



# A social contract for low carbon and sustainable development: Reflections on non-linear dynamics of social realignments and technological innovations in transformation processes



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## ABSTRACT

The transition to a low carbon and sustainable economy represents a major transformation that can only be compared to one other comprehensive transition in modern human history: the industrial revolution. Like the low-carbon transformation, the process of industrialisation was above all an energy regime change. However, industrialisation cannot be solely reduced to a fundamental change in the energy system. The “global metamorphosis” towards industrial societies was driven by economic, cultural and social processes progressing at different speeds. Transformations are actually the result of “Häufigkeitsverdichtungen von Veränderungen” (Osterhammel, 2009), a concurrence of multiple changes. The non-linearity of far-reaching transformations becomes particularly apparent in the non-parallelism between the history of ideas and real socio-economic changes. The social, cultural and cognitive “software” of modern societies was already developed by the thinkers of the Enlightenment. The concept of “Sustainability” follows very similar trajectories. Against this background the concept of a social contract for sustainability gains relevance. It symbolises that the transformation to sustainability implies a fundamental realignment of societies, which requires the legitimisation of their citizens. In the last part of his paper the author describes emerging pillars for the social contract of sustainability. An optimistic interpretation of these trends would be: although global emissions are still rising, in many societies the cognitive, normative and cultural conditions for a sustainability transformation are now being established.

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## 1. The three phases of climate protection strategies

The debate regarding climate protection strategies has thus far undergone three phases. Within the scope of international climate negotiations the first phase was primarily concerned with reducing the greenhouse gas emissions of states and the 2-degree upper limit for the global warming process. The crucial question during this phase was: how large should the reductions in greenhouse gas emissions be for which countries? Implicit here were naturally also the costs of avoiding greenhouse gas and consequently issues of apportionment and

fairness. During this phase efforts to protect the climate system were primarily viewed as environmental policy challenges. The analogy of the climate negotiations was the Montreal Protocol, in which the successful withdrawal from CFC-based economic processes was agreed. However, the difference between CFCs and CO<sub>2</sub> emissions, as the key engines of global warming, is striking. CFCs only affected a few economic fields and businesses; the substance was easily substituted and the costs of conversion limited. Economies as a whole were scarcely affected by the Montreal Protocol. In contrast, the burning of fossil fuels concerns the core elements of the global economy, such as the global energy system, mobility and residential infrastructures as well as significant parts of industrial production. Reductions in greenhouse gas emissions

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compatible with the 2-degree target therefore imply the extensive restructuring of the global economy – ultimately the departure from the fossil fuel economy that has arisen since the industrial revolution.

It was only after the climate conference held in Copenhagen in 2009 that the climate protection discussion entered a second phase, in which it became more systematically linked to the question of the transformation of economies in the direction of climate-compatible, low carbon development trajectories. The climate protection discussion evolved successively into a debate regarding technological innovations, the transformation of economic structures and the transition to a new stage of development. This shift in discourse was significant, as it led the climate debate out of the close environmental protection community into the big arena of the global economy. Examples of this shift in climate protection discourse include a series of comprehensive reports of multilateral organisations detailing the transition to a global low carbon economy (OECD, 2011a; UNEP, 2011; World Bank, 2012). This pattern is similar to earlier sustainability debates. At the beginning of the 1970s the “Limits to growth report” (Meadows et al., 1972) focused on the basic idea of bringing resource consumption down. Time was needed to translate this resource challenges into action oriented sustainability strategies (WCED, 1987).

The discussion regarding the low carbon transformation was initially focused on the analysis of technological options for the conversion of energy and industrial systems, increasing greenhouse gas efficiency, the costs of introducing low carbon technologies and policies and incentive systems for managing the switch to a climate-compatible economic structure (Edenhofer et al., 2009; IPCC, 2011; IRENA, 2013; GEA, 2012). However, when taking into account the breadth and speed of the necessary structural transformation that the global economy and national economies would be faced with if the 2-degree goal was consistently pursued, it becomes apparent that the transformation will not only be based upon the introduction of optimally greenhouse gas-efficient technologies at prices that are as reasonable as possible, on the basis of smart incentive structures (WBGU, 2011; World Bank, 2012). Beyond this, the economic business model of the past 250 years with its regulations, research landscapes, education systems, social and cultural concepts as well as the corresponding foreign, security, development, transport, business and innovation policies, based on the use of fossil fuels, is called into question (Mitchell and Maxwell, 2010; Blowfield and Johnson, 2013; Messner, 2015; Scoones et al. 2015). Social, normative and cultural innovations will therefore be as significant as technological change processes. This perspective has heralded the third phase of the climate protection discussion, which this paper intends to contribute to. The remainder of this article develops the following arguments.

The transition to a low carbon economy represents a major transformation that can only be compared to one other comprehensive transition in modern human history: the industrial revolution (WBGU, 2011). It is therefore helpful to cast a look back to the history of the industrial revolution. This reveals that the industrial revolution, like the low carbon transformation of the present day, required the establishment of a new energy infrastructure as a prerequisite (Pearson and Foxon, 2012). However, the energy revolution in the transition to the industrial society was prepared, accompanied and

interwoven with far-reaching cultural and cognitive innovations originating in part from the concepts of the theorists of the Enlightenment, which pointed out the significance of the law, science, the rationality and own responsibility of people as well as democracy for modern societies. The transition to the industrial society was also based on the “invention” of industry-related research, for example in Wilhelmine Germany, and accompanied the rise of a new science of economics (as promoted by John Stuart Mill, for example), which addressed the transformation from an agrarian to an industrial society. The comprehensive transformation of the economic and social system over the course of the 19th century, therefore, extended far beyond technological innovation.

