

Prochaska, Leonard; Schiller, Daniel

Article — Published Version

An evolutionary perspective on the emergence and implementation of mission-oriented innovation policy: the example of the change of the leitmotif from biotechnology to bioeconomy

Review of Evolutionary Political Economy

Provided in Cooperation with:

Springer Nature

Suggested Citation: Prochaska, Leonard; Schiller, Daniel (2021) : An evolutionary perspective on the emergence and implementation of mission-oriented innovation policy: the example of the change of the leitmotif from biotechnology to bioeconomy, Review of Evolutionary Political Economy, ISSN 2662-6144, Springer International Publishing, Cham, Vol. 2, Iss. 1, pp. 141-249, <https://doi.org/10.1007/s43253-021-00033-8>

This Version is available at:

<https://hdl.handle.net/10419/287648>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>



An evolutionary perspective on the emergence and implementation of mission-oriented innovation policy: the example of the change of the leitmotif from biotechnology to bioeconomy

Leonard Prochaska¹ · Daniel Schiller¹

Received: 16 March 2020 / Accepted: 1 January 2021 / Published online: 1 April 2021

© The Author(s) 2021

Abstract

The design and implementation of innovation policy funding programmes has been the subject of scientific and political debate for decades. Especially the increasingly popular approach of mission-oriented innovation policies is a much discussed subject. The question of how missions arise, what rhetoric accompanies them and how they are eventually implemented has not yet been sufficiently clarified and specification is lacking. Whether mission-oriented innovation policy actually follows a strict top-down logic, or whether the policymaking process rather resembles a certain evolutionary scheme is questioned in this study. On the basis of the change within many policy strategy papers from biotechnology to a much broader bioeconomy, it is shown that, in reality, the transition does not follow a linear sequence. Neither excessive prioritisation nor neglect of a selected sector can be confirmed in this analysis. Within the bioeconomy, however, a clear change can be identified. Biotechnology funding was visibly reduced as part of the change of leitmotif while R&D increased in the agricultural sector in particular. Furthermore, it becomes clear that the issue of missing markets, which is predicted in theoretical studies, can also be confirmed empirically. So far, in terms of public involvement, little effort has been invested in the practical application of bioeconomical knowledge, which is why the intended transition towards bio-based economic activities is lagging behind expectations.

Keywords Innovation policy · Policy design · Funding data · Biotechnology · Bioeconomy

JEL codes H50 · O38 · O52 · Q57

✉ Leonard Prochaska
leonard.prochaska@uni-greifswald.de

1 Introduction

The notion of transformative system change and its implementation has been the subject of discussion in various disciplines for some time now. In the context of innovation policy, Weber and Rohracher (2012) illustrated the rationales for governmental interventions in order to initiate sustainable development and turn away from pure growth-thinking. In the past, classical mission-oriented strategies that go beyond a market-fixing mechanism and instead pursue market-shaping strategies have earned their justification. The idea of ‘tilting the playing field’ in the direction of markets or technologies identified by the government, generated the opportunity and necessity to anticipate and trigger desired technological paths, although they often focused narrowly on technical innovations (e.g. Apollo Project or Cleantech-industries) (Aghion et al. 2009; Mazzucato and Perez 2015, p. 245). Yet, the aim of modern innovation policies has progressed over time and adjusted to new conditions and challenges. Thus, increasingly more holistic, fundamental and normative elements of the socio-technical system are being targeted (Daimer et al. 2012). In fact, Kattel and Mazzucato (2018) portray the evolutionary development of innovation policy and categorise it into three stages. Accordingly, the most recent innovation policy era is characterised by normative principles and distinguishes itself from previous generations by its comprehensive approach that also includes non-technical innovations (Kuhlmann and Rip 2018). A prominent example of such a modern approach, that tackles far-reaching and fundamental shortcomings, is the Grand Societal Challenges (GSC), which are addressed, for instance, in the EU’s mission-oriented framework programme Horizon 2020 (Daimer et al. 2012). One integral objective within the EU’s GSCs as well as in various other sovereign countries is the implementation of a bioeconomy (GBC 2018; EU 2020). Over the last couple of years, the concept of a bioeconomy (the term ‘bio-based economy’ is used synonymously in this paper) has gained momentum due to the urgency to overcome dependence on fossil resources and also as a response to anthropogenic climate change. In simple terms, bioeconomy is understood as the concept of a ‘gradual replacement of fossil-based feedstocks with bio-based ones’ (OECD 2018, p. 11). A wide range of published strategy papers and interest groups, such as environmentalists or dedicated companies, have raised awareness of a bio-based economy as a leitmotif for politics, economy, the public and science.

It shows that innovation policy and the character of targeted objectives have evolved successively. However, it is often not clear how a transition of policy goals is defined and consequently pursued. In light of this fact, it is our aim to assess whether and in what way the shift in political discourse from biotechnology to bioeconomy has been reflected by a transition in both funding programmes and projects. In order to achieve this, we go back to the origin of public bio-themed R&D support at a programmatic level, starting with systemic biotechnology funding, and illustrate the evolution from biotechnology to bioeconomy. At the same time, we trace the implementation at a project level so that we can both assess the actual execution of the stated transition and identify the priorities within the bioeconomy. For this purpose, we built a database consisting of all relevant bioeconomy projects that have been funded by the German government between 1995 and 2015. In the process, we divided the bioeconomy into its components to determine realised funding measures. We chose Germany as the observation unit due to its early commitment to the bioeconomy and the availability of sufficient data, which allows an examination of the funding patterns and for conclusions to be drawn about the policy change over time.

With this study we are contributing to existing research in two respects. Firstly, by tracing the evolution of thematic shifts at both programmatic and project levels, we gain a better understanding of how political trends emerge, develop and are implemented. There is still a lack of knowledge about evolutionary mechanisms underlying policymaking processes. By addressing the different leitmotifs of biotechnology and bioeconomy support, we are able to shed light on the question whether policy evolution either follows a linear top-down approach or is rather accompanied by bottom-up dynamics and feedback loops. Secondly, social-science literature dedicated to the bioeconomy is still rare and based on different opinions about the bioeconomy's scope. We therefore make the bioeconomy tangible by dissecting it and thus illustrate its comprehensive character along several parts of the value chain from raw materials to final products and industrial applications. This allows us to categorise and quantify its publicly funded knowledge-based component.

This article is structured as follows: First we discuss the transformation of innovation policies and outline the topic of mission-oriented strategies more in greater detail. This is succeeded by a discussion of mechanisms in the policymaking process. Subsequently, we embed this discussion in the bioeconomy context, followed by an historical overview of bio-related funding in Germany on a programmatic level. Thereafter, the data at the project level are described, analysed and evaluated. Finally, the results are discussed and conclusions are drawn.

2 Innovation policy in a state of change

Within the last two decades increasingly more attention has been paid to the subject of innovation policy (Edler and Fagerberg 2017). As Edler et al. (2016) emphasise, there are manifold innovation policy instruments to attain certain objectives within economies, either through supply- or demand-side policy. This set of policy tools has undergone a persistent progression and can be distinguished according to the corresponding theoretical principles (Schot and Steinmueller 2018). In the second half of the twentieth century, neoclassical thinking has dominated economics. The integration of technological progress as a decisive factor for growth (cf. Solow-Swan model) led to the pursuit of a policy scheme with the primary goal to prevent market-failures such as insufficient R&D spending. Consequently, funding for foundational research or direct support to firm R&D have been the most common and popular instruments in this era (Edler and Fagerberg 2017; Kattel and Mazzucato 2018). Further applied mechanisms were regulations and direct subsidies for specific industries like tax treatments (Schot and Steinmueller 2018). This conception altered considerably in the late 1980s due to the establishment of the innovation system approach amongst others by Freeman (1987) and Freeman and Lundvall (1988) (Weber and Rohracher 2012). By acknowledging failures at the system-level, new policy tools complemented the former market failure-perspective. As a result, cluster policies, network stimulating approaches and the encouragement of agency such as start-up finance and fostering entrepreneurship have been introduced as crucial means (Edler and Fagerberg 2017). Up to this point, economic incentives such as preventing inferior technical systems, relinquishing industries in a state of negative lock-in or gaining first-mover advantages in novel technologies were main rationales for innovation policy (Aghion et al. 2009). However, increasingly negative social and ecological externalities, partially induced by growth and innovation, required a new political discourse (Weber and Rohracher 2012; Biggi and Giuliani 2020). While Kattel and

Mazzucato (2018, p. 788) identified a ‘normative turn’ in modern policy strategies, Weber and Rohracher (2012) as well as Schot and Steinmueller (2018) point to the necessity of a transformative innovation policy. Climate change, growing income disparities within and between countries, and lack of access to education are just some examples for comprehensive problems that need to be tackled by governmental authorities. This, again, requires novel practices in policy steering and illustrate the incessant adjustments that are mandatory in order to cope with changing circumstances.

One highly debated aspect in this context is the proactive mission-oriented approach to overcome conventional ‘neutral’ innovation policies (i. a. Martin 1995; Aghion et al. 2009; Weber and Rohracher 2012; Kivimaa and Kern 2016; Mazzucato and Semieniuk 2017). In lieu of subsidising regardless of the technological field, systematic funding that contributes to a selected mission is more likely to shake up existing structures than mere broad unspecific funding tending to maintain the status quo. Mazzucato (2014, p. 5) justifies the necessity of state intervention since it is ‘providing the vision and the dynamic push to make things happen that otherwise would not have’ and implies the government’s opportunities to take up structural challenges and shape necessary markets. Since individual firms are not capable to solve problems that span multiple sectors and most economic actors have a lack of commercial incentives, national or even supranational policies are crucial in order to create a coherent, stable and long-term roadmap as well as to compensate for deficient investments in the private sector (Mazzucato 2014). In addition, commercial actors rarely contribute financially to basic and applied research since new developments in emerging sectors are highly uncertain and therefore risky. This lack of patient or long-term investments in more difficult to manage and ambitious paths is a restraining factor for scientific advancement. Therefore, the rationale behind public involvement is well established (Aghion et al. 2009).

Nonetheless, there is also scepticism with regard to mission-oriented policies. For instance, since it is anything but trivial for a government authority to plan and forecast the economic system (Hayek 1945) and because of imperfect knowledge (or ‘pretence of knowledge’ (Hayek 1975)) there is a risk involved with merely ‘picking winners’. The most uncertain and demanding part of policies is to identify or rather anticipate market-failures as a basis for the development of appropriate programme designs (Ergas 1987). This is related with a distortion of competition by public authorities and could potentially carry a certain arbitrariness. To illustrate the latent underlying risk of this process, Hughes (2012, p. 39) terms this process as ‘choosing races and placing bets’. Moreover, the concrete realisation of a comprehensive, normative mission such as the implementation of a bio-based economy remains a highly complex task. A deeper understanding is needed whether clearly articulated missions (Frenken 2017; Mazzucato 2018), room for experimentation on all levels (policy design, producer, user, society etc.) (Weber and Rohracher 2012; Schot and Steinmueller 2018), or a combination of both might suit best for holistic objectives that concern the entirety of a (global) system.

3 The character of mission-oriented policymaking processes

A considerable part of the criticism about mission-oriented approaches within innovation policy is provoked by its strict top-down character. In other words, the fact that political decision-makers determine a distinct direction that favours chosen technologies or economic sectors and thereby neglects or weakens other segments of the

economy might lead to the distortion of natural competition. Along with this argument, there is also the question of how missions are chosen and how they are implemented. According to Mazzucato (2014), one main argument for the state's intervention is to supply a specific vision or strategy that can be pursued mutually and otherwise would not have been tackled. Therefore, a linear top-down process could be assumed: a goal will be set by the policy and is accompanied by a certain political and public discourse and rhetoric, which will subsequently be expressed in the form of concrete funding programmes. This, in turn, is reflected in changed foci of funded projects that contribute to the stated mission.

However, in political science, over many decades a lively discussion has evolved around the character of the policymaking process (Weible 2014). In the past, this process was often understood as a multipart process that was divided into several stages such as 'Issue Definition', 'Agenda Setting', 'Policy Adoption', 'Implementation' or 'Policy Evaluation' (deLeon 1999). Initially, Lasswell (1956) conceptualised the public policymaking as a 7-step linear temporal-sequential process, which built the foundation for more elaborate phase-based concepts. Within this framework, Jones (1970) derived the notion of a policy cycle, which emphasises the evolutionary and self-evaluative nature of public policies, and only comes to an end when a policy is terminated. Subsequently, this theoretical model faced varied criticism, for instance that a classification into a specific sequence is neither a realistic assumption nor empirically verifiable (Sabatier and Jenkins-Smith 1993). Furthermore, the basic presumption of the top-down character of policies might lead to a bias that oversimplifies the interaction between stages, actors and other policy programmes (Sabatier and Jenkins-Smith 1993). For that reason, work in contemporary literature rather focusses on specific elements of the policy cycle, integrates theories into the entire policy process or is dissociated from thinking in distinct stages (Sabatier and Weible 2014).

Since there is a clear lack of empirical evidence about the issue of the emergence and development of novel missions or policy strategies, an explorative analysis can help provide a more detailed understanding of this process. Based on these theoretical deliberations about mission-oriented policy on the one hand and the policymaking process on the other, two contrary trajectories of policy formulation and implementation seem possible:

1. The mission-oriented policy is implemented in a linear, top-down manner. Thus, the policymakers provide the foresight to steer the process in the direction of a specific mission and subsequently, priorities in policy and the direction of projects change correspondingly.
2. The development of any policy, from identifying a mission to changing priorities within strategies to actual implementation, is a combination of top-down and bottom-up mechanisms, i.e., it resembles rather a self-renewing and evolutionary process with several interactions between not clearly separated stages.

This empirical study on bioeconomy in Germany, therefore, concentrates on the interplay between the political discourse and the implementation of the priorities determined in the form of enacted programmes and executed projects. That means, two factors are most essential in this context: timing and content. In case (a), the government sets the mission (biotechnology and bioeconomy) and consequently initiates corresponding funding programmes dedicated to this goal shortly after. Consequently, there are measurable rapid changes in quantity and content in publicly-funded R&D projects in the respective field. If

(b) applies, we assume that the mission is connected to preceding missions and is in constant evolution due to successes and failures. Funding programmes are also inspired by previous experiences and are adapted to changing circumstances. In consequence, alterations in project content and numbers will rather appear more steadily over a longer time frame.

In order to probe the case, we will initially shed light on the public bioeconomy discourse, before we concentrate on the development of funding programmes for the bioeconomy. Ultimately, analysis at the operative project level will provide insights into the implementation of the bioeconomy discourse.

4 The public bioeconomy discourse

Within the last decade, the notion of a bioeconomy replacing the current fossil resource-based economy has become prominent due to the desire to find an instrument to combat anthropogenic climate change, to transform energy systems towards renewable energies or even to deal with world hunger.

While previous support programmes had often focussed on biotechnology, the EU introduced the approach of a knowledge-based bioeconomy (KBBE) within their ‘Seventh Framework Programme’ in 2004 (Golembiewski et al. 2015). Subsequently, several other countries seized the idea of holistic bio-based systems with different national flavours depending on their idea of bioeconomy (McCormick and Kautto 2013). For instance, in 2010, the government in Germany announced a funding programme along with a policy strategy targeting the transition towards an integrated bioeconomy as one of the first countries to do so. This financing scheme is part of the ‘Hightech-Strategy’ which has been running since 2006 and represents a mission-oriented approach to benefit from the enhancing nature of the strong NIS (BMBF 2017b). Moreover, the funding measure meets the EU’s requirements to invest in education and R&D, as stipulated in the Lisbon Strategy (2000) and Europe 2020 (2010) (EP 2000; EC 2018).

It has become clear that, amongst others, politicians have high expectations that this approach will contribute to solutions for EU’s GSCs and to reach the UN’s Sustainable Development Goals (SDG). Referring to the success of the IT industry in the USA, Mowery (2006) and Aghion et al. (2009) propose combining governmental missions (e.g. demand-side policies) and sufficient public funding to achieve underlying market-shaping strategies. Acknowledged by over 50 governments worldwide, an increasing number of countries have implemented either dedicated bioeconomy strategies or incorporated bioeconomy-related strategies into their policy (GBC 2018; OECD 2018). The German government is pursuing the goal of assuming a pioneering role in this development and has therefore designed a mission-oriented programme to gain early mover advantages in anticipated technologies.¹

Although the situation looks promising at this initial stage, the establishment of a bio-based economy is anything but certain. With all the advantages that come from the holism of the bioeconomy concept, there are some idiosyncrasies which illustrate the differences between previous mission-oriented approaches and the identified bio-based

¹ One needs to take into consideration that dissimilarities between conceptions of bioeconomy ideals and the multi-faceted nature of bio-based economies result in differing foci of programme designs. For instance, the interpretation of the German NFSB, originating from the biotechnology funding scheme, is an integral component of the ‘Hightech-Strategy’ and points to a pronounced technology-driven conception of the bio-based economy and might overlook the ecological limitations of the concept (Hausknost et al. 2017).

transformation. First and foremost, the most apparent distinction when compared to path-forming policies, which are already occurring and have been evaluated, is the character of the targeted objective. Most preceding policies were aimed at specific technologies, both those which were successfully realised such as biotechnology (Lazonick and Tulum 2011), NASA's space-projects (Mazzucato 2014), Cleantech-industries (Jacobsson and Lauber 2006) or failed attempts such as supersonic aviation (Concorde) (Mazzucato 2014) or magnetic levitation trains (Transrapid) (Büllingen 1997). The bioeconomy, however, endeavours the transformation of the entire oil-based economic system and thus affects different sectors, technologies and knowledge bases. Therefore, in order to attain this objective, solutions are required that go beyond single trajectories. Thus, there is a demand for conjunctions between multiple, previously only loosely linked, paths (Tödtling and Trippel 2018). Moreover, since the imperative of the identified economy is derived predominantly from negative externalities, many markets still need to emerge in the first place. In essence, past technology policies were based on clearly defined and pegged technological targets with previously known markets and, in many cases, with the state itself as the biggest customer. In contrast, GSCs in general and the bioeconomy in particular are characterised by their complexity as well as a lack of both precise targets and consumers (Frenken 2017; Schot and Steinmueller 2018).

In addition, history has proven that the transition of energy regimes has invariably been an arduous and slow process (Philp 2018). While Frenken (2017) states that mission-oriented strategies ordinarily take 5-10 years, the relevant policy strategies cover even longer time frames, i.e. 20 years. In order to achieve the self-imposed targets it is imperative that the mission will not suffer in terms of its implementation or even be terminated after changes of government. At present, the bioeconomy is still gaining momentum on a global scale, nevertheless a long-term commitment is not invariably made due to (geo)political developments. In contrast, innovation policy aspirations often underlie a discursive process and, as a result, require broad public acceptance (Cantner and Pyka 2001). In this respect, the bioeconomy seems to have difficulties with public relations. The broad population, save for a small set of professionally affected communities, is not aware of the politically-induced leitmotif. However, the bio-based industry has the basic prerequisites to involve the entire economic system, i.e. producers and consumers in all aspects, and therefore, it demands communication with and the sensitisation of the public (Dietz et al. 2018).

Another crucial aspect for the bioeconomy's success and a frequently raised objection is the feasibility of strategy implementation in terms of capacity limits. In other words, is it viable to substitute fossil resources with renewables, develop novel products consisting of biomass and, at the same time, meet the paramount goal of securing the food supply for the increasing global population without exploiting and irreversibly damaging the ecosystem (Priefer et al. 2017)? On the basis of this issue, the underlying argument about the government's 'pretence of knowledge' (Hayek 1975) becomes clear and calls into question the identified future system. That is to say, any identified strategy not only carries the risk of not being the most efficient solution, but rather entails the danger of aggravating the current market-failure. For instance, the advancement of genetically modified organisms (GMOs) is eminently contested. There are numerous severe concerns about the intensification of this technology, which is why the EU, amongst others, has rigid restrictions against genetically modified

foodstuffs (cf. precautionary principle). There is a possibility that a new trajectory is created which exacerbates prevalent problems or generates novel ones (e.g. lead in fuel or CFC in refrigerators). Another example is the increasing production and processing of biological substances, which could lead to rebound effects caused by overcapacity and, eventually, intensify conflicts over land use. As a consequence, serious concerns have been raised about whether the bioeconomy is the optimal solution for the current problems or if, eventually, the market will develop the most efficient solution by itself (e.g. utilisation of hydrogen or the like) (Friedman 1982[1962]).

5 Political interventions to foster bioeconomy in Germany at the programme level

By looking at the previously depicted development of the bioeconomy, it becomes clear that the discourse surrounding biological research has changed substantially in the last 20 years. Before the turn of the millennium, both nationally and globally, biotechnology was one focus of mission-oriented policies. However, a trend towards the bioeconomy has been established in the political dialogue since 2004 (Patermann and Aguilar 2018). This acknowledged shift of approaches offers the opportunity to get insights into recent mission-oriented policymaking and allows to track the evolution of a current strategy that gets increasing recognition globally. Future research is encouraged to check whether the bioeconomy is an atypical case with an evolutionary structure or whether other mission-oriented strategies (e.g. the Quantum Technology Strategy or the most recent Hydrogen Strategy) follow a similar pattern. For this reason, we now provide a brief historical background of past and present bio-themed funding programmes in Germany.

Pioneering endeavours in Germany to promote biotechnology date back to the period around 1970 (Warmuth 1991; BMBF 2011; Schüler 2016). Most funding in biotechnology largely favoured basic research by public institutions and was aimed at the generation of scientific knowledge (Warmuth 1991). By establishing the innovation system approach in policies, the first systematic, regional funding strategy to commercialise biotechnological procedures was launched in 1995 (Cooke 2008; McCann and Ortega-Argilés 2013). As one of the earliest examples, the BioRegio contest was carried out by the German BMBF from 1997 to 2005 and supported the biotechnology sector in the four winning regions (Stahler et al. 2006). This political programme aimed to initiate a cold start in order to lift the lagging biotechnology sector in Germany and make it competitive and eventually, to have the leading biotechnology industry within Europe (Dohse 2000).

Subsequently, further programmes (i. a. BioProfile, BioChance, BioFuture) were added in order to continue this mission-oriented place-based² approach (Eickelpasch and Fritsch 2005; Cooke 2007; BMBF 2017d). In 2001, the BMBF introduced another funding measure ('Rahmenprogramm Biotechnologie' – 'Framework Programme Biotechnology' (FPB)) to not only foster biotechnology independent of the location (in contrast to

² BioProfile was a contest between regions that could apply with a special profile for biotechnological procedures (Stahler et al. 2006). The three winning regions were the network of Brunswick, Göttingen & Hanover, the network of Berlin & Potsdam and the network of Stuttgart, Tübingen, Esslingen, Reutlingen & Neckar-Alb. BioChance and BioFuture did not have a focus on specific regions.

BioRegio and BioProfile), but also biosciences in general. Eventually, starting in 2010, this programme merged into the ‘Nationale Forschungsstrategie Bioökonomie 2030’—‘National Research Strategy Bioeconomy 2030’ (NFSB), which is carried out by 6 Federal Ministries³ who jointly promote and fund the holistic bioeconomy concept (Hüsing et al. 2017). Afterwards, this scheme resulted in additional specific programmes, e.g. the ‘Roadmap Bio-refinery’ in 2012, and the ‘National Policy Strategy on Bioeconomy’ of the BMEL in 2013. Moreover, the coalition agreement of 2018 determined that the bioeconomy vision called ‘Von der Biologie zur Innovation’—‘From biology to innovation’ (‘Bio-Agenda’) would be pursued further instead of specific biotechnology support (Bundesregierung 2018b; BMBF 2020). In 2020, the Research and Policy Strategies were bundled to form an overall strategy (BMBF and BMEL 2020). For an overview of the dedicated bio-related strategies, see Table 1. Evidently, the German policy has altered over time from a focus on a specific technology towards a scheme aimed at tackling GSCs (Hüsing et al. 2017). Yet, this policy development pattern did not take place exclusively in Germany; it was rather a global process (OECD 2018).

The foci of the drafted programmes differed significantly. For instance, BioRegio aimed at the emergence of dedicated biotechnology firms and contained predominantly start-up financing of private companies to initiate a cluster building process. BioProfile’s measures, however, targeted public institutions in order to broadly fund biotechnology-related basic research in the regions’ respective profile areas (Stahler et al. 2006; Dohse and Stahler 2008). The subsequent FPB targeted a wider range of grantees within the biosciences, whereby the primary focus was still biotechnology. This framework supported R&D in public institutions and private projects almost equally with 44% and 38% of the overall promotion fund respectively (BMBF 2011).

The bioeconomy strategy instruments, however, cover an extensive spectrum of technologies, sciences and industries due to the holistic character. The actual number of funding lines increased with the implementation of the NFSB and a wider spectrum of topics were covered. For instance, because the government aspired to include several industries, it introduced the measure ‘Bioeconomy as societal change’ to address the underlying socio-economic challenges such as the systematic monitoring of bioeconomic processes or communication with the public (PTJ 2020). Other suitable measures to achieve the intended linking of sectors are the governmental incentives ‘Innovation spaces Bioeconomy’ which does not have any specific core branch and ‘Agrarian systems for the future’, which approaches the issue of agriculture as a whole (PTJ 2020).

