Smart Specialisation, Sustainable Development Goals and environmental commons

Conceptual framework in the context of EU policy

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ABSTRACT

This report contributes to a new transformative narrative aligning Smart Specialisation with the UN 2030 Agenda and the European Green Deal by offering directionality towards the Sustainable Development Goals and combining different levels of policy to achieve the needed sustainability transformations. The report highlights the role of policy coherence and coordination for the transformation. It presents approaches to increase policy coherence to harness synergies and alleviate trade-offs across different objectives with a focus on environmental issues. Throughout this report a number of selected cases is used to illustrate the conceptual discussion developed in a more theoretical part of the report. These cases presented in the report cover countries and regions from within and outside the European Union. Both EU and third countries present lessons learnt on the different topics linked to Smart Specialisation, sustainability and environmental commons. The report concludes by a discussion on how to orient existing smart specialisation approaches towards sustainability challenges and the achievement of the SDGs. This is a part of a broader ongoing effort on place-based innovation strategies for sustainability (S4).

ACKNOWLEDGEMENTS

EXECUTIVE SUMMARY

Smart Specialisation Strategies, a place-based EU-made innovation policy concept, were designed to identify and foster the set of transformative activities to drive knowledge-based economic transformation of places (Foray 2020). The increased commitment of the European Union to Sustainable Development Goals and the European Green Deal calls for a reflection on the how this new directionality, the commitment to support the transitions in key systems and the focus on sustainability should affect the narrative and goals of Smart Specialisation Strategies.

The purpose if this paper is to contribute to a new transformative narrative aligning Smart Specialisation with the UN 2030 Agenda and the European Green Deal by offering directionality towards the Sustainable Development Goals (SDGs) and combining different levels of policy to achieve the needed sustainability transformations. It is part of a broader effort summarizing different practical and theoretical aspects of this change and contributes to the ongoing debate and methodological underpinning of place-based innovation strategies for sustainability (S4).

The particular focus of this publication is on different dimensions of this upcoming change, with a special attention on the environmental commons. It analyses the relations of the new directionality resulting from a set of globally shared values with the traditionally bottom-up approach of Smart Specialisation, but also looks at the new challenges such as policy coherence needed to drive systemic change and resulting need of multi-level governance. Yet another aspect is the post-COVID 19 recovery challenge.

This overview is accompanied by a short outline of the emerging new approaches that can support the delivery of Smart Specialisation Strategies for SDGs. One of them is innovative budgeting, in particular SDG budgeting and sustainability-proofing of government budgets. Other approaches look at the reduction of the environmental impacts at

all scales and the transformative potential of the recovery packages adopted by EU Member States and bringing large investments that can support the key transitions. These insights are used to reimagine possible transformation towards Smart Specialisation for SDGsin three main aspects: at the level of the new thematic priority areas, their translation into transformational roadmaps and implementation.

The authors call for broadening the narrative of Smart Specialisation towards mobilising innovation for sustainability and connecting local innovation with global commons. This should be mainstreamed in the full policy cycle, from the design to implementation and monitoring stage. The focus on not only economic, but also societal and environmental dimensions of sustainability need a more inclusive approach and harnessing more diversified stakeholder perspectives, including new groups of actors that were not included in the policy-making process so far. The challenge of pandemic offers a new opportunity to reconsider our goals and values and use the recovery efforts for real transformations in all places, not only the sustainability leaders of now. Finally, no single strategy has potential to bring the necessary change. Policy alignment and coherence are crucial to minimise negative trade-offs or cancelling effects of different policies. Smart Specialisation for SDGs should be a joint effort on many levels that will enable progress towards achieving the sustainability objectives of both Agenda 2030 and the European Green Deal.

Introduction

Sustainable development is enshrined in the Treaty on European Union and adopted as a priority for both internal and external policies. The European Union and its Member States have also significantly contributed to the *2030 Agenda for Sustainable Development* unanimously adopted by all UN Member States in 2015. The subsequent Addis Ababa Action Agenda stated that science, technology and innovation can help achieve much faster progress in delivering the Sustainable Development Goals (SDGs). SDGs form a part of the European Commission's political priorities and are being integrated into all proposals, policies and strategies, with an ambition to achieve tangible progress[1].

The urgency of global cooperation around six key transformations has been strongly emphasised in the *Global Sustainable Development Report 2019*[2] and is further strengthened in the TWI2050 report prepared by the World in 2050 initiative. The 2020 edition focuses on *Innovations for Sustainability: Pathways to an efficient and sufficient post-pandemic future*[3]. Both reports acknowledge the transformative power of sustainable development and the key role of science, technology and innovation in achieving it.

The EU has committed to the global 2030 Agenda and its Sustainable Development Goals, making the European Green Deal the main channel to deliver on this ambition. The global shock of COVID-19 created a recovery challenge, but also offered an opportunity to reinvent our systems and not only 'build back better' but also build back dif-

ferently. The key EU policies, such as the Recovery and Resilience Facility, Cohesion Policy, but also their external dimension – development cooperation and foreign policy – are vehicles providing instruments and funding for change. These instruments are effectively deployed in locations, and it is at local, regional and national level that priorities and corresponding innovative solutions need to be identified. The localisation (regionalisation, nationalisation) of challenges is a necessary aspect of change, which can make it socially acceptable and meaningful to our diverse communities. We should strive to ensure that the great European and global transformations leave no one and no place behind.

The new challenges and priorities have prompted an ongoing reflection on how Smart Specialisation Strategies (S3) can deliver Sustainable Development Goals. This publication is a part of this reflection, and focuses on the necessary changes in the S3 narrative, wider policy coherence and new approaches that can be inspiring in this context, leading to making the concept evolve into place-based innovation strategies for sustainability (S4). It shows that we need to move from the classic logic of economic transformation to the one where science, technology and innovation delivers solutions for economic, societal and environmental challenges. This calls for growing understanding of environmental and societal impacts of economic growth and aims to mobilise our communities, knowledge and innovation for a sustainable transition.

Europe has committed to green and digital transitions towards sustainability, but not all territories are equally equipped to benefit from them. The drive towards a green and digital future can leave some places behind and make sustainability a public good for few. This is why inclusive and

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1   *https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals_en*.

2   *https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf*.

3   *https://iiasa.ac.at/web/home/research/twi/Report2020.html*.

place-based approaches – such as Smart Special-isation Strategies, newly remodelled towards the 2030 Agenda and Green Deal – are necessary to make sure that recovery and sustainable growth are available for all types of places at different territorial levels. The work and investment is a part of Europe's continental effort to achieving climate neutrality, making our economy sustainable and leaving no person or place behind.

The proposed changes build upon the classic Smart Specialisation process adapted to deliv-er not only regional competitive advantage but also environmental and social goals. These are not handled separately. Alternatively, the authors encourage the consideration of synergies and trade-offs while keeping in mind the big picture and global goals we all contribute to. The notion of contribution is also worth considering. The new logic focuses on the inter-relatedness of process-es and territories – looking at each region, city or country and each Smart Specialisation strategy – not as separate events and places but rather those not only contributing to individual bur also collective futures, including that of humanity. We should then consider whether the contribution we deliver is indeed positive, and our innovation good for the planet.

A new transformational narrative

1.

The **European Green Deal (EGD)** offers an aspirational vision of a sustainable future for the European Union (EU) without leaving anyone behind, accelerating and tilting the transitions in key systems: the energy, agri-food, manufacturing, housing and the mobility systems as well as considering biodiversity and pollution. It also aims to ensure a leading role for the EU and its Member States in implementing **the UN 2030 Agenda with its 17 Sustainable Development Goals (SDGs)** (UN, 2015). At the same time, **Smart Specialisation (S3)** is a unique process for promoting bottom-up innovation and entrepreneurial discovery to support place-based development at territorial level based on specific local resources, capacities and capabilities and stakeholder engagement. This process should become an essential contribution towards achieving the EGD and the SDGs by complementing these top-down visionary agendas with bottom-up initiatives. Currently, the European Commission services, in collaboration with stakeholders and public authorities, are discussing the possible transformation of S3 towards Smart Specialisation Strategies for Sustainability (S4) for countries, regions, cities and transnational partnerships. S4 may become a crucial approach within the EU's activities on Science, Technology and Innovation (STI) to support socio-economic recovery and achieve sustainable, resilient, just and inclusive growth. S4 encompassing the EGD and UN 2030 Agenda objective may provide an action agenda that could be truly transformative for the EU and beyond.

For this purpose, the S3 logic will need to be reoriented and updated to foster the transformative EGD and SDG narratives for inclusive and sustainable development and combine them with the innovative core of EU regions and local communities. S3 needs to be reinterpreted, redesigned and integrated to deliver on the EGD and SDGs. There are numerous lessons to be learnt based on experiences of S3, building on decades of devising and implementing Regional Innovation Strategies, Regional Programmes of Innovative Actions and S3.

The integration of S3 with the EDG and the SDGs we refer to here as S4[4]. They need to be inclusive and embrace all levels, from supranational and national to regional, local and individual. Pervasive change and adjustment will be necessary to make this transformation happen (TWI2050, 2018). S3 provides a useful vehicle at regional level to develop a policy-framing narrative by combining innovative, industrial and sustainability policy. S3 may contribute widespread stakeholder engagement and support for sustainability transformation across the political spectrum and within countries.

This is even more pertinent during the period of the COVID-19 pandemic and the emerging economic recovery measures at EU and national levels. Achieving the SDGs and EGD during the COVID-19 pandemic requires realising the potential of synergies and co-benefits to avoid regions falling (even further) behind and enabling regions to catch up and recover again (McCann and Soete, 2020). The pandemic has shed light on and has risen awareness for inequalities in vulnerabilities, impacts and capacities. Weaker regions will need support and

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4   *The final S4 concept is being developed by the JRC and its partners*

incentives to implement S3 with a strong focus on sustainability. 'Using […] S4+ to incentivise weaker cities and regions to engage with the sustainable growth and inclusive growth agendas will be essential if one wants to avoid sustainability becoming the preserve of the more prosperous places, an outcome which could undermine the success of the European Green Deal' (McCann and Soete (2020), p. 21). The Just Transition Mechanism (JTM)[5] will be an important tool to facilitate the inclusion of weaker regions in the transitions and support their diversification and innovation activities. S4 can contribute to this mechanism to support regions in revamping their industries. A shift from unsustainable and carbon-intensive activities could benefit novel development opportunities for previously disadvantaged regions, in particular. Up-front support is required for such a transformation for the long-term advantages for all.

By harnessing the power of systems and integrative approaches for SDG interactions for a sustainable future without leaving anyone behind, S4 can be used for green recovery and inclusive development so that the recovery process does not infringe upon the climate (Bennett, 2020) or other sustainable development objectives. The recovery should be taken as an opportunity to reset, to invest in innovations which meet multiple sustainability criteria (TWI2050, 2020). Enhancing innovation could be seen as an intermediate step towards the longer-term goals of fostering sustainability and inclusiveness. This is reflected in the Recovery and Resilience Facility that aims at helping countries to come out of the COVID-19 crises stronger. In national Recovery and Resilience Plans, countries will set forth how they 'focus investments and reforms on the challenges related to the green and digital transitions, […] and make the Union more resilient' (European Union, 2020). Innovation activities will be assessed with respect to their potential contributions to promoting sustainable development (Schot and Steinmueller, 2018).

5   *https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/just-transition-mechanism_en.*

At the core of S3 in the previous programming period 2014-2020 was the region, which is free to innovate and sketch out a development vision, given its starting point in terms of resource endowments, capacities and actors. S3 aimed at regional economic transformation promoting sustainable and inclusive growth, with limited consideration of the implications of its actions beyond the region's borders. S3 was aligned with the thematic objective: strengthening research, technological development and innovation through a limited set of priorities. It was an ex-ante conditionality for Cohesion funds to individual EU member states as an economic stimulus for less developed regions in 2014-2020 and is an enabling condition for Policy Objective 1 in 2021-2027.

S3 is an evolutionary entrepreneurial process that relies on engagement and input from the innovators and stakeholders who drive it. Inherently, this results in the challenge of directionality (Foray, 2019) but also timing: macro-level, global long-term development objectives need to meet the bottom-up, local and often shorter- to medium-term prioritisation of activities. As such, within a newly proposed S4, bottom-up and top-down elements and visions come together in one comprehensive strategy, which also poses a unique entry point to deliver on the EGD and the SDGs (McCann and Soete, 2020).

