practices emerge, for instance where sustainable entrepreneurs exploit circular bio-based technologies and operate as front runners to promote radical circular bio-based innovations which are adopted by early adopters. This micro level is supported by the meso level of the current regime of institutions and policies, for instance new emerging policies to stimulate the transition to the CBE. In order to enter the next phase of transition to the CBE, therefore, huge investments are made by European policymakers. There are also obstacles at the meso level, for instance the vested interests of the fossil fuel industry that have an interest in delaying the transition. In the end, the meso or regime level of change is influenced by long-term trends at the landscape level, for instance concerns regarding climate change or economic crises (Bosman and Rotmans 2016; Geels 2002; Geels and Schot 2007; Long et al. 2019). It is assumed that the transition to the CBE evolves when developments at these three levels align (Grin et al. 2010; Geels 2002). In a recent study on transitioning to the circular economy in the Netherlands, this dynamic was depicted as shown in Figure 14.1.

Figure 2. Visual summary of results

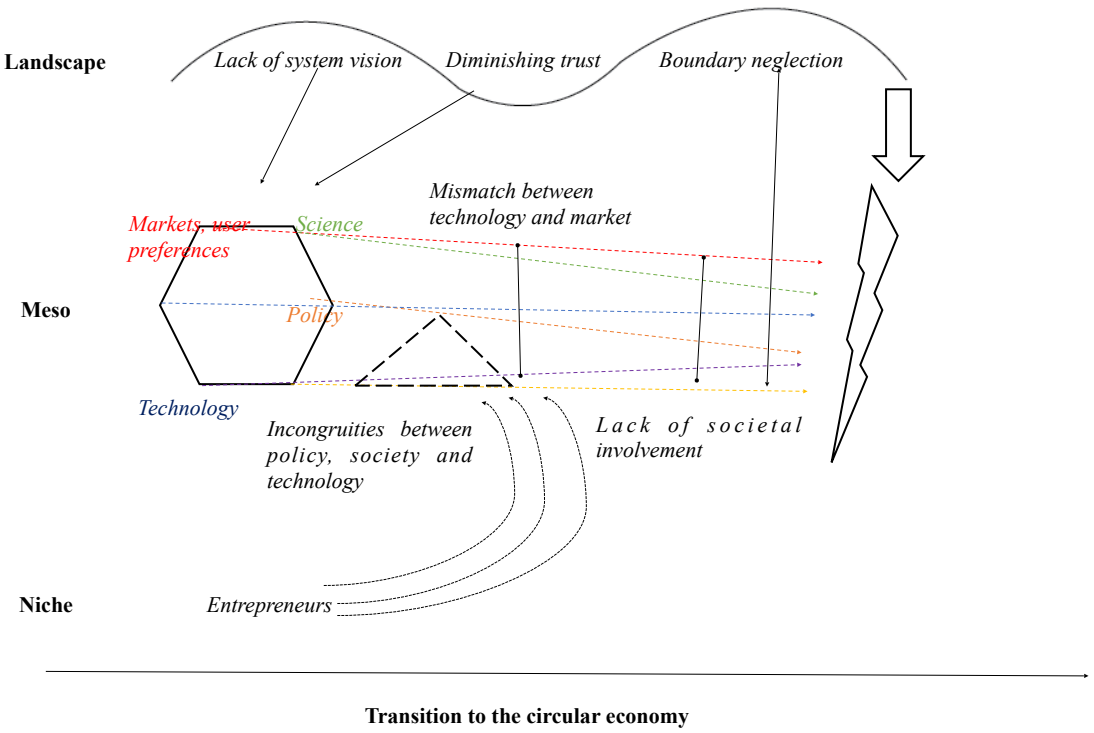

Figure 14.1 Transition to the circular economy (Inigo and Blok 2020)

Why has transitioning to the CBE not yet happened? From a multilevel perspective, the technological challenges and the policy and regulatory drivers and barriers are often highlighted (Bosman and Rotmans 2016). For instance, because residual streams are framed as 'waste', reuse of these materials for food is difficult and requires new rules and regulations (Sira Consulting 2011). What is often missed in the literature, however, are the normative and social dimensions that can be seen as barriers to transitioning to the CBE (Murray et al. 2017; Inigo and Blok 2019). Although we acknowledge the importance of the other barriers to the transition to the CBE, we concentrate on the normative and social dimensions of this transition in this chapter.

