The integration of key transformative R&I principles in European policies

A multiple case study analysis

Andrea FERRANNINI, Roberto MARTINO, Mario BIGGERI, Océane PEIFFER-SMADJA, Julien RAVET

Research and Innovation

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Working paper

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ABSTRACT

This paper analyses how European R&I policy contributes to the sustainability agenda. It assesses how the principles guiding transformative R&I policy as developed in the 2020 edition of the Science Research and Innovation Performance of the EU - i.e., transformation, directionality, co-creation, diffusion, and uptake - are reflected, embedded and made operational in a selection of EU policy interventions. It demonstrates that innovation processes are at core of a transformative change towards sustainable development across different EU policy domains and that the transformative R&I principles potentially reinforce each other in the context of EU policy.

1.   Introduction: A new framing for EU transformative R&I policy

International organisations, supranational institutions, national governments and local authorities have increasingly put sustainable development at the heart of their strategies and policies (UN, 2021; OECD, 2022; UCLG, 2022). This is apparent not only in the UN Agenda 2030 for Sustainable Development and in the consequent national and local strategies for sustainable development, but also in the efforts devoted by the European Commission under the Juncker presidency (2014-2019) and under the von der Leyen presidency (2019-2024), with notably the launch of the European Green Deal as the new growth strategy of the EU.

The COVID-19 pandemic has made evident the vulnerabilities of our societies (Ferrannini et al., 2021), and its differentiated impacts in terms of generations, social groups, territories and countries is undeniable (OECD, 2021), with particular concerns for the most vulnerable social groups, regions and economies that were already at risk. This puts even more pressure to pursue sustainability in its three dimensions – social, environmental and economic – while ensuring recovery and building more resilient and just societies (EC, 2020a).

The Russia's invasion of Ukraine invasion enhanced further challenges to Europe, potentially affecting the transition to a carbon-neutral, circular and sustainable economy. On the one side, energy independence from Russia could accelerate EU energy diversification efforts, bolstering the European Green Deal. On the other side, the risk is to postpone the transition due to a renewed reliance on obsolete and high-polluting sources and technologies to respond to energy poverty and shortages.

Research and innovation (R&I) policies undoubtedly lie at core of a transformative change towards sustainable development (Chataway et al., 2017; Capriati, 2017; Mazzucato, 2018; UN, 2019; Schot and Steinmueller, 2018). Indeed, in a previous contribution to this R&I Paper Series, Biggeri and Ferrannini (2020) argue that R&I plays a pivotal role for the pursuit of – and transition towards –

sustainable development, by: i) pursuing a direction for transformation; ii) creating, expanding, advancing and disseminating knowledge; and, iii) finding, testing and evaluating solutions (that can be scaled-up and replicated) to pursue human wellbeing, global public health, sustainability, social progress and societal prosperity today and in the future. Moreover, they argue that an expanded framing for European R&I with new missions, objectives, stakeholders, resources and processes is required to empower individuals, communities and societies with innovative solutions, expanded knowledge and information, raised awareness and enhanced capacities to pursue sustainable human development.

The ambition for European R&I policy is to act as a leverage for transformation in the transition towards sustainable development, empowering individuals, communities and Member States to meet societal needs and build sustainable and inclusive societies. This is especially true and relevant in the current situation characterised by the post-pandemic recovery, undeniable climate change effects and energy crisis. In other words, European R&I policy is expected to answer to these concomitant challenges, accelerating the necessary transformation in our production systems, consumption patterns, and institutional and business models.

To realise this ambition, European R&I policy needs to fully embrace the principles underpinning transformative change towards sustainable development – transformation, directionality, co-creation, diffusion, and uptake (EC, 2020b) – and make them operational, going beyond a consolidated narrative. For this reason, in this paper, we analyse how these principles are reflected and embedded in the design and implementation of EU policies across different domains. The analysis is not an ex-post assessment of the impacts of the policies, but we rather focus on their design and implementation to better understand to what extent current and planned European R&I policy is equipped to contribute to the sustainability agenda.

2. Key principles for transformative R&I policy design and implementation

In the framework of the post-pandemic recovery, EU R&I policy is under pressure to adapt to ensure that R&I contributes to an ample concept of sustainability – social, environmental and economic – while driving EU competitiveness and ensuring recovery and resilience. Indeed, Europe's competitiveness should build on a framework of institutions, policies and factors that ensure sustainability in the long term – i.e., sustainable competitiveness – and sustainability should become a key driver of Europe's competitiveness and growth – i.e., competitive sustainability (EC, 2020b). To achieve this, the 2020 edition of the Science, Research and Innovation Performance report of the EU (EC, 2020b), which analyses Europe's performance dynamics in science, research and innovation, identified five key principles that should underline a roadmap for a new approach to R&I policy: transformation, directionality, co-creation, diffusion and uptake. These principles

are then mentioned also in the 2022 and 2020 editions of the Science, Research and Innovation Performance report of the EU (EC, 2022).
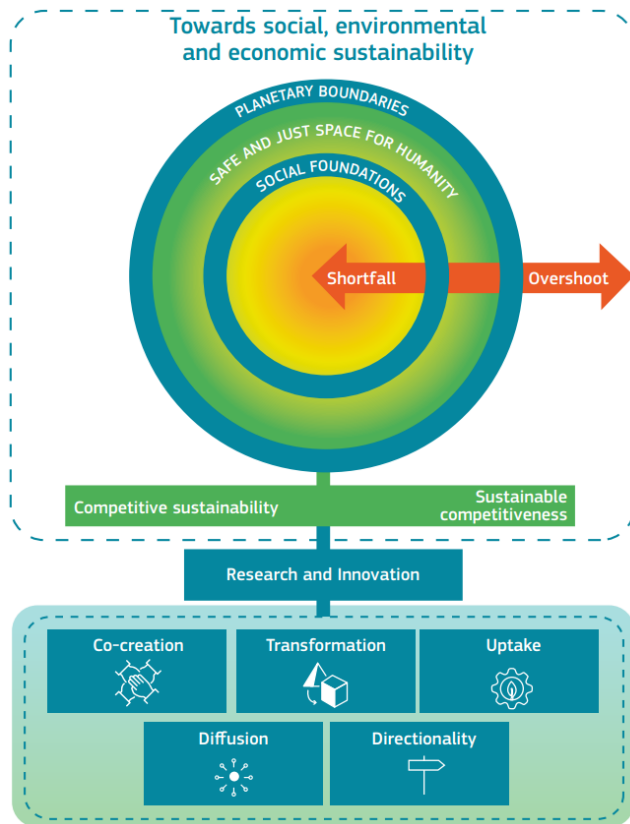
Source: EC(2020b). Note: Doughnut visualisation based on Kate Raworth's work on the Doughnut Economics.