In the current programming period (2021-2027), the place-based innovation-led S3 transformation agenda should benefit from directionality to tackle societal and planetary challenges. The present Smart Specialisation Cohesion Policy objectives are connected to aim at a smarter Europe by promoting innovative, smart and digital economic transformation. Within the new approach, strategic objectives and implementation actions across different levels and EU, national and regional policies should be harmonised. This is more often than not happening in the world, with both countries and international organisations trying to align their actions with visionary development objectives, such as the SDGs. In the case of the EU, the EGD and SDG provide the broad development narrative that acts as a framework for all EU policies across dif-

FIGURE 1

Duality of directionality - directional approach combining top-down directionality with bottom-up developments. A global, long-term development-framing narrative for an aspirational future of humanity guides local policy action, harnessing its vehicles to deliver on its objectives on the ground.
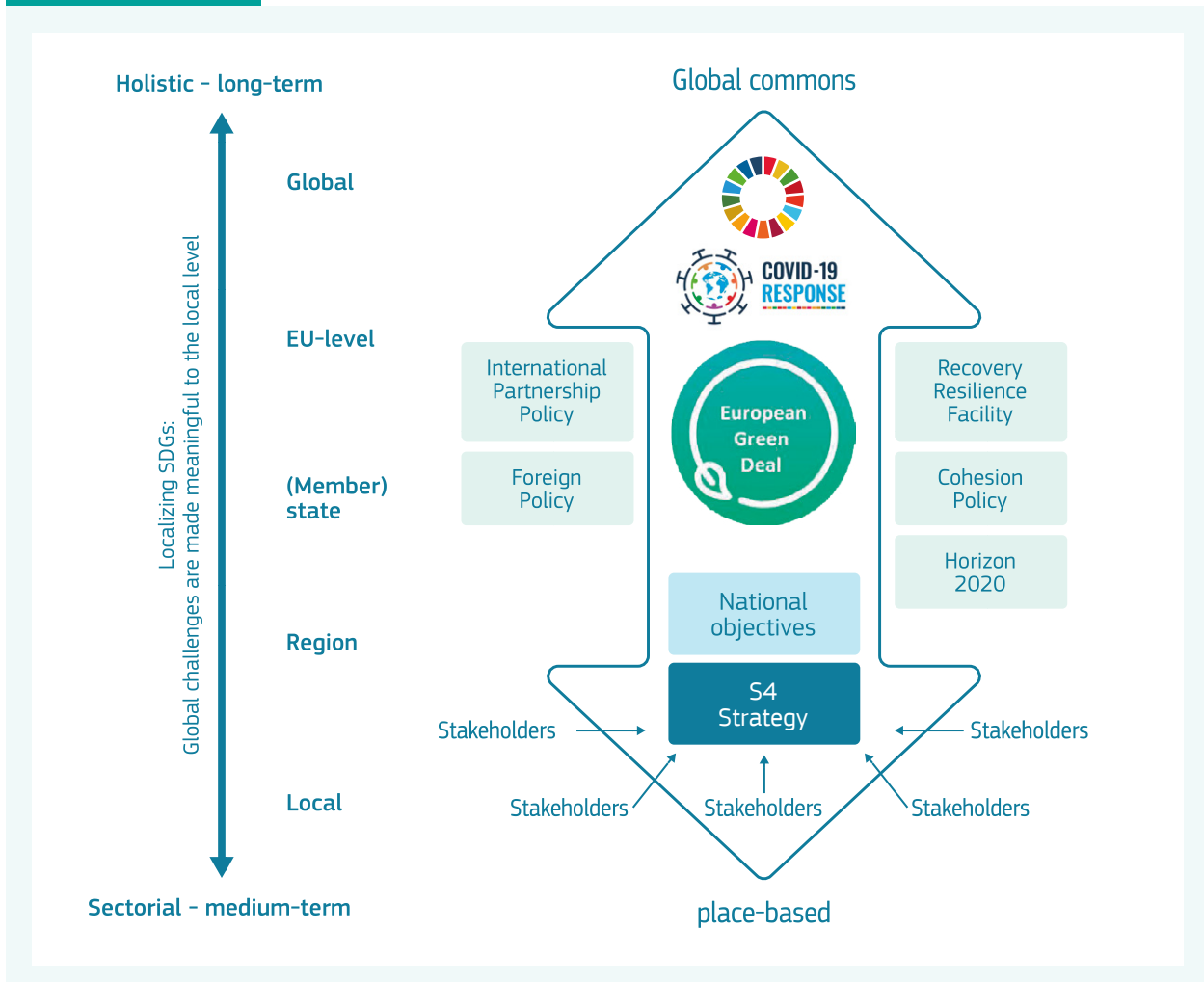
ferent levels, aiming to deliver those higher-level goals based on their well-established networks, programmes and structures on the ground. The newly proposed S4 provides a vehicle to translate this EGD and SDG framework into the regional context and address the local level ('localising' SDGs) objectives (*Figure 1*). This may enhance ownership of the 2030 Agenda at lower territorial levels.

1.1 Improving policy coherence and coordination through directionality

One way to integrate the EGD and SDGs is to improve policy coherence horizontally and vertically across EU and national, regional and local levels

(*Figure 1*). The joint vision for the future of Europe provides an orientation for all policy fields and actors and thus also enables improved policy coherence.

S3 strategies already contributed to selected SDGs[6] from 2014 to 2020 (see also Box 1 on the ongoing pilot case in Serbia and Box 7 on the RIS3 for Västerbotten as an example for the previous programming period). We clearly do not start from scratch. This was not by design, however, and SDG

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6   *The JRC Smart Specialisation Platform features several examples of RIS3 and their SDG relevance: https://s3platform.jrc.ec.europa.eu/sustainable-development-goals. The examples cover different levels: urban (e.g. Sofia), regional (e.g. Abruzzo and Catalonia) and national (e.g. Poland and Cyprus).*

impacts were often showcased ex post, sometimes even occurring *par hazard*.

As an initially pan-European territorial innovation policy focused on the industrial/economic dimension, S3 was foremost supposed to guide investment and support STI prioritisation, drawing on locally-based assets and endogenous knowledge to achieve competitive advantage. The prioritisation process was based on wide sources of information (i.e. a broad concept of entrepreneurial knowledge) and a combination of policy and business needs. This was combined in a coherent manner based on unique local and regional conditions, while avoiding the duplication and fragmentation of efforts. Depending on the priority area chosen and specific activities supported during the implementation phase, some contribution to the SDG and some sustainable innovations in line with EGD objectives emerged, but this was not a condition or a targeted outcome. This needs to be changed. Going forward, EGD objectives and SDGs need to be, intentionally, integrated into S3; hence the development of the S4 framework, as proposed in this concept note.

The new generation of S3 strategies will contribute to (or at least not remain in the way of) the overarching objectives of the SDGs and EGD (*Figure 2*). Broader impacts need to be considered to identify interlinkages to meet priorities, harness synergies and alleviate potential trade-offs. For Smart Specialisation, the focus remains on a few priority areas for driving structural change and diversification, but within a holistic approach. This will contribute to the overall policy coherence of the wider EU policy frameworks. The Smart Specialisation processes may leverage and support the implementation of the EGD in European regions and beyond.

The future S4 should contribute to a pervasive diffusion of innovations, in line with the intentionality and directionality that the EGD provides. This means that activities supported by S4 need to be harmonised with the EGD: one minimum requirement could be that they do not contribute to any worsening of the status quo in their respective

FIGURE 2

The different S4 strategies together help the EU achieve its vision.

domain and ideally result in an improvement (i.e. in terms of pollution, biodiversity loss or societal impact), thus not hampering the EGD objectives. A more ambitious approach could interpret the directionality from the EGD that S4 activities need to facilitate the achievement of the EGD through innovations enhancing sustainable consumption, production, mobility, etc., thus enabling the EGD. The latter is preferred.

Martin Heidegger (1977) argued that 'innovations [and technology] are … [a means to an end] [and] a human activity' or a means to a human end. Ultimately, diffusion is a social and economic process as it encompasses mutual interactions of concurrent technological, institutional, behavioural and social change (Schot and Steinmueller, 2018). It is

not a linear but rather a complex interactive process including 'bundles' or 'clusters' of technologies. The entire process requires reorientation and mutual enhancement towards a circular economy (incl. plastic, materials recycling, elimination of pollution) and sustainable food, energy and health systems. The prioritisation process needs redirecting towards societal and environmental challenges. Local STI should deliver to overcome those challenges. There is not one single template that is suitable for all regions but common guiding principles such as resilience, sufficiency and efficiency are applicable to all. These principles need to be considered in specific contexts and in relation to one another. They also come with trade-offs between them (e.g. sufficient systems may not be the most efficient, or resilience requires a degree of redundancy).

Diversification in terms of related and unrelated variety (Boschma et al., 2017), which is at the heart of S3, and regional development are tightly linked. Diversification is a path-dependent process based on sectoral or product relatedness (Frenken et al., 2007, Hidalgo et al. 2007), so not every region can or even should go down similar industry or technology pathways. However, the guiding principles remain the same. Based on the starting conditions, e.g. skills or resources, a discovery process into related and proximate industries and technologies

(Frenken et al., 2007) can be initiated. This approach needs to now be re-assessed. Knowledge transfer and innovation can lead to harnessing existing skills in related industries, while reorienting them towards sustainability objectives in line with the EGD. A more ambitious approach would be to also mobilise science, technology and innovation for social and environmental goals and challenges. This is one aspect where policy coherence can support the process and lead to the consideration of synergies and trade-offs.

Policy coherence allows contradictions to be detected and avoided and synergies between different EU policies to be built – at EU and Member State level – but also relating to those that are relevant to partner countries. Smart Specialisation, while still a core concept for Cohesion Policy, should now be more broadly embedded together with different EU fields – for recovery, industry, research, foreign affairs, development, agriculture, etc. – under the umbrella of the EGD for an innovation-driven policy ambition (*Figure 3*).

Policy coherence is primarily relevant to EU Member States but also comes with implications for countries beyond EU borders, through European Development Policy and the EU's vision for leading the transition to sustainable development. The shift towards EGD will also be reflected in trade, security and foreign policy. The EU and its member

FIGURE 3   *Building blocks of innovation-driven EU policy under a coherent EGD umbrella.*

countries are the world's largest donors with an amount of €75.2 billion in 2019, making up more than half of OECD development aid (European Commission, 2020a)[7].

S3 has gained wide traction within but also outside of the EU. The concept has been picked up by countries and regions globally. It has thus also become an element of international cooperation. It is also a tool to support the policy priority of a stronger Europe throughout the world.

At international level, the Joint Research Centre of the European Commission joined the Global Pilot Programme on STI for SDG Roadmaps[8] as a strategic partner. S3 was recognised as one of the global methodologies for the Science, Technology and Innovation (STI) Roadmaps for SDGs (see UN Guidebook STI for SDGs Roadmaps (IATT, 2020)). Serbia (*Box 1*) is one of the pilot countries that uses the national processes of S3 to design and implement STI for SDGs roadmaps contributing to the achievement of sustainable development strategies. In addition, other countries and regions worldwide are using the S3 approach, e.g. Australia, Mexico, Rwanda, Tunisia and Ukraine.

1.2 COVID-19 as an immediate challenge

Innovations, as a result of the S3 implementation of priorities emerging from the Entrepreneurial Discovery Process, should aim to enhance sufficiency and resilience in terms of robustness and adaptive capacity (TWI2050, 2020) in the face

of emerging challenges in the EU. We need entrepreneurial convergence into systems and innovation collaboration, rather than decoupled and independent individual projects. The COVID-19 pandemic and disruptions to global supply chains have laid bare the need for action in several key sectors. One example could be the pharmaceutical industry, which is very innovative – as we can see in the case of the COVID-19 vaccine. Digital technologies are a similar case. Discovery and recovery will have to go hand-in hand, aiming to mutually reinforce one another.

