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The Green Deal and Mission-Oriented Innovation Policy in Europe – What about Smart Specialisation?

Abstract: The European Commission's Green Deal seeks to provide an opportunity to battle climate change, make production and consumption more sustainable and less energy-intensive, and to decouple economic growth from environmental degradation. The green transition in Europe is not only an opportunity for economic development but also to address the shortcomings of European research and innovation policy. To exploit these opportunities, reforms of different extent are required. A suitable framework to coordinate this effort considering green transition in Europe can be Smart Specialisation which is already an instrument of European innovation policy and possesses the capacity to coordinate investment in certain technologies, supporting selected sectors and to explore new niches of structural diversification. The missing link between green transition and Smart Specialisation can be the concept of mission orientations as a new frame of innovation policy. The authors argue that a combination of Smart Specialisation with green missions can be mutually beneficial.

Keywords: Green Deal, Sustainability, Smart Specialisation, EU, Mission-oriented Innovation, Regional Policy

JEL-Code: O3, O4, O52; Q5

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A. Introduction

Europe today faces challenges that are stumbling blocks for continued economic growth and are unlikely to be addressed by business-as-usual approaches. Among these challenges are low innovation intensity, the consequences of the Corona pandemic and the necessity of a green transition of the European economy.[3] Thereby, a holistic approach which focuses on innovation and provides an opportunity to address multiple challenges at the same time is required.[4] These challenges differ when it comes to their actuality. For instance, low growth constitutes a phenomenon which is experienced in several advanced economies since the aftermath of the global financial crisis starting in 2007 and following years.[5] The intensity of innovation in Europe and in Germany has diminished in recent years. Almost 50% of German companies have failed in adapting their innovation profile to recent changes and about 11% engage in almost no innovation at all. Especially the gap between large and small-to-medium-sized enterprises (SMEs) in terms of innovation is increasing to the disadvantage of SMEs.[6] On a broader scale, the innovation gap between the EU and the United States and Japan as main competitors remains significant and measures to address this growing gap by, for instance, increasing R&D spending to 3% of GDP, have not been achieved.[7] Moreover, the lessons learned from the Corona pandemic call for a new kind of policy that not only restores the pre-Corona situation but sets the basis for a resilient post-pandemic economy and society.[8]

Finally, the green transition to fulfil the Paris agreement and limit global warming to 1.5°C will need to be far more ambitious and faster than the current path development implies.[9] The fundamental and short-term nature of this transition will swipe away businesses and business models that do not manage to transform themselves to a sustainable path. On a national level, the cards get shuffled anew. An economically leading position of today is no guarantee of tomorrow's prosperity so that established mechanisms and structures are challenged. While the situation is characterised by a

3 *Lund Declaration*, 2009; 2015.
4 *Dachs et al*., 2015.
5 *Deledi et al*., 2019; *European Commission*, 2017.
6 *Breitinger et al*., 2021.
7 *Barca*, 2009; *European Commission*, 2017.
8 *Gianelle et al*., 2020a.
9 *David*, 2009; *IPCC*, 2021.

high level of uncertainty, the transformation also bears the opportunity to overcome present shortcomings.[10]

Such a successful transition requires a change in several areas of which innovation and structural policy is one of the most important ones. Recently, innovation is increasingly regarded not as an end in itself, but rather as a measure to contribute to societal developments.[11] This viewpoint requires the recognition of a target and the establishment of missions to reach future prosperity.[12] Mission-driven approaches to innovation policy are increasingly adopted in countries which are regarded as strong innovators or innovation leaders.[13] The European Commission already expressed its ambition to focus not only on quantitative but also on qualitative growth under the premise of being smart, inclusive, and sustainable.[14] One of the challenges to motivate missions is the green transition, institutionalised in the European Green Deal.[15]

Against this backdrop, the paper at hand will contextualise the Green Deal in the context of new approaches to innovation policy and discuss its potential integration in existing innovation policies in Europe, namely the Smart Specialisation approach.[16] To do so, the paper is structured as follows: firstly, the Green Deal as a challenge and innovation as an instrument are introduced. Secondly, mission-oriented policies are discussed as a new narrative of innovation policy in reaction to grand challenges. This discussion is, thirdly, complemented by an overview of practical examples of mission orientation in the context of green transitions. Fourthly, the European understanding of innovation instruments of Smart Specialisation is introduced and discussed as a potential mechanism for implementation of the Green Deal. The paper closes with a conclusion and an outlook.

B. The Green Deal and Innovation Policy

It is increasingly recognised both publicly and politically that several grand challenges have occurred over time and need to be addressed. For instance, the first Lund Declaration in 2009 called on the EU to focus on society's

10 *Breitinger et al.,* 2021.
11 *Breitinger et al.,* 2021; *Tuffs et al.,* 2020.
12 *Mazzucato,* 2015.
13 *Angelis,* 2021.
14 *European Commission*, 2017; *Mazzucato*, 2015.
15 *European Commission*, 2021a.
16 *Gianelle et al.*, 2020a.