The German cabinet identified and determined five fields of action within the NFSB, in which a sustainable economy oriented towards the natural cycle of materials was to be established (BMBF 2010). Hüsing et al. (2017) illustrated the differing priorities of the strategy in an in-depth evaluation of the measures undertaken within the programme. They found that the field of action ‘Industrial utilisation of renewable resources’ in particular has the greatest significance within this scheme. Less attention is paid to the following three fields of action: ‘Securing global food supplies’, ‘Sustainable agricultural production’ and ‘Production of healthy and safe food’. The promotion of the core issue ‘Biomass-based energy

³ Under the leadership of the BMBF, the following federal ministries are responsible for implementation: Ministry of Economic Affairs and Energy (BMWi), Ministry of Food and Agriculture (BMEL), Ministry of Environment, Nature Conservation and Nuclear Safety (BMU), Ministry of Economic Cooperation and Development (BMZ) and the Federal Foreign Office (AA).

Table 1 Milestones of bio-themed funding in Germany

Leit-motif	Time-period	Funding Programme	Purpose & Implementation
Biotechnology	1979-1983	'Benefit plan Biotechnology 1979-1983'	1 st programme to foster narrowly defined biotechnology
	1985-1988	'Applied Biology and Biotechnology'	Mainly basic research in biotechnology
	1997-2005	'BioRegio'	Fostering biotechnology in four regions
	1999-2007	'BioProfile'	Fostering biotechnology 'profiles' in three regions
	2001-2010 (into NFSB)	'Framework Programme Biotechnology'	Fostering Biotechnology and related biosciences
	since 2006 (continued 2014)	'Hightech-Strategy'	Prioritisation of innovations; including non-technical solutions since 2014
Bioeconomy	2010-2020	'National Research Strategy Bioeconomy' connected to the Hightech-Strategy	Conceptualisation of a bioeconomy in Germany
	2013-2020	'National Policy Strategy Bioeconomy'	Connecting multiple policy areas in the bioeconomy framework
	since 2019	'Innovation spaces Bioeconomy'	Fostering four selected regions within the bioeconomy scope
	since 2020	'National Bioeconomy Strategy' – Bundling Research and Policy Strategy	Pursuit of a mutual 'Bio-Agenda'

Source: own draft according to BT 1990; Warmuth 1991; Staehler et al. 2006; BMBF 2011; Schüler 2016

sources' is almost negligible. Further funding measures favour the development of cross-sectional technologies or the assistance of SMEs and the formation of companies (Hüsing et al. 2017). It is apparent that the origin of the strategy, which lies in biotechnology, remains an essential pillar and reflects the claim of the German government that it conducts technology-oriented and innovative R&D. In fact, twelve out of the 36 evaluated funding measures were initially a component of the former FPB (Hüsing et al. 2017). This is not extraordinary since biotechnology, labelled by the EU as 'key enabling technology', is presumed to be a driving force behind innovative processes in all upstream and downstream parts of the bioeconomy according to political thinking and thus, functions as an interdisciplinary technology that can be applied in the entire bioeconomy (BMBF 2010; EC 2012).

While the advancement of biotechnological solutions seems to be paramount considering the past and current governmental strategy for action, one key issue is the lack of diffusion of new knowledge into marketable products (Hüsing et al. 2017). Apart from extensive SME subsidisation and start-up financing, the policy seldom aims to achieve this crucial element, which simultaneously highlights the problematic nature of missing markets. Moreover, the aspect of ecological sustainability seems to be only implicitly addressed by technological advances at various levels. In fact, no explicit environmental protection measures were integrated into the framework of public funds. The same applies with regard to the matter of insufficient (governmental) demand for bio-based solutions.

In conclusion, it can be said that the innovation policy strategy has developed dynamically on paper. Initially, the focus was exclusively on biotechnology. This thematic focus, however, expanded gradually due to altered preconditions, became increasingly extensive, and eventually led to the bioeconomy concept. Thus, there was no distinct event that

terminated the biotechnology funding and afterwards launched the bioeconomy strategy. This process resembles an evolution, in which the focal point biotechnology remained constant and policy changes happened as a consequence of changed circumstances.

Considering this development, we also aim to evaluate, at project level, the actual implementation of the strategies. To be able to conduct this analysis, a clear understanding of the bioeconomy concept as well as a meaningful dataset are necessary. After delineating the structure and definition of the bioeconomy for the analysis, the data provenance and preparation will be described in the following chapters.

6 Structure of the bioeconomy


Due to the lack of a uniform and tangible bioeconomy comprehension, it is necessary to find a coherent definition for the bioeconomy concept that is suitable for the empirical analysis. Therefore, we gathered data and conceptions from various actors involved with the bioeconomy concept and systemised their opinions within a breakdown of the bioeconomy along the value chain. Since the bioeconomy is ‘largely driven by policy action and the contents of bioeconomy strategies worldwide’ (Viaggi 2016, p. 105), the political vision has determined our definition to a large degree (see Table 6 for the sources). Thus, the derived definition has a broad range, similar to the German strategy paper NFSB. We propose a breakdown into four pillars: the input, processing and output dimension as well as a socio-economic framework (see Table 2).

Although experts and literature differentiate some components of the bioeconomy in more detail than proposed, for the sake of a sensible interpretation we pooled some related subdivisions. For example, *green biotechnology* is closely connected to agriculture and often involves the research and breeding of plants and crops as well as animals and livestock. Blue biotechnology, however, which deals with the processing and utilisation of biological resources from marine habitats such as algae and fish, is defined solely by the aquatic origin of its resources (EC 2012; Zinke et al. 2016), and shows major structural overlaps with green biotechnology. For that reason, we combined these two segments.

Furthermore, while the other segments of biotechnology can be clearly demarcated and assigned to a specific industrial sector, the *white biotechnology* (or industrial biotechnology) concept is rather blurry. The common definition is the utilisation of biological resources within industrial processes and products (OECD 2009). Consequently, its application area is extremely wide and contains, for instance, the creation of innovative processes and technologies to provide biological basic material (e.g. instead of plastic) or to identify, extract and produce substances from or with organic substances within various industries. Another example is the application of microorganisms in sewage treatment plants during the purification process. It becomes clear that the scope of *white biotechnology* is quite large (BMBF 2010). We also integrated so-called grey biotechnology (environmental procedures) into this category (OECD 2009; Zinke et al. 2016).

Another field of application for the bioeconomy is the production of bio-based *products and materials* (BMBF 2010; Staffas et al. 2013). Apart from the mere substitution of existing fossil-based products, this pillar includes the development of commodities that fulfil new tasks. Additionally, branches such as the pulp and paper industries also fall into this category (EC 2012; Purkus et al. 2018).

Table 2 Structure of the bioeconomy

	Dimension	Components/Elements
	Input dimension (production)	agriculture & forestry climate & environmental protection
	Biotechnology (processing)	green biotechnology (agriculture and aquaculture, e.g. plant and animal breeding on land and in water) red biotechnology (medicine, e.g. biopharmaceuticals, human genes) white biotechnology (industry and environment, e.g. sewage treatment, new materials)
	Output dimension (material utilisation of biomass)	products and materials energy & fuels food & feed
	Socio-economic framework including non-tangible matters such as	coherent policy viable financing for companies within the bioeconomy platforms and arrangements for networking education and qualification sensitisation of the society

Source: own conception

Eventually, most stakeholders agree that for a successful implementation of the bioeconomy approach, apart from all fields directly related to biological materials and processes, a *socio-economic framework* is indispensable. In the case of realising a bio-based economy, it encompasses several generic factors like a coherent policy (Dietz et al. 2018), viable financing for companies within the bioeconomy (Viaggi 2016), platforms and arrangements for networking (OECD 2009) as well as the creation of novel professions and their qualification (formas 2012). In addition, bioeconomy-specific determinants are included. These are especially, yet not solely, the sensitisation of the society towards enlightened and conscious thinking/behaviour to trigger sustainable development (Pietzsch 2017) as well as a debate about ethical justifiability (e.g. concerning genetically modified organisms or animal welfare) (McCormick and Kautto 2013). All these features are bundled in the dimension *socio-economic framework*.

One objective of this study is to trace the transformation from biotechnology towards bioeconomy. Therefore, it is necessary to distinguish between the initial sector-focussed funding, namely the biotechnology sector, and the additional dimensions of bio-related support, which were conceptualised by the bioeconomy strategy. This is why the components of the bioeconomy concept are henceforth categorised and designated as follows (Fig. 1):

- biotechnology nucleus: green, red, and white biotechnology
- bioeconomy shell: input and output dimensions as well as the socio-economic framework

The biotechnology nucleus and the bioeconomy shell jointly represent the bioeconomy concept.

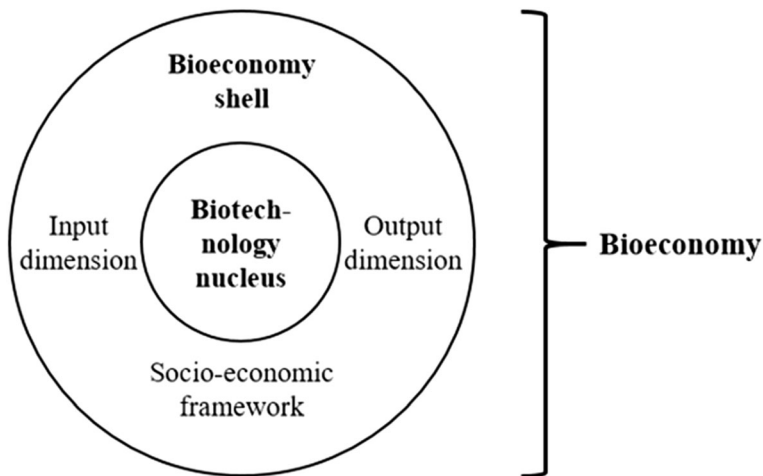


Fig. 1 Illustration of the bioeconomy components and structure. Source: own draft

7 Data and method

In order to examine the scope and scale of the actual biotechnology/bioeconomy implementation, we built a distinct database containing all projects funded by the federal ministries, which are recorded in the German funding database called ‘Förderkatalog’ (BMBF 2017a)⁴. By April 2017, the dataset comprised 191,347 projects with valid information, with the earliest entry being from 1968. The data is structured based on the applied funding measures. This internal BMBF classification is called ‘Leistungsplansystematik (LPS)—Benefit plan systematics’ and has superordinate topics such as ‘A—Health research and health economy’, ‘D—Food, Agriculture and Consumer Protection’ or ‘E—Energy research and technologies’. This classification is refined by two further tiers. Eventually, bioeconomy R&D is aggregated in its own category: ‘B—Bioeconomy’. However, there are two issues which need to be taken into account during the analysis. On the one hand, the segment ‘B’ includes projects that date from far before the official bioeconomy policy concept was formulated—the first record in this category is dated 1968, whereas the start of the bioeconomy strategy was in 2010. On the other hand, it is apparent that numerous topics or projects within several other classes such as ‘EB1920—Energetic use of biomass’, ‘GC2060—Organic electronics’ or ‘KA1210—Nanobiotechnology’ can clearly be assigned to bioeconomy, but are not covered by this class. For that reason we considered it necessary to integrate all these projects that actually

⁴ According to a statement by the BMBF, the database contains approximately 95 percent of all R&D projects funded by their ministry (with an increasing tendency). However, it is the responsibility of the other departments (e.g. Federal Ministry of Food and Agriculture, Federal Ministry for Economic Affairs and Energy) to record their projects and the data suggests that only a fraction of the ministries’ projects have been entered into the database. However, the BMBF is not only in charge of implementing the biotechnology and bioeconomy strategies, but also accounts for approximately 58% of total R&D expenditure in Germany (BMBF 2017c) and therefore, is responsible for the lion’s share of all funding. Thus, this database is sufficient in order to make empirical statements about the knowledge-driven bioeconomy funding landscape.

operate in the scope of the bioeconomy approach, including projects outside of the category ‘B—Bioeconomy’.

The database ‘Förderkatalog’ is openly accessible and offers valid information about the temporal horizon, the monetary investment, the names of the grantees as well as the executing organisation along with their respective locations and also information about the collaboration partners in the case of joint projects. We diagnosed two types of information about each undertaking’s topic which were most relevant for the identification process. In addition to the BMBF’s internal classification (LPS) that gives explanations about the subject area, the title of the project provides genuine indications about the project’s content.

Given these circumstances and based on the BMBF classification⁵, we first categorised the dataset into three divisions on the basis of comprised projects and further derived statistics per LPS (see Fig. 3), namely:

- [i] classes that were ascertained to belong to the bioeconomy,
- [ii] classes that only partially belong to the bioeconomy and
- [iii] further categories that are unlikely to contain bioeconomy projects⁶.

Consequently, with common text-mining techniques (e.g. removing whitespaces and stopwords, converting to lower cases) the project titles were simplified. Considering the main principle of the bioeconomy, namely the involvement of biological materials and processes, it is, in our opinion, an appropriate measure to draw on this basic idea and hence to create a collection of biomass-connected terms and expressions. For that reason, we detected all phrases that belong to biological substances and processes that appeared in at least five project titles and had a unique stem within division [i]. The result was a set of 374 terms (see Table 7). With this array of phrases, we calculated the amount of bioeconomy-relevant terms in each project title to identify relevant projects in [ii] and [iii]. Using these calculations, after gradual refinement of the adjusting parameters, we applied a step by step procedure to select projects relevant to the bioeconomy:

1. Classification of subdivisions from the funding database with regard to their relatedness to the bioeconomy. As a part of this classification, all projects from the subdivision [i] were selected and added to the database.
2. Application of distinct thresholds⁷
 - a. Within division [ii], we chose all projects that featured at least two keywords.
 - b. Due to certain bio-related projects in unanticipated classes [iii], the counting threshold value was set to four.

In order to categorise the bioeconomy projects into the dimensions mentioned above (see Table 2), we determined groups within BMBF’s internal classification (LPS), which are clearly assignable to one of the previously determined bioeconomy sections along the

⁵ It should be noted that this internal system is constantly reviewed and thus, retroactively changes over time.

⁶ We excluded the funding area ‘C – Civil security research’ entirely, as biological warfare agents are not part of the bioeconomy notion.

⁷ Through repeated experimentation, it became clear that the choice of threshold values of two and four proved to be the most sensible. The reduction to lower thresholds involved too many projects that were not in the bioeconomy scope. When the threshold value was lifted, too many relevant projects were excluded.

value chain. A significant proportion, however, had to be attributed by hand, which also served as a result review and occasionally led to the identification of projects which did not fit and were subsequently eliminated from the database. Table 8 displays the entire BMBF classification in which the categorisation of the bioeconomy concept is described in more detail. Furthermore, a schematic visualisation of the dataset building process is depicted in Fig. 2. Even though the database covers projects dating back to 1968, the analysis is limited to a time frame from 1995 to 2015. In Germany, the change within bio-themed funding towards the bioeconomy officially begun with the launch of the bioeconomy strategy in 2010. While the historical development of biotechnology funding before 1995 could offer interesting insights, the focus of this study is on more recent trends. By employing this method, 16,500 projects within the observation period could be identified as relevant to the bioeconomy and were included in the final dataset. Table 3 lists the basic descriptive statistics of the data.

8 Results: public funding of the bioeconomy at project level

In the following, the prepared project data will be analysed. Initially, we will give an overview of both the general development of the bioeconomy and the overall funded R&D projects. Subsequently, the structural change within the bioeconomy will be presented before the individual subclasses are examined more closely.

As has been established, the issue of the bioeconomy is increasingly attracting attention in political agendas on a global scale. While it is evident that there is a rise in bio-related strategies at a programmatic level as well as a thematic expansion, this change is less clearly evident in terms of distinct bioeconomy projects.⁸ Although the number of projects related to the bioeconomy more than quadrupled from 316 in 1995 to 1.374 in 2015, the proportion in relation to the overall amount of projects only increased slightly (see Fig. 3). The share oscillated between approximately 12 and 13 percent during the initial years of the BioRegio funding until 2003. After two steep rises to almost 20 percent of all funded R&D projects in 2004 and 2007 respectively, it has levelled off at 14 to 15 percent in recent years. Notably, there was no detectable growth in the share of bio-related R&D with the introduction of the bioeconomy strategy and the connected funding measures in 2010.

However, due to the depicted structural changes in bio-related innovation policy accompanied by the successive inclusion of a broader scope of decisive sectors, we find there was a shift within the funding of the bioeconomy. Therefore, we split the dataset into biotechnology core and bioeconomy shell (see Fig. 4). In the first years of our observation period, three quarters of all bio-related research was in biotechnology, dominated by red biotechnology. Until 2006, the general development was characterised by fluctuations without a persistent trend. From that point on, we found a significant increase of R&D beyond solely biotechnology. Eventually, in 2012, in the third year after the introduction of the bioeconomy strategy (NFSB), the number of projects in the biotechnology core was for the first time smaller than in the bioeconomy shell. Hence, the data suggest a transition of funding associated with the alteration of strategy at a programmatic level. Nevertheless, two aspects must be taken into account in this context. Firstly, while we find a clear structural

⁸ A project is only counted in the year of its beginning. As such, each project is considered only once in the following analyses.

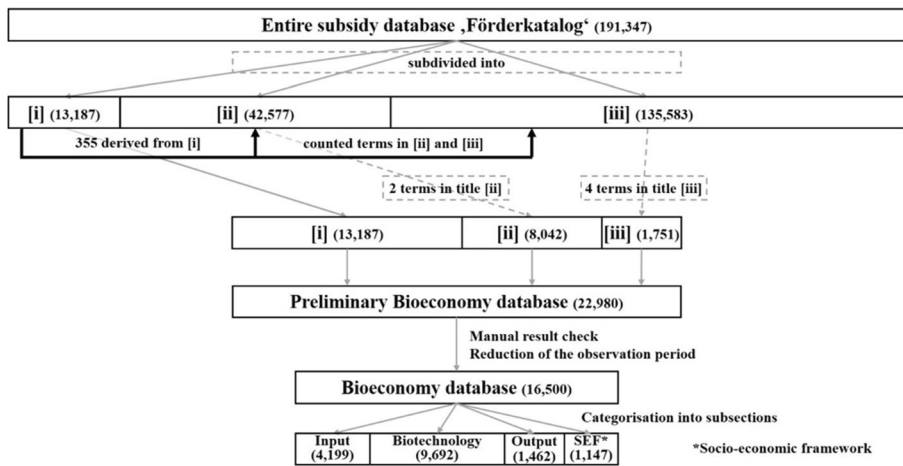


Fig. 2 Schematic process of the database derivation (not proportional). Source: own draft

transformation within bio-related support, as previously stated the proportional share of all the projects funded in Germany did not increase significantly. Secondly, the tangible change towards a biotechnology-transcending scheme at project level started roughly in 2007, possibly even in 2001, whereas the NFSB was not established until 2010. Thus, the trend towards more general bioeconomy funding was already implicitly addressed by several other funding measures (mostly driven by grants for sustainable agriculture & forestry as well as R&D in biomass-based energy & fuels). However, a great leap in favour of bioeconomy R&D activities as a consequence of the NFSB did occur in 2012. This somewhat delayed response can be explained by two facts. First, the transition from a biotechnology strategy towards a bioeconomy strategy proceeded fluidly, in which one third of all funding measures originated from the former ‘Framework Programme Biotechnology’. Secondly, each step of the process, from the announcement of the strategy to the preparation of specific funding programmes, the submission of project applications, revisions etc. up to the final project start, takes months or sometimes years.

As the structural changes within the bioeconomy sectors reveal more detailed information about the transition than the mere number of funded projects, a breakdown of these developments is illustrated in Table 4. The most obvious structural change to the

Table 3 Comparative figures of the funding datasets (1995–2015)

	Full database	Bioeconomy
Number of projects	114,448	16,500
Average funding per project in €	546,911	426,936
Median funding per project in €	208,685	235,916
Average project duration in days	995	1,118
Median project duration in days	1,095	1,095
Share of joint projects	.59	.72
Share of public organisations	NA	.66

Source: own calculations

bioeconomy funding is the steady increase of agriculture & forestry funding. At the same time, the share of support for red biotechnology dropped noticeably by 19 percentage points between the start and end of the observation period. The sector agriculture & forestry ultimately became the most funded area within the bio-based economy (based on the project count). The main driver for the conspicuous growth in significance is the involvement of the BMEL. From 2002 on (except 2005), the BMEL funded the majority of the R&D projects within agriculture & forestry. The BMBF is by far the most relevant funding source in most other areas (with the exception of energy & fuel). This illustrates the character of the bioeconomy, in which different departments are planned to deal with this subject. Two broadly defined categories were responsible for the steep increase: Between the years 2002 and 2011 the majority of projects in this sector were financed in the field ‘Sustainable agriculture, horticulture, forestry, fisheries and food industry; development of the potential of renewable raw materials’. Since 2012, the main driver has been ‘Studies on the emergence of wood and agricultural biomass, on the mobilisation of utilisation and production reserves and on increasing the use of wood and agricultural raw materials, including new production processes and products’. The BMBF had only one funding line in agriculture and forestry that featured somewhat greater aspirations: ‘Research for a future-oriented forestry’.

The second subclass of the input dimension, climate & environmental protection, was one of the most frequently considered pillars and after losing some relevance during the 2000s, it has been focussed on incrementally more since 2010. This funding, however, stems from various measures and, unlike agriculture & forestry, does not concentrate on a specific support line.

Over time, the funding share of biotechnological projects, as previously established, has become much less significant. Green and white biotechnology have remained quite stable at about ten percent (except for 3.4% in 2013-2015) and between 15 and 20 percent respectively. In contrast, only roughly half of the projects in red biotechnology were financed in the latest time period compared to previous funding. In green biotechnology, most R&D-projects were promoted with a focus on plant research. Naturally, in white biotechnology many undertakings are related to industry and are found within LPS such as ‘BioIndustry 2021’, ‘Biotechnology 2020+’ or specifically in ‘Optical technologies for lighting and environmental protection’ or ‘Analytics – Sensors, measurement methods and models’. Analogous to this, R&D in health dominates funding in red biotechnology. First and foremost, projects in the field ‘Systems biology’ have the biggest share throughout the whole observation period. More recently, funding of SMEs and thereby a bigger focus on specific market solutions can be perceived. One needs to bear in mind that the overall amount did not decline (on the contrary, project numbers in the red biotechnology almost doubled from 483 to 916 between the first and last time period shown), but other bioeconomy sectors have recorded more significant increases in terms of the number of projects.

The subclasses of the output dimensions generally fluctuated at a low base level except for energy-related projects. This outcome reflects and confirms Hüsing et al.'s (2017) and Frenken's (2017) findings that there is a lack of clear markets and customers for bioeconomy products. Projects to develop bio-based products or materials have had some peaks, resulting from temporary funding measures such as ‘Identification and investigation of marine natural substances’ or ‘Integrated environmental protection in the timber and furniture industries’, but did not receive persistent research grants. Interestingly, energy & fuels from biomass is the only segment of all classes in the output pillar that shows a slightly positive development in terms of the project count. Contradictory to Hüsing et al. (2017), who identified the field of

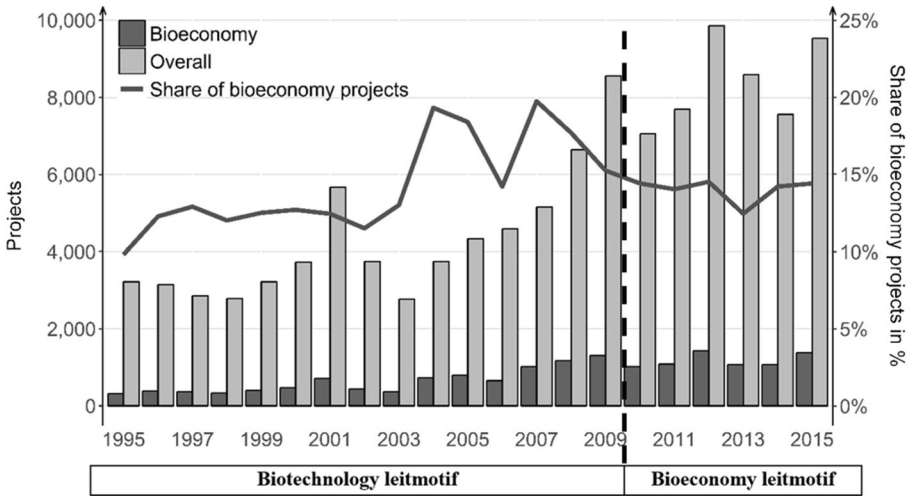


Fig. 3 Funded projects in Germany (1995–2015). Source: own calculations

action 'Biomass-based energy sources' as being neglected in terms of public R&D, we find a rise from zero projects in 1995–1997 to around 200 each in the last three time periods. As mentioned before, this segment differs slightly from the others, as more than half of the R&D funding are derived from the Federal Ministry for Economic Affairs and Energy. 'Energetic use of biomass' and 'Basic energy research' are the categories with the most undertakings within this category. R&D in food & feed industries only had a very limited share of the bioeconomy funding in the past. Even the topic 'Global food supply', which is mentioned in the NFSB as being a principal goal of all those stated in the NFSB, only had 14 and 42 projects financed in 2012 and 2013 respectively and funding stopped in the following years.