In response to COVID-19, purposeful innovation occurred across Europe, sectors and technologies in e.g. medication, health equipment and vaccine development and technological and organisational efforts to transition to virtual work and schooling, often facilitated through digital technologies. Examples from the medical sector include: Isinnova[9] from Lombardy, Italy, that used 3D printing to adapt snorkelling masks for intensive care units; Xenothera[10], based in Nantes, France, working on a treatment for patients with moderate COVID-19; Entremo[11], based in Budapest, Hungary, which offers fast and efficient patient monitoring; or Project ViruShield[12], an alternative high-performance personal protective equipment initiative lead by Aachen University, Germany (EIC and EIT, 2021). However, all kinds of sectors had to be creative to deal with the new situation: museums put their exhibitions and guided tours online (e.g. the art history museum (Kunsthistorisches Museum) in Vienna[13]), doctors provided medical support online and were supported with apps by a company that had to look for new clients for its table-allocating software for restaurants when they were closed[14], companies moved their workforce as much as possible to telework, as did schools and universi-

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7   *The USA is the single largest OECD donor with $34.62 billion. China is not a member of the Organisation for Economic Co-operation and Development's Development Assistance Committee (OECD-DAC) and does not provide its support figures, but estimates for 2014 reached $38 billion, which would make it the single largest donor (Jennings, 2017).*

8   *A Global Pilot Programme on STI for SDGs Roadmaps was announced during the HLPF (High-level Political Forum) in July 2019, focusing on five pilot countries: Ghana, Ethiopia, Kenya, India and Serbia. More information available at: https://sustainabledevelopment.un.org/partnership/?p=33852.*

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9   *https://www.isinnova.it/easy-covid19-eng/.*

10   *https://www.xenothera.com/.*

11   *https://entremo.com/ (from Team Discover who won the EIC #EUvsVirus Hackathon).*

12   *https://eithealth.eu/project/virushield/.*

13   *https://shop.khm.at/digitaleangebote/.*

14   *https://www.drwait.de/.*

ties with their educational programmes. All of this required new processes and adjustments throughout society, which will partly remain.

The geopolitical and economic impacts of COVID-19 are undermining the enabling conditions of (initially) successful responses, such as cross-country and international collaboration and open borders. Supportive innovation ecosystems at supra-national, national and regional level (incl. public policies) are needed for both discovery and recovery. Innovation ecosystems are under increasing pressure with shifting public policy priorities and ideological debates.

S3 is intended to guide regions in selecting a limited number of research and innovation priorities with a high growth potential for public investment, and thus optimise the use of limited public resources. This is similar to the prioritisation of recovery funds in the current situation. Some countries and regions risk falling behind due to lower administrative capacities, their strategy to mimic winners or inadequate political decisions. The strength of the S3 approach lies in engaging local stakeholders in the design as well as implementation of the strategy. This approach could be implemented by the Recovery Resilience Facility via National Recovery Plans when local stakeholders not only endorse the plans, but fully own the process and the strategy. The facility aims to reinforce key EU programmes and support Member State efforts to boost private investment and support ailing companies and sectors. It should be combined with Smart Specialisation for Sustainability – S4 and the stakeholder networks on the ground while also delivering on the EGD (i.e. energy efficiency or industrial transitions).

1.3 What role can Smart Specialisation play in delivering the SDGs, EGD objectives and recovery?

The EGD and SDGs highlight that the EU and global systems, respectively, needs to be transformed towards a new resilient dynamic trajectory, given

the challenges emerging through mutually reinforcing changes. This will call for integrating local and regional development and environmental challenges that are linked to the global commons, such as climate change. The EU has 30 years to reach net-zero emissions around mid-century, a path necessary to limit warming to well below 2 °C and avoid further and more severe negative climate impacts as set out in the Paris Agreement (Rockström et al., 2017). To achieve decarbonisation, the EU set the goal to reduce emissions to 55% by 2030 compared to the 1990 level (related policy package 'Fit for 55' to be adopted). This a very ambitious goal consistent with achieving net-zero by 2050 and will require vigorous reductions across all sectors including carbon removal through land-use changes.

It will not be easy to achieve the ambitious objectives of the EGD, such as achieving an emissions reduction of 55% by 2030 and net-zero later on. Humanity will face difficult barriers that are linked to vested interest, the capacity of institutions, the complexity of the task, the role of stakeholders, etc.

In the following section we will present different approaches that have dealt with policy coherence. Based on a grounded-theory conceptual framework, we showcase some existing gaps in terms of the S3 mandate, approach and tools to achieve policy coherence with regards to the higher-level policy objectives and challenges. SDG-oriented societal and environmental aspects will have to be included throughout the entire S3 process, from design to implementation as well as monitoring and evaluation. At the same time, 'the duality of directionality' implies that the higher-level policy objectives can be adjusted based on feedback from local and regional initiatives (two-way learning). Adding directionality to Smart Specialisation is not only about aligning bottom-up initiatives with the higher-level goals but is also about refining policy design by learning about what works on the ground.

We try to illustrate experiences with case studies on the lessons learnt throughout this note. We follow the terminology summarised in Box 2. We

| BOX 1 | *Case study on international applications of S3 for the SDGs – Serbia.* |

Serbia provides an example of an EU candidate country that has implemented the S3 development process in an innovative way, adapting it to the SDGs. Serbia is one of five countries in the Global Pilot Programme on STI for SDGs Roadmaps for SDGs from the United Nation's Inter-Agency Task Team on Science, Technology and Innovation for the SDGs. Serbia was supported by the Joint Research Centre in applying and developing a methodology to combine the transformative power of the SDGs and Smart Specialisation. The process and methodology are well documented and freely accessible online: *https://s3platform.jrc.ec.europa.eu/pilot-methodology*.

Serbia's S3 strategy is called '4S – Smart Specialisation Strategy Serbia' and was adopted in February 2020. The accompanying Action Plan – STI for SDGs Roadmap was adopted in April 2021. These will guide the country's innovation policy until 2027. The priorities were chosen in participative bottom-up processes that also included the thorough assessment of how these priorities contributed to the achievement of the SDGs and their targets. A few selected highlights of the methodology are as follows.

■ The 'classic' S3 process was geared towards and combined with the SDGs. The SDGs provided the ultimate objective to be achieved but also checkpoints for where to start and guideposts along the implementation path.

■ The methodological approach brings together the challenges and potential solutions in its analytical pillars, i.e.: i) regulatory framework, ii) sustainable development challenges (SDGs) and iii) STI potential.

■ The entire approach is strongly supported by data, benefitting from the availability of assessments, databases and other kinds of information on SDG achievement, the R&D environment and potential.

■ The approach combines national strengths and provides international support, where needed. The establishment of national capacities during the strategy development process is crucial for successful implementation of the strategy.

■ Strong stakeholder engagement throughout the process.

■ Several assessments were carried out during the development phase. An initial assessment of Serbia's standing in terms of innovation and sustainability provided a starting point. The impact and assessment and mapping exercise examined the potential impacts of S3 on the SDGs, but also the transformative potential of SDG interlinkages in STI outputs. Even though the priority areas are clearly linked to a limited set of SDGs, these assessments do not drop individual SDGs but account for the direct and indirect effects and spillovers to other SDG targets. A combination of different assessment approaches leaves room for divergence and discussions.

▶ *The case of Serbia shows how different objectives can be integrated to achieve essential synergies. The SDGs are used to guide and sharpen the development of Smart Specialisation/ STI road-mapping exercises. At the same time, the implementation of the UN 2030 Agenda is supported by providing such an orientation and checking the impacts of the activities on different SDG domains. It provides a valuable example of both knowledge transfer and methodological development that provides lessons learned for future applications and refinements of S3.*

only highlight certain elements that would have to be revisited in detail once consensus has been reached on the overall framing. This could include materials on design, implementation, monitoring and evaluation (e.g. guidance documents, methodologies, templates, checklists, workshop and learning materials, questionnaires, indicator lists for impact monitoring).

BOX 2   *Glossary of terms frequently used in this concept note.*

Directionality: providing (or maintaining) guidance in a direction.

Efficiency: the good use of resources (i.e. time, energy, water, minerals) that avoids waste.

Innovation: refers to 'a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)' (OECD/Eurostat, 2018).

Policy coherence: refers to an approach that aims to 'design, implement and monitor coherent and integrated policies for sustainable development. This entails fostering synergies across economic, social and environmental policy areas; identifying trade-offs and reconcile domestic and international objectives; and addressing the spillovers of domestic policies on other countries and on future generations' (OECD).

Resilience: refers to the capacity of a system to absorb major external disturbances and shocks (Holling, 1973). Please note that while we may want systems to be resilient towards adverse shocks, resilient systems are also harder to transform.

Sufficiency: an adequate amount of something, especially of something essential.

Sustainability: approaches that do not infringe upon the wellbeing and development prospects of future generations in environmental, social and economic terms.

Synergies: the interaction or cooperation of two or more organisations, substances or other agents to produce a combined effect greater than the sum of their separate effects.

Systems thinking: entails seeing overall structures, patterns, interconnections, feedback and causality in systems, rather than seeing only specific events or individual elements within the system. It requires a shift in mindset, from linear to circular. It focuses on synthesis to further understand emerging phenomena through a holistic approach by understanding the entire and parts of the system at the same time, along with the relationships, the interconnections and the dynamics.

Trade-offs: a balance achieved between two desirable but incompatible features – a compromise.

Transformation: an open-ended change in form, nature or appearance (i.e. changes in the energy sector to a decarbonised energy system).

Advancing policy coherence

2.

Cooperation, coordination and communication between stakeholders are at the core of S3. Achieving policy coherence across different levels and policy fields will first require 'action coherence' between various actors for whom processes introduced within S3 will be crucial. This, in turn, will rely on the building of trust between stakeholders and establishing the enabling environment for complex, meaningful and productive dialogue with democratic solution-finding processes. The consolidation of local governance, which started in the first generation of S3 policy, will need to be strengthened and opened-up to co-create and co-design a more comprehensive, systemic sustainability transformation. Such new transformative governance will have to go beyond departments and sectors, establishing a comprehensive approach, beyond technologies to innovative solutions, beyond the national innovation system to innovation for a transformation of societal and industrial systems.

We present exemplary approaches towards policy coherence that rely on systemic thinking to enhance S3 for the next programming cycle, to improve the sustainability focus of Smart Specialisation:

- innovative budgeting approaches,

- reduction of environmental impacts at all levels by harnessing synergies,

- economic recovery packages and their transformative potential.

2.1 Innovative budgeting approaches

Sustainability-proofing budgets can improve policy coherence at two levels as defined by Hege et al. (2019) – ensuring that there are no conflicts between different resource allocations and, secondly, ensuring the alignment of country-level budgets with international obligations such as the 2030 Agenda (Hege, 2019). A move to 'governance through goals' could identify and therefore address the competition for limited finances that currently exists between various government portfolios (Kanie et al., 2019). Ideally, such an approach can help ensure continuity of policy objectives beyond electoral cycles. Evaluating and adjusting budget allocations and processes can improve effective policy design and performance. By linking budgets to the SDGs, government accountability and performance could be assessed. Such budget approaches may be implemented at all levels, from local community level to national level. Public procurement and public-private partnerships can also be used as a strategic policy lever to support SDG implementation (OECD, 2019).

The sustainability-proofing of government budgets – should include 'a structured process of ensuring the effective application of tools to maximise the social, environmental and economic benefits and to avoid or at least minimize harmful impacts' of government spending (SDG Watch Europe, 2020). For example, the 'People's Budget'[15] campaign in Europe encourages harnessing the budget pro-

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15   http://www.peoplesbudget.eu/.

cess to influence resource allocation to reflect the priorities and qualities of public policy and to restructure revenues and expenditure to promote sustainability and COVID-19 recovery (SDG Watch Europe, 2020). Sustainability-proofing instruments can be applied at substantive (e.g. objectives and indicators), procedural (e.g. project selection criteria) and institutional (e.g. administrative support) level. *Box 3* provides examples and lessons learned from SDG budgeting in selected EU Member States.

Other budgetary approaches that evaluate and adjust the allocation of resources to increase policy coherence and which have already been applied for some time before the adoption of the SDGs include: gender budgeting, green budgeting or intergenerational budgeting. While they already introduce a wider and interconnected perspective, they do not cover the breadth and complexity of the UN 2030 Agenda.

■ Gender budgeting aims to tackle gaps related to gender in education, employment, health, entrepreneurship and public life opportunities and outcome through the budget process.

