skew. At the same time, the authors emphasize the normative nature of the process of analysis:

> "Our task as policy scholars is not only to provide persuasive analysis that points to problems, their interpretation and possible solutions, but also to critically examine what values (and whose values) should be taken into account in doing this […] [I]n every society at specific times certain ultimate ends (e.g. prosperity, happiness and peace) and values (e.g. freedom and democracy) result in normative rules that shape but do not determine specific actions." (Morlacchi and Martin 2009: 580)

As the empirical chapters will show, looking closely at the policies that frame science, technology and innovation means to scrutinize underlying structures and ideas, such as how decisions are made on the type and mode of science chosen for a specific purpose. Additionally, I will expose which conceptions of (sustainable) development underlie policies and what policies ultimately aim at.

2.3   Concepts of (sustainable) development

As I resort to (sustainable) development as a normative background of my analysis of science policy, the next sections of this chapter are dedicated to tracing different conceptualisations of both *development* as well as *sustainable development*. While today, even mainstream policy and public view development as a phenomenon encompassing social, political, economic as well as ecological aspects (Klochikhin 2012), this encompassing notion is indeed quite a recent turn: For a long time, in mainstream representations, *development* was limited to economic aspects, while *sustainability* was reduced to environmental concerns. In policy and practice the discourses of *development* and *environment* still are often dealt with by different communities in separated institutional structures (Sachs 2010a; Leach et al. 2012). Therefore, I scrutinize both terms separately. I will then expose different takes on science, technology, and innovation in the context of (sustainable) development, which will provide a backdrop for the empirical analysis of German science policy for cooperation with developing countries later.

2.3.1   Development

Development is a multi-faceted concept. Thomas (2000) differentiates between different denotations of the term *development*. While historical developments present one facet, another meaning denotes a vision or idea for the future, closely related to specific objectives and aspirations, which present a further meaning of the term. Last, development (cooperation) can also signify the intentional practice aimed at a specific kind of improvement. Similarly, Kothari and Minogue (2002) distinguish

between ideas, objectives and activities as interrelated elements of development as an idea. The authors agree that next to multiple development theories, there are also multiple objectives and practices of development: It is open to different, context-dependent conceptualisations. Rist (2007) argues that in most conceptualisations of development the normative aspect of positive change prevails, which often deviates from actual processes taking place on the ground.

In practice, *development* has been interpreted in different ways in different time periods and by different actors in different development paradigms (Cornwall and Brock 2005; Gore 2000; Ziai 2011). Historically, a multitude of different definitions and interpretations have succeeded and co-existed, often contradicting and contesting each other (Kothari and Minogue 2002). The openness of development as a term has enabled different actors to use the concept according to their own interests. Different conceptualisations of development therefore mirror the underlying worldviews of those in power to form the prevailing concept of development (Thomas 2000; Kothari and Minogue 2002; Cowen and Shenton 2003; Rist 2007; Cornwall and Eade 2010; Esteva 2010; Ziai 2010; 2014; 2015).

While concepts and agendas have changed over time, still there is little consensus on what exactly is to be understood by development, how it can be reached, or if it is even desirable to achieve it (Ziai 2009). On the background of the multiplicity of perspectives on development, scholars of a critical social science perspective acknowledge the discursive nature of the development agenda. Instead of searching for a shared, unambiguous definition, authors discuss the underlying issues of power, knowledge and resulting practices in international cooperation which follow from the specific way development is defined in the predominant discourse (Escobar 1992; Gardner and Lewis 2000; Gore 2000; Esteva 2010; Ziai 2010; 2015; della Faille 2011; Nederveen Pieterse 2011).

The idea of development has historical roots in the 19th century, when first intentional development thinking and practice emerged in Europe. First directed at alleviating social problems in the own country, stemming from rapid urbanisation during industrialisation, the idea of development as a state intervention was then extended to the colonies. Here, the objective was to *modernize* traditional societies by triggering economic growth and introducing modern institutions, values and norms (Crewe and Harrison 1998; Cowen and Shenton 2003).