Although measuring the socio-economic framework has never been done in previous attempts to assess the scope of the bioeconomy, we identified a not insignificant allotment of funded projects in this pillar. Between 1996 and 2000, this was mainly

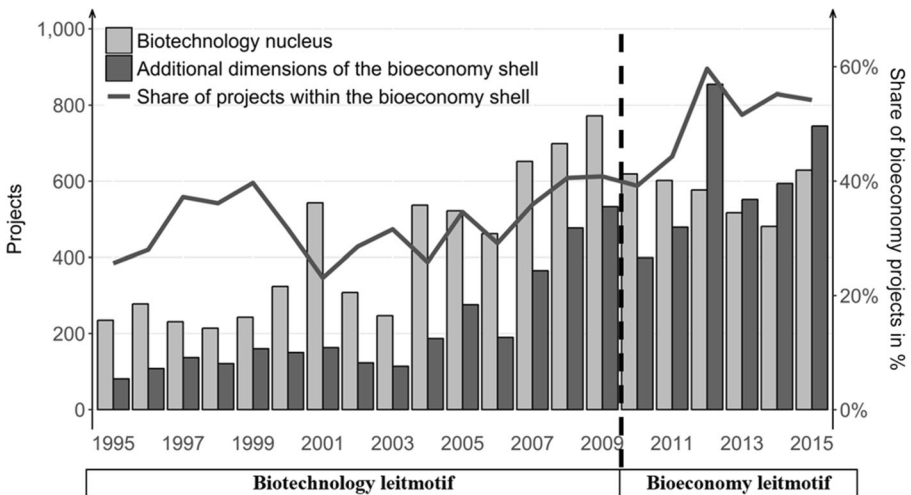


Fig. 4 Comparison between bioeconomy and biotechnology funding (1995–2015). Source: own calculations

Table 4 Public R&D projects within the bioeconomy in Germany (1995–2015) (number of projects)

Bioeconomy dimension	1995–1997	1998–2000	2001–2003	2004–2006	2007–2009	2010–2012	2013–2015
Input	Σ 16%	15%	11%	18%	27%	30%	37%
Agriculture & forestry	1%	3%	5%	12%	22%	24%	28%
Climate & environment	15%	12%	6%	6%	5%	6%	9%
Processing	Σ 8%	65%	73%	70%	61%	50%	46%
Green biotechnology	45%	12%	9%	9%	9%	8%	3%
Red biotechnology	16%	36%	42%	42%	37%	28%	26%
White biotechnology	Σ 3%	17%	22%	19%	15%	14%	17%
Output	4%	11%	10%	9%	9%	9%	9%
Products & materials	0%	8%	4%	3%	1%	1%	2%
Energy & fuels	1%	1%	1%	3%	7%	6%	5%
Food & feed	Σ 1%	2%	5%	3%	1%	2%	2%
Socio-economic framework	10%	9%	6%	4%	4%	9%	9%
Total (absolute numbers)	1070	1212	1498	2174	3498	3530	3518

Source: own calculations

driven by the BioRegio-Contest, in which e.g. network activities were fostered between firms and institutions. After a loss in relevance from 2001 to 2011, inter alia, investments in international cooperation and further exchange opportunities for scientists (via scholarships) have received considerable support, indicating the significance attributed to this issue. Subjects like animal welfare, general infrastructure or social-ecological research still appear less frequently, but have become more apparent in recent years.

To gain a more complete or differentiated understanding of the bioeconomy funding in Germany, the monetary dimension has to be considered as well. In Table 5, it can be seen that the overall development follows the same trend as the project count, yet in different magnitudes, i.e., R&D projects to promote biotechnological processes receive more financial support on average than projects in the input, output dimensions and also more than those in the socio-economic framework. While this can generally be explained by the cost-intensive equipment used in biotechnology, we also find that red biotechnology is the predominant driver for this issue. It is only within the more recent time intervals that green and white biotechnology were issued more funding than projects in relative terms. Apart from that, it is interesting that R&D projects in climate & environment have a bigger monetary share than their share by the project count. In every other category at almost any other time period, the project number is equal to or higher than its financial stake.

In essence, public funding of bio-related R&D projects co-evolved gradually with programmatic changes. A rise in projects related to the bioeconomy shell became visible well before the introduction of the NFSB in 2010. This gradual change started already around 2001 and a further marked rise of funding in the bioeconomy shell occurred in 2012 with a delay of two years after the introduction of the NFSB. The significant decline of projects in red biotechnology since 2010 in favour of R&D in agriculture and forestry, mainly driven by the involvement of the BMEL, as well as investments in undertakings related to the socio-economic framework of the bioeconomy, has been most apparent. Most pillars do not follow a consistent trend and fluctuate around a certain value, whereas much less attention has been paid to the output dimension. The biotechnology core still plays a very important role, which can be traced back to the funding history in Germany and the special role attributed to biotechnology as key enabling technology (KET).

9 Discussion

In the analysis, we used a broad definition of the bioeconomy, which made it possible to supplement preceding bioeconomy research and to overcome existing drawbacks regarding both a detailed definition and meaningful data (cf. e.g. Bugge et al. 2016; Pietzsch 2017; Wessler and Braun 2017). These data revealed a steady increase from 316 funded projects in 1995 to 1,374 in 2015. However, in the same time period the growth in the overall amount of funded projects advanced at almost the same rate, which is why it is not possible to speak of a clear prioritisation of bio-related R&D. The argument that priorities and, accordingly, public governance are shifting to an extent that one sector or branch is massively promoted or neglected cannot be confirmed here. Nevertheless, we found a considerable structural change within the bioeconomy R&D funding at the expense of red biotechnology, which was, amongst others, a focus area of the previously pursued funding schemes. The biotechnology segment was, proportionally, by far the most heeded pillar

Table 5 Public R&D funds within the bioeconomy in Germany (1995–2015)

Bioeconomy dimension	1995–1997		1998–2000		2001–2003		2004–2006		2007–2009		2010–2012		2013–2015	
	Σ	18%	Σ	20%	Σ	14%	Σ	14%	Σ	16%	Σ	22%	Σ	28%
Agriculture & forestry	3%		4%		3%		7%		11%		13%		18%	
Climate & environment	15%		16%		11%		7%		5%		9%		10%	
Processing	Σ	71%	62%		73%		78%		73%		67%		59%	
Green biotechnology	6%		12%		7%		7%		8%		9%		4%	
Red biotechnology	52%		40%		48%		53%		47%		40%		35%	
White biotechnology	13%		10%		18%		18%		18%		18%		20%	
Output	Σ	3%	8%		9%		5%		7%		8%		11%	
Products & materials	2%		5%		3%		2%		1%		1%		3%	
Energy & fuels	0%		1%		2%		2%		6%		6%		4%	
Food & feed	1%		2%		4%		1%		0%		1%		4%	
Socio-economic framework	Σ	7%	11%		5%		2%		3%		3%		4%	
Total (in million EUR)	515		696		692		916		1,557		1,438		1,230	

Source: own calculations

between 1995 and 1997. Due to the shift at the programmatic level and BMEL's growing engagement, biotechnology lost in relative significance in governmentally funded R&D projects. In spite of this, biotechnological processes still enjoy the most attention in funding programmes and make clear the vision of the Federal Government, whose procedural model consists of solving emerging issues mainly via technological innovations (Hausknost et al. 2017; Bundesregierung 2018a).

Against the backdrop of the debate about new innovation policy approaches, Kattel and Mazzucato (2018) highlight how non-technological innovations have gained value in the third generation of the innovation policy. Apart from technological innovation, one can distinguish between a great variety of innovations within organisations (Damanpour 1991) as well as other concepts such as social innovations (EC 2013). While Grimm et al. (2013) emphasise the great potential of social innovations as a policy tool, McCann and Ortega-Argilés (2015, p. 1299) stress attention to the 'adaption, adoption and diffusion' of existing innovations as an appropriate measure to implement technologies like biotechnology in practice. In view of the relatively recent implementation of such approaches in innovation policy (since 2014 in the German Hightech-Strategy), an evaluation with regard to an adequate quantity and effectiveness is still somewhat premature (Kuhlmann and Rip 2018).

However, the data also reveal that the share of the biotechnology sector diminished over time, which might be an indication of the acknowledgement of facets apart from technological R&D. The biggest beneficiary of this development is the agriculture & forestry sector. At the same time, the output dimension's stake as a whole has not significantly increased, which highlights the frequently mentioned issue of missing markets (Hüsing et al. 2017; Frenken 2017). In fact, analysing the share of public grantees over time, we find no clear tendency of an increasing marketisation by private companies. Furthermore, it turns out that the fuel & energy sector is most frequently promoted within the output dimension in the later phases. The energetic use of biomass, in contrast, is often regarded as the last stage of cascade utilisation with the lowest added value. The debate on the prioritisation of the respective bioeconomy fields is justified at this point (e.g. food or fuel).

Another concern raised is the feasibility in terms of ecological sustainability and capacity limits respectively. While there are objections about the general practicability of a bioeconomy, no dedicated funding measures concentrate exclusively on the substantial issue of climate and environmental protection. Additionally, in the data one can find evidence that this pillar lost significance over long periods and only recently regained attention. This could be explained by the lack of prioritisation, but also because the topic is implicitly addressed in other funding measures assigned to different segments as well as due to its cross-sectional character. The same applies to some aspects of the socio-economic framework such as the sensitisation of the broad population and the entire societal discourse on the subject. With regard to this issue one does not find an explicit line of support, because it is included more as a cross-sectional field of action in both major strategies of the Federal Ministries (BMBF 2010; BMEL 2014).

Looking at the development at both programmatic and project level, we argue that, in this instance, an innovation policy with a rigid and linear top-down character, in which policy makers determine the direction of R&D funding in empty space, does not apply. By considering the content and time dimension in political discourse, funding programmes and approved R&D projects, it is more likely that other mechanisms can be assumed. It shows that funding measures are based on previous and existing strategies, which thereby have an impact on further schemes in future. In other words, the assumption that the

polymaking process is self-enforcing and evolutionary with several evaluation loops between phases, which are not clearly separated, is more likely to be the case than a strictly government-driven process independent of other determinants. One consequence would be the expectation that the long-term aim of establishing a vital and innovative biotechnology landscape in Germany has led to an early commitment to a dedicated bioeconomy strategy, in which the cross-cutting biotechnology still plays a fundamental role. Hence, the current priority which favours the bioeconomy concept will prospectively also influence forthcoming innovation policies (see Fig. 5).

In conclusion, the criticism of the top-down character of mission-oriented innovation policy might be justified to some extent, but due to the illustrated implementation of a strategy such criticism does not seem to be so well-founded. The data suggest that the implementation resembles an evolutionary process successively driven by a diversity of actors from business, research and other stakeholders (e.g. civil society) who continuously influence the mission or strategy. The advantage of using this approach is that a certain continuity can be achieved, which is conducive to planning and the long-term visions of all concerned actors. However, the question as to whether the 'race chosen and bet placed' was the most efficient choice remains. Moreover, this self-enhancing path-dependent process might eventually lead to a lock-in situation in which a specialisation is achieved that is difficult to overcome.

10 Concluding remarks and future research

In the context of this study we have focussed on the multi-faceted subject matter of the changing character of innovation policies as well as the emergence and development of state-selected missions. The applied innovation policy tools have been adapted in line with the zeitgeist and indicate the increasing relevance of holistic perspectives in modern times. However, how missions surface and are subsequently realised in tangible programmes and projects has largely not been elaborated on. Therefore, the aim of this study was to shed light on the efforts and transformation of bio-themed innovation policy in Germany. Due to the diagnosed shift from a mere technology policy towards a trans-sectoral approach, the expounded case allows the reproduction of the sequence of political actions. To capture the dimension of the underlying changeover, we analysed the development in two stages. First, we traced back political interventions at the programmatic level, which aimed at the construction of a leading biotechnology sector and the implementation of a bio-based economy. Secondly, we built a database containing all publicly funded bio-related R&D projects to identify the development of the measures undertaken.

Overall, it is not possible to draw any final conclusion as to whether and to what extent a critical mass of projects or monetary incentives must be provided in order to assure the realisation of a bioeconomy. Furthermore, it is debatable whether the specification of a direction is necessary or whether other paths induced by the market would guarantee a more efficient and meaningful solution to the EU's GSCs or the UN's SDGs. Nevertheless, past research has shown that a mission-oriented policy has its *raison d'être*. Particularly in the case of the bioeconomy, it is apparent that economic reasons have not been the sole driver for the innovation policy as was the case for most previous interventions. Instead, ecological imbalances and capacity limits require the commitment of governments to steer and pave future paths.

Through this analysis, we have responded to two deficiencies in the existing literature. Firstly, we are able to show in which way innovation policies occur and

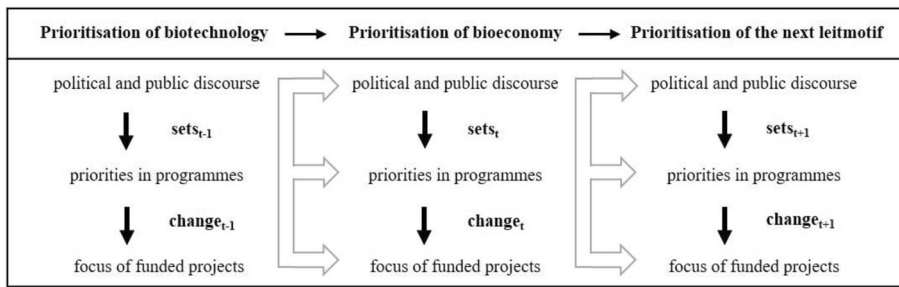


Fig. 5 Hypothetical interdependencies during the evolution of bio-based innovation policy

develop as well as whether and how those policies are implemented through concrete projects. Secondly, while most studies deal with the technological facet of the bioeconomy, topics covering its socioeconomic component are still quite rare. By proposing a classification along the value chain, we acknowledge the comprehensive character of the bioeconomy and suggest a model, in which novel components can be added. Hence, our contribution is a better understanding of the concept and an overview of the general evolution of bio-themed R&D funding in Germany.

The case outlined is an individual case study. It is therefore conceivable that mission-oriented innovation policies may in reality be characterised by strict top-down planning (e.g. for developing countries). Nevertheless, there are good arguments that this process is to some extent similar in other contexts as well. That means, path dependencies might play a key role in other fields of innovation policy as well. Due to a lack of capacities, it is impossible for a single country to specialise in all kinds of technologies and pathways and therefore a certain focus is necessary (Schot and Steinmueller 2018). It is expected that existing structures and knowledge are decisive for future endeavours and that mechanisms of relatedness and branching occur in this respect. In this case it would have been unlikely to foster the bioeconomy concept at a very early stage without the biotechnology efforts of previous decades. The same is also conceivable for strategies in other fields of innovation, which remains a topic for future research. However, the findings must be embedded in the general shift of innovation policies within the last two decades. Since structural changes within mission-oriented innovation policy approaches and the emergence of bioeconomy promotion took place simultaneously and possibly mutually influenced each other, it would be too early to postulate a strict path dependency of missions-oriented policy schemes.

In this study, we one-sidedly examined the input dimension of innovation in terms of R&D projects in the bioeconomy. Other mechanisms, such as market shaping approaches, have been installed by politics to realise the bioeconomy mission, but are not examined here. Also, further research about actual output is required to get a better grasp of the scope, volume and sustainability of the intended knowledge-based bioeconomy. Furthermore, distinct impact studies to evaluate public endeavours are crucial to assess its ramifications and hence, legitimise the political engagement in anticipated and not yet established fields such as the bio-based economy.

Although we were able to present a more comprehensive image of the R&D projects that foster the realisation of a bioeconomy in Germany than previous research, there are still concerns that need to be considered. First, the database we used for the keyword search only provided us information about the title of the project. More detailed information about the objective of the individual projects would have created a better foundation for the

identification of bioeconomy projects. In addition, it should be noted that by categorising the projects into different parts of the bioeconomy, we are able to provide a new perspective in terms of content. Yet some projects cannot be attributed in a clear-cut way. For instance, agriculture and forestry may be closely related to green biotechnology or food and feed industries. Cross-cutting subjects such as climate and environment and the socio-economic framework may also be found jointly in projects that have their core objective in other areas.

While this work addresses the interaction between political rhetoric and the actual translation into corresponding programmes and projects, neither downstream research subjects such as the adoption and evaluation of undertaken policy nor qualitative insights into the individual features were part of the contents of this examination. With our findings, we are able to conclude that there is not a simple linear direction from political discourse that introduces or adjusts programmes and has consequently altered the priorities in projects. However, it is still a matter for further research to determine which factors set which processes in motion or influence them (see Fig. 5) and remains the focus of future (qualitative) research. In these regards, additional studies are required to understand the mechanisms of the policymaking process in general and innovation policy in particular.

Acknowledgements This study was funded by the German Ministry of Education and Research (BMBF) within the framework ‘Bio-Economy as Societal Change’ (grant number 031B0234B). The authors would also like to thank the two anonymous referees of Review of Evolutionary Political Economy for their helpful comments.

Funding Open Access funding enabled and organized by Projekt DEAL.

Declarations

Appendix 1

Table 6 Parts of the bioeconomy considered by policies and academia

Subject and objectives	Dimensions	Source
Sustainable agriculture & forestry	Input— agriculture & forestry	GBC 2009; OECD 2009; BMBF 2010; EC 2012; formas 2012; Karp et al. 2015; Pietzsch 2017; Wesseler and Braun 2017
Climate & environmental protection	Input—climate & environment	OECD 2009; EC 2012; McCormick and Kautto 2013; Bugge et al. 2016; Hausknot et al. 2017
Green biotechnology	Processing— green biotech.	OECD 2009; BMBF 2010; McCormick and Kautto 2013; Golembiewski et al. 2015; Karp et al. 2015; Lee 2016; Wesseler and Braun 2017
Blue biotechnology	Processing— green biotech.	EC 2012; McCormick and Kautto 2013; BMEL 2014; Zinke et al. 2016

Table 6 (continued)

Subject and objectives	Dimensions	Source
Red biotechnology	Processing—red biotech.	OECD 2009; BMBF 2010; The White House 2012; Petersen and Krisjansen 2015; Bugge et al. 2016; GBC 2016; Wesseler and Braun 2017
White biotechnology	Processing—white biotech.	Aguilar et al. 2009; OECD 2009; BMBF 2010; EC 2012; Sillanpää and Ncibi 2017
Food & feed production/refinement	Output—food & feed	GBC 2009; BMBF 2010; EC 2012; BMEL 2014; Viaggi 2016; Sillanpää and Ncibi 2017
Chemicals, organic components	Output—products & materials	GBC 2009; BMBF 2010; EC 2012; Staffas et al. 2013; Golembiewski et al. 2015; Karp et al. 2015; Sillanpää and Ncibi 2017; Wesseler and Braun 2017
Pulp and paper industries	Output—products & materials	BMBF 2010; EC 2012; Pietzsch 2017; Sillanpää and Ncibi 2017; Wesseler and Braun 2017; Hermans 2018; Purkus et al. 2018
Energy production from biomass	Output—energy & fuels	BMBF 2010; EC 2012; McCormick and Kautto 2013; Sillanpää and Ncibi 2017
Coherent policies & their evaluation	Socio-economic framework	BMBF 2010; EC 2012; McCormick and Kautto 2013; BMEL 2014; Dietz et al. 2018; Philp 2018
Communication with & sensitisation of the public	Socio-economic framework	BMBF 2010; EC 2012; BMEL 2014; Bugge et al. 2016; Pietzsch 2017
Bio-related education & qualification	Socio-economic framework	EC 2012; formas 2012; McCormick and Kautto 2013; BMEL 2014; Zinke et al. 2016; Sillanpää and Ncibi 2017
Venture capital, financing of bioeconomy firms	Socio-economic framework	EC 2012; Zilberman et al. 2013; BMEL 2014; GBC 2016; Viaggi 2016
Networking, partnership, knowledge-diffusion	Socio-economic framework	Albert 2007; OECD 2009; BMBF 2010; McCormick and Kautto 2013; Zilberman et al. 2013; BMEL 2014; McDonagh 2014; Bugge et al. 2016
Ethics (GMO, animal welfare etc.)	Socio-economic framework	Paula and Birrer 2006; Bennett 2007; McCormick and Kautto 2013; Bugge et al. 2016; Sillanpää and Ncibi 2017
Competitive land use	Cross-cutting	Pietzsch 2017
Working in cascade, minimising waste, circular economy	Cross-cutting	Lee 2016; Pietzsch 2017

Appendix 2

Conflict of interest The authors declare no competing interests.

Table 7 Keywords and counts for text-mining

Key words for text-mining—counting as 1

actinomy, aeruginosa, agrar, agri, agro, aktinomycet, alga, alge, algi, alkaloid, <alle>, <allele>, allelop, amino, anbau, antig, antikörper, apfelfanbau, apheres, apoptos, aptam, arabidopsis, archae, array, assay, astacus, autotroph, baccatin, bacillus, bact, bakt, barley, basidiomycet, baum, bäum, beet, bio, blut, bodenfruchtbarkeit, brassica, breed, canola, carotin, cellulose, cereal, cerevisia, chitin, chitosan, chlorophyll, chloroplast, chromosom, clib, coli, coryne, cuphea, cyto, denitrifikation, derivat, diversitat, dna, drosophila, edelkreb, eiwei, elisa, embryo, endog, enzym, epilyz, epitop, erblich, ernte, erreger, escherichia, esteras, eukary, eutropha, farming, fauna, feedstock, ferkel, ferment, fett, fettsaur, fettsäur, flachsfaser, flavonoid, fleisch, flora, food, forst, freiland, frucht, frucht, fruecht, fungeos, fungus, fusarium, futter, gartenbau, geflügel, gehirn, <gen>, <gene>, <genen>, gerst, getraenke, getränke, getreid, gewachs, gewächs, gewachshaus, gewachs, glioblastom, glucos, glutamat, glutamicum, glyc, glyk, golgi, grain, haploid, harnstoff, hefe, hepatozyten, heterotroph, hoelz, holz, hölz, homolog, homozygot, honigbi, hormon, hortinlea, <hsp, human, hydroformyl, hydrolys, inhibitor, insekt, interferon, inulin, ipas, kairomon, kartoffel, kartoffelkreb, kaskad, kautschuk, keim, kiefer, klonal, kohlenhy, koksaghyz, kollag, kolorektal, kom, kultivierung, landrass, landwirtschaft, leben, leber, legehenn, leguminos, lektin, liganden, lignin, ligno, lipas, lipid, lockstoff, lymph, lysin, lyso, maesus, mais, malign, marin, markergestützt, maus, mäus, meliloti, mesenchymal, metabol, methylier, mikroalg, mikroben, mikrobic, milch, milchkuh, miscanthus, mistel, mitochond, mizell, monozyt, morbus, morphism, mrna, mutant, mutation, mykorr, nachwachs, nachr, nahr, nähr, napus, natuer, natur, nematod, neuron, nukleas, nuklease, nuklein, nukleinsäure, nukleinsaure, <oel>, <oil>, okolog, okosys, <öl>, oled, oligom, oligonukleotid, omega, omics, organ, osmose, palmoel, palmöl, papier, pappel, pathog, pcr, pektin, peptid, pferd, pflanz, phaeno, phano, phäno, phanomics, phenom, pheromon, photosynth, phytopathog, pilz, plant, plantag, plasmid, pluripotent, polymerase, polyoma, pradikativ, prädikativ, praedikativ, preparat, prokaryot, proteas, protein, proteom, protoplast, pseudomonas, qtl, raps, rekomb, resistenzg, retikulum, rezeptor, rhizobium, rhizosph, ribosom, <rna>, <mas>, <ms>, rogg, saat, sacch, samen, schädling, schaedling, schwein, sequenzanalys, serum, sinapin, sirna, snp, solanum, somat, sonnenblum, staphylococcus, staphylokinas, starkevarietat, stärkevarietät, steroid, stofflich, stoffumwandl, stoffwechsel, streptomycet, stroh, subtilis, tannen, taraxacum, tarulin, thaliana, thuringiensis, tierisch, tilling, tissu, transgen, transkriptom, tropi, vakzin, vegeta, vitamin, vitro, vivo, vulgaris, wald, wein, weißstängel, weisstängel, weiz, wheat, wood, wuchsstoff, xylos, zebra, zellkultur, zerocarbf, zoonos, zucht, zücht, zucker, zuecht, zwitter

