Alma Mater Studiorum – Università di Bologna

DOTTORATO DI RICERCA IN

Science, Cognition and Technology

Ciclo XXIX

Settore Concorsuale: 14/C2 – Sociologia dei processi culturali e comunicativi

Settore Scientifico Disciplinare: SPS/08 – Sociologia dei processi culturali e comunicativi

Which science for which Europe? Between the lines of policy discourses in European science policies

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Esame finale anno 2018

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Introduction: the exposed nerves of science policy

In September 2012, I participated to the first meeting of the European network PicoSEC-MCNet, held in Lyon, in a room of the medical department of the UCBL University.

In presenting the planned activities for the next four years, the Network Coordinator, an experienced CERN researcher, listed numerous training events: the majority was focused on specialized scientific and technologic subjects, relevant to the projects' aim – scintillators, laser lithography, single-photon imaging. However, a relevant part of the trainings was going to be devoted to non-technical topics: management, marketing and sales, certification of medical products, intellectual property rights; one of them was named "the route to market: how innovation moves from laboratory to product". Facing a slight surprise of the researchers, the EU projects support officer emphasized that the Commission was very much concerned with their training on these aspects of the scientific activity, and that their willingness to engage with them was to be considered a determining part of the work.

The project, coordinated by CERN, was geared at bridging the gap between the endeavours of fundamental physics – including, alongside basic research, the development of cutting-edge technologies for particle detectors – and the application of the same technologies to real-life important issues: in this case, the diagnosis of cancer. The project objective was the elaboration of a new class of ultra-fast photon detectors, suitable for applications in medical diagnostics and in high energy physics – new, quicker and more precise PET[1] machines and better detectors for the big particle physics experiments.

I had been recruited in the project a couple of months earlier as science communicator and assistant to the Network Coordinator: my task was, on one hand, to help smoothing the Network organizational issues, involving complex interplays among the partners – eleven academia and companies, distributed over six European countries. On the other hand, I had to study the project contents, observe the researchers' activities and find the most appropriate ways to communicate them to the public. My working place was a building at CERN, in Geneva, where some of the PicoSEC researchers collaborated with other young and senior scientists coming from all over the world, and frequently travelling to other countries for conferences or new jobs proposals.

[1] Positron Emission Tomography.

I shared with the researchers their surprise about the training topics: educated as a physicist, I didn't expect marketing and management competencies to be promoted for scientific curricula. This was not, in my eyes, the only peculiarity: public and private partners were mixed in the same project; basic research, technological development and commercialization coexisted; the twenty-two researchers, with backgrounds in different scientific disciplines, were native of diverse European and non-European countries, and had to work in other different countries, finding at the same time the way to collaborate effectively towards the same objective.

As a science communicator, I was asked to present the project's activity in a simple and organized way, in order to convey an image of success and effectiveness of EU funding on research; it was my daily job to reflect on the different perspectives from which I could promote the network, while at the same time learning which were the images most encouraged or deterred by the Commission.

I became curious about who was taking the decisions over the features of EU-funded scientific research, about how and where such decisions were taken, and about the historical development that led to such a vision, which I found fairly different from the idea of scientific research I obtained from my academic studies.

Unravelling the tangle of European research policy landscape, features and framing would have formed the subject of my subsequent PhD research.

The evolving nature of science

The features of EU research policy evolved against the background of wider transformations occurred in the conceptualization of science and of its role in public policies.

The evolving understanding of science. During the last century, not only the involvement of scientific research in national policies radically changed, but the same understanding of the scientific activity was questioned and discussed.

The vision that science students learn at University usually dates back to the 19th century model of "academic science" (Ziman, 2000), when research was carried out by professional scientists inside universities, and the scientific community was self-governing by means of internal procedures, specific social interplays and a set of norms and values founding the scientific activity. R.K Merton identified these principles, underlying the *ethos* of modern science, in communalism, universalism, disinterestedness and organized scepticism[2]: the scientist produces public knowledge, accessible to everybody (communalism); no social or political condition influences the validity of science (universalism); researchers don't pursue personal interests, but contribute to the advancement of the common scientific endeavour

[2] Scholars of science studies use for this set of principles the acronym CUDOS.

(disinterestedness); they disregard *ipse dixit* in favour of systematic testing and discussion (organised scepticism).

This conceptualization of science – which anyway, even in the period when it was more resembled by concrete realizations, represented an ideal-type of the purest form of science – changed with the Second World War. The new scientific *ethos* connoting the "post-academic" era was identified by qualities diametrically opposed to the Mertonian values: contemporary science is proprietary, local, authoritarian, commissioned, expert[3] (Ziman, 2000). It is no more based on the public nature of knowledge, but rights of property play a notable role; it focuses on local, technical issues rather than on general problems; scientists don't act as free individuals, but under managerial control; their work is committed to specific targets, not to the advancement of science *per se*; finally, they act more frequently as expert problem-solvers than as creative thinkers.

The new, "Mode 2", production of knowledge is context-driven, «socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities» (Gibbons et al., 1994; Nowotny, Scott, & Gibbons, 2003). Scholars have underlined the frequency of deviations from the Mertonian norms in real scientific activity, like scientific disputes, interests bargaining, secrecy, plagiarism, "cherry picking" of results, or the tendency to attribute credit, prestige and funding to already renowned and successful scientists (the so-called "Matthew effect"). The social studies of science developed an understanding of knowledge as socially constructed, like all the other aspects of social reality, and emphasised the influence of the context, even through its material artefacts, on the construction of scientific knowledge.

In the new, post-academic, context, the socio-political environment and the scientific community can no longer be viewed as autonomous, self-governed sectors, but continuously interacting social realms, in constant mutual reshaping. The attention payed to the deep embodiment of science in society has been interpreted principally in two main directions: to advocate more participation of society in the shaping of science (the "democratic" approach of many STS scholars[4]) or conversely to argue for a hybridisation of science and businesses.

To express the deep, non-deterministic, interconnection between science, technology and society, the STS scholar Sheila Jasanoff developed the concept of «co-production» as (Jasanoff, 2004):

> *Briefly stated, co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. Knowledge and its material embodiments are at once products of social work and constitutive forms of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports. Scientific knowledge, in particular, is not a transcendent mirror of reality. It both embeds and is embedded in social practices, identities, norms, conventions, discourses,*

[3] The new acronym is PLACE.
[4] See in this respect the paragraph *Social orientation of knowledge, or the "knowledge for society" frame*.

instruments and institutions—in short, in all the building blocks of what we term the social. The same can be said even more forcefully of technology.

The appropriate features of scientific activity, in a context denoted by a diffused mistrust in the capacity of knowledge to advance certainties and control over the natural world, have to be, according to Silvio Funtowicz and Jerome Ravetz (Funtowicz & Ravetz, 1993), «based on the assumptions of unpredictability, incomplete control, and a plurality of legitimate perspectives», transcending the «old dichotomies of facts and values, and of knowledge and ignorance» and dismissing reductionism to acknowledge complexity and dynamicity of natural systems. The resolution of "post-normal" science policy issues, according to them, should be based on an "extended peer review", including a wider set of legitimate actors in the evaluation of scientific outputs. Sheila Jasanoff names "civic epistemologies" the «historically and politically situated, culturally specific, public knowledge-ways», that should be included in the evaluation of science in contemporary knowledge societies (Jasanoff, 2005).

Besides, other academic sectors advocated for more and better inclusion of businesses and industries methods and cultures in the scientific activity: scholars discussed about an "asymmetrical convergence" between academia and industry: universities adopt business-like tenets and organization, while businesses absorb some practices of the scientific community. The "triple helix" model (Etzkowitz & Leydesdorff, 2000) interpreted innovation as produced by the interplay of industry, university and government; universities would be, moreover, called to a "third mission", alongside the two traditional ones of teaching and researching, consisting in the diffusion of knowledge through industrial enterprises, public communication and expert consultancy.

The rightful place of science. Against this convoluted conceptual landscape, the understanding of the role of knowledge production in public policies changed completely: governments shifted from a substantial patronage approach – allowing and supporting the activity of scientists without interfering with the development of science – to the acknowledgement of the strategic importance of scientific research for the achievement of national targets, and increased their control over the objectives and organization of science[5]. On the other hand, the new features of "big science" – needing larger size machines, laboratories, staff and, consequently, budgets no longer affordable to universities – required the scientific community to accept, rely on and call for public funding of research.

However contemporary research policies still don't share a common position on «the rightful place of science». This sentence, although pronounced by the US president Obama to state his support to science[6], is open to a multitude of interpretations (Zachary et al., 2013): what is the rightful place of science? Is it the

[5] see *Horizon 2020: three priorities for three visions of the role of research* for a detailed account of the transition to state-controlled scientific research.

[6] President Obama pronounced it during his first inaugural speech in 2009 (Obama, 2009): «We'll restore science to its rightful place, and wield technology's wonders to raise health care's quality and lower its cost. We will harness the sun and the winds and the soil to fuel our cars and run our factories. And we will transform our schools and colleges and universities to meet the demands of a new age. All this we can do. All this we will do».

Polanyian «republic of science», or Bernal's «socialized integrated scientific world organization»[7]? Is the task of knowledge fuelling economic growth or promoting the development of citizenship? And should it have a role at all?

All these questions emerge in the study of the European research policies presented in this work.

Why studying conceptual frames in European science policies?

The relevance of conceptual frames. The analysis is conducted along two principal dimensions: the reconstruction of the historical development of the different understandings of knowledge policies, and the systematic, compared, analysis of policy discourses on science, as reported in publicly available documents[8]. On the one hand, hence, the cultural and contextual origins of the different visions are traced, while on the other the consequences of the incorporation of such visions in contemporary policies are investigated.

My attention is focused primarily on discourses: studying the European research policy-making, I soon realized the recurrence of specific mind-sets, or frames, in which the policies were inserted and by which decisions were legitimised. «Conceptual frameworks» is one denomination among the numerous by which the social, anthropological, political and science studies literatures (reviewed in the paragraph *Disclosing Discourses*) have identified powerful shared worldviews, able to make sense of a community past events and to point the direction for future developments. These frames have an influential prescriptive effect: they distinguish among actors and issues, identifying the most relevant ones; they define the horizon of acceptable actions, and establish the reference values and norms; they determine the choice criteria among different policy options.

Their importance is even more pronounced in a political entity like the European Union, where the weakness of political debate doesn't allow the identification of clear political positions and strong responsibilities over decisions, and – at least in the field of knowledge policies – abiding reference is made to previous strategies and documents in order to legitimise choices and actions.

Every discourse is inextricable from the process producing it. Notwithstanding the importance of policy frames, which form the main subject of this work[9], every discourse is inextricably linked to the context in which it is produced: for this reason, my first concern was understanding the European policy-making procedure in the field of scientific research.

Again, the European context is complex and multifaceted, also with respect to policy-making: different modes can be identified for different policy areas, and the same scientific policies are not governed with a unique mode. However, the Framework Programmes (FPs) emerged as the dominant instrument of governing science in the EU context, constituting the major research funding initiative.

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[7] See paragraph *Horizon 2020: three priorities for three visions of the role of research*.
[8] Presented in the section *How does Europe talk about science? The choice and analysis of the policy documents*.
[9] See the chapter *Frames and narratives in EU policy discourses on science*.

I traced the procedure leading to the approval of FPs throughout the European institutions, identifying the stages when conceptual frames are developed and incorporated into documents, and explored the actors involved in shaping scientific policies. In so doing, I couldn't rely on comprehensive guides describing the European scientific policy making: a proper shared reference literature, to my knowledge, doesn't exist; I undertook, hence, an exploration of the fragmented corpus of information available both in institutional documents and in EU policy-making literature (where usually science policies appear as examples or minor sectors); alongside, I had the chance to interview some actors involved in the process, and to obtain from them the details of the procedure and the evaluation of their experience[10].

Science policies and European integration. Analysing the historical evolution of European research policies, it clearly appears that the development of EU science support is closely interrelated with the dynamics of European integration: the factors and visions influencing integration had consequences also on science policies, and decisions on research represented a test site for integration options and a battleground for competing political visions.

I traced the history of EU research policy since the Communities foundation, in the '50s, with a particular attention on highlighting the 'phase transitions' between periods denoted by different understandings of the role and purpose of research (in the section *Which science for which Europe?*). The features of the current vision are clearly grounded to its historical development.

Why are European visions of research so important? The importance of European research policies has constantly increased in recent years: EU is both a source of funding and an influential conceptual reference for what concerns the policies on research.

The EU research funding budget grew constantly in the last three decades (see paragraph *The story told by the Framework Programmes establishing acts*, Fig. 3 and Fig. 9). If compared with national funding to research, EU funding represents on average 15% of the total public expenditure on research in single member states (Frenk, Hunt, Partridge, Thornton, & Wyatt, 2015; Maes et al., 2011). However, a great share of national funds is invested in salaries and in ordinary expenditures for research infrastructures; conversely, EU funds are usually targeted directly at financing research projects, so their relevance for researchers' activity is increasingly notable.

The impact on national funding is not the only influence of EU research policy: the tenets and conceptual frames developed and promoted by the Union in the field of knowledge policies, in fact, filter to the government levels and shape the national approaches on science on the model of the European understandings and orientations of research funding (see, for example how the reference to the European research policies is frequent and influencing in the Italian document on the National Research Programme, MIUR, 2015).

[10] See the section *The EU decision-making process(es) for scientific research*.