In this chapter, we will first argue that current practices in CBE are framed within the market or economic logic and miss the normative dimension of the call for circularity. The transition to the CBE requires a fundamental reflection on the role of economic actors in the social and ecological environment with significant consequences for their business practices. Second, we will argue that the transition to the CBE requires the acknowledgement of the normative and social dimensions of this transition at the meso and macro levels, and the establishment of an environmental and social logic on the micro level of business practices. Third, we will argue that the concept of responsible innovation (RI) can help to articulate the normative and social dimensions of the transition to the CBE, and enables the operationalisation of the environmental and social logic at the micro level. In this respect, RI can be understood as a driver for the transition to the CBE.

14.1 The Normative Dimension of the Transition to the Circular Bio-Based Economy

In current research into the CBE, there is a strong focus on either technical or economic issues. The main question is how we can technologically redesign products in a way that is restorative or regenerative by design, and in an economically viable way. There is a strong focus on economics in new product development, which limits the production of new circular bio-based products to those that are economically viable and for which a business case can be made.

Theoretically, almost everything can be recycled, repaired and reused. In the free market, however, only CBE opportunities are explored and exploited for which a business case can be made. Where a business case cannot be made for a product, this does not lead to the shutdown of its production. Instead, the end-of- life concept of linear economic thinking remains dominant in its continuous production. This explains why the current picture of the circular scenario for 2050 shows only a limited decrease of CO_2 emissions (see Figure 14.2).

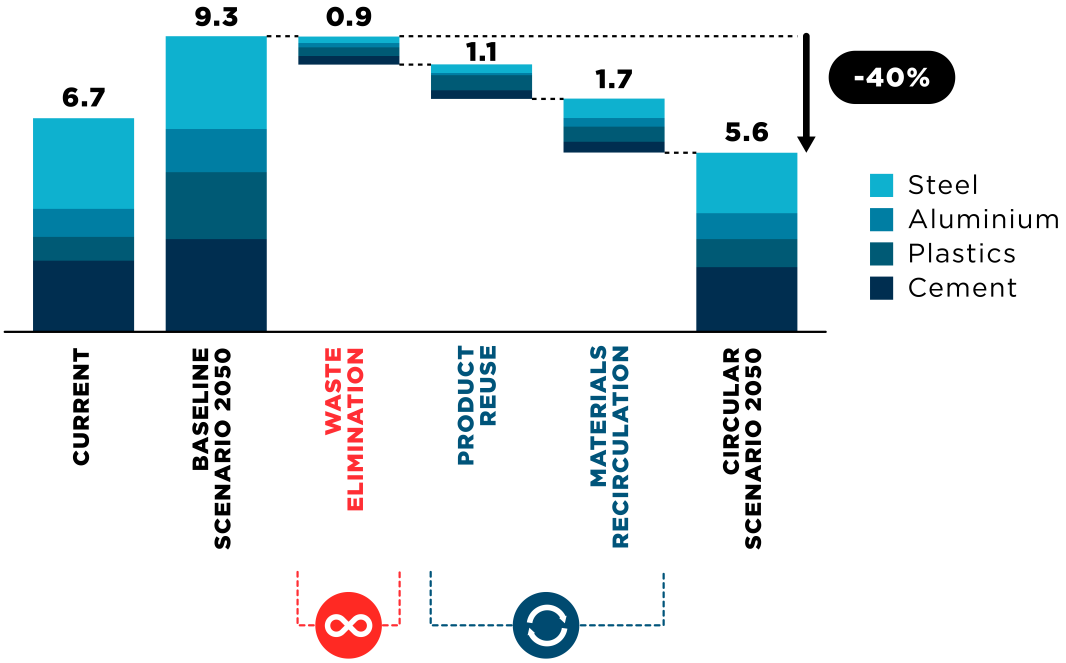

Figure 14.2 Global CO_2 emissions from four key materials production (billion tonnes of CO_2 per year) (Ellen MacArthur Foundation 2019)

This may be explained by the fact that the current conceptualisation of the CBE is not based on the carrying capacity of planet Earth but remains based on economic parameters (Veraart et al. 2019).