■ Similar to SDG budgeting, green budgeting for harmonising objectives with regards to environmental goals and moving away from harmful subsidies and improving resilience to climate shocks has been pushed, for example by the OECD Paris Collaborative initiative[16]. The EGD calls for greening national budgets to send the right price signals, by reorienting public investment, consumption and taxation towards green priorities.

■ Intergenerational budgeting looks at the (financial) sustainability of budgetary and fiscal measures, originally often related to pension systems. However, when broadening the concept of sustainability to planetary stewardship, this kind of budgeting is very close to SDG budgeting.

Sustainability proofing and SDG budgeting can be used in the design of S3 for sustainability policy

mixes, boosting reflection and adaptation of the instruments and budget allocations if needed. Some potential guiding questions may be as follows.

■ Do the planned policy instruments and measures contribute sufficiently to the social, environmental and economic goals of S3 and priority SDGs?

■ What are the potential social, environmental and economic impacts of the planned policy instruments and measures?

■ Which goals and SDGs are prioritised according to budget allocations? Are these allocations compatible with the hierarchy of strategic goals and the shared vision?

■ Is the scale of the planned intervention sufficient to deliver planned changes as described in the shared vision and goals?

The strategies are implemented through budgets, so applying the sustainability principles in policy and financial mixes of S4 can make a real change to the impacts actually achieved on the ground.

2.2 Reduction of environmental impacts at all levels by harnessing synergies[17]

The EGD sketches out a set of key transformations to focus on during 2021-2027, which is in line with the environmental SDGs, i.e. SDG 13 (Climate Action), SDG 14 (Life below Water), and SDG 15 (Life on Land). These transformations are discussed in scientific literature and reports by international organisations (i.e. UNEP, 2021; TWI2050, 2018; GSDR, 2019; Sachs et al., 2019) that call for fundamental changes in how our societies

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16   *http://www.oecd.org/environment/green-budgeting/*

17   *The focus in this concept note is placed on environmental aspects of sustainability. However, care needs to be taken not to imply the reduction of sustainability on environmental concerns only or implying far less (or no) attention on social challenges. It will be difficult to achieve the lofty environmental goals we aspire to if social (alongside economic) concerns are not taken seriously.*

BOX 3   *SDG budgeting and mainstreaming in Italy.*

In Italy, the Presidency of the Council is in charge of coordinating the implementation of the SDGs (SDG Watch Europe, 2021), which are integrated into the public budget. The National Sustainable Development Strategy (NSDS) (approved in December 2017) defines broad guidelines for environmental, social and economic policies. It also draws upon an important role for institutions and civil society on the long road to implementing the 2030 Agenda in Italy, but dedicated commitment by line ministries and linkages with other plans are lacking. Budgeting in Italy has recently changed to become an integrated budget explicitly related to the SDGs (see below). Other interlinkages between strategies – such as the NSDS and the National Reform Programme – provide improved coordination (Mulholland and Berger, 2019).

The Italian Alliance for Sustainable Development (ASviS – Alleanza Italiana per lo Sviluppo Sostenibile) represents civil society organisations along with universities and companies. Regular meetings are conducted, also with other networks, and there are frequent policy dialogues with the government. The Italian government was receiving input from NGOs during the preparation of its first Voluntary National Review (VNR), submitted in 2017 (UNDESA, 2021). Within its VNR, Italy highlighted the need for multiple instruments in implementing the SDGs, including budgetary policies and structural reforms (Italian Ministry for the Environment, Land and Sea, 2017) and highlighted that its 2017 Budget Law was also set up taking into account the NSDS and the measures were taken considering the SDGs.

Italy introduced gender budgeting to assess the impacts of fiscal policy on women and men in terms of money, services, work time and unpaid work (OECD, 2019) in 2001. Since then, numerous initiatives have been carried out without any central coordination or conceptual approach, which has led to diverse experiences (Bettio and Roselli, 2018). Identifying a general methodology and evaluating gender budgeting experiences and impacts are also featured as a cross-cutting objective in the VNR (2017).

The periodic monitoring of targets through a set of indicators was launched in 2011 by the Italian National Institute of Statistics (ISTAT) to measure fair and sustainable wellbeing (BES) in addition to economic conditions. It considers economic parameters alone as inadequate and complements them with social and environmental information on inequality and sustainability. Selected indicators, e.g. CO_2 emissions, income inequality, have found their way into economic programming documents (Mulholland and Berger, 2019). These indicators facilitate the evaluation of policy and legislation (ASviS, 2020b).

The 2020 Budget Law, while only adopted in 2020, can be seen as the furthest step taken recently, introducing a paradigm shift. This legislation represents a break from the past and significantly shifts its objective towards sustainable development, promoting the adoption of needed reforms. It is in line with EU-level policies (ASviS, 2020b). While most of the provisions in the 2020 Budget Law concerned the cancellation of safeguarding provisions and the related increase in VAT – thus avoiding a sharp rise in the tax burden, which would also have had negative effects on inequalities – many provisions are specifically aimed at sustainable development (implementing various recommendations by civil society organisations): including a link between Industry 4.0 incentives and

> BOX 3

those for the circular economy, the launch of an Italian Green New Deal, commitments to sustainable mobility and innovation, the fight against gender inequality and focusing attention on housing and suburban problems. At the same time, the 2020 Budget Law shows some shortcomings concerning, for example, biodiversity protection and the issue of the insufficient allocation of resources in areas such as education, development cooperation and youth employment, especially taking into account the 21 targets with deadlines in 2020 (ASviS, 2020b).

ASviS (2020b) assesses the impact of the 2020 Budget Law on the different SDGs and targets in detail and provides many recommendations on how the budget process could be further aligned with the SDGs, examples include: i) include the principle of sustainable development in the constitution; ii) include impact assessment before the adoption of laws; iii) adopt an annual law on sustainable development; iv) improve information for citizens; v) adapt the legislation that provides for reporting BES indicators within the budget cycle; vi) entrust the Parliamentary Budget Office with the task of carrying out quantitative assessments of the impact of the main planning and budgetary documents regarding the SDGs; vii) develop an urban agenda for sustainable development; and viii) orient policies towards a circular economy.

The 2020 Budget Law manifested the greatest commitment to sustainable development in the last five years; the actions taken in response to the pandemic were largely aimed at protecting the socio-economic system, rather than transforming it to put it on a more sustainable path. Given the country's high debt, Italy has to be aware of the possible consequences of a continued COVID-19 pandemic and possible impacts. These may be aggravated by the disparities in recovery potential between the Italian regions; the socio-economic consequences could accentuate the conditions of regional disparity precisely in a country which is already the recipient of considerable funding for territorial cohesion and development (ASviS, 2020b).

Further key initiatives in the overall policy framework are: the 'Climate Decree', the 'Tax Decree' and the 'Milleproroghe Decree', which contain significant interventions for some of the SDGs, as well as the 'South Plan 2030', which illustrates the actions envisaged for the development of the South (ASviS, 2020b).

While just the beginning of a long process, it marks an important step towards aligning policies and national budgeting with the 2030 Agenda in Italy (Mulholland and Berger, 2019). The effectiveness of the individual measures will depend on the speed of execution. Acceleration in investments is needed as well as strengthened cooperation between all stakeholders.

▶ *How budgets are financed and allocated show the priorities of annual and multi-annual development objectives. The budget process has wide-reaching impacts throughout the economy and society, e.g. determining the distribution of wealth and the availability and quality of public services. Improving how budgets are performing in terms of their SDG impacts will support the transformation.*

and economies develop in the future. There are many synergies and entry points for harnessing them. We focus here mainly on the environmental domains, but societal transformations (e.g. related to education) also come with ample multiple benefits, including those related to environmental issues (e.g. the adoption of more sustainable behaviour). UNEP (2021) in its recent flagship report, for example, emphasises the need for action on climate change, air pollution and biodiversity. The question of multi-level governance that is capable of orchestrating these transformational synergies goes beyond the scope of this paper (please see literature on integrated environmental management and nexus and transformative governance for further information). An example of a multiple policy benefit is given in Figure 4, which shows that the simultaneous achievement of energy security, air pollution and health and climate mitigation objectives can be achieved at lower costs compared to tackling these policy objectives independently. This covers several of the objectives of the EGD related to energy supply, pollution, climate ambition, energy efficiency but also mobility. The costs of achieving societal objectives can be combined with the objectives for energy sustainability under different policy prioritisation frameworks. Global policy costs are cumulative (2010-2030) and represent the net financial requirements (energy-system and pollution-control investments, variable and operations and maintenance costs) over and above baseline energy-system development, which is itself estimated at 2.1% of the globally-aggregated GDP. Triangular schematics above the bars summarise the performance of scenarios that achieve 'stringent' fulfilment only for the objective(s) targeted under the corresponding policy frameworks.

A common characteristic of sustainable development pathways that meet multiple SDGs (*Figure 5*) are low end-use demands or sufficiency levels, reductions in losses and waste and highly efficient conversion and circular systems (for energy, water, food, materials) (TWI2050, 2018; Grubler et al., 2018), as called for by the EGD and SDG12 (Responsible Consumption and Production). Figure

5 contrasts a demand-side transformation strategy (using, as an example, a low energy demand (LED) scenario (Grubler et al., 2018)) with more conventional supply-side strategies that primarily aim to limit global warming to below 1.5 °C, as well as their corresponding (no climate policy) baselines for six illustrative SDGs and associated quantitative indicators. The demand-side, service-oriented efficiency strategy of LED generally outperforms other scenarios in all six SDG indicators examined in Figure 5. The LED scenario scores highly on the social goals-oriented SDG indicators (i.e. SDG2, SDG3, SDG7) due to its approach of maximising useful service delivery with minimal resource inputs and its normative scenario feature of providing at least decent standards of living for all, while also allowing regional variation in culturally framed sufficiency levels on top of this. Due to its (lowest) resource demand, the scenario also either outperforms or equals more alternative supply-side-oriented scenarios for environmental- and global commons-related SDGs (i.e. SDG13, SDG14 and SDG15). As such, a high level of ambition for and fulfilment of SDG12 can generate significant SDG co-benefits that are not apparent from alternative strategies with no demand-side and service delivery focus (TWI2050, 2018).

Illustrative examples of such resource processing systems' steps and associated conversion losses drawn from the literature are shown in *Figure 6*. The systems covered are:

■ energy (direct energy conversion efficiencies (Nakicenovic et al., 1993; De Stercke, 2014)),

■ water use in food production systems (water use efficiency and embodied water losses in food production, processing and consumption (Lundqvist et al., 2008; Sadras et al., 2011)), and

■ materials (Ayres and Simonis, 1994; Fischer-Kowalski et al., 2011), using the example of steel manufacturing, use and recycling at global level (Allwood and Cullen, 2012).