Transformation

Putting the global economy on a sustainable development path requires a radical transformation in our production systems, consumption patterns, and business and institutional models. R&I will have a major role in this process, as science and technology are not only key levers for productivity growth, but they are also fundamental tools to enhance sustainable solutions (Schot and Steinmueller, 2018; Bell et al., 2019; United Nations, 2019; Biggeri and Ferrannini, 2020). Therefore, R&I policy aiming at being transformative in the meaning discussed above should promote the development and deployment of innovative solutions, while at the same time contributing, alongside other policies, to the renewal and transformation of social, economic, institutional, and business models beyond technological change. This means framing R&I also outside the markets towards a broader "societal function" (Vollenbroek, 2002; Smits et al., 2010).

Directionality

Transformation towards sustainable development implies making a choice on what societies and economies need and should achieve. Therefore, it calls for European (and national) R&I policy to provide such a direction, including an effective framework ensuring coordination, alignment and synchronisation in the design and implementation of different policies. First, directionality is about priority setting in the research and innovation agenda, i.e., where should efforts be directed to. Second, this process should avoid being prescriptive on the way objectives are going to be fulfilled. SDGs and Missions are typical examples that find implementation in European R&I policy: they define clear objectives and targets without specifying how actors should work to achieve them (Mazzucato, 2018 and 2019). These are clear elements for a "working" application of the directionality principle.

Co-creation

The benefits stemming from the active and continuous engagement of stakeholders support the "co-creation" principle, which is complementary to the "directionality" principle discussed above. The concept of co-creation is primarily about the identification and the definition of priorities discussed above, adding a "bottom-up" approach to an otherwise purely "top-down" exercise. It also goes beyond that. It includes the mobilisation of citizens, local communities and stakeholders to nurture the dialogue between science and society, to involve a wide range of stakeholders in the debate on societal challenges to spur operative initiatives. At the same time, it leverages wide-ranging expertise and knowledge to better deliver on sustainable development (Fleurbaey et al., 2018; EC, 2019). Finally, an active engagement with society, scientists, and industry allows also for a better monitoring and assessment of policy design, its implementation and the evaluation of its results (Mazzucato, 2019).

Diffusion

New knowledge, solutions and innovations benefit companies, citizens and communities only as long as they are diffused to a broad set of actors. The "diffusion" principle takes this concept and applies it to innovation outcomes in a broader sense, including both the traditional innovation outputs and new solutions aimed at improving societal wellbeing and tackling the grand challenges contemporary societies are facing, from climate change to a more digital but fairer economy. A transformative R&I policy needs to be able to ensure that new knowledge is shared across society, territories, and people, creating functioning links among actors nurturing the flow of knowledge. This applies to both "radical" and "cumulative" innovations diffusing into markets and society, including

business, civil society and policy environments (Kanger et al., 2020; Mylan et al., 2019).

Uptake

The other side of the coin of knowledge and innovation diffusion is their uptake. For a truly effective transformative change, "beneficiaries" should be able to fully absorb and implement the innovative solutions they are exposed to, depending on their absorptive capacity (Cohen and Levinthal, 1990; Griffith et al., 2003). The extensive literature on the economics of innovation has shown that, while knowledge and technology diffusion are key drivers of aggregate innovation and productivity growth, diffusion alone is not enough to ensure that technological (and/or transformative) change takes place widely. As highlighted in the seminal paper by Cohen and Levinthal (1990), the uptake of innovations does not come naturally, but it requires specific capabilities built by companies, public bodies and other organizations to be able to absorb and implement them. Such degree of relatedness depends on cumulated knowledge either specific to the innovation to be adopted or in closely related fields, both defining the absorption capacity of the recipient firm, public body or organizations, and requiring specifying investments to build it. Said differently, while there cannot be uptake without diffusion, knowledge can diffuse without actual uptake and implementation due to the lack of (absorption) capacities by the potential recipient, as discussed in European Commission (2020b). This holds true at any aggregation level, including firms, regions, and public bodies. Therefore, R&I efforts and policy may fulfil the ambition to shape the climate, environmental, social, and economic transitions only if the innovative outcomes and knowledge produced meet the required capacity for absorption and practical implementation, both on a small and a large scale. When this capacity is not present, the policy design may want to contribute to develop it in order to improve its potential impacts. These objectives may be achieved through the use of financial instruments, as well as by sharing best practices and supporting their implementation, being it in companies, local governments or innovation / development agencies.

3. Methodology

3.1 Research design and case study selection

In this paper, we use a multiple case study approach (Yin, 2017) to assess how the five principles of transformative R&I policy have been applied across policy tools at the EU level, purposively selected due to their focus on innovation processes and practices across different dimensions of sustainable development.

For the purpose of this paper, we consider policies across different programmes to understand whether and how the principles were accounted for within and beyond the main EU instrument for R&I - i.e., the Framework Programme (FP) for R&I.