The concept of logics has been used to illustrate how values, mindsets and motivations impact what issues are conceived as important and how they are addressed (Stubbs 2017). If an economic or market logic is dominant, actors focus on profits, efficiency and operational effectivity, while if a social logic is dominant, actors focus on the public good and benefits for society (Long and Blok 2019). While the transition to the CBE involves a combination of economic, social and environmental logics, and should therefore lead to radical new circular bio- based products and services, current practices in the CBE are dominated by the market logic. This idea is not only substantiated by the circular scenario for 2050 (Ellen MacArthur Foundation 2019) but also by current practices in the bio-based economy. Currently, the bio-based economy is largely determined by biomass as source of renewable energy and not (yet) by higher value adding bio-products like fine chemicals and biopharmaceuticals. This focus on biofuels does however not automatically lead to the CBE but only to a 'greening of coal-fired power plants', as Bosman and Rotmans (2016: 10) put it, i.e. to CBE practices based on renewable resources. The same can be seen in the circular economy. Although recycling is less environmentally advisable than reduction, reusing and repairing

materials, due to energy dissipation and the downgrading of these resources, current practices in the circular economy are largely determined by recycling because of economic reasons, and not (yet) by potentially more sustainable practices (Bilitewski 2012; Stahel 2013; Inigo and Blok 2019). The economic or market logic is appealing to CBE practices as it holds the promise that companies can continue with their business as usual.

We do not object to the idea that technological and economic feasibility is important in the transition to the CBE. Without a feasible business case, the CBE would not get off the ground because front runners in the CBE would go bankrupt before that transition could take place for instance. The question is however whether sustainable development can be achieved within this conceptualisation of the CBE (Beames et al. 2019). In the first instance, we have to acknowledge that sustainable development, which is the main aim of the CBE, is a normative concept; it does not describe the world as it is, but as it should be. The difference can become clear if we compare sustainability with child labour or food safety. The moral question of the acceptability of child labour or the violation of food safety does not concern efficiency or optimisation. The rejection of child labour and obligation to secure food safety is due to a normative standard or principle for what is considered ethical business practice and not to do in business practice. The concept of the CBE is ambiguous, despite its § de facto practice as economy-based economy (Veraart and Blok 2019). Under the concept of the CBE the biosphere of planet Earth operates as such a normative standard; it would be an economy based on and relying on the biosphere or the carrying capacity of planet Earth. So although the CBE contains the biosphere as a normative standard for new circular bio-based product development, the restorativity or regenerativity of the natural resources that are required for new product development is not taken as such a normative standard in current business practices, but only as a guideline for optimisation. The problem at hand becomes clear if we once again compare it with the concerns regarding child labour or food safety. If we argued that we should only try to avoid child labour or should only try to guarantee food safety, it would not be acceptable at all.

In fact, in current practice the biosphere of planet Earth is not seen as such a normative standard. On the contrary, the biosphere is seen as a subset of human economy, i.e. as resource for production (Blok 2018a). In this conceptualisation, natural capital is seen as interchangeable with and replaceable by human made capital (labour and technology). But the normative dimension of the CBE raises the questions whether it concerns just a new way of doing business as usual, in which biomass is for instance seen as a source of added value for economic returns, or whether its ambition is to establish a sustainable economy, one that really operates within the carrying capacity of the biosphere of planet Earth and considers the well-being of people (Garver 2013)? While in current management

theory business practices are self-evidently depicted as if they lack biophysical foundations (Mead 2014), the massive experience of climate change today shows that natural capital can no longer be seen as interchangeable with human-made capital in business practices. On the contrary, the environmental crisis we face today shows that the economy is a subsystem of the larger biosphere of planet Earth, which sets limits to the growth ambitions of economic actors and functions as a limit in which new product development practices should operate. Climate change shows that the current environmental problems concern an ecosystem failure to provide infinite resources for production and consumption, to provide optimum conditions for sustained production and consumption, and to do justice to intra- and intergenerational equity criteria (Korakandy 2008). As long as environmental problems are seen as market failures, the solution to these failures is found within the economic paradigm, in which the environment is seen as a subset of human economy, i.e. as a resource for production (Blok 2018a).