However, a look at history not only reveals the mutual relationships between technological change and cultural, cognitive and normative realignment, but also that these processes are characterised by non-linear dynamics and asynchronicity. History does not occur in accordance with the “political cycle” (May and Wildavsky, 1978) still so popular amongst political scientists (social pressures arise–these are analysed by academic and scientific actors–proposals are drafted for the resolving of these problems–political actors make decisions on the basis of these–these cause effects in society–these are evaluated by academic actors–corrections are undertaken ... and the ideal cycle begins once again). Actual change dynamics occur in a far more complex, deferred manner, there are steps and feedback loops both forwards and backwards. Looking back at history therefore indicates that it is by no means trivial to determine in the present if transformation processes such as the transition to a climate-compatible society are progressing, treading water or facing failure. It is only when looking back – i.e. in the future – that it becomes apparent if a transformation (in this case towards climate compatibility) has been a success or a failure.

It is against the background of these historic perspectives that the concept of the German Advisory Council on Global Change (WBGU) regarding a “social contract for sustainability” (WBGU, 2011) has been sketched out. The social contract for sustainability follows on from the social contract concepts of the intellectual fathers of the transition from the agrarian to the modern industrial societies (such as Rousseau, 1762; Locke, 1689; Kant, 1797). The core elements and the significance of such a social contract for the “great transformation” are detailed. In conclusion, three actual change dynamics are depicted, which show that mental, normative and cognitive realignments are currently underway in many societies which could be interpreted as sources for a social contract for sustainability: discussion covers the altered values of people, the increasing acceptance of low carbon development concepts in business, society and international organisations as well as new welfare concepts that acknowledge ecological limits and identify the non-economic conditions of a “good life”. A complex picture emerges. Low carbon business models are becoming increasingly attractive in many countries. Dynamism in the direction of climate compatibility is no longer restricted to niche projects, but instead stands in the focus of a comprehensive structural transition towards sustainability, for example in the case of the German energy transition (Kemfert et al., 2015). Nevertheless, greenhouse gas emissions worldwide continue to rise. At the same time, there is some

evidence that the cognitive and normative change dynamics that could be observed in many societies for a number of years now are establishing the cultural “conditions of possibility” (Kant) for a low carbon transformation. As with the industrial revolution, the transformation to sustainability is characterised by asynchronous and non-linear aspects.

## 2. The industrial revolution as a historical laboratory for the transformation to sustainability

### 2.1. The transformation of the energy system as a starting point

Interestingly, the dynamic in the direction of a low carbon economy that can currently be observed and the industrial revolution have a common starting point. Like the low-carbon transformation, the process of industrialisation, which emerged based on productivity gains and innovations in soil and nutrient management in the agricultural sector, was above all accelerated by an energy regime change (Sieferle et al., 2006; Fouquet and Pearson, 2012; Allen, 2012). The radical transformation of the energy system covered several decades, triggering innovation dynamics in adjacent economic sectors that resulted in a wholly new economic structure. Until the late 18th century, pre-industrial societies were based on a limited range of energy sources other than manpower. Water, wind, firewood, peat and beasts of burden limited the economies' productive capacity and ability to expand. The worry that energy availability might not keep pace with population growth was ever-present. The “Malthus Controversy”, instigated by his “Essay on the Principle of Population” (Malthus, 1798), testified to these worries and became embedded in the historical memory of many generations.

Around 1780, all societies depended on the use of energy from biomass. A good century later, at the beginning of the 20th century, the world was divided into a small group of industrialised countries, where the expansion of infrastructure for the use of fossil energy carriers had succeeded, and a majority of nations which were forced to continue to rely on traditional energy sources. The energy-regime changeover in these industrialised countries was by no means sudden. The “era of fossil fuels” (Osterhammel, 2009) commenced around 1820. During this phase per capita income, previously stagnant over a long period, also grew. The substitution of animal and human muscle power and wood and peat with energy stored in a fossil fuel (coal) revolutionised the economy.

Coal powered steam engines, ships and railways catapulted the industrialising societies into an era of interconnectedness, acceleration and national integration. As late as the middle of the 19th century, coal provided only a small, but steadily rising amount of the energy used, even in Europe. The history of crude oil began in Pennsylvania in 1859, when it was first extracted commercially. It took around seven decades for mineral fuels (coal and oil) to overtake biomass in global economic importance, even though the majority of the global population remained reliant on traditional energy carriers by the end of the 19th century. Japan represents an interesting case of catch-up, learning, copying and accelerating fossil development. In 1860, Japan still lagged many decades behind Britain in terms of energy technology. By 1900, however, it had completely caught up (Osterhammel, 2009; Wrigley, 2010).