Reading between the lines of policy documents. The aim of this work is to identify and expose the different political visions on knowledge production, tracing their evolution across EU policy discourses, identifying their features and elaborating on their consequences for future developments. To my knowledge, no previous account has been drafted on a systematic study and comparison of the European research policy frames. Given the complexity of the scenario, with diverse strands intertwining at different moments and in different discourses, I refrained from the ambition of surgically dividing the discussion in independent and exhaustive chapters: rather, I will return repeatedly on the same subjects, or events, shedding light on different perspectives and trying to depict the complex and multifaceted picture of EU research policy.

The research is conducted against the background of the reflections about science and democracy: the identification and description of the main frameworks on the role and nature of science policies is meant as a service to the quality improvement of the European democratic deliberation. A relevant feature of conceptual frameworks, in fact, is their frequent tacit employment in discourses, in order to obtain consensus with arguments that don't need further demonstrations, in so doing closing up the space for an open public debate on the desired political developments.

In contemporary knowledge societies, knowledge is considered the basis of social, political and economic relations: the analysis of the policy frames highlights a series of critical points related to the coexistence of diverse, competing, visions of knowledge production. The tensions among different legitimising values and orientations, which emerge manifestly in political discourses and – as described in the opening – in research practice, should not be downplayed but explored in their capacity of revealing the exposed nerves of science policy and lead to sounder, shared and more democratically grounded choices on European future.

Conceptual frames, narratives and European scientific discourses

Not ideas, but material and ideal interests, directly govern men's conduct.
Yet very frequently the 'world images' that have been created by 'ideas' have, like switchmen,
determined the tracks along which action has been pushed by the dynamic of interest.
(Max Weber, "The Social Psychology of World Religions", 1913)[11]

I therefore claim to show, not how men think in myths,
but how myths operate in men's minds without their being aware of the fact
(Claude Lévi-Strauss, "The raw and the cooked", 1969)

Introduction

The idea that in every collective system there are shared visions or myths expressing the society's identity, its origin and orientation, and consequently shape the relations among the relevant social actors and with the outside world, is not a novel idea in the fields of social and cultural theory.

In political analysis, the significance of «ideas» in the interpretation of political development has had changing fortunes, rivalled by the notions of «power», «interests», or «rational choice»; however, it is currently regaining attention on the thrust of the «argumentative», «interpretive» or «cognitive» turns in social and political sciences.

Shared narratives are not simple "stories": they at once are shaped and contribute to shape the society in which they are originated. On one side, then, they can be analysed in search of the values, actors and institutional structures they provide as societal guide and legitimation, and they can be explored as interpretation lenses to read past historical developments. At the same time, these visions are particularly relevant since they acquire the power to shape new developments, they become prescriptive, causative and performative (Nowotny, 2014; Wynne et al., 2007), defining the horizon of possible and acceptable actions, imposing classifications, legitimating actors, distinguishing issues from non-issues. When adopted in the public arena, they often influence, as choice criteria, important decisions.

Notwithstanding their importance, one peculiar feature of these kind of imaginaries is that they usually remain implicit, tacit, and their cultural origin is no longer recognised: they simply make sense, they

[11] (Weber, 1913), cited in (Sanz Menéndez & Borrás, 2000).

don't need any demonstration, and they are evoked as unquestionable bases to political actions. They are also commonly used in political debates and in media, acting as important argumentative tools when confronting different positions on the interpretation of news or policy actions.

My attention here is focused on the argumentations that are adopted in defining *publicly* political issues, in order to understand the underlying structures of thought and bring them to the surface, where they regain a public *disputability*.

Disclosing Discourses

The study of ideas and shared worldviews has a (relatively) recent but rich tradition. The importance ascribed to interpretation, communication and language is actually a peculiar feature of contemporary culture, in philosophy as well as in social and political sciences, dating back to the late XIX century. In recent years, furthermore, a renewed interest in the study of frames, imaginaries and argumentation emphasized the role of structures in the construction of individual beliefs and behaviours, counteracting the rationalist or instrumental understandings of social and political dynamics.

Since the times of Weber and Durkheim, the attention to imaginaries has played an important role in the field of social studies, and anthropology has always been concerned with shared beliefs and hidden patterns recurring in different cultures. However, scholars identify in the early '70s a discontinuity in social sciences, that they named "the interpretive turn" (Rabinow & Sullivan, 1988; Yanow, 2007), pointing to a significant increment in the study of the systems by which individuals give meaning to historical events and socio-political structures. Such a shift was influenced by the development, in the late XIX and early XX century, of new philosophies emphasizing the role of interpretation and subjective experience, opposing to the prevailing posivist approaches to social and political phenomena; Hermeneutics and Phenomenology schools in particular were influential for policy analysis (Yanow, 2007). The primacy of structure over individuals argued by the structuralist school furthermore prompted the reflections on the collective cultural dimensions of socio-political and historical phenomena, that the structuralists often studied by means of linguistic and narrative analysis. Interpreting historical change as the change in the discourses over the world was a specific trait of the structuralist school (e.g Levi-Strauss's studies on myths and Foucault's *History of Insanity*).

In this context, I am specifically interested to the conceptual frames adopted in public discourses about scientific policy by the European Union, and to how these have influenced the interpretation of past events and determine future developments. The visions we are concerned with have been named and described in a variety of ways, according to the features that the author intended to emphasize and the positioning inside his system of thought: in the following I will describe and analyse the theoretical approaches of a selected group of authors, particularly relevant for my analysis. Science policy, for its same intrinsic structure, can be observed and analysed by a multiplicity of points of views, and any review cannot

but be multidisciplinary: hence I will present the reflections of authors belonging to different fields – among which the most relevant are philosophy, policy studies, sociology and science and technology studies (STS) – , showing how converging and mutually reinforcing reflections have developed in the different disciplines and how these are relevant to the object of this study.

Collective representations. Durkheim, in "The Elementary Forms of Religious Life" (1912), designates «collective representations» the ideas, beliefs and values emerging from collective religious experiences that cannot be reduced to the sum of individual activities; these representations, according to him, help to make sense of the world, express and symbolize social interplay and are able to inhibit or stimulate actions in the group. His work on «collective representations» was taken up and continued by the social psychologist Serge Moscovici, who proposed the term «social representations» (1961) to identify the specific forms that knowledge takes when expressed by the society or by groups therein, and that are often shared as "common sense" ideas. They are evolving structures, dynamically related with phenomena, that they interpret and process in order to organize the reality and let the members of the group to behave and communicate effectively (Palmonari, Cavazza, & Rubini, 2012).

Thought collective. In the field of the sociology of science, Ludwick Fleck's notion of «thought collective», developed in the '30s, was influential on later thinkers like Thomas Kuhn and Michel Foucault. Fleck noticed that groups where people are in close intellectual contact, sharing ideas, influence each other to the point of creating a «thought collective», to which they scarcely realize to belong, and that «styles of collective thought» look to them almost impossible to criticize.

Paradigms. Kuhn' concept of «paradigms» builds on Fleck's reflections. Refusing the idea that the scientific effort is simply an accumulation of knowledge, he identifies in the history of science periods of «normal science», when scientists work to accumulate and consolidate knowledge coherently with a paradigm, and «scientific revolutions», which change the overall world view in favour of a new, often incompatible, one. Paradigms are, hence, the set of theories, rules, procedures commonly accepted and practiced by a scientific community, and revolutions point the change of paradigms.

> *(…) some accepted examples of actual scientific practice — examples which include law, theory, application, and instrumentation together — provide models from which spring particular coherent traditions of scientific research. These are the traditions which the historian describes under such rubrics as 'Ptolemaic astronomy' (or 'Copernican'), 'Aristotelian dynamics' (or 'Newtonian'),…and so on.* (Kuhn, 1962)

In the most general sense, the paradigm is more than a model or a theory alone: it's an introjected system of thought, able to make sense of scientific evidence and to set the direction for the development of the scientific work.

Epistemes. Foucault's «epistemes» resemble Kuhn' «paradigms» in that they both refer to the conditions making the existence and development of knowledge possible; specifically Foucault refers to the codes ruling the empirical «orders» in which people live, the «historical a priori» of ideas (Foucault, 1966):

> *[I am concerned to show] in what way, as one traces - against the current, as it were - language as it has been spoken, natural creatures as they have been perceived and grouped together, and exchanges as they have been practised; in what way, then, our culture has made manifest the existence of order, and how, to the modalities of that order, the exchanges owed their laws, the living beings their constants, the words their sequence and their representative value; what modalities of order have been recognized, posited, linked with space and time, in order to create the positive basis of knowledge as we find it employed in grammar and philology, in natural history and biology, in the study of wealth and political economy. Quite obviously, such an analysis does not belong to the history of ideas or of science: it is rather an inquiry whose aim is to rediscover on what basis knowledge and theory became possible; within what space of order knowledge was constituted; on the basis of what historical a priori, and in the element of what positivity, ideas could appear, sciences be established, experience be reflected in philosophies, rationalities be formed, only, perhaps, to dissolve and vanish soon afterwards.*

Foucault recognizes in the period of time spanning from the XV to the XX century two discontinuities: the first, at roughly half of the XVII century, ended the Renaissance period and opened the Classical Age, which lasted until the beginning of the XIX century, when the Modern Age began. Each period is characterized exclusively by one «episteme» at a time, able to coherently base all theoretical and practical knowledge.

Symbolic universes. While Foucault's concept of episteme is centred on knowledge pre-conditions, Berger and Luckmann's «symbolic universes» focus on the legitimizing aim of the shared structure of beliefs. Institutions, according to them, need to be explained and justified: this happens through linguistic transmission, proverbs and common sense expressions, specialist rationalizations, all concurring to the construction of symbolic universes. These encompass and explain all aspects of life and are able to integrate different spheres of meaning; multiple symbolic universes can coexist in complex societies and can generate conflicts. Symbolic universes are self-legitimizing; when they become a problem, for generational shifts or intercultural confrontation for example, specific procedures of universe-maintenance are undertaken, often by elite groups, among which Berger and Luckman recognize the creation of the discourses of mythology, theology, philosophy and modern science (Berger & Luckmann, 1967).

Metanarratives. The French philosopher Lyotard introduced in 1979 the concept of «métarécit», or metanarrative, which has remained as one of the most cited, often under the denomination of «master» or «grand narratives», even in "pop" culture. Metanarratives, similarly to Foucalt's epistemes, are introduced by Lyotard in order to describe the structures of thought that distinguish the past eras; the accent is here, however, on the narrative character of these all-encompassing argumentations: knowledge was expressed

by means of stories in traditional societies as well as in modern times. The end of these «big narratives» would be, according to him, the key feature of the «postmodern» condition of knowledge (Lyotard, 1984):

> *Simplifying to the extreme, I define postmodern as incredulity toward metanarratives. This incredulity is undoubtedly a product of progress in the sciences: but that progress in turn presupposes it. To the obsolescence of the metanarrative apparatus of legitimation corresponds, most notably, the crisis of metaphysical philosophy and of the university institution which in the past relied on it. The narrative function is losing its functors, its great hero, its great dangers, its great voyages, its great goal. It is being dispersed in clouds of narrative language elements—narrative, but also denotative, prescriptive, descriptive, and so on.*

The metanarratives Lyotard refers to are the «Enlightenment» and «Idealistic» ones: the first framing knowledge as an emancipatory instrument, favouring the progress and freedom of mankind, the second promoting disinterested, pure knowledge. These conceptual frames could not only explain, but legitimate knowledge: when intersecting with society, they were able to make sense of historical developments and justify existing power relations and traditions. One of the peculiar features of such master narratives, underlined by Lyotard, is the shift from description to prescription: metanarratives, in this sense, are not simple stories because they have a *prescriptive* nature; unlike pure denotative discourses, they position in the range of values and are able to influence individual choices and societal developments. Lyotard's judgement on *métarécits* was clear: these are to be considered instruments of oppression, because they tend to be all-encompassing, excluding any other vision and working to reinforce power structures.

Metanarratives are described as very comprehensive systems of long-term historical meaning-making, totalitarian in their effect of foreclosing alternatives; Kuhn's «paradigms» play an analogous role in the more restricted arena of the scientific community; Foucault's «epistemes» represent the historical *a priori* of knowledge. These ideas can be regarded as the most-encompassing connotations of conceptual systems, able to denote long historical periods; consequently, one of their shared distinctive feature is resistance to change.

Policy frames. The research about analogous systems of thought in policy analysis focuses on more dynamic structures, retaining the same cognitive and prescriptive capabilities, but being more adaptable to changes, and less comprehensive: different policy discourses can coexist, and the confrontation on such different visions is a natural feature of the political arena. Nonetheless, policy scholars have recently re-valued the role of ideas in policy change, problematizing hidden or implicit conceptual frameworks affecting conflicts resolution. The field of policy analysis, moreover, is not only concerned with the observation and description of political developments, but rather it is oriented towards developing visions and instruments actively useful in policy negotiations. The scholars Donald Schön and Martin Rein developed in the early '90s the concept of «policy frames» (Schön & Rein, 1994) to overcome the difficulties in the resolution of

«intractable policy controversies», which they define as the ones which cannot be solved resorting to facts (conflicts that can be solved through successive bargaining are named just «disagreements»).

