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Innovation Ecosystems in the EU: Policy Evolution and Horizon Europe Proposal Case Study (the Actors' Perspective) [†]

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Abstract: At the European Union (EU) level, innovation matter is acknowledged as crucial for progress and sustainability. Related policy action is materialized through Horizon Europe, the 9th Framework Program (FP) for research and development (R&D). The present 8th FP, Horizon 2020, is already considered the biggest public innovation support program in the world. Accordingly, the 9th FP is a cornerstone of innovation ecosystems configuration in the EU and, thus, should be carefully evaluated. In this paper, the analysis of the forthcoming FP proposal is made and a previously developed framework for the structural advancement assessment of innovation ecosystems was applied. The Actor's viewpoint from the “innovation helix” is especially advantageous for a thorough evaluation. In conclusion, the Horizon Europe proposal does take into account the knowledge triangle or triple helix (Academia, Government, Industry) with “tacit”, however not very explicit, commitment towards complementing Society and Natural Environment dimensions. The process perspective of innovation is highlighted, particularly in terms of overcoming the “valley of death”; nevertheless, private innovation financing levels are still a matter of concern. If the sustainability is to be achieved, consistently allowing for socioecological transformation, authors recommend the orchestration of efforts, especially in the involvement of Society and implication in innovation, as well as in the Natural Environment orientation.

Keywords: innovation; innovation ecosystems; innovation helix; EU innovation policy; 9th R&D Framework Program; Horizon Europe; innovation sustainability; socioecological transformation

1. Introduction

In Europe, there are the “explicit” policies, where innovation is not only acknowledged but also at the very heart of its objectives, and there are “tacit” ones where innovation can be recognized within other general policies. This makes the overall innovation picture highly complex. The data landscape regarding the subject is additionally fragmented, from a temporal as well as from a definition angle. Some areas of data are replicated several times and others are lacking. Additionally, 5–7 years of framework of approaches have been reinforcing these tendencies. In sum, it is quite problematic to bridge the innovation information; even more, when it comes to the agreement about further directions for innovation development in the highly complex EU landscape, as is the case with the Horizon Europe proposal [1]. For this purpose, this subject needs to be fully understood and afterwards revised.

If Europe aims to be more innovative and achieve overall progress and sustainability, there is a need for analytical tools that enables the assessment of the maturity and structural advancement of innovation ecosystems and their determinants. The first [2] of these set of articles about the Innovation Ecosystems in the EU, elaborates such a tentative theoretical framework, a model through which the understanding can be grounded.

EU innovation policy is regarded as a cornerstone in the evolution of configuration of innovation ecosystems. Thus, the aim of the present document is to carry on the European policy case study, applying the proposed analytical framework, on the key innovation policy document, i.e., Horizon Europe FP proposal. Firstly, the general history of the innovation policies in the EU and the evolution of the institutional framing is briefly introduced to prepare the background and underpinning for further research, presenting the scenario of the Horizon Europe FP proposal emergence and application. The institutional arrangement is included; nonetheless, only European Union policy centred institutions are disclosed, as they are the ones directly affected. Even if some of them are multilateral in nature, connecting EU governance level, industry (i.e., small and medium enterprises) and academia, the thorough examination of the innovation intermediary institutions is out of scope of the present work. However, this part can be dealt with in a future desirable line of studies, because their density and emergence are pondered as a decisive feature of the structural maturity of innovation ecosystems.

Secondly, the Horizon Europe proposal document is analysed applying the theoretical framework for structural advancement assessment of innovation ecosystems, in this case, their policy determinants. In this way, the main innovation helix actors positioned in Horizon Europe can be disclosed: Government (the European Union level), Academia, Industry (established companies and start-ups), together with Society and Natural Environment which are particularly relevant for socioecological transformation and sustainability. The international articulation of the innovation between the EU and the rest of the world, is taken into account too. The questions such as a climate change cannot be addressed by one country or region only, collaboration and cooptation are indispensable.

From the multilevel innovation process perspective, as this is a general innovation policy strategy evaluation, just general indications are to be found here; they are included mainly in the Industry or business dimension descriptions. Nonetheless, the process viewpoint could be an interesting subject for another study with other base materials to be examined.

The foreseen budget assignments (even if changing slightly during the approval process) are considered a paramount reality check for declarations of intention. Main tacit innovation policies and funding institutions with synergies to Horizon Europe are listed in order to complete the thorough picture.

International tendencies and complementary aspects are also included to provide the reframing and discussion ground for the structural advancement of the innovation ecosystems of EU depicted by its strategic policy.

Through creating and applying a living model of the innovation world which can be constantly interrogated and improved, the authors aim to contribute to the discussion about the European innovation policy evolution including therein the socioecological dimension revision and strategic implementation directions that are essential to reach progress and sustainability.

2. Materials and Methods

The purpose of this work is the qualitative analysis of the innovation policies of the European Union (EU), as a next step after the establishment of a tentative framework for the assessment of the structural advancement of EU innovation ecosystems [2] (Figure 1). In particular, the Horizon Europe proposal [1] is investigated, under the scope of a multilevel innovation process [3] perspective, but concentrated specifically on the “reframed innovation helix” [4] actors division and assignment. This is a necessary dimension between the framework building and the assessment of a particular sector of economy, i.e., banking [5].

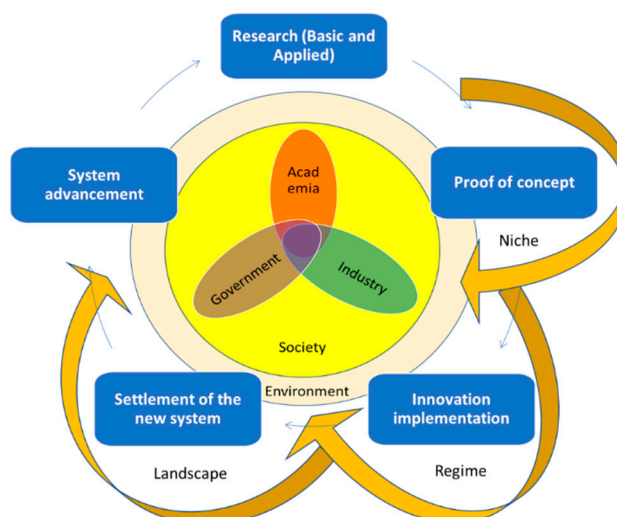


Figure 1. Reframed Innovation Helix: Process loop with the actors involved. (Source: González Fernández, S. et al. [2] (p. 200)).

The mapping of innovation actors and processes gives a more dynamic and comprehensive approach, providing an understanding of the (eco)system. The systemness is a meaningful topic here, especially from the point of view of evolving character of innovation patterns. A system is more than the sum of its parts, because it counts on the synergies between them. In this sense, it becomes even more imperative to have these parts or, in this case actors, well defined and well-conceived; moreover, their determinants, roles, and potential in the “straightforward” process rules of the innovation game. These actors need to complement, compete, and interact together, thus, allowing for collective intelligence emergence and orchestration [6] (p.113).

As a result, it can help the adaptation to threats, handling force and mobilizing long-term resources. From the sustainability prospect, different actors (for example, business, the European Commission, universities, social or ecological organizations) are allowed to make claims, resolve conflicts, or demand sacrifices. Shared views of a model, its standards, quality, and purpose, as well as the focus and cultures of learning, are vital.

This model or framework can be defined as an attempt on the agreement of how to define and discover the truth about the innovation ecosystem, how this ecosystem works and what motions are far-reaching, thus is worthy of attention and action. It is also an economizing tool for a strong collective, since the members can think more quickly and efficiently together. This is so because the model is a starting point for individual and collective intelligence. We experience the world through the models, and data and observations (history or evolution paths included) can be refracted only through them. The concept of the innovation applied here is centred on disruptive innovation, corresponding especially to developed economies, its value and impact emphasize society and the natural environment, allowing the socioecological transformation necessary for the achievement of sustainability.

The actors’ definition and its theoretical background is thoroughly described in the proposed framework [2], applied as a qualitative, analytical tool. Only the main concepts are to be reminded for a better understanding of this paper as an autonomous document of the set, which can be read apart.

The Triple Helix [7,8] idea is rooted in the Sabato triangle [9] concept of a government, industry and science interaction node, corresponding to regulation, production, and knowledge functions for a society living in a particular (natural) environment. In modern times, the society becomes more active. Due to new technologies, social forces display more agency. The natural environment subject, related to climate change and sustainability, stays in need of a new agency as well. Thus, the reframed innovation helix with five dimensions is regarded here as a more reasonable framework for innovation strategy assessment.

The level of evolution of each of the innovation actors is out of the scope of the present document, as it would require more detailed information which cannot be found at the Horizon Europe proposal evaluation stage.