The predominance of a fossil-energy regime (particularly in Britain, Germany and the USA) from the 1880s led to a second generation of industrial innovations that were based on the new energy carriers: electricity (light bulbs, electric motors, power station technologies), chemicals and the automobile. The energy revolution therefore triggered a complex, self-contained innovation cycle. This was accompanied by other innovations, such as radio transmission (1895) and cinematography (1895) (Landes, 1969; Senghaas, 1982).

### 2.2. The industrial revolution was preceded by changes in ideas and concepts

However, the industrial revolution cannot be solely reduced to a fundamental change in the energy and industrial system. In his 1500 page treatise “Verwandlung der Welt – Eine Geschichte des 19. Jahrhunderts” (“Global Metamorphosis – a History of the 19th Century”, 2009), the historian Osterhammel describes the great transformation which led to the industrial society. He analyses the period from 1770 to the 20th century. Instead of a transformation, he refers to the phase of intense change from agrarian to industrial societies he observes in “the five or six decades around 1800”, which he variously refers to as the “Schwellenjahrzehnte” – the decades of emergence, the “Epochenwandel” – a time of epochal transition, “Sattelzeit” – a time of historical discontinuity – or “Wendezeit”, the turning point (Osterhammel, 2009). Osterhammel concludes that great epochal transitions leading to a “global metamorphosis” last several decades. In these phases of “Übergänge” and “Zäsuren” (transitory and incisive change), economic, cultural and social, but also ecological processes progressing at different speeds (Braudel, 1958) become more concentrated, gelling into transformative dynamics, influenced by a great number of actor groups which ultimately, albeit with potentially differing intentions, advance the change in a specific direction (Osterhammel, 2009).

History therefore knows no clearly definable temporal evolutionary tipping-points heralding an epochal change. Historical waves and comprehensive transformations are actually the result of “Häufigkeitsverdichtungen von Veränderungen”, “a concurrence of multiple changes, which can either be an ongoing progress or take place with interruptions; they can occur either additively or cumulatively, either reversibly or irreversibly, either at a steady or an unsteady pace” (Osterhammel, 2009). Only ex-post analysis reveals whether an epochal change, as in this event from the era of agrarian to the era of industrial societies, has taken place.

In these transformation processes there are variables that only change slowly, triggering creeping changes (such as core human beliefs, social concepts and heuristics) and other variables that can trigger rapid changes of direction (technological innovations) (Eßer, 1998; Messner, 1997; Kahneman, 2011).

The non-linearity of far-reaching social transformations becomes particularly apparent in the non-parallelism between the history of ideas and real political changes. A look at the history of Enlightenment shows that considerable time passes before radical ideas and new guiding principles permeate societies to ultimately lead to great changes. Ideas are therefore “slow change variables”, they do not generally have a direct effect on societies (Appiah, 2010). However, at the same time

the following also applies: the core principles of modern societies, the importance of legal systems, liberties and civil rights, rationality and science were developed far in advance of the energy-oriented fundamental innovations of the industrial revolution. The social, cultural and cognitive “software” of modern societies was developed by the thinkers of the Enlightenment. John Locke (1632–1704) argued for Enlightenment and Reason for the entire second half of the 17th century. French philosopher René Descartes (1596–1650) established the French rationalism later expanded by Voltaire (1694–1778) and Rousseau (1712–1778). Kant’s famous essay “An Answer to the Question: What is Enlightenment?”, in which he demanded “man’s emergence from his self-imposed immaturity”, was published in 1784 (Kant, 1784). Whilst the philosophers of the Age of Enlightenment advocated liberty, reason, science, and the “welfare of humanity”, and “preconceived” democratic societies, their own were still dominated by the counter-enlightenment philosophies propagated by either the Catholic or the Protestant Church, depending on locality. In either case, they were living a life embedded in agrarian societies still far removed from the new ideals of the Enlightenment. In a later phase this “software” of the Enlightenment and the technological “hardware” of the engineers of the arising industrial economy succeeded in laying the foundations for the modern industrial society. New concepts and ideas do not translate immediately into societal change. They need time to be absorbed into their societies. This is an important result of the literature on socio-technical transitions (Rotmans et al., 2001; Grin et al., 2010; Geels, 2014) and of the literature on the dynamics of cognitive, normative or cultural shifts and (r)evolutions in societies alike (Kant, 1797; Mayntz, 2012; Appiah, 2010). In this respect, the concept of “Enlightenment” and the concept of “Sustainability” follow very similar trajectories. Both are forerunners and pioneers of economic transformation processes.

### 2.3. Direct symbioses of industrial and cultural transformation

The proponents of the Enlightenment contributed to the development of the history of thought as the basis for modern societies long before the industrial innovations transformed agrarian society. Their social and cultural “inventions” formed a reservoir of ideas, norms, values and principles that could be accessed by society over the course of time. The legacy of the Enlightenment delivered a long-term effect, making the convergence of industrial society, science and law as well as subsequent industrial societies, democracies and welfare states possible.