As a discourse, embedded in institutions and practice, and thus in a dispositive sustaining the idea (ch. 3), development grew strong in parallel to the rise of capitalism after World War II. Many scholars point to US president Truman's inaugural speech (1949) as a marker of the beginning of the era of development as practice as we know it today (Rist 2007; Esteva 2010; Sachs 2010a; Ziai 2014). Even in postcolonial times, development discourse was based on the idea of modernisation: Development represented a transition to a *modern* society through economic, scientific and technological progress, which were understood to enable social and economic

upwards movement. Development discourse, modernisation and capitalist values are closely intertwined in this conceptualisation (Norgaard 1994; Crewe and Harrison 1998). The underlying assumption was a linear transition, or rather progress, from one stage of development to the next, with the western industrialized nations as examples to follow (Smith 2009). Modernisation thinking was prominent in the *take-off* model, depicting the stages of economic growth, which pictured innovation as a key factor for economic development (Rostow 1990 [1960]).

Since the mid-20th century, the discourse on development has been wildly successful. It is sustained by national governments (of developing countries, emerging economies as well as industrialized countries), in international organisations as well as by NGOs (Gore 2000; Mitlin et al. 2007) and has been converted into a binding international frame in form of the United Nations' Millennium Development Goals, followed by the Sustainable Development Goals (UNDP 2013a; UN 2015).

Despite of the overall stability of a modernisation-based development discourse, in the worldwide diffusion of the development discourse, meanings of development and resulting practices have fluctuated. Some reconceptualisations have successfully entered mainstream discourse in development policy and practice. After market-oriented, neoliberal approaches to development prevailed in the 1980s (Gore 2000; Esteva 2010), the dominant development discourse began to diversify. Instead of uniform theoretical approaches pushed by the state as main actor, different stakeholders with different concepts and approaches began to contest the notion of a single possible development path and added further dimensions of development to be tackled. Some alternative ideas, such as participatory development and ownership concepts began to influence mainstream development approaches (Cowen and Shenton 2003).

Nevertheless, the idea of modernisation continues to lie at the core of most development concepts in theory, policy and practice as a sort of *meta theory* (Kothari and Minogue 2002) and mainstream development concepts continue to be inherently linked to capitalist ideas of reducing poverty through increased economic activities and growth (Thomas 2000; Cowen and Shenton 2003; Rist 2007; Esteva 2010; Sachs 2010a). In addition, certain assumptions coined during colonialism, such as beliefs in the superiority of the metropolitan economy, technology, institutional organisation and governance, expertise and knowledge underlie even post-colonial development theories and practice (Kothari 2002; Ziai 2010). This explains why more radical reconceptualisations of development have developed into an alternative discourse rather than being taken up in mainstream development policy and practice. At the furthest pole, post-development discourse questions the underlying assumptions of development and contests its desirability. As such, it seems inherently incompatible with the current ideas and practice of mainstream

development discourse (Nederveen Pieterse 1998; Escobar 2000; Ziai 2010; Esteva 2010).

Considering nature as part of development, thus including an ecological dimension in the conceptualisation of development is a quite recent phenomenon. For a long time, development and ecological concerns seemed to be incompatible, and were dealt with in different discursive communities. In the 1970s, discourses began to interlink, finally leading to the emergence of a discourse on *sustainable development* (Sachs 2010b).

2.3.2   Sustainable development

The concept of sustainability, or sustainable development, most frequently defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987: 41), increasingly gained currency during the late 20th century. As a concept, *sustainability* stems from ideas on long-term forest management and was first mentioned by von Carlowitz in 1712. However, it did not achieve widespread usage until it was taken up in the environmental debates leading to the publication of *Our Common Future* by the World Commission on Environment and Development (WCED, the Brundtland Commission) in 1987, source of the famous quote above. The WCED turned sustainable development into its central concept, paving the road to the first United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 (Scoones 2010). This milestone event, also termed Earth Summit, lead to the publication of key documents for the further conceptionalisation and implementation of sustainability, such as the Agenda 21, the Rio Declaration on Environment and Development, the United Nations Framework Convention on Climate Change or the United Nations Convention on Biological Diversity, among others (UN 1997).