In general, data (even if highly fragmented) and information about innovation in the EU is available and present, e.g., the data about the FPs are accessible almost fully and in real time. The question is to acquire a comprehensive, global but practical knowledge which is not easy to assemble. Two levels of information can be distinguished: Very global and very detailed, while a middle layer is rather lacking in almost every area. The public is, thus, easily prone to manipulation as almost nobody has the ability to fully process the details which can be underpinned directly to the global level, creating the subjective structures to countersign the interests of the proponent and to defend whatever ideologies, sometimes even contradictory ones.

The proposal document of Horizon Europe [1] studied below is fluctuating, notwithstanding the main lines are maintained, even if slightly reformulated. It should be said that the changes have not affected, so far, the main Horizon Europe proposal document, introduced in a more detailed manner further on. They are being announced somehow seamlessly, without an easily identified notification and the source of changes, by just introducing the new version—first in a mixed way and then the modified one—as if it was always so (see, for instance, the renaming of the first pillar from Open to Excellent Science) [10–12].

The global megatrends of social and climate/ecological change are the lighthouse focus of this analysis, providing an overall, comprehensive, cognitive framework, not exclusively detailed but giving relevant insights for action and the orchestration of innovation in order to propel collective intelligence and sustainability.

2.1. Institutional and Regulatory Framing for Innovation Policies in the EU

In this part of the document, the evolution of regulatory and institutional framing for innovation policies in the EU is presented. These materials convey an underpinning for the examination of the Horizon Europe proposal, as it depicts its operational context and impact roots for innovation ecosystems. The basis for the study is provided by the EU treaties analysis from the innovation angle. The main institutions summarized have definition outlines in their website information. It follows with the brief introduction of the overall picture of Framework Programs for Research and Innovation (R&I).

2.1.1. Research and Innovation Policies in EU Treaties

As shown in the Figure 2, R&I Policy within the European Communities, can originally be found in the Treaty constituting the European Coal and Steel Community (ECSC) [13], formally established by the Paris Treaty of 1952 (dates of coming into force) and the creation of CERN—the European Organization of Nuclear Research in 1954, and afterwards the EURATOM (European Atomic Energy Community) Treaty from 1958 [14] where the Joint Research Centre (JRC) was created, as well as the Council Resolution from 1974 [15] on “the coordination of National policies and the definition of actions of community interest in the field of science and technology”.

In the 1983, the ESPRIT Programme [16] was introduced with the “consortium” only 50% support by the EU founding (significant to innovation process from the multilateral agreements angle, i.e., requiring different actors’ interaction) and inclusion of EFTA countries; in the next year, it was followed by the first Framework Programme (FP) 1984–1987. Already since 1987, with the Single European Act [17], science became an EU competence and it gave the research and technological development policy a new and explicit basis founded on the concept of “Framework Programs” for five-year periods. The Maastricht Treaty from 1993 [18] introduced the co-decision procedure of the Council and Parliament for their approval and redefined the objective of the Community Research, Technology and Development (RTD) policy.

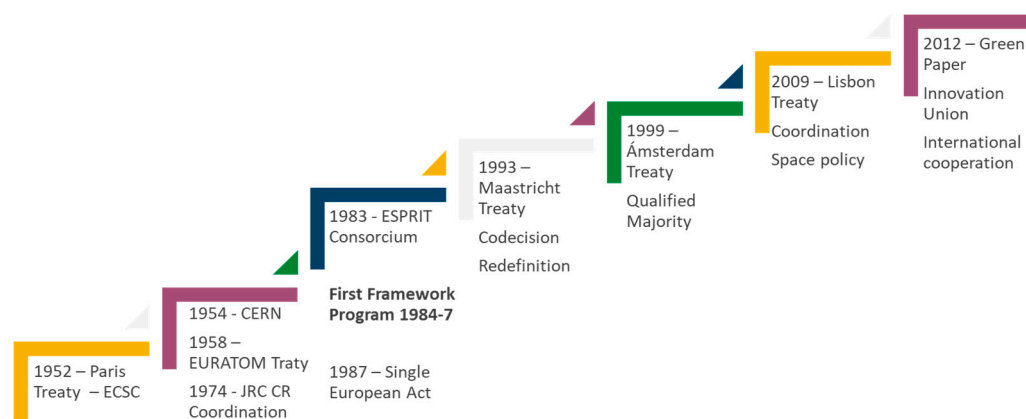


Figure 2. Timeline of research and innovation policies in the EU Treaties. (Source: Own elaboration).

After the Treaty of Amsterdam, which entered into force in 1999 [19], the unanimity condition of the Council decisions was replaced with the vote by qualified majority for the approval of co-decisions in the FP.

The new and current Treaty of the European Union, signed in Lisbon and in force since 2009 [20], devotes several articles to R&D policy, replacing the ones of the Treaty of Amsterdam. The focus is on coordination and rules of the policy as well as the European Space Policy. In 2012, the Green Paper (state of the Innovation Union) [21] on Common Strategic Framework was published, followed in the next year by the communication for international cooperation in this field.

2.1.2. European Framework Programmes for R&I

In the history of the EU, seven Framework Programmes have already been implemented. The current one under implementation, named Horizon 2020, is claimed to be the biggest R&I funding program in the world; it takes up about 8 per cent of the European Commission budget, and about the same share of total government R&D spending across the EU.

The forthcoming 9th FP for 2021–2027 was proposed in 2018 and is called Horizon Europe. It is based on the Treaty of the Functioning of the EU (TFEU), titled ‘Industry’ and ‘Research and technological development and space’ (Articles 173, 182, 183, and 188) [22]. The Euratom research and training programme is based on Article 7 of the Euratom Treaty [14]. Horizon Europe relies on subsidiarity and is a shared (parallel) competence of the EU (Article 4(3) TFEU). In the following sections, the 9th FP will be thoroughly described and analysed from perspective of the innovation ecosystem, especially the actors’ perspectives.

In general, none of the FPs were a revolution but rather an evolution, presenting a revamped structure, covering new challenges along with striving for simplicity.

2.1.3. EU Research and Innovation Entities

Even if there has been an effort to create the framework for common European Research and Innovation Policy, at the institutional level, the corresponding R&I entities are not clearly distinguished.

Inside the troika of EU institutional pillars (in general shown in the Appendix A and innovation in the Figure 3), i.e., the European Commission, the EU Council and the EU Parliament, this policy has been put together with other wide areas. Inside the European Commission it is DG GROW—the Internal Market, the Industry, Entrepreneurship and SMEs. For the European Parliament, there is ITRE—the Committee for Industry, Research and Energy; as well a Panel for the Future of Technology and Science (STOA) launched in 1987, which not only conducts Technology Assessment and Scientific Foresight projects and organises events, but also recently started running the European Science Media Hub (ESMH) which aims at promoting the relations between Parliament, scientists, media and citizens.

Inside the Council of the EU, we have COMPET—the Competitiveness Council, which covers the policies like internal market, industry, research and innovation as well as space.

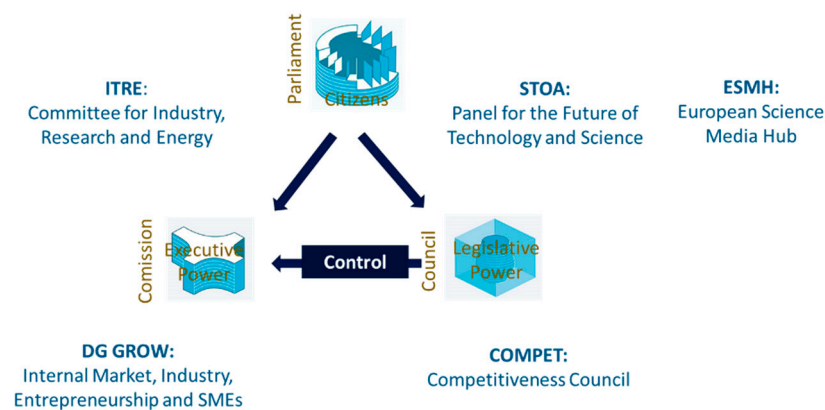


Figure 3. The troika of EU institutional pillars from an innovation perspective. (Source: Own elaboration).

Below, in the Figure 4, the main EU R&I entities are presented. These are the main ones from: The historical viewpoint, their global scope and their consideration at the EU and FP level. Joint Research Disruptive Initiative (JEDI) and European Science Foundation (ESF) are interesting examples of initiatives launched outside of the EU main policy stream.