The onset of the energy revolution is associated with further cultural change dynamics, arising in direct symbiosis with technological innovations. Energy became a “cultural leitmotiv” (Osterhammel, 2009). The links between science and industry became closer and the age of large-scale industrial research began. The scientific organisations “invented the method of invention” (Alfred North Whitehead, from Osterhammel, 2009). Commercially successful inventors such as Werner Siemens, who discovered the electro-dynamic principle in 1866, and Thomas Alva Edison, who investigated electricity generation and distribution, helped to shape the founding years of Germany’s Wilhelmine era. Fossil energy carriers completely altered the way humankind saw the world,

as people were no longer forced to depend on elemental natural forces, particularly in the form of fire. By way of the steam engine, fossil fuels released previously unimaginable forces and application possibilities, increased the productivity of manpower in the emerging industry as well as in agriculture, and, thanks to the railway, allowed acceleration and geographical interconnectedness (Landes, 1969; Senghaas, 1982).

These changes also affected business sciences and economics. In the middle of the 19th century, Karl Marx referred to industrialism and capitalism as new social structures (Marx, 1867); in 1848, John Stuart Mill outlined the various approaches of traditional political economy in his comprehensive synthesis “Principles of Political Economy”, which became the analytical foundation for an economy in which industry was replacing agriculture as the leading sector (Mill, 1848). These changes also resonated in art and philosophy. Around 1830, the heyday of philosophical idealism and romanticism in European, and particularly French, German and English literature, came to an end (Honour, 1979). European painting underwent a transition towards realism (Arp Museum/Bucerius Kunst Forum, 2015).

### 3. The transformation to low carbon development – the idea of a social contract for sustainability

This sketch of the technological, social and cultural dimensions as drivers behind the industrial revolution that resulted in the transition from an agrarian to an industrial society over the course of a number of decades highlights the necessity of also regarding the “great transformation to sustainability” (WBGU, 2011) as a comprehensive process of social change. The climate protection discussion began as a scientific debate of the prime movers and possible consequences of global warming (IPCC, 1990); this transformed itself – by analogy with the CFC problem that resulted in the Montreal Protocol – into a global environmental protection discourse regarding the reduction of greenhouse gases (WBGU, 2009), evolving into an innovation and industrial policy discussion regarding possible paths to a low carbon economy (OECD, 2011a; Pegels, 2014; Lütkenhorst et al., 2014; Scoones et al. 2015) and expanding to form a search process for the core elements of the transformation of a 250-year-old social formation into a new welfare model that could unite the contracting boundaries of the earth system with the needs and requirements of soon-to-be 9 billion people (Rockström et al., 2009; Jackson, 2009; WBGU, 2011). The central element of such a social change is the formation of transformative narratives that can contribute to the successive overcoming of the concept of the industrial society that has prevailed for over two hundred years, a concept based on fossil fuels and high consumption of resources.

Recent research in the fields of behavioural economics (Akerlof and Shiller, 2009), experimental psychology (Tomasello, 2014), evolutionary anthropology (Dunbar, 2010), political economy (Ostrom and Walker, 2003), or on “Actor-oriented Institutionalism” (Mayntz, 2002) concur with regard to the importance of widely accepted narratives to guide the activities of actors. Narratives reduce complexity, create collective perspectives, support reliability of expectations, build a basis for current and future-oriented action plans, and are a foundation for the co-operation between actors (Messner et al.,

2014). What is needed now is a new “storyline” to further develop human civilisation as well as the terms “modernisation” and “development”. That is easier said than done, because Keynes (1972) was probably quite correct when he surmised: “The difficulty lies not so much in developing new ideas as in escaping from old ones” (Keynes, 1936).

Against this background the WBGU (2011: 293–94) has introduced the concept of a social contract for sustainability into the discussion. The WBGU is developing this idea on the basis of social contract constructions that arose in the transition from agrarian society to modern industrial society. The idea of the social contract was developed from the natural law of the early Modern era, by authors such as Thomas Hobbes (1998), Locke (1689), Rousseau (1762) and Immanuel Kant (1797). The social contract enquires how an agreement between rulers and the ruled can guarantee order and the cohabitation of the people in an alliance between state and society. The contemporary background to these contractual theory considerations was the religious and territorial conflicts of the emerging structure of European states.

The “basis of contract” of the industrial revolution can be described as an interaction between companies, engineers and bankers with an open, progressive administration and confident middle class. These actors successively cast off the feudal shackles and religious dogma of the hierarchical and agrarian society, utilising an unwritten social contract to secure the loose coupling of the resultant, autonomous system of state, politics, business, technology and bourgeois society for the mutual benefit of all of these. The underlying construction was as follows: free and equal individuals assign their rights to a government, with this assignment itself obliging the state to protect its citizens, with these in turn subject to civic duties (such as taxes, military service). The state thereby establishes its monopoly on the use of force, which protects the citizens with its elementary fundamental rights to inviolability and individual opportunities to develop, as well as guaranteeing property rights. Parliaments, representing the people, decide upon the use of the state's resources, which are generated by the people. Ideally, these ruling organisations enjoy the approval and thereby legitimisation of all those concerned. This contractual construct does not reflect the exact description of actual processes, however, it is an effective norm for the founding of a modern state that is not bestowed by God, but rather established by sovereign people.