In the field of ecological economics, it is therefore argued that the transition to the CBE requires a systems transition, namely an economic system that is based on the biosphere and uses the carrying capacity of planet Earth as a normative framework of economic activities (Constanza et al. 2015). Rockström et al. (2009) use planetary boundaries to show to what extent the carrying capacities of planet Earth have been exceeded, and these indicators show absolute boundary conditions within which the CBE has to operate. In other words, what is called for is a new paradigm of the CBE, in which the economic or market logic of the business-as- usual approach is replaced by an environmental logic that guides the further development CBE research and practices. According to such a logic, the economic, societal and ecological spheres are nested systems, in which economics is seen as dependent on society and, in the end, on the biosphere of planet Earth. The biosphere operates as a planetary boundary that affects the space in which economic activities can take place in a normative way. An example can be found in the planetary boundaries provided by Rockström and colleagues. These boundary conditions enable us to reject new product developments that increase climate change, while it allows new products developments that increase chemical pollution (Rockström et al. 2009). Another example can be found in the 'life's principles' provided by the Ellen MacArthur Foundation (2010), which represent overarching patterns of how life on Earth creates conditions conducive to life. One can think of principles like 'adapt to changing conditions', 'be resource efficient' and 'be locally attuned and responsive' (Ellen MacArthur Foundation 2010), that can be used as a measure or standard for circular bio-based business practices (Blok 2016; Muijsenberg and Blok 2019). The CBE constitutes a different economy, namely an economy that operates within the carrying capacity of planet Earth, if circularity is a normative concept that limits and restricts new product development.

To conclude this first section, we have seen that current practices in the CBE are framed within the market or economic logic and miss the normative dimension of the transition to the CBE. Such a transition requires fundamental reflections on the role of economy in ecology with significant consequences for CBE practices. With a few exceptions (Weber and Hemmelskamp 2005; Jacobsson and Bergek 2011; Schlaile et al. 2017), however, the normative dimension of the transition to the CBE is underrepresented in current literature; the lack of attention directed towards this normative dimension can be seen as one of the main barriers to the transition to the CBE.

We are not implying that economic actors should fundamentally reconsider their role in society and adopt a social and environmental logic in their business practices. The normative dimension holds as well for the demand side of the CBE, namely the consumers. Based on a long-term analysis, Verbong and Geels (2007) argued that we cannot expect a smooth transition to a new (circular bio-based) energy system as long as they are not driven by environmental concerns in society. Also, in other fields of the transition to the CBE, like climate smart agriculture, one of the main barriers is the lack of customer demand for climate smart products and services (Long et al. 2019). On the contrary, while consumers may accept recycling, they are less likely to accept the more sustainable opportunities provided by the CBE, like reuse and repair. The transition to the CBE requires that both supply- and demand-side actors adopt a social and environmental logic in their production and consumption processes.

Even if economic actors take responsibility for circular bio-based new product development, transformation to the CBE will not get off the ground if there is no willingness to take care on the side of consumers. The normative dimension of the transition to the CBE holds therefore both for producers and consumers.

One can argue that economic actors are primarily responsible for circular bio- based new product design, as they are primarily polluting to the environment. Accordingly, it can be argued that the expectation that consumers engage in reuse and repair activities actually means that this responsibility is transferred to consumers, and that this transfer is not legitimate. Although we agree that economic actors have a responsibility that cannot be transferred to the consumer, actual engagement in the more sustainable opportunities provided by the CBE like reuse and repair requires the engagement of consumers as well in order to take full advantage of this potential (Schlaile et al. 2017). In this respect, the responsibility of economic actors to redesign their products and services and to engage in new circular bio-based product development corresponds with a willingness to engage in circular bio-based products and services from the side of the consumers. Therefore, we argue that the main barrier to the transition to the CBE is found in a lack of the normative dimension of this transition on both the supply side of circular bio-based products and services, as well as on the demand side.

14.2 The Social Dimension of the Transition to the CBE

Not only is the normative dimension of the transition to the CBE often missing in current conceptualisations: so too is the social dimension. This becomes clear if we reflect on the triple bottom line (planet, people, profit) as the basic idea behind the call for sustainable development. In current conceptualisations of the CBE, the main focus is on the planet (in terms of resource efficiency and waste minimisation) and profit (in terms of economic efficiency and profitability). So while the call for sustainable development involves the economic, environmental and social dimensions, current practices in the CBE seem to cover only the first two dimensions (Kirchherr et al. 2017).

It is especially this social dimension of the transition to the CBE that raises all kinds of questions, for instance ethical issues of intra- and intergenerational equity (Murray et al. 2017). An example is the demand for biofuels that has resulted in the replacement of tropical forests by soy fields (Farigone et al. 2008), which puts pressure on food production in poor countries (Murray et al. 2017). For this reason, Murray et al. (2017) call for the application of social and solidarity principles in order to democratise the CBE beyond economic profitability (Inigo and Blok 2019). The replacement of the market or economic logic by a social logic would lead to a social conceptualisation of the CBE, as is proposed by Murray et al. (2017: 377): the CBE is 'an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximise ecosystem functioning and human well-being'. This conceptualisation enables us to raise questions about ownership of the (public) biomass resources and who may benefit from CBE practices: do stakeholders such as consumers who contributed to restorative and regenerative design by engaging in recycling, reusing and repairing behaviours benefit from the sustainability performance of the economic actor?