Policy controversies cannot be solved on the basis of cost-benefits analysis, as would argue the rational choice school, nor negotiating on competing interests, which can be disproportionately unbalanced, nor trying to balance win-win policies satisfying all stakeholders, a compromise that doesn't take into account the fluidity of groups and cannot address conflicts over basic values. The authors propose, then, a «frame-critical approach»: «intractable» conflicts can be re-framed by policy actors who reflect «in action on the frame conflicts that underlie controversies». This process might not lead directly to resolution but could creatively modify the conflict and open up communication channels. «Action frames», or frames underlying policy practices, are distinguished by Schön and Rein in «policy frames» that the actors use to construct specific policy problems, «institutional frames», wider visions embodying the institutions' prevailing belief system, and «metacultural frames», or culturally shared narratives, metaphors and symbols. Once again, the key feature of frames is the deflection from pure description in favour of normativity: different frames imply different types of envisaged solutions, which are seen as «graceful, compelling, even obvious» (Schön & Rein, 1994). Frames do not erase the importance of interests, but they concur in defining the different actors' perceptions of which are their respective interests. Frames are difficult to handle: the same issue can be viewed coherently in more than one frame, belonging to different policy actors, hence often the need of cross-frame communication arises; the non-existence of a neutral frame could imply the in-principle failure of the debate, given that all the frames are equally relative; moreover, it appears to be very difficult indeed to recognize each actor's own frame from inside, and hence there is no possibility of any unbiased reconstruction of others' frames. The authors anyway analyse different policy conflicts and design several processes that can help reducing the incommunicability across frames, possibly leading to the conflict mitigation, especially at the practical level: Schön and Rein's reasoning, as already mentioned, is particularly oriented to real policy practice.

The argumentative turn: argumentations, discourses, narratives, deliberations and rhetoric. The 1993 book *The Argumentative Turn in Policy Analysis and Planning* marked a new orientation in the field of policy analysis, taking stock of the ongoing valorisation of the role of language and argumentation in policy making (Fischer & Forester, 1993):

> *What if our language does not simply mirror or picture the world but instead profoundly shapes our view of it in the first place? (…) If analysts' ways of representing policy and planning issues must make assumptions about causality and responsibility, about legitimacy and authority, and about interests, needs, values, preferences, and obligations, then the language of policy and planning analyses not only depicts but also constructs the issues at hand. (…)*
>
> *This book, accordingly, explores practically and politically a simple but profound insight: Policy analysis and planning are practical processes of argumentation.*

The starting point of the authors' analysis is the departure from the «dominant empirical, analytic approach to problem solving», in favour of a new approach that focuses on «argumentation» as the way by which «people – including opponents – reach and justify mutually acceptable decisions», embracing «an understanding of human action as intermediated and embedded in symbolically rich social and cultural contexts» (Fischer & Gottweis, 2012). Drawing from Habermas' reflections on communicative action and converging with the contemporary developments in social sciences on discourses, interpretation, deliberation and social constructivism, the «argumentative» approach investigates the processes of policy argumentation, «in particular as reflected in the thoughts and deliberation of politicians, administrators, and citizens».

The authors discuss the concept of argumentation, in comparison with the related notions of discourse, narrative, deliberation and rhetoric. Argumentation, they argue, refers specifically to the process by which people «seek to reach conclusions through reason» engaging in persuasive dialogues, by means of «formal logic», but also of «informal logic» and «practical reason». Argumentation, hence, is very close to «deliberation», although with a stress on the linguistic nature of the concept. Conversely, «rhetoric» refers to the methods of argumentation, both for what concerns the linguistic structure and the communicative means in relation with the audience; although in common language rhetoric has acquired a negative connotation, it is an essential aspect of argumentation, aiming at constructing a «particular representation of reality» focused on the audience, instead than on the object itself.

While rhetoric is a specific facet of argumentation, a «discourse» is a more general concept, pertaining to «a body of concepts and ideas that circumscribe, influence and shape argumentation»; a discourse, then, is a set of ideas, concepts and categories that constitute the reference world view and to which arguers draw when trying to persuade others. Such a "pool" of reference, then, includes and circumscribes «the views that can be legitimately accepted as knowledge, and constitutes the actors taken to be the agents of knowledge»; a discourse acknowledges the shared set of values and «supplies society with basic stories and narratives that serve as modes of behaviour».

Moreover, discourses don't need to be completely coherent, but they usually incorporate «conflicting, unresolved elements» deriving from the historical struggles that have shaped that specific mind-set; discourses, finally are continuously evolving, since no argumentation is deterministically shaped by the available knowledge, but contributes to produce new rationales and narratives better suited to the context.

«Narratives» and discourses are often used as synonymous, although narrations, unlike discourses, are essentially stories: they are structured as a sequence of events by which experiences are meaningfully reconstructed and related orally or in written form to other people. Narratives are then, *stricto sensu*, contained inside discourses.

The role of ideas in European policy analysis. In the context of the EU studies, Sanz Menendez and Borrás reviewed the «role of ideas in policy change» (Sanz Menéndez & Borrás 2000; Borrás 1999) when

discussing what Borrás called a «cognitive turn» in EU studies. In the late '90s ideas and values acquired new relevance in EU policy-making, following the Communities' shift from exclusively economic to political entity with the Maastricht Treaty, that revamped the discussion about the European legitimacy. Before that moment, the traditional approaches in EU studies had analysed the dynamics of interests as the prevailing frame of analysis, marginalising the role of conceptual dynamics: ideas were mainly considered as instrumental argumentative tools in interest negotiations. A central contribution to this «cognitive turn», according to Sanz-Menéndez and Borrás, came from Institutional scholars, who began evaluating the role of policy makers' and experts' individual cognitive backgrounds in policy deliberation: they underlined the fact that some «paradigms» (a concept drawn from Kuhn's works) prevailed on others when these were promoted in institutional contexts like universities and think tanks and shared by influencing groups. Within the academic community of the European studies, however, Borrás recognized different level of commitment, distinguishing between strong cognitivists – who argue for a substantial constructivist approach, emphasizing the essential embeddedness of actors in their societal context, and opposing the rational choice or interest bargaining understandings of policy processes – and weak cognitivists – who are willing to include the dynamics of ideas among the other relevant factors, in a complementary position (Borrás, 1999).

Socio-technical imaginaries. The analysis of the policies specifically centred on science adds further complexity to the study of conceptual frames: scientific policy, indeed, situates at the intersection of different sectors – politics, society, science, economics – each with its own view of the issues at stake and with a specific understanding of the relevant social actors, their interactions, and the legitimate goals of actions.

Recently, Jasanoff and Kim have proposed the concept of "socio-technical imaginaries" to describe collectively shared visions where techno-science plays a central role (Jasanoff & Kim, 2015):

> *(…) we redefine socio-technical imaginaries as collectively held, institutionally stabilised, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology.*

According to the authors, socio-technical imaginaries connect the socio-political theorizations of collective imaginations and the complex, but «politically neutered» descriptions of hybrid socio-technical systems in in STS (Science and Technology Studies). Socio-technical imaginaries, they argue, are distinct from the aforementioned political conceptualizations, and from other commonly related notions: they are less monolithic than master narratives, more connected to imagination than ideologies, wider in scope and longer-termed than plans or projects. Allowing for the coexistence of multiple visions, they avoid determinism and «restore some of the indeterminacy of history». Moreover, they are deeply intertwined with practice, performance and «materialization through technology», and less focused on language than discourses. They are finally specifically pertaining to the social area «below the seats of power», differently

from public reason, which is more related to institutionalized exchanges between citizens and ruling class (Jasanoff & Kim, 2015, p. 20).

Jasanoff and Kim underline how socio-technical imaginaries are often particularly exposed in some specific contexts, where they are forced to crystallize in a permanent shape, and therefore can be identified and studied. These are the languages of power and social ordering, like political discourses, laws and legal disputes, and the arenas where these are spread and discussed, such as popular culture, communication, media and advertising products.

Performative political imaginaries. Performance is an aspect of collective imaginaries that Jasanoff and Kim highlighted in their description, drawing from the work of the political scientist Yaron Ezrahi on contemporary democracies and the contribution of science and technology to them as a continuous public, and legitimating, demonstration of power (Ezrahi, 1990, 2012). In the shift to post-modern democracies, he argues, the founding myths of modern democracies – natural law, autonomous individual, rationality, progress, faith in the possibility of consensus based on scientific facts – are eroding, showing the «bottomlessness» of power structures. New political metaphors, he asserts, refer no more to the «machine», but to the «theater», and the political performance of leaders is of increasing importance. In order to avoid «both anarchy and tyranny», democracies need to reinvent their repertoire of «cultural and political grounds», and «collective political imagination» represents the main instrument of this process (Ezrahi, 2012, p. 3):

> *I will argue that some political fictions become more real than others, insofar as they function as causes of political behavior and institutions. (…) I define these causative fictions as imaginaries. Political imaginaries, for our purpose, refers to fictions, metaphors, ideas, images or conceptions that acquire the power to regulate and shape political behavior and institutions in a particular society.*

«Performative political imaginaries», according to Ezrahi, are more advantageous, as analytical tools, than the other more traditional notions of myths, ideas and political knowledge, in that they link the «normative, cognitive, and emotional components of politics» (Ezrahi, 2012, pp. 7–8):

> *(…) the imagination is probably the most neglected form of power in the field of modern political science and, in particular, political theory. One of my main concerns is with the question of how the restoration of the imagination to its rightful place in our understanding of politics could and should affect political theory, political arguments, and, most importantly, our interpretations of political practice. It is because the political imagination is indispensable to the creation of the political order while also inherently dangerous to its very stability that it constantly problematizes the political.*

Collective imaginaries are «necessary fictions» that make democracy work, hiding its inner machinery, and invoking the suspension of disbelief – usually evoked for novels or theatrical performances – «to authorize public decisions and actions in the midst of uncertainties and differences of opinions, while

enabling tolerance for the incoherences, ambiguities, and compromises that are inescapable in any government by the people» (Ezrahi, 2012, p. 320).

Conceptual frameworks. While for Ezrahi political fictions should not only be criticized, but regarded as necessary elements of any real political systems, the political scientist Benoit Godin, in his work on «conceptual frameworks», shows a rather negative judgement of rhetoric, used, according to him, to manipulate consensus in the political arena and sustain policy-making everyday activity.

He has recently compiled a review of conceptual frameworks in science, technology and innovation policy in the period 1945-2005 (Godin, 2009) where, building on Schön and Rein's notion of «frames», he analysed some relevant conceptual constructions invoked in post-war policy-making. His work is here particularly relevant for the structure he observed in scientific policy discourses:

> *I define a conceptual framework as an argument or discourse that acts as an organizing principle to give meaning to a socioeconomic situation and answers to a series of analytical and policy questions. Ideally, a conceptual framework:*
>
> *1. Identifies a problem, its origins and the issues involved;*
>
> *2. Suggests an explanation of the current situation;*
>
> *3. Offers evidence, often in terms of statistics and indicators;*
>
> *4. Recommends policies and courses of action.*

Often, he argues, policy frames are constructed as stories, or «narratives», which are able to give meaning to situations. In case of science policies, these typically have the following structure(Godin, 2009, p. 14):

> *1. Premise: science, technology and innovation are good for you and for society.*
>
> *2. Something new is happening in society (CHANGE) and it is quite different from the past.*
>
> *3. Let's call this change … (NEW NAME).*
>
> *4. The new phenomenon or event will generate big effects, rewards/returns.*
>
> *5. Let's collect STATISTICS as evidence.*
>
> *6. It is essential that policies be developed.*
>
> *7. Let's imagine a FRAMEWORK to this end.*

Meaning-making, prescriptive, structuring, tacit: discourses and conceptual frameworks. All the described formulations share the principle of recognizing the importance of conceptual structures to the political ordering of societies, both as meaning-making of past history and as providers of coherent direction for future actions; these tools, in other words, are characterized by their effective past-projected interpretive functions combined with their powerful prescriptive effect on future policies.

As for the structuring effects they have on society, paradigms, epistemes or symbolic universes are able to define social relations, to legitimize institutions and power relations, and to define the relevant knowledge and its direction of development. At the same time, they share the feature of being

predominantly hidden, tacitly referred to in debates and only rarely brought to the surface of public confrontation. Furthermore, they don't need to be demonstrated, they are self-legitimizing, with the consequence of appearing hardly contestable from the inside and possibly reaching the extreme consequence of working as totalitarian ideologies.

When dealing with the European scientific policy documents, we are naturally not expecting to find all-encompassing structures like Lyotard's metanarratives, Foucault's epistemes or Kuhn's paradigms: however, these are powerful reference concepts (and guides for understanding) when researching sub-universal thought systems with analogous interpretive and prescriptive effects.

In the following, I will analyse the incorporation of thought structures in politically relevant documents of science policy: the key operational references will be the notions of discourses, as described by Fischer and Gottweis, and of conceptual frameworks, as developed by Godin (after Schön and Rein's frames). In fact, these approaches have been developed to interpret (and possibly help solving) policy controversies and are particularly suitable to analyse documents that represent the written outcome of political negotiations, like the Commission ones, and position papers developed with the aim of being used in successive bargaining, like experts' reports: discourses retain the marks, and even the eventual contradictions, of previous confrontations. I prefer not to use directly the concept of argumentation, though, since the EU documents I will study have not been developed to be directly used in confrontations – as would be for lawyers' pleadings or politicians' speeches for example – but are conceived as a pool of reference of ideas, concepts and categories, useful to decision-makers or able to form the basis of long-term strategical positions. The viewpoints expressed in science policy documents, moreover, are often rooting on in-principle visions, including value-related points of view, and are consequently more prone to give rise to "intractable" controversies, well described by Schön and Rein's frames, than to solvable problems, reducible to interests bargaining.

Additionally, I will use Godin's observations on the structure of policy discourses and narratives, sometimes adapting them to the description of my specific context, while from socio-technical imaginaries I will maintain the attention paid to science, with its rich and specific nature and its complex interplay with society, and the accent on public performance, as described by Ezrahi.