The social contract constructions of the authors named above differ in their form. Hobbes considered the “war of all against all” to be the natural status, thus justifying the state monopoly on the use of force. Locke and Kant viewed people as individuals driven by reason, principally capable of peaceful coexistence if they create a mutual order for themselves (the social contract). The social contract concept of the WBGU follows on from the image of mankind held by Locke and Kant. In principle, people are sensible creatures capable of recognising a crisis in the earth system as a consequence of their own production and consumption style – and of remedying this. This calls for a social contract for sustainability, one that takes account of three challenges that Locke and Kant were not faced with in their time: firstly, ongoing globalisation means that the nation state is no longer the sole basis for the contractual relationship, instead the citizens of the nation state are required to include global risks (e.g. for the earth system)

and the legitimate interests of third parties, i.e. other members of the global society; secondly, the interaction between mankind, the environment and the earth system must play a central role in the new social contract; thirdly, in addition to states and citizens, the new social contract must acknowledge the significance of self-organising civil societies and the community of scientific experts whose findings make it possible to assess future risks, for example of climate change, and to develop options for action.

The great transformation towards sustainability will require significant investment and a wide range of innovations, which will need to confront considerable inertia within societies. The trade-off in the social contract for sustainability lies in citizens and civil society supporting innovation expectations that are normatively bound to the postulate of sustainability and for the subsequent benefits and corresponding participation rights for which they abandon their inertia. The WBGU (2011) proposes four central, normative axes of a social contract for sustainability. The contract is based firstly upon a culture of mindfulness of the earth system and the sub-components thereof that are central to people (out of ecological responsibility, out of stewardship to the earth system, “ecological citizenship”) (Dobson and Bell, 2005); secondly, on a culture of local and global stakeholding (out of democratic responsibility) (Leach et al., 2005; Koa, 2007; Scholte, 2007) and thirdly a culture of obligation towards future generations (responsibility to the future) (Barry, 1997); fourthly, the contract is based upon a culture of global fairness, in order to balance out the costs and benefits of the sustainability transformation in and between societies and between generations in an appropriate manner (responsibility to fairness in and between societies and between generations) (Pogge, 2011, Swilling and Annecke, 2012).

The concept of the social contract symbolises that the transformation to sustainability implies a fundamental realignment of societies, which requires the legitimisation of their citizens. It will also require fundamental shifts and realignments in global institutions, global governance processes, and global civil society networks as a social contract for sustainability in a highly interdependent world which needed to be anchored on local and global levels (Berkhout et al., 2003; Biermann, 2007; WBGU, 2014). The core elements of the contract proposed by the WBGU indicate the direction in which sustainable societies could develop. They outline the key orientation points for a development corridor towards sustainability. Some decades will pass before we are able to determine ex post if such a cultural, normative and cognitive realignment occurred at the beginning of the 21st century or if inertia and adherence to established paths prevented such a transformation. We are able to *think* of possible future social dynamics, but not to *predict* these.

The following is a reconstruction of three actual change processes, representing cognitive, cultural and normative realignment in current industrial societies which can be interpreted as potential “sources” for the social contract of sustainability. An outline is provided of (a) the worldwide shift in individual values towards sustainability, (b) the erosion of legitimisation for traditional resource-intensive and climate-damaging development concepts and the increasing willingness of companies, governments and international organisations to perceive low carbon business models as an option, opportunity or normative challenge, as well as (c) the discourse regarding new welfare models as models for the assessment of social

progress and determination of the elements of “a good life” in the 21st century. It is possible that the interaction of these cultural and cognitive search processes and innovations will give rise to the mental infrastructures of a transformation towards sustainability, whilst emissions and the consumption of resources still continue to follow the old path of development and power structures, reflecting the old development model, still hinder sustainability transformations (Newell, 2015). As Osterhammel illustrated, asynchronicity is a characteristic of far-reaching transformation.

### 3.1. Changes in attitude towards sustainability as a universal pattern

The discussion regarding the ecological boundaries of the industrial society is more than four decades old. One of its starting points was the study “Limits to growth” (Meadows et al., 1972), which triggered international consideration. The sustainability discourse of the past decades has left its mark worldwide in the attitudes of people to central environmental issues. The findings of the 5th World Value Survey indicate that 89.3% of the people surveyed in 49 countries consider global warming to be a manmade, serious problem for the future of our society (WVS, 2010). Even in countries with an influential, climate-sceptical public, such as the USA, South Africa or China, the majority of the population supports these views. The survey also shows that it is not just climate change that is being taken seriously by a similarly large number of people, but also other challenges to sustainability such as the loss of species and threats to biodiversity. The survey documents that material prosperity and social security continues to be of great significance to the wellbeing of people, although sustainability issues are gaining increasingly in significance. For the majority of people in the countries surveyed material and post-material value spheres no longer represent a contradiction, instead they are interwoven with one another. This applies, as the WVS data shows, in accordance with the theories on value shifts (Inglehart, 2008), clearly in prosperous societies but also increasingly in less affluent societies such as Colombia, China and South Africa. The findings of the World Value Survey have also been confirmed by other studies (Danish Board of Technology, 2009; Research Center, 2009; Gallup, 2010). According to this information, sustainability-oriented discourse and policies meet the agreement of many people in many countries and regions of the world. “Sustainability” is therefore no longer a niche subject, but has instead become a key element of the canon of norms and values, worldwide and through all sections of society. Nevertheless, in specific cases sustainability goals may conflict with other objective systems (social systems, employment, security issues). The shift in values towards sustainability is therefore not automatically translated into altered personal, economic or political behaviour, but without this shift in values fundamental “green transformations” would be scarcely conceivable. The World Value Survey and other studies therefore point to extensive cultural, normative and cognitive changes in the deep structures of many societies which, as described by Osterhammel (2009), can interact with other dynamics to contribute to transformative change. The shift in values detailed is a necessary albeit insufficient condition for sustainability transformation. It creates the basic structure, the “soft ware” for

legitimate action and policies towards sustainability and changes therefore the dynamics of the “politics of the green transformation” (Scoones et al. 2015).