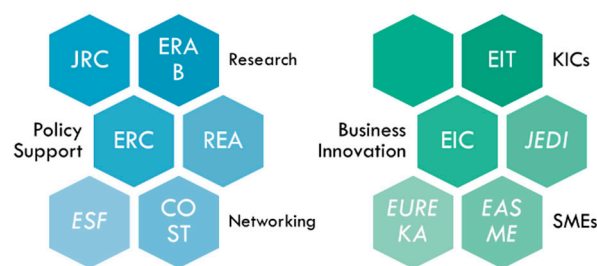


Figure 4. EU Innovation Entities landscape. (Source: Own elaboration. *In italics*: ancillary entities.).

- Joint Research Centre (JRC)—EU Science Hub

The JRC is centred on the scientific advice provided to policy makers. Together with the Policy departments of the European Commission, it operates 6 knowledge centres for: Food Fraud and Quality, Territorial Policies, Migration and Demography, Disaster Risk Management, Bioeconomy and Global Food Security. It should be said that the JRC pillars of operations are much larger in extent: A fairer and more competitive economy, the digital transformation, a Union that protects and towards a sustainable Europe. In Horizon Europe, it is foreseen to play a strong role in Pillar II. JRC has recently been recalibrating its image towards the citizens and customer service.

- European Research Area Board (ERAB)

The ERAB together with the European Commission has been promoting Europe as an open space for knowledge and growth. It includes experts from academia, industry, and civil society. It was constituted in 2008, replacing the 2001–2007 functioning European Research Advisory Board.

- European Research Council (ERC)

The ERC and its Executive Agency (ERCEA) were funded in 2007 together with the 7th FP. It manages the Horizon Programmes and executes and implements calls for proposals for funding. It aims at supporting frontier research on the basis of scientific excellence and has currently seven

working groups. Gender balance, open access, innovation and relations with Industry, widening European and strengthening international participation, key performance indicators (KPIs), and science behind the projects.

- Research Executive Agency (REA)

Similarly, to ERC, REA was funded in 2007 to help the management of the 7th FP (different programmes). It supports various DGs—Directorate-Generals of the European Commission.

- COST

The European Cooperation in Science and Technology (COST), founded in 1971, is an intergovernmental framework for international cooperation forming pan-European research networks among nationally funded research. It has 38 states and one cooperating member. In 2013, the COST Association was established by its members.

- European Science Foundation (ESF)

The ESF was set up in 1974 in Strasbourg and, at the beginning, concentrated on pan-European funding (competence of the European Commission). It was discontinued in 2014 and is currently providing scientific services such as peer reviews. In 2011, it created Science Europe to promote its interests in Brussels and strengthen ERA. In 2017, Science Connect was created for the support of scientific decision-making.

- European Institute of Innovation and Technology (EIT)

The EIT, created in 2008, helps business, education and research besides public authorities (the so-called “knowledge triangle”) from different levels to join forces through KICs—Knowledge and Innovation Communities—and become international consortia. Their aim is in general to advance knowledge and innovation in critical fields, but, in particular, it is to develop new innovative products and services, start up the companies, and train the new generation of entrepreneurs. It is considered a first stage towards a knowledge economy. The EIT operations from 2014 are defined by its Strategic Innovation Agenda (SIA).

- European Innovation Council (EIC) pilot

The EIC is a reinforcement of ERC, currently being launched. It aims to bring together innovators, small companies and scientists and creates a one-stop shop to bring the ideas from laboratories into the market. It will have two funding instruments: Pathfinder and Accelerator, correspondingly for early stage and for development and market deployment.

- Join Research Disruptive Initiative (JEDI)

Recently being established, and mirroring the US DARPA (Defense Advanced Research Projects Agency), is JEDI, called a European Moonshot factory. It is to be controlled by participating governments supported by the Commission, rather than driven and run by the Commission. The legal distinction could make it easier for the agency to perform military research, barred from Horizon 2020, invite UK participation post-Brexit, or the funding of “European universities”, formed by creating networks of existing universities that offer new EU-wide diplomas.

JEDI aims at bringing a breakthrough technology with speed, higher expectations, and massive risk taking. Its four big missions are: Decarbonizing the world, securing a human-centric digital transition, massively improving healthcare and exploring new frontiers.

- EUREKA

EUREKA platform was funded in 1985 and it is an intergovernmental distributed network (involving EU) supporting the R&D&I cooperation, promoting and supporting market-oriented projects in this area. It helps to get the financing for the companies involved in its projects through its “quality seal”. It looks for synergies with FPs and ERA.

- EASME—Executive Agency for Small and Medium-sized Enterprises

Created in 2014 (in replacement of the Executive Agency for Competitiveness and Innovation) by the European Commission for the fields of SME support and innovation, environment, climate action, energy, and maritime affairs. It has been set-up to manage on behalf of EC several EU programmes.

2.2. Horizon Europe Proposal

The Horizon Europe proposal [1] is the main material of the research in this paper. In this part of the document, the basic notions of the Horizon Europe FP are presented, together with the pack of other proposal documents regarding it. The three-pillar structure is briefly introduced, followed by the corresponding budgetary disposal.

Other policies and financing sources with synergies and tacit innovation content are stated as well.

2.2.1. Horizon Europe Basis and Package

For Horizon Europe, the “Lamy” High Level Group conclusions on maximising the impact of EU R&I Programmes [23] were taken into account and enforced by its mission-oriented proposal. Five key criteria were established to select them [24]. In 2017, the EU Innovation Council was set up following the recommendations of High Level Group of Innovators [25]. Another High Level-Strategy Group [26] on industrial technology proposed the redefinition of KETs (Key Enabling Technologies).

Horizon Europe targets are based mainly on the Agenda for Jobs, Growth, Fairness and Democratic Change and global policy priorities (the Sustainable Development Goals) [27]; a target of investing 3% of the Union’s GDP on research and development and on the Communication “A renewed European agenda for Research and Innovation—Europe’s chance to shape its future” [27]. Besides, it was previously agreed in the Rome Declaration of 25 March 2017 [28].

The Horizon Europe package [1] consists of proposals for:

- A Framework Programme for Research and Innovation entitled “Horizon Europe”, including laying down its rules for participation and dissemination (as per the Treaty on the Functioning of the European Union – ‘TFEU’), a specific programme to implement “Horizon Europe” (‘TFEU’),
- A Research and Training Programme under the Euratom Treaty complementing Horizon Europe,
- associated impact assessment and legal financial statements.

Defence research is apart of the FP and is included in the regulation for the European Defence Fund for this period. The EU Space Program is envisaged to bring synergies.

In Horizon Europe, two current legal acts are merged (the Framework Programme and the Rules for Participation and Dissemination).

2.2.2. Horizon Europe Structure

The three pillars vision of Horizon Europe is based on the previously elaborated vision for the EU Future, i.e., Open Science, Open Innovation and Open to the World [29]; however, the openness to the world has been reformulated because of struggles against global challenges and industrial competitiveness. Open Science and Open Innovation are to be bottom-up oriented (researcher or innovator driven), while the Global challenges and Industrial Competitiveness are bottom-down (determined by strategically defined EU policy priorities). On the way to approval process, the Open Science pillar was once more renamed Excellent Science. This reflects an internal struggle between

bibliometrics excellence and research openness which is not so much concentrated on the bibliographic scores Below, in the Figure 5, the version based on the current proposal of Horizon Europe [1] is presented, even if in ancillary EU documents it is modified.



Figure 5. Horizon Europe—the 3 pillars structure. (Source: [30] (p. 3), based on [1]).

2.2.3. Horizon Europe Budgetary Structure

Budget assignment is presented in general lines in Figure 6 and, in more detailed manner, in Figure 7. Numbers are based on the studied Horizon Europe Proposal [1]. Undeterred by some fluctuations, they were used to maintain the general lines. In the first part of the revision and approval process, the number being proposed were raised, but in the second part, they were lowered, so that at the end they are rather close to original proposal. Clearly the majority of funds is oriented toward Pillar II, while the basis for the pillars—Strengthening of the European Research Area—is only a minor 2% part of it.

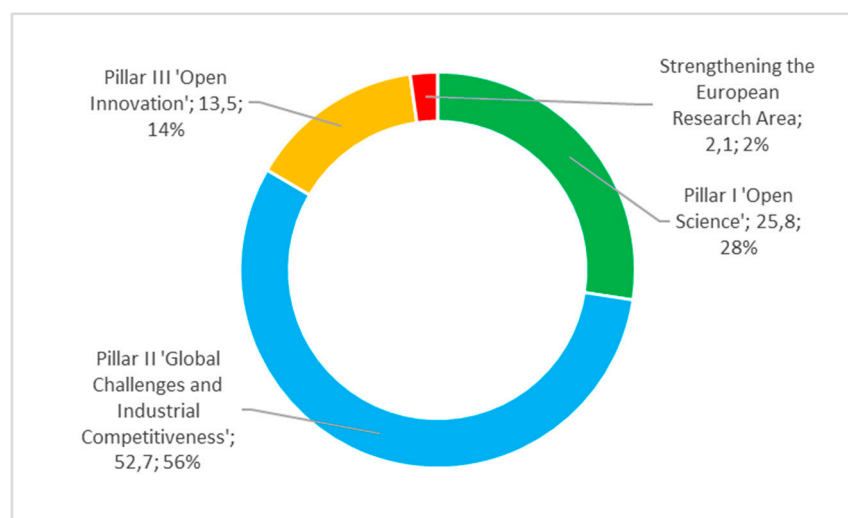


Figure 6. Horizon Europe Budget disposal (main lines), in current prices, billions of Euros. (Source: Own elaboration based on the data from [1]).