Efficiency cascades of resource use for energy (top panel a), aggregate and efficiency by main consuming sector; water embodied in food (middle

FIGURE 4

Global multiple benefits of decarbonisation and energy efficiency with regards to pollution control and energy security
(axis values normalised from 0 to 1 based on the full range of scenario ensemble outcomes; CC = Climate Change, ES = Energy Security, PH = Air Pollution and Health).
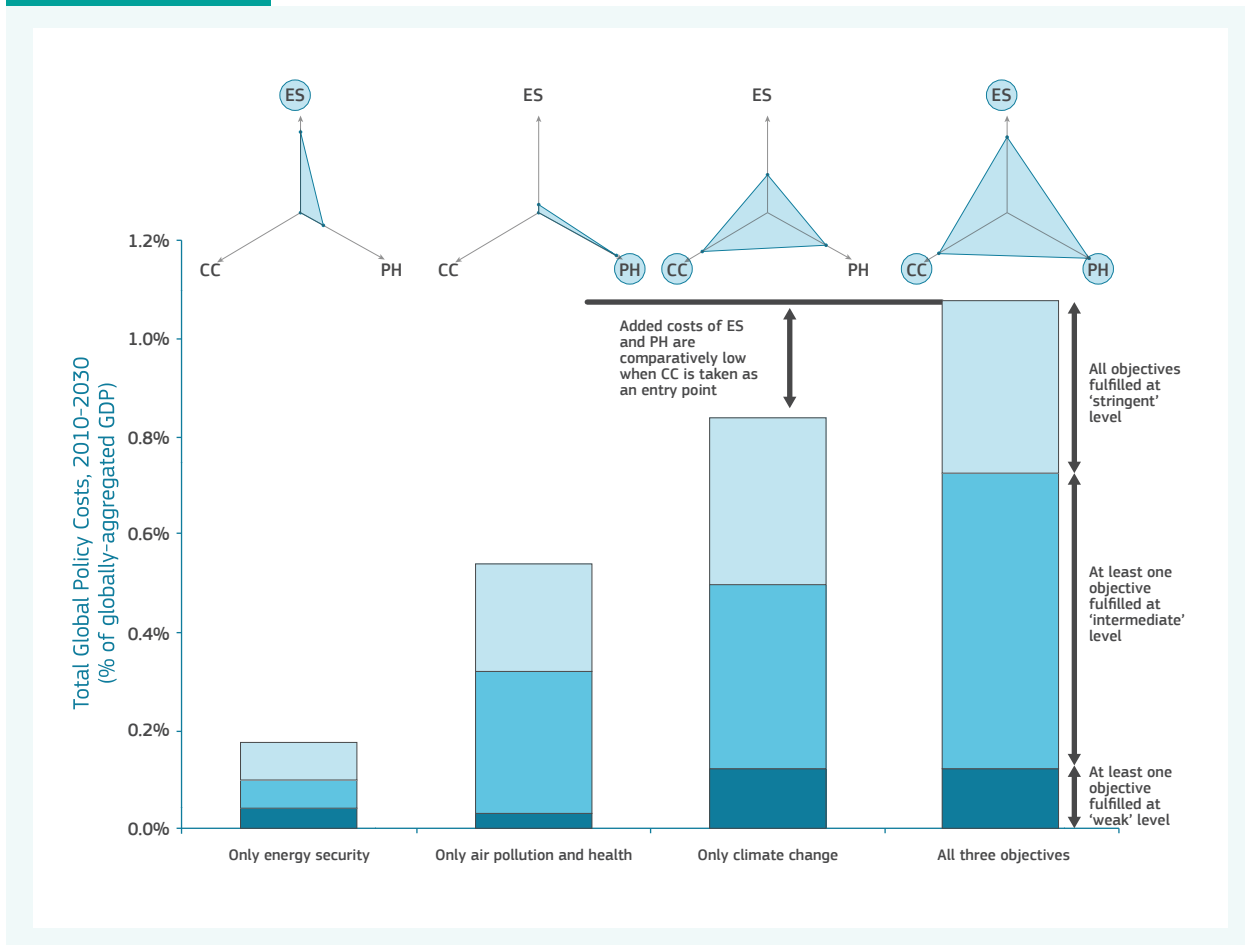
Source: McCollum et al. (2012).

panel b); and materials using the example of steel (bottom panel c). The percentage of the original primary resource extracted remains at each respective conversion step until service delivery is shown as a percentage. Panel c (bottom) materials efficiency is shown for the example of steel from primary raw material inputs (iron ore and steel scrap) to final retail, and recovery of post-use steel (scrap). The difference between primary inputs is comprised of additions to the material stock in the form of buildings and infrastructures but also due to material losses, part of which may be recoverable in the future.

As losses along the conversion chain are high, reductions on the demand side come with great leverage potential to reduce the overall system size. Such smaller and more efficient systems are more flexible and thus come with smaller negative impacts on the environment (e.g. in terms of negative emissions and land use). For example, an overall smaller energy demand has more flexibility in terms of energy sources used to meet the demand, which makes rapid decarbonisation through extensive use of renewable energies easier. The transformation towards renewable energy systems and decarbonisation of the energy system are interesting from a regional perspective as resource endowments and needs are heterogenous. The long-term objective of a decarbonised, affordable and reliable energy system should be shared between regions to achieve the EGD.

For global trends of terrestrial biodiversity affected by land use change to stop declining and start recovering by 2050 or earlier, research (Leclere et

FIGURE 5

Scenario comparison of SDG synergies and co-benefits of demand-side-focused versus supply-side-focused scenarios for meeting a 1.5 °C climate target (SDG13). Desirable directions for select SDG indicators shown.
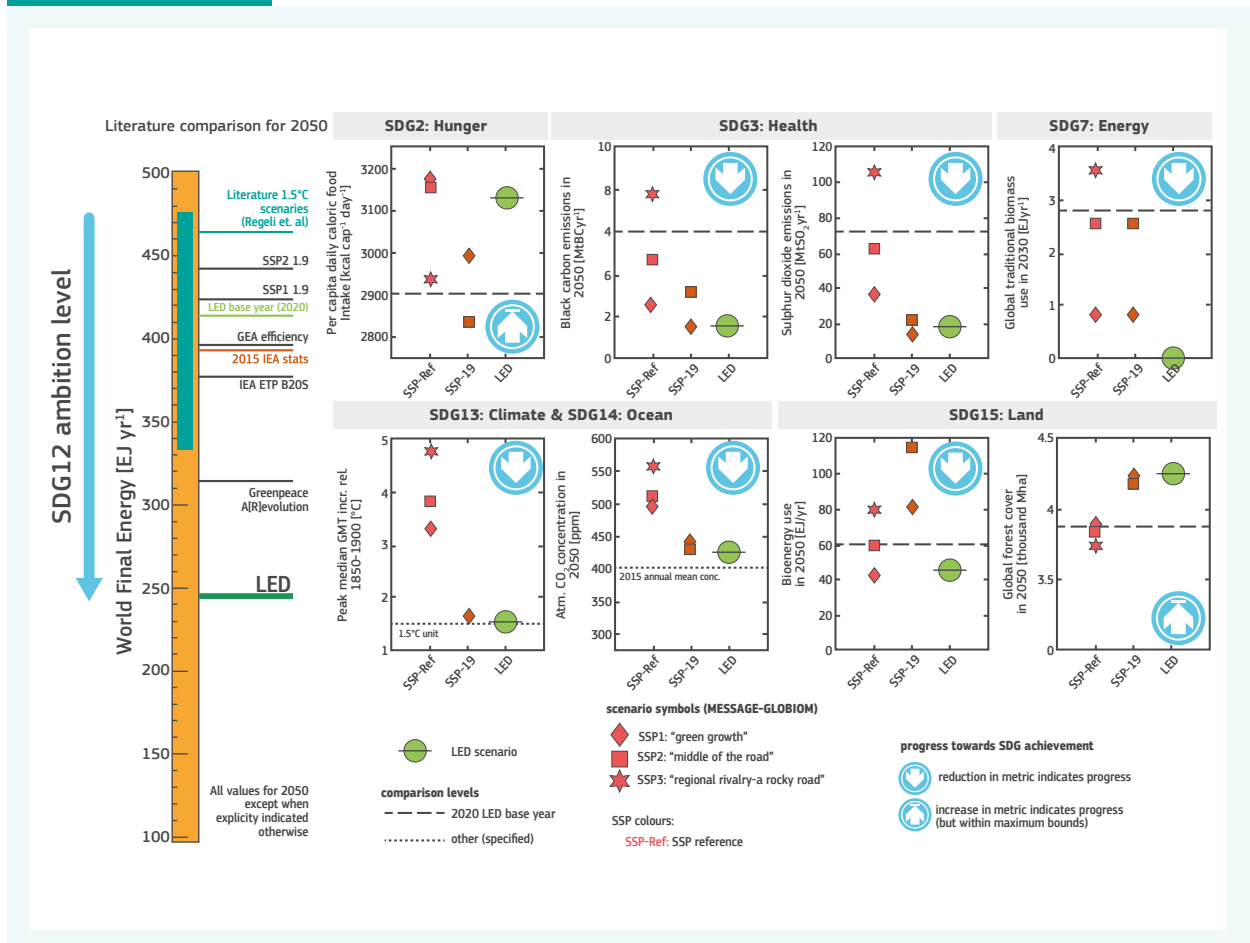
Source: After Grubler at al. (2018), cf. TWI2050 (2018), Figure 3.7.

al., 2020) has identified two key integrated transformations that are in line with the EGD's agri-food Farm to Fork and Biodiversity strategies to bend the biodiversity loss curve by the mid-century:

1. in the food system, the transformation efforts include reduced food waste, diets that have a lower environmental impact and further sustainable intensification and trade;

2. conservation and restoration efforts, together with increased management effectiveness, will have to be stepped up rapidly and land-use planning efforts that balance production and conservation objectives on all managed land. Without such efforts, reductions in biodiversity may only be slowed down rather than halted and any potential recovery would remain slow.

The EGD announced a zero-pollution action plan for air, water and soil (European Commission, 2019) – for humans and nature. Several interlinkages exist here with other domains, notably health (e.g. reduced air pollution (Amann et al., 2020)), as well as benefits for the sustainability of ecosystems. However, challenges remain, such as excess nitrogen deposition. Additional reductions in ammonia emissions to tackle eutrophication will be required to improve biodiversity protection. This is predominantly linked to transformations in agriculture and food, energy and manufacturing systems. Safely managing chemicals and waste will require a combination of changes to which innovation in processes and materials can contribute.

Green recovery plans that include large-scale home renovation programmes will ensure warm,

healthy homes and affordable energy bills for all, addressing the pandemic impacts and sustainability challenges together (Zangheri et al., 2020). As a result of the pandemic and related measures, energy poverty has been aggravated in several European countries (estimated at around 30 million people (Taylor, 2021)), with residents finding it difficult to pay energy bills – e.g. households in European cities are spending an estimated additional €18-25 per month for energy. Traditional poverty measures in electricity provision, such as purchasing prepayment meters, have been supported in a number of EU countries (Goyens, 2020). Focusing on drastically increasing the energy performance and quality of buildings can provide co-benefits for the resilience and living conditions of vulnerable groups, the environment and the labour market. Experiencing the hardships of low-quality buildings and energy poverty even more acutely during 2020 may increase the popularity of deep energy renovations. At national level, several countries (for example, the UK, Germany) have added building refurbishments to their recovery and stimulus packages, hoping to also improve local employment and economic activity. Actions regarding retrofitting and guidelines for more sustainable housing come with synergies for energy poverty, health, job creation, climate mitigation and local economic stimulus.

Smart mobility systems, together with changes in how we work and learn, are facilitated through digital technologies and services, and these also impact resource demand. This will change our cities and communities. Digitalisation is an autonomous trend that is impacting almost every aspect of our lives. It offers many opportunities to improve our lives through better service quality, harnessing efficiency potentials, facilitating communication and information exchange and creating new opportunities, while at the same time reducing environmental and adverse impacts. This simultaneously comes with challenges for sustainable development for which strong governance at all levels is required (TWI2050, 2019).

Several of these EGD priorities call for the development of more sustainable alternative innovations from companies and research organisations to be developed and put on the market. Innovation and investment systems should focus on technologies and services that enable net-positive environmental impacts. We need new business models, materials, services, or production and recycling processes to meet the ambitious objectives. The environment needs to be endogenised within all of our actions, thus also within the S3 Entrepreneurial Discovery Process. This can be tackled by accounting for estimates of potential resource impacts and requirements, such as greenhouse gas emissions (both grey and actual) or reduced material needs. For these transformations sketched out by the EGD and the SDGs, a combination of changes in governance, technology, investment, processes, behaviour and culture is required.

Innovation and research, the digital agenda, small and medium-sized businesses (SMEs) and the low-carbon economy were the priorities in the 2014-2020 Cohesion Policy cycle. During the new 2021-2027 cycle, Smart Specialisation will again play a crucial role in the EU cohesion approach and regional development in particular (Common Provisions Regulation, 2020). Given the thematic focus, which already touched upon several aspects of the transformational narrative in 2014-2020, lessons from low-carbon S3 strategies could be drawn upon and inform the upcoming policy initiatives (*Box 4*).