Such research design is especially helpful in examining poorly understood phenomena in their natural settings and explicating processes related to "how" research questions (Langley, 1999). A multiple-case study includes two or more cases to investigate the same phenomena, allowing to compare and replicate the findings and thus producing more compelling evidence, so that the study is considered more robust than the single-case study (Eisenhardt and Graebner, 2007).

Following this research design, five European policies were selected as case studies based on three main criteria:

- First, we selected policies that are related to R&I processes, directly or indirectly.

- Second, we selected policies that explicitly deliver on the green and twin transition, while paying attention to one or more dimensions of sustainability, namely social, environmental, and economic.

- Third, we selected policies that embrace at least one of the principles of transformative R&I policy, according to their design, definition, scope, way of implementation, targeting.

Additional selection criteria refer to their potential for learning, and information accessibility.

Based on these criteria, the following five policies were selected.

POLICY	BRIEF DESCRIPTION
European Innovation Ecosystems (EIE)	As part of Horizon Europe, EIE focus on building an interconnected, inclusive innovation ecosystem that encompasses European, national, regional, and local initiatives as well as under-represented actors and territories, while also reinforcing the ecosystems' innovation capacity. It focuses on promoting and co-funding joint innovation programmes managed by national authorities targeting collaborative research, technology and knowledge transfer, internationalisation, and digitalisation. It also wants to deliver mentoring, coaching, technical assistance, and other services for innovators, in cooperation with local, European and international partners. It explicitly targets innovation procurement as a way to spur the development of new goods and services, with the end goal of providing market opportunities to European innovators.
European Digital Innovation	The EDIHs are not-for-profit entities (or a coordinated group of actors with complementary expertise) that provide support to the digital transition of companies, most notably SMEs, and public sectors organisations. Their main activities include the provision of services such as training and skills

Hubs (EDIH)	development, testing of products, support in accessing funds or innovation ecosystems. All in all, EDIHs help companies improving their business processes, products, and services using digital technologies, providing them with skills and training needed for a successful digital transformation. Similarly, they may also support public institutions in the deployment of digital services and infrastructure needed by the local innovation ecosystem.
LIFE Programme	The LIFE Programme aims at fostering a just transition towards a sustainable, circular, energy- efficient, renewable energy-based, climate-neutral and -resilient economy, to the protection, restoration and improvement of the quality of the environment and of health, and to halting and reversing biodiversity loss and tackling the degradation of ecosystems, either through direct interventions or by supporting the integration of those objectives in other policies. It finances relatively small-scale projects adapted to local, regional or national contexts, acting at the same time as a catalyst for broader action at EU level and mobilising further investment by mainstreaming environmental and climate policy into major EU spending instruments.
European Urban Initiative (EUI)	EUI is the successor of the former Urban Initiative Actions (UIA), putting forward a wider ambition on the grounds of the lessons learnt from the previous policy experience. The EUI addresses cities as crucial actors in the undertaking of innovative solutions to promote the different dimensions of integrated sustainable urban development. The main objective of the EUI is to strengthen an integrated and participatory approach to sustainable urban development in local urban contexts, building a stronger link to other European policies.
EU Programme for Employment and Social Innovation (EaSI)	The Employment and Social Innovation (EaSI) programme is a financing instrument at EU level to promote a high level of quality and sustainable employment, guaranteeing adequate and decent social protection, combating social exclusion and poverty and improving working conditions. In particular, EaSI fosters evidence-based policy-making and social experimentation, social entrepreneurship and labour mobility, in order to create employment and promote social inclusion. Mostly, it focuses on social innovation by supporting analytical activities. Moreover, to counter labour market shortcomings and develop an integrated EU labour market, it supports cross-border partnerships, mutual learning between public employment services, social inclusion and education, co-creation among Member States in the areas of employment and social policy, as well as EU-wide targeted labour-mobility schemes.

As such, there is clearly an intentional selection bias, since our analysis is addressing more the *how* rather than the *if* question concerning the embeddedness of transformative R&I principles in the design and implementation of EU policies. In other words, the extent to which the principles found their way into the policy design and implementation is the main object of analysis.

Neither the budget nor the dimension of the policy have been crucial elements for the selection. Rather, we take a comprehensive approach including both large and relatively smaller policy tools.

Similarly, the selection of the policy tools allows for a broad range of beneficiaries, defined as the "target" groups of the policy: the list does include SMEs, local

governments, public innovation/development agencies, hubs, start-ups, and civil society organisations alike, ensuring a comprehensive approach.

The selection of policies was also thought to be encompassing of the ongoing global changes, in order to take on board the broader narrative driving the latest policies in Europe, most notably the European Green Deal; the need to embrace and lead the digital transformation deeply changing the physical world and moving the boundaries between digital and physical; and the need to ensure that the twin transition is also "just", meaning that policy needs to pay due attention to the social groups and places left behind or at high risk to be left behind. Furthermore, the identified policies touch upon the three sustainability areas – prosperity, planet and people – as defined in the 2030 Agenda for Sustainable Development (UN, 2015) and recognised in recent policy documents by the European Commission (EC, 2019).

3.2 Data collection

The investigation of each policy is based on the combination of

- extensive desk-based analysis of available public documentation (e.g., work programmes, regulations, evaluations and assessments, staff working documents, reports and publications, brochures, websites, promotional materials);

- collection of direct in-depth insights through semi-structured interviews to key informants, namely internal staff (heads of units and officers) within related EC DGs and Agencies.

In other words, interviews were meant to validate and complement information extrapolated from the desk analysis, along with exploring the real rationales and processes underlying policy design and implementation.