Another aspect of the lack of interest in the social dimension of the transition to the CBE is that it leads to the sole focus on the eco-efficiency of new circular bio- based technologies and practices, without taking unknown safety and health risks and unknown impacts and side effects into account. An example is the introduction of precision livestock farming (PLF) in the agricultural sector. PLF can be defined as 'the management of livestock production using the principles and technology of process engineering ... PLF treats livestock production as a set of interlinked processes, which act together in a complex network' (Wathes 2009). By the integration of smart technology and the internet of things – in which computers, sensoring devices, GPS systems but also robots and even animals communicate with one another and function autonomously in an integrated farm management system – farmers can engage in the CBE (Bos and Munnichs 2016). PLF provides

concrete strategies to engage in CBE while it at the same time raises social and ethical issues associated with the increased corporatisation and industrialisation of the agricultural sector (e.g. digitalisation of farm animals and mega stalls) (Blok 2018b), in which animals are merely treated as objects of production, and not as living beings.

These circular bio-based technologies have unknown safety and health risks related to the composition of the biowaste that is used as input in bio digesters for instance, and to the residual waste streams that come out of the bio digesters. The health risks of the low frequency sounds produced by wind turbines and heat pumps received less attention in the literature as well but may provoke societal resistance against the adoption of such technologies in local communities. Also, the consequences, impacts and side effects of life science technologies for CBE are unknown. Many circular bio-based technologies have a dark side, for instance if a green technology requires rare earth materials like neodymium that can only be mined at the expense of considerable environmental costs (Zhang et al. 2000), or rely on materials that are hard to recycle (Murray et al. 2017). One of the major targets of synthetic biology for commercial application of synthetic biology is for instance the production of the next-generation biofuels, while the consequences and side effects of synthetic biology are completely unknown and contested.

On the one hand, societal resistance against the transition to the CBE may be fuelled because the high expectations regarding new technology are often not redeemed. On the other hand, we can expect that the more radical circular bio- based technologies are, like life science technologies for CBE, the more it will raise societal questions, requiring more responsibility of actors. In current CBE research and practice, however, the social dimension of the transition to the CBE receives relatively little attention, which may prevent further successful implementation (Winans et al. 2017; Inigo and Blok 2019). The lack of focus on the ethical acceptability and societal desirability of CBE technologies and practices may cause societal resistance and can therefore be seen as one of the key barriers to the transition to the CBE.

The inclusion of the normative and social dimensions of the CBE requires an extension of the economic or market logic with a social and environmental logic in order to safeguard that the CBE does not only focus on ecological efficiency and economic profitability, but starts to acknowledge the limitations of the carrying capacity of planet Earth while contributing to the common good. An example can be found in the conceptual development of biomimetic PLF, which integrates a strong critique of the reification of animals for food production (Blok and Gremmen 2018). Currently there is however little research on how a social and environmental logic can be implemented in CBE research and practice, and exactly how it could be aligned in a constructive manner. Next to normative reflections on the CBE, it would

require the involvement of multiple stakeholders involved in or affected by the CBE to address the normative and social dimensions of the CBE collectively, i.e. to prevent the social and ethical risks of circular bio-based technologies and practices, and to better embed these technologies and practices in society.

14.3 RI as Driver of the Transition to the CBE

One way to substantiate the strategy to consider the normative and social dimensions of the transition to the CBE is RI. Responsible Innovation as a concept emerged in the European policy context to prevent failure of promising innovations because ethical and societal questions are not taken into account (Owen et al. 2013). The problem was that innovative developments often start with the promise of positive impact – e.g. genetic modification, nanotechnology and digital technologies like artificial intelligence – but later on turn out to have negative impacts and raise ethical concerns as well. This raised the question how we can steer innovative developments like the CBE in such a way that they meet societal and environmental goals like sustainable development and the common good. The consideration of responsibility issues in new product development requires reflections on how we can explore the potential positive and negative impacts or consequences of innovative developments, and on the question to what extent we can abandon or modify innovations because of ethical and social concerns. These ideas have led to the conceptualisation of RI as 'a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products' (von Schomberg 2012: 9). It provides a systematic framework for the identification, evaluation and management of ethical and social issues within technology development in order to achieve ethically acceptable, societally desirable and sustainable outcomes.