2.3 Economic recovery packages and their transformative potential

In an era of budget constraints and the need to address multiple objectives such as SDGs, the EGD and COVID-19 recovery, governments are increasingly discussing how to leverage synergies. We observe an increasing number of sustainable recovery commitments made by governments in Europe (GIZ, 2020). This synergetic tendency demonstrates a stronger uptake of approaches, recognising interactions between different policy fields and sustainability targets compared to

FIGURE 6   *Efficiency cascades of resource use.*
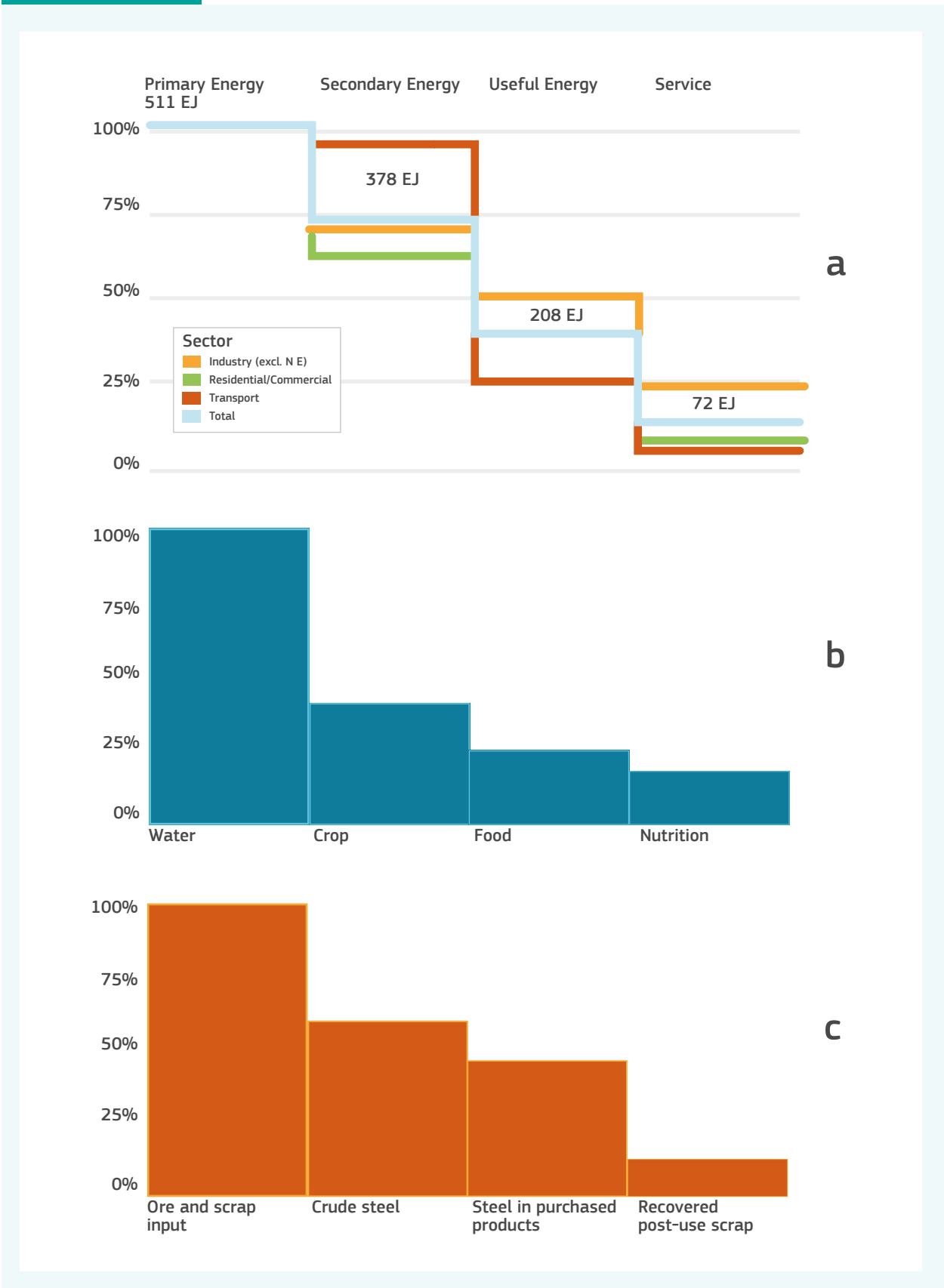
Source: First-order estimates based on Lundqvist et al. (2008) and Sadras et al. (2011), updated with 2016 data (J. Cullen pers. comm.) from Allwood and Cullen (2012); Ayres and Simonis (1994), Fischer-Kowalski et al. (2011). Graphic courtesy of Arnulf Grubler and Benigna Boza-Kiss, cf. TWI2050 (2018), Figure 2.24.

<table>
<tr><td>**BOX 4**</td><td>*Case study on enabling the environmental transition through a circular economy approach – Slovenia.*</td></tr>
</table>

Given its size, Slovenia has one S3 strategy for the entire country. It is called 'S4' in Slovenia (i.e. 'Slovenian Smart Specialisation Strategy' – similar to Serbia and not to be confused with S4 used previously where the fourth S stands for sustainability), but we will stick to S3 to avoid confusion. In its S3, Slovenia wishes to build on its natural assets and a vision of the green Slovenia. It explicitly aims to enhance its development on circular economy principles to benefit from a safe environment and use its resources in a smart way (Republic of Slovenia, 2014). This puts this enabling factor for an environmental transition at the core.

The other two priority areas, besides 'Circular', are 'Industry 4.0' and 'Digital'. The 'Circular' priority area has three components: 'sustainable tourism', 'sustainable food production' and the most transversal, 'Networks towards Circular Economy', implemented through the Strategic Research and Innovation Partnership (SRIP) - Circular Economy (one of many SRIPs created to support the implementation of the S3 in Slovenia), set up in 2016 to establish new value chains according to the economic principles of closed material flows. SRIPs are public-private clusters to facilitate knowledge exchange and bring together stakeholders (i.e. companies, educational and research institutes, non-governmental organisations, other interested partners and public entities) around a common theme to implement the RIS3. They emerged out of a long and open consultative process (SRIP, 2017).

The SRIP - Circular Economy is not organised for or dominated by any sector. It aims to support Slovenia's transition to a circular economy across sectors, with a focus on: sustainable energy; biomass and alternative raw materials; secondary raw materials; functional materials (e.g. sustainable composites, advanced packaging); processes and technologies; and circular business models. The power of a transition towards circular economy in supporting the efficiency and competitiveness of the Slovenian economy motivates this entity that aims to overcome the fragmentation of relevant knowledge. It also provides a link for local SMEs to international and EU-level collaboration and financing. Technologies, R&D infrastructure and attractiveness to investors, business models as well as a suitable regulatory support environment are all elements of this public-private partnership that was set up for the long-term. The SRIP - Circular Economy has also managed to introduce the concept of circular economy in the action plans for the other SRIPs supporting the RIS3. Its members benefit from knowledge transfer and exchange, standardisation and certification (SRIP, 2020).

The chosen approach is cross-cutting, mainstreaming the concept of circular economy in different sectors for different actors, and for different approaches. The choice of priority fields is also reinforcing as they all provide entry points and linkages for one another. A circular economy is relevant for reinventing industry and can be facilitated through digitalisation, a synergetic approach for the smart use of resources across local value chains (e.g. chemical industry). Slovenia builds on a broad transformative process where adjustments along the (existing) value chain are expected and even promoted. This allows for spillover effects and the reorganisation of the status quo.

previous economic recovery periods such as the 2008 financial crisis. The need for well-planned, forward-looking and transformational recovery packages to avoid lock-ins is clear. In **Box 5** we present some early experiences of a national recovery plan. S3 has the potential to guide the place-based, territorial applications of National Recovery and Resilience Plans.

By offering territorially-specific shared visions and values to be achieved by mobilising science, technology and innovation for sustainability transition, S4 can become a useful approach to define regional contributions to national Recovery and Resilience Plans. The bottom-up, territorial approach can also reduce territorial inequalities and make sure that no place is left behind.

| BOX 5 | *Case study on a sustainable recovery package – Germany.* |

The Covid-19 crisis has united German political actors. In late March 2020, a €600 bn economic stabilisation fund was agreed by the government. In June 2020, Germany was the first EU country to announce a large recovery package of €130 bn. Additional measures for the mobility sector were added in November 2020. In December 2020, a draft Recovery and Resilience Plan (RRP) was presented that described the use of funds from the EU Recovery and Resilience Facility (€29.3 bn). To fund these packages, the German Government broke its longstanding commitment to not take on new debts.

Although the amounts of foreseen investments are enormous (around €140 bn in total at national level), the transformational potential of the German recovery measures has been assessed as 'moderate'. A green spending share is 34%, below the requested 37% EU benchmark, and an additionality is less than 30% because the majority of financial resources will support measures that already existed (Reitzenstein et al., 2021).

Surprisingly, insufficient linkages exist between planned measures and longer-term sustainability objectives, i.e. decarbonisation. The EU Recovery and Resilience Facility funds are not predominantly used for additional transformative measures at national level. The measures on mobility can be seen as those that are most supportive of a transformation of this sector. They include €15 billion for sustainable transport, including electric car and bus subsidies, EV-charging infrastructure and public transportation. However, they are not fully in line with a sustainability transition because plug-in hybrid vehicles and ICE trucks are still included. The stimulus package does not subsidise petrol or diesel passenger vehicles as was the case after the financial crise in 2007, despite strong demands from the German automotive sector, following a public debate.

Another €7 billion are earmarked for clean hydrogen technology and market development (incl. research, international collaboration, pilot applications), which is particularly important for decarbonising heavy transportation and industry (Dagnet and Jaeger, 2020) in the medium- and long-term. However, comparatively little funding (€2.5 bn) is planned for readily available solutions such as energy efficiency measures that are also linked to job creation.

▶ *Recovery packages provide the opportunity to use vast amounts of public money in a transformative manner, which would have usually not been disbursed. In many cases, however, funds are relabelled and are not really additional or rather cement the status quo for longer without harnessing their potential for change in society and the economy.*

Conceptual guidance – from S3 to S4

3.

Over the last eight years, the S3 framework and its methodological approach have been discussed, tested and evaluated. What emerged strongly from this experience is the fact that S3 lacks directionality, especially concerning the transformational objectives mentioned in the EGD and SDGs. This is specifically evident in the case of environmental protection, including local air pollution and the avoidance of waste to maintain the critical functioning of Earth systems. The environment-related actions also need to be just, equitable and respect the rule of law and other European values. In other words, no one should be left behind. The direction of development is 'green and just'.

Guidance is presented on how to improve the analysis of the potential contribution of S3 to the achievement of the SDGs and the EGD priorities, thereby transforming S3 into S4.[18] This will necessarily entail a shift in logic and focus. Several elements will not be touched upon by this twist, specifically the engagement of local stakeholders' strong emphasis on collaboration, and the importance of local diversification would remain in place. The overall transformational narrative objective, however, does call for some fundamental shifts.

When reflecting on the shift from the S3 approach to S4 for sustainability, the following should be done:

- consider the core focus of S3 on innovation and industry policy through the lens of a transitions and systems approach;

- adopt a holistic approach towards S4 development, combining a bottom-up approach (Entrepreneurial Discovery Process) with top-down guidance (missions and grand societal challenges);

- aim for policy coherence and coordination (within administrative decision authority and cross-borders);

- integrate EGD/SDGs goals and objectives into the S4 design and implementation, e.g. a checklist;

- consider the three principles of sufficiency, resilience and efficiency;

- evaluate capacities, competences and available resources needed for effective implementation, e.g. a concept such as the additionality followed by the Clean Development Mechanism may be too complex in terms of baseline and verification procedures;

- consider environmental impacts, e.g. greenhouse gas emissions, air and water pollution, land-use or water impact, within and across regional and national borders;

- go beyond ex-post reporting or checklist exercises on related SDGs through ex-ante planning;

- consider opportunities and the possible impacts of digitalisation (i.e. see changes associated with the COVID-19 pandemic).

Some countries or regions have already followed a concept of sustainability in their S3 strategies, either because they started later when the SDGs had been adopted or because they embedded their S3 in a broader development strategy. *Box 6* provides a case study on the Swedish region of

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18   *The final S4 concept is being developed by the JRC and its partners*

| BOX 6 | *Case study on aligning with other development strategies – Västerbotten, Sweden.* |

Västerbotten in northern Sweden developed and implemented S3 later than some other European regions. The first S3 ran from 2014-2020 and also extended to novel actors in the innovation system (Leino & Hunter, 2020). Västerbotten is a highly skilled knowledge economy but also faces the challenges of peripherality and old industrial communities and strong natural resource endowments that shape the economy.

The priorities of the first S3 were rather numerous and broad, including innovative healthcare; life science; technology and service in the industry; testing activities; sustainable energy and environmental engineering; experience industries and cultural and creative industries; and digital services (Region Västerbotten, 2014). The region has faced the challenge of integrating S3 into sustainability as it needed to educate stakeholders about both concepts, even when initiatives were already ongoing (Teräs et al., 2020).