Unravelling the policy-making tangle: the actors' experiences and the documents' conceptual foundations

A complex institution's process of policy design is never a simple, technical, procedure: it embodies the very self-definition of the group, in the passage from the ideas and values to their concretization in actions; it involves a multiplicity of interplay levels, that cooperate in shaping and developing the institution's political visions and influences its future evolution. Research policy conceptual frames are chosen, shaped and established throughout this process.

Exploring European policy discourses in order to identify the conceptual frames on knowledge production proved to be a demanding objective, both in the phases of discourses analysis and for the previous necessary stage of context recollection.

The main instrument I decided to adopt for the exploration of conceptual frameworks and policy narratives was documental analysis: European Union is characterised by a remarkably prolific production of documents of different types and scopes which is very often the prominent medium by which the community exchanges information internally, between the institutional bodies, and with the Member States, the involved stakeholders and the citizens. Although complemented with other forms of communication – meetings and workshops, consultations, and, most recently, audio-visuals – documents represent the preferred instrument by which the European Union communicates formally its political positions and developments. Furthermore, EU documents are frequently regarded as the reference for the development of subsequent policies, both at the European and at the national levels.

Since every document is a «situated product» (De Lillo & Arosio, 2010; Prior, 2003), inevitably connected with the context in which it was produced, the first period of my research was devoted to the study of European policy-making in the scientific field. To understand the formal and informal stages of the process and investigate the role and involvement of the relevant actors, I realized a small group of pilot interviews to people chosen for their institutional positioning along the policy-design chain, from which I obtained information on the details of the procedure, especially with regards to the production of documents, as well as interesting insights on the interviewees' personal experiences and their evaluations of the European research policy.

How does European scientific policy-making work? Pilot interviews to stakeholders and policy-design actors

To understand the context in which the policy documents were produced, I needed to trace the European policy-making process in the scientific field. Alongside written accounts of policy scholars, describing the EU procedure in general terms (e.g. Borrás et al., 2009; Princen, 2011; Wallace, Pollack, & Young, 2015; Wallace & Wallace, 2006), and publicly available information (e.g. EP, n.d.-a, 2011, 2013), I

decided to realize some interviews to people participating to the specific process regarding research policies definition, chosen according to their role inside the involved institutions.

The purpose was multifold: these people could actually guide me in understanding the details of the procedure, both in its formally defined structures and in the informal aspects, while at the same time I could obtain an evaluation of their experience inside the process. They could, in other words, describe the landscape of EU research funding programmes and instruments in which the policy documents are produced, evaluate the processes and political dynamics they identified and provide a significant diachronic account, identifying and assessing evolution, turning points and perceived changes in EU R&D support and coordination activities.

The interviewees and their role are listed in Table 2. Naturally, the number of the interviews is not enough ample to represent a proper social research, nor this was their aim. The interviews were relevant to obtain information on the procedures' fine details and to shed light on some blind spots of the process; secondly, they were important to compare the written institutional procedural summaries, often inherently aseptic, to real experiences, and to obtain insights on the process and personal evaluations from different strategic standpoints. Not least, the interviews were useful for their insights on the intersection of personal experiences, knowledge and beliefs with the conceptual frameworks discussed in policy offices and used in documents, critically informing policy choices.

The interviewees' positions in the policy-design process. The choice of the interviewees was primarily connected with their institutional task: they all shared the feature of playing a role in the European process of policy development, particularly at the crucial stage of policy-design.

Studying the process, I mapped the formal groups involved in the definition of research policies, focusing especially on the phase of policy-shaping centred around the Commission, taking place before the policy proposal is submitted to the Parliament and the Council for the formal legislative procedure. The majority of policy documents are produced along this policy-shaping chain, whose principal actors are listed, along with their role, in Table 1. An exception is represented by the documents published on the Official Journal, which undergo also the subsequent legislative procedure, and result from the negotiations on the Commission proposals carried out by the European legislative bodies; the Parliament is especially active in discussing the proposals, and its marks on the documents are discussed throughout this work.

Table 1: The principal actors of the EU policy-shaping process in the field of research policies.

Policy-shaping actor	Role in the policy-shaping process
Commission Directorates (DGs)	Organise the development of policy proposals, collecting the information base and the policy orientations, gathering inputs from the stakeholders, commissioning expert advice, negotiating policy contents and drafting the documents on which the legislative bodies will work.
Public administrations	Provide political input based on the national interests on contents, instruments and budgets.

Policy-shaping actor	Role in the policy-shaping process
National delegates	People entrusted by the Governments to express the National position on a specific issue to be inserted in research policies.
National Contact Points (NCPs)	The network of reference people and organisations chosen by governments to offer country-specific practical information and assistance on the participation to Framework Programmes.
Joint Research Centers (JRCs)	European Commission in-house science and knowledge research service to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.
Lobby groups	"Interest Groups" (IGs), working to influence the design and execution authorities[12].
Research infrastructures	Provide input on contents, instruments and budget allocation regarding their specific field of activity at diverse stages of policy-design.
Researchers in the field	Provide input on contents and instruments regarding their specific field of activity.
Universities	Provide input on contents, instruments and budget allocation regarding their specific fields of activity at diverse stages of policy-design.
Companies and SMEs	Provide input on contents and instruments regarding their specific field of activity.
Consulting companies	Provide advice on design and evaluation of policies, and carry out technical assessment of behalf of the Commission.
Non-governmental Organizations (NGOs)	Provide input on contents and instruments regarding their specific field of activity.
International organisations	Provide input on contents, instruments and budget allocation regarding their specific fields of activity at diverse stages of policy-design.
Citizens	Provide their opinions answering to public consultations.

To explore the origins and features of conceptual frameworks, I focused my attention on the phase of policy-shaping, and identified a group of interviewees involved in this process.

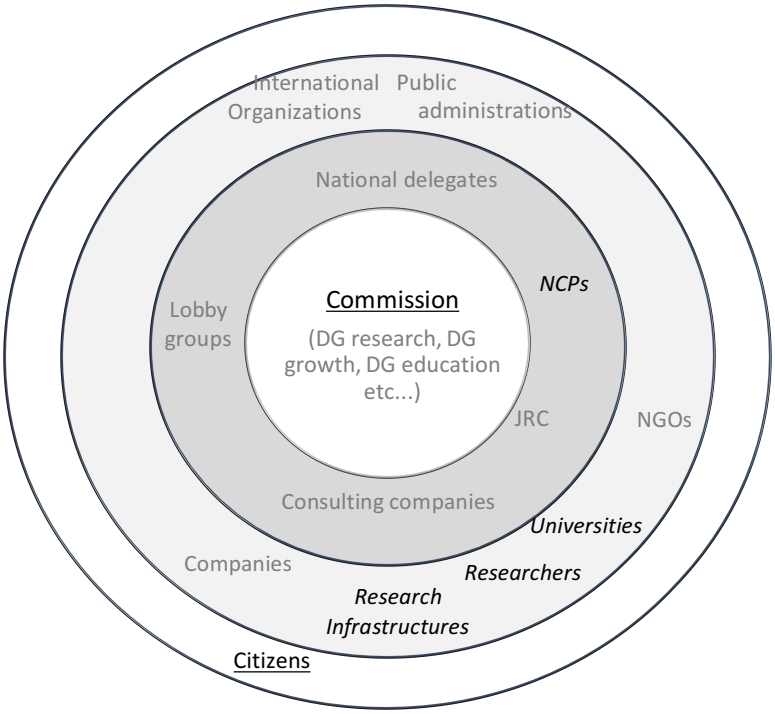
Along the process, a sharp step can be recognised between the involvement of the actors working inside or next to the European Institutions – mostly, in the case of the elaboration of scientific policies, at the Commission – and the actors, whose activity is closely related to EU policies, working outside Brussels: while the first are more involved in the first phases and can actually orient the policies, the second group is consulted at later stages and usually provides inputs on the details concerning their specific interest field. Fig. 1 schematically depicts the 'layers' I recognised around the Commission Directorates – the main actor of policy-shaping – distinguished according to their different involvement with the process. The inner circle represents the Commission offices in Brussels, where the development of the policies is organised, the inputs collected and the policy documents committed or realised; the external one depicts the position of the European citizens, which are the final recipients of the policies. The two inner circles (in grey) show the

[12] Their activity in the EU context is regulated by the Treaty of Lisbon as "European Interest Representation".

intermediate actors, mainly stakeholders and knowledge brokers, and it is distinguished into two further layers: the darker one, where some of the actors more involved with Brussels offices are listed, and the light-grey one, where the remaining ones are included.

Alongside the formal positioning of actors, the literature and the progress in the interviews has shown that a dense network of informal exchanges of ideas and interests taking place below and alongside the formal procedure: consequently, many actors are connected to diverse roles at the same time, or interact with the Commission through various channels and at multiple stages[13].

Fig. 1: A schematic depiction of the different actors participating in the European policy development chain, and the positioning of the interviewees (in black italic).



Although not covering the entire spectrum of the actors participating to the definition of the policies, the interviewees appear to be well distributed in the intermediate layers, and sufficiently diverse to represent different perspectives. The interviewees positions and roles are listed and explained in Table 2.

Table 2: The interviewees and their institutional role.

Interviewees' position at the host organization	**Role in the policy-making process and relations to EU structure**
Senior scientist, CERN	Lobbying activity in favour of a scientific community sector; Experience of advisor to the European Commission; Coordinator of European Projects and ERC grantee.

[13] See the chapter on *The scientific policy-making process in the European Union.*

Interviewees' position at the host organization	Role in the policy-making process and relations to EU structure
Member of the EU Support Office at CERN	Development of inputs to the Commission and the Parliament in relation to consultations addressed to CERN as stakeholder of EU policies and big European research infrastructure.
National Contact Point	Italian National Contact Point.
ARIC – Research and Third Mission Division at University of Bologna	Development of opinions in relation to her concerned field in occasion of consultations where the University plays the role of the stakeholder.

The first interview I realized was to a senior scientist at CERN, whose scientific career intertwined with an enduring effort to organize and reinforce its research sector through the creation of international collaborations, not least in the European frame: he personally obtained an ERC grant. His standpoint, hence, is from a high-level position in the researchers' community, partially disentangled from the national interests for his affiliation with CERN; moreover, his experience returned a career-long history of reflections on the management and organization of research, with a constant attention to political support.

The second person I could interview was from the CERN European projects support office: in addition to assisting and helping the management of the projects ongoing in the laboratory, his office was repeatedly involved by CERN's Director General in the elaboration of inputs for the European consultations on the development of scientific policies, particularly the Framework Programmes, both by the Commission and by the Parliament. His standpoint, then, is next to the higher levels of a European relevant laboratory, involved in thorough reflections on the nature and directions of European research, and personally witnessing the policy-making mechanism concerning its organization.

I had the chance, then, to interview his counterpart in a University organization: the third interviewee was from the office devoted to Research and Third Mission at the University of Bologna. From her viewpoint, she could observe and participate to the involvement of the University in the European policy definition phases, reviewing the Work Programmes[14] and suggesting greater emphasis for some issues pertaining to her field or even the inclusion of forgotten subjects. Although she was not involved in the policy-definition phase, her testimony was very useful on the involvement of academia in the process of refinement of the policies and on the institutional actors included.

These three interviewees can be securely positioned, both for their institutional role and for their testimony, in the outside light grey layer of Fig. 1, with the other stakeholders which are autonomous from the Commission; the following interviewee's position, conversely, is closer to the Commission, both by formal affiliation and professional experience, even though her role's influence on the definition of the policies is not so straightforward.

[14] The preparation of Work Programmes and their relation with Framework Programmes establishing acts and calls is described in section *The EU decision-making process(es) for scientific research*.

The fourth interviewee, in fact, was belonging to the Italian Agency for the Promotion of European Research (APRE), which represents the National Contact Point (NCP) for H2020: devoted NCPs exist for every issue in the Programme in each country involved in the Framework Programme (including associated and third countries). Their role is to provide information, guidance and support to all the participants and potential applicants to the Programme; they are nominated by national governments, but they interact directly with specific Commission officers. The interviewee insisted on the fact that the NCPs' task is predominantly technical, in the sense that they don't provide support for political choices in Brussels, nor they collect requests of political pressures from the Italian stakeholders. Naturally though, from her position she had the chance to observe from a privileged standpoint – next to both the national government and the Commission, and in touch with the national stakeholders' community – the dynamics of European scientific policy-making in the last two decades.

Each interviewee shed light on a specific channel of interaction with the European Commission, and showed to be interested in reconstructing the complete landscape of research policies design, which, however, none of them showed to grasp completely – nobody could answer to the final question on the political responsibility of European scientific policy decisions.

Interviews type and contents. The interviews were semi-structured, flexibly answering to the emergence of themes during the conversation. After a brief introduction on my research topic, I explored the biographical background of the interviewees, and asked for a description of their professional task and role inside their host institution; the core of the interview, then, covered two main poles: their experience with the European policy-making in the scientific field and their knowledge and evaluation of scientific research in Europe. The first focus was stimulated by means of examples of involvement in the process – their eventual contacts with policy-makers, their employment as advisors, or their participation to policy negotiations on R&D issues – and further explored asking for the details of their experience, their identification and evaluation of the procedure, of the involved actors, of the information base, of the decision-makers.

The second, conceptually broader, pole was explored by asking the interviewees' opinion about the strengths and weaknesses of the European system, about their ideas on the orientation of EU research policy and about their experience of the historical and ideational development of European R&D programmes: conceptual origins, turning points, instruments comparisons. The interview usually was concluded with a question on their opinion on where, and by whom, the fundamental decisions on research policy ideation and development were taken.

The description of the policy-making process reported in section *The EU decision-making process(es) for scientific research*, and the identification and analysis of the three main conceptual frames described in chapter *Frames and narratives in EU policy discourses on science* were confirmed and notably enriched by the personal experiences and evaluations of the interviewees.