In total, 9 interviews were conducted using the following structure:

SECTION	QUESTIONS
Brief introduction	- How is the policy supporting R&I processes in Europe? - To what extent and how is a sustainable development vision underlying the policy?
Transformation	- To what extent and how is the policy addressing a transformation in consumption patterns / production processes / business and institutional models towards sustainability?
Directionality	- Which Sustainable Development Goals (SDGs) and R&I Missions is the policy directed to? - Which was the priority setting process? - Does the policy have specific targets in terms of inputs,

	outcomes and/or impact? - To what extent and how is the policy coordinated with other EC policy tools and synchronised with other investments towards the same direction?
Co-creation	- To what extent and how is a whole-of-society approach made operational in the policy design and implementation (e.g., consultation, participatory processes, demand-driven innovation)? - To what extent and how is the policy encouraging the interaction/contamination across different scientific disciplines, economic sectors and policy domains towards common objectives (e.g., SDGs, R&I Missions, etc.)? - To what extent and how is the policy encouraging collaboration among governance levels within the same country and/or collaboration among countries?
Diffusion	- Is the policy (and how) encouraging technological and knowledge transfer (e.g., university-industry linkages, SMEs collaboration, competence / innovation centres, HR investments)? - Is the policy (and how) contributing to make new knowledge and innovation open and accessible to everyone? - Is the policy (and how) devising dissemination processes to / among institutions in different countries and at European level?

Uptake	- How is the policy encouraging and facilitating the uptake and implementation of new knowledge and innovations by
	  o market actors (e.g., within products and production processes)?
	  o institutional actors (e.g., within policies and public management)?
	  o societal actors (e.g., within citizenship actions and behavioural / consumption patterns)?

Final remarks	- Would you envisage any further improvement / trajectory for change in the policy to foster the role of transformative R&I towards sustainable development?

4. Results

Here, we report the results of our analysis by presenting the main arguments for each principle, along with a summary in a 5x5 matrix format (Principle X Policy).

4.1 Transformation

The five case studies demonstrate the operational integration of the transformation principle in European instruments, through the combination of radical and incremental innovative solutions to transform production processes, behaviours, and business / institutional models. Several aspects are covered by the design and implementation of these policies that can be linked to this principle.

Changes in the framework conditions

First, the policies aim at inducing changes in the framework conditions of European societies. Indeed, LIFE targets transformative governance and institutional mechanisms to promote the application of European environmental legislation. Through testing and evaluating innovative solutions with a view to upscaling them, EaSI promotes social innovation to respond to emerging needs on the ground and societal challenges. Our other case studies also embed innovation in national and local strategies intending to transform innovation practices in the public sector. EIE promotes innovation procurement in national and local strategies. LIFE does it as well through funding projects which have an innovation component, both incremental innovations and close-to-market processes, in order to facilitate their application in local contexts and communities searching for alternative tools. Finally, the EUI also supports new radical innovative proposals under the lead of urban authorities and target incremental solution fitting the specific strengths and challenges of local frameworks.

Transformation of behaviours and models

LIFE aims at transforming general public acceptance and behaviours, while the EIE aims at diffusing good practices in Europe and targets transformation through mutual learning and linkages between public authorities, start-ups, and funding bodies. Besides, the identification, diffusion, and uptake of the technologies identified in the Digital Europe Program, in which the EDIHs are embedded, makes the transformation of private and public entities a crucial component of the main objectives of the EDIHs. The EUI enables the development of "in-house" capabilities and knowledge supporting the design and implementation of sustainable policies and creates a shared knowledge base for better policy making in cities. It also promotes participatory approaches to sustainable urban development. Finally, some programs, such as LIFE, fund directly projects which can transform local economies, and EaSI contributes to transform business operations to be more inclusive and environmentally sustainable by fostering the development of the market eco-system related to microfinance for micro-enterprises.

4.2 Directionality

Each policy instrument considered in this study holds a degree of directionality as their main aim is contributing to achieve European priorities. As such, the policy instruments provide a well-defined direction to the transformative process while enabling collective action. Three main dimensions are of interest.

Specific thematic objectives or priorities

All case-studies are "directed", meaning that they focus on specific thematic objectives based on overarching priorities set at the European level. The R&I missions shape the objectives of the EIE and the LIFE programme, while the Cohesion policy provides the overall development vision for the EUI. The Digital Agenda, the 2030 Digital Compass and the Digital Europe Programme (DEP) identify the priorities in the case of the EDIHs, while the overall strategy set in the Green Deal and in Horizon Europe under Pillar 3 defines the framework for the EIE. It is worth mentioning that the SDGs define the policy objectives of specific actions across the five case studies. The EaSI programme implicitly contributes to the achievement of four SDGs, while the SDGs complement the R&I missions in defining priorities for the EIE, though not defining boundaries of actions. LIFE is directed to developing a comprehensive response to the United Nations 2030 Agenda for Sustainable Development, dealing (directly and indirectly) with almost all elements of the SDGs framework. Furthermore, the EUI refers to the priorities set in the Urban Agenda and in the integrated sustainable urban development vision of the Cohesion Policy. As previously discussed, one of the main features and challenges of the directionality principle is to combine a top-down priority setting with a bottom-up participatory approach, involving stakeholders in the definition of specific thematic priorities. The need to strike a balance between the two approaches is explicitly foreseen in the case of the EIE, EUI and LIFE, while the EDIHs encourage single hubs to develop their specific innovation trajectories based on the regional Smart Specialisation Strategies, while acting as access points to capacities at the digital frontier.

Thematic targets and indicators

Directionality of policies is also pursued through the definition of a set of measurable targets, which helps in the tracking of the progress towards the direction foreseen for the instruments. Amongst the five policies, three of them identify targets and indicators. Financing criteria are established for both the EDIHs and LIFE, the latter setting targets for expenditure supporting climate (61%) and biodiversity (7.5% in 2024, 10% in 2026 and 2027) objectives. Besides, all hubs under EDIHs need to refer to Key Performance Indicators, articulated in terms of inputs, outputs, and impacts. A proposal of potential indicators of outcomes was under scrutiny at the time of the interview for the EUI, distinguishing among output and result indicators. The ESF+ regulation provides the guidance for the indicators to monitor implementation of EaSI, including in terms of resources allocation to tackle poverty and promoting social inclusion. The EIE stands as an exception as its soft policy makes the identification of measurable indicators of impact less straightforward compared

to the other policies and, at the time of the interviews, there was no substantial progress in this respect.