In the literature on RI, two broad traditions can be distinguished. First, there is a normative substantial approach that starts with norms and values as predetermined (substantial) inputs in the innovation process in order to generate responsible outputs, i.e. products and services that serve society (von Schomberg 2012). Second, there is also a procedural approach, which focuses primarily on the innovation process and the way actors anticipate risks, reflect on desirable outcomes and engage stakeholders to this end (Ruggiu 2015). It conceives RI as 'collective commitment of care for the future through responsive stewardship of science and innovation in the present' (Owen et al. 2013). The procedural approach does not proclaim predetermined normative claims regarding the output of the innovation process but focuses primarily on the responsible governance or management of the

innovation process itself (Lubberink et al. 2018). According to the procedural view on responsible governance of innovation, RI contains four dimensions: anticipation of possible and unexpected risks (asking what–if questions); reflection on intentions and purposes (asking questions regarding one's own commitments, assumptions and biases); inclusion of and deliberation with societal actors (asking who is involved and how stakeholders are consulted); and responsiveness towards societal concerns and needs (asking questions regarding the alignment of new product development with societal values and concerns) (Owen et al. 2013). While the normative substantial approach of RI can be criticised because unilateral and shared values cannot be identified in case of complex societal problems like the transition to the CBE (stakeholders have in fact different and often opposed value frames), the procedural approach can be criticised because stakeholder inclusion and deliberation cannot replace the ethical considerations that are at stake in new product development (Blok 2019a). Agreement among stakeholders does for instance not necessarily exclude biases regarding intra- and intergenerational equity in new product development. As I have argued elsewhere, the integration of both the substance normative approach and the procedural approach of RI is needed, and requires an action-based conceptualisation of RI (Blok 2019b). For the purposes of this chapter, we consider the contribution which the procedural and the normative substantial approach of RI can provide if it comes to new circular bio-based products in the transition to the CBE.

The procedural approach of RI can help to anticipate possible futures and impacts of the CBE. It helps to identify the negative impacts, unintended consequences and side effects of circular bio-based technologies (e.g. food for fuel), bio digesters (e.g. safety and health risks due to the composition of the biowaste and residual waste streams) and wind turbines or heat pumps (e.g. health risks due to low frequency sounds). It also helps to address these negative impacts in an early stage together with multiple stakeholders, and to anticipate impacts at a more fundamental level, for instance the impacts of the increasing industrialisation and corporatisation of the agricultural sector on social well-being (Blok 2018b).

The procedural approach of RI can help us to reflect on the assumptions and possible biases involved in the transition to the CBE. We can think of reflections on the dominance of the economic and market logic in current CBE practices, which leads to simplistic goals of the CBE, and reflections on the possibilities of adopting a social and environmental logic. And if economic actors already engage in CBE practices that count on consumers' involvement (reuse, repair), RI can help them to engage in second-order reflection on their real intentions and commitments; are we really engaging consumers to serve the common good with our circular bio-based technologies and practices, or are we in fact shifting our 'corporate' responsibility for sustainable development to consumers? Furthermore,

we can reflect on the focus on eco-efficiency in circular bio-based technologies and practices, and on the impact, this focus on eco-efficiency has for our understanding of the human condition, which is also associated with enjoyment and wastefulness (Veraart and Blok 2019; Zwier et al. 2015).

The procedural approach of RI can help to include stakeholders in the assessment and redesign of circular bio-based technologies and practices. One can think of citizens who live in the neighbourhood of bio-based factories and facilities. Inclusion may also address the current lack of attention for the role of consumers as systemic barrier to the transition to the CBE (Mignon and Bergek 2016). It may also address the current lack of interest in the role of stakeholder engagement in CBE research and practice (Korhonen et al. 2018; Inigo and Blok 2019). Finally, it enables questions to be asked regarding the diversity of stakeholders involved in the assessment of the ethical acceptability and societal desirability of circular bio-based technologies and practices. These considerations may lead to the inclusion of a more diverse range of stakeholders in order to address ethical issues of intra- and intergenerational equity in the transition to the CBE.

Finally, the procedural approach of RI can help to respond to call for the transition to the CBE and contribute to the common good. One can think of responsiveness at an operational level, for instance the redesign of circular bio- based technologies to address societal concerns and reduce risks, but also of responsiveness at a strategic level of economic actors who decide to adopt the normative dimension of the CBE in their business practices, for instance the adoption of sustainable business models or life's principles in biomimetic design (Muijsenberg and Blok 2019; Muijsenberg et al. 2019).