### 3.2. Co-existence of old and new development thinking

It is not only individual values that are changing, but also the discourse regarding socio-economic development paradigms and sustainable economic business models. In 1992, the year of the first Rio Conference on “Environment and Development”, sustainability was still a niche discourse in most societies, with little impact on “real politics” or “real business” decisions. Since then it has become a widespread pattern of perception that permeates politics, the economy and society. The legitimacy of the established high-carbon regime has suffered radical erosion in recent years in many countries. That the fossil-fuelled growth model has no long term future is hardly disputed these days, not even, as a rule, by the protagonists of greenhouse-gas-intensive companies, sectors or economies. In many societies, firms, or international organisations the proponents of the old development paradigm have gone on the defensive, they try (at international climate conferences or in the context of national reform processes) to delay the transformation to a low carbon economy, they argue for the protection of their interests, the legitimacy of which is under pressure, and they advocate greenhouse gas emission reduction targets that are “realistic” (i.e. as undemanding as possible), instead of reductions which are compatible with a 2 degrees global warming trajectory (Leggewie and Messner, 2012; Lütkenhorst et al., 2014; Kemfert et al., 2015). The change in the basis of legitimacy is not a sudden process, but rather an ongoing and non-linear one. Fig. 1 shows phases in processes of change occurring in companies and organisations as a consequence of external shocks (Meifert, 2011). This heuristic and the division into phases of change help to illustrate the process of transformation towards a low carbon development concept. The questioning of the old growth model in “Limits to growth” (Meadows et al., 1972), for example, was initially rejected and stigmatised as a naive world view (Phases 1 and 2). The 1987 Brundtland Report (WCED, 1987) and the 1992 Rio Conference confirmed the core criticisms levelled at the established growth paths. They enjoyed a considerable degree of recognition (Phase 2/3: from denial to abandonment of old safeguards), but were not yet able to replace the old high carbon growth concept. The 2006 Stern Report on the cost of climate change (Stern, 2006) and the 2007 IPCC Report (IPCC, 2007) have resulted in many companies and governments throughout the world accepting that fossil fuels really do not have a future as the basis of the world economy (Phase 4). Yet the changes are certainly not occurring synchronously at international level. Whilst such countries as Russia and many actors in the USA are still between Phases 2 and 4 (rejection, overestimation of their own abilities; abandonment of old safeguards; acceptance of pressure for change), the 12th Five-Year Plan launched by the Chinese government in 2011, in which energy efficiency and low-carbon development plays a central role for the first time, or the renewable energy plan of the government of Morocco may indicate that the decision-makers have opted to take up the challenge of climate-compatible transformation (Phases 5 and 6). Germany’s ambitious change of energy policy, which now provides for the renewable share of energy generation to

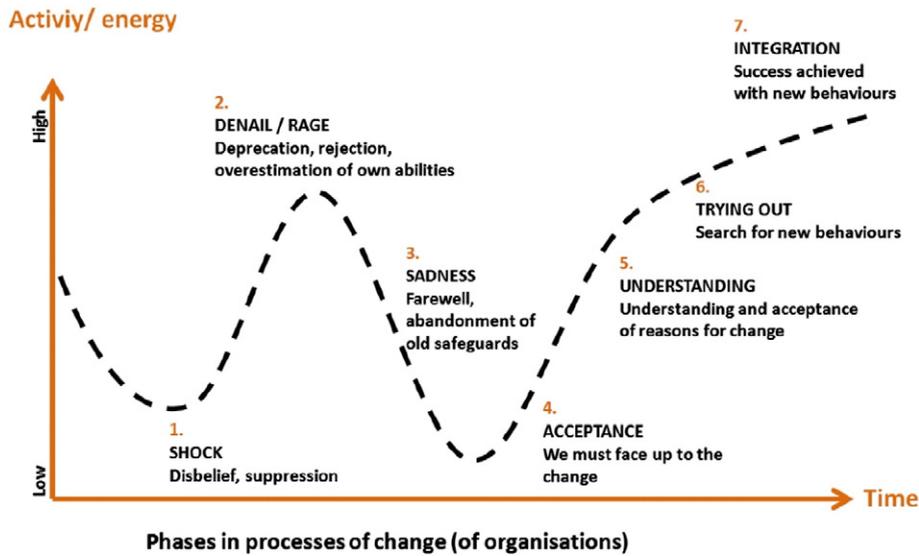


Fig. 1. Phases in processes of change (of organisations).  
Source: Meifert, 2011.

rise to 40% by 2020 and to at least 80% by 2050, is in itself a proactive transformation strategy (Phases 6 and 7).