Complementarities and synergies

European policy instruments often lie at the cross-roads of several key European priorities. Hence, their implementation calls for the identification and exploit synergies between EU tools and the overarching programmes. Both the interviews and the available material suggest that design of the five policies explicitly takes into account such complementarities, and at times they are included as indicator of impact, as for instance in the case of EUI when it comes to the synergies with actions URBACT IV and ERDF. Due to the embeddedness of the hubs in the regional ecosystems, the EDIH are expected to become an interface for the implementation of EU sectoral, SMEs and eGovernment policies, complementing actions under Cohesion Policy, the NextGen EU architecture, and the Recovery and Resilience Facility (RFF). The implementation of the LIFE Programme is strongly grounded on synergies and complementarity with other EU funding programs both to integrate environmental and climate protection requirements into the definition and implementation of all Union policies and activities. It is also meant to concretely leverage multiple funds at local level to speed up the transition to a carbon-neutral, circular and sustainable economy. EaSI is strictly interconnected with the other ESF+ funding instruments, with InvestEU, with Erasmus+ as well as with Horizon Europe due to the common focus on the societal challenges. Finally, EIE is thought to complement the other two instruments under Pillar 3 of Horizon Europe (EIT and EIC)

4.3   Co-creation

European policy instruments embed the co-creation principle through different mechanisms which allow to consult stakeholders for the design of the policies / instruments but also their implementation. In this way, R&I objectives, actions, resources, and processes are contributing to empower European individuals, communities, and societies with innovative solutions, expanded knowledge and information, raised awareness and enhanced capacities to pursue sustainable human development today and in the upcoming future.

Consultation of stakeholders in the design phase

For EIE, LIFE and EUI, stakeholders were involved in an extensive consultation process at different stages of the policy design, whose outcomes strongly contributed to the definition of the Work Programmes, complementing the top-down strategy with bottom-up inputs. The consultation for the design of the

LIFE program was also based on the findings of the mid-term evaluation and impact assessment of the 2014-2020 LIFE programme and the collection of opinions by the European Parliament, national parliaments of Member States, advisory committees and main stakeholder groups about the proposal on the new regulation drafted by the European Commission. The design of the EUI also benefitted of the appointment of an external expert and an Expert Working Group, also drawing from the impact assessment of the predecessor UIA. For EASi, the consultation involved the EU Member States and strategic dialogues with key EU-level organizations substantially informed the annual work programme. Moreover, it is important to highlight that policies are often able to combine top-down and bottom-up approaches in their design. For instance, the priority setting of EIE brings together the EC perspective from the top (as defined in the Horizon Europe Strategy under Pillar 3) and bottom-up voices (relying on the outcomes of stakeholders and experts' engagements, most notably the stakeholder consultation and the EIE survey) approach. Similarly, the LIFE Programme enables the alignment in each project between a bottom-up approach based on local priorities in each specific context of intervention with objectives and targets stated in supranational policy frameworks.

Participatory approaches for the implementation of the instrument

Beyond the policy design process, co-creation and participatory approaches are critical for the implementation of the instruments, such as for the EDIHs, requiring collaboration with local and international partners within and outside these hubs to provide the needed digital and innovation services. The embeddedness of the hubs in the regional ecosystem, the relevance of the smart specialization strategies, the capacity building approach, and the co-funding mechanisms place the EDIHs quite well in regards to co-creation. A whole-of-society approach is ensured in the LIFE program by engaging multiple actors (including small and medium-sized enterprises, local and regional public authorities, non-profit organizations and consumers) within local communities during the design and implementation of each project. While the EIE is running, the EIC forum brings together public representatives, experts, and stakeholders, and it is meant to contribute to the "evolution" of priorities. The EUI benefits of the established use of interactive methods and an online platform where interested stakeholders may contribute to the working groups. EaSI Technical Working Group discusses the implementation of the EaSI strand and oversees that the voice of key stakeholders is heard. Furthermore, the EaSI implementation builds on shared commitment and responsibility and the strategic composition of partnerships.

Multilevel cooperation

Facilitating cooperation across and within countries / territories is a key aspect of co-creation, allowing both to share practices as well as to joint pursue and

shape pathways towards sustainability. It also paves the way for a wider diffusion and uptake of knowledge, ideas, solutions and innovations at different levels in Europe. The EDIHs encourage cooperation among hubs located in different EU regions to help SMEs and stakeholders to connect, to benefit from "external" knowledge and expertise and seek synergies with other European innovators, for then help the company to "bring back home" the acquired expertise. The DIHs are expected to support companies to access to and get in contact with financial institutions and intermediaries, while at the same time providing the latter with the needed information about the digital technologies developed in the hubs. The success of Strategic Integrated Projects and Strategic Nature Projects of the LIFE program depends on close cooperation between national, regional and local authorities and the non-State actors within countries. For EASi, collaboration within countries is ensured by nurturing cooperation, mutual trust, exchange of information and competence, across governance levels. Networking and capacity-building activities across countries are fundamental to elaborating social and employment standards and developing an integrated EU labour market.

4.4   Diffusion

The five policies foresee different channels to promote the diffusion of knowledge, both by fostering the creation of knowledge flows and by promoting the dissemination of the results to the business community, civil society, and public institutions. They aim at advancing and disseminating knowledge across European economies and societies, setting the conditions for the market, institutional and societal uptake of sustainable solutions, their scale-up and replication.