The detailed information about the budget disposal is shown in the Figure 7. Pillar I ERC together with Pillar II Clusters “Climate, Energy and Mobility” and “Digital and Industry”, are summed up by almost 50% of the budget, notwithstanding EIC and Cluster “Food and Natural Resources” which have relevant assignments in the budget as well.

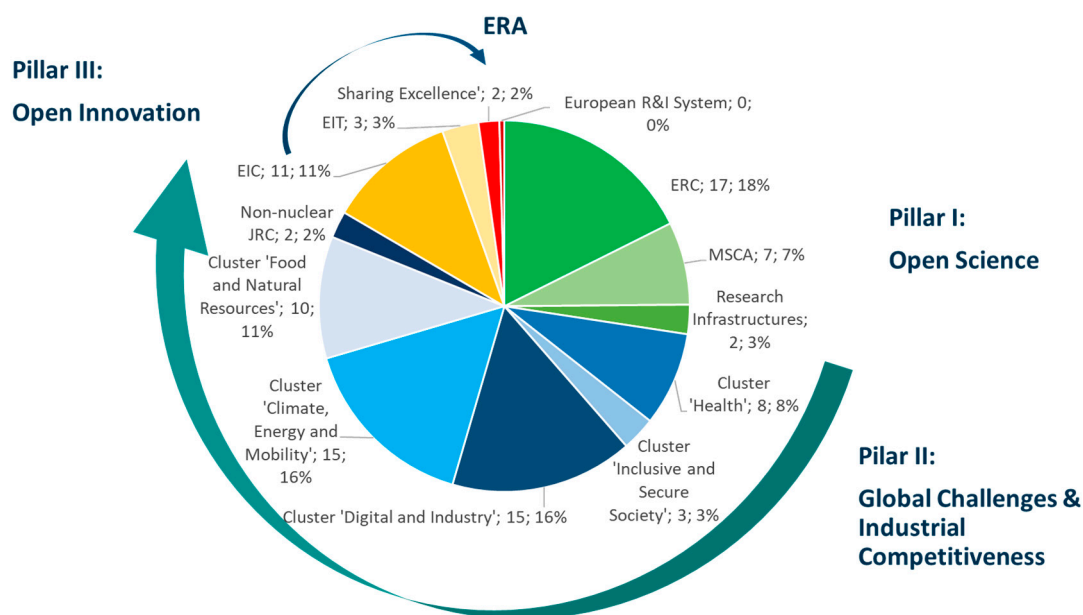


Figure 7. Horizon Europe Budget disposal (details), in current prices, billions of Euros. (Source: Own elaboration based on the data from [1]. Colours are in line with Figure 6.).

2.2.4. Tacit Innovation Programs and Budgeting with Synergies to Horizon Europe

The programmes with synergies for Horizon Europe include among others [1] (p. 14):

- The common agricultural policy (CAP);
- the European Regional Development Fund (ERDF); with its focus on building infrastructure for research and innovation ecosystems, modernisation of public and private sectors, cooperation networks and clusters;
- the European Social Fund (ESF+);
- the European Space Programme;
- the Single Market Programme;
- the Programme for Environment and Climate Action (LIFE);
- the Connecting Europe Facility (CEF);
- the Digital Europe Programme (DEP);
- the Erasmus Programme;
- the InvestEU Fund;
- and the external action instruments (Neighborhood, Development and International Cooperation Instrument (NDICI) and Instrument for Pre-accession Assistance (IPA III)).

As presented, the overall innovation picture of the European Union that emerges is highly complex. The common EU budget is dominated by agricultural and regional funding, which together comprise of more than two thirds of the overall budget. Strategic R&I amounts to only 8%.

In order to reinforce the available funds for critical EU policies in the future, there are some proposals of new taxes on the 27 remaining EU countries. These could include an EU-wide carbon-based air flight ticket tax; a carbon border adjustment tax; a fuel tax; a net wealth tax; a financial transactions tax; or a common corporate tax base. The EU does not currently have the power to control national tax rates, and any change to this would require a unanimous vote by all members.

As for the “tacit” innovation budget assignment, the following sources for innovation financing are stated apart from “strategic” financing of Horizon Europe:

- ESIF—European Structural and Investment Funds will contribute to smart growth on the basis of the submission of a Smart Specialization Strategy.

- EFSI—European Found for Strategic Investments managed by EIB—European Investment Bank. It helps to finance strategic investments in key areas such as infrastructure, research and innovation, education, renewable energy and energy efficiency, environment, agriculture, digital technology, education, health and social projects. Through the EFSI, the EIB Group is able to provide investment for higher-risk projects, risk finance for small and medium-sized enterprises (SMEs), besides including the additionality principle by mobilizing member states and private financing. The rationale of EFSI is to allow the EIB Group to take higher risk and mobilize private capital to mobilize additional financing for strategic investments and SMEs and mid-caps [31].

ESIF and EFSI, being different and separate mechanisms, are envisaged to be combined together at project or financial instruments level to achieve coordination, synergies and complementarity [31]. The ESI Funds can be used to support the risk-bearing capacity of an EFSI Investment Platform in the form of a “layered fund”, and leverage other sources of finance, most notably private investors as well as NPBs (National Promotional Banks) [32].

3. Results

3.1. Actors in the Innovation Process of Horizon Europe

Horizon Europe [1] (p. 13) is promising a new approach towards more impact-focused partnerships, including: academia, industry, member states and philanthropic foundations. It is aimed at correcting the plethora of partnerships, which need to be rationalised and consolidated, avoiding overlaps and duplications.

There are three levels of partnerships foreseen:

- Co-programmed based on Memoranda of understanding or contractual agreements.
- Co-funded based on single, flexible program co-fund action.
- Institutionalised partnerships (article 185 or 187 of TFEU and EIT Regulation on KICs and the Strategic Innovation Agendas (SIAs) for the periods of FPs).

Further on, different actors of the EU innovation policies are studied in more detail, following the Horizon Europe proposal, together with other collateral policies which can bring more effectiveness to them.

3.1.1. Government

The EU Regulatory framework is under revision to check if it hinders or encourages innovation. The Commission Initiative of Better Regulation [33] or The Interinstitutional Agreement for Better Law-Making [34] takes the innovation perspective into account. It has led to better public, especially cross-border, procurement procedures.

As for the Member States, they are implementing national reforms in the areas of R&I; measures such as self-assessment tools, country review pilots and learning seminars are in place for this purpose. Thus, in March 2015, the Policy Support Facility was launched. Moreover, countries are given specific recommendations for the R&I area in the context of the European Semester.

The Commission will seek as well to implement a pilot on “innovation deals”, which is a new bottom-up approach to assess and clarify regulatory obstacles for innovative solutions, by setting up agreements with private stakeholders and national public authorities.

New monitoring tools to benchmark the innovative behaviour of public administration are being put in place together with the OECD.

In principle already in the Horizon 2020, it was stated that the European Union is becoming an actor in the innovation process. Common mission and partnership areas orientation and citizen involvement seem to be two outstanding points. Mission orientation should help the assessment of excellence and impact not only the individual project or action but also at the portfolio level for a specific goal and within a set timeframe. More efficient science-policy interface should “address

better policy needs and strengthen the impact of research and innovation in developing, supporting and implementing Union policies” [1] (p. 17). In this sense, tools such as the Scientific Advice Mechanism have been put in place to ensure that policy making takes into account science criteria or is more evidence-based.

The evolution lines of the FP recommended by different studies are concentrated on the simplification, support of breakthrough innovation, increase of inner synergy within EU programmes, openness, international cooperation strengthening and the rationalisation of the funding landscape [23]. There are some remarkable advancements in management ways as well, i.e., the increase of legal certainty or reduction of administrative burden (standard procedures), with arrangements in place such as cross reliance on audits, rearrangements of cost options, the Mutual Insurance Mechanism or the seal of excellence for proposals exceeding the threshold of requirements but not funded due to the lack of budget available, which opens the way for them to receive support from complementary sources.