Ambigious phrases—counting as 0.5

boden, böden, boeden, cell, erzeug, gen, kultur, laendlich, landlich, ländlich, leben, life, nachhalt, natur, oeko, öko, ressource, rohstoff, umwelt, wirkstoff, zell

Excluded phrases

anorgan, antibakt, antibio, antimikrob, biografi, biographi, biometrie, biometrisch, biomimetik, biomimetisch, bionic, bionik, bionisch, implant, lagerstätt, oberkiefer, organisa, organiza, transplant, unterkiefer, vorgang

The symbol '<' means that a phrase is only detected when no other letter or symbol is in front of the key word; same applies to '>' for the ending of a key word; e.g. <gen> is only counted as one if it stands alone and thus means 'gene'; that leads to a search where words such as 'genug' (enough) are not recognised as a key word

Appendix 3

Table 8 Table of BMBF classification (LPS) and their relevance to the bioeconomy ('Class')

Code	Funding area	Funding priority	Label	Class	VC	Pr.
AA0110	A—Health research and health economy	AA—Health research and health economy	Infection	[iii]		88
AA0120			Nervous system and psyche	[iii]		119
AA0130			Cardiovascular	[iii]		0
AA0140			Cancer	[iii]		2
AA0150			Metabolism	[iii]		8
AA0160			Other disease-related and cross-cutting measures	[iii]		14
AA0210			Medical genome and post-genome research	[ii]	RBT	227
AA0220			Basics of regenerative medicine	[iii]		79
AA0230			Systems Biology	[i]	RBT	1174
AA0231			Systems Medicine	[iii]		0
AA0232			Medical Informatics	[iii]		0
AA0240			computational neuroscience	[iii]		2
AA0250			Translational Research	[ii]	RBT	458
AA0260			Clinical evaluative research	[iii]		7
AA0270			Specific population groups	[iii]		47
AA0280			Research on framework conditions/ELSA	[ii]	SEF	80
AA0285			Alternative methods to animal testing	[ii]	RBT	152
AA0289			Methodology development	[ii]	RBT	2
AA0310			Prevention	[iii]		0
AA0320			Nutrition	[ii]	RBT	130

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
AA0330			Epidemiology	[iii]		1
AA0410			Care-related research	[iii]		0
AA0420			Health Economics	[iii]		0
AA0430			Specific measures	[iii]		0
AA0510			Medical Technology	[ii]	RBT	95
AA0520			Pharmaceuticals/active substance research	[ii]	RBT	115
AA0530			Structural measures	[iii]		3
AA0610			widespread diseases	[iii]		65
AA0620			Individualised medicine	[ii]	RBT	177
AA0630			Prevention and nutrition research	[iii]		0
AA0650			Health Management	[iii]		13
AA0710			Programme planning, international cooperation (including KX)	[ii]	SEF	8
AA0720			Other in the Health Research Framework Programme (including DO, VER, KX)	[iii]		1
AA110			NA	[iii]		0
AA140			NA	[iii]		0
AA5090			Project staff costs	[iii]		0
AA5099			Other in the context of health and medicine	[iii]		0
AA610			NA	[iii]		0
B00101	B—Bioeconomy		Plant research	[i]	GBT	359
B00102			World Food Supply	[i]	F&F	56
B00109			International cooperation	[i]	MIX	145
B00201			Biological safety research	[i]	MIX	172
B00202			Innovative plant breeding in the cultivation system	[i]	MIX	29

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
B00203			Competence networks in agricultural and food research	[i]	MIX	64
B00204			Sustainable land use	[i]	MIX	63
B00209			International cooperation	[i]	MIX	29
B00301			German Plant Phenotyping Network DPPN	[i]	GBT	3
B00302			Animal breeding and husbandry	[i]	GBT	69
B00309			International cooperation	[i]	MIX	40
B00401			Sustainable organic production	[i]	MIX	166
B00402			Bioindustry 2021	[i]	WBT	143
B00403			Purification technologies	[i]	MIX	47
B00404			Biotechnology 2020+	[i]	WBT	99
B00405			Innovation initiative on industrial biotechnology	[i]	WBT	60
B00406			Genome research on microorganisms	[i]	MIX	137
B00407			Biorefineries	[i]	MIX	26
B00409			International cooperation	[i]	MIX	125
B00501			BioEnergy2021	[i]	E&F	40
B00509			International cooperation	[i]	MIX	3
B00601			BioChancePLUS	[i]	MIX	260
B00602			KMU-innovativ: Biotechnology-BioChance	[i]	MIX	410
B00603			GO-Bio	[i]	MIX	105
B00604			BioProfiles	[i]	MIX	176
B00605			BioFuture	[i]	MIX	57
B00606			New products for the bioeconomy	[i]	MIX	71
B00609			International cooperation	[i]	MIX	198

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
B00701			Junior research groups within the framework of the concept "Bioeconomy as social change\."	[i]	SEF	0
B00702			Thematic projects and consortia	[i]	SEF	0
B00703			Monitoring within the framework of the concept "Bioeconomy as social change\."	[i]	SEF	0
B00992			Advisory bodies (SK)	[i]	SEF	1
B00993			Events	[i]	SEF	1
B01001			Environmental biotechnology	[i]	MIX	11
B01002			BioChance	[i]	MIX	47
B01004			BioRegio	[i]	MIX	131
B01005			Neurobiological research	[i]	RBT	59
B01006			Medical Genome Research: Systematic Methodological Platforms (SMP)	[i]	RBT	192
B01007			Medical genome research: Disease-oriented genome networks (KG)	[i]	RBT	1
B01008			Medical Genome Research: Exploratory Projects (EP)	[i]	RBT	36
B01013			Biomass production (completed in 1992)	[i]	A&F	0
B01014			Process for the conversion of biomass (completed in 1992)	[i]	GBT	0
B01015			Use of biomass -without renewable energy—(completed in 1992)	[i]	MIX	0
B01016			Gene Centres	[i]	MIX	0
B01017			Other priority projects in biotechnology	[i]	WBT	0
B01020			Projects on ethical, legal and social issues (bioethics); public discourse (see now 3004/685 31)	[i]	SEF	11
B01021			Research Fellowships	[i]	SEF	6
B01022			strain collections, databases for protein and gene sequences	[i]	MIX	1

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
B01023			Studies, accompanying investigations, preparation and evaluation of support measures (biotechnology)	[i]	SEF	7
B01024			Cooperation projects (biotechnology)	[i]	MIX	4
B01031			Other within the scope of biotechnology	[i]	SEF	6
B01034			Other in the framework of human genome research	[i]	SEF	18
B01035			Nanobiotechnology	[i]	MIX	1
B01037			RNA Technologies	[i]	RBT	4
B01038			tissue engineering	[i]	MIX	30
B01045			Alternative methods to animal testing	[i]	SEF	0
B01046			Lead project nutrition	[i]	GBT	33
B01047			Prevention	[i]	F&F	3
B09901			Promotion of the biotechnology industry—indirect specific promotion (Phase I)	[i]	MIX	0
B09902			Promotion of the biotechnology industry—indirect specific funding (Phase II)	[i]	MIX	31
C01010	C—Civil security research		Scenario-oriented security research	[iii]		0
C01020			Technology alliances	[iii]		0
C01030			Humanities and social science dimensions of security research	[iii]		0
C01050			International cooperation	[iii]		0
DA0100	D—Food, agriculture and consumer protection	DA—Food	Healthy nutrition, improvement of eating habits and nutritional information	[ii]	SEF	13
DA0101			Studies on nutritionally active substances and the nutritional effects of foods and food ingredients	[ii]	SEF	2
DA0102			Studies on the health effects of nutrition, individual foods and food components, including allergies and intolerances	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DA0103			Further development of monitoring methods and their implementation in nutritional issues	[iii]		1
DA0104			Research on the information and communication behaviour of consumers and development of strategies for effective nutrition communication	[ii]	SEF	0
DA0105			determinants of dietary behaviour, including studies on diseases related to malnutrition and physical inactivity and on the effectiveness of preventive measures to improve relationships and behaviour	[iii]		0
DA0106			Studies on nutritional and health claims in the marketing of food and on warnings	[iii]		0
DB0200		DB—Sustainable agriculture and rural areas	Sustainable agriculture, horticulture, forestry, fisheries and food industry; development of the potential of renewable raw materials	[i]	MIX	948
DB0201			Evaluation and conservation of genetic resources in agriculture, horticulture, viticulture, forestry, fisheries and the food industry, and testing of plant and animal genetic resources for their agronomic and breeding suitability	[i]	MIX	43
DB0202			Studies on the recording, conservation and sustainable use of biological diversity in agro-ecosystems, forests, inland waters and seas	[i]	CEP	21
DB0203			Breeding research, including the development and evaluation of breeding methods to improve the sustainability of agricultural production, in particular to improve the quality of plant products, the resistance to biotic and abiotic stress, and the quality of agricultural products	[i]	MIX	145
DB0204			Evaluation of genetically determined characteristics of plant varieties and further development of methods for genotypic differentiation of plant varieties and development of	[i]	GBT	15

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DB0205			phenotypic criteria which can influence the progress of breeding in agricultural and horticultural crops. Breeding of high-quality and climatically adapted vine and fruit varieties with high resistance to biotic and abiotic causes of damage	[i]	GBT	12
DB0206			further development of environmentally sound, socially equitable and economically viable production, storage, handling and processing methods for agricultural, horticultural, forestry and fishery products	[i]	A&F	154
DB0207			Risk and safety research on genetically modified organisms (GMOs) and their release, including the development of concepts and strategies for monitoring GMOs and research to ensure the coexistence of agricultural production systems	[i]	SEF	3
DB0208			Studies and assessments of the impact of invasive alien species	[ii]	CEP	0
DB0209			Risk-based phytosanitary research and assessment of harmful organisms on plants and plant products and development of scenarios as a basis for future management decisions and further development of concepts for monitoring methods and procedures.	[i]	A&F	33
DB0210			Studies and evaluations of the effects of the use of substances relevant to agriculture (e.g. plant protection products, veterinary medicines, fertilisers) on the environment	[i]	CEP	40
DB0212			Studies for the further development of orderly, sustainable and near-natural forest management, including forest reproductive material	[i]	A&F	6
DB0213			Studies on the dynamics and management of wildlife populations, including hunting	[i]	MIX	3

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DB0214			Studies on the biology, diagnosis and prognosis of harmful organisms and abiotic damage to plants and plant products as well as to food, feed, renewable raw materials and wood	[i]		102
DB0215			studies on the prevention and control of animal diseases and the economic consequences of animal diseases	[i]		33
DB0216			Investigations to reduce the risks that can arise from the use of plant protection products and plant protection processes for humans, animals and the natural environment	[i]		84
DB0217			Identification, evaluation and impact assessment of the impact of different production systems in the agriculture, horticulture, forestry, timber, fisheries and food sectors in terms of sustainability, including life cycle assessment studies; and	[i]	MIX	5
DB0218			Development or further development of strategies for the improvement of production methods, also with regard to changed climatic conditions or the conservation of soil resources for good agricultural practice in conventional agriculture, in organic farming	[i]	A&F	190
DB0219			Studies for the protection of inland water ecosystems and for the sustainable use of aquatic resources of inland waters	[i]	CEP	3
DB0220			Studies and monitoring for the protection of marine ecosystems and the sustainable management of living marine resources	[i]	CEP	5
DB0221			Recording and assessment of the exposure of marine organisms to pollutants and their biological effects; radioactivity monitoring in biota	[i]	CEP	1
DB0223			Investigation of the interaction between production, processing, trade and consumers on the national, EU-wide and international markets, also with a view to improving the market position and the information available to German producers	[ii]	SEF	2

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DB0224			National and international, macro- and micro-economic competition analyses of the agricultural, horticultural, forestry, timber, fisheries and food industries, including renewable raw materials and products of organic farming	[ii]	MIX	0
DB0225			Studies on the effectiveness, targeting and accompanying effects of policy measures such as direct payments (including cross-compliance), compensatory allowances, agri-environmental measures, environmental legislation and market regulation measures, as well as product and agricultural policy	[iii]		1
DB0226			Investigations on the occurrence of wood and agricultural biomass, on the mobilisation of utilisation and production reserves and on increasing the use of wood and agricultural raw materials including new production processes and products	[i]	A&F	689
DB0227			Analysis and evaluation of the effects of increasing material and energetic use of renewable raw materials as well as of corresponding promotional measures on the food and feed market and the competition of material and energetic uses	[i]	MIX	0
DB0228			Studies on business management issues in agriculture, horticulture, forestry, fisheries and food industry	[ii]	MIX	6
DB0229			Studies on occupational health and safety and on professional qualifications in the agricultural sector	[iii]		0
DB0230			Studies on the situation and securing world food supplies	[i]	F&F	2
DB0300			Perspectives for rural areas	[iii]		0
DB0301			Economic, social and environmental policy impact assessment, including analysis of the overall system of rural development policy, such as agri-environmental programmes	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DB0303			Studies on demographic development and changes in living and working conditions in rural areas, on design and control options for securing services of general interest and infrastructure, and on socio-economic development	[iii]		0
DB0304			Studies on growth and employment and on the development of job and value creation potentials in rural areas	[iii]		0
DB0400			Climate protection and adaptation to climate change	[i]	CEP	15
DB0401			Analysis of the effects of climate change on agriculture, forestry, horticulture, fisheries, the food industry, cultural landscapes, rural areas and aquatic ecosystems, including inventory of undesirable immissions (Depositio)	[i]	MIX	18
DB0402			studies for the characterisation, prevention and control of organisms harmful to plants and abiotic pests, natural contaminants, animal diseases and zoonoses, new or increased as a result of climate change and, where appropriate, their	[i]	MIX	48
DB0403			Analysis and development of methods, cultivation systems, products and services for the adaptation of agriculture to changing climate conditions, including their economic and ecological evaluation	[i]	A&F	10
DB0404			Inventory of undesirable climate-relevant and air-polluting emissions from the agricultural and food industry, including studies on the comprehensive recording of gaseous emissions from soil and vegetation and their evaluation	[i]	CEP	1
DB0405			Development or further development of methods to reduce undesirable climate-relevant emissions from agriculture	[i]	CEP	8
DB0407			Development or further development of the protection and expansion of biogenic carbon reservoirs	[i]	E&F	4
DB0408			Further development of renewable raw materials for a sustainable and stronger substitution of fossil energy sources and	[i]	E&F	5

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DB1000			fossil/mineral raw materials as well as evaluation of technological, economic, ecological and social aspects			
DC0500		DC—Health and economic consumer protection	Ecological aspects of sustainability Health protection of consumers by improving food and product safety; combating zoonoses	[i] [ii]	MIX MIX	19 27
DC0501			Investigation and development of monitoring systems and analytical methods for the identification, characterisation and quantitative assessment of risks from undesirable and desirable substances in feed and food, ornamental plants and cut flowers	[ii]	MIX	5
DC0502			Investigations on hygiene and on general and process-specific hygiene parameters of food and feed including the development of methods for the detection of microbial hazards for risk-based assessment of food	[ii]	F&F	11
DC0503			studies on contaminants and residues in food and feed including risk assessment, assessment of population exposure and development of mitigation strategies	[ii]	F&F	2
DC0504			Development of concepts and strategies to detect, assess, control and minimise microbiological, chemical and particle size risks in feed and food (including R	[ii]	F&F	18
DC0505			Assessment of the resistance situation of microorganisms and development of avoidance strategies including minimisation of the use of veterinary drugs in livestock farming and use of new substances to promote performance	[ii]	A&F	18
DC0506			Improvement of production methods, product and process quality in livestock farming and feeding and in plant production from the point of view of food and feed safety and of other products	[ii]	MIX	43

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DC0508			Development of models for risk analysis for animal diseases and zoonotic agents and risk assessment and communication for animal diseases and zoonoses	[ii]	MIX	0
DC0509			Development or enhancement of methods for diagnosis, prevention and control of animal diseases, zoonoses and other infectious diseases, including new or emerging infectious diseases in animals, including vector-borne infectious diseases	[ii]	A&F	14
DC0510			Development of modern diagnostics and vaccines for animal diseases and zoonoses as well as development of drugs for diseases in economically less important animal species such as fish, bees etc.	[ii]	A&F	1
DC0511			Studies on the physiology and pathophysiology of the immune system of animals	[ii]	A&F	1
DC0512			Development of strategies for good practice in feeding, feed production, animal husbandry and animal breeding to ensure or improve animal health	[ii]	A&F	14
DC0513			Examination of the effectiveness of monitoring and sanctioning regulations under pharmaceutical law in animal husbandry and research into the possible effects of various distribution channels for veterinary medicinal products on drug safety and consumer protection	[ii]	MIX	1
DC0514			Develop or upgrade databases to monitor the health status of animals and plants and the movement of animals and goods of animal and plant origin	[ii]	F&F	3
DC0516			Identification and evaluation of health risks arising from material properties of cosmetic products, tattooing agents, tobacco products, allergenic plants, plant products and consumer goods, as well as development of S	[ii]	MIX	0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DC0600			Ensuring and improving product and process quality in food, feed and other products	[ii]	F&F	22
DC0601			Development of chemical, physical, microbiological and sensory methods and processes for characterising product properties and assessing the quality of food, feed and other agricultural products	[ii]	F&F	40
DC0602			Studies on the influence of applied and possibly novel technological and biotechnological processes, market structural and legal framework conditions on the production chain and the quality of food and feed	[ii]	MIX	13
DC0603			Studies on the life cycle assessment of food and other agricultural products	[ii]	F&F	0
DC0604			studies on private and public trademarks, quality or quality labels and the protection of geographical indications and designations of origin for agricultural products, foodstuffs and other products and services	[ii]	F&F	0
DC0605			Breeding research to improve the quality of agricultural and horticultural products	[ii]	MIX	2
DC0606			Studies to improve animal welfare in connection with animal breeding, animal husbandry, live stock, animal transport and slaughter	[ii]	SEF	59
DC0608			Development or evaluation of scientific and organisational procedures for traceability and control of the origin of food and other products including those from organic production (e.g. by means of isotope analysis)	[iii]		0
DC0610			Development of concepts and strategies for the improvement of production methods, for the increase of product and process quality in animal and plant production	[ii]	A&F	56
DC0700			Economic consumer protection; improving consumer information	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
DC0701			studies on the determinants of consumer behaviour, including the information and communication behaviour of consumers	[iii]		0
DC0702			Studies on the influence of advertising and similar practices	[iii]		0
DC0703			Studies and concepts on the possibilities of improving market transparency for consumers of goods and services, including the improvement of product and process transparency within the value chain	[iii]		7
DC0704			Development of concepts to protect consumers against deception and misleading	[iii]		0
DC0705			Analysis of the institutional, organisational, legal and technical framework for consumer information and possibilities for its further development	[iii]		2
DC0706			Studies and concepts for the further development of institutional, financial, organisational, legal and technical frameworks for the protection of consumers' economic interests or for the protection or representation of such interests	[iii]		1
DC9910			Other projects	[iii]		0
DC9990			Project staff costs	[iii]		0
EA1110	E—Energy research and energy technologies	EA—Rational energy conversion	prospecting of coal	[iii]		0
EA1120			Exploration of coal	[iii]		0
EA1131			Mining of coal—tunnelling and mining technology	[iii]		0
EA1132			Coal mining—mine planning and logistics	[iii]		0
EA1140			Coal preparation	[iii]		0
EA1150			Underground conversion and coal research	[ii]	WBT	1
EA1180			Other activities in connection with the exploration, extraction and processing of coal	[iii]		0
EA1211			Oil and gas—prospection	[ii]	WBT	0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA1212			Oil and gas—exploration	[iii]		0
EA1213			Oil and gas—extraction, transport and storage	[iii]		0
EA1219			Oil and gas—other	[iii]		0
EA1221			Bitumen and heavy oil—methods of extraction	[iii]		0
EA1222			Bitumen and heavy fuel oil—treatment processes	[iii]		0
EA1229			Bitumen and heavy oil—other	[ii]	WBT	0
EA1231			Tertiary oil production—chemical development	[iii]		0
EA1232			Tertiary oil production—field trials	[iii]		0
EA1239			Tertiary oil production—other	[iii]		0
EA1240			Deep drilling technology for fossil fuels	[iii]		0
EA1250			Oil shale	[iii]		0
EA1260			Microbiological processes in energy technology—petroleum	[i]	WBT	0
EA1311			Conventional power plant technology—process development	[iii]		0
EA1312			Conventional power plant technology—component development	[iii]		0
EA1313			Conventional power plant technology—Environmental protection technology	[iii]		0
EA1314			Conventional power plant technology—system studies	[iii]		0
EA1321			Advanced power plant systems—fluidised bed technology unpressurised	[iii]		0
EA1322			Advanced power plant systems—fluidised bed technology under pressure	[iii]		0
EA1323			Advanced power plant systems—power plants with pressurised coal gasification	[iii]		0
EA1324			Advanced power plant systems—other systems	[iii]		0
EA1325			Advanced power plant systems—component development	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA1326			Advanced power plant systems—power plants with zero emissions	[iii]		0
EA1330			Combustion technology for industry and small-scale consumption	[iii]		0
EA1340			Other within the scope of firing and power plant engineering	[iii]		2
EA1410			Coal liquefaction—construction of pilot plants	[iii]		0
EA1420			Coal liquefaction—operation of pilot plants	[iii]		0
EA1430			Coal liquefaction—component development and basics	[iii]		0
EA1440			Coal liquefaction—demonstration plants	[iii]		0
EA1480			Coal liquefaction—other	[iii]		0
EA1510			Coal gasification—construction of pilot plants	[iii]		0
EA1520			Coal gasification—operation of pilot plants	[iii]		0
EA1530			Coal gasification—component development and basics	[iii]		0
EA1540			Coal gasification—environment and safety	[ii]	WBT	0
EA1580			Coal gasification—other	[iii]		0
EA1910			Coke production	[iii]		0
EA1920			Other coal conversion technologies	[iii]		0
EA1940			Combustion and power plant technology for fossil fuels -except coal-	[iii]		0
EA1990			Project staff costs	[iii]		0
EA1999			Other activities Fossil fuels	[iii]		0
EA2111			Parameter studies, methodological studies on supply concepts	[iii]		0
EA2112			Regional supply concepts	[iii]		0
EA2113			Local supply concepts	[iii]		0
EA2114			Studies on district heating supply	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA2120			Studies and basic research on combined heat and power (CHP)	[iii]		0
EA2121			Cooling of thermal power plants and waste heat recovery	[iii]		0
EA2122			District and local heat generation—decoupling from large power plants	[iii]		0
EA2123			district and local heat generation—industrial waste heat for district heating purposes	[iii]		0
EA2126			District and local heat generation—combined heat and power plants (CHP)	[iii]		0
EA2128			District and local heat generation—cooling from district heating	[iii]		0
EA2141			Large heat storage tank	[iii]		0
EA2142			Aquiferous storage	[iii]		0
EA2143			High-temperature storage	[iii]		0
EA2144			Low-temperature storage tank	[iii]		0
EA2148			Mechanical and other memories	[iii]		0
EA2151			Heat transport and distribution—new installation methods	[iii]		0
EA2152			Heat transport and distribution—self-biasing	[iii]		0
EA2153			Heat transport and distribution—friction reducer	[iii]		0
EA2155			Heat transport and distribution—VSI-Rohrtechnik	[iii]		0
EA2156			Heat transport and distribution—operation optimisation	[iii]		0
EA2157			heat transport and distribution—mobile district heating	[iii]		0
EA2158			Heat transport and distribution—district heating renovation-East	[iii]		0
EA2211			Hydrogen production—electrolysis, PEM	[iii]		0
EA2212			Hydrogen production—electrolysis, alkaline	[iii]		0
EA2213			Hydrogen production—high-temperature electrolysis	[iii]		0
EA2214			Hydrogen production—reformer	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA2215			Hydrogen production—photochemistry and photoelectrochemistry	[ii]	E&F	0
EA2219			Hydrogen production—other technologies and not allocated	[iii]		0
EA2220			Electrolysis, transport, storage	[iii]		0
EA2221			Hydrogen storage—pressure	[iii]		0
EA2222			Hydrogen storage—solid state	[iii]		0
EA2223			Hydrogen storage—cryocomp	[iii]		0
EA2229			Hydrogen storage—other technologies and not allocated	[iii]		0
EA2231			Hydrogen conversion—methanation	[ii]	E&F	3
EA2232			Hydrogen conversion—production of higher hydrocarbons	[iii]		0
EA2239			Hydrogen conversion—other technologies and not allocated	[ii]	E&F	0
EA2251			Fuel cell—PEMFC	[iii]		0
EA2252			Fuel cell—HT-PEMFC	[iii]		0
EA2253			Fuel cell—MCFC	[iii]		1
EA2254			Fuel cell—SOFC	[iii]		0
EA2255			Fuel cell—DMFC	[iii]		0
EA2259			Fuel cells—other technologies and not allocated	[iii]		0
EA2273			Electricity storage	[iii]		0
EA2279			Electricity miscellaneous	[iii]		0
EA2295			Hydrogen transport—all technologies	[iii]		0
EA2299			Material storage and fuel cells—Miscellaneous and unallocated	[iii]		0
EA2311			Electrochemical storage—sodium-sulphur batteries	[iii]		0
EA2312			Electrochemical storage—lithium-based batteries	[iii]		0
EA2313			Electrochemical storage—redox flow batteries	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA2314			Electrochemical storage—zinc-air batteries	[iii]		0
EA2315			Electrochemical storage—sodium nickel chloride batteries	[iii]		0
EA2319			Electrochemical storage—other technologies and not allocated	[iii]		0
EA2321			Electrical storage tanks—capacitors	[iii]		0
EA2322			Electric storage tanks—SMES	[iii]		0
EA2329			Electrical storage—other technologies and unallocated	[iii]		0
EA2331			Mechanical accumulators—compressed air	[iii]		0
EA2332			Mechanical storage—rotational energy	[iii]		0
EA2339			Mechanical storage—other technologies and unallocated	[iii]		0
EA2399			Power storage—miscellaneous	[iii]		0
EA2411			Transmission system components	[iii]		0
EA2412			Transmission system—network planning	[iii]		0
EA2413			Transmission system—operational management	[iii]		0
EA2419			Transmission system—other technologies and not allocated	[iii]		0
EA2421			Distribution network—components	[iii]		0
EA2422			Distribution network—network planning	[iii]		0
EA2423			Distribution network—operational management	[iii]		0
EA2429			Distribution network—other technologies and not allocated	[iii]		0
EA2499			Transport of electricity—miscellaneous	[iii]		0
EA2511			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2512			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2519			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		1