The idea of sustainable development introduced a notion of development into worldwide policy making that included environmental aspects next to social, political and economic ones (Redclift 2005). As conceptualized in the Brundtland Commission's report, sustainability thus encompassed human needs as well as environmental ones and thereby presented an alternative to the prevailing economy and growth-oriented development model (Hopwood et al. 2005). Similarly, the Rio Declaration stressed the interdependence of social, environmental and economic aspects as three pillars of sustainability and called for an integrated development (UNCED 1992a).

While quite unanimously, the Brundtland Report as well as the Earth Summit are viewed as starting points of a sustainable development discourse on a larger political and societal scale, the conceptualisations introduced have been criticized, further developed, reinterpreted and extended. In consequence, subdiscourses of sustainable development coexist today, exposing a diversified range of stances and

approaches (for an overview, see Robinson 2004; Hopwood et al. 2005; Redclift 2005; Hugé et al. 2013).

Most concepts of sustainable development still coincide in encompassing environmental, economic and social concerns and considering the interactions between these dimensions (Keiner 2005). They differ in their interpretations and weightings, however. Hugé et al. (2013) differentiate between subdiscourses according to their emphasis on the interdependence and integration of the dimensions of sustainability; the conceptualisation of boundaries set by the environmental carrying capacities; and the process of change envisaged.

Hopwood et al. (2005) introduce a continuum of standpoints on sustainability along the level of concern in view of socio-economic equality on one axis and the level of ecological concern on the other, thereby arranging extremes such as neoliberal economics, socialism, ecosocialist/ecofeminist movements as well as ecofascism on different ends of the axis (Hopwood et al. 2005: 41). In view of the extent of changes pursued, followers of different strands of sustainability subdiscourse can be additionally categorized as supporters of the status quo, as supporters of incremental change and reform or as supporters of substantial transformation. Furthermore, approaches can be differentiated according to their take on technology as a potential substitute of natural resources (weak vs. strong sustainability debate).

Some of the most influential subdiscourses of sustainable development in current policy making – followed by institutions such as the OECD or the World Bank as well as national governments – include the subdiscourses on the *green economy* (and related green growth or green innovation), and *ecological modernisation* (Hopwood et al. 2005; Schwachula et al. 2014). These stances can be positioned at the economy-oriented end of the continuum proposed by Hopwood, relying on technological means to solve environmental concerns.

Ecological modernisation as well as green economy discourses believe in saving the environment with the economy's help, mainly through technologies such as renewable energies (Mol and Spaargaren 2000; Mol and Sonnenfeld 2000; Brand 2012). Conceptualisations of sustainability from an ecological modernisation or green economy perspective rarely address social issues such as equality or power issues (Unmüßig et al. 2012; Jessop 2012; Partzsch 2015). Similar to green economy or ecological modernisation, green innovation approaches argue for maintaining the current system while adding green innovation systems to foster the development of eco-friendly technologies (Altenburg and Pegels 2012).

Neither ecological modernisation (nor green growth or green innovation approaches) belief that current institutions, such as the state or the economic system, require fundamental changes in order to reach a sustainable future (Mol and Spaargaren 2000). This makes them quite attractive for economic and political actors who are interested in maintaining the current status quo. Not surprisingly, ideas

of eco-modernisation and green economy have turned into the dominant subdiscourse of sustainability in policy and economy (Redclift 2005; Martínez-Alier et al. 2010; Wright and Kurian 2010).

In contrast, critical scholars point at the inherent ambiguity of the concept of sustainable development in view of reconciling economic progress as well as social development while respecting the environment – which is perceived as an internal conflict of goals (Robinson 2004; Redclift 2005; Sachs 2010b; Brand 2012; Hugé et al. 2013). Therefore, sustainable development is critically perceived as the "21st Century's wicked problem" (Göpel 2016: 183).