Creation of knowledge flows

The creation of knowledge flows is at the core of four of the five policy instruments considered. The exchange of talents, competence, knowledge and technology is central to the activity of the EIE, which promotes the creation of networks involving business actors together, public bodies, and funding entities, as well as using the support of other tools as the EIC forum. This approach is consistent with the idea that the bottlenecks to the diffusion of knowledge are the key factors to be addressed in order to boost productivity and innovation prospects (OECD, 2015). The EDIHs implements a similar framework, promoting technology diffusion *and* spillovers on two different layers. First, the policy aims at empowering local stakeholders navigating around the hubs by providing them access to knowledge, funds and expertise they would hardly get otherwise. Second, the focus on cooperation among hubs located in different EU regions is expected to promote spillovers at the EU-

levels, enabling processes of the reduction of the digital divide between hubs in lagging regions and hubs located in regions closer to the frontier, consistently with a Single Market approach. For what concerns the EUI, the policy addresses knowledge diffusion at the local level by providing local stakeholders with access to the knowledge created by the projects, including (big, linked, and open) data, mutual learning platforms and peer-2-peer exchanges. Finally, LIFE projects support business both in testing technologies and solutions and by promoting the share of best practices, with the aim to create the conditions for the large-scale deployment of relevant technologies.

Dissemination strategies and open access

The dissemination of results is an additional and complementary approach to enhance the diffusion of knowledge, increasing awareness and providing support to local actors. This is particularly relevant for LIFE, the EUI and EaSI. The LIFE programme complements a dissemination strategy at the European level, including open access to knowledge and practices, with dissemination activities in each Member States and regions during and after the life span of the financed projects, aiming at enhancing impact over time. Similarly, the EUI provides a unified network of contact points operating in Member States, which will disseminate the knowledge outcomes by supporting urban policy actors and local practitioners in their mother tongue. Finally, communication and dissemination activities constitute the tool to diffuse results in the EaSI projects, the aim being to assist the upscale and or replication of results. A key element of EaSI is the strong preference for making all outcomes open and accessible to both institutional and societal actors.

Replicability of outcomes

These policies also put special attention to the replicability of the projects funded for deep transformation of European societies. LIFE projects, for example, are not strictly required to have a trans-national focus unless they deal with ecosystems or environmental issues that cross national borders. Nevertheless, many LIFE-funded projects provide a replicable model for other regions and Member States. Furthermore, EaSI National Contact Points increase participation and assist in upscaling, replication and/or mainstreaming of results. A clear EU added value and a multiplier effect are particularly emphasized for analytical activities, social experimentation and networking in EaSI. The EDIHs are also meant to support local public authorities in the digital transition. In particular, the DEP foresees the deployment of the "Transformation Platform Ecosystem".

4.5 Uptake

European R&I policy is going well beyond a simple consolidated narrative of transformation towards sustainable development, fostering also the uptake of new knowledge, ideas, solutions and innovations to empower individuals, communities and Member States to meet societal needs and build sustainable and inclusive societies. Despite the institutional, market and societal uptake depends on the real willingness and commitment of public, private and social actors, thus being out of direct control by the EC itself, the analyzed policies are clearly devoting efforts and resources for it.

The European network of EDIHs core objective is to facilitate and foster the uptake of digital technologies by companies. All the activities foreseen in the hubs – including the creation of European network – are meant to build the digital capacity of public bodies. For LIFE, market uptake is fostered by focusing on solutions that are ready to be implemented in close-to-market conditions, preparing and supporting market players for the application and assimilation of innovative solutions. Institutional uptake of relevant policy solutions is fostered by building a national, regional and local policy framework on environment-, energy- and climate-related issues, especially through Standard Action Projects, Strategic Integrated Projects and Strategic Nature Projects. Societal uptake is fostered by impacting on general public awareness and acceptance, and on consumer engagement and behavioural change within local communities searching for innovative ways to respond to environment and climate challenges. The EUI aims at promoting a virtuous cycle enabling and nurturing the systematic uptake of tested innovative solutions, good practices and toolkits, through an internal intervention logic that makes use of projects' outputs as inputs in the learning and disseminating process. The "implementation rate of sustainable urban development strategies in cities" is among the outputs indicators proposed for quantifying the impacts of the EUI. The societal uptake of EaSI knowledge, evidence, innovative practices and approaches lies at the very core of its approach, enabling that stronger evidence translates in policy-making and social experimentation is upscaled, replicated and/or mainstreamed at a wider level. This is pursued by detecting what is uptakable, implementing a robust communication and dissemination strategy and assess uptake in terms of outcome indicators. Dedicated funding is allocated to ensure that outcomes from EIE projects will be implemented. Furthermore, the EIC forum is defined as a "place" to collect feedback by stakeholders concerning uptake and implementation and to transform the policy priorities according to stakeholders needs.

Here below, we also report the main findings in a 5x5 matrix format (Principle X Policy).