In 2020, the region started to update the S3 strategy, which is expected to be completed in 2021 and will likely feature fewer priority fields. Social innovations are expected to play an important role, and the industrial value chains will be extended from manufacturing to finalised products (Leino & Hunter, 2020).

The concept of sustainable development 'hållbarhet' has been high on the regional development agenda in North Sweden for quite some time, even before the SDGs were launched. The SDGs are seen as a globally accepted tool that can be used regionally and facilitate comparison. Sustainability and holistic approaches for sustainable innovation and development feature considerably in the thinking and initiatives of the Regional Council. The Region Västerbotten has explicitly integrated the SDGs into its regional development plans (Region Västerbotten, 2019a, Region Västerbotten, 2019b). The embedding of the SDGs into a regional Smart Specialisation strategy is currently underway. Furthermore, the EU climate-neutrality targets are reflected in these strategies. In particular, efforts are undertaken to deliver on SDG2, SDG3, SDG7, SDG11, SDG12 and SDG13. Västerbotten achieves a national average on progress for SDG6 and SDG16. New industrial initiatives evolve around sustainable resource use and a green industrial and energy transition, in line with the EGD.

The embedding of sustainability has paved the way for sustainable S4 approaches to become a substantive opportunity for Västerbotten to fully utilise the combination of sustainable development and Smart Specialisation in the future. Further aligning and harmonising regional sustainable development and Smart Specialisation and communicating the transformative potential of S4 at the beginning of the new EU programming period 2021-2027 is a timely occurrence for regional authorities and stakeholder coalitions in Västerbotten (Teräs et al., 2020).

▶ *Smart Specialisation does not operate in a vacuum but in addition to other local, regional, national and even supra- or international policies. Policy coherence across different initiatives provides the opportunity to leverage synergies and avoid contradicting messages or decisions. Smart Specialisation can contribute to the design and implementation of regional sustainable development strategies and vice versa.*

Västerbotten that integrated aspects of SDGs into its S3 strategy.

3.1 Understanding the origins, revising for the future

In the previous sections we discussed the need for a shift from the original S3 approach to S4 to meet the challenging objectives of the EGD and UN 2030 Agenda, and we provided some specific examples. In this section we will touch briefly on how to include the sustainability objectives in S3 development. We acknowledge that the sustainability discourse cannot be limited to strategy development alone, but has to be an integral part of the implementation, monitoring and evaluation; however, due to the limited scope of this study, we narrow down our focus to cover three aspects of the S3 process:

Aspect 1 : Identification of the thematic priority areas

Aspect 2 : Translation of the priority areas into transformational roadmaps

Aspect 3 : Implementation.

These three aspects (Foray, 2019) can be accompanied by SDG-mainstreaming and awareness raising regarding the transformational narrative.

ASPECT 1 : IDENTIFICATION OF THEMATIC PRIORITY AREAS

While the thematic priority areas are discussed, possible synergies and trade-offs with other (eco) systems of these and associated priority areas need to be identified and assessed ex ante. For this, discussion and consultation with stakeholders is essential.

Starting with practice and policy guidelines, for example, adjusting the design of the mapping towards the SDGs and the EGD can provide an initial point of entry to test the practicability of the strategy's reorientation (*Figure 5*). Societal and environmental challenges (individually and not combined) are added to economic, innovative and scientific potential during the analytical phase. Of course, statistical analysis and data cannot provide a complete picture; they need to be comple-

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FIGURE 7 *Example – S4 during the mapping exercise calls for broader and more systematic considerations of synergies and trade-offs and relevant stakeholders.*
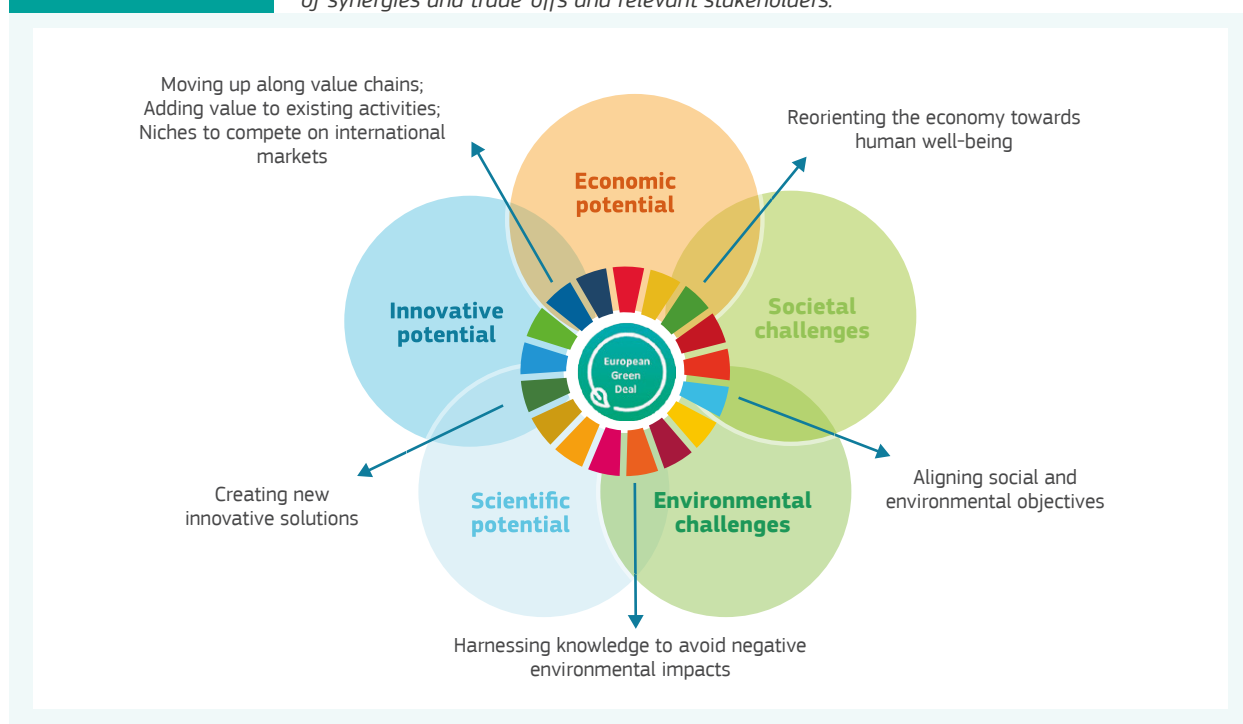
Source: Adapted from the JRC.

mented and verified through consultations and the Entrepreneurial Discovery Process.

Adjustments to the analytical framework, as in the one presented in *Figure 7*, are needed to expand the scope and scale of the strategy. Consequently, the implementation policy mix and instruments will have to observe changes made in the analytical and design model/phase.

ASPECT 2 : TRANSLATING PRIORITY AREAS INTO TRANSFORMATIONAL ROADMAPS

After the identification of thematic priority areas at the cross-roads of the existing potentials and challenges, it is necessary to develop transformational roadmaps. The roadmaps should reflect upon possible trade-offs between priorities and targets, potential synergies and plans on how trade-offs could be alleviated. Regions' ambitions can and will vary depending on their capacities, accumulated experience and knowledge, yet the direction of S4 should not be modified. Regions also face different environmental and socio-economic challenges that will shape the options on the roadmap.

The *ex-ante* evaluation of identified priority areas could indicate a possible contribution to sustainability. This includes goal setting, which can be tracked during implementation (i.e. in terms of environmental or societal impacts of the different actions). Goal setting (including SMART goals – specific, measurable, achievable, realistic and timely) provides a basis for monitoring and evaluating during implementation (see below). Thought-provoking and partly visionary questions (see below for examples) that the strategy wants to help answer (i.e. how can we contribute to a zero-waste economy and society?) can help in guiding this process. This can motivate stakeholder groups to come together to work towards a common goal and help guide the Entrepreneurial Discovery Process.

Thought provoking questions

- How can we contribute to achieving a zero-waste economy and society?

- How can we reuse waste materials / end of life materials?

- How can all transport- and mobility-related emissions and other negative impacts (e.g. air pollution, noise, accidents) be avoided?

- How can we return more land to nature?

- How can we use already converted land/space more efficiently without developing new land?

- How can we turn available building stock into plus-energy or zero-emissions buildings?

ASPECT 3 : IMPLEMENTATION

During the implementation phase and in preparation for monitoring and evaluation, synergies and avoided trade-offs are measured and tracked, where possible (see also Annex for examples on monitoring and evaluation indicators, such CO_2 intensity, recycling rate or avoided greenhouse gas emissions). The SDG framework also provides examples of relevant indicators. A catalogue of suitable indicators or checklists for different domains could be developed to then be picked for strategies depending on the actions. Below we provide exemplary checklists and questions to illustrate this idea.

Climate change mitigation

- Are all energy efficiency, demand reduction and optimisation potentials (e.g. using waste heat, automatisation, demand management) being exploited?

- Is new renewable/green energy generation/storage an option?

- What impact will the project and its operations have on local infrastructure (i.e. local air pollution, traffic)?

- LCA (Life Cycle Assessment) of the actions related to construction, products and services to be developed with the aim of zero-impact actions:

  · Carbon, material and water footprints of the project actions incl. grey energy,

- Emission-reduction contributions of the actions.

- Mobility & transport concept – Reduction in travel emissions through virtual conferencing, combining trips and generally more environmentally friendly travel modes (i.e. facilitated for proximity to public transport networks).

- How are climate change scenarios being considered in the strategies?

RESOURCES

Sustainable S4 strategy operations

- Sustainability policy to be streamlined in activities, with reporting requirements.

- Sustainability training for staff and collaborators/stakeholders.

- Incentives for the sustainable behaviour of employees/workshops (e.g. vegan/vegetarian catering, waste reduction / zero-waste approaches).

Ongoing monitoring and evaluation (again following SMART principles) and ex-post assessments of the impacts and the goals of the strategy need to be enhanced. This will also facilitate comparisons between strategies, collecting lessons learned to feed back into the process and make necessary adjustments along the way and quantify the overall impacts of activities.

3.2 Bringing in the relevant groups

Stakeholder groups need to be involved in the process from the outset to cover the wider perspective on interlinkages and systemic thinking when designing and implementing the S3 strategy. Stakeholder involvement is relevant to all three phases described above. The S3 process includes the essential element of Entrepreneurial Discovery Process-stakeholder involvement. This allows stakeholders to co-own the process of strategy design and implementation.

However, the scope and type of stakeholders will inevitably need to be broadened to include actors from the civil society sector (i.e. environmental NGOs or experts) and citizens themselves via, for example, citizens' fora. Moreover, it is important that stakeholders co-own the S4 strategy to ensure an even more efficient implementation process and impact.

3.3 Mainstreaming tools and materials

One way forward will include mainstreaming current S3 tools and guidelines with the broader transformative sustainability narrative sketched out above. The new S4 approach has to be reflected in all guiding and background documents as well as tools and indicator lists. In general, sustainability is predominantly seen from financial perspectives; little consideration is given to broader societal (beyond jobs) and environmental impacts while economic growth is at the heart.

An example of such an update is given in McCann and Soete (2020, pp. 25-26) on how the guidance on learning modules for S4 would be based on S3 guidance. Further concrete examples where S3 materials are not in line with the new broader transformative narrative are given in the Annex. This primarily pertains to the term sustainability, which previously referred to financial sustainability and did not cover social and environmental aspects. This should showcase the need for an overhaul of materials instead of a mere addition of 'sustainability' and SDG terminology. This also relates to the involvement of stakeholders and how to benefit from their perspectives.

The new tools, methodologies and guiding documents will support the policymakers involved in implementing their strategies and achieving a greater level of sustainability.

Concluding remarks and outlook

4.

The overarching ambition of a more sustainable and inclusive Europe has triggered reorientation of EU policy frameworks. With S3 incorporating sustainability challenges and targeting the achievement of the SDGs, it will be possible to align a new generation of place-based innovation strategies (S4) to the twin green and digital transitions (European Commission 2020b).