More radical views on sustainability therefore demand system transformations towards more sufficiency instead of efficiency in production and consumption. For example, as a recent critical perspective, degrowth perspectives stress social and environmental concerns. Based on the argument that "growth is not the solution but a part of the problem" (Martínez-Alier et al. 2010: 1742), degrowth opposes green growth or ecological modernisation as unsustainable pathways. Instead, the degrowth discourse challenges the traditional social primate of the economy, thus calling for a deep systemic transformation of society as a basis of sustainable development (Martínez-Alier et al. 2010; Demaria et al. 2013; Brand 2014).

In view of the diversity of competing definitions, contemporary scholars seem to agree that there is no single, unified concept of sustainable development. No standard objectives, goals, or pathways to reach sustainable development can be agreed upon. As a discursively constructed concept, which includes a normative dimension, sustainable development is open to different interpretations, which reflect the particular discursive perspective of the interpreter (Robinson 2004; Hopwood et al. 2005; Redclift 2005; Sneddon et al. 2006; Wright and Kurian 2010; Unmüßig et al. 2012; Hugé et al. 2013).

The diversity of different discursive conceptualisations as well as the own internal ambiguity allows a broad range of societal actors to subscribe to sustainable development. This may explain its wide usage and its success as a discourse on the political as well as other societal levels. Instead of discrediting sustainable development as an empty term, some scholars therefore consider sustainable development as a boundary term, which bridges different ideas and different groups of actors, including scientists as well as policy makers and civil society (Scoones 2010). Sneddon et al. equally contend that the concept supplies "some common ground for discussion among a range of developmental and environmental actors who are frequently at odds" (2006: 259). The discursive nature of the term thus may turn into a potential if ambiguities and conflicts of interest and goals are laid open and discussed in broad participatory processes.

Other scholars however paint a direr picture. According to different scholars, the ambiguity of the term does not lead to a reconcilement of interests and conflicting goals (Hopwood et al. 2005; Robinson 2004; Wright and Kurian 2010; Hugé

et al. 2013). Instead, they perceive the ambiguity as a danger: The vagueness allows deviation from the threefold objectives of sustainable development in favour of specific interests. Sustainability as a term therefore is open to co-option. Instead of leading to change, the concept of sustainable development enables politics and economy to maintain their status quo and continuing previous practices, while still profiting from a rebranding and seemingly doing the right thing (Redclift 2005). In the last years, labelling things as sustainable has become a normatively accepted disguise for economic growth, and as such appropriated even by neoliberal politics (Jessop 2012). Similarly, green activists put forward that the term has suffered a hostile take-over:

> "A 1980s term that was formerly emancipatory and critical of the system has been absorbed by Realpolitik and the economy, as well as ruling institutions and mindsets, and associated with meanings and reform options that are acceptable to them." (Unmüßig et al. 2012: 21)

The coexisting conceptualisations of (sustainable) development document that development is best perceived as a socially constructed phenomenon. As such, it must be understood as a contested, changing, and normative concept – and it is not the aim of research to give a satisfactory definition of the term. Rather, I acknowledge that manifold discursive positions have historically evolved and continue to co-exist contemporarily in science, in civil society, in policy, in institutions of development cooperation, with different agendas and aims.

As I am specifically interested in investigating and exposing in which way the concept of sustainable development is constructed in the policies of the BMBF aimed at cooperation with developing countries and emerging economies, the next section will deal with the potential impact of science (and its political frame) on sustainable development.

2.4   Science, innovation and (sustainable) development

The idea of knowledge as a precondition of (sustainable) development has a long tradition and continues to be maintained without big controversies in current development practice and policy (Hornidge 2012). Embedded in a discourse of knowledge for development, striving for knowledge as a driver of future development has become a normative goal that many governments and institutions adhere to (Hornidge 2014a). Similarly, and although certain aspects of the concept of knowledge for development are debated in the scientific community – such as its best use (Narayanaswamy 2013); the role of local or indigenous knowledge and problems of conceptualizing it as opposite of scientific knowledge (Agrawal 1995; Sillitoe 2000;