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA2521			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2523			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2529			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2531			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2532			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2533			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2534			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2541			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2542			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2543			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2551			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2552			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2553			NIP—special markets, storage technology vehicles	[iii]		0
EA2554			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA2556			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2561			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2562			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2563			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2565			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2566			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2567			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA2581			National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)	[iii]		0
EA3010			Competitive tenders for electricity efficiency STEP up! individual projects	[iii]		0
EA3201			Energy-saving industrial processes—heat exchangers	[iii]		0
EA3202			Energy saving industrial processes—heat pumps, refrigerants	[iii]		0
EA3203			Energy-saving industrial processes—heat transformers/ORC systems	[iii]		0
EA3204			Energy-saving industrial processes—Industrial furnaces	[iii]		0
EA3205			Energy saving industrial processes—power engines with external combustion	[iii]		0
EA3206			Energy saving industrial processes—shredding of solids	[iii]		0
EA3207			Energy-saving industrial processes—drying processes	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA3208			Energy-saving industrial processes—mechanical and thermal separation processes	[iii]		1
EA3209			Energy-saving industrial processes—electrolytic separation processes	[iii]		0
EA3215			Energy-saving industrial processes—chemical industry, production of plastic and rubber goods	[iii]		0
EA3220			Energy-saving industrial processes—quarrying and processing of stone and earth, fine ceramics, glass	[iii]		0
EA3230			Energy-saving industrial processes—iron and steel industry	[iii]		0
EA3240			Energy-saving industrial processes—non-ferrous metal industry	[iii]		0
EA3250			Energy-saving industrial processes—mechanical engineering, vehicle construction, electrical engineering, precision mechanics, optics, EBM goods	[iii]		0
EA3260			Energy-saving industrial processes—wood, paper and printing	[ii]	MIX	3
EA3270			Energy saving industrial processes—leather, textile and clothing	[iii]		0
EA3280			Energy-saving industrial processes—food and beverage industry	[ii]	MIX	0
EA3285			Energy-saving industrial processes—general and others	[ii]	MIX	11
EA3299			Other horizontal tasks in the context of the rational use of energy	[iii]		0
EA3310			Cross-cutting tasks—system analysis	[iii]		2
EA3320			Cross-cutting tasks—information processing	[iii]		0
EA3330			Cross-cutting issues—IEA	[iii]		0
EA3391			Cross-cutting tasks—project supervisors and external individual experts	[iii]		0
EA3399			Cross-cutting tasks—miscellaneous	[iii]		0
EA3410			Energy-efficient and climate-friendly production processes Individual projects	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA3490			Energy-efficient and climate-friendly production processes Project staff costs	[iii]		0
EA4111			Passive solar energy use—studies and basic research	[iii]		0
EA4112			Passive solar energy use—development of components	[iii]		0
EA4113			Passive use of solar energy—windows, double glazing	[iii]		0
EA4114			Passive use of solar energy—translucent thermal insulation	[iii]		0
EA4115			Passive use of solar energy—use of daylight	[iii]		0
EA4116			Passive use of solar energy—room air flows	[iii]		0
EA4117			Passive use of solar energy—buildings as structural and energy engineering units, residential buildings	[iii]		0
EA4118			Passive use of solar energy—buildings as structural and energy engineering units, commercially used buildings	[iii]		0
EA4121			Active use of solar energy—solar collectors, absorbers, heat pipes, inspection and test procedures	[iii]		0
EA4122			Active use of solar energy—selective coating	[iii]		0
EA4123			Active use of solar energy—solar water heating for sports facilities and swimming pools	[iii]		0
EA4124			Active use of solar energy—solar water heating for households	[iii]		0
EA4125			Active use of solar energy—solar hot water preparation for small-scale consumption	[iii]		0
EA4131			Heat pumps—electric	[iii]		0
EA4132			Heat pumps—internal combustion engine driven	[iii]		0
EA4133			Heat pumps—absorption	[iii]		0
EA4151			Rational use of energy in households and small-scale consumption—conventional thermal insulation, inspection and test procedures	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EA4152			Rational use of energy in households and small-scale consumption—controlled ventilation, heat recovery	[iii]		0
EA4153			Rational use of energy in households and small-scale consumption—energy-saving household appliances	[iii]		0
EA4154			Rational use of energy in households and small-scale consumption—improving conventional heating systems	[iii]		0
EA4155			Rational use of energy in households and small-scale consumption—advisory, information and forecasting systems	[iii]		0
EA4159			Rational use of energy in households and small-scale consumption—comprehensive measures, status seminars	[iii]		0
EA4181			Preparatory project funding for the funding measure SOLARTHERMIE-2000	[iii]		0
EA4182			Accompanying project funding for the SOLARTHERMIE-2000 funding measure	[iii]		0
EA4200			NA	[iii]		0
EA4300			Solar-optimised building	[iii]		5
EA4400			Energy-optimised improvement of the building fabric	[iii]		0
EA5010			Lead project \Energy generation and storage for decentralised and mobile use\”—coordination phase	[iii]		0
EA5020			Lead project \Energy generation and storage for decentralised and mobile use\”—implementation phase	[iii]		0
EA6010			Basic energy research	[ii]	E&F	186
EB1011	EB—Renewable Energies		Crystalline silicon base material	[iii]		0
EB1012			Crystalline silicon cell development	[iii]		0
EB1013			Crystalline silicon module technology	[iii]		0
EB1014			Crystalline silicon Overall development	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EB1021			Thin-film technologies silicon; photovoltaics—amorphous silicon	[iii]		0
EB1022			Thin Film Technologies Chalcopyrite	[iii]		0
EB1023			Thin film technologies CdTe	[iii]		0
EB1024			Thin film technologies OPV	[ii]	P&M	3
EB1028			Thin-film technologies Other materials/technologies	[iii]		0
EB1029			Thin-film technologies General questions	[iii]		0
EB1031			Concentrating Photovoltaics (CPV) Cell development	[iii]		0
EB1032			Concentrating photovoltaics (CPV) Module technology	[iii]		0
EB1033			Concentrating Photovoltaic (CPV) system	[iii]		0
EB1041			Quality assurance, reliability, long-term stability Components	[iii]		0
EB1042			Photovoltaics—other structures—other: quality assurance, reliability, long-term stability Systems	[iii]		0
EB1051			System technology network coupling	[iii]		0
EB1052			Systems engineering island systems	[iii]		0
EB1053			Systems engineering Application and demonstration	[iii]		0
EB1054			Photovoltaics—application and demonstration—stand-alone operation	[iii]		0
EB1059			Systems engineering Other	[iii]		0
EB1060			Accompanying project funding for the Bund-Länder-1000-Dächer-1000-Photovoltaik-Programm	[iii]		0
EB1070			Photovoltaics—devices and small systems	[iii]		0
EB1080			Research infrastructure	[iii]		0
EB1099			Photovoltaics—cross-cutting and other investigations	[iii]		0
EB1210			Wind turbine development, R&D	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EB1211			wind turbines—rotors, rotor blades	[iii]		0
EB1212			Wind turbines—drive train	[iii]		0
EB1213			Wind turbines—power transmission, gears, bearings	[iii]		0
EB1214			Wind turbines—generator, electrical components	[iii]		0
EB1215			Wind turbines—other components	[iii]		0
EB1220			Wind energy—onshore	[iii]		0
EB1230			Wind energy—offshore	[iii]		1
EB1231			Wind energy offshore—foundations, foundations	[iii]		0
EB1240			Wind energy—wind physics, meteorology	[iii]		0
EB1250			Logistics, plant installation, maintenance and operational management	[iii]		1
EB1260			Environmental aspects of wind energy, accompanying ecological research	[iii]		0
EB1261			Sound minimisation, sound insulation	[iii]		0
EB1280			Other in the context of wind energy	[iii]		0
EB1300			Support measure 100/250 MW wind	[iii]		0
EB1411			Thermal use in agriculture—development of air collectors	[iii]		0
EB1412			Thermal use in agriculture—solar drying	[i]	A&F	2
EB1413			Thermal use in agriculture—greenhouses	[i]	A&F	0
EB1419			Thermal use in agriculture—other	[iii]		0
EB1420			Thermal utilisation in the high-temperature range for the supply of process heat	[iii]		0
EB1425			Solar seawater desalination and brackish water treatment	[iii]		0
EB1430			Solar powered water pump	[iii]		0
EB1435			Solar cooling	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EB1445			Component development for solar thermal power generation	[iii]		0
EB1451			Solar thermal power plants from 100 kW—SSPS	[iii]		0
EB1455			Small solar thermal power plants	[iii]		0
EB1458			Solar thermal power plants—paraboloids	[iii]		0
EB1480			Cooperation projects (renewable energies)	[iii]		0
EB1481			Cooperation projects (renewable energies)—Eldorado Sun 2	[iii]		0
EB1482			Cooperation projects (renewable energies)—Eldorado Wind	[iii]		0
EB1484			Cooperation projects (renewable energies)—NCRD/Israel	[iii]		0
EB1485			Cooperation projects (renewable energies)—solar village REI/Indonesia	[iii]		0
EB1486			Cooperation projects (renewable energies)—Lykovrissi/Greece	[iii]		0
EB1489			Cooperation projects (renewable energies)—Other	[iii]		0
EB1511			Molecular biological investigations to increase photosynthetic substance production in plants	[i]	E&F	0
EB1512			Biological hydrogen production	[i]	E&F	0
EB1520			Energy use of plants (completed in 1992)	[i]	E&F	0
EB1611			Prospection and exploration of geothermal energy	[iii]		1
EB1612			Hot water and steam deposits	[iii]		0
EB1613			Hot Dry Rock (hot deep rock)	[iii]		0
EB1619			Other in the context of geothermal energy	[iii]		1
EB1710			Promotion within the framework of the EU Renewable Energies Directive	[iii]		0
EB1721			Biomass and waste—direct combustion (completed)	[i]	E&F	0
EB1722			Biomass and waste—thermal conversion (completed)	[i]	E&F	0
EB1723			Biomass and waste—biogas (completed)	[i]	E&F	0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EB1729			Biomass and waste—other (completed)	[i]	E&F	3
EB1730			Hydropower	[iii]		0
EB1790			Project staff costs	[iii]		0
EB1795			Studies (renewable energy sources)	[ii]	E&F	2
EB1796			Conferences, status seminars (renewable energy sources)	[ii]	SEF	0
EB1797			Measurement programmes, test stands (renewable energy sources)	[iii]		0
EB1799			Other in the context of renewable energy sources	[ii]	E&F	29
EB1810			Energy storage	[iii]		0
EB1820			Networks	[iii]		1
EB1821			smart grids, load management	[iii]		1
EB1822			System services	[iii]		0
EB1830			Combined cycle power plants, virtual power plants	[iii]		0
EB1840			Forecasts, predictions	[iii]		0
EB1841			Feed-in forecasts	[iii]		0
EB1850			Mobility	[iii]		0
EB1860			Integration of renewable energies and renewable energy supply systems, other	[iii]		0
EB1920			Energetic use of biomass	[i]	E&F	262
EB1930			NA	[iii]		0
EB1953			NA	[iii]		0
EB2011			Collector concepts, collector development	[iii]		0
EB2012			Optimisation of production processes	[iii]		0
EB2013			Materials Technologies	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EB2014			Building integration and combined use	[iii]		0
EB2021			Optimised water storage tanks	[iii]		0
EB2023			New high energy density storage devices	[ii]	E&F	5
EB2024			Seasonal heat storage in heating networks	[iii]		0
EB2030			System technology solar heating and WW—preparation for large plants	[iii]		0
EB2031			Solar heating, solar active building	[iii]		0
EB2032			Planning tools, control and hydraulic concepts, heat transport	[iii]		0
EB2033			Monitoring, functional control and yield assessment	[iii]		0
EB2041			Components for solar thermal driven refrigeration processes	[iii]		0
EB2042			System technology solar cooling	[iii]		0
EB2043			Monitoring of pilot and demonstration plants	[iii]		0
EB2050			Solar process heat	[iii]		0
EB2051			Process Integration	[iii]		0
EB2052			Systems engineering and standardisation	[iii]		0
EB2053			Monitoring of pilot and demonstration plants	[iii]		0
EB2060			accompanying research, measuring programmes	[iii]		0
EB2070			Pilot and demonstration plants	[iii]		0
EB2111			Tower power plants receiver	[iii]		0
EB2112			Tower power plants Heliosats/field design/control	[iii]		0
EB2113			Tower power plants overall system	[iii]		0
EB2121			Parabolic trough technology collector/field/control	[iii]		0
EB2122			Parabolic trough technology receiver	[iii]		0
EB2123			Parabolic trough technology overall system	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EB2131			Fresnel technology collector/field/control	[iii]		0
EB2132			Fresnel technology receiver	[iii]		0
EB2133			Fresnel technology overall system	[iii]		0
EB2140			Setup, logistics, operation, O&M measures	[iii]		0
EB2150			Quality assurance, certification, standardisation	[iii]		0
EB2160			Studies and concepts for solar thermal power generation	[iii]		0
EB2170			Memory	[iii]		0
EB2180			Other technologies	[iii]		0
EB6010			Basic energy research	[iii]		14
EC1100		EC—Nuclear safety and disposal	Breeder reactors (SBR)—compact sodium-cooled nuclear reactor plant (KNK II)	[iii]		0
EC1210			Breeder reactors (SBR)—SNR 300—construction (including plutonium)	[iii]		0
EC1220			Breeder reactors (SBR)—SNR 300—project supervisor	[iii]		0
EC1230			Breeder reactors (SBR)—SNR 300—research and development related to construction, commissioning and operation	[iii]		0
EC1310			Breeder reactors (SBR)—further development—safety-related work	[iii]		0
EC1330			Breeder reactors (SBR)—further development—R&D within the framework of European cooperation	[iii]		0
EC1400			Breeder reactors (SBR)—fuel cycle	[iii]		0
EC2100			THTR 300 (including project support)	[iii]		0
EC2211			HTR combined heat and power generation—studies, expert opinions	[iii]		0
EC2212			HTR cogeneration—technology, safety	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EC2220			HTR fuel cycle	[iii]		0
EC2231			HTR process heat—studies, expertises	[iii]		0
EC2232			HTR process Heat—nuclear heat generation system (NWS)	[iii]		0
EC2233			HTR process heat—components, methods	[iii]		0
EC2234			HTR process heat—planning	[iii]		0
EC2299			Other in the context of the further development of HTR	[iii]		0
EC3010			Niederreichbach nuclear power plant (completed)	[iii]		0
EC3020			Hot steam reactors (closed)	[iii]		0
EC3030			Light water reactors (closed)	[iii]		0
EC3040			Research reactors (especially MPR 30—Indonesia)	[iii]		0
EC3050			Studies and expert reports in the context of other reactor development	[iii]		0
EC4110			uranium exploration and mining	[iii]		0
EC4130			Uranium hexafluoride conversion process	[iii]		0
EC4140			Fuel element development	[iii]		0
EC4150			Enrichment reduction for research and material test reactors	[iii]		0
EC4190			Project staff costs	[iii]		0
EC4191			Project supervisors and external individual experts (PB,RE)	[iii]		0
EC4210			Gasutra centrifuge process	[iii]		0
EC4211			2000 annual URENCO programme	[iii]		0
EC4220			Laser processes in the context of uranium enrichment	[iii]		0
EC4230			Other new uranium enrichment processes	[iii]		0
EC5110			Radioecology	[iii]		0
EC5120			reprocessing (including Eurochemic)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EC5130			Return of fuels from reprocessing	[iii]		0
EC5140			Transport of radioactive materials	[iii]		0
EC5150			Fissile material monitoring	[iii]		0
EC5200			Treatment and conditioning of radioactive waste; fission product and actinide conversion	[iii]		0
EC6000			Basic research energy/nuclear safety research	[iii]		8
EC6111			Final disposal—basic work Salt	[iii]		0
EC6112			Disposal—basic work for geological formations other than salt, e.g. sea beds	[iii]		0
EC6113			Disposal—basic research Safety analysis and assessment	[iii]		0
EC6120			Final disposal—other disposal techniques	[iii]		0
EC6130			Final disposal—Konrad project	[iii]		0
EC6140			Final disposal—Gorleben project	[iii]		0
EC6150			Interim and final storage of spent fuel elements from research reactors	[iii]		0
EC6200			Research projects for the decommissioning of nuclear facilities	[iii]		0
EC6300			Financial contribution to the expiring EU supplementary HFR-Petten programme	[iii]		0
EC6910			Analyses and concepts for disposal	[iii]		0
EC6999			Other in the context of disposal	[iii]		0
EC8110			Loss of coolant, emergency cooling, containment, accident management measures	[iii]		0
EC8120			Container failure (reactor safety)	[iii]		0
EC8130			External events (reactor safety)	[iii]		0
EC8140			Component safety (reactor safety)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
EC8210			Reactor safety—breeder reactors (SBR)	[iii]		0
EC8220			Reactor Safety—high-temperature reactors (HTR)	[iii]		0
EC8230			Reactor safety—inherently safe reactor systems	[iii]		0
EC8310			Core melts, fission product transport and radiation exposure, hydrogen generation and behaviour	[iii]		0
EC8320			Quality assurance (reactor safety), non-destructive testing methods	[iii]		0
EC8330			Interaction of man and machine (reactor safety)	[iii]		0
EC8340			Risk and reliability (reactor safety)	[iii]		0
EC8350			Reactor safety studies at HDR	[iii]		0
EC8360			Analytical activities, international cooperation, other reactor safety research activities	[iii]		0
EC8380			International Atomic Energy Agency (IAEA)	[iii]		0
EC8490			Project staff costs	[iii]		0
ED1000			Removal of nuclear installations	[iii]		4
ED2000		ED—Disposal of nuclear installations	Backfilling and securing nuclear repositories	[iii]		0
ED5000			Nuclear energy risk sharing	[iii]		1
EF6000		EF—Fusion energy research	Basic research energy/fusion research	[iii]		0
FA0410	F—Climate, environment, sustainability	FA—Climate, climate protection;	Climate protection, climate protection law	[iii]		0
FA0480		global change	Adaptation to the effects of climate change	[iii]		0
FA0490			—	[iii]		0
FA1010			Climate Forecast	[iii]		0
FA1011			Climate Processes	[iii]		5
FA1012			Climate monitoring	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FA1020			Climate protection in business and society	[iii]		0
FA1021			Mitigation	[ii]	CEP	46
FA1022			Climate Adaptation	[iii]		21
FA1030			Integrated assessment and knowledge transfer	[iii]		0
FA1031			Competence Centres Climate Change and Adapted Land Management in Africa	[iii]		1
FA1032			Air conditioning services	[iii]		0
FA1033			Economics, governance and finance	[iii]		1
FA1060			Instruments and methods	[iii]		0
FA1080			Atmospheric processes	[iii]		0
FA1081			airborne trace substances/—pollutants	[iii]		5
FA1082			Effects of air pollutants on ecosystems and material goods	[iii]		0
FA1083			Biological effects of increased UV radiation	[ii]	MIX	0
FA1085			Ozone research	[iii]		0
FA1099			Other activities in the field of climate and atmospheric research	[iii]		0
FA1901			KSI—starter package for energy saving models in KSJSS	[iii]		0
FA1902			KSI—climate protection investments in KSJSS	[iii]		0
FA1904			KSI—national competition climate protection in cycling	[iii]		0
FA1906			KSI—climate protection investments in data centre infrastructures	[iii]		0
FA1911			KSI—creation of climate protection concepts	[iii]		0
FA1912			KSI—consulting support for climate protection concepts	[iii]		0
FA1913			KSI—climate protection technologies in electricity use	[iii]		0
FA1914			KSI—model projects for climate protection	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FA1915			KSI Master Plan 100%	[iii]		1
FA1916			KSI—measure within the framework of the advisory monitoring	[iii]		1
FA1917			KSI—invest mobility	[iii]		0
FA1918			KSI—investment landfills	[iii]		0
FA1919			KSI—consulting for beginner communities	[iii]		0
FA1930			KSI—supporting programme	[iii]		0
FA1940			KSI—evaluation of the national part of the Climate Protection Initiative of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	[iii]		0
FA1950			KSI—promotion of climate protection projects in the fields of business, consumers and education within the framework of the National Climate Protection Initiative of the Federal Ministry for the Environment	[iii]		0
FA1951			KSI—individual projects—grants	[iii]		1
FA1952			KSI—further development	[iii]		0
FA1953			KSI—individual projects—contracts	[iii]		0
FA3010			Biodiversity dynamics and ecological processes	[i]	CEP	17
FA3012			Forecasts	[ii]	CEP	0
FA3020			Biodiversity in economy and society	[i]	CEP	13
FA3021			Ecosystem services	[ii]	CEP	6
FA3022			Economy and Governance	[ii]	CEP	4
FA3023			Nature conservation research	[i]	CEP	19
FA3030			Integrated assessment and knowledge transfer	[i]	CEP	127
FA3031			Ecological concepts in regions	[i]	CEP	28
FA3060			Instruments and methods	[ii]	CEP	3

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FA3061			Data management	[ii]	CEP	6
FA3099			Other activities in the field of biodiversity and ecosystems	[i]	CEP	7
FA5010			Sustainable land use	[i]	CEP	12
FA5011			Land use and climate change	[i]	CEP	31
FA5012			Land use and ecosystems	[i]	CEP	40
FA5013			Land use in river basins	[i]	CEP	83
FA5014			Land use and desertification	[iii]		0
FA5021			Megacities and metropolitan areas	[iii]		0
FA5060			Instruments, methods, platforms and networks	[iii]		0
FA5099			Other activities in the field of globalised habitats	[iii]		1
FA9010			Participation in national and international research programmes and advisory bodies	[iii]		0
FA9090			Project staff costs	[iii]		0
FA9093			Technical accompanying measure(s)	[iii]		0
FA9094			Administrative accompanying measure(s)	[iii]		0
FA9099			Other in the area of global change	[iii]		0
FB1010			Global systems research	[ii]	CEP	81
FB1020			Impact research (e.g. ocean/atmosphere interaction)	[iii]		1
FB2010	FB—Coastal, marine and polar research, earth sciences		Regional systems research (Baltic Sea, North Sea, deep sea, polar regions, etc.)	[ii]	CEP	97
FB2020			Impact research (e.g. pollutant flows and effects)	[ii]	CEP	30
FB3010			Identification and investigation of marine natural products	[i]	P&M	75
FB3020			Other marine resources	[ii]	A&F	1