How does Europe talk about science? The choice and analysis of the policy documents

Political discourses are interesting sources to analyse the dynamics of every political entity: policy documents are even more important in a context like the EU where the internal political debate is weaker than in nation states, and consequently most decisions ground on previously established strategies, expressed mainly by means of written reports. The abiding reference to previous EU decisions or strategical frames is characteristic of European documents, be them laws, Commission's positions or experts groups reports.

The documental production of the European Union is particularly abundant and, also thanks to the digital archives, it steeply increased in size in recent years. Consequently, it appeared not feasible to read and analyse all the R&D-related documents of the European institutional bodies (the keyword "research" on the EU documental repository online gives 75704 results[15]), especially if the analysis is intended to be conducted qualitatively, and only for a tiny part by means of computing instruments.

The choice of the documents. All the analysed documents were institutional public documents, diffused by the European bodies and available in public repositories: hence, all the documents were drafted and circulated to express an official vision, even though time- and context-dependent, belonging to EU institutions about specific aspects related to research policy.

The prime criterion employed in the choice was the importance ascribed to policy documents inside documents themselves: beginning with the most recent, I traced back the history of references in the analysed documents, considering the frequency or emphasis of the citations as an indicator of relevance – a snowball-type sampling method. For example, the Sapir, Strauss-Kahn, Kok and Aho reports were cited as notably influential in the development of the Lisbon strategy by the account on the design of the 7th Framework Programme drafted by the Commission research policy officers (Muldur et al., 2006, pp. 76–77), and references appear in numerous other documents.

Secondly, I favoured the documents showing a wider-ranging political gaze, rather than reports narrowly focused on specific or particularly technical issues (the Commission is exceptionally prolific in producing such reports).

Table 3 shows the principal types of analysed documents, distinguished by authors, recipients and aim.

[15] Research on the EU law and publications repository (EU, 2017), realized on Nov. 30, 2017.

Table 3: The most relevant documents with regards to scientific policy-making analysed in this work, and their main features.

Documents	Authors	Recipients	Time period	Aim
Framework Programmes establishing acts	EU law-making bodies[16]	European bodies, Member States, citizens[17]	1984-2014	Normative and descriptive acts
ERC establishing acts	EU law-making bodies	European bodies, Member States, citizens	2006-2013	Normative and descriptive acts
Commission policy docs	Commission	Council, Parliament, Member States	ca. 1990-2017	Prepare and describe the relevant political decisions
Commission Green Papers[18]	Commission	EU stakeholders	ca. 1990-2017	Organize and communicate policy lines for debates and consultations
Reports	Experts Groups, mandated by the Commission	Commission	ca. 2000-2017	Provide the science base and an expert opinion on a policy issue
Commission policy officers' books	Commission policy officers	R&D policy concerned public	1998, 2006	Trace, explain and legitimize the work done in preparation of the Framework Programmes
Communication documents (leaflets, videos, institutional magazines)	Mostly Commission	Research funding concerned public, European public at large	ca. 2006-2017	Spread information and generate consensus on EU policies

Framework Programmes and ERC establishing acts are the legal acts, published on the European Official Journal, enacting the initiatives, and describing their rationales and contents.

The Commission policy documents, usually identified with the labels COM or SEC, describe the Commission's proposed legislations and their preparatory documents for the other EU bodies and the Member States. Among the documents issued by the Commission, the Green Papers are documents meant to stimulate a debate and organize consultations. White Papers are the usual outcomes of such consultations (in the table they have been considered inside the group of Commission Policy docs). A particular group of documents originating from the Commission are the two books drafted by the Commission policy officers responsible for the preparation of the Framework Programmes; these documents, although published in a form other than ordinary one, proved particularly significant for the exploration of research policy procedures and conceptual frameworks from the standpoint of the Commission.

[16] The EU law-making bodies changed over time together with the evolution of the EU institutional asset: the first Framework Programmes (up to the third) were established by the Council, while from the Fourth on the law-making bodies were jointly the European Parliament and the Council.

[17] Depending on the type of act, and on the legal framework in force at the time of publishing (see also note 16), European laws are binding to varying degrees and for different subjects. However, we can say that European legal acts, as communication products, are relevant for all the actors of the Union.

[18] Although Green Papers are part of the Commission policy documents, they are presented as distinct entries in this table because of the different recipients: contrarily to ordinary policy documents, containing political proposals to be evaluated by the other institutional bodies, the Green Papers are targeted to the widest public of European stakeholders.

European bodies, and especially the Commission, notably rely on experts groups for enriching the decision-making knowledge base and evaluating the advancement of policy initiatives: the experts' positions are expressed in reports, to be subsequently employed for the development of policies.

Finally, although not institutional documents *stricto sensu*, communication products provide a specific interesting perspective on the Commission's research policy framing (e.g. the introductory video on Horizon 2020 repeatedly cited in chapter *Frames and narratives in EU policy discourses on science* for its concise inclusion of many of the analysed features of the frames).

The group of documents on which the research was based is reported in the tables below, and, to my knowledge, these constitute the most influential conceptual milestones that concurred to shape the current European research policy physiognomy, or represent notable keys for the interpretation of the different perspectives.

The Framework Programmes and the ERC establishing acts

The final outcome of the policy-making process, involving Commission, Council and Parliament[19], is a legal document (or a set of legal documents) published on the Official Journal of the European Union (OJEU)[20] and binding for each Member State.

These documents are very interesting for this research project since they are active instruments by which the Union exerts its influence on European science, while at the same time they are lengthy and detailed descriptions of the scientific landscape visions belonging to the European Institutions, and of their projects to modify it. Moreover, these documents bear the signs of the complex negotiations conducted among the policy-making actors to reach the agreement on the final text.

The Framework Programmes establishing acts (Table 4) are constituted of a short first part, more formally legal, where the purposes and main features of the Programme are listed, together with the general provisions and the references to other legislation; the second, more extended, part (usually in the form of an Annex) contains the details of the Programmes structure, and each research theme is explained with regards to its aims, contents, and relevant issues; an Annex concerning the total budget and the shares devoted to each issue is always included as well. On the basis of this documents, work programmes are constructed and calls for applications are launched.

The relevant difference in length between the first Programmes establishing acts and the last ones (the First Programme, dated 1983, is only 4 pages long, while FP6 is 33, FP7 is 41 and Horizon 2020 is 69) provides an additional evidence of the increasing importance of Framework Programmes in European scientific policy-making.

[19] Described in the section *The scientific policy-making process in the European Union.*
[20] Called until 2003 "Official Journal of the European Communities (OJEC)".

The authors of the establishing acts changed over time with the evolving European legislation on the law-making bodies: the first three FPs were promulgated by the Council alone, while all the following required also the involvement of the European Parliament; the type of legislation transformed as well: the first Framework Programmes was proposed through a Council *resolution*, not legally binding, while the following were Council decisions, binding on those to whom they were addressed; Horizon 2020 was set up with a *regulation*, i.e. the strongest form of binding legislative act, to be applied throughout the Union (see Table 4 and Table 11).

Table 4: The Framework Programmes establishing acts formal denominations and references.

Author(s)	**Title**	**Year**	**OJEC/OJEU ref.**
Council of the European Union (CEU)	*Council resolution of 25 July 1983 on framework programmes for Community research, development and demonstration activities and a first framework programme 1984 to 1987.*	1983	OJEC C208, 4.8.83
CEU	*Council decision of 28 September 1987 concerning the framework programme for Community activities in the field of research and technological development (1987 to 1991).*	1987	OJEC L302, 24.10.87
CEU	*Council decision of 23 April 1990 concerning the framework programme of Community activities in the field of research and technological development (1990 to 1994).*	1990	OJEC L117, 8.5.90
European Parliament and Council of the European Union (EP & CEU)	*Decision No 1110/94/EC of the European Parliament and of the Council of 26 April 1994 concerning the fourth framework programme of the European Community activities in the field of research and technological development and demonstration (1994 to 1998).*	1994	OJEC L126, 18.5.94
EP & CEU	*Decision No 182/1999/EC of the European Parliament and of the Council of 22 December 1998 concerning the fifth framework programme of the European Community for research, technological development and demonstration activities (1998 to 2002).*	1998	OJEC L26, 1.2.1999
EP & CEU	*Dec. No 1513/2002/EC of the European Parliament and of the Council of 27 June 2002 concerning the Sixth framework programme of the European Community for research, technological development and demonstration activities, contributing to the creation of the European Research Area and to innovation (2002 to 2006).*	2002	OJEC L232, 29.8.2002
EP & CEU	*Decision No 1982/2006/EC of the European Parliament and of the Council of 18 December 2006 concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013).*	2006	OJEU L412, 30.12.2006
EP & CEU	*Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC.*	2013	OJEU L347, 20.12.2013

The ERC establishing acts (Table 5) show a similar nature: they are legal acts published on the Official Journal, although they are not as lengthy as the FPs establishing acts. The author, in this case, is most frequently the European Commission, since the ERC was founded on the model of an executive agency of the

Commission (see the paragraph *Regaining the autonomy of the scientific community: the rise of the ERC*), while the Council is involved for what concerns the implementation of the ERC inside the Framework Programmes.

Table 5: The documents relevant to the establishment of the ERC.

Author(s)	Title	Year	OJEC/OJEU ref.
CEU	*Council decision of 19 December 2006 concerning the specific programme: Ideas implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)*	2006	OJEU L400, 30.12.2006
Commission of the European Communities (CEC)	*Commission decision of 2 February 2007 establishing the European Research Council*	2007	*OJ L57*, 24.02.2007
European Commission (EC)	*Commission decision of 14 December 2007 setting up the "European Research Council Executive Agency" for the management of the specific Community programme "Ideas" in the field of frontier research in application of Council Regulation (EC) No 58/2003*	2007	OJEU L9, 12.1.2008
EC	*Commission decision of 12 December 2013 establishing the European Research Council*	2013	OJEU C373, 20.12.2013

Exploratory analysis of the occurrences of key terms. As mentioned, the Framework Programmes establishing acts are the result of both the stages of policy design, the first one centred around the Commission proposal preparation, and the subsequent formal discussion and approval phase, realized in the EU legislative bodies: Council and Parliament. They are, in other words, the final output of the conceptual frames incorporation into research policies. Furthermore, they show a peculiar structural uniformity, and they are not sector-specific, but they encompass the whole landscape of research initiatives (i.e., they incorporate all the conceptual frameworks). Consequently, they were particularly suitable for an exploratory analysis by means of computing assistance, in order to explore the occurrences, frequencies and evolution along time of the key terms.

The analysis of keywords is particularly meaningful in the FPs establishing acts since the argumentations are very rarely posited in negative terms: in other words, the terms are used to propose and describe, and only exceptionally to deny or forbid. Hence, it is possible to trust that, for example, the word «market» is used in the documents with a positive meaning, to support and sustain its development and not in negative expressions like, e.g., «market outputs must be excluded». The occurrences of words, hence can be safely considered as a hint for conceptual preference.

The Framework Programmes establishing acts have been analysed with the web-based text reading and analysis environment Voyant[21], and further elaborated by the author in order to isolate the most relevant

[21] Sinclair, Stéfan and Geoffrey Rockwell, 2016. Voyant Tools. Web. http://voyant-tools.org/ .

thematic groups and study their evolution along time (the most relevant ones are reported in Fig. 30, Fig. 31 and Fig. 32). The sectors and categories labelling the following documents owe their first input to this exploratory analysis.

The Commission policy documents

The Commission's principal policy documents analysed in this work are listed in Table 6.

They all express the official positions of the Commission on the specific issues; however, the group is not as uniform as the FPs and ERC establishing acts: the documents were produced by different groups inside the Commission, with reference to different debates and political objectives. On the basis of the FPs acts preliminary analysis of themes, each document was itemised along with its main subject, i.e. the activities landscape and intellectual reference in which it was written.

The Commission's documents constitute the main research source for the identification of policy frames, since they are produced with the specific aim of developing and describing policy proposals for the discussion in EU legislative bodies.