In the question of the interconnection between especially the start-ups and other innovation actors, the new rule for procurement, even if mainly to be addressed by other synergy policies, can become a far-reaching driving force for innovation strengthening, as there is a huge budget that could potentially become involved in innovation development and implementation. Fourteen percent of the EU GDP is spent through public procurement, accounting for 2 trillion € [35].

There are two types of procurement considered at FP level, which are especially relevant for innovation: Pre-commercial and public procurement of innovative solutions. A pre-commercial procurement means “the procurement of research and development services involving risk-benefit sharing under market conditions, and competitive development in phases, where there is a clear separation of the research and development services procured from the deployment of commercial volumes of end-products” [1] (p. 27). Public procurement of innovative solutions means “procurement where contracting authorities act as a launch customer for innovative goods or services which are not yet available on a large-scale commercial basis, and may include conformity testing” [1] (p. 27).

The government sector can become a role model for the adoption of the innovative solutions, creating large and stable demands before the commercial market is made available. Be that as it may, the bureaucracy and long payment times can be an inhibitor in this sense, as start-up companies do not have deep-pockets and cannot wait long for the project and money to materialise.

Regulations especially for newly created innovative technology can be better and more safely prepared (temporally and geographically limited) in a collaborative way through the regulatory sandboxes.

In principle, the government sector can and should make its data and services available and reusable, enabling the Academia and GovTech, RegTech or LegTech start-ups innovation based on them. Academia should get the data available at the first stage, as the partner responsible mainly for its exploitation; at further stages the companies could be made available for this kind of access. Public data use is more easily sold when the reason is the development of science and not private profits. GovTech companies aim for the creation of digital solutions for government. In this sense, the digitization or eGovernment services are a prerequisite. The government platforms should allow the interoperability-by-default and open government interfaces. LegTech companies are helping the joint creation of a legal environment for innovative solutions. RegTech start-ups are aimed at the regulatory subjects.

3.1.2. Academia

In the Horizon Europe [1], substantial investment in scientific and technological research and innovation is recognized as the first of levels of action in order to improve the national R&I systems efficiency and quality.

Pillar I “Open Science”, is based on 3 lines: the European Research Council (ERC), the Marie Skłodowska-Curie Actions (MSCA) and research infrastructures (see Figure 5). The naming of “Open Science” was anyhow changed in the European Parliament Legislative Resolution of 17th April 2019 [10]

(p. 9, 45), being mainly rephrased to “Excellent and Open Science” with “Excellent” first or in bold, and finalised as “Excellent Science”.

Open Science is to go beyond “Open Access” to publications and should foster the principle of the data to be FAIR: Findable, Accessible, Interoperable, and Re-usable. Research data management plans should become open, thus, strengthening the European Data Space [36], using European Open Science Cloud—EOSC when possible.

EOSC [37] was launched in November 2018 where researchers are able to get one-stop-shop access to data from any laboratory or scientific discipline across Europe. As stated in its website, it is aimed at a “virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines by federating and interconnecting existing scientific data infrastructures run by commercial and publicly-funded providers, adding software, metadata, data registries and other tools needed to glue these existing services together”, currently dispersed across disciplines and the EU Member States’.

It is complemented by the Open Science Policy Platform and Open Science Monitor. As for the Open Science Monitor, it is one of the sources to run the evaluations by the European Commission. Another collateral discussion is the handling of confidential and/or classified information.

Even if the award criteria for Horizon Europe are based on excellence, impact and quality and efficiency of the implementation, the research and ERC take almost exclusively the excellence as the criterion. It refers mainly to the publication in highly considered journals with impact factors (citations) and, in general, the high costs of publishing (bibliometrics excellence). To some extent it can be regarded as helping the maintenance of the status quo of already well-established research institutes from richest EU countries, concentrating there the flow of the EU budget for R&I and propelling the oligopoly of publishing platforms. With the excellence criteria, science resembles entering closed circles: scientific research’s final aim seems to be the quotation in other scientific research in order to be recognized and bring funding for the author/s to proceed with further scientific research. The National Science Foundation from the US uses criteria such as the wider impact (on the society etc.), intellectual merit and also, but not only, peer esteem (which can be expressed by an impact index/citations of publications).

In principle, in European policies, there is indeed a will to introduce a new set of research assessment indicators, such as research integrity. It can make the knowledge more reliable, efficient and accurate as it can be more easily compared with other available research, but it is rather difficult to find the basis for the hope to make them this way, better understood by society and more responsive to its needs.

The current configuration and practices of the publishing market oligarchy are under suspicious regard and boycotts of many publications due to their practices have stifled the growth of public access to knowledge and has made slower the advance of Open Science, at the same time dangerously becoming the main force in the dysfunctional, ever more dependent, publishing market. Some consider that the ethos of “radically collaborative science” is entering into allegiances with “platform capitalism” [38], leading to “bibliomatrix” relations with researchers.

ERA is seen as a genuine single market for knowledge, research and—more recently—innovation, enabling researchers, institutions and businesses to circulate, compete and co-operate across borders. This certainly includes training enough researchers and, even more, promoting interesting employment conditions.

Part of “Strengthening European Research Area” has its objectives of sharing excellence with less performing R&I countries (teaming, twinning, ERA chairs, etc.) and reforming and enhancing the European R&I System by the next generation Policy Support Facility. Despite bold objectives for ERA, which include the FP support, furthermore modernising European universities, supporting enhanced international cooperation between science, society and citizens, the money devoted to this purpose are a small fraction of the budget.

The ERA needs important levels of public investment, thus the rules for the EU's Regional Cohesion Policy aim at making innovation a priority for all European regions, supporting "Smart Specialisation Strategies", developing related research infrastructures and a level playing field for competition between researchers and institutions [39].

3.1.3. Industry

Business Innovation is given high consideration in EU innovation policies, above all in terms of budget assignment. Industry is dealt with as the main channel through which Horizon Europe is to be realised (through the creation of sustainable jobs and growth). The business environment should become more innovation friendly and less risk averse. The innovation is to be supported throughout its cycle and this commitment is highlighted several times. Full engagement of the Industry is envisaged, including all its levels from individual entrepreneur to SMEs to big corporations. Pillar III of "Open Innovation" is focused on the process view of innovation, overcoming the "valley of death" and the scaling-up of companies. The institutions such as EIT and the recently created EIC should serve this purpose. EIC is to offer a one-stop-shop for high-potential innovators, bridging the investment towards InvestEU, which is seen as crucial.

The aims of innovation, digitisation and decarbonisation, notably through KET's investment, are seen as the main objectives for Industry and the future. Conceptually difficult, the market failures or suboptimal investment situations should be overcome without the distortion of competition.

The pillar of "Global Challenges and Industrial Competitiveness" is addressed at the Industry, divided into in principle cross-dimensional clusters, in a hope of incentivising "cross-disciplinary, cross-sectoral, cross-policy and international collaboration" through their intervention areas.

The pillar of "Open Innovation" is focused on the entrepreneurship as the main force driving the breakthrough innovations into the market and allowing its spreading through the scaling-up. EIC (Pathfinder and Accelerator instruments) and EIT (KICs) are the main partners from the EU side in this process. In particular, Accelerator is seen as the instrument to help overcome the "valley of death". "Support schemes provided by the EIT should benefit to EIC beneficiaries, while start-ups emerging from EIT KICs should have access to EIC actions" [1] (p. 21). Education of entrepreneurs and support for start-ups seem to be the key.

One of the points to develop in the innovation ecosystem is the collaboration between the corporations and start-ups [35]. It is a question that is not so easily assessed. The corporations are obliged by their rules of functioning to fulfil several auditing criteria which require in turn to fulfil several rules like the robustness of their partners or the presentation of several proposals to choose from in a procurement. While opting for an innovation start-up, both of these conditions cannot be fulfilled, as the start-up by its nature is a newly created company without big history to rely on and when the solution is innovative, there is only one such company to choose from. Innovative projects with start-ups are thus processed with difficulty through the corporate structures and proceedings. Furthermore, recent fashion of innovation "agile" areas through which the corporations are collaborating with start-ups, have had a huge difficulty of reconciling their output with the innovation efforts already going on in the business as the usual structures, which want to be likewise innovative and centred on business operations and budget. At the end, in many cases, the innovation collaboration with start-ups becomes not only agile, but also very light, with small budgets being invested. It is so, because efforts are rather centred on the innovation branding than real doing.

Outside Horizon Europe, the Smart Specialization Platform, called the S3 Platform, was created to provide advice to EU countries and regions for the design and implementation of their Smart Specialisation Strategy (S3). Besides, there is a specific instrument called COSME for strengthening the Small & Medium Enterprises (SMEs) which provide 85% of new jobs created. COSME funds the European Enterprise Network (EEN) to help access EU SME financing, but also open the markets (internationalisation), supporting entrepreneurs' expertise, lessening regulatory burden for this type of companies and creating business-friendly environment.