major challenges and move beyond rigid short-term limitations in the form of a new deal among European institutions.[17] First successes have been achieved in the meantime, regarding the aspiration to align European and national strategies and instruments.[18] However, it is debatable which trends really are grand challenges that motivate larger efforts. One approach would be to analyse current megatrends that shape development in Europe and beyond as listed in foresight studies and comparable documents. Among these trends are demographic change, digitalisation, security, health, work and production, or sustainability.[19] Here, foresight studies are helpful to identify trends and future opportunities, but they do not deliver a complete and commonly accepted list of grand challenges.[20] In this regard, the Sustainable Development Goals (SDGs) formulated by the UN give more orientation by formulating global societal goals such as no poverty (SDG 1), good health and well-being (SDG 3), gender equality (SDG 6), or climate action (SDG 13). However, from a practical perspective, the SDGs are still too broad and need to be divided into clear and actionable objectives or missions.[21]

In the context of sustainability and green transition, particularly global warming, tightening supplies of energy, water and food, or public health play a major role and will most likely define the challenge of transforming Europe into an eco-efficient economy.[22] The European answer to all these challenges was presented with the introduction of the European Green Deal in 2019. This Green Deal, a reference to Roosevelts New Deal in the 1930s, announces to transform the EU into a modern, resource-efficient, and competitive economy with the goals of (1) zero net emissions of greenhouse gases by 2050, (2) economic growth decoupled from resource use, and (3) no person and no place left behind.[23] The targets align with previous strategies such as the Europe 2020 strategy which was based on the objectives of smart, sustainable, and inclusive growth.[24]

As a reaction, the European Commission has recently formulated five guiding missions to spell out its approach to the grand challenges of our time. These missions are: (1) adaptation to climate change, (2) cancer, (3)

17 *Lund Declaration,* 2009.
18 *Lund Declaration,* 2015.
19 *Mesloh et al.,* 2021.
20 *Mazzucato & Penna*, 2018; *Dachs et al.,* 2015.
21 *Mazzucato*, 2018.
22 *Lund Declaration,* 2009.
23 *European Commission,* 2021b; *European Commission,* 2020.
24 *Doranova et al.*, 2012.

restore our ocean and waters by 2030, (4) 100 climate-neutral and smart cities by 2030, (5) a soil deal for Europe. One can already observe the high status of sustainability in these missions, of which four directly contribute to the superior challenge of green transition. Each of these missions is divided into smaller objectives such as supporting 150 European regions and communities to become climate resilient by 2030. Moreover, each mission is led by a mission manager and gets supported by a mission board of up to 15 experts.[25]

Defining objectives is the one thing but developing a way how to get there is another discussion. Here, two of the major instruments to achieve the green transition are research and innovation.[26] The Green Deal not only recognises the urgency for a green transformation as formulated in the Paris Agreement, but explicitly emphasises the role of research and innovation policy in this regard.[27] Although it is true that not all grand challenges can be achieved by innovation, the green transition in Europe relies to a large degree on this strategy.[28] This is based on the notion in economic literature that innovation constitutes one of the main engines of economic growth and well-being, and research is considered the key to innovation.[29] Additionally, improving productivity and facilitating structural change as well as addressing social and environmental challenges are major outcomes of focused innovation.[30] This discussion is particularly important when it comes to catching-up processes in lagging behind regions.[31] But research and innovation are not ends in themselves and not every kind of innovation automatically contributes to addressing the grand challenges such as a green transition. To exploit their potential, a focused policy of research and innovation is required that channels activity according to certain priorities. This means that the research process as such needs to be embedded in a new narrative that recognises a direction and an overarching contribution to transformative change.[32] This is the basic idea of mission-oriented innovation policy.[33]

25 *European Commission,* 2021a.
26 *Mazzucato*, 2018.
27 *Wolf et al.*, 2021.
28 *European Commission,* 2017.
29 *Solow*, 1957; *Mazzucato & Penna,* 2020.
30 *Mazzucato & Penna,* 2020.
31 *Pîrvu et al.*, 2019; *European Commission,* 2020.
32 *McCann & Soete,* 2020; *European Commission,* 2020.
33 *Dachs et al.*, 2015.

C. Mission Orientation in Innovation Policy

Historically, innovation policy is divided into two frames, the first ranging from the aftermath of World War II until the 1980s and the second one from the 1980s ranging until today. Both frames are characterised by different understandings of growth processes, market functionalities, and knowledge creation and resulted in different political implications. The first frame of innovation policy focused on innovation for growth. Experience from the recent World War led to the notion that a strong governmental influence on the economy was desirable and able to achieve tremendous benefits and economic growth. Accordingly, the societal consensus generally argued in favour of a strong role of the state when it came to promoting innovation and addressing market failures.[34] The second framing set in in the 1980s when a new direction of economic theory became dominant, closely linked to the Reagan and Thatcher governments. This new framing added a narrative of efficiency and public saving rather than action. In the context of intensifying international competition and globalisation, the focus shifted to national systems of innovation (NIS).[35] The main focus of NIS understands the linkage of involved actors as aspects of shaping knowledge bases (i.a. know-what, know-who, know-why) and commercialisation.[36] The evolution of innovation economics came up as well as its approach on the individual firm behaviour and its dynamic within a framework of institutions.[37]