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FB4010			Technology/infrastructure development and provision (monitoring systems, research accompanying monitoring, innovative technology and equipment carriers)	[iii]		4
FB5010			Integrated coastal zone management	[iii]		0
FB5020			Ecosystem research	[i]	CEP	20
FB6010			Construction of a medium-sized ship	[iii]		0
FB6020			Instrument pool for marine research	[iii]		0
FB6030			Large, medium-sized research vessels; ship pool	[iii]		0
FB7010			Marine aquaculture	[i]	A&F	10
FB8010			Recording and forecasting natural conditions in coastal areas	[iii]		0
FB8020			Interactions sea/coastal structure	[iii]		0
FB8099			Coastal engineering, Other	[iii]		0
FB8592			Advisory bodies (SK)	[iii]		0
FB8599			Other in the framework of marine and polar research	[iii]		0
FB8620			Surface and underground exploration	[iii]		0
FB8630			technical and economic feasibility studies	[iii]		0
FB8710			Geo-processes of the continental and oceanic lithosphere	[iii]		0
FB8720			Scientific drilling in marine, terrestrial and polar areas (IODP; ICDP; NAD)	[iii]		0
FB8810			Processes of the Earth's interior; mapping and exploration of resource and risk capital	[iii]		0
FB8820			Acquisition of the System Earth from space	[iii]		0
FB8840			Gas hydrates: energy source and climate factor	[iii]		3
FB8850			Natural disasters: Early warning systems in earth management	[iii]		0
FB8860			Geo-Information Systems in Earth Management	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FB8870			Continental margins	[iii]		0
FB8880			Use and protection of the underground space	[iii]		3
FB8885			Mineral Surfaces	[ii]	WBT	17
FB8894			Tomography of the usable underground	[iii]		0
FB8999			Other in the context of geosciences	[iii]		0
FB9010			Continental deep drilling programme (KTB)	[iii]		0
FB9020			Scientific investigations within the scope of deep drilling	[iii]		0
FB9030			Processing KTB	[iii]		0
FB9510			Mining Technology	[iii]		0
FB9520			Processing of mineral raw materials	[iii]		0
FB9530			Depositology	[iii]		0
FB9540			Exploration methods	[iii]		0
FB9611			Ore processing	[iii]		0
FB9612			Ore processing by bacterial leaching	[i]	WBT	0
FB9620			Metal production	[iii]		0
FB9630			Recovery of valuable metals	[iii]		0
FC0160		FC—Environmental and sustainability research	Social science environmental issues, social and (youth) cultural change; environment, tourism and sport	[iii]		0
FC1011			Space management	[iii]		4
FC1013			Ecological concepts for cities	[iii]		1
FC1014			Cross-cutting themes on soil research, urban and industrial soils	[ii]	CEP	25
FC1020			Rural areas	[iii]		55
FC1021			Ecological concepts for agricultural soils	[i]	CEP	18
FC1022			Agroecosystem research at representative locations	[i]	CEP	16

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FC1023			Other ecological research for agricultural landscapes	[i]	CEP	10
FC1034			Ecological concepts for industrial landscapes, e.g. post-mining landscapes	[i]	CEP	32
FC1040			Recording and evaluation of contaminated sites	[ii]	CEP	18
FC1099			Other on ecological research for urban-industrial landscapes	[iii]		0
FC2010			Rivers and lakes	[ii]	CEP	4
FC2011			Ecological concepts for river and lake landscapes	[ii]	CEP	16
FC2013			Water protection technologies	[ii]	CEP	50
FC2020			Sustainable use of water resources	[iii]		16
FC2021			Planning instruments for sustainable water management	[iii]		0
FC2022			Development of sustainable water technologies	[ii]	WBT	36
FC2023			Flood management	[iii]		0
FC2024			Integrated water resources management	[iii]		4
FC2025			Decentralised water supply and sanitation	[ii]	WBT	15
FC2026			Valuable substances from water treatment	[iii]		0
FC2027			Unconventional water extraction	[iii]		0
FC3010			Water supply	[ii]	WBT	66
FC3020			Water reuse	[iii]		4
FC3030			Municipal wastewater	[ii]	WBT	20
FC3040			Industrial waste water	[ii]	WBT	40
FC3050			Sewage sludge	[ii]	WBT	9
FC3060			Analytics—sensors, measuring methods and models	[ii]	WBT	78
FC3070			Basics, forecasts, planning of waste management	[iii]		0
FC3080			waste management	[ii]	WBT	52

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FC3085			Underground storage	[iii]		1
FC3099			Overarching and other water/waste treatment projects	[iii]		2
FC4010			Social-ecological research	[iii]		43
FC4020			Reporting systems on sustainability	[iii]		0
FC4040			Other on social-ecological sustainability research	[iii]		0
FC5010			Dissemination strategies	[iii]		0
FC5011			International measures	[iii]		8
FC5012			Further development for sustainability strategies	[iii]		0
FC5013			Legal framework	[iii]		0
FC5014			Security research and technology	[iii]		0
FC5015			Other sustainability issues	[iii]		0
FC9010			Noise reduction	[iii]		0
FC9020			Air pollution control method	[ii]	WBT	2
FC9030			Measuring method for air pollutants	[ii]	WBT	0
FC9050			Detection and control of oil/chemical pollution at sea	[iii]		0
FC9099			Other in the context of regional environmental aspects	[iii]		0
FD0800	FD—Ecology, nature conservation, sustainable use		Fundamental issues of nature conservation policy	[iii]		1
FD0820			National and international species protection	[i]	CEP	0
FD0830			National and international protection of ecosystems and habitats (Natura 2000, forests, wilderness, seas, etc.)	[i]	CEP	1
FD0850			Nature conservation and society	[i]	CEP	1
FD0860			Nature conservation accompanying research on energy system transformation	[iii]		0
FD0870			---	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FD1010			Field of need nutrition	[ii]	F&F	19
FD1040			Field of need Recreation/living	[iii]		0
FD2011			Research for future-oriented forestry	[i]	A&F	179
FD2012			Forest Ecosystem Research Solling, Research Centre Göttingen	[ii]	CEP	4
FD2013			Forest damage research, clarification of the causes	[i]	CEP	0
FD2040			Material efficiency in raw material-intensive production processes	[ii]	WBT	57
FD3010			Key technological innovations	[ii]	WBT	37
FD3020			Key non-technological innovations	[iii]		0
FD4010			Internal and external business processes	[iii]		0
FD4020			Product strategies	[iii]		0
FD5010			BIKON Bionics Competence Network	[iii]		0
FD5020			Bionic developments	[iii]		10
FD6010			Technologies for sustainability and climate protection	[ii]	MIX	10
FD7010			Framework conditions for innovations for sustainable management	[iii]		1
FD7020			Economic principles of sustainability	[iii]		0
FD8010			Integrated environmental protection in the timber and furniture industry	[i]	P&M	56
FD8020			Integrated environmental protection in the area of agriculture and food	[i]	F&F	118
FD8030			Integrated environmental protection in the field of chemicals and plastics	[iii]		4
FD8040			Integrated environmental protection in the textile and leather industry	[ii]	P&M	24

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
FD8050			Integrated environmental protection in the metal producing and metal processing industry	[iii]		1
FD8060			Integrated environmental protection in the electrical/electronics industry	[iii]		0
FD8070			Integrated environmental protection in the construction, glass and ceramics industries	[iii]		0
FD8081			Integrated environmental protection in vehicle construction	[iii]		0
FD8082			Integrated environmental protection in the pulp and paper industry	[i]	P&M	8
FD8083			Integrated environmental protection in the packaging industry	[iii]		3
FD8084			Integrated environmental protection in the health sector	[iii]		0
FD8085			Integrated environmental protection in other industries/thematic fields	[ii]	P&M	21
FD9031			Overarching themes on ecotoxicology	[ii]	CEP	8
FD9032			Environmental pollution Health	[iii]		3
FD9040			Security research and security technology	[iii]		0
FD9080			Radiation exposure, radiation measurement methods and equipment (completed)	[iii]		0
FD9092			NA	[iii]		0
FD9099			Other cross-sectional activities for integrated environmental protection, environmental technology	[iii]		1
GA1010	G—Information and communication technologies		Development of software methods and tools	[iii]		3
GA1011		GA—Software systems; knowledge technologies	Embedded systems	[iii]		0
GA1012			Integrated application systems	[iii]		0
GA1013			Services	[iii]		0
GA1040			Correctness and redundancy in information systems	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GA1050			Manipulation security of information systems	[iii]		0
GA1060			Security in data processing networks	[iii]		0
GA1080			Other within the scope of software technology	[iii]		0
GA2010			Parallel architectures	[iii]		0
GA2020			Parallel Software	[iii]		0
GA2030			Mathematical foundations of scientific computer applications	[iii]		0
GA2040			Modeling/simulation	[iii]		0
GA2050			Visualisation	[iii]		0
GA2060			GRID	[iii]		2
GA2080			Other in the context of supercomputing	[iii]		0
GA3010			Evolutionary Algorithms	[iii]		0
GA3080			Other biological solutions in information processing	[iii]		0
GA4010			Neural networks and their applications	[iii]		0
GA4020			Neuroprosthetics	[iii]		3
GA4030			Recognition and understanding of writing and images	[iii]		0
GA4040			Knowledge processing/expert systems	[iii]		0
GA4080			Other in the context of intelligent systems	[iii]		0
GA5010			Recognition, understanding and translation of language	[iii]		0
GA5020			Intelligent methods of human-machine communication	[iii]		4
GA5030			Virtual reality/augmented reality	[iii]		0
GA5080			Other in the context of language technology and man-machine communication	[iii]		0
GA6010			Project proposals/preliminary studies	[iii]		0
GA6011			Applied research and experimental development	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GA9010			Analyses, forecasts and evaluations Informatics	[iii]		0
GA9020			International cooperation in the context of information processing, if not assigned to the individual topics	[iii]		0
GA9077			Software design (completed DV program)	[iii]		0
GA9078			Basic software (completed DV program)	[iii]		0
GA9079			System design (completed DV program)	[iii]		0
GA9080			Molecular Bioinformatics (completed DV programme)	[ii]	RBT	1
GA9081			Data processing systems and technologies (completed DV-Prgr.)	[iii]		0
GA9082			DV applications, information systems (completed DV-Prgr.)	[iii]		0
GA9083			Database software (completed DV-Prgr.)	[iii]		0
GA9084			Data processing in education (completed DV-prgr.)	[iii]		0
GA9085			Information technology for office and administration, data security technology (completed DV-Prgr.)	[iii]		0
GA9086			Regional computer centres (completed DV-Prgr.)	[iii]		0
GA9087			Supra-regional research programme in computer science (completed DV-Prgr.)	[iii]		0
GA9088			Nuclear DV (completed DV-Prgr.)	[iii]		0
GA9089			Other DV (completed DV-Prgr.)	[iii]		0
GA9099			Other (also standardisation) within the scope of informatics	[iii]		2
GB1010		GB—	IT Security Work Programme	[iii]		0
GB1011		Communication technologies and services	Secure Cloud Computing	[iii]		0
GB1012			IT security in critical infrastructures	[iii]		0
GB1013			High-tech for IT security	[iii]		0
GB1070			Quantum Information Technology	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GB1080			Privacy in the digital world	[iii]		0
GB1099			Miscellaneous in the context of IT security	[iii]		0
GB2010			Network-based services in medicine	[iii]		0
GB2011			Network-based services in transport	[iii]		0
GB2099			Other in the context of network-based services	[iii]		0
GB5010			Optoelectronics	[iii]		0
GB5020			Photonics	[iii]		0
GB5040			Network technologies	[iii]		0
GB6111			Terminals (without ISDN)	[iii]		0
GB6112			ISDN terminals	[iii]		0
GB6113			Broadband ISDN terminals	[iii]		0
GB6119			Other within the scope of the terminal equipment of communication systems	[iii]		0
GB6121			Video technology	[iii]		0
GB6122			Video recording procedure	[iii]		0
GB6123			High definition television	[iii]		0
GB6131			Mobile radio	[iii]		0
GB6132			Digital Mobile Communications	[iii]		0
GB6139			Other in the context of radio technology	[iii]		0
GB6140			Radio-based network technologies	[iii]		0
GB6210			Picture technology	[iii]		0
GB6220			Flat screen	[ii]	WBT	24
GB6299			Other within the scope of display technology	[iii]		0
GB7010			German Research Network (DFN)—completed, see I51010 -	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GB7020			Local area networks (LAN)—locked -	[iii]		0
GB7030			Open networks, standards—closed, see I51020	[iii]		0
GB7099			Other in the context of data communication—closed, see I51099	[iii]		0
GB8010			Development and investigation of novel materials and manufacturing processes	[iii]		0
GB8020			Integration technology with compound semiconductors (e.g. quantum structure components)	[iii]		0
GB8030			Integrated circuits with superconducting, magnetic and organic materials (especially molecular electronics)	[iii]		1
GB8040			Internet technologies	[iii]		0
GB8099			Other in the field of new materials and component structures	[iii]		0
GB9010			Systems engineering, circuit technologies for broadband networks (optical communications engineering)	[iii]		0
GB9020			Components broadband networks (fiber optics, laser, photodiodes)	[iii]		0
GB9099			Other in the context of communication technology (including cross-sectional studies)	[iii]		0
GC1010			Nanolithography process	[iii]		0
GC1020	GC—Electronics and electronic systems		Computer-aided chip design (EDA)	[iii]		1
GC1030			New materials and process technologies	[iii]		0
GC1040			New analysis and test methods for nanostructures	[iii]		0
GC1050			Cooperation projects, research networks (AMTC, CNT, NaMLab, ASSID)	[iii]		0
GC1055			magnetoelectronics, spintronics	[iii]		0
GC1065			1D and 2D electronics	[iii]		0
GC2010			Devices and structures for the sub-100-nm range	[iii]		5

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GC2012			Microelectronic integration for transdisciplinary applications	[iii]		0
GC2020			Assembly and connection technology, 3D integration	[iii]		0
GC2025			Chip-based security for digitisation	[iii]		0
GC2030			Power electronics	[iii]		0
GC2035			Novel microelectronic components and sensor-based electronic systems	[iii]		1
GC2040			Automotive electronics, IAE, E/ENOVA	[iii]		0
GC2060			Organic electronics	[i]	WBT	1
GC3010			Battery system research	[iii]		0
GC3020			Complete electric vehicle system (with focus on vehicle electronics and energy management, vehicle concepts and manufacturing processes)	[iii]		0
GC3040			NA	[iii]		0
GC3050			Automotive electronics, IAE, E/ENOVA	[iii]		0
GC4010			Cross-cutting activities (in particular analysis, prognosis, impact research; also cross-cutting for the entire field of information technology)	[iii]		0
GC4040			Measures to accompany innovation	[iii]		0
GC4050			Training and further training measures	[iii]		0
GC4070			Cross-cutting activities (e.g. Joint Secretariat for Electric Mobility of the Federal Government)	[iii]		0
GC5010			New power electronic converters and integrable components	[iii]		0
GC5020			Intelligent energy management systems and systems for grid quality/grid stability	[iii]		0
GC5030			New manufacturing and AVT concepts and materials for power electronic systems	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GD1110		GD—Microsystems Technology	Application of microelectronics (without microperipherals)—project funding	[iii]		0
GD1200			Application of microelectronics (without microperipherals)—indirect specific funding	[iii]		0
GD2110			Microperiphetic—power components	[iii]		0
GD2120			Microperiphery—final control elements	[iii]		0
GD2130			Microperiphetic—indicators, large area displays	[iii]		0
GD2140			Microperiphery—semiconductor sensors	[iii]		0
GD2150			Microperiphery—microoptical sensors	[iii]		0
GD2160			microperiphetic—chemical sensors	[ii]	WBT	0
GD2170			Microperiphetic—micromechanical sensors	[iii]		0
GD2180			Microperiphery—connection technologies	[iii]		0
GD2199			Other within the scope of microperiphery	[iii]		0
GD2200			Microperipherals (especially sensors and actuators)—indirect-specific funding	[iii]		0
GD3110			System capability	[iii]		0
GD3120			manageability of microsystems technology for small and medium-sized enterprises	[iii]		0
GD3130			Systems engineering development	[iii]		0
GD3140			Model solutions in microsystems technology	[iii]		0
GD3150			Microtechnologies for service providers	[iii]		0
GD3161			Microsystems technology—cross-cutting issues	[iii]		0
GD3162			Microsystems technology—qualification	[iii]		0
GD3163			Microsystems technology—quality assurance	[iii]		0
GD3170			Basic industrial research in microsystems technology	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GD3181			Further development of system technologies	[iii]		42
GD3182			Development of standard components of microsystems	[iii]		9
GD3183			Development of prototypes of advanced microsystem solutions	[iii]		17
GD3184			Development of production technology for microsystems	[iii]		0
GD3185			Scientific principles for microsystems technology	[iii]		7
GD3199			Other in project funding for microsystems technology	[iii]		36
GD3210			Development of microsensors	[iii]		0
GD3220			Development of microactuators	[iii]		0
GD3230			Development of miniaturised sensor elements	[iii]		0
GD3240			Development of miniaturised actuator elements	[iii]		0
GD3250			Development of signal processing components	[iii]		0
GD3260			Development of micro components using combinations of micro techniques	[iii]		0
GD3299			Other in the indirect specific funding of microsystems technology	[iii]		0
GD3320			Technology transfer (MST)—dissemination of information	[iii]		0
GD3340			Technology transfer (MST)—promotion of demonstration centres	[iii]		0
GD3380			Technology transfer (MST)—evaluation and assessment	[iii]		0
GD3399			Technology Transfer (MST)—other	[iii]		0
GD3410			Industrial diffusion of microsystems technology	[iii]		0
GD3420			Technology assessment for microsystem solutions	[iii]		0
GD3430			Exchange of scientists	[iii]		0
GD3440			Education and training networks	[iii]		0
GE1010			German Research Network (DFN)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GE1099		GE—Multimedia—	Other in the context of multimedia data communication	[iii]		0
GE2010		Development of convergent ICT	Digital process chain, information technology value added services	[iii]		0
GE2020			Telecooperation within and between organisations	[iii]		0
GE2030			e-government, virtual city	[iii]		0
GE2040			Virtual networks	[iii]		0
GE2050			Other strategic projects	[iii]		0
GE2060			Safety and ease of use through technology	[iii]		0
GE2070			Internet of things	[iii]		0
GE2080			Internet of services	[iii]		0
GE2081			Internet-based knowledge infrastructure	[iii]		0
GE2083			Internet of energy	[iii]		0
GE2084			Qualification through multimedia	[iii]		0
GE2085			eStandards	[iii]		0
GE2086			Usability	[iii]		0
GE2087			eCompetence network for companies	[iii]		0
GE2088			Mobile Internet	[iii]		0
GE2094			Medium-sized businesses 4.0—agencies	[iii]		0
GE2095			Medium-sized businesses 4.0—competence centres	[iii]		0
GE4010			Teleworking and SMEs (completed)	[iii]		0
GE4020			Multimedia business start-ups	[iii]		0
GE4030			Multimedia competence centres (completed)	[iii]		0
GE4095			Other in multimedia (completed)	[iii]		0
GE5090			Project staff costs	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GE7010			Innovative forms of teaching and learning at universities	[iii]		3
GE7020			Notebook university concepts	[iii]		0
GE7030			Virtual university	[iii]		0
GE7040			Institutes for information technology	[iii]		0
GE7050			Non-university research in the field of information and communication technology	[iii]		0
GE9011			Fact banks—chemistry	[iii]		0
GE9012			Fact banks—energy, physics, mathematics	[iii]		0
GE9013			Fact banks—space and construction	[iii]		0
GE9019			Fact banks—other	[iii]		0
GE9021			Reference banks—chemistry	[iii]		0
GE9022			Reference banks—energy, physics, mathematics	[iii]		0
GE9023			Reference banks—space and construction	[iii]		0
GE9024			Reference banks—social sciences	[iii]		0
GE9029			reference banks—other	[iii]		0
GE9030			Full text banks—patents	[iii]		0
GE9110			Electronic publishing—completed, see I53010 and I53020 -	[iii]		0
GE9120			Information network (specialist information data centres)	[iii]		0
GE9180			Other through the use of new technologies in the field of technical information	[iii]		0
GE9210			New specialist information services	[iii]		0
GE9220			Information provision—completed, see I53030	[iii]		0
GE9230			Literature supply	[iii]		0
GE9240			Other services within the scope of the technical information	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
GE9310			Basic research and applied research within the framework of specialist information	[iii]		0
GE9320			International cooperation within the framework of professional information	[iii]		0
GE9330			Other subject-specific projects within the framework of the technical information	[iii]		0
GE9360			Improvement of performance in the field of professional information, information awareness	[iii]		0
GE9365			Standardisation (technical information)	[iii]		0
GE9370			Education, further education (technical information)	[iii]		0
GE9380			Other within the scope of the scientific information	[iii]		0
GE9420			Preliminary phases of institutional funding within the framework of specialist information	[iii]		0
HA1000	H—Vehicle and transport technologies, including maritime technologies	HA—Vehicle and transport technologies	Mobility in urban areas (lead projects)	[iii]		0
HA1010			Traffic Management 2010 (Leitvision)	[iii]		0
HA1030			Innovative transport infrastructures and modes of operation	[iii]		0
HA2010			Long distance rail transport	[iii]		0
HA2020			Local and regional transport	[iii]		0
HA2031			Maglev—system development (until 1996)	[iii]		0
HA2032			Maglev—TRANSRAPID Test Facility (TVE) in Emsland (until 1996)	[iii]		0
HA2040			Intermodal transport	[iii]		0
HA2050			Control and information systems for road traffic	[iii]		0
HA2060			Control and information systems for rail-guided traffic	[iii]		0
HA3010			Combined transport and transshipment systems	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
HA3020			Logistics and transport chains	[iii]		0
HA3030			Rail freight transport 2010 (guiding vision)	[iii]		0
HA3040			General and bulk transport	[iii]		0
HA4010			Emission reduction and energy saving in road transport	[iii]		0
HA4011			Alternative drive technologies	[iii]		0
HA4020			Quiet traffic	[iii]		0
HA4030			Protection of the environment and resources in other traffic	[iii]		0
HA5010			road safety	[iii]		0
HA5020			Safety in rail-guided traffic	[iii]		0
HA6000			Better understanding of mobility and transport	[iii]		0
HA8010			Standardisation and certification	[iii]		0
HA8020			Cross-cutting technologies	[iii]		0
HA8030			International research cooperations	[iii]		0
HA8040			ICT	[iii]		0
HA8050			Vehicle integration of electrified powertrains (especially drive management, integration into safety systems)	[iii]		0
HA8060			Electromobility showcase	[iii]		0
HB1010	HB—		Marine resources—prospection and exploration (completed)	[iii]		0
HB1020	Maritime		Marine raw materials—materials handling (completed)	[iii]		0
HB2010	technologies		Offshore technology for hydrocarbons—fundamentals (completed)	[iii]		0
HB2020			Offshore hydrocarbon engineering—prospection and exploration (completed)	[iii]		0
HB2030			Offshore technology for hydrocarbons—production engineering (completed)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
HB2040			Transport and storage technology -Pipeline, sea transport, storage-	[iii]		0
HB2050			Process plants, energy conversion offshore (completed)	[iii]		0
HB2060			Service facilities—supply vessels, surveillance—(completed)	[iii]		0
HB2070			Underwater technology (completed)	[iii]		0
HB3010			Fundamentals of marine engineering (completed)	[iii]		0
HB3020			Maritime transport systems, special ships (completed)	[iii]		0
HB3030			Marine ice breaking technology (completed)	[iii]		0
HB3040			Ship propulsion systems (locked)	[iii]		0
HB3050			Ship operation technology (completed)	[iii]		0
HB3060			Shipbuilding technology (completed)	[iii]		0
HB4010			Ship technology	[iii]		0
HB4020			Production of maritime systems	[iii]		0
HB4030			Shipping	[iii]		0
HB4040			Inland navigation	[iii]		0
HB5000			Marine technology	[iii]		5
HB9010			Recording and forecasting natural conditions in coastal areas	[iii]		0
HB9020			Interactions sea/coastal structure	[iii]		0
HB9090			Project staff costs	[iii]		0
HB9099			Other in the context of marine technology	[iii]		0
IA1011	I—Aviation and space travel	IA—Aviation	Commercial aircraft—Megaliner	[iii]		0
IA1012			Commercial aircraft—Eurojet	[iii]		0
IA1013			Commercial aircraft—Regioprop	[iii]		0
IA1019			Commercial Aircraft—General	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
IA1020			General aviation aircraft	[iii]		0
IA1030			Helicopter	[iii]		0
IA1040			Environmentally friendly drive	[iii]		0
IA2010			Air traffic control/ground systems/navigation	[iii]		0
IA2020			Avionics/equipment	[iii]		0
IA3010			Wind tunnels	[iii]		0
IA3020			Other experimental facilities	[iii]		0
IA4010			Hypersonic aircraft	[iii]		0
IA4020			Hypersonic drive	[iii]		0
IA4030			Other concept studies	[iii]		0
IA5010			Air jet propulsion	[iii]		0
IA5020			ramjet drives	[iii]		0
IA6010			Aerothermodynamics	[iii]		0
IA6020			Materials/construction	[iii]		0
IA6030			Subsystems/equipment	[iii]		0
IA7010			Drive test stands	[iii]		0
IA7020			Hypersonic wind tunnels	[iii]		0
IA9010			Technological basis aviation research and hypersonic technology	[iii]		0
IA9020			Cross-sectional tasks free of guiding concepts	[iii]		0
IA9030			Structural technology/materials	[iii]		0
IA9080			Manufacturing technologies	[iii]		0
IA9099			Other in the context of aeronautical research and hypersonic technology	[iii]		0
IB1010			Atmospheric physics	[iii]		1