The EGD focuses prevalently on climate and environmental sustainability and just transitions. If we keep the objectives of the SDGs in mind and draw upon learnings from the COVID-19 pandemic, we have to acknowledge that social and societal aspects need to be taken into due consideration. Inequalities between and within countries are increasing, partly accelerated by the process of digitalisation and as a result of the COVID-19 crisis. Solidarity, that contributes to achieving social justice, is thus needed just as much as sustainability. This leads us to the consideration of solidarity as an important mission to be delivered through Smart Specialisation (*Figure 8*). In fact, existing Smart Specialisation strategies have already focused to some extent on societal issues (*Box 7*), and this could lay great foundations for future work.

FIGURE 8   *The future of Smart Specialisation – From S3 via S4 to S5, accounting for sustainability and solidarity.*

COVID-19 RESPONSE

European Green Deal

S3 SMART SPECIALISATION PLATFORM

Smart Specialisation S3

Smart Specialisation for Sustainability S4

Smart Specialisation for Sustainability and Solidarity S5

BOX 7   *Case study on mission-oriented RIS3 – Northern Netherlands, Netherlands.*

Societal challenges that are both regional but also universal and how they can be overcome is at the core of the Northern Netherlands' S3/RIS3 (SNN, 2013). With the S3 strategy, no sector is prioritised but competences that may contribute solutions to the identified challenges (i.e healthy and secure food, sustainable energy, clean water) that are all linked to the good health of the society. The perspective is that any sector can contribute to this endeavour. Companies may discover specific niches and develop (future) strengths as a result of a continuous Entrepreneurial Discovery Process with strong stakeholder engagement. This has already led to discoveries in versatile sectors, such as blue energy (hydrogen), the agro-chemical industry and health and big data (Hulsmann, 2018).

The strategy focuses on objectives, and not on specific activities. All kinds of collaborations and consortia are welcome to contribute to objectives, where the consortia are able to define how to reach or contribute to the objective. The entire design of the approach includes close stakeholder involvement and is flexible by nature (SNN, 2013). This mission-oriented approach is in line with Mazzucato's (2018) recommendations and criteria for mission-driven policies – foremost inspirational and societal relevance – ambitious cross-sectorial challenges that can spark multiple bottom-up solutions across different disciplines, sectors and type of actors. It clearly indicates that there are multiple ways of contributing to achieving the mission.

Small and medium-sized enterprises (SMEs) make up more than 95% of all companies in the Northern Netherlands region. Hence, such a broad concept where everyone can participate in this change enables the inclusion of highly diversified sectors and companies in the region (Hulsmann, 2018). SMEs struggle to harness existing knowledge and/or generate new knowledge. The S3 strategy addresses this by i) fostering collaboration between businesses and between businesses and knowledge institutes; ii) improving the access to knowledge; iii) improving the effectiveness and accessibility of support measures; and iv) facilitating cross-border collaboration.

Collaboration is at the heart of the Northern Netherlands' regional Smart Specialisation strategy with the objective to bring businesses, knowledge centres and preferably end-users together in innovative environments where open innovation and entrepreneurial discoveries are stimulated. The aim is to create a fertile ecosystem for innovation in the Northern Netherlands (S3 Consortium, 2018). The strategy aims to strengthen the knowledge base of SMEs to ensure that they are better equipped to exploit existing knowledge, generate new knowledge and to incorporate innovation within their operations (Beyond EDP, 2021).

Most recently, the Northern Netherlands applied this approach to an open innovation call aimed at pushing the Entrepreneurial Discovery Process further, being as open as possible and not focusing on activities but objectives.

▶ *This mission-oriented approach that focuses on society's wellbeing is something that is at the core of S4. To achieve large-scale transformations as required, everyone has to find a way to contribute to their field without clear prescription. This will help develop novel approaches to overcome societal challenges. A broad perspective on what constitutes societal wellbeing, similar to the SDGs, will entice diverse approaches and ideas.*

BOX 8   *Key messages.*

1 **Broaden the narrative of Smart Specialisation and direct the focus: S3 for sustainable innovation strategies.**

The SDGs and the EGD call for a broader transformational narrative, which guides all EU policy fields, including Smart Specialisation. Smart Specialisation can be seen as a vehicle connecting local innovation action with global commons by following the three principles of sufficiency, resilience and efficiency.

2 **Mainstream the full approach and project cycle.**

For Smart Specialisation to deliver on the new policy ambition, the full approach needs to be mainstreamed for sustainability, encompassing economic, societal and environmental aspects. All materials and tools guiding the project cycle need to reflect this new orientation.

3 **Harness experiences from different perspectives through local stakeholder engagement.**

This reorientation may go hand in hand with broadening the stakeholder groups that need to be consulted throughout strategy development and implementation. This can lead to wider perspectives and acknowledgement of important interlinkages that were previously side-lined.

4 **Use pandemic recovery as an opportunity for building a sustainable future for all and reorienting ongoing initiatives.**

Building back or building back better ignores the need for fundamental transformations, as called for by the EGD and the SDGs. Funds and opportunities emerging from the COVID-19 recovery can speed up the process.

5 **Policy coherence and coordination are key to leveraging synergies and avoiding negative trade-offs.**

Policies at different levels and in different fields can enhance one another if aligned. As a minimum, an adverse or cancelling effect can be avoided. Ideally, such an interaction check could happen during the budget allocation and design of novel policy frameworks.

6 **Design a process that is inclusive and usable for (less-resources) regions.**

S3 was already challenging for some regions due to lacking capacities, methodological rigidity and weak innovation ecosystems. Sustainability should not be seen as an added complexity that cannot be dealt with but as a helpful guiding post supporting the design and implementation of S4.

Discussion

ANNEX

THE FOLLOWING EXEMPLARY SECTIONS FROM FUNDAMENTAL S3 LITERATURE HIGHLIGHT THE NEED FOR A SHIFT IN FOCUS AND THINKING.

The S3 approach focuses on the deployment of innovative activity and the establishment of new connections within and beyond the region, enabling the region concerned to trans-form itself and develop new competitive advantage based on these transformations. The other raison d'être of S3 is to encourage regions to build competitive advantage on their specific strengths, potentials and opportunities, rather than doing as others do. Thus they avoid doing the same 'good' things as others, which in the end will in many cases prove inconsistent and unrelated to the region's existing assets and potentials and does not provide any comparative advantage. Instead, the region achieves the specific critical mass needed for a significant change in the regional economy (Foray, 2019).

▸ **Reframing needed as long-term competitive advantage only achievable if within SDGS**

More a script than the 10 Commandments! It is therefore quite obvious that an S3 must not rely on an immutable formula that every-one must adhere to in order to avoid failure – like the 10 Commandments! Let us leave the regions the freedom to invent their own approach, while still insisting on the necessity of adhering to the three stipulated phases. Here we can be inspired by the idea of a script: a set of simple rules like those the theatrical director gives the actor he is asking to improvise concerning a certain theme. (Foray, 2019)

▸ **Freedom within a support framework and narrative provide a clear framework for the regions to operate in in view of the SDGs through the transformational narrative**

S3 as a transformation process provides a great starting point: 'There is also this idea of a concentration of resources, not on a structure but on a transformation process.' (Foray, 2019)

▸ **The SDG/EGD combination is also a transformation process that aligns well**

The ultimate decider should be the growth of productivity. Indeed we observe significant effects of productivity created by a transformation consisting essentially of processes of development and adoption of generic technologies invented elsewhere. This is the profound contribution of the analytical framework of general-purpose technologies. Within this framework, the horizontal propagation of a generic technology – in other words, the development of new applications adapted to more-or-less traditional sectors and the formation of new capabilities (skills, management) – represents a key factor of productivity (Bresnahan, 2010). Indeed, with respect to regional development, breakthrough innovation and frontier research cannot be viewed as the only sources of productivity, growth and development. There are many types of innovation-related actions that are relevant for productivity and growth, such as building up human capital, adopting (not inventing) new technologies, diffusing novel management practices, generating complementarities between key enabling technologies and traditional sectors as well as developing

social innovations. All these activities are important in order to strengthen capabilities and leverage the growth and development potential of a regional economy; and all need to be included in any S3 exercise as important drivers of innovation, growth and structural change. As the great innovation economist Manuel Trajtenberg (2010) wrote a few years ago: 'They are perhaps less exciting and flamboyant than high-tech and world-class science, but they ultimately represent the key to economy-wide growth in most regional economies.' (Foray, 2019)

▸ **In general, the traditional focus on growth would need adjusting to the core S3 argument to encompass SDGs and move away from the notion of continuous growth, which is especially exponential in the EU. Development may include circularity and de-growth options. Diversification and more versatile structural changes within the broader transformational framework are in line with S3 ideas. At the core should be a decent and good life for all and the preservation of natural capital rather than material growth per se.**

'S3 is not suitable for the regions at the tails of the distribution but the intermediate regions.' (Foray, 2019)

▸ **The sustainability transformation is needed for all! Ex-ante conditions are not important as one size does not fit all. This needs to go beyond the narrow Entrepreneurial Discovery Process and embrace a more holistic perspective. Starting conditions and challenges as well as transformation pathways are both fundamentally different between regions, while also sharing similar characteristics.**

THE S3 HANDBOOK (GIANELLE ET AL., 2016) PROVIDES SEVERAL ENTRY POINTS FOR ADJUSTING THE FOCUS IN LINE WITH S4, SUCH AS THE FOLLOWING.

The Entrepreneurial Discovery Process refers to *sustainable* innovation. It already argues that 'investments and their social and economic impact – may only be visible in the long term' (Handbook, p. 14). Investments need to include the preservation and promotion of natural capital rather than its destruction through competitive market forces.

▸ **Sustainability is used in a way to reflect longevity, expanding towards sustainability in terms of social & environmental & economic longevity!**

One advantage of S3 lies in the *broad concept of stakeholders*.

▸ **Open process further to include a wide variety of stakeholders (to consider impacts/synergies).**

The public sector fulfils multiple roles: policy coordination and policy coherence across multiple policy fields. According to the principle of integrated implementation (Handbook, p. 45): a holistic approach to sectoral development that goes beyond narrow concerns with science and technology or infrastructure and seeks to understand their multiple and interconnected needs. This certainly impacts upon a range of policy areas from employment and education to environment and planning. S3 cannot be implemented by one type of instrument; national and regional authorities will instead have to consider various policy mixes.

▸ **Ideal starting point for broader policy approach.**

Different categories for correct S3 implementation are suggested (Handbook, p. 61): Example 4. Defining priorities and criteria for funding innovation infrastructure to align them with the S3 agenda.

▸ **Introduce link to SDGs / transformational narrative!**

Selection criteria for projects in view of implementing S3 (Handbook, p. 73).

| FIGURE 9 | *Selection criteria for S3 projects.* |

Relevant selection criteria for projects in view of implementing S3:

Alignment with S3

- Incorporation of S3 objectives in project objectives
- Expected contribution to smart specialisation domains

Regional dimension

- Expected regional benefits
- Possibilities for scaling up and capitalizing on project's results to create spillovers beyond project partners
- Stakeholders' involvement, bottom-up approach, endorsement by a wide community of regional actors
- Synergies with other regional initiatives or projects

International dimension

- Demonstration of positioning of projects in a wider value-chain perspective
- Development of capacity of regional players to link with and embed external inputs
- Intensity of external cooperation for the benefit of the project

Viability-sustainability

- Financial viability
- Legal viability
- Presence of private co-funding
- Alignment/complementarity with national orientations
- Inclusion of clear targets and realistic follow-up process and indicators

Funding mix

- Appropriate articulation of public regional, national, EU (ESIF and other) and private funding sources

Source: Gianelle et al. (2016).

Viability–sustainability is a category for criteria

▸ **Expand concept (not merely financial sustainability):**

The monitoring system (Handbook, p. 100 et seq.)

The monitoring system should reflect the S3 logic of intervention. In order to be a proper and effective management tool, the S3 monitoring system should fully reflect the logic of intervention of the strategy. In particular, it has to capture the actual socio-economic results linked to specific objectives and expected changes explicitly identified for each and all S3 priority areas. It will also need to keep track of how policy measures deliver their output in relation to the expected changes and declared results.

▸ **Adjust, in light of broadening objectives, additional indicators and minimum requirements and their focus, linking with other monitoring systems to avoid duplications and the overburdening of entities (e.g. energy, material, land-use and waste-related indicators, poverty measures, indicators collected for SDG reporting).**

Measuring

Issue if you introduce additional indicators that need to be measured with regards to SDGs as this could become an additional burden or just a reporting exercise.

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