On this basis, the understanding of innovation processes and innovation policy has changed significantly over the past 10-15 years, forming a third framing. The earlier framings stated that innovation was mainly driven by the individual genius of entrepreneurs, with the public sector at best as a facilitator, inspired by Schumpeter. Schumpeter defined innovation as a function of new combinations of scarce resources. The combinatory function is known as 'entrepreneurial function' (*Unternehmertum*). Schumpeter emphasised, moreover, the important aspect of innovation diffusion. In his early works Schumpeter's entrepreneurial function is major for innovation (Schumpeter Mark I), while in later works he emphasised the innovative large firm (Schumpeter Mark II) to enable radical and disruptive innovations.[38] As opposed to that, Mazzucato (2015) underlines that innovation is a collective process in a system of heterogenous actors, a fundamentally

34 *Schot & Steinmueller*, 2018; *European Commission*, 2017.
35 *Schot & Steinmueller,* 2018; *Kattel & Mazzucato,* 2018.
36 *Lundvall, 1992.*
37 *Nelson & Winter,* 2002.
38 *Schumpeter,* 1943*; Fagerberg*, 2005.

uncertain process in a Knightian sense and a path-dependent, cumulative, and highly clustered process. This is following the notion that earlier understandings of innovation policy, which were focused on marginal change and market-fixing, have their strengths in identifying areas with underinvestment in research and development (R&D), but fall short when it comes to identify areas with high potential profits. The idea of mission orientation as the third framing of innovation policy distances itself from earlier approaches. While the earlier framings had their justification in their time, the fact that developing countries hardly benefited from former innovation policy and the existence of grand societal challenges, require a new approach to innovation.[39]

Although the new framing is still evolving, its outlines become clearer with a focus on the question how R&D can contribute to meeting social needs on a more fundamental level.[40] First of all, the measurement of success takes a different perspective in the third framing of innovation policy. While the primary focus of earlier frames was to increase the quantitative rate of innovation in the system (e.g. measured by the number of patents or jobs), mission-oriented innovation policy asks the question of the qualitative direction of innovation and whether it contributes to address the grand challenges.[41] This approach is also found in the idea of "unbalanced growth" formulated by, among others, Albert Hirshman who argued in favour of structural renewal by directing innovation in a desirable direction.[42] The modern equivalent in the context of the Green Deal would be the facilitation of research and innovation for actions against climate change.[43] To not induce untargeted growth is already based in European policy which has formulated the ambition to achieve a particular type of economic growth – namely smart, inclusive, and sustainable growth – which admits that economic activity is not only characterised by a rate but also by alternative directions.[44] In this regard, missions are considered a tool to steer economic growth and focus research, innovation, investment, and other activities on solving the grand challenges.[45] The key idea of mission orientation is thereby to provide a target for development and establishing an environment to

39 *Kattel & Mazzucato*, 2018; *Deledi et al.,* 2019; *Mazzucato et al.*, 2019; *Weber & Rohracher*, 2021; *Jütting*, 2020.

40 *Schot & Steinmueller,* 2018.

41 *Foray*, 2009; *Kattel & Mazzucato,* 2018; *Mazzucato et al.*, 2019.

42 *Mazzucato et al.*, 2019.

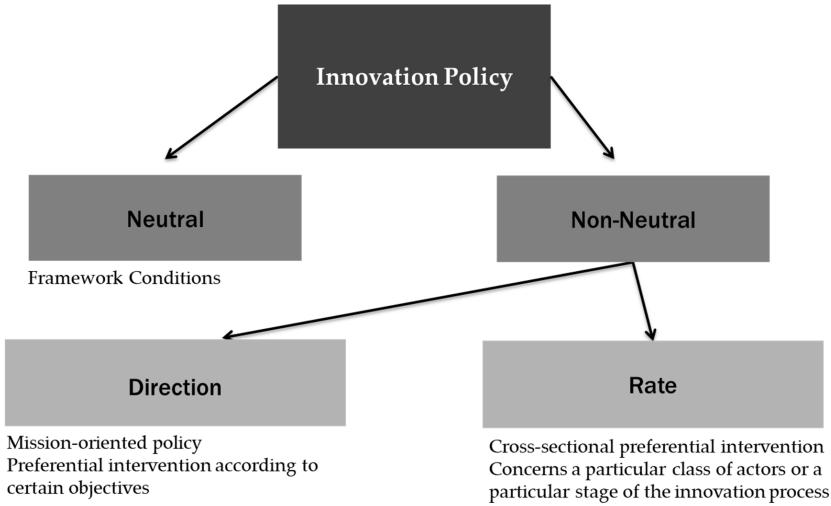
43 *Foray*, 2009.

44 *Kattel & Mazzucato,* 2018.

45 *Mazzucato*, 2018.

reach this target. The playing field of the market is thereby not levelled, as proclaimed in earlier framings, but intentionally tilted in favour of certain missions.[46] Figure 1 summarises this structure of innovation policy schematically using neutrality of direction as a distinguishing characteristic.

Figure 1: Schematic Summary of Innovation Policy



Source: Foray (2015; 2018).