In Horizon Europe, it is vital to rationalise the Union funding landscape, including, by streamlining, the range of partnership initiatives and co-funding schemes.

Blended finance, combining non-repayable EU funds and repayable funds from other public/private finance institutions and investors is leveraging private and public funds. EIT/Horizon Europe blended finance is “a combination of a grant or a reimbursable advance with an investment in equity” [1] (p.29). It allows the financing of emerging and frontier markets, especially for SDG.

InnovFin—EU Finance for Innovators of EIB has been applied in Horizon 2020. In a like manner, the European Venture Capital Funds were established together with European Venture Capital Passport.

3.1.4. Society

In Europe there is a big issue of the communication between European Union institutions and society, which was broadly and bluntly acknowledged by the failed EU constitution in 2005 [40]. Even if the constitution was somehow retrieved through the Lisbon Treaty, there were several efforts to better approach the citizens: Plan D for Democracy, Dialogue and Debate [41] or the Europe for Citizens program. The intention was to foster a broad public debate through the visits of the Commissioners to the Member States, through the European Round Tables for Democracy, better use of the Europa Direct network and through the European Goodwill Ambassadors (similar to the United Nations). Especially, bearing in mind the May 2019 elections for the European Parliament, there is a strong bet for increasing citizen participation in the voting and for the acknowledgment of the benefits of the EU by the broader public.

In this sense, there are several efforts to make European communication more attractive and accessible in cyberspace (social networks), like EU Tube on YouTube. These communications fall into two categories: 1–5 min announcement of some policies which are visual but with almost no substance in the content, and 30 min to two hour lectures about Europe. It is hard to get some user-friendly information with some substance in the content, i.e., 10–15 min, even about such basic topics like the most basic EU Policies.

Recent democratic governance practices include the proposals of direct Society participation in the decisions concerning it, at EU, national and local level. There is an EU Public Consultation site for expressing the opinions on the scope, priorities and added value of EU actions for new initiatives, or evaluation of existing policies and laws, and also for the Horizon Europe proposal itself [12].

Over and above, there is a Futurium platform where the society was invited to score EU policies related to the future [42], or to discuss policies, with different groups such as Digital4science to enable citizens to participate together with researchers in the design of future policies and work programmes. Another example is the Kuorum.org online platform which helps the government and enterprises to innovate through the online participation.

The participation in this kind of platforms and public consultations is indeed in need of improvement, especially due to their limited attractiveness, user-friendliness and transcendence, i.e., connection between the effort put in the participation and the results of it, especially for the participant.

In case of Horizon Europe, the public consultation, is de facto limited to Pillar 2, as it can be seen in the large and rather unnecessarily complex document of Orientations [12], including the Sustainable Development Goals mindset and reframing EU future policy priority to: Protective, competitive, fair, sustainable and influential Europe. There, the protective side is focused on civil security for society, that in principle should be related to defence matters and a fairness dimension is almost exclusively related to health issues, because social cohesion (and inclusiveness) is stated but not really developed.

One of the three levels pondered in Horizon Europe in order to improve the quality and efficiency of national innovation systems is to “ensure that European citizens get supported through what will be a fast and, for some, turbulent transition driven by innovation, digitisation and global megatrends such as artificial intelligence and the circular economy” [1] (p. 4). In principle it seems that it is strongly oriented toward the Future of Work, but there is no such articulated line of work.

Horizon Europe sees a meaningful relationship of society and science as a crucial question. It pretends to “engage and involve citizens and civil society organisations in co-designing and co-creating responsible research and innovation agendas and contents, promoting science education, making scientific knowledge publicly accessible, and facilitating participation by citizens and civil society organisations in its activities” [1] (p. 4). Culture and arts involvement are increasingly acknowledged as the ways for achieving new quality of sustainable innovation. The tools for that are seen in the R&I communication and outreach campaigns targeting general public. Dissemination, exploitation (especially stressed) and knowledge diffusion should help all the actors and are supposed to be done by the EU and the beneficiaries.

In Horizon Europe Pillar II, Global Challenges and Industrial Competitiveness is to take forward societal challenges but it is not clear how it is going to take society along this path.

Notwithstanding, there is a part of the innovation policies centred on social innovation. Social innovation is understood as “innovations that are both social in their ends and in their means, remaining open to the territorial, cultural, etc. variations it might take. So, the social is both in the how, the process, and in the why, the social and societal goals you want to reach” [43] (p. 5). This is developed into the platform for solutions to global challenges, implying different actors of the process: Public authorities (with a special accent on the renewal capacity it can bring for them), private companies, and third sector organisations. As for Horizon Europe, it considers mainly foundations in the last category.

Social innovation implies the assumption of a more active role of the society, not only as mere consumers but as prosumers. It can be conjointly addressed at the needs of vulnerable groups in society, integrating social, economic and, recognized only in some cases, environmental aspects. They imply co-production and co-creation CitiLabs, makers spaces, residences and sites. Social innovation characteristics imply more openness to knowledge sharing, multidisciplinary, hybrid and integrative approaches (broader and more varied communities). Moreover, social innovation environments are participative and more empowering, enhancing society’s capability to act, they demand rather than supply led and adapted to particular, local conditions. In some sense they mirror the practice of citizen science, but instead of research and science development they promote solutions and social economy/entrepreneurship, in this way impulsing collective intelligence. The stages are similar to multilevel perspectives but without the R&D. Nonetheless, the social innovation community was disconnected at the beginning of 2019. TRANSIT project for transformational impact of social economy was discontinued in 2017. At least, there is an information about that on the respective websites. It can be seen, moreover, as hype in the crisis times [44], also because the updated documents are difficult to find.

Innovation culture in Europe requires a closer involvement of society [45]. It is foreseen to involve society in all the stages of innovation cycle. In this way, innovation ideation can be enriched and seen as more relevant and acceptable and, in this way, it can be easier to uptake. Citizens and users should be at the centre of new open innovation policies [46].

Inclusiveness of innovation is indeed needed and can be achieved through better mainstreaming and simpler access rules. Gender equality is in this sense one of the concerns of Horizon Europe, namely, the participation of women in STEM, technology and encouraging them to have a more active role in the technology entrepreneurship [35].

Models of crowdfunding for research are envisaged as enriching the approach and involvement of society [39], although they can become a tool to take out the responsibility of other actors for complying with it. Crowdfunding models are under evolution and their different forms are approaching modes of action of the business angels or venture capital, allowing for more granular investment (less capital and more participants); however, the final costs in terms of commissions, interests, processing time investment, etc. are rather less competitive.

Above this, there is a concept of citizen science referred as “general public engagement in the scientific research activities when citizens actively contribute to science either with their intellectual

effort or surrounding knowledge or with their tools and resources” [47] (p. 9). In the European Union such practices are already at its highest state-of-art, introduced in Denmark in the Consensus Conference, where a participatory process involving citizens is used to complement scientific reports and affect political decisions.

3.1.5. Natural Environment

There is no specific pillar or line of action that referring to natural environment in Horizon Europe, yet it reflects “the importance of tackling climate change in line with the Union’s commitments to implement the Paris Agreement and the United Nations Sustainable Development Goals, this Programme will contribute to mainstream climate actions and to the achievement of an overall target of 25% of the EU budget expenditures supporting climate objectives” [1] (p. 24). This target in principle is to be achieved through the marker system, used at the “appropriate” level of disaggregation.

The Eco-innovation Action Plan (EcoAP), was adopted by the Commission in 2011. An eco-innovation is “any innovation that makes progress towards the goal of sustainable development by reducing impacts on the environment, increasing resilience to environmental pressures or using natural resources more efficiently and responsibly” [48] (p. 3).

The EU’s 7th Environment Action Programme (7EAP) set out a vision of “living well within the limits of the planet”, including the need to “turn the Union into a resource-efficient, green, and competitive low-carbon economy” by 2050.

The European Resource Efficiency Knowledge Centre (EREK) was launched in 2018 to help European companies, especially SMEs, save energy, material and water costs. They make available tools, information and business opportunities that show new and better ways to be resource efficient and benefit from circular economy business models which turn waste into an asset. The Circular Economy Package was presented first in 2014 and amended in 2015 [49]. As a part of it an Action Plan was included [50]. Be that as it may, this subject was already initially developed in the 2011 Roadmap to Resource Efficient Europe [51].