On the one hand, the four dimensions of the procedural approach of RI may support the transition to the CBE, as they address some of the ethical and social issues that cause societal resistance against the CBE and can be seen as barriers to the transition to the CBE. On the other hand, the procedural approach of RI also requires a normative substantial dimension as we have seen. The contribution of the normative substantial approach of RI is different from the procedural approach, because it mainly helps to reflect on the normative dimension of the CBE, i.e. the core values of the biosphere on which the CBE should be based and the common good the CBE should contribute to.

Because the integration of the normative and social dimensions is often missing in current CBE research and practices, we propose that the concept of RI is a useful strategy to integrate the normative and social dimensions in CBE research and practice. RI can substantiate the social and environmental logic which were claimed to be prerequisites for the transition to the CBE in the previous section. If RI is adopted in CBE research and practice, it can be seen as a driver for the transition to the CBE.

14.4 Philosophical Reflections on RI as Driver of the Transition to the CBE

One can question, however, to what extent RI is able to identify the normative dimension of the CBE as one universal principle that guides circular bio-based practices. Sustainable development is a highly complex or 'wicked' problem (Rittel and Webber 1973). Wicked problems are complex, ill-structured and public problems like lifestyle diseases, poverty in the South and climate change. Several authors have indicated that global warming is such a highly complex problem because it concerns global and interconnected issues like climate change, increasing populations and changing consumption patterns, which cannot be solved in usual ways or by simple solutions (Blok et al. 2016; Brennan 2004; Ehrlich and Ehrlich 2009). Further indications of this wickedness can be found in the dispersion of causes and effects – emissions of greenhouse gases (GHGs) are produced in a particular geographical area but have global effects – in the fragmentation of agency – there is no centralised system of global governance to tackle this global problem, while local agents have the tendency to serve their own (unsustainable) interests (Hardin 1968) – and in institutional inadequacy – local enforceable sanctions to enhance and secure more sustainable behaviour is limited by the current, mainly national institutional context (Gardiner 2006; cf. Jamieson 2007). In such a context, it is difficult, if not impossible, to conceptualise how different human stakeholder groups and institutions, who have a broad variety of perspectives and interests, accept responsibility for the transition to the CBE.

If the key characteristic of wicked problems like global warming is that the distinction between responsible and irresponsible behaviour is difficult because of their complexity, we can critically question whether it is possible for RI to identify a normative principle or value of the biosphere on which the CBE should be based. At the same time, we can argue that planet Earth itself could function as sovereign principle or norm that should guide the transition to the CBE. On the one hand, we can identify the Earth as sovereign principle for our existence, to the extent that human existence emerges, unfolds and expands based on the pre-existence of the Earth, and threatens to go back into the Earth at the end of this era in which humanity is threatened by global warming (Blok 2016). The unique situation of planet Earth that is threatened by global warming unsettles us – we experience our full dependency on the carrying capacity of the Earth for the first time – and calls us to sustain this Earth as supportive ground for human existence. This call is normative, since the Earth as supportive ground operates as norm or regulative idea that guides circular bio-based practices. This normativity of planet Earth can inform the substantial normative approach of RI as driver for the transition to the CBE. At the same time, this norm is 'open' for revision, as opposed to general or universally valid, to the extent that the application of this norm remains always a

finite or limited one compared to the wickedness of the problem, remains always questionable, adjustable and improvable. This means that any norm always remains situational – only valid in a limited way and for a specific purpose and time frame – while we have to remain principally critical towards the applicability of such a norm or principle in light of this wickedness of the problem at stake. The critical engagement with the Earth as sovereign principle and acknowledgement of the openness and fallibility of this norm can be established by the procedural approach of RI as driver for the transition to the CBE.

Based on these considerations, we propose the integration of the substantial normative and procedural approach of RI as driver for the transition to the CBE, in which planet Earth itself operates as normative dimension for the CBE. This normative dimension of the CBE acknowledges the ultimate dependency of economic actors on the biosphere and carrying capacity of planet Earth. We develop four preliminary characteristics of a CBE that substantiates the substantial normative and procedural approach of RI, and with this, substantiates the transition to a responsible CBE.