What further differentiates the mission-oriented approach from previous framings is its emphasis on cooperation as well as the recognition of multiple drivers and heterogenous actors shaping the innovation process.[47] This is also because thematically limited approaches, such as a purely scientific or technological focus, are too narrow to address a grand challenge with its systemic extent. By contrast, the cooperation between different disciplines ("creative corporatism", "varieties of cooperation") and all relevant stakeholders constitutes a strength of mission orientation.[48] This cross-sectoral approach also applies to the general environment of innovation which might

46 *Mazzucato et al.*, 2019.
47 *Kattel & Mazzucato*, 2018.
48 *Mazzucato*, 2018; *Kuhlmann & Rip*, 2018; *Breitinger et al.*, 2021; *Mazzucato et al.*, 2019; *European Commission*, 2021a.

become subject to further modifications.[49] Also, bottom-up experimentation is considered a key feature since each mission possesses its own characteristics and therefore requires different solutions.[50] Decentralisation and local decisions processes are emphasized rather than centralisation and top-down governance. The risk associated with entrepreneurial discovery, bottom-up creativity, and experimentation is thereby an inevitable component of mission-oriented innovation.[51] Only by having the courage to fail, is disruptive innovation enabled and new solutions "outside the box" come up.[52]

Such an inclusion of a wider range of stakeholders, cross-sectoral and cross-disciplinary linkages requires new governance arrangements to steer such an extensive process.[53] The involvement of new and larger stakeholder groups also means the involvement of civil society in early stages of missions as well as close interactions between governing institutions such as the European Commission and member states in Europe.[54] This is also related to a new and more prominent role of the state in the scope of mission-oriented policy. Here, the state is regarded as a creator of markets and provider of mission targets while also involving the aspect of financing. Strategic investments can determine a direction of growth and function as guidance for further private investment.[55]

Studies on the efficiency of different public policies imply that mission-oriented spending on innovation performs well above traditional forms such as tax cuts, or investment in "shovel-ready" projects and infrastructure when it comes to economic effects. In this regard, such policies lead to permanent rather than temporary effects on the level of output and tend to positively affect other economic areas by generating a GDP multiplier effect around ten times larger than standard government spending excluding R&D, implying a "supermultiplier" effect. Also, private investment appears to get crowded-in by mission-oriented spending rather than getting crowded-out.[56]

In Europe, the early steps towards mission orientation trace back to the 1990s, and the beginning of the 2000s, in the context of societal challenges

49 *Kuhlmann & Rip*, 2018; *Ergas*, 1986.
50 *Kattel & Mazucato*, 2018; *European Commission*, 2017; *Larrue*, 2021.
51 *European Commission*, 2017.
52 *Mazzucato*, 2018; *Breitinger et al.*, 2021.
53 *Wittmann et al*., 2020; *Dachs et al.*, 2015.
54 *European Commission*, 2017; *Mazzucato & Penna*, 2020; *Larrue*, 2021; *Mazzucato et al.*, 2019.
55 *Mazzucato et al*., 2019.
56 *Deledi et al.*, 2019.

such as global warming.[57] The "Maastricht Memorandum" from 1993 already called for a new mission for science and technology policy.[58] However, mission orientation needed several further years to gather pace in Europe. In 2006, the Aho Group demanded actions to provide a suitable environment for research investment, followed by the ERA Rationales Group in 2007 that proposed structuring programmes along grand challenges. This proposal was the basis for an expert group proposing a stage-based process to design research and innovation policies for such challenges in 2009.[59] The ongoing discussion came hand in hand with an attention shift after the targets of the Lisbon Strategy 2000-2010 had been missed and a debate to reform the European research system set in.[60] One of the most prominent results on research and mission orientation was an adaptation of the European Horizon 2020 funding programme structure.[61]

Horizon 2020, the European framework programme funding research, technological development, and innovation, introduced seven societal challenges and innovation partnerships as a new approach of governing and steering innovation and research.[62] The first attempts failed to achieve a transformative impact on the European economy and social goals. Therefore, it was proposed in 2017 to introduce a mission-oriented approach to address the global challenges which were already recognised in the previous programming period 2014-2020.[63] A perspective on the representation of sustainability-related research in the Horizon 2020 programme is presented in Table 1. Here, sustainability-related projects were identified based on the calls and their relation to green transition, including, among others, blue growth, renewable energy, circular economy, green vehicles, energy efficiency, or biotechnology. The comparison with the total number of projects funded under Horizon 2020 reveals that, although the number of sustainability-related projects was relatively high particularly between 2015 and 2018, the funding they received was lower than their proportion would have suggested. It is open to the fact that partial aspects of sustainability-related projects can also be included in the other projects and thus enable a cross-sectoral approach to innovation transfer and development. Accordingly, the next programming period of the framework programme, called Horizon

57 *Wittmann et al.*, 2020.
58 *Larrue*, 2021.
59 *European Commission*, 2017.
60 *McCann & Soete*, 2020.
61 *European Commission*, 2021a.
62 *Mazzucato*, 2018.
63 *European Commission*, 2017.

Europe, will take up the call for large-scale research and innovation missions rather than individual calls.[64] At almost the same time, the European Commission put the transition to a healthy planet, the digital economy, and a sustainable development, which all refer to grand challenges, at the core of its long-term policy agenda.[65]

Table 1: Sustainability-related Research Projects in Horizon 2020

Year	All Projects		Sustainability-related Projects			
	Total	Funding (in bn EUR)	Total	% of all Projects	Funding (in bn EUR)	% of all Projects
2014	380	44.84	30	7.89	0.56	1.24
2015	4,706	27.29	468	9.94	1.80	6.58
2016	4,945	71.07	481	9.73	2.04	2.87
2017	4,975	41.74	417	8.38	1.77	4.25
2018	5,062	63.03	270	5.33	1.50	2.38
2019	5,552	69.47	154	2.77	1.08	1.55
2020	4,503	76.86	173	3.84	1.41	1.83
2021	4,085	79.66	132	3.23	0.95	1.19
2014-21	34,208	473.95	2,125	6.39	11.11	2.34

Source: Data Europe (2021).