The European Circular Economy Stakeholder Platform is also in place. Extended Producer Responsibility (EPR) schemes provide the producers with the incentives to take into the consideration the full life cycle of the product, many times exerted collectively through the Producer Responsibility Organizations (PROs). Even financial contributions paid by producers to EPR schemes were foreseen to be modulated based on the costs necessary to treat their products at the end of their life. All these commitments are in line with the U.N. 2030 Agenda for Sustainable Development and the G7 Alliance on Resource Efficiency. This action plan is additionally instrumental in reaching the Sustainable Development Goals (SDGs) [50]. The Ecodesign Directive from 2009 [52] however, pertinent only to energy-related products, considers energy efficiency. In the future, issues such as reparability, durability, upgradability, recyclability, or the identification of certain materials or substances are to be envisaged.

The Commission further promotes best practices in a range of industrial sectors through the “best available technique reference documents” (BREFs) and Best Available Techniques Conclusions (BATCs).

The SEE (Sharing Experience Europe Platform) of the ECIA (European Creative Industry Alliance) is focused on strengthening the role of creative industries and, in addition, it is being applied to policy-making to accelerate the introduction of design in the process of innovation [53].

3.2. International Cooperation in the Innovation Policies of Horizon Europe

For the Commission, international cooperation is a tenet of research policy. It wants to be at the centre of a web of global science and technology. The Horizon Europe FP is based on the concepts and definitions of the World Trade Organization, the Frascati Manual for Research [54] and the Oslo Manual for Innovation [55], Technological Readiness Levels—TRL.

The EU designed Framework Programmes are supposed to be as open as possible to participation from across the globe as this raises excellence and visibility, support trans-national mobility and attracts the best talent [1] (p. 3). An advisory body of the European Council, called the Strategic Forum for International Science and Technology Cooperation (SFIC), provides the forum to discuss the priorities among the MS (Member States).

There are several forms of collaboration [56]:

1. Coordinated Calls are agreed through joint steering committees with international partner countries. The EU and a third country agree upon the content, funding, evaluation procedures, timing and other procedures, but both of them issue legally separate calls which run in parallel. For instance, the agreement with Japan.
2. Joint Calls are jointly managed with a third country. It includes third countries scientific and technological organizations and agencies, international organizations and non-profit legal entities.
3. Another form of cooperation can involve Third Party Entities from industrialized countries (so, without funding) which are unable to sign a grant agreement. Participants from those countries must be contracted to a regular participant who must obtain the intellectual property rights from the third party as if results were generated by the full participant itself.

There are several categories of countries involved, for calls as well as for innovation prizes [1] (p. 35). They can be split into two groups:

1. “Associated countries”—EFTA/EEA can act as EU MS (Norway, Israel, UK after Brexit). Acceding countries, candidates and potential candidates as well as the countries covered by the European Neighborhood Policy are to follow the terms of their respective agreements.
2. Third countries and territories—with a good capacity in science, technology and innovation, committed to a rule-based, democratic open market economy.

The European Code of Conduct is to be applied. Human cloning and genetic modifications or human embryos only for the purpose of research are in principle excluded from the Horizon Europe financing framework. Ethics and security checks are to be run at any time of the research, if needed. There are strict rules regarding transparency (bearing in mind Intellectual Rights Protection), non-discrimination, equal treatment, sound financial management, proportionality and competition. To attract entrepreneurs from third countries, Europe is envisaging the extension of the Blue Card Directive to them. For scientists from third countries, a scientific visa is available.

There is an option for participation from third countries by becoming a part of Consortium, where in general only one, from at least three participants, is from the EU MS or associated countries. ERC and EIC have the possibility to directly involve one or more legal entities with the same requirement.

Entities from the third countries exceptionally can benefit from calls while being in principle from low- or middle-income countries (the increase of their share in the research funding is one of the Pillar II aims) and if the country is identified in the Commission work programme or is deemed essential to implement the action.

The Commission issues a bi-annual report on the implementation of the international cooperation strategy, that includes a set of country-specific roadmaps for R&I cooperation. Furthermore, the Commission has formal science and technology agreements with several third countries that are guided, reviewed and reported by joint steering committees.

Beyond the FP, EU participates in many multi-lateral R&I initiatives such as the Intergovernmental Panel on Climate Change (IPCC) and the Global Earth Observation System of Systems (GEOSS) that will link satellite systems worldwide, also regional initiatives as EaPConnect (Eastern Partnership), to develop a regional EaP Research and Education Network of Centres of Excellence and its interconnection to GEANT was launched in June 2015 (S. Commission, 2016). EU works with the OECD and other organisations to improve cooperation on framework conditions [56]. The participation of legal entities established in the third countries and international organisations is promoted in Horizon Europe

In the future, Europe is envisaged to allow more bottom-up collaboration—with third-country applicants approaching the EU for open funding calls, not restricted by topic area or a pre-defined R&I framework.

Bottom-up cooperation could be advanced, not through potentially expensive and burdensome project calls, through the exchange of researchers. Long-term scholarships, lasting more than the one-year standard today, encourage the exchange of people and ideas, fostering links between countries. The Marie Skłodowska-Curie actions were very popular and effective. In the sense of international talent attraction, European Union should probably better leverage its competitive advantage in diversity and quality of life [35].

The COST Association has been expanding its international scientific networking activities, as a low-cost way to bring together researchers across borders. Additionally, EUREKA's GlobalStars instrument allows member-states of EUREKA to form partnerships in third countries to create an open call, with topics and funding agreed between them. Participants can then apply through their respective and amended national R&I procedures.

4. Discussion

Explicit but also tacit European Innovation Policies are gaining momentum. From what can be seen in Horizon Europe, the knowledge triangle [9] or triple helix [8] actors are explicitly considered: Government, Academia and Industry, with additional dimensions such as Society and Natural Environment are nonetheless at the tacit level only. The authors consider strong socioecological orientation as a paramount requirement for sustainability. A richer understanding, communication and action is required, based on shared models, codes, roles and rules. In this way, more “we” quality can be reached, making the EU more resilient and thus setbacks and defeats can be coped with more optimally. In a geopolitical scale such as the EU one, there is also a greater risk of delusion and capture by special interests [6]. Thus, the EU innovation ecosystem should be able to reinvent itself as a system of intelligence, where all actors can act in a more comprehensive and integrated way, having shared views of standards and quality with a shared purpose. A model is a tool for thinking, applying it, actors can better complement, compete and interact with each other. A revision of living innovation ecosystems strategy policy against a comprehensive and dynamic framework is the main contribution of this paper. Observations, inputs and data are refracted through models which are tied to identity and experience of reality.

Generating options and correcting errors of reasoning is vital for strategies. There are several efforts regarding the policies of the EU which are always present. One of them is simplicity. Even if it is one of the main aims, from the outside the policies look ever more complex. The learning can be that this is due to the ever-evolving reality, consequently the casuistic to attain the results becomes more cumbersome. This can override (collective) intelligence if new models are not configured. According to the statements which seem rational, the landscape, even if becoming more complex, is less complicated to manage and to find a way through it for the actors. The administrative burden, related to the auditing and accountability exigencies, now includes several measures to alleviate it. Continuity of the policies can be helpful as well, but it collides with the changes, even if seen as improvements. The grants mechanism is counterproductive in this sense, as by its nature it is a one-shot project, even if extendable, this extension is only palliative. Another aspect is a bottom-up approach calling for high quality expertise of the “bottom” or general citizenry and very good institutional arrangements, thus reinforcing the position of the already strong players. After this thorough research process, the authors have learnt that while more omnipresent is the mantra or repeated are some declarations of intentions, more pervasive can be its effects on status quo maintenance and escalation. For instance, in the 7th Framework Programme that ran from 2007 to 2013, Eastern countries only won four per cent of the total EU research budget. In the current Horizon 2020, that number has improved, but only by 0.4 per cent. The lion's share of funding continues to go to research institutes and companies in the UK, Germany, France and the Netherlands, an exception being Spain. In the meantime, in Horizon

Europe, there is only an expressed concern regarding outermost regions (mainly old colonies and Canary Islands) about improving the participation rates of countries with weaker R&I muscle.

Below we present the main conclusions from the previously exposed results of the analysis of innovation actors.

At the Government level, the innovation approach evolved in the EU towards networks and clusters, mainstreaming innovation into sectorial policies and with the EU itself acting as an innovator [46]. Apart from the general revision of the policies and their possible impact on the innovation, it tries to be more approachable thanks to EU-declared missions and be closer to citizens and also scientists through a scientific advice mechanism for policy institutions. A serious asset lies in public procurement as when it opens to innovation, it can provide much needed funding. The authors recommend that regulatory sandboxes for innovation and the opening of government data for scientific research and RegTech or LegTech companies are other implicitly far-reaching lines of action.

As for the Academia, data and research processes and the openness of results are burning questions while the exclusiveness of excellence criterion and the current development of the global publishing markets affecting the European ones require closer revision.