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
IB1020	IB—National space research and space technology		Exploration of the solar system	[iii]		0
IB1030			Astronomy and astrophysics	[iii]		1
IB1040			Technology developments for extraterrestrial missions	[iii]		0
IB1060			Cross-cutting and other issues in the context of space exploration	[iii]		0
IB1080			Studies in the context of space exploration	[iii]		0
IB1091			Project supervisors and external individual experts (PB,RE)	[iii]		0
IB2000			Earth observation	[iii]		0
IB2011			Research projects—application-oriented basic research (signatures)	[iii]		15
IB2012			Research projects—methodological studies on data processing in the context of earth observation	[iii]		1
IB2013			Research projects—pilot and demonstration projects	[iii]		1
IB2021			Development and use of equipment—Land, ocean and sea observation	[iii]		0
IB2022			Equipment development and use—physics of the solid earth	[iii]		0
IB2023			Equipment development and use—trace gas concentrations in the atmosphere, radiation balance	[iii]		0
IB2060			Cross-cutting and miscellaneous Earth observation	[iii]		0
IB2080			Studies in the context of Earth observation	[iii]		0
IB3010	Research under space conditions—materials science	[iii]		2		
IB3020	Research under space conditions—life sciences and medicine	[ii]		MIX	79	
IB3030	Research under space conditions—development and construction of experimental facilities	[iii]		0		
IB3040	Research under space conditions—flight programmes	[iii]		0		

Table 8 (continued)

Code	Funding area	Label	Funding priority	Class	VC	Pr.
IB3060		Cross-cutting and miscellaneous in the context of research under space conditions		[iii]		0
IB3080		Studies in the context of research under space conditions		[iii]		0
IB3091		Project supervisors and external individual experts (PB,RE)		[iii]		0
IB4010		Drive technology		[iii]		0
IB4020		Structures, construction methods and fuel tanks		[iii]		0
IB4030		Reentry technology for reusable carrier systems		[iii]		0
IB4040		Vehicle system concepts		[iii]		0
IB4060		General and miscellaneous space transportation		[iii]		0
IB4080		Studies in the field of space transport		[iii]		0
IB5010		D2—space mission performance		[iii]		0
IB5020		Multidisciplinary space mission services		[iii]		0
IB5030		Exploration		[iii]		0
IB5060		General and miscellaneous in the field of space station and manned space flight		[iii]		1
IB5080		Studies in the field of space station and manned space flight		[iii]		0
IB6010		Payload developments and technologies including antennas in the context of satellite communications		[iii]		0
IB6020		Bus developments and technologies in the context of satellite communication		[iii]		0
IB6060		Overarching and miscellaneous satellite communications		[iii]		0
IB6080		Studies in the context of satellite communications		[iii]		0
IB7010		System studies and technology for satellite navigation		[iii]		0
IB7020		Pilot and demonstration projects for satellite navigation applications		[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
IB7030			Receiver and antenna technology for satellite navigation	[iii]		0
IB7060			General and other aspects of satellite navigation	[iii]		0
IB7080			Studies in the context of satellite navigation	[iii]		0
IB8010			Technology for space systems	[iii]		1
IB8015			Robotics for space systems	[iii]		0
IB8020			Product assurance in the context of space research and space technology	[iii]		0
IB8030			SME programme and commercialisation in the context of space research and space technology	[iii]		1
IB8040			Operating systems in the context of space research and space technology	[iii]		0
IB8050			School and youth projects	[iii]		0
IB8070			Plants of the Industrieanlagen-Betriebsgesellschaft (IABG)	[iii]		0
IB8080			Strategic studies in the framework of space research and space technology	[iii]		0
IB8091			Project supervisors and external individual experts (PB,RE)	[iii]		0
IB8092			Advisory bodies (SK)	[iii]		0
IB8098			Continuing education in space research and space technology (completed)	[iii]		0
IB8099			Other in the framework of space research and space technology	[iii]		0
JA1002	J—Research and development to improve working conditions and in the service sector	JA—Research to improve working conditions	Reduction and defence of harmful and annoying working materials	[iii]		0
JA1003			Reduction of vibrations and shocks	[iii]		0
JA1004			Improvement of the climate situation at the workplace	[iii]		0
JA1007			Research and reduction of combined loads	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
JA1008			Examination of mental and nervous stress; stress	[iii]		0
JA1009			Improvement of occupational safety and accident prevention	[iii]		0
JA1010			Reduction of noise pollution	[iii]		0
JA1011			Noise reduction in sheet metal processing	[iii]		0
JA1012			Noise reduction in the textile industry	[iii]		0
JA1020			Reduction and defence of loads during welding	[iii]		0
JA1021			Reduction and prevention of pollution in the packaging industry	[iii]		0
JA1040			Working conditions and health of the workforce	[iii]		0
JA1041			Cancer risks in the workplace	[iii]		0
JA1042			Allergic reactions and diseases	[iii]		0
JA1050			Occupational health and safety 2000	[iii]		0
JA2010			Humane application of new technologies in the office and administration	[iii]		0
JA2011			Protection of health at work with new information and communication technologies	[iii]		0
JA2020			Humane application of new technologies in production	[iii]		0
JA2021			Protection of health when new techniques are used in production	[iii]		0
JA2022			Humane application of new technologies in series assembly	[iii]		0
JA2050			Services of the future	[iii]		0
JA2060			Pilot projects for job-creating/employment-generating innovations	[iii]		0
JA2099			Humane application of new technologies in other areas	[iii]		0
JA3001			Implementation through information tools and materials	[iii]		0
JA3002			Implementation through consulting	[iii]		0
JA3003			Implementation through qualification	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
JA3004			Development and testing of extended methods of economic efficiency calculation	[iii]		0
JA3009			Implementation research; other	[iii]		0
JA4001			Humane design of working conditions in mining	[iii]		0
JA4002			Improving working conditions in forestry and agriculture	[iii]		0
JA4003			Humane design of working conditions in the foundry industry	[iii]		0
JA4004			Humane design of working conditions in the forging industry	[iii]		0
JA4009			Improvement of working conditions in other metalworking industries	[iii]		0
JA4010			Improvement of working conditions in the electrical industry	[iii]		0
JA4019			Improvement of working conditions in other metalworking industries	[iii]		0
JA4020			Improvement of working conditions in the carpentry and furniture industry	[iii]		0
JA4021			Improvement of working conditions in the textile industry	[iii]		0
JA4022			Improving working conditions in the garment industry	[iii]		0
JA4023			Humane design of working conditions in the construction industry	[iii]		0
JA4030			Humane application of new technologies in the printing industry	[iii]		0
JA4039			Improvement of working conditions in other sectors of the manufacturing and processing industry	[iii]		0
JA4040			Improving working conditions in the hotel and catering sector	[iii]		0
JA4041			improving working conditions in the social and health services	[iii]		0
JA4042			Humane organisation of working conditions in road freight transport	[iii]		0
JA4049				[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
JA4059			improvement of working conditions in the field of passenger and other freight transport			0
JA5010			Improving working conditions in other service sectors	[iii]		0
JA5030			Innovative design of work organisation	[iii]		1
JA5040			Labour Research	[iii]		0
JA5060			Prevention	[iii]		0
			Working, learning, competence development/in-company training	[iii]		0
JA5080			Basic and cross-sectional questions on innovative work design	[iii]		0
JA8001			Industrial science	[iii]		0
JA8002			Occupational medicine	[iii]		0
JA8003			Sociology of work and work psychology	[iii]		0
JA8004			Study and improvement of the working conditions of special groups of people	[iii]		0
JA8050			Demographic consequences for gainful employment in the future	[iii]		0
JA8081			Development and testing of new work structures in production	[iii]		0
JA8082			Development and testing of new working structures in the office and administration sector	[iii]		0
JA8099			Other cross-cutting issues	[iii]		0
JB6010			Knowledge-intensive services	[iii]		0
JB6020		JB—Research in the service sector	Design of service companies and work	[iii]		1
JB6040			skilled service work	[iii]		0
JB6050			Services for the 21st century	[iii]		0
JB6060			Services demography and technology	[iii]		0
JB6080			Basic and cross-sectional issues concerning innovative services	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
KA1010	K—Nano-technologies and materials technologies	KA—	Lead innovation NanoMobil	[iii]		1
KA1020		Nano-technologies	Lead innovation NanoLux	[iii]		0
KA1030			Lead innovation NanoForLife	[ii]	RBT	4
KA1040			Lead innovation NanoTex	[ii]	WBT	21
KA1050			Lead innovation NanoChem	[iii]		4
KA1060			Lead Innovation NanoTecture	[iii]		0
KA1080			Further lead innovations	[iii]		0
KA1110			Process technology and nanoanalytics	[ii]	MIX	14
KA1120			Process technology	[ii]	MIX	6
KA1130			Ultra-thin layers	[ii]	WBT	4
KA1210			Nanobiotechnology	[i]	MIX	100
KA1220			Nanomedicine	[ii]	RBT	152
KA1310			Nanostructure materials	[ii]	MIX	27
KA1320			Nanocomposites	[iii]		0
KA1330			Carbon NanoTubes	[iii]		0
KA1340			Nano centres	[ii]	MIX	2
KB2010		KB—Materials technologies	Resource-efficient materials	[ii]	WBT	15
KB2110			Lightweight construction	[ii]	M&P	6
KB2210			Electromagnetic materials	[iii]		0
KB2220			Li-ion batteries	[iii]		0
KB2310			Intelligent materials	[ii]	MIX	10
KB2410			Bionic materials	[iii]		3
KB2510			Layers and interfaces	[ii]	MIX	3
KB2610			Virtual material development	[ii]	MIX	1

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
KB2710			Materials in the border area	[iii]		0
KB2810			OLED	[i]	WBT	29
KB2820			Organic photovoltaics	[i]	WBT	33
KB3010			New catalytic process routes	[ii]	WBT	15
KB3020			Microrreaction technology	[ii]	WBT	3
KB3110			Materials for life sciences	[ii]	WBT	21
KB4010			SMEs including NanoChance	[ii]	WBT	63
KB4020			Promotion of young talent	[ii]	WBT	15
KB4030			education and training	[ii]	WBT	2
KB4040			Measures to support innovation	[iii]		0
KB4210			Events	[iii]		0
KB8805			Other specialised topics of chemical technologies	[iii]		2
KB8810			Basic funding of the ACA	[iii]		0
KB8820			Old projects chemical technologies	[iii]		2
KB9099			Other activities and cross-sectional activities Materials research, other	[iii]		0
KB9901			Old projects materials research	[iii]		0
KB9902			Old projects materials for future technologies	[iii]		17
L01110	L—Optical technologies		Optical technologies for information and communication	[iii]		1
L01120			Optical technologies for lighting and environmental protection	[ii]	MIX	137
L01130			Optical technologies for life sciences and health	[ii]	MIX	181
L01140			Optical technologies for production	[iii]		5
L01150			Optical technologies for mobility and traffic	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
L01160			Optical technologies: cross-application technology field development	[iii]		20
L01170			Optical technologies: Accompanying measures for site development	[iii]		0
L02011			Development of systems, equipment and processes—surface technologies	[iii]		0
L02012			Development of systems, devices and processes—microstructure techniques	[iii]		0
L02019			Development of systems, equipment and processes—cross-cutting and other developments	[iii]		0
L02021			New analytical methods and measuring techniques—surface techniques	[iii]		0
L02022			New analytical methods and measurement techniques—microstructure techniques	[iii]		0
L02030			New surface materials and layers, especially applications	[iii]		0
L02080			Other, in particular technology transfer in the context of surface and microstructure technology	[iii]		0
L03000			Plasma technology (without fusion)	[iii]		18
L04010			Superconducting materials	[iii]		0
L04020			Magnet construction	[iii]		0
L04030			New applications of superconductivity	[iii]		0
L04031			Power engineering	[iii]		0
L04032			Sensors	[iii]		0
L04033			Electronics, HF technology	[iii]		0
L04040			Cryogenics	[iii]		0
L05010			Lateral nanostructures	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
L05020			Nano-optoelectronics	[iii]		0
L05030			X-ray technology	[iii]		0
L05070			Ultra-precision machining	[iii]		0
L05110			Lateral nanostructures	[iii]		0
L05170			Ultra-precision machining	[iii]		1
L05199			Other nanotechnologies and cross-sectional activities (competence centres, expert and strategy circle)	[iii]		0
L06010			Electronic correlation and magnetism/magneto-electronics	[iii]		0
L06020			Non-linear dynamics	[iii]		0
L06030			Photonic crystals	[iii]		0
L06070			Other new activities in the field of physical technologies	[iii]		8
L06080			Technology transfer and other cross-cutting activities	[iii]		0
L07510			Electronic image technology	[iii]		0
L07520			Sensor technology (as far as lead time for physical technologies)	[iii]		0
L07533			Adaptronics	[iii]		0
L07534			Bionics	[iii]		0
L07560			Expiring measures in the framework of physical technologies	[iii]		0
L07561			Key components of physical technologies	[iii]		0
L07562			Measurement and analysis technology	[iii]		0
L07563			control and feedback control systems	[iii]		0
L07564			Electron microscopy	[iii]		0
L07565			Applied electron and ion optics	[iii]		1
L07566			Components and methods of optics and precision mechanics	[iii]		0
L07567			Material development for components of physical technologies	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
M01010	M—Production technologies	M—Production technologies	Computer aided development, design and manufacturing—CAD/CAM	[iii]		0
M01015			Computer integrated manufacturing (CIM)	[iii]		0
M01020			Flexible manufacturing systems	[iii]		0
M01030			Industrial robots, assembly and handling systems	[iii]		0
M01040			Material flow, information flow, concatenation	[iii]		0
M01050			Manufacturing processes and technologies	[iii]		0
M01060			Quality assurance, early damage detection and diagnosis	[iii]		0
M01070			Analyses, preparatory investigations and evaluations Production engineering, if not assigned to the individual areas	[iii]		0
M01075			International cooperation production engineering, if not allocated to the individual areas	[iii]		0
M01081			Process control with computer systems (completed)	[iii]		0
M01099			Other, cross-sectional activities (production engineering)	[iii]		0
M02010			Computer aided development, design and manufacturing—CAD/CAM	[iii]		0
M02020			Industrial robots, handling systems including intelligent periphery	[iii]		0
M02030			Computer integrated manufacturing (CIM)	[iii]		0
M03000			Production engineering—standardisation	[iii]		0
M05010			Technology transfer production engineering	[iii]		0
M05020			Technology transfer manufacturing technology with foreign countries	[iii]		0
M05030			Technology assessment, impact research, accompanying research in the social, labour and economic sciences within the framework of production technology	[iii]		0
M07010			Basic research in the context of quality assurance	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
M07020			Application-oriented research within the framework of quality assurance	[iii]		0
M07030			Technology transfer within the framework of quality assurance	[iii]		0
M07040			Standardisation within the scope of quality assurance	[iii]		0
M08010			Strategies and methods for product planning	[iii]		6
M08020			Manufacturing technologies and production equipment	[iii]		38
M08030			New forms of cooperation between enterprises	[iii]		0
M08040			Specialist and managerial staff for production	[iii]		0
M08099			Research for production—other projects	[iii]		7
M08110			Analyses, preliminary studies, programme evaluation	[iii]		0
M08120			Priority actions (UA) for the preparation of fields of action	[iii]		0
M09010			Product development methods and production processes	[iii]		0
M09020			Economic activity in cycles	[iii]		0
M09030			Logistics for production	[iii]		0
M09040			Information technology for production	[iii]		0
M09050			Production in a turbulent environment	[iii]		0
M09060			Overarching themes for the Production 2000 framework concept	[iii]		0
M09100			Production 2000 framework concept: standardisation research accompanying development	[iii]		0
M09200			Production 2000 framework concept: technology transfer, technology design, qualification, analyses	[iii]		0
NB1010	N—Regional planning and urban development; building research	NB—Building research	Rational construction methods (prefabrication and site fabrication)	[iii]		0
NB1020			modernisation, rehabilitation and upgrading of transport infrastructure	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
NB1030			Reduction of primary energy/raw material consumption and susceptibility to damage in the production and use of building materials, elements and composite components	[iii]		0
NB1040			Computer-aided optimisation of construction planning and execution control	[iii]		0
NB1051			Reduction/repair of construction and environmental damage and disturbance loads during construction, on buildings (especially monuments) and their surroundings	[iii]		0
NB1052			Construction in existing buildings (renovation, modernisation, repair)	[iii]		0
NB1053			New construction methods and technologies for space-saving, dense urban construction	[iii]		0
NB1060			Preventive structural building fire protection	[iii]		0
NB1070			Measures with specific objectives (e.g. basic research, knowledge transfer and qualification, test facilities and experiments, e.g. overall system optimisation, research into the preservation of historical monuments)	[iii]		0
NB1099			Other within the scope of building research and technology	[iii]		0
NB2010			Sustainable urban and spatial development	[iii]		0
NB2020			housing research (e.g. consequences of structural developments for housing needs and demand)	[iii]		0
OB0400	O—Innovations in education	OB—Research in education	Support for disadvantaged persons	[iii]		0
OB0500			Monitoring	[iii]		1
OB0600			Programme \Early recognition of qualification requirements\''	[iii]		0
OB1001			Transfer of innovation to adapt vocational training practice to technical and structural requirements	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
OB1002			further development of vocational training, in particular new qualification structures	[iii]		0
OB1003			Equivalence of vocational education and training to general education	[iii]		0
OB1004			improving vocational training for the disadvantaged	[iii]		0
OB1005			Improving opportunities for women	[iii]		0
OB1010			Departmental research, scientific conferences, exchange of experience in the field of vocational training, other	[iii]		0
OB1050			Experimental and model facilities and programmes in the field of vocational training	[iii]		0
OB1100			Qualification of vocational training personnel	[iii]		0
OB1710			Training place developer incl. Regiokom-Ost	[iii]		0
OB1720			STARegio Program	[iii]		0
OB1730			Training offensive	[iii]		0
OB1740			Job starter program	[iii]		0
OB5000			Programme future education	[iii]		0
OB5100			Educational Research	[iii]		2
OB5200			Innovative development programmes	[iii]		0
OB5300			Cultural education	[iii]		0
OB5400			Programme school-economy/working life	[iii]		0
OB6000			Other in the field of educational research (excluding vocational training or tertiary education)	[iii]		0
OB7000			Reform and implementation strategies for lifelong learning in national and international contexts	[iii]		0
OB7100			Quality development and structural improvement of general continuing education	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
OB7200			Promotion of continuing education at universities	[iii]		0
OB7300			Modernisation and quality assurance in continuing vocational training	[iii]		0
OB7400			Research on continuing vocational training in enterprises	[iii]		0
OB8020			Demonstration Programme/Internationally Oriented Study Programmes\''	[iii]		0
OB8510			European Schools	[iii]		0
OB9000			Other in tertiary education	[iii]		0
PA1010	P—Humanities; economic and social sciences	PA—Humanities research	Research in the Humanities—Project Funding	[iii]		6
PB2010		PB—Social science research	Social sciences—project funding, international activities	[iii]		0
PB2030			Science Research—Project Funding	[iii]		0
PB2510			German Foundation for Peace Research	[iii]		0
PB2599			Other activities in the field of research for a policy of peace-building	[iii]		1
PD1010		PD—Infrastructure	NA	[iii]		0
PD3000			\''Brain gain\'' instead of \''brain drain.\''	[iii]		0
PD3100			Research centres at universities and improvement of research infrastructure	[iii]		2
PD4100			NA	[iii]		1
PD4370			NA	[iii]		2
PD4380			NA	[iii]		0
QA2050	Q—Promotion of innovation by small and medium-sized enterprises	QA—Start-up support	Technology centres in the new federal states	[iii]		0
QA2060			Technology-oriented business start-ups in the new federal states (TOU-NBL)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
QB4010		QB—Technology promotion of medium-sized companies	Research cooperation in the medium-sized economy (Foko)	[iii]		1
QB4090			Project staff costs	[iii]		0
QB4110			Central innovation programme for SMEs (ZIM)—cooperation promotion	[iii]		0
QD2010		QD—Research infrastructure medium-sized businessstruktur	Contract research and development for commercial enterprises	[iii]		0
RB0510	R—Innovation-related framework conditions and other	RB—Structural cross-sectional activities	Strategy funds	[ii]	MIX	19
RB0520			Promotion of measures to improve the international visibility of science and research	[iii]		0
RB0530			Problem-oriented technology assessment	[iii]		1
RB0550			Development and testing of new concepts in the entire education system and in research	[iii]		2
RB0570			Technology transfer university—economy/public-private-partnership; EXIST	[ii]	MIX	107
RB0580			Utilisation offensive	[iii]		7
RB0581			Technology transfer through standardisation	[iii]		0
RB0591			Project supervisors and external individual experts (PB,RE)	[iii]		0
RB0592			Advisory bodies (SK)	[iii]		0
RB1510			Planning; analyses; educational, scientific and research data	[iii]		0
RB2010			Promotion of additional R&D personnel capacity	[iii]		0
RB2510			Promotion of women's research/gender research in the fields of education, science and research	[iii]		0
RB2520			measures to promote equal opportunities for women in science, research and technology	[ii]	SEF	34

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
RB2530			Innovative study and networking concepts	[iii]		0
RB2540			Women in the information society	[iii]		0
RB2550			Measures to improve the training and professional development opportunities for women	[iii]		0
RB2560			Developing and testing effective strategies to enforce equal opportunities and promote a change in awareness	[iii]		0
RB2570			Specialist events	[iii]		0
RB2580			Improving the further training of women and expanding the range of professions	[iii]		0
RB3010			Promotion of innovation in the new Länder	[ii]	MIX	564
RB3091			Project supervisors and external individual experts (PB,RE)	[iii]		0
RB6010			Promotion of innovative networks -Inno-Net-	[ii]	SEF	69
RB8015			Costs for pilot projects to increase efficiency in the federal administration	[iii]		0
RB8020			Competitions and prizes	[ii]	MIX	0
RB8030			Exhibitions and conferences (if not in other areas)	[iii]		0
RB8040			Promotion of the exchange of scientists; scholarships	[iii]		0
RB8050			Scientific cooperation with other countries (if not in other areas)	[iii]		0
RB8075			Construction, refurbishment and purchase of equipment for non-university research centres (Chapter 60 03 Title 893 01)	[iii]		0
RB8082			Investment grants for non-institutionally funded institutions outside the universities (completed funding)	[iii]		0
RB8099			Cross-cutting structural activities; other	[iii]		0
RB9000			High-tech strategy	[ii]	MIX	15
RB9010			Research premium I	[ii]	MIX	29
RB9020			Research premium II	[ii]	MIX	16

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
RB9030			Cluster competition	[ii]	MIX	268
RB9040			New instruments and model projects in knowledge and technology transfer	[ii]	MIX	22
RB9050			KMU-innovative	[ii]	MIX	7
RB9051			Hightech-Strategie: Biotechnology (SMEs)	[i]	MIX	119
RB9100			Innovative medium-sized businesses	[iii]		0
RB9510			Digital change	[iii]		6
RC1010		RC—Demographic change	Human-technology interaction for demographic change	[iii]		33
RE1010		RE—Miscellaneous	Research at universities of applied sciences	[ii]	MIX	176
RE8015			Costs for pilot projects to increase efficiency in the federal administration	[ii]	SEF	15
RE8020			Competitions and prizes	[iii]		0
RE8030			Exhibitions and conferences (if not in other areas)	[iii]		0
RE8040			Promotion of the exchange of scientists; scholarships	[ii]	SEF	109
RE8050			Scientific cooperation with other countries (if not in other areas)	[ii]	SEF	242
RE8060			Cooperation with foreign research institutes (if not in other areas)	[ii]	SEF	77
RE8099			Innovation-related framework conditions and other cross-sectional activities, other	[ii]	SEF	48
TB0500	T—Funding organisations, restructuring of research in the accession area, higher education construction and special programmes mainly related to higher education	TB—	Restructuring of research in the accession area	[iii]		0
TB0700		Miscellaneous	Promotion of top universities	[iii]		0
TB6010			Higher Education Pact 2020	[iii]		0
TB7000			Teaching quality pact	[iii]		0
U01011	U—Large-scale equipment for basic research		Structure and interaction of fundamental particles—activities at CERN	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
U01012		U—Large-scale equipment for basic research	Structure and interaction of fundamental particles—activities at DESY	[iii]		0
U01013			Structure and interaction of fundamental particles—activities at CERN and DESY	[iii]		0
U01014			Structure and interaction of fundamental particles—activities at other centres	[iii]		0
U01019			Structure and interaction of fundamental particles—miscellaneous	[iii]		0
U02021			Hadron and nuclear physics—activities at CERN	[iii]		0
U02022			Hadron and nuclear physics—activities at SIN/PSI	[iii]		0
U02023			Hadron and nuclear physics—activities at other international accelerators	[iii]		0
U02024			Hadron and nuclear physics—applications of nuclear physics methods	[iii]		2
U02025			Hadron and nuclear physics—activities at COSY	[iii]		0
U02026			Hadron and nuclear physics—activities at FAIR	[iii]		0
U02032			Hadron and nuclear physics—activities at GSI	[iii]		0
U02033			Hadron and nuclear physics—activities at the ILL	[iii]		0
U02034			hadron and nuclear physics—high-density matter	[iii]		0
U02035			Hadron and nuclear physics—activities at several accelerators	[iii]		0
U02039			Hadron and nuclear physics—other	[iii]		0
U03041			Atomic and molecular physics—synchrotron radiation	[iii]		0
U03042			Atomic and molecular physics—particle beams	[iii]		0
U03049			Atomic and molecular physics—other	[iii]		0
U03051			Research of condensed matter—neutron scattering	[iii]		6