D. Mission-Oriented Innovation Policy in National Practices

The most iconic example of mission-oriented innovation policy is probably the Apollo "man on the moon" mission announced in 1961. Characterised by a high technological complexity, an ambitious objective and countless involved stakeholders, the mission succeeded in 1969 with the first moon landing. However, the positive effects of the mission did not cease here but inspired further research in multiple sectors at later stages.[66] Still, the moonshot mission was not the only mission-oriented policy, since basically all leading economies of that time oriented their innovation policy in a comparably designed approach.[67] Mission orientation in innovation policy inspired particularly the United States and major Western European countries, but

64 *Larrue*, 2021; *Mazzucato*, 2018.
65 *McCann & Soete, 2020.*
66 *Mazzucato*, 2018.
67 *Kattel & Mazzucato,* 2018.

also strategies in Canada (NCE – Networks of Centres of Excellence, GCC – Grand Challenges Canada), Japan (MITI – Ministry of International Trade and Industry) or the Soviet Union have stood out at some time.[68] Moreover, Latin America has produced a variety of examples of mission-oriented policies with different results and lessons learned. However, the focus of such policy approaches remains in developed countries although the potential in developing countries might be even higher looking at ways to overcome a resource extraction lock-in, infrastructural investments, security, or energy and the environment.[69]

From a European perspective, other global players such as China or the United States appear to perform better in terms of innovation. Europe therefore needs to be creative to outperform the (arguable) disadvantage of a fragmented rather than centralised innovation system like in China or the United States.[70] When it comes to mission orientation in innovation policy, particularly the UK, France, Sweden, the Netherlands, and Germany have successfully adopted mission-oriented approaches in European contexts.[71] The British example includes the British Innovation and Research Strategy for Growth calling for a more active role of the state, or the Industrial Strategy White Paper.[72] Moreover, the UK formulated four missions, namely clean growth, artificial intelligence, ageing society, and the future of mobility that should shape innovation actions.[73] France also has a long and successful history of implementing mission-oriented projects while also Sweden formulated missions linked to global sustainability as a ground for cross-sectoral cooperation.[74] Comparably, Ireland has set up challenge-based funding to direct research expenditure towards societal challenges, as did the Netherlands where missions and priorities are negotiated between the relevant ministries and responsible stakeholders and guide both public strategies as well as public and private innovation activities. [75]

Germany, as the largest economy in Europe, also has some tradition in mission orientation. These experiences go back to the 19th century and the "System Althoff" in Prussian higher education and research policy.[76] Re-

68 *Breitinger et al.*, 2021; *Kattel & Mazzucato*, 2018; *Dachs et al.*, 2015.
69 *Mazzucato & Penna,* 2018.
70 *Mazzucato*, 2018.
71 *Breitinger et al.,* 2021.
72 *Mazzucato et al.,* 2019; *Wittmann et al.,* 2020.
73 *Breitinger et al.*, 2021.
74 *Ergas*, 1986; *Dachs et al.*, 2015; *Angelis*, 2021.
75 *Angelis*, 2021; *Hekkert et al.*, 2020.
76 *Kattel & Mazzucato,* 2018.

cently, the idea of mission orientation has been introduced in the German Hightech-Strategy.[77] But probably the most prominent example of mission orientation as a tool for green transition is the German "Energiewende". The goal of this initiative was to phase out nuclear power in Germany by the end of 2022 through transforming the energy system towards renewable energy and enhanced energy efficiency. Measurable targets were to generate at least 60% of final energy consumption and at least 80% of gross electricity consumption by renewable energy while reducing greenhouse gas emissions by 80-95% by 2050. The four objectives of the Energiewende were to (1) fight climate change, (2) phase out nuclear power, (3) improve energy security, and (4) guarantee industrial competitiveness and growth. A look back reveals important progress towards the goals set: renewable energy has become the most important source of energy; nuclear power is phased out as planned and there is a (moderately) positive progress towards energy efficiency. Although the emission reduction target is not likely to be met if external factors such as pandemic-related economic slowdown are not considered, the Energiewende can be attested a success when it comes to target evaluation.[78]

The Energiewende was characterised by a high level of ambition, complexity, risk, and experimentation. As the success largely depended on technological innovations related to renewable energy, it constituted an important aspect to not prioritise a certain kind of technology over another but to provide a general direction and underline technology-openness. Creating an innovative environment, supported by public incentives, has released a certain level of excitement in terms of research, development and innovation that ensured not only an effective but also an efficient implementation. Accordingly, there was a mixture of top-down definition of directions and bottom-up work buy-in. Another important success factor was the legitimacy and public support gained through the engagement of citizens. Although the electricity consumers pay the bill of the transformation via feed-in tariffs, which has significantly increased the energy price, the positive public opinion was not significantly impacted negatively. Thereby, the cost-intensive aspect was complemented by creating the opportunity of private ownership in renewable energy generation to also exploit the benefits privately. Finally, the Energiewende successfully used the windows of opportunity that emerged over time, e.g., the Fukushima accident in 2011 or international climate agreements, to pass complex decisions.[79] However,

77 *Dachs et al.*, 2015.