Table 6: The Commission policy documents and Green Papers relevant to the development of scientific policy lines considered in this work

Title	Year	Main subject	Commission classification code
Growth, competitiveness, employment - The challenges and ways forward into the 21st century - White Paper	1993	Growth	COM(93)700
An Industrial Competitiveness Policy for the European Union	1994	Growth	COM(94) 319 final
Green Paper on Innovation	1995	Innovation	COM(95) 688 final
Towards a Europe of Knowledge	1997	Education	COM(97) 563 final
Agenda 2000 - For a stronger and wider union	1997	Growth	COM(97) 2000 final
The First action plan for innovation in Europe	1997	Innovation	
Science, society and the citizen in Europe - Commission Working Document	2000	Science & Society	SEC(2000) 1973
Towards a European research area	2000	ERA	COM(2000) 6 final
European governance - A White Paper	2001	Political integration	COM(2001) 428 final
Science and society - Action plan	2002	Science & Society	
Innovation policy: updating the Union's approach in the context of the Lisbon strategy	2003	Innovation/Lisbon strategy	COM(2003) 112 final
The role of the universities in the Europe of knowledge	2003	Education	
Europe and Basic Research	2004	Basic Research	COM(2004) 9 final
Implementing the Community Lisbon Programme: More Research and Innovation - Investing for Growth and Employment: A Common Approach	2005	Innovation/Lisbon strategy	COM(2005) 488 final

Title	Year	Main subject	Commission classification code
Working together for growth and jobs - A new start for the Lisbon Strategy - Communication from President Barroso in agreement with Vice-President Verheugen	2005	Innovation/Lisbon strategy	COM(2005) 24 final
Putting knowledge into practice: A broad-based innovation strategy for the EU	2006	Innovation/Lisbon strategy	COM/2006/0502 final
Commission decision of 2 February 2007 establishing the European Research Council	2007	Basic research	OJ L57
A single market for the 21st century	2007	Growth	COM(2007) 724 final
Inventing our future together. The European Research Area: New Perspectives - Green Paper	2007	ERA	COM(2007) 161
Europe 2020 Flagship Initiative Innovation Union	2010	Innovation	COM(2010) 546 final
Europe 2020 - A strategy for smart, sustainable and inclusive growth	2010	Innovation	COM(2010) 2020 final
Green Paper - From Challenges to Opportunities: Towards a Common Strategic Framework for EU Research and Innovation funding	2011	Innovation	COM(2011) 48 final
Horizon 2020 - The Framework Programme for Research and Innovation	2011	Research/Innovation	COM(2011) 808 final
The Grand Challenge. The design and societal impact of Horizon 2020	2012	Research/Innovation	
A Reinforced European Research Area Partnership for Excellence and Growth	2012	ERA	COM(2012) 392 final
European Research Area - Progress Report 2014	2014	ERA	COM(2014) 575 final
Taking stock of the Europe 2020 strategy for smart, sustainable and inclusive growth	2014	Innovation	COM(2014) 130 final/2
Research and innovation as sources of renewed growth	2014	Research/Innovation	COM(2014) 339 final

In addition to official Commission documents, I analysed the Commission policy officers' books on the design and implementation of FP5 and FP7 (Table 7), which proved to be detailed descriptions of the officers' reflections on the evaluation of past programmes, of the issues to address, of the relevant actors and the most appropriate procedures, and finally legitimising the chosen policy options. Although not published in the same form of the other Commission documents, they provide an interesting account on research policy from the standpoint of the Commission. To my knowledge, such accounts have been drafted only for the mentioned Framework Programmes, the first in view of the set of policies on knowledge launched at the turn of the Millennium, the second as the output of the first exercise of *ex-ante* impact assessment, compulsory since 2003, on Frameworks Programmes. The *ex-ante* impact assessment of H2020 was published as well, and it is listed among the Commission's policy documents, but it is far more a technical report than a political account, and it appears less relevant.

Table 7: The Commission policy officers' books on the conceptual foundations, design and implementation of the 5th and 7th Framework Programmes

Authors	Title	Year
Caracostas, P., & Muldur, U.	*Society, the endless frontier. A European Vision of Research and Innovation Policies for the 21st Century.*	1998
Muldur, U., Corves, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., & Vanslembrouck, S.	*A New Deal for an Effective European Research Policy - The Design and Impacts of the 7th Framework Programme*.	2006

The experts groups reports

Experts groups report form a significant part of the documental production of the European Union. They result from the Commission assigning the study of specific issues to groups of academics, civil servants, politicians or company managers, usually assisted and coordinated by Commission officers. The choice of the relevant experts is realized case by case, showing significant variations in the number and in the composition of groups as for, e.g., the balance between public and private sectors, academia and business, or different academic fields.

Experts reports may be endorsed in subsequent political discourses and cited in following documents, exerting a notable influence on policy developments, or conversely be archived without any significant implementation. However, all the reports in Table 8 proved to be influential, at least for the development of the specific political stream for which they were developed (corresponding to the subject of the analysis identified in the last column[22]).

Table 8: The Experts Groups reports relevant to the development of scientific policy strategies considered in this work

Authors (chair)	Title	Year	Main subject
Sapir, A. et al.	*An Agenda for a Growing Europe- Making the EU Economic System Deliver, Report of an Independent High-Level Study Group established on the initiative of the President of the European Commission*	2003	Lisbon Strategy / Innovation
Mayor, F. et al.	*The European Research Council - A Cornerstone in the European Research Area - Report from an expert group.*	2003	Basic science
Kok, W. et al.	*Facing the challenge - The Lisbon strategy for growth and employment, Report from the High Level Group chaired by Wim Kok*	2004	Lisbon Strategy / Innovation
Strauss-Kahn, D. et al.	*Building a Political Europe - 50 proposals for tomorrow's Europe*	2004	Political integration
Harris, W.C., et al.	*Frontier Research: the European Challenge - High-Level Expert Group Report*	2005	Basic science
Aho, E., at al.	*Creating an Innovative Europe - Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit and chaired by Mr. Esko Aho*	2006	Lisbon Strategy / Innovation

[22] The subject identification is analogous to the one conducted for Commission's documents.

Authors (chair)	Title	Year	Main subject
Wynne, B. et al.	*Taking European Knowledge Society Seriously. Report of the Expert Group on Science and Governance to the Science, Economy and Society Directorate*	2007	Science & Society
Rocard, M. et al.	*Science Education Now: A Renewed Pedagogy for the Future of Europe - High Level Group on Science Education*	2007	Education
Georghiou, L. et al.	*Challenging Europe's Research: Rationales for the European Research Area (ERA) - Report of the ERA Expert Group*	2008	ERA
Soete, L. et al.	*The role of community research policy in the knowledge-based economy - Expert Group Report*	2009	Lisbon Strategy / Innovation
Von Sydow, B. et al.	*A Knowledge-intensive future for Europe - Expert Group Report*	2009	Lisbon Strategy / Innovation
Ozoliņa, Ž. et al.	*Global Governance of Science - Report of the Expert Group on Global Governance of Science*	2009	Science & Society
Barre, R. et al.	*ERA Indicators and Monitoring - Expert Group Report*	2009	ERA
Sutcliffe, H.	*A report on Responsible Research & Innovation.*	2011	Science & Society
van den Hoven, J., et al.	*Options for Strengthening Responsible Research and Innovation - Report of the Expert Group on the State of Art in Europe on Responsible Research and Innovation*	2013	Science & Society
Hudson, R. et al.	*The knowledge future - Intelligent policy choices for Europe 2050 : report by an expert group on foresight on key long-term transformations of European systems - research, innovation and higher education (KT2050)*	2015	Knowledge policy
Soete, L. et al.	*From the old ERA to a new era of "Open Knowledge Creation in Europe" - Policy Brief by the Research, Innovation, and Science Policy Experts (RISE)*	2015	Knowledge policy
Hunter, A., et al.	*Evaluation of Joint Programming to Address Grand Societal Challenges - Final Report of the Expert Group*	2016	Research and Innovation
Lamy, P. et al.	*LAB – FAB – APP - Investing in the European future we want - Report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes*	2017	Research and Innovation

The communication products

Although not institutional documents *stricto sensu*, the communication products realized by the Commission with the purpose of promoting research programmes resulted very interesting to identify and examine the most relevant conceptual frameworks employed in policy discourses. Communication products, indeed, commonly strive to convince the public about the good use of communitarian resources and cannot avoid relying on legitimising arguments, revealing the value-based rationales of the initiatives; moreover, the attention to clarity usually imposes a certain simplification of the discourse, resulting in a clearer exposure of the features of the different conceptual frames.

A wide use of the media is a relatively recent strategy for European institutions, and it is very difficult to find communication products, in the field of research, older than a decade (the YouTube channel of EU Science and Innovation – where the videos are commonly published – was opened in only in 2010, the European Commission's one in 2006).

Table 9: The communication products analysed in this work.

Title	Year	Media type	Bibliographic reference
Inside the Seventh Framework Programme - Its past, progress and key players, and how it is viewed by its partners | RTD info - Magazine on European Research - Special Edition	2007	magazine	(EC, 2007)
Innovation-Union	2010	video	(EC, 2010d)
Innovation Union (Act 2)	2010	video	(EC, 2010e)
Responsible Research and Innovation - Europe's ability to respond to societal challenges	2012	leaflet	(EC, 2012b)
Discover Innovation Union	2013	video	(EC, 2013a)
Horizon 2020 - EU research and innovation	2014	video	(EC, 2014d)
Horizon 2020 - General overview	2014	video	(EC, 2014e)
Horizon 2020 in brief. The EU Framework Programme for Research & Innovation	2014	leaflet	(EC, 2014f)
Research and Innovation: Pushing boundaries and improving the quality of life	2014	leaflet	(EC, 2014g)
Responsible Research and Innovation: aligning R&I with European society.	2015	video	(EC, 2015d)
30th Anniversary EU Research Framework Programmes 1984-2014 | Horizon Magazine - Special issue	2015	magazine	(EC, 2015a)
Horizon 2020 video - How to apply?	2015	video	(EC, 2015c)
Horizon 2020, the new generation of European funding.	2015	video	(EC, 2015b)
The European Research Area (ERA)	2015	video	(EC, 2015e)
FP7 - Funding by Member State - Report card	2016	leaflet	(EC, 2016d)
FP7 - What's next - Report card	2016	leaflet	(EC, 2016e)
Research and Innovation Funding: making a real difference	2016	leaflet	(EC, 2016h)
Horizon 2020 - Two years on	2016	leaflet	(EC, 2016g)
FP7 - Boosting Research Capacity - Report Card	2016	leaflet	(EC, 2016b)
FP7 - Dispelling some myths - Report Card	2016	leaflet	(EC, 2016c)
FP7 for Excellent Science - Report Card	2016	leaflet	(EC, 2016f)

The documents analysis. After the preliminary phases of documents exploration, constituting of a first study of the most relevant terms in FPs establishing acts, followed by the examination of the documents in search of categories and principal themes – I constructed an account of the main conceptual frameworks, their features and sub-narratives, articulated along reading paths and reported in detail in the chapter on

Frames and narratives in EU policy discourses on science. The accounts combine historical sources, documents citations and scholarly references to depict the evolution and features of the frames incorporated in EU research policy. Often the same documents are mentioned as significant in more than one account, for their intrinsic relevance but also because analytical categories may overlap and the same reference can be meaningful for more than reading.

The documents reported in this work are the most relevant for the development of the theoretical landscape of this research; some of the documents listed in the tables above, even though analysed, are not explicitly cited, but they anyway contributed to shape the analysis. Conversely, some additional documents are referenced in bibliography but not listed in the tables above – for example, some important Council documents (the '74 decisions on the coordination of research, or the Presidency conclusions of the Lisbon 2000 Council) – because their relevance resides more in their historical meaning than in their contents, and they appeared less relevant for the identification of the features of conceptual frames.

European integration and the policy-making process on scientific research

In reality, the history of the European research policy could almost be described as that of the gradual development of a small pool of ideas formulated thirty years ago, that, broadly speaking, we continue to exploit today. (…) The fact is that situations only evolve very gradually, and ideas take the Commission over 40 years a long time to be formulated, understood, assimilated and accepted, and an even longer time to be finalised and to have a discernible effect on the real world.
(Michel André, DG Research adviser, interviewed in (CEC, 2007d))

The basic, founding ideas on the role, meaning and configuration of scientific research in Europe have been influenced and shaped by a number of different factors; in the European case, in particular, the confrontation on the different models of integration never stopped and it is still clearly visible in the institutional asset. The history of the European integration had also a profound influence on the development of a communitarian scientific policy, and it is not possible to understand the current configuration if not acknowledging its historical impressions.

Which science for which Europe?

Notwithstanding the role played by research policy in the process of European integration, science and technology weren't recognised as areas of communitarian interventions[23] in the 1957 Treaty establishing the European Economic Community (EEC). This lack of legal provision delayed the debate on a European unitary science policy until the '70s, and a real coordination of actions was established only in the '80s with the inception of the Framework Programmes, currently representing the principal instruments of European research policy.

The evolution of the European policy on research was marked by diverse internal and external factors: the radical developments occurred in the physiognomy of science after WWII, the laborious process of European integration, the major geopolitical historical events. However, the dynamics of opposing interests and political-economic powers alone cannot explain the changes occurred in European R&D policy, and the subsequent shifting paradigms on the role of science and technology in economy and society (Borrás,

[23] With the exception of scientific research in agriculture (*Trattato che istituisce la Comunità economica europea*, 1958) .

2000; Sanz Menéndez & Borrás, 2000): in other words, the role of "policy frames" needs to be rightfully considered as well, both as the consequence of the evolution in the understanding of research policy and as prescriptive tools of following developments, defining its new universe, actors, values and methods.

Post-war reconstruction and the foundation of the European big laboratories. The national urgencies of the immediate post-war period mainly concerned the reconstruction efforts, in material, political and economic terms; however, the fields related to science and technology underwent relevant interventions as well, mainly geared, in the interests of national governments, towards the supply of energy sources (the traditional coal and the new nuclear energy, regarded as the basis of an approaching industrial revolution), and driven by the scientific community demand of new structures to enable European science to regain the ground lost to United States (Guzzetti, 1995).

The high costs and complexity of research infrastructures soon led to the proposal of joint projects, realised through multilateral agreements among the governments. The post-war "golden age" of welfare states, considered the principal model of state-economy relations, legitimised massive direct interventions in the production of scientific knowledge, supported by the belief that the exploitation of that knowledge in industrial and economic terms would have been consequent, although happening in the long term and through paths positioned out of the reach of political control (Borrás, 2000). In 1951 and 1957 the European Coal and Steel Community (ECSC) and the European Atomic Energy Community (Euratom) were founded; analogously to the EEC, their primary objective was economic and politic[24] – they were aimed at developing an internal market in the respective sectors – and only secondarily scientific and technical. The evolution of the Euratom was marked by political conflicts regarding its aims and role with respect to the national policies; it transformed from a tool of industrial development to an instrument of energy policy and finally into a techno-scientific research organization in the nuclear field; the launch of the research on fusion, a possible future clean energetic resource, with the project JET (Joint European Torus) in 1979, brought back the lost prestige to Euratom, which is currently included in the Framework Programmes principally for this research line[25] (Borrás, 2000; Guzzetti, 1995).