PRINCIPLE	European Innovation Ecosystems (EIE)	European Digital Innovation Hubs (EDIHs)	LIFE Programme	European Urban Initiative (EUI)	EU Programme For Employment and Social Innovation (EaSI)
TRANSFORMATION	While the policy is not explicitly aimed at sustainable development, it sets in the general framework provided by Pillar 3 of Horizon Europe and the Green Deal. EIE want to diffuse good practices in Europe, by promoting mutual learning and linkages between public authorities, start-ups, and funding bodies. There is a specific provision to transform innovation practices in the public sector, most notably by promoting the embedment of innovation procurement in national and local strategies.	The identification, diffusion, and uptake of the technologies identified in the DEP makes the transformation of private and public entities a crucial component of the main objectives of the EDIHs. Europe has committed to "tackling climate and environmental-related challenges that is this generation's defining task", while ensuring that the twin digital and green transition makes Europe more competitive and just.	The LIFE Programme operates to simultaneously transform local economies in the area of green economy and sustainable development, governance and institutional mechanisms to promote the application of European environmental legislation, and general public acceptance and behaviours. These three transformative components may be combined and balances in a different way in each LIFE-funded project. All projects have an innovation component focusing on incremental innovations and close-to-market processes, in order to facilitate their application in local contexts / communities searching for alternative tools.	The main aim of the EUI is to enable transformation in local institutions, by enabling the development of "in-house" capabilities and knowledge supporting the design and implementation of sustainable policies. The creation of a shared knowledge base for better policy making will support the capacity building process in cities. The EUI will both promote new radical innovative proposals under the lead of urban authorities and target incremental solution fitting the specific strengths and challenges of local frameworks.	Through testing and evaluating innovative solutions with a view to upscaling them, EaSI promotes social innovation to transform policies and institutions in order to respond to emerging needs on the ground and societal challenges. EaSI also contributes to transform business operations to be more inclusive and environmentally sustainable by fostering the development of the market eco-system related to microfinance for micro-enterprises.

PRINCIPLE	European Innovation Ecosystems (EIE)	European Digital Innovation Hubs (EDIHs)	LIFE Programme	European Urban Initiative (EUI)	EU Programme For Employment and Social Innovation (EaSI)
CO-CREATION	Stakeholders were involved in an extensive consultation process at different stages of the policy design, whose outcomes strongly contributed to the definition of the Work Programme, complementing the top-down strategy with bottom-up contributions. The EIC forum brings together public representatives, experts, and stakeholders, and it is meant to contribute to the "evolution" of priorities while the policy is running.	Beyond the policy design, a participatory approach is critical for the implementation of the EDIHs, requiring collaboration with local and international partners within and outside the hubs to provide the needed digital and innovation services. The specialisation of the hubs should include one or more of the key digital technologies identified in the DEP, being horizontal prerequisites to the digital transformation. The embeddedness of the hubs in the regional ecosystem, the relevance of the smart specialisation strategies, the capacity building approach, and the co-funding mechanisms place the EDIHs at the crossroads of different policy domains. The EDIHs encourage cooperation among hubs located in different EU regions to help SMEs and stakeholders to connect with each other, to benefit from "external" knowledge and expertise and seek synergies with other European innovators.	An extensive public consultation process underlined the design of the new LIFE programme for 2021-2027, based on the findings of the mid-term evaluation and impact assessment of the 2014-2020 LIFE programme and the collection of opinions by the European Parliament, national parliaments of Member States, advisory committees and main stakeholder groups. A whole-of-society approach is ensured by engaging multiple actors within local communities during the design and implementation of each project. The success of Strategic Integrated Projects and Strategic Nature Projects depends on close cooperation between national, regional and local authorities and the non-State actors within countries. Many LIFE-funded projects provide a replicable model for other regions and Member States.	The design of the EUI benefitted of an extensive consultation process, including a public consultation, the appointment of an external expert and an Expert Working Group, also drawing from the impact assessment of the predecessor UIA: The policy benefits of the established use of interactive methods and an online platform where interested stakeholders may contribute to the working groups.	Consultation with the Member States and strategic dialogues with key EU-level organisations substantially informed the annual work programme. EaSI Technical Working Group discusses the implementation of the EaSI strand and ensures the engagement of key stakeholders. The EaSI implementation builds on shared commitment and responsibility and the strategic composition of partnerships. EaSI National Contact Points increase participation and assist in upscaling, replication and/or mainstreaming of results. Collaboration within countries is ensured by nurturing cooperation, trust, and information-sharing across levels. Analytical activities, social experimentation and networking deploy a clear EU added value and a multiplier effect. Networking and capacity-building activities across countries are fundamental to elaborating social and employment standards.

PRINCIPLE	European Innovation Ecosystems (EIE)	European Digital Innovation Hubs (EDIHs)	LIFE Programme	European Urban Initiative (EUI)	EU Programme For Employment and Social Innovation (EaSI)
DIFFUSION	The policy is mainly about exchange of talents, competence, knowledge, and technology (soft side), addressing the bottlenecks in the implementation of R&I policy through the creation of networks among ecosystems and using the EIC Forum. Expected outcomes include improved flows of innovation resources, knowledge, and talent between innovation ecosystems at various levels of development.	The European network of EDIHs promotes knowledge diffusion and technology spill-over. On the one hand, this will benefit local stakeholders in getting access to knowledge, funds, expertise, and innovation opportunities, and gives them the possibility to become more integrated in global value chains. On the other hand, the expected knowledge spill-overs between countries at the frontier of digital innovation and those which are behind will be a strong force supporting the development of a stronger Single Market, and reducing the digital divide. The EDIHs are also meant to support local public authorities in the digital transition. In particular, the DEP foresees the deployment of the "Transformation Platform Ecosystem".	LIFE projects help businesses to test small-scale technologies and solutions and supports the sharing of best practices, paving the way for a large-scale deployment of relevant technical solutions. The LIFE dissemination strategy at European level by CINEA ensures open-access to knowledge and practices relying on a wide and consistent set of tools. This is also complemented by dissemination strategies by each Member State (and also regions), as well as by after-LIFE plans for each funded projects to continue monitoring, assessing and disseminating their impact over time.	The EUI foresees sharing mechanisms to provide local stakeholders with access to the created knowledge, including the provision and creation of data supporting urban policy making, access to mutual learning platforms, peer-2-peer exchanges, and methodological support. It will enable and encourage the "reuse of public sector information and the promotion of big, linked and open data", including the information produced or gathered under its three strands of actions. A single network of contact points will operate in Member States, to favour dissemination processes at the subnational level, providing support to urban policy makers and local practitioners directly in their mother tongue.	Communication and dissemination activities are a crucial part of the programme to assist in upscaling, replicating and/or mainstreaming of results achieved by EaSI projects. Strong efforts are devoted to make all EaSI-related knowledge and practices (including all analytical activities) open and accessible to institutional and societal actors.