78 *Kuittinen & Velte*, 2018.

79 *Kuittinen & Velte*, 2018; *Mazzucato*, 2018; *European Commission*, 2017.

the recent stagnation in German climate politics shows how changing regulating environments can disrupt functioning environments.[80]

On a European level, the experience from German Energiewende, as well as from other mission-oriented approaches in different countries, can be used as lessons learned when it comes to formulating research and innovation missions for the green transition. Particularly the selection process with a political steering, topics of societal relevance, and the mobilisation of public involvement have proved to be crucial success factors. Probable missions for Europe are thereby decreasing the burden of dementia, a plastic-free ocean, or 100 carbon-neutral cities by 2030 which show a strong relation to sustainability and green transition which have been presented as grand challenges above.[81]

E. Smart Specialisation for Green Transition?

The European approach to tackling the major challenge of the green transition will primarily be based on research and innovation activities. The primary instrument of innovation in Europe are the so-called Smart Specialisation Strategies (S3), which is based on the deployment of innovative capacity and the creation of new connections between stakeholders both within and beyond a region to develop competitive regional advantages.[82] Smart Specialisation as an instrument has been conceptualised to tackle the increasing productivity gap between Europe and, particularly, the United States which implied a more structured and focused research effort in Europe.[83] It was found that spreading the limited public investment thinly across several technological areas, copying the example of successful regions, did not make much of a successful impact.[84] Instead, the place-based characteristics of a region should be the starting point to develop particular strategies based on regional strengths. Every region needs to find its own niche in the economy as there is no one-size-fits-all solution.[85] Smart Specialisation is not a top-down planning doctrine that defines a particular set of strategies that a region must focus on. Instead, the concept is based on the so-called

80 *Kruse*, 2021.
81 *Mazzucato*, 2018.
82 *Foray et al.*, 2021.
83 *Barca*, 2009.
84 *Foray et al.*, 2009; *Midtkandal & Sörvik,* 2012.
85 *Gianelle et al.*, 2020a.

entrepreneurial discovery to explore and discover new technological and market opportunities in a region by regional actors themselves.[86]

The nature of Smart Specialisation as a tool of assessing already existing economic structures and reflecting on their further development has made it an important tool for regional structural transformation processes in Europe. Since the regional approaches should not just copy successful strategies from other regions, which might fail to be replicable due to different regional characteristics, the regional entrepreneurial discovery allows to break regional lock-in situations and really focus on particular comparative advantages.[87] From an economic perspective, Smart Specialisation builds upon theories of national and regional innovation systems as well as cluster theories. It now represents a core component of EU Cohesion Policy and most regions in Europe have developed Smart Specialisation Strategies.[88] The tremendous success of Smart Specialisation in less than a decade is explained by a strong political will of implementation, particularly from the European Union.[89]

Nevertheless, the short time between idea formulation and practical implementation, makes Smart Specialisation an example of "policy running ahead of theory".[90] Accordingly, the concept is subject to continuous adjustments both motivated by academic research and pragmatic implementation.[91] The ongoing adjustment of Smart Specialisation explains why results of the policy are still fragmented.[92] Preliminary results indicate that Smart Specialisation has only been partially implemented and mechanisms circumvent the idea of selective intervention. This may be explained by lobbying, political considerations such as higher support through widespread investment, risk-averse attitudes of policy makers as well as a lack of adequate institutional and administrative capacity.[93] Moreover, Smart Specialisation has introduced new processes and requirements that proved to be difficult in implementation for some regions.[94] Therefore, the concept is currently under revision for the current financing period 2021-2027. It is this revision that has provoked a variety of comments and recommendations from acade-

86 *Foray*, 2013; *Di Cataldo et al*., 2020; *Girejko et al.,* 2019.
87 *Foray et al*., 2011; 2021; *Gianelle et al*. 2020a.
88 *Tuffs et al.,* 2020; *Foray et al.,* 2021; *Montresor & Quatraro*, 2018.
89 *McCann & Soete,* 2020.
90 *Foray et al*., 2011: 1.
91 *McCann & Ortega-Argilés,* 2016.
92 *Foray et al*., 2021.
93 *Gianelle et al*., 2020b.
94 *Kroll*, 2016.

mia on the future of Smart Specialisation.[95] Some authors argue in favour of a critical evaluation to strengthen the process and ensure an effective and comparable implementation across Europe without adding additional objectives.[96] Other authors see the revision phase as a chance for European innovation policy to align with the challenges defined by the Green Deal.[97]

The position of using Smart Specialisation as an instrument not only for cohesion and regional innovation but also for the green transition of Europe is currently gathering pace.[98] This is backed by research on updating regional innovation systems in the context of grand challenges. Different approaches are proposed, for instance challenge-oriented regional innovation systems (CoRIS) that go beyond competitiveness and economic growth as guiding principles for innovation,[99] Dedicated Innovation Systems,[100] Challenge-led innovation policies to address grand societal challenges,[101] Mission-oriented Innovation Systems (MIS) ,[102] or transformative innovation policy.[103]