On the other hand, on the pure science side, among the first pro-Europeans figured some prominent scientists, like the physicists Edoardo Amaldi and Pierre Auger, and the director of the French Commission à l'Energie Atomique, Raoul Dautry, who proposed in 1949 the creation of a European laboratory for nuclear research. The project was welcomed also by the US, whose post-war policy was in favour of reinforcing Europe – e.g. with the Marshall Plan – in order to counterbalance the rise of Soviet Union; a strong scientific community in Europe was regarded as a coherent development of this policy (Krige, 2005). In 1953 twelve

[24] The political objective of the Communities was to realize a union *de facto*, that the fathers of Europe were confident would have brought to the realization of a proper political union: see also the "functionalistic" approach to European integration, explained in the paragraph *Theories of EU integration and the European institutional structure*.

[25] And for what concerns the research activities related to nuclear reactor maintenance and decommissioning. The Euratom Treaty, unlike the ECSC one which expired after 50 years in 2002, didn't provide a deadline for the collaboration: Euratom is still legally distinct from the European Union, but has the same member states and it is administered by the European Institutions.

European countries[26] signed the agreement establishing CERN (Conseil Européen pour la Recherche Nucléaire) in Geneva, on the French-Swiss border[27], devoted to research in fundamental physics. Although antecedent to the establishment of the European Community, CERN represented the first, successful, attempt of collaboration among European countries – former, very recently, wartime enemies – in the field of scientific research: CERN was the first non-national laboratory in Europe, profiting from the contributions of all the member states.

CERN represented a model for the establishment of other big European laboratories, appropriate for the developments of the new "big science", whose features were shifting towards great concentration of scientists, funds and infrastructures. All the European laboratories were founded on the basis of intergovernmental, ad-hoc, agreements among countries interested in pooling resources in the disciplines judged most promising, also in response to USA and USSR progresses in the same fields: ESO (European Southern Observatory) was built in 1962 in Chile by Belgium, Germany, France, The Netherlands and Sweden, while EMBL (European Molecular Biology Laboratory) was established in Heidelberg in 1974 by the collaboration of Austria, Denmark, France, Germany, Israel, Italy, The Netherlands, Sweden, Switzerland and United Kingdom. Furthermore, ESA (European Space Agency) was founded in 1975 from the merge of two earlier organisations[28], and it shared with Airbus, established in 1970, a prevailing orientation towards industrial applications.

Towards a European coordinated scientific policy. All these developments were characterised by a set of common features: they were publicly funded, basic science, non-military, big installations[29]. Public debate evolved, modelled after the successful example of CERN.

During the '60s and '70s the understanding of science policy changed, in Europe as well as in the whole Western area: while previously the main rationale for funding science with public funds was essentially political (and military in the immediate post-war), with the aim of gaining prestige and catching up with competing countries, in the '70s the changed global landscape – the ending "thirty glorious years" of increasing prosperity with the succession of oil crises, the weakening Cold War and the rise of globalisation – led to focus concerns no longer on the fear of a new war, but on a "technological gap" between Europe and USA/Japan and triggered a shift towards the objective of industrial competitiveness; consequently, basic science was superseded by technological development as the most appropriate instrument to achieve "economic security" (Borrás, 2000; Caracostas & Muldur, 1998). Moreover, big and expensive projects (like the big laboratories) no longer seemed adequate to the new public sensibility, concerned with the limits of growth, the pollution issues and the risks related to nuclear technology.

[26] Belgium, Denmark, France, Germany, Greece, Italy, The Netherlands, Norway, Sweden, Switzerland, United Kingdom, Yugoslavia.

[27] The laboratory is currently still built partly on the French soil and partly on the Swiss territory.

[28] ELDO (European Launcher Development Organisation) and ESRO (European Space Research Organisation).

[29] With the partial exception of ESA and Airbus, whose orientation was prevailingly industrial, and in the case of Airbus, not founded by countries, but as a consortium of industries.

Gradually, the scientific research paradigm shifted from the building of great infrastructures to the realization of transnational networks of scientists, institutions and industries (Liverani, 2010). The network model proved to be particularly suitable for the European context, overcoming the fears of some countries to suffer a disadvantage with respect to the nations hosting the laboratories: a network structure is able to reinforce the links among the scientific actors throughout Europe without questioning the national sovereignty and the equilibrium among countries (Barry, 2001). COST (Coopération européenne dans le domaine de la recherche scientifique et technique) and ESF (European Science Foundation), created respectively in 1971 and in 1974 were the first examples of multidisciplinary, network-like organisations, working as a meeting point of governmental research institutions, industries and universities.

Debates on the «technological gap» led to a shared feeling of the need for more coordination in the European system of scientific research; the main unsolved issue among European politicians was the management model of the networks. There were two main options: the intergovernmental one, based on targeted agreements among interested countries, and the centralized one, aimed at profiting of the economies of scale at continental level. Clearly, the countries keen on nationalism preferred the intergovernmental paradigm, based on peers' agreements, in order to preserve their complete sovereignty.

An additional problem affected the centralized model: it was not straightforward to justify a communitarian action in the field of scientific research, given the fact that there was no mention of such activities in the Treaty establishing the European Economic Community. In order to establish a centralized coordination of scientific research it was indeed necessary to amend the Treaty, and there was not enough time and agreement among the European countries for that. A compromise was reached in the Summit of Heads of State and Government held in Paris in 1972: new policies, including the support to scientific research, had to be grounded to the contribution to economic development, which was then perfectly lawful, representing the main aim of the European Economic Community[30]. Following the 1973 enlargement of the Communities to Great Britain, Ireland and Denmark, the structure of the Commission Directorates connected with research policies was reorganised: Research, Science and Education went to DG XIII, under Commissioner Ralf Dahrendorf, while Industry and technological affairs remained to DG III, under the responsibility of Commissioner Altiero Spinelli (Guzzetti, 1995). These two Directorates, under different political responsibilities, were going to be central for the development of EU R&D policy[31].

In 1974 the European Community for the first time legislated on scientific and technologic development, with the rationale that «a common policy in the field of science and technology is likely to

[30] Art. 235 of the Treaty of Rome allowed for any communitarian action that «appears necessary to achieve, in the functioning of the Common Market, one of the aims of the Community in cases where this Treaty has not provided for the requisite powers of action» (*Trattato che istituisce la Comunità economica europea*, 1958).

The aim of the Community was «to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increased stability, an accelerated raising of the standard of living and closer relations between its Member States» (*Trattato che istituisce la Comunità economica europea*, 1958).

[31] See in Table 18 and Table 19 the list of Commissioners responsible for the two portfolios devoted to industry and research, under their different denominations.

contribute to social progress, to balanced economic expansion and to an improvement in the quality of life» (CECs, 1974). It was just a one-year pilot programme, aimed at selecting projects relevant to the overall socio-economic needs of the Community, in order to contribute to the «development of a common policy on science and technology», but it paved the way for the developments of the following decade.

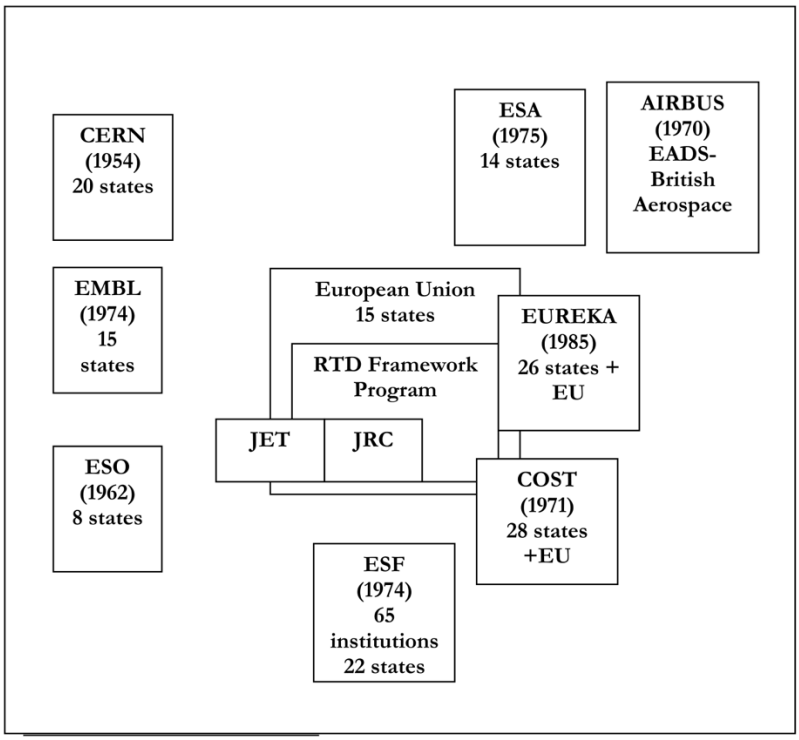
In the '80s, the emphasis on technological applications and industrial development, paired with the economic-political objective of competitiveness was on top of the research policy agenda: in 1982 the Commissioner for industry and S&T Etienne Davignon launched ESPRIT (European Strategic Programme for Research and Development in Information Technology), an initiative essentially different from the previous: it involved the most relevant industries in the IT sector[32] from the programme design phase, in so doing circumventing the governments' resistance to interventions in strategic industrial sectors (since it would have implied not to support the proposals of the respective "national champions"); in subsequent years, a similar, industry-oriented, model was applied to the BRITE (Basic Research in Industrial Technologies) and EURAM (European Research in Advanced Materials) programmes, launched in 1985 and 1986.

However, the confrontation among the two management paradigms – strong, central, or weak, intergovernmental, collaboration – was still not solved: this «was not only due to the question of identity related to the new 'Europeanisation' of the competitiveness problem, but also to the question about the extent and forms of public intervention in science and technology issues in a period of predominant liberal and right-wing ideology» (Borrás, 2000). The plastic representation of such alternative visions was the co-existence of EUREKA (EUrope REsearch Koordination Action), market-driven and state-controlled, launched in 1985 by the French President François Mitterand as a clear political signal of distrust for communitarian initiatives, and the First Framework Programme (FP1), supra-nationally controlled and pre-competitive oriented. The Programme, spanning over the period 1984-1987, was the first attempt to reorganise the diverse and sparse European R&D activities in a comprehensive plan that would serve as planning as well as funding instrument. Although modest in dimensions and still hindered by some member states, the efficacy of the Framework Programme as a planning instrument, together with the success of the other Community-run programmes like ESPRIT, modified the attitude of the opponent states and opened the way for the uninterrupted series[33] of consecutive multiannual Framework Programmes, currently representing the main instrument of European research policy.

[32] The so-called «Big Twelve»: ICL, GEC and Plessey from Great Britain; AEG, Nixdorf and Siemens from Germany; Thomson, Bull and CGE from France; Olivetti and STET from Italy; Philips from the Netherlands (Guzzetti, 1995).

[33] Second Framework Programme (1987-1991), Third Framework Programme (1990-1994), Fourth Framework Programme (1994-1998), Fifth Framework Programme (1998-2002), Sixth Framework Programme (2002-2006), Seventh Framework Programme (2007-2013).

Fig. 2: The European S&T infrastructures, collaborations and Programmes landscape in the '80s, until the turn of the Millennium (the European Union includes Euratom) *(source: Borrás, 2000, p. 19)*.



In 1986, at last, with the Single European Act, the Treaties were amended with the addition of a section on scientific research, explicitly establishing that periodical Framework Programmes had to be designed and implemented by the European Institutions. The rationale for scientific research grounded on the mid '70s 'compromise' of anchoring research to economic development (*Single European Act*, 1986):

> *The Community's aim shall be to strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level. In order to achieve this, it shall encourage undertakings including small and medium-sized undertakings, research centres and universities in their research and technological development activities.*

A fundamental point to solve for the realization of the First Framework Programmes, in consideration of the differences between nationalistic and pro-European perspectives, was the justification of the communitarian intervention. A set of criteria, named after the German minister Reisenhuber, was elaborated to define the limits of European interventions, and inserted in the Council Resolution enacting the First Framework Programme; communitarian action was legitimate in the following cases (CEU, 1983):

> *— research on a very large scale for which the individual Member States could not, or could only with difficulty, provide the necessary finance and personnel,*
>
> *— research, the joint execution of which would offer obvious financial benefits, even after taking account of the extra costs inherent in all international cooperation,*
>
> *— research which, because of the complementary nature of work being done nationally in part of a given field, enables significant results to be obtained in the Community as a whole for the case of problems whose solution requires research on a large scale, particularly geographical,*

— research which helps to strengthen the cohesion of the common market and to unify the European scientific and technical area and research leading, where the need is felt, to the establishment of uniform standards.

This first set of criteria was the core of the principles shaping the relations among European centralized management and national governments, later inserted in the Maastricht Treaty under the denomination of "subsidiarity principle". According to subsidiarity, the EU shall take action «only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore, by reason of the scale or effects of the proposed action, be better achieved by the Community» (EU, 1992). It was then established that in European Union the national governments were the main subjects of policy-making, while at the European level were delegated all those activities too expensive, too big or too difficult to be managed by the single nations. Subsidiarity is, of course, not only an organizational principle, but an embodiment of the political identity of European Union, in abiding search of a balance between central management and the national governments.

The political unification and the transition to innovation. The Maastricht Treaty, signed in 1992, marked a major change in Europe: the political unification of Europe was established, four decades after the establishment of the Communities in the '50s. However, the new-born European Union presented some weaknesses: it didn't have a Constitution nor a single currency, it showed different policy models[34] and it had to deal with the requests of the newly established European citizens to be included in the decision-making processes[35].