Despite these dynamics of change, the erosion of the legitimacy of the old growth model globally and in the national economies is not yet so far advanced, nor is the development of the legitimacy of the new development path yet so manifest that the transformation to a low carbon development path can be considered a foregone conclusion. Instead, the old and new development concepts often co-exist (Leggewie and Messner, 2012). This co-existence can be described as a process in which tipping-point situations arise between “the old” and “the new”. Interestingly, dynamics that point in the direction of a low carbon transformation are emerging, not only as a result of low-carbon innovators and pioneers outside the mainstream of their respective economies and societies (as in the context of the 1992 Rio Conference), but in established firms and

institutions themselves. This greatly improves the chances of transformation (Fig. 2).

Tipping-point constellations can be observed, for instance, in the following areas: the World Bank continues to have strong departments and actors who support the fossil-fuel-based development model and obstruct the transformation to a low-carbon economy, whilst the promoters, programmes, analytical reports and investment pledges that endorse the efforts to achieve climate compatibility are steadily gaining in importance in parallel (World Bank, 2012) – recently supported by the new president of the World Bank. In many established companies (in the automotive, chemical and energy industries) small CSR departments that once looked into the environmental and social effects of their “core business” have grown into strong green innovation divisions. Within the same companies the established “fossil-fuel-based corporate fields” are now

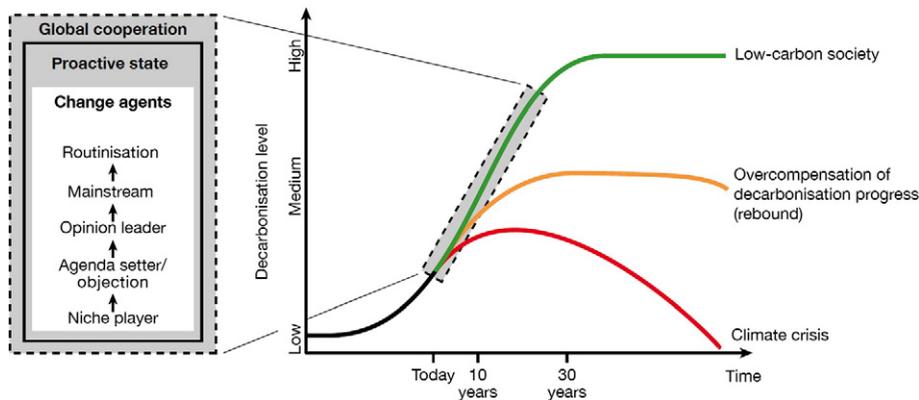


Fig. 2. The transformation’s temporal dynamics and action levels. The goal of the transformation is a low-carbon society. Central to the transformation is the decarbonisation of energy systems. Left: The proactive state and the change agents are the key players. As far as the change agents are concerned, they must move away from a marginalised existence and increase their impact through widespread inclusion in social routines. Right: Decisive action for a change of course towards transformation must be taken within the next decade if the conversion is to succeed within the next 30 years. The sustainable path (green) manages the transition from high-carbon to low-carbon society in time. Overcompensation for decarbonisation advances (for example through rebound effects) could lead to rendering climate protection measures ineffective, so that the transformation fails (yellow). Moderate endeavours only carry the risk of path dependencies that will lead to a global climate crisis (red).

Source: WBGU – German Advisory Council on Global Change, 2011; modified acc. to Grin et al., 2010.

confronted by departments that are planning for a green future and gaining in strength. Old business concepts and low-carbon-oriented business plans are coexisting in many firms (Altenburg, 2012; Altenburg et al., 2012; Lema et al., 2013; Kemfert et al., 2015; Global Investor Coalition on Climate Change, 2014). In many societies the challenges posed by the transformation towards low carbon development trajectories are no longer being fought out between “green” and “conventional” parties, but within parties across the whole political spectrum (Giddens, 2009). The transformation dynamics have thus migrated from the low-carbon pioneers outside the high-carbon mainstream to the centre of the economy and society, thus increasing the potential for a low carbon transformation.

### 3.3. Debates regarding new welfare concepts – intellectual laboratory for “a good life” in the 21st century

Alongside the shift in individual values and the growth in significance of low carbon development concepts, accompanied by the erosion of legitimation for high-carbon concepts, reference is also to be made to a further international process that could contribute to a sustainability-oriented realignment of our societies. Since the beginning of the 1970s research and discussion of new welfare concepts have been growing in significance, extending beyond the long-dominant concept of growth as the central, if not unique indicator for the development of welfare in society. This discussion initially has been conducted on the margins of the dominant development discourses. But during the last two decades “beyond growth” approaches have been adopted pro-actively by an increasing number of governments, parliaments and influential International Organisations (such as the OECD or the World Bank).

These normative welfare discussions can be interpreted as intellectual laboratories for the operationalisation of the WBGU social contract concept. The normative guidelines for sustainable development proposed by the WBGU merely describe a corridor, a space for socio-economic development and core principles of social cohabitation as well as the responsibility of people (for the consequences of their actions for other people in the global society, for future generations and the earth system). The arrangement of this space may take very different forms. In this respect, the global discourse on new welfare concepts as well as future-capable and desirable lifestyles can be interpreted as contributions to the operationalisation of these general principles.