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
U03052			condensed matter research—synchrotron radiation	[ii]	MIX	61
U03053			Condensed matter research—particle beams	[iii]		0
U03054			Research of condensed matter—with other methods	[iii]		5
U03059			Condensed matter research—other	[iii]		0
U03060			Nuclear chemistry (completed)	[iii]		0
U04065			Selected fields of mathematics	[iii]		7
U04066			Selected fields of astrophysics	[iii]		0
U04067			Selected fields of particle astrophysics	[iii]		0
U05071			Apparatus development—light sources	[iii]		0
U05072			Apparatus development—particle sources	[iii]		0
U05073			Equipment development—accelerator technology	[iii]		0
U05079			Equipment development—other	[iii]		0
U06003			SNQ , ESS	[iii]		0
U06004			Research reactor Munich II (FRM II)	[iii]		0
U06005			BESSY	[iii]		0
U06011			X-ray free-electron laser XFEL	[iii]		0
U06021			Accelerator facility FAIR	[iii]		0
U06031			Large Hadron Collider (LHC)	[iii]		0
U06099			Other within the framework of large-scale facilities for basic research	[iii]		1
U07080			Other within the framework of research on large-scale facilities for basic research	[iii]		0
U07085			Cooperation with the United Institute for Nuclear Research (VIK) in Dubna	[iii]		1
U07088			Investigations in plasma physics (completed)	[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
U07089			Radioclude technology (completed)	[iii]		0
U08000			Application of scientific methods in the humanities	[ii]	MIX	0
U08500			Fusion research	[iii]		0
YB1000	Y—no classification	YB	exchanges with other countries in the field of vocational training and scholarships	[iii]		0
YB2000			Promotion of gifted young people in vocational education and training	[iii]		0
YB3000			Inter-company vocational training centres	[iii]		0
YB3500			Measures to improve career guidance	[iii]		0
YB5000			Other specific programmes in the field of vocational training	[iii]		0
YB9000			Other non-R&D expenditure on vocational training	[iii]		0
YC2000		YC	Grant to the association "Villa Vigoni" Conversion and extension measures"	[iii]		0
YC3000			Grants to student support organisations	[iii]		0
YC4030			Return of German scientists and young researchers from abroad	[iii]		0
YC5010			Establishment of a Center of Advanced European Studies and Research (CAESAR), foundation share of the federal government	[iii]		0
YC5040			Other science and education-related compensatory measures of the Federal Government for the Bonn region	[iii]		0
YC7000			Promotion of the exchange of students and scientists as well as the international cooperation of scientists	[iii]		0
YC7100			Promotion of university-related central measures by student associations and other organisations	[iii]		0
YC9000			Other education expenditure not related to R&D	[iii]		0
YC9025				[iii]		0

Table 8 (continued)

Code	Funding area	Funding priority	Label	Class	VC	Pr.
ZMAN	Z	ZM	Mainly university-related individual activities of the former BMBW (outside the LP funding priorities A5/A6/S2) for all clients	[ii]	MIX	655

In 'Class' is captured in which of the three classes (chapter 'Data and method') the respective LPS category was assessed.

The column VC shows what LPS categories have been categorised into the bioeconomy concept:

A&F—Agriculture & Forestry

CEP—Climate & Environmental Protection

GBT—Green BioTechnology

RBT—Red BioTechnology

WBT—White BioTechnology

P&M—Products & Materials

E&F—Energy & Fuels

F&F—Food & Feed

SEF—Socio-Economic Framework

MIX & no entry—Class could not classified blankly → individual categorisation process

'Pr.' corresponds to the number of projects within the observation period from 1995–2015 → overall 16,500 projects

Labels automatically translated by deepl.com

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Aghion P, David PA, Foray D (2009) Science, technology and innovation for economic growth - Linking policy research and practice in 'STIG Systems'. *Research Policy* 38(4):681–693. <https://doi.org/10.1016/j.respol.2009.01.016>
- Aguilar A, Bochereau L, Matthiessen L (2009) Biotechnology as the engine for the Knowledge-Based Bio-Economy. *Biotechnology and Genetic Engineering Reviews* 26(1):371–388. <https://doi.org/10.5661/bger-26-371>
- Albert S (2007) Transition to a bio-economy - A community development strategy discussion. *Journal of Rural and Community Development* 2(2):64–83
- Bennett B (2007) Law and ethics for the bioeconomy and beyond. *Journal of law and medicine* 15(1):7–13
- Biggi G, Giuliani E (2020) The noxious consequences of innovation: what do we know? *Industry and Innovation* 2(3):1–23. <https://doi.org/10.1080/13662716.2020.1726729>
- BMBF (Bundesministerium für Bildung und Forschung) (2010) Nationale Forschungsstrategie BioÖkonomie 2030 - Unser Weg zu einer bio-basierten Wirtschaft. https://www.bmbf.de/pub/Nationale_Forschungsstrategie_Biooekonomie_2030.pdf. Accessed 15.05.2017.
- BMBF (Bundesministerium für Bildung und Forschung) (2011) Ergebnisbericht: Evaluation des Rahmenprogramms Biotechnologie. https://www.bmbf.de/pub/evaluation_rahmenprogramm_biotechnologie.pdf. Accessed 18.08.2020.
- BMBF (Bundesministerium für Bildung und Forschung) (2017a) Förderkatalog. <https://foerderportal.bund.de/foekat/jsp/StartAction.do?actionMode=list>. Accessed 05.04.2017.
- BMBF (Bundesministerium für Bildung und Forschung) (2017b) Fortschritt durch Forschung und Innovation - Bericht zur Umsetzung der Hightech-Strategie. https://www.kmc-chemnitz.de/files/cto_layout/img/Inhalt/download/2017_Fortschritt_durch_Forschung_und_Innovation.pdf. Accessed 18.08.2020.
- BMBF (Bundesministerium für Bildung und Forschung) (2017c) FuE-Ausgaben der Bundesrepublik Deutschland und ihre Finanzierung - Zeitreihe: 1965 - 2015. <http://www.datenportal.bmbf.de/portal/1.1.2>. Accessed 18.08.2020.
- BMBF (Bundesministerium für Bildung und Forschung) (2017d) Innovation durch Biotechnologie - Zehn Jahre KMU-innovativ: Biotechnologie - BioChance. https://www.bmbf.de/pub/Innovation_durch_Biotechnologie.pdf. Accessed 18.08.2020.
- BMBF (Bundesministerium für Bildung und Forschung) (2020) Bioökonomie - Biobasierte Ressourcen und biologisches Wissen für eine nachhaltige Wirtschaft. <https://www.bmbf.de/de/biooekonomie-neue-konzepte-zur-nutzung-natuerlicher-ressourcen-726.html>. Accessed 18.08.2020.
- BMBF (Bundesministerium für Bildung und Forschung), BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2020) Nationale Bioökonomiestrategie. https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/nationale-biooekonomiestrategie-langfassung.pdf?__blob=publicationFile&v=3. Accessed 18.08.2020.
- BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2014) Nationale Politikstrategie Bioökonomie - Nachhaltigende Ressourcen und biotechnologische Verfahren als Basis für Ernährung, Industrie und Energie. https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/Biooekonomiestrategie.pdf?__blob=publicationFile&v=3. Accessed 18.08.2020.
- BT (Deutscher Bundestag) (1990) Faktenbericht 1990 zum Bundesbericht Forschung 1988. Bonn.
- Bugge MM, Hansen T, Klitkou A (2016) What Is the Bioeconomy? - A Review of the Literature. *Sustainability* 8(7):691–713. <https://doi.org/10.3390/su8070691>
- Büllingen F (1997) Die Genese der Magnetbahn Transrapid - Soziale Konstruktion und Evolution einer Schnellbahn. Deutscher Universitätsverlag, Wiesbaden

- Bundesregierung (2018a) Die Hightech-Strategie 2025 - Forschung und Innovationen für die Menschen. https://www.bmbf.de/pub/Forschung_und_Innovation_fuer_die_Menschen.pdf. Accessed 18.08.2020.
- Bundesregierung (2018b) Koalitionsvertrag zwischen CDU, CSU und SPD - 19. Legislaturperiode. https://www.bundesregierung.de/Content/DE/_Anlagen/2018/03/2018-03-14-koalitionsvertrag.pdf?__blob=publicationFile&v=6. Accessed 18.08.2020.
- Cantner U, Pyka A (2001) Classifying technology policy from an evolutionary perspective. *Research Policy* 30(5):759–775
- Cooke P (2007) European asymmetries - A comparative analysis of German and UK biotechnology clusters. *Science and Public Policy* 34(7):454–474. <https://doi.org/10.3152/030234207X251425>
- Cooke P (2008) Regional innovation systems - origin of the species. *International Journal of Technological Learning, Innovation and Development* 1(3):393–409. <https://doi.org/10.1504/IJTLID.2008.019980>
- Daimler S, Hufnagl M, Warnke P (2012) Challenge-oriented policy-making and innovation systems theory. In: Daimler S et al (eds) *Innovation system revisited*. Fraunhofer Verlag, Stuttgart, pp 217–234
- Damanpour F (1991) Organizational Innovation: A Meta-Analysis Of Effects Of Determinants and Moderators. *Academy of Management Journal* 34(3):555–590. <https://doi.org/10.5465/256406>
- de Leon P (1999) The Stages Approach to the Policy Process: What Has It Done? Where Is It Going? In: de Leon P (ed) *Theories of the policy process*. Westview Press, Boulder, Colo, pp 19–34
- Dietz T, Börner J, Förster JJ, von Braun J (2018) Governance of the Bioeconomy - A Global Comparative Study of National Bioeconomy Strategies. *Sustainability* 10(9):3190. <https://doi.org/10.3390/su10093190>
- Dohse D (2000) Technology policy and the regions - the case of the BioRegio contest. *Research Policy* 29(9): 1111–1133
- Dohse D, Staehler T (2008) BioRegio, BioProfile and the Rise of the German Biotech Industry. Working Paper Series: Kiel Institute for the World Economy No.1456.
- EC (European Commission) (2012) *Innovating for Sustainable Growth - A Bioeconomy for Europe*. ec.europa.eu/research/bioeconomy/pdf/official-strategy_en.pdf. Accessed 18.08.2020.
- EC (European Commission) (2013) *Social innovation research in the European Union - Approaches, findings and future directions - policy review*. European Union, Luxembourg.
- EC (European Commission) (2018) *Europe 2020 strategy*. https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en. Accessed 18.08.2020.
- Edler J, Fagerberg J (2017) *Innovation policy - What, why, and how*. *Oxford Review of Economic Policy* 33(1):2–23. <https://doi.org/10.1093/oxrep/grx001>
- Edler J, Cunningham P, Gök A, Shapira P (2016) Introduction: Making sense of innovation policy. In: Edler J et al (eds) *Handbook of Innovation Policy Impact*. Edward Elgar Publishing, Cheltenham, pp 1–17
- Eickelpasch A, Fritsch M (2005) Contests for cooperation—A new approach in German innovation policy. *Research Policy* 34(8):1269–1282. <https://doi.org/10.1016/j.respol.2005.02.009>
- EP (European Parliament) (2000) *Lisbon European Council 23 and 24 March 2000 - Presidency Conclusions*. http://www.europarl.europa.eu/summits/lis1_en.htm. Accessed 18.08.2020.
- Ergas H (1987) Does Technology Policy Matter? In: Ergas H (ed): *Technology and Global Industry*. National Academy Press, Washington, D.C, pp 191–245.
- EU (European Union) (2020) *Societal Challenges*. <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges>. Accessed 24.07.2020.
- formas (2012) *Swedish Research and Innovation Strategy for a Bio-based Economy*. http://www.formas.se/PageFiles/5074/Strategy_Biobased_Ekonomi_hela.pdf. Accessed 18.08.2020.
- Freeman C (1987) *Technology Policy and Economic Performance - Lessons from Japan*. Pinter, London
- Freeman C, Lundvall B-Å (eds) (1988) *Small Countries Facing the Technological Revolution*. Pinter, London
- Frenken K (2017) *A Complexity-Theoretic Perspective on Innovation Policy. Complexity, Governance & Networks* (2017) - Special Issue: Complexity, Innovation and Policy 2017):35–37. <https://doi.org/10.20377/cgn-41>.
- Friedman M (1982[1962]) *Capitalism and freedom*, [Reprint]. The University of Chicago Press, Chicago.
- GBC (German Bioeconomy Council) (2009) *Combine disciplines, improve parameters, seek out international partnerships - First recommendations for research into the bio-economy in Germany*. http://biooekonomierat.de/fileadmin/Publikationen/Englisch/BOER_recommandation01.pdf. Accessed 18.08.2020.
- GBC (German Bioeconomy Council) (2016) *Weiterentwicklung der "Nationalen Forschungsstrategie Bioökonomie 2030"*. http://biooekonomierat.de/fileadmin/Publikationen/empfehlungen/181116_Ratsempfehlungen_fu_r_die>Weiterentwicklung_der_Forschungsstrategie_final.pdf. Accessed 06.02.2019.

- GBC (German Bioeconomy Council) (2018) Internationale Bioökonomiestrategien. <http://bioekonomierat.de/bioökonomie/bioökonomie-international/>. Accessed 18.08.2020.
- Golembiewski B, Sick N, Bröring S (2015) The emerging research landscape on bioeconomy - What has been done so far and what is essential from a technology and innovation management perspective? *Innovative Food Science & Emerging Technologies* 29:308–317. <https://doi.org/10.1016/j.ifset.2015.03.006>
- Grimm R, Fox C, Baines S, Albertson K (2013) Social innovation, an answer to contemporary societal challenges? Locating the concept in theory and practice. *Innovation: The European Journal of Social Science Research* 26(4):436–455. <https://doi.org/10.1080/13511610.2013.848163>
- Hausknost D, Schriebl E, Lauk C, Kalt G (2017) A Transition to Which Bioeconomy? - An Exploration of Diverging Techno-Political Choices. *Sustainability* 9(4):669. <https://doi.org/10.3390/su9040669>
- Hermans F (2018) The potential contribution of transition theory to the analysis of bioclusters and their role in the transition to a bioeconomy. *Biofuels, Bioproducts and Biorefining* 12(2):265–276. <https://doi.org/10.1002/bbb.1861>
- Hughes A (2012) Choosing Races and Placing Bets. In: Hughes A (ed) *The UK in a Global World*. Centre for Economic Policy Research, London, pp 37–70
- Hüsing B, Kulicke M, Wydra S, Stahlecker T, Aichinger H, Meyer N (2017) Evaluation der „Nationalen Forschungsstrategie BioÖkonomie 2030“ - Wirksamkeit der Initiativen des BMBF – Erfolg der geförderten Vorhaben – Empfehlungen zur strategischen Weiterentwicklung.
- Jacobsson S, Lauber V (2006) The politics and policy of energy system transformation - explaining the German diffusion of renewable energy technology. *Energy Policy* 34(3):256–276. <https://doi.org/10.1016/j.enpol.2004.08.029>
- Jones CO (1970) *An introduction to the study of public policy*. Wadsworth Publishing Company, Belmont, CA
- Karp A, Beale MH, Beaudoin F, Eastmond PJ, Neal AL, Shield IF, Townsend BJ, Dobermann A (2015) Growing innovations for the bioeconomy. *Nature plants* 1):15193. <https://doi.org/10.1038/NPLANTS.2015.193>.
- Kattel R, Mazzucato M (2018) Mission-oriented innovation policy and dynamic capabilities in the public sector. *Industrial and Corporate Change* 27(5):787–801. <https://doi.org/10.1093/icc/dty032>
- Kivimaa P, Kern F (2016) Creative destruction or mere niche support? - Innovation policy mixes for sustainability transitions. *Research Policy* 45(1):205–217. <https://doi.org/10.1016/j.respol.2015.09.008>
- Kuhlmann S, Rip A (2018) Next-Generation Innovation Policy and Grand Challenges. *Science and Public Policy* 45(4):448–454. <https://doi.org/10.1093/scipol/scy011>
- Lasswell HD (1956) *The Decision Process - Seven Categories of Functional Analysis*. University of Maryland, College Park, Md
- Lazonick W, Tulum Ö (2011) US biopharmaceutical finance and the sustainability of the biotech business model. *Research Policy* 40(9):1170–1187. <https://doi.org/10.1016/j.respol.2011.05.021>
- Lee D-H (2016) Bio-based economies in Asia - Economic analysis of development of bio-based industry in China, India, Japan, Korea, Malaysia and Taiwan. *International Journal of Hydrogen Energy* 41(7):4333–4346. <https://doi.org/10.1016/j.ijhydene.2015.10.048>
- Martin BR (1995) Foresight in Science and Technology. *Technology Analysis & Strategic Management* 7(2): 139–168. <https://doi.org/10.1080/09537329508524202>
- Mazzucato M (2014) *The Entrepreneurial State - Debunking Public vs. Private Sector Myths*, Rev. ed. Anthem Press, London.
- Mazzucato M (2018) *Mission-oriented research & innovation in the European Union - A problem-solving approach to fuel innovation-led growth*. Publications Office, Luxembourg
- Mazzucato M, Perez C (2015) *Innovation as Growth Policy*. In: Mazzucato M, Perez C (eds) *The Triple Challenge for Europe*. Oxford University Press, Oxford, pp 229–264
- Mazzucato M, Semieniuk G (2017) Public financing of innovation - new questions. *Oxford Review of Economic Policy* 33(1):24–48. <https://doi.org/10.1093/oxrep/grw036>
- McCann P, Ortega-Argilés R (2013) Modern regional innovation policy. *Cambridge Journal of Regions, Economy and Society* 6(2):187–216. <https://doi.org/10.1093/cjres/rst007>
- McCann P, Ortega-Argilés R (2015) Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy. *Regional Studies* 49(8):1291–1302. <https://doi.org/10.1080/00343404.2013.799769>
- McCormick K, Kautto N (2013) The Bioeconomy in Europe - An Overview. *Sustainability* 5(6):2589–2608. <https://doi.org/10.3390/su5062589>
- McDonagh J (2014) Rural geography III: Do we really have a choice? - The bioeconomy and future rural pathways. *Progress in Human Geography* 39(5):658–665. <https://doi.org/10.1177/0309132514563449>

- Mowery DC (2006) Lessons from the History of Federal R&D Policy for an "Energy ARPA". Testimony at Committee on Science. U.S. House of Representatives, Washington
- OECD (Organisation for Economic Co-operation and Development) (2009) The Bioeconomy to 2030 - Designing a Policy Agenda. http://www.oecd-ilibrary.org/economics/the-bioeconomy-to-2030_9789264056886-en. Accessed 18.08.2020.
- OECD (Organisation for Economic Co-operation and Development) (2018) Meeting Policy Challenges for a Sustainable Bioeconomy. OECD Publishing, Paris.
- Patermann C, Aguilar A (2018) The origins of the bioeconomy in the European Union. *New biotechnology* 40(Pt A):20–24. <https://doi.org/10.1016/j.nbt.2017.04.002>
- Paula L, Birrer F (2006) Including Public Perspectives in Industrial Biotechnology and the Biobased Economy. *Journal of Agricultural and Environmental Ethics* 19(3):253–267. <https://doi.org/10.1007/s10806-005-6170-2>
- Petersen A, Krisjansen I (2015) Assembling 'the bioeconomy' - Exploiting the power of the promissory life sciences. *Journal of Sociology* 51(1):28–46. <https://doi.org/10.1177/1440783314562314>
- Philp J (2018) The bioeconomy, the challenge of the century for policy makers. *New biotechnology* 40(Pt A): 11–19. <https://doi.org/10.1016/j.nbt.2017.04.004>
- Pietzsch J (ed) (2017) *Bioökonomie für Einsteiger*. Springer Spektrum, Berlin, Heidelberg
- Priefer C, Jörissen J, Frör O (2017) Pathways to Shape the Bioeconomy. *Resources* 1(6):No.10. <https://doi.org/10.3390/resources6010010>
- PTJ (Projektträger Jülich | Forschungszentrum Jülich GmbH) (2020) Nationale Forschungsstrategie Bioökonomie 2030. <https://www.ptj.de/projektfoerderung/biooekonomie>. Accessed 18.08.2020.
- Purkus A, Hagemann N, Bedtke N, Gawel E (2018) Towards a sustainable innovation system for the German wood-based bioeconomy - Implications for policy design. *Journal of Cleaner Production* 172:3955–3968. <https://doi.org/10.1016/j.jclepro.2017.04.146>
- Sabatier PA, Jenkins-Smith HC (eds) (1993) *Policy change and learning - An advocacy coalition approach*. Westview Press, Boulder, CO.
- Sabatier PA, Weible CM (eds) (2014) *Theories of the Policy Process*. Westview Press, New York
- Schot J, Steinmueller WE (2018) Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy* 47(9):1554–1567. <https://doi.org/10.1016/j.respol.2018.08.011>
- Schüler J (2016) *Die Biotechnologie-Industrie - Ein Einführungs. Übersichts- und Nachschlagewerk*, Springer Spektrum, Berlin, Heidelberg
- Sillanpää M, Ncibi C (2017) *A Sustainable Bioeconomy - The Green Industrial Revolution*. Springer International Publishing AG, Cham
- Stahler T, Dohse D, Cooke P (2006) Evaluation der Fördermaßnahmen BioRegio und BioProfile. https://www.e-fi.de/fileadmin/Evaluationenstudien/Evaluation_der_Foerdermassnahmen_BioRegio_und_BioProfile.pdf. Accessed 18.08.2020.
- Staffås L, Gustavsson M, McCormick K (2013) Strategies and Policies for the Bioeconomy and Bio-Based Economy - An Analysis of Official National Approaches. *Sustainability* 5(6):2751–2769. <https://doi.org/10.3390/su5062751>
- The White House (2012) National Bioeconomy Blueprint. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf. Accessed 18.08.2020.
- Tödting F, Trippel M (2018) Regional innovation policies for new path development - beyond neo-liberal and traditional systemic views. *European Planning Studies* 26(9):1779–1795. <https://doi.org/10.1080/09654313.2018.1457140>
- Viaggi D (2016) Towards an economics of the bioeconomy: four years later. *Bio-based and Applied Economics* 5(2):101–112
- von Hayek FA (1945) The Use of Knowledge in Society. *The American Economic Review* 35(4):519–530
- von Hayek FA (1975) Die Anmaßung von Wissen. *ORDO: Jahrbuch für die Ordnung von Wirtschaft und Gesellschaft* 26):12–21.
- Warmuth E (1991) Biotechnology 2000 - A new German R&D programme. *Research Evaluation* 1(2):79–88. <https://doi.org/10.1093/rev/1.2.79>
- Weber KM, Rohrer H (2012) Legitimizing research, technology and innovation policies for transformative change - Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy* 41(6):1037–1047. <https://doi.org/10.1016/j.respol.2011.10.015>
- Weible CM (2014) Introducing the Scope and Focus of Policy Process Research and Theory. In: Weible CM (ed) *Theories of the Policy Process*. Westview Press, New York, pp 3–21
- Wesseler J, von Braun J (2017) Measuring the Bioeconomy - Economics and Policies. *Annual Review of Resource Economics* 9(1):275–298. <https://doi.org/10.1146/annurev-resource-100516-053701>

- Zilberman D, Kim E, Kirschner S, Kaplan S, Reeves J (2013) Technology and the future bioeconomy. *Agricultural Economics* 44(supplement):95–102. <https://doi.org/10.1111/agec.12054>
- Zinke H, El-Chichakli B, Dieckhoff P, Wydra S, Hüsing B (2016) Bioökonomie für die Industrieration - Ausgangslage für biobasierte Innovationen in Deutschland verbessern. http://biooekonomierat.de/fileadmin/Publikationen/berichte/Hintergrundpapier_ISA_Vero_ffentlichung_2.pdf. Accessed 18.08.2020

Affiliations

Leonard Prochaska¹ • Daniel Schiller¹

Daniel Schiller
daniel.schiller@uni-greifswald.de

¹ Institute of Geography and Geology, University of Greifswald, Friedrich-Ludwig-Jahn-Str. 17a, 17487 Greifswald, Germany