A responsible CBE is characterised by a state of inclusion, namely the inclusion of human existence in the biosphere of planet Earth. This state of inclusion does not only highlight the dependency of circular bio-based producers and consumers on the Earth as supportive ground for their public and private operations, but also their responsibility when it comes to sustaining the Earth as such a supportive ground. The state of inclusion highlights the individual responsibility of circular bio-based producers and consumers as intimately connected with this supportive ground. Circular bio-based producers and consumers are not only held responsible for global warming based on general norms and principles, but also actively take responsibility for the transition to the CBE in actual sustainable action and behaviour (Blok et al. 2016), through which the Earth as *oikos* (home) for human existence and its institutions subsists. At the same time, circular bio-based producers and consumers acknowledge the situational and fundamentally limited character all circular bio-based technologies and practices in light of the wickedness of global challenges like global warming.

A responsible CBE is not only conditioned by the singularity of the circular bio- based producers and consumers, as if the procedural approach of RI as driver for the transition to the CBE is sufficient and does not require the normative dimension of the CBE. This would suggest that an economy that is based on the biosphere as *oikos* of human existence is primarily in the hands of circular bio- based producers and consumers to provide for the needs of human life. But in fact, also the efforts of circular bio-based producers and consumers are always already dependent on the Earth as supportive ground. In this sense, a responsible CBE is always already Earth-bound, i.e. primarily conditioned by grand challenges like

global warming that unsettle actors and call them to action to engage in the transition to the CBE, here and now. Circular bio-based producers and consumers are responsive to the normative dimension of planet Earth that operates as a regulative idea or 'open' norm, without being able to derive universally held rules or principles that can be univocally applied.

Because of the situational character of a responsible CBE (characteristic 1) in response to the normative dimension of the CBE (characteristic 2), circular bio- based producers and consumers acknowledge the principal fallibility of our interventions in light of the complexity or wickedness of global warming. This fallibility of the CBE – the possible negative impacts, unintended consequences and side effects of the CBE that we discussed in the previous sections – is not only due to the situational character of circular bio-based production and consumption but may also be due to the instability and volatility of planet Earth itself, as is indicated in the structural possibility of spontaneous environmental events like earthquakes, volcanos and tsunamis.

At the same time, since massive challenges like global warming can be seen as urgent problems, the transition to the CBE can no longer consist in a business-as- usual approach, in which biomass is seen as new a source of added value for economic returns, but calls for a responsible CBE, and establishes an economy that operates within the carrying capacity of the biosphere of planet Earth. It consists in the development of responsible patterns of circular bio-based production and consumption. Responsible circular bio-based production and consumption practices can be seen as enactment of this normative dimension of the CBE, in which the Earth functions as normative principle that enforces circular bio-based practices. Because of the fallibility of any norm or principle, RI for the transition to the CBE does no longer look for perfect solutions to global challenges like climate change, but for satisficing solutions that are, first of all, satisfactory and sufficient to maintain planet Earth as supportive ground for human existence and its institutions and, second, are radically open to future subversions, revisions and improvements (Blok 2018a). Producers and consumers feel responsible for the transition to the CBE and engage in the exploration and exploitation of such satisficing solutions but acknowledge the complexity or wickedness of global warming at the same time.

Conclusion

In this chapter, we argued that current practices in the CBE are framed within the market or economic logic and miss the normative and social dimensions of the CBE. The transition to a responsible CBE requires fundamental reflections on the relationship between the economic sphere and the ecological sphere on which it is based, with significant consequences for CBE practices. We subsequently identified

the lack of attention paid to the normative and social dimensions of the CBE as one of the main barriers for the transition to the CBE and called for a social and environmental logic in CBE practices. We then proposed Responsible Innovation as a strategy to address the normative and social dimensions of CBE research and practice and identified RI as potential driver for the transition to a responsible CBE. Finally, we critically reflected on the normative dimension of the biosphere of planet Earth if we deal with highly complex problems like global warming. Based on our reflections, we proposed to integrate both the substantial normative and procedural approach of RI as driver of the transformation to the CBE and developed four preliminary characteristics of a responsible CBE that substantiates the substantial normative and procedural approach of RI, and with this, substantiates the transition to the CBE.

Future research should engage in both conceptual philosophical reflection on the relation between economy and ecology in our conceptualisation of a responsible CBE. More empirical work is needed to address the question how a social and environmental logic can be integrated in CBE research and practices, to what extent the economic and social/environmental logic can align or exclude each other, and how multiple stakeholders involved in CBE practices can successfully address the social issues at stake in current CBE research and practice. Finally, more empirical research is needed on the opportunities and limitations of RI in the CBE and its contribution to the transformation to a responsible CBE.

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