The work on future welfare concepts is grouped around four topics. Firstly, there is a series of approaches that consider further facets of socio-economic development beyond the mere consideration of growth rates and GNP dynamics. The most prominent example is the Human Development approach (UNDP, 1990), which has been established for around two decades now. In addition to the amount of per-capita GNP it also represents educational indicators and human life expectancy, with the index also differentiating between men and women. The current debates on inequality challenges can be perceived as being part of this broader discussion on socio-economic development indicators (Jolliffe, 2015; Rippin, 2015). Secondly, Sen (1999) in particular has contributed to regarding opportunities for people to participate as a key dimension in a reasonable and appropriate understanding of welfare (“the capability approach”). Sen emphasises that opportunities to participate

are, on the one hand, the condition for people articulating their social needs and rights in the first place and, on the other hand, that participation opportunities are independent dimensions of a comprehensive understanding of welfare. In international development co-operation this approach has acquired great practical significance. Thirdly, a further direction of sustainability-oriented welfare concepts indicates that welfare calculations should systematically take account of the ecological costs of economic and social development. This resulted in proposals for a realignment of national accounting (Nordhaus and Tobin, 1973), the calculation of the real costs of environmental damage (Albala-Bertrand, 1993), concepts for the assessment of natural capital and its significance for economies and societies (Hawken et al., 1999), and not at least the idea of defining planetary boundaries (Rockström, 2012) and planetary guardrails (WBGU, 2009, 2011, 2014), which could define and describe a “safe operating space for humanity” (Rockström et al., 2009). Fourthly, comprehensive concepts for recording human welfare have been developed that attempt to provide answers to the question “how we want to live” (OECD, 2011b). These approaches show that human welfare and the “quality of life” is not only dependent upon economic and social chances, opportunities for participation and an environment worth living in, but that other factors such as the absence of violence, trust-based relationships, relative equality and transparent public institutions are also of great importance. Happiness research (Layard, 2005; Helliwell et al., 2015), which questions the factors influencing human contentment, also makes a contribution in this direction. That such comprehensive approaches to the conditions for a “good life” (“human wellbeing”) have been discussed in recent years in reports of the OECD (OECD, 2012), the German Bundestag (Deutscher Bundestag, 2013), the French government (Stiglitz et al., 2009), and in the global debates on the next generation of “Sustainable Development Goals” (SDSN, Sustainable Development Solutions Network, 2015) highlights the fact that the search for a future-capable welfare concept is gradually becoming central in many societies, analogue to the shifting values of individuals. The “buen vivir” discussion in Latin America (Gudyanas, 2011) and comparable search processes in Asia (Son, 2011) and Africa (Bérenger and Verdier-Chouchane, 2005) indicate that these change processes are by no means limited to wealthy societies.

## 4. Conclusions

Four conclusions can be drawn here.

Firstly, the approximately four-decade-old discourse on sustainability arose in a period in which real processes in business and society have been dominated by narrow minded growth concepts. Similar to the ideas, concepts and theories of the Enlightenment in advance of the industrial revolution the sustainability discourses can be interpreted as cognitive and normative innovations serving to prepare the way for economic and technological transformation processes.

Secondly, the analysis of the shift in values amongst people, the creation of low carbon and sustainability-oriented business models and development concepts as well as new welfare concepts are taking place worldwide and have recently made their way from the margins to the centre of social and economic debate in many societies. These could form the basis of an implicit social contract for sustainability.

Thirdly, these shifts in individual values, the increasing acceptance and significance of sustainability-oriented business models and development concepts as well as the rise of new welfare concepts as newly emerging standards for “successful development” and conditions for “a good life” as per Osterhammel could be interpreted as “concurrences of multiple changes” (Häufigkeitsverdichtungen) for cognitive and normative dynamics in the direction of a transformation to sustainability. It is possible that the cultural, cognitive, and normative “conditions of possibility” (Kant) for the transition to a sustainable social order are being created here.

Fourthly, over the course of the past decades this altered “software” of societies is accompanied by significant investments and technological developments in the direction of sustainability in an increasing number of economies and sectors. Similar to the process of the industrial revolution, these social, economic and technological processes could compact to form accelerated transformation dynamics.

With regard to the question of whether the transformation to climate compatibility is on a good or poor path, it is possible to interpret this both optimistically and pessimistically. The optimistic interpretation would be: although the emissions worldwide are continuing to rise, fossil energies are only slowly losing their significance and so far few societies have undertaken ambitious attempts towards climate compatibility, in many societies the cognitive, normative and cultural conditions for a sustainability transformation are now being established. A few demonstration cases for the economic feasibility of major low carbon investments (such as within the scope of the German energy transition) could lead to a rapid process of change and compacting of change dynamics in the direction of sustainability (WBGU – German Advisory Council on Global Change, 2014).

The pessimistic interpretation would be: although key mental infrastructures of a sustainability transformation are spreading relatively quickly now in many societies, path-dependent investment dynamics are leading to an extension of the fossil growth pattern, with the consequence that the meeting of the 2-degree limit for global warming could already be impossible over the course of the next 1–2 decades. Time pressure is therefore an important issue. The shift in values and welfare concepts could then possibly contribute to further damage limitation, but would not be effective enough to bring about a transformation to sustainability.

It is only with the aid of historic hindsight that we will be able to definitively assess where the current socio-economic dynamics, power constellations, concurrences of change, forces of inertia and transformative innovations in the first half of the 21st century lead. From a normative perspective, the most important question is: “Is there a fast track to the green transformation?” (Schmitz, 2015).

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