What makes Smart Specialisation a probable instrument in light of the Green Deal is its versatility in target dimensions. Smart Specialisation today is already utilised as a tool for convergence in less-developed regions.[104] Apart from that social aspect, Smart Specialisation is also considered a key tool for the achievement of smart and sustainable growth.[105] Particularly its characteristic of combining top-down directionalities with bottom-up enterprise engagement makes Smart Specialisation a tool for green transition which is a comparable kind of transformational policy as the one Smart Specialisation was developed for.[106] This is even more true as the transition needs to recognise place-based factors and should build upon regional specialisations.[107] While Smart Specialisation lacks the directionality that the Green Deal can provide, the latter is in need of a policy framework like that of Smart Specialisation to mobilise resources and stakeholders all over

95 *Hassink & Gong,* 2019; *Kruse & Wedemeier,* 2019.
96 *Benner*, 2020.
97 *Doussineau et al.,* 2021.
98 *Larosse et al.*, 2020.
99 *Tödtling et al.,* 2021.
100 *Pyka*, 2017.
101 *Raven & Walrave,* 2020.
102 *Hekkert et al.*, 2020.
103 *Schot & Steinmueller,* 2018; *Weber & Rohracher,* 2021.
104 *Kruse & Wedemeier,* 2020; 2021.
105 *Kogut-Jaworska & Ociepa-Kicinska,* 2020.
106 *McCann & Soete*, 2020; *Nakicenovic et al.,* 2021.
107 *Montresor & Quatraro*, 2018.

Europe. This would combine direction and technology-open autonomy and might lead to a more unified European innovation system.[108]

The observation of a possible combination of the Green Deal and Smart Specialisation follows a discussion to ascribe the grand challenges a more prominent role in Smart Specialisation Strategies.[109] This discussion has proceeded so far that a renaming of Smart Specialisation Strategies (S3) to Smart Specialisation Strategies for Sustainable and Inclusive Growth (S4+) was proposed and a concept for Smart Specialisation Strategies for Sustainability (S4) is currently under development by the EU Joint Research Centre.[110] This new S4 concept should introduce a green dimension in Smart Specialisation to complement economic and social aspects.[111] Certain countries such as Serbia and Slovenia have already experimented with including the SDG goals into their Smart Specialisation Strategies or put an emphasis on enabling factors required for an environmental transition. Moreover, the S3 of the Swedish region of Västerbotten strongly emphasises social innovations and sustainable development which might become a role model also for other regions when it comes to updating and refining their Smart Specialisation Strategies.[112]

Despite the ongoing discussion of green transition in Europe, the inclusion of green transition targets or SDGs in regional Smart Specialisation Strategies is still in an early phase.[113] This claim is underlined by Figure 1 which portrays the notion of sustainability-related policy objectives in regional Smart Specialisation Strategies in Europe. The S3 of European regions have been browsed for notions of sustainability-related sectors in their policy objectives[114] using data from the Eye@RIS3 platform (Joint

108 *Larosse et al.*, 2020; *Tuffs et al.*, 2020; *European Commission*, 2020; *Robinson & Mazzucato*, 2019; *McCann & Soete*, 2020.

109 *Hassink & Gong*, 2019; *Doranova et al.*, 2012; *Neto et al.*, 2018; *Larosse et al.*, 2020; *Lund Declaration*, 2015; *Esparza-Masana*, 2021.

110 *McCann & Soete*, 2020; *Nakicenovic et al.*, 2021.

111 *Landabaso*, 2020.

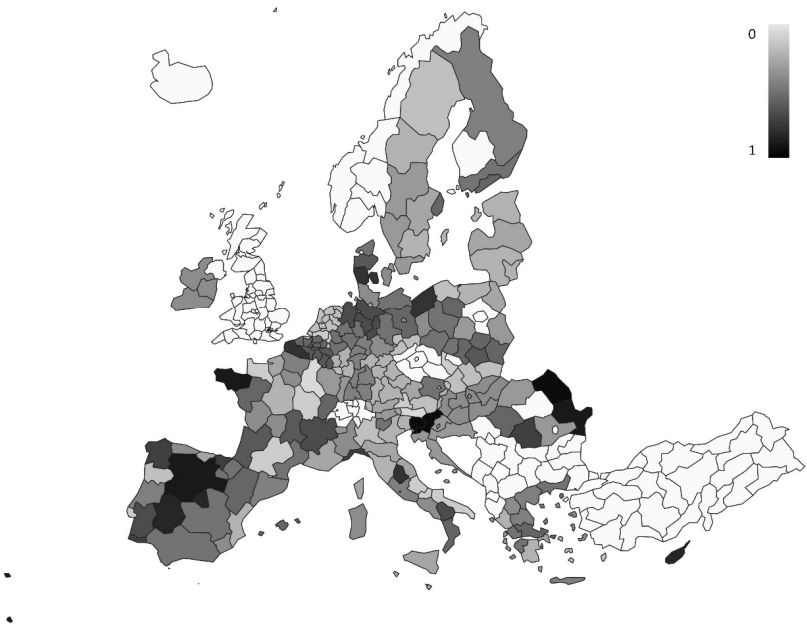
112 *Nakicenovic et al.*, 2021.