Acting at the EU level allows the investment in the segments of R&I which are more difficult to be promoted at other levels, as it is for high risk and long-term venture. It can be achieved thanks to “sharing the risk and generating breadth of scope and economies of scale”.

For the Industry, the creation of the EIC should bring reinforcement of the innovation policies and funding. An imperative is here the process approach, supporting the start-up companies in the “valley of death” and scaling-up parts of their development. Collaboration with the big corporations is of relevance, as they can become customers or partners, bridging the financing for innovation. Several initiatives are undertaken to improve Venture Capital participation in European innovation schemes. They fall behind the US standards—these are not developed in the Horizon Europe apart from stating that the blended finance tool is a foreseen step to improve financing on the border of public and private entities.

There is a strong orientation of efforts towards Society, which is to be informed and, what is more, invited through hopefully more interactive and participative processes. Not only information diffusion, but also citizen science or social innovation processes (not so the collaborative economy [57]) are encouraged, however their real implementation will need further checks. There is a huge space for improvement in the interaction dimension with society, especially when fake news and tribalism are rampant on the social networks, provoking distrust and an easy harbour for populist, and in general, nationalist and anti-European parties.

Natural environment participation in the innovation is limited to the implicit budget assignment commitment of 25%. Other programs especially related to circular economy are crucial, as probably the innovation sector has the best ability to implement them, while starting from scratch.

European Partnerships seem to be the initiatives allowing the joint participation of different actors, including the EU itself, where market, regulatory and policy uptakes are considered jointly with research and innovation.

Anyway, European Union markets are split by comparatively small countries and in some cases by regions, with different regulatory landscapes and rules for functioning, they are fragmented, and it is much more difficult to scale-up companies and overcome the valley of death. Indeed, it is true for talent acquisition across different countries and access to capital. There are very few pan-European VCs [35]. The difference is much deeper in what is referred to as the innovation approach of culture—attitudes toward challenging the status quo or risk-taking are very different.

None of the new big tech giants are based in the EU, thus it is rather difficult to harness their deep-pockets for innovation. The platform economy has many depredatory results on economic, social and environmental landscapes, thus the first runner advantages can be overturned by a more balanced and sustainable approach. Following the example of China, many of these platforms, which

at the beginning would require significant technological investment can be now quite easily made and replaced by pan-European platforms with more ethical aims (i.e., Facebook).

As it can be seen from this study, EU policy regarding innovation is highly complex, many initiatives are fragmented, others are doubled in several lines of action. The nomenclature is changing quite frequently. It is difficult to track the progress of different initiatives or entities on the web, as each of them seems to be created at a specific point of time (during the project execution period) and not updated very frequently, if at all. Only in some recent cases when policy is discontinued, this fact is stated. If not, checks on other sites to guess what has happened are indispensable. Each policy is presented as the most important and comprehensive one. When objectives are not attained, it is not easy to find explanations, but several forecasts and other future dealing elaborations are very popular nowadays, even if it is obvious that their importance is mainly psychological, allowing everybody to believe that we can somehow control the future which by its nature is not controllable [58].

In the Horizon Europe proposal [1], the criteria of scientific, social and economic impact pathways are taken into account, but from the authors' point of view, they are not seen from the actionable perspective of the actors of each dimension. Scientific imprint is measured as the creation and spreading of high-quality new knowledge, skills, technologies and solutions. Societal impact takes on the implementation of the EU policies and supports the uptake of innovative solutions in society and industry. Economic impact relates to fostering of all forms of innovation, market deployment is especially emphasized in this sense. The matching of these criteria to the aims of each of the dimensions is rather difficult. The science orientation towards the diffusion of new technologies or solutions, can be rather oriented to the industry role. Societal impact is based on the assumption that the EU Policies are a direct instrument focused on society. A collectively intelligent, knowledge-based and future (of work) oriented society objective is missing. Economic impact conveys the impression of being related to the number of innovations entering the market. Addressing global challenges is the aim of all these criteria. These same criteria should be matched on the evaluation side of the proposals for project budgeting. Close to real-time monitoring is one of the concerns, with the detailed information about the participants and their applications, but cross-cut multidimensional comprehensive perspective is difficult to find.

A monitoring and evaluation system is crucial for the estimation of the innovation policies and FP impact, R&I is recognized as crucial to fulfil the Union priorities, in particular for jobs and growth, the Digital Single Market, the Energy Union and climate action. The evaluation is to be based on the Interinstitutional Agreement [34] in order to "strengthen evidence-base for policy-making". They are useful, not so much because of the allowance for measurements, but for the detection of the improvements' possibilities. Some, especially in the business-related field claim that "what cannot be measured does not exist" which the authors consider one of big conceptual problems of our times, as imperfect measurements add a certainty to the ignorance and no respect for the unknown seems to be required (unknown "grey point" in this way ceases to exist in the controlled landscape). As Daniel J. Boorstin said: "the greatest obstacle to knowledge is not ignorance, it is the illusion of knowledge". Connected to the mechanism of psychologic cognitive dissonance, it is a real scour.

The monitoring and benchmarking of innovation across Europe as well as with its main international partners are implemented through tools as the Innovation Union Scoreboard [59], the Regional Innovation Scoreboard and the Innovation Output Indicator which provide regular updates on the subject. They elaborate several indicators for the innovation assessment. Be that as it may, they are rather static in nature.

The aim of this research is covered by providing the EU innovation policies with historical evolution and structuring. Thus, a dynamic and comprehensive picture of innovation policies in general, and in Horizon Europe in particular, is created, assessed by the actors' roles in the innovation process and their appropriateness for advancement and sustainability.

This assessment framework can be used for further studies of innovation policies or sectors innovation; for instance, a banking sector case study has already been run [5]. Nonetheless, it is more

oriented towards the developed countries prospect, taking into account good institutional governance and democracy structures. As stated in the original document of innovation model, in the third world countries, some additional factors and processes should be taken into account while others would not be relevant.

Regarding future possible studies, a research of intermediary innovation institutions would be a far-reaching field for research, as there is a foreseen strong correlation between their quality and density on one side and the maturity and structural advancement level of the innovation ecosystems on the other. Notwithstanding, after preliminary revision, the information landscape in this phase is far from a good outlook.

The innovation process perspective is another interesting line for scrutiny, but it would require other materials for innovation strategy examination, Horizon Europe being too general in this aspect.

Probably, from the innovation ecosystems frame of reference, it would be interesting to assess the Future of Work or Sustainability through the lenses of a proposed model, checking different actors and processes for levels of advancement and orientation.

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Appendix A

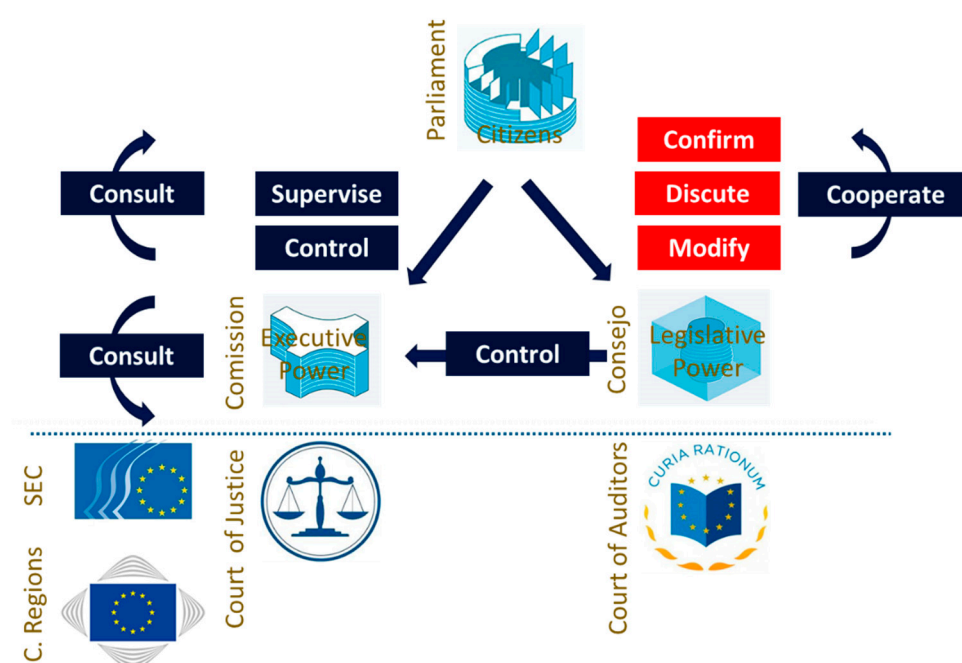


Figure A1. EU Troika Institutions. (Source: Own elaboration).

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