PRINCIPLE	European Innovation Ecosystems (EIE)	European Digital Innovation Hubs (EDIHs)	LIFE Programme	European Urban Initiative (EUI)	EU Programme For Employment and Social Innovation (EaSI)
UPTAKE	Dedicated funding is allocated to ensure that outcomes from EIE projects will be implemented. The EIC forum is defined as a "place" to collect feedback by stakeholders concerning uptake and implementation and to transform the policy priorities according to stakeholders needs.	The European network of EDIHs is itself facilitating and fostering the uptake of digital technologies by companies. All the activities foreseen in the hubs – including the creation of European network – are meant to build the digital capacity of public bodies.	Market uptake is fostered by focusing on solutions that are ready to be implemented in close-to-market conditions, preparing and supporting market players for the application and assimilation of innovative solutions. Institutional uptake of relevant policy solutions is fostered by building a national, regional and local policy framework on environment-, energy- and climate-related issues, especially through Standard Action Projects, Strategic Integrated Projects and Strategic Nature Projects. Societal uptake is fostered by impacting on general public awareness and acceptance, and on consumer engagement and behavioural change within local communities searching for innovative ways to respond to environment and climate challenges.	The EUI aims at promoting a virtuous cycle enabling and nurturing the systematic uptake of tested innovative solutions, good practices and toolkits, through an internal intervention logic that makes use of projects' outputs as inputs in the learning and disseminating process. The "implementation rate of sustainable urban development strategies in cities" is among the outputs indicators proposed for quantifying the impacts of the EUI.	The societal uptake of EaSI knowledge, evidence, innovative practices and approaches lies at the very core of its approach, enabling that stronger evidence translates in policy-making and social experimentation is upscaled, replicated and/or mainstreamed at a wider level. This is pursued by detecting what can be taken up, implementing a robust communication and dissemination strategy and assess uptake in terms of outcome indicators.

5. Final remarks

All in all, our analysis for each policy can be briefly summarised as follows:

- The European Innovation Ecosystems embraces the transformative R&I principles by promoting the development of good practices within and between ecosystems, favouring the flow of knowledge and ideas with transformation potential.

- The European Digital Innovation Hubs embrace the transformative R&I principles by enabling the uptake of digital technologies at the frontier, involving regional stakeholders in the innovation ecosystem, facilitating the connection of EU-wide actors and the deployment of specialisation strategies.

- The LIFE Programme embraces the transformative R&I principles by directing innovation efforts in market-based solutions, policies and public attitudes towards the transition to a carbon-neutral, circular and sustainable economy.

- The European Urban Initiative embraces the transformative R&I principles by fostering the transformation of policy design in local institutions towards innovative and integrated urban solutions, leveraging knowledge sharing and uptake.

- The EU Programme for Employment and Social Innovation embraces the transformative R&I principles by enhancing an enabling environment for social policy innovation to foster a just and socially inclusive transition.

Taken together, the analysis shows that innovation processes are at core of a transformative change towards sustainable development across different EU policy domains. In particular, the analysed policies promote a combination of radical and incremental innovative solutions to transform production processes, behaviours, and business / institutional models. Furthermore, they provide a clear direction to the transformative process, bringing together bottom-up solutions with overall priorities, while enabling collective action for a better society, involving a wider set of actors, governance levels and countries. The policies aim at advancing and disseminating knowledge across European economies and societies, pushing for the market, institutional and societal uptake of sustainable solutions, their scale-up and replication.

Notwithstanding relevant spaces for improvement, especially in terms of directionality, diffusion and uptake, the analysis suggests that the design and – where the case – implementation of R&I objectives, actions, and processes and the involvement of stakeholders as foreseen in the policies is a potential policy lever to empower European individuals, communities, and societies with innovative solutions, expanded knowledge and information, raised awareness and enhanced capacities in the pursuit of sustainable human development.

Therefore, in the current era of human and societal insecurity, it appears highly necessary that European R&I policy across different domains continues to make transformation, directionally, co-creation, diffusion and uptake fully operational, placing Europe at the forefront of a global transition towards sustainable development.

Despite having engaged with a limited number of purposively selected illustrative policies, this study contributes to show how European R&I policy is going beyond a simple consolidated narrative of transformation towards sustainable development, effectively leveraging new knowledge, ideas, solutions and innovation to empower individuals, communities and Member States to meet societal needs and build sustainable and inclusive societies.

Finally, the interim evaluation of the previous edition of the European Framework Programme for R&I - Horizon 2020 - stressed that "the landscape for EU R&I support is difficult to navigate and may lead to less coherent interventions". In this context, evaluation of external coherence of the FP, focusing on synergies and links with other instruments, including the four instruments analysed in this study which are not part of the FP, is particularly relevant. While our analysis was not originally focused on assessing coherence between the five policy tools, we found that, through the integration of key transformative principles, the different tools evolved to add and modify mechanisms in their design and implementation phases that could foster synergies with other European R&I policies.

Future research may continue this line of investigation to better assess – and systematize – the effective translation of transformative R&I principles into the concrete practice of policy design and implementation across different domains, contributing to place Europe at the forefront of sustainable development transition.

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This paper analyses how European R&I policy contributes to the sustainability agenda. It assesses how the principles guiding transformative R&I policy as developed in the 2020 edition of the Science Research and Innovation Performance of the EU - i.e., transformation, directionality, co-creation, diffusion, and uptake - are reflected, embedded and made operational in a selection of EU policy interventions. It demonstrates that innovation processes are at core of a transformative change towards sustainable development across different EU policy domains and that the transformative R&I principles potentially reinforce each other in the context of EU policy.

Studies and reports