113 *Polido et al.*, 2019.

114 Sustainability-related sectors: B09 – Blue renewable energy, F43 – Biodiversity, F44 – Ecotourism, F45 – Nature Preservation, J61 – Bioeconomy, J62 – Climate change, J63 – Eco-innovations, J64 – High-speed rail-road transportation systems, J65 – Resource efficiency, J66 – Smart grid & integrated transport systems, J67 – Sustainable agriculture, J68 – Sustainable energy & renewables, J69 – Sustainable land and water use, J70 – Sustainable production and consumption, J71 – Waste management, D22 – Cleaner environment & efficient energy networks and low energy computing, D30 – Intelligent inter-model and sustainable urban area (e.g. smart cities).

Research Centre, 2021). The number of mentions per region is portrayed as an index between 0 (1 mention) and 1 (17 mentions). When a region did not present an own S3 but the related country did, these numbers were used (e.g. Croatia or Hungary). Missing data are illustrated in white. Figure 2 shows that sustainability has become an official policy objective in almost all European regions but to a differing degree. Although some strategies are currently being updated and will most likely reflect sustainability more prominently than the last strategy, mainstreaming sustainability in regional innovation in Europe is still developing.

Figure 2: Sustainability in Policy Objectives of Smart Specialisation Strategies



Source: Joint Research Centre (2021).

In order to really use Smart Specialisation as a channel and mechanism for the governance in the implementation of the green deal, adjustments of the existing mechanism are required that go beyond mere formalities.[115]

115 *Montresor & Quatraro,* 2018; *Larosse et al.*, 2020.

Naturally, a grand challenge, such as the green transformation of the European economy, will not be achieved by isolated efforts of some regions but only via a major effort of the European research and innovation system and other related systems. Therefore, a mutual mission as a focus point of regional Smart Specialisation would allow for interregional cooperation and learning from other regions with similar challenges and provoke a level of excitement within Europe that can kindle the aspired green transformation.[116] Changing the relatively new process of developing a Smart Specialisation Strategy again in favour of green transition and sustainability topics might provoke a certain level of confusion. Nevertheless, the green transition mission might be just the topic that Smart Specialisation has been missing so far to give a real meaning to the process apart from empowering regional competitive advantages.

F. Conclusion

It can be concluded that green growth and sustainable transition are societal goals and fulfil the requirements as grand challenges.[117] The Green Deal, introduced by the European Commission in 2019, seeks to provide an opportunity to fight climate change, make production and consumption more sustainable and less energy-intensive, and to decouple economy growth from environmental degradation. Moreover, the green transition in Europe is an opportunity for economic development, to become a global role model, and to address the shortcomings of European research and innovation policy.[118] Although the EU spends a higher relative amount on research and development (R&D) than competitors such as China, Japan, or the United States, the productivity gap between Europe and its competitors remains large – to the disadvantage of the EU.[119] Particularly the fragmented nature of European research, the persistence of national policy cultures, and insufficient cooperation are problems that may be addressed by an overarching mission-oriented structure.[120] Comparable approaches to innovation policy have already been successfully introduced historically and in different geographical backgrounds. For Europe, the aspiration of an excellent science based, world-class research infrastructure, and a new generation of resear-

116 *McCann & Soete*, 2020; *European Commission*, 2017.
117 *Gianelle et al.*, 2020a.
118 *Tuffs et al.*, 2020.
119 *European Commission*, 2017; *Larosse et al.*, 2020.
120 *European Commission*, 2017; *Kattel & Mazzucato*, 2018.

chers are both a prerequisite of a successful transformation and a result of pursuing a mission-oriented approach that could, at the same time, address shortcomings of the European innovation system.[121]

To exploit these opportunities, several reforms of different extent are required. First, a clear and manageable challenge is to be defined in a participatory process to guide research, innovation, investment, and cooperation. This challenge, for instance the green transition of Europe, then needs to be complemented by practical missions. The state in this regard is assigned to organise the process of demand articulation and develop the public capacity to support the process. Another culture towards failure and experimentation, combined with the establishment of institutional spaces for socio-technical experiments would allow for a technology-open search process for the best solutions. A decentralised innovation policy with a strong perspective of cities and regions, under a common challenge and regulation, would correspond to this new kind of innovation environment.[122]

A suitable framework to coordinate this effort in light of a green transition in Europe can be Smart Specialisation which is already an instrument of European innovation policy and possesses the capacity to coordinate investment in certain technologies, supporting selected sectors and to explore new niches of structural diversification.[123] This is in line with an increasing discussion to introduce missions as a guiding principle to Smart Specialisation which is, as yet, missing. Smart Specialisation, on the other hand, combines the required factors for a successful implementation of the Green Deal, such as mobilising resources and investment, building upon place-based characteristics and combining top-down directionality with bottom-up entrepreneurial activity. Examples such as the Energiewende in Germany have shown how a well implemented mission-oriented policy can enable green innovation at a large scale. These examples should be a starting point when it comes to reforming European innovation policy.

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121 *Lund Declaration,* 2015.

122 *Frenken,* 2017; *Mazzucato*, 2015; *Kattel & Mazzucato*, 2018.

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