A new transition in the research policies happened during the '90s: in parallel to the focus on competitiveness, typical of the '80s, a new emphasis was put on innovation as the objective of R&D policies: the academic community was indeed abandoning the "linear model" for innovation – increasing funding for scientific research leads "automatically" to an increased technological and economic development, through the separate steps of basic research, applied research, development, (production and) diffusion (Godin, 2006b) – in favour of a "systemic" view: "systems of innovation" were understood as involving all the economic actors, linked by multiple, non-linear interplays, and the role of public policies was to support the creation of an environment conducive to innovation.

In the view of European scientific policy officers, this turn to innovation would have been paired to the rise of social objectives, to be pursued by research (Caracostas & Muldur, 1998); actually for the European Union, this transition coincided, as a consequence of the political unification, to the inclusion for the first time, of «economic and social cohesion» and « protection of the rights and interests of the nationals of its Member States through the introduction of a citizenship of the Union» among the objectives of European

[34] See below, *The European policy-making models*.
[35] Explained in details in paragraph *The citizens' place in EU democracy.*

policies. The paired objectives of boosting competitiveness and realizing social progress would have been the distinguishing mark of the "European model".

The years 2000s. The evolution of the European research policies after the turn of the Millennium was determined by the launch of the three-folded EU strategy – Lisbon strategy, ERA and Bologna process – inserting knowledge policies at the heart of the political agenda.

The Bologna process, centred on the harmonisation of European higher-education systems, was not strictly speaking a communitarian initiative – it was rather an intergovernmental accord – , but EU rapidly associated it to its new strategy, aimed at transforming the Union into «the most competitive and dynamic knowledge-based economy in the world» (Council, 2000). To realise the Lisbon strategy, a special attention was paid to the research system, and in 2000 the European Research Area initiative was launched in order to reduce the fragmentation of the national research systems. The conceptual reference in this decade was initially the «knowledge society» framework, which was gradually superseded by the notion of innovation as the driving force of development (this conceptual shift and the 2000s knowledge policies are described in detail in the paragraph *From Knowledge society to Innovation Union: a paradigm-shift*). Europe 2020, the growth strategy following Lisbon (closed in 2010, without having achieved its targets), is in fact critically grounding on innovation the research funding programmes – especially the current Framework Programme, opened in 2014 under the name Horizon 2020 and aimed at realizing the «Innovation Union» (EC, 2011a, 2014k).

The budget for research. Fig. 3 shows the evolution of the share of European budget devoted to research, as extracted from EU Financial Reports[36] (CEC, 2009; EC, 2012a, 2014, 2016a): research allocations experienced continued growth, both in absolute terms and as a percentage of the total EU budget. Yet the increase of the overall budget for research, including the FPs, is, in relative terms, less impressive: it fluctuated in the period 1984-2015 between 2% and 7% of the EU total budget; as a comparison, funds for agriculture decreased in the same period from about 70% to about 40% of the total EU expenditure (cf. Fig. 3 and Fig. 30).

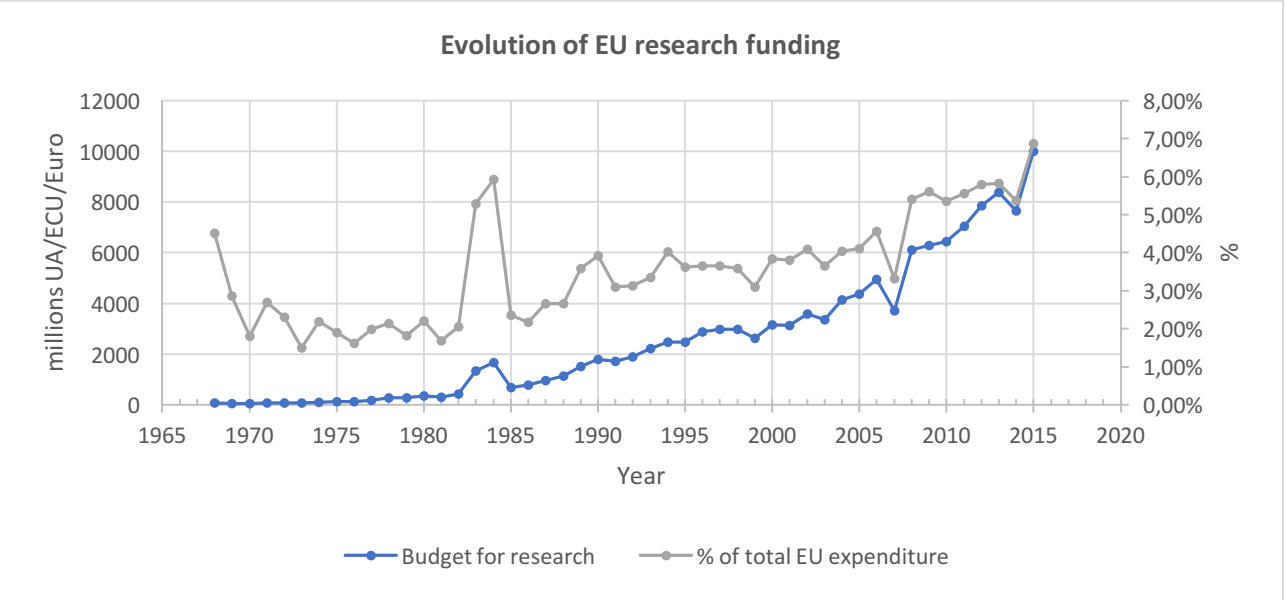
Although the years around 2000 represent a fundamental turning point in strategical terms, they singularly didn't involve an increase in the budget share devoted to research; conversely a notable peak is visible around the years of preparation and launch of the first Framework Programme (see Fig. 3, the peak of the years 1982-1985).

A negative peak is, on the other hand, recognizable in 2007, corresponding to the cuts in research budget decided during the FP7 negotiations; also Horizon 2020 underwent budget negotiations, but the cut was not so severe as for FP7[37].

[36] I.e., the data appearing in the plot express the allocations traced and grouped under the label «research» by the Commission itself (see in particular CEC, 2009).

[37] See the section on *The EU decision-making process(es) for scientific research* for a detailed account of the budget negotiations for FP7 and H2020.

Fig. 3: The evolution of the European share of budget dedicated to research (source: Financial Reports 2008, 2011, 2013, 2015 (CEC, 2009; EC, 2012a, 2014, 2016a); from 1968 to 1977: UA (Unit of Accounts); from 1978 to 1998: ECU (European Currency Units); from 1999: euros)



A not-yet-completed evolution. Table 10 summarises in the form of a timeline the milestones of European research policy, since the Communities' foundations in the '50s, highlighting the reference paradigm shifts: from big laboratories to collaborations or coordinated programmes, from political to economic objectives and from basic science to technological development.

Table 10: Timeline of the European research policy milestones, grouped by type pf initiative: EU institutional events relevant to research policy, foundation of big laboratories, establishment of scientific collaboration or coordinated research initiatives. The discussed major research policy paradigms are reported in the last column (the beginnings and conclusions years are, naturally, approximate, since every periodisation is conventional; in this case I adopted the time spans included in *(Caracostas & Muldur, 1998)*).

	EU R&D-related institutional milestones	**Big laboratories**	**Scientific Collaborations / Coordinated research initiatives**	**Research policy paradigm**
1951	Signature of the Treaty establishing the European Coal and Steel Community (ECSC)			Pairing of basic science & political objectives: - political objectives (prestige); - focus on basic science; - public funding; - big science laboratories.
1954		Foundation of CERN		
1957	Signature of the Treaty establishing the European Atomic Energy Community (Euratom) Signature of the Treaty establishing the European Economic Community (EEC)			
1962		Foundation of the European Southern Observatory (ESO)		

	EU R&D-related institutional milestones	Big laboratories	Scientific Collaborations / Coordinated research initiatives	Research policy paradigm
1970			Foundation of Airbus	
1971			Foundation of COST (Coopération européenne dans le domaine de la recherche scientifique et technique)	
1972	Paris Summit of the Heads of State and Government			
1974		Foundation of the European Molecular Biology Laboratory (EMBL) Foundation of the European Science Foundation (ESF)	Pilot programme on the coordination of research policies	
1975		Foundation of the European Space Agency (ESA)		
1979		Foundation of the Joint European Torus (JET)		Pairing of technology & industrial objectives: - economic objectives (competitiveness); - focus on technological development; - scientific collaborations or centrally coordinated programmes.
1982			Launch of ESPRIT (European Strategic Programme for Research and Development in Information Technology)	
1984			Launch of the First Framework Programme (FP1)	
1985			Launch of BRITE (Basic Research in Industrial Technologies) Launch of EUREKA (EUrope REsearch Koordination Action)	
1986	Signature of the Single European Act		Launch of EURAM (European Research in Advanced Materials)	
1987			Launch of FP2	
1990			Launch of FP3	
1992	Signature of the Maastricht Treaty			
1994			Launch of FP4	
1995	Green Paper on Innovation			
1998			Launch of FP5	Innovation-centred model: - tension between social and economic objectives;
1999	Signature of Bologna accords			
2000	Launch of the Lisbon Strategy			

	EU R&D-related institutional milestones	Big laboratories	Scientific Collaborations / Coordinated research initiatives	Research policy paradigm
	Launch of ERA			- problem-oriented, applied science; - innovation systems of private and public R&D actors.
2002			Launch of FP6	
2007			Launch of FP7 Foundation of the ERC (European Research Council)	
2010	Launch of Europe 2020			
2014			Launch of Horizon 2020	

While the models centring on the "Pairing of basic science & political objectives" and on the "Pairing of technology and industrial objectives" (adapted from Caracostas & Muldur, 1998) show actual discontinuities, the current "innovation paradigm" appears more as an update of the second model, or a not-yet-completed transitional period, sharing the economic focus (from competitiveness to innovation) with the previous period, but presenting significant news like the societal involvement and the revaluation of basic science (see the conceptual frameworks identified in the chapter on *Frames and narratives in EU policy discourses on science*): the current period could hence represent a very propitious opportunity for confronting on the different visions on the nature and positioning of knowledge and the diverse coexisting frames on the role of research in Europe, laying the groundwork for future developments.

The scientific policy-making process in the European Union

Any analysis regarding the conceptual frameworks developed and inserted in scientific policy documents cannot disregard the process by which the same documents have been produced, and the institutional actors who played a role in shaping them. Equally relevant, particularly so given the argument of this research, are the ideas about European integration, that sustained the Community creation and evolution and that are still influential to the EU current self-understanding and political development[38].

Theories of EU integration and the European institutional structure

European Union process of policy-making is particularly convoluted, mainly because it bears the signs of its not-yet-completed integration history. The confrontation among Member States on the different views of European integration has never stopped, and the respective positions were also tested on the battleground of R&D policies. The traditional depiction of European integration theories is bi-polar, with the various schools schematically assigned to either "neo-functionalist" or "intergovernmentalist" approaches, the first calling for more powers to a central European government, and the second working to preserve the

[38] In the following, the academic "state of the art" on European integration theories and of the Institutional structure is based on the description of the 7th edition of the manual "Policy-Making in the European Union" edited by Helen Wallace, Mark A. Pollack and Alasdair R. Young (Wallace et al., 2015).

full member states' sovereignty, with the aim of reducing European cooperation to a set of bilateral agreements among the Member States. Despite the fact that this binary schema is still visible, real positions are more faceted, and the centre of gravity of the theoretical debate in EU integration studies has moved nowadays nearer to the distinction between rationalist and constructivist schools.

A federalist Europe. The idea of a political unification of Europe was developed as early as the '20s, but the project gained real impetus only at the end of the Second World War, when it was considered a valuable countermeasure to the devastations produced by the exasperation of nationalisms. According to the analysis of the promoters of a «federalist» Europe, the nation state in crisis can no longer be considered an instrument of freedom and progress, but has become a self-sustaining «divine entity, an organism that has to consider only its own existence, its own development, without the least regard for the damage this might cause to others» (Spinelli, Rossi, & Colorni, 1944); in their view, hence, after the defeat of Germany the future of Europe would have resided in a united, federalist, Europe (Spinelli et al., 1944):

> *the foundation must be built now for a movement that knows how to mobilise all forces for the birth of the new organism which will be the grandest creation, and the newest, that has occurred in Europe for centuries; and the constitution of a steady federal State, that will have an European armed service instead of national armies at its disposal; that will break decisively economic autarchies, the backbone of totalitarian regimes; that will have sufficient means to see that its deliberations for the maintenance of common order are executed in the single federal States, while each State will retain the autonomy it needs for a plastic articulation and development of a political life according to the particular characteristics of the various people.*

The European states, in the federalist vision, should renounce to their national sovereignty in some sensitive fields – defence, foreign policy, long-term economic strategies – in favour of European supranational institutions; nations would retain the power to deliberate in the other fields, but would not be able to contrast federal decisions. Such a polity would not rise from diplomatic agreements among states, but would need the establishment of a democratically elected constituency assembly and would be based on the principles of liberal democracies, in particular the rule of law funding on fundamental rights and representative governments.

The neo-functionalist model of integration. The European Community was actually established in the '50s with similar aims but with a radically different approach, following the «neo-functionalist» theory of integration, that represented the prevailing model in the first period of the European Economic Community (EEC) – approximately 1958-1963 – applying to the development of the Common Agricultural Policy and of the customs union. According to this vision, placing certain sectors under the authority of central European authorities would have led to "functional spill-overs" to neighbouring sectors, causing further integration and possibly leading to the creation of a new political entity (Schumann declaration, 1950):

Europe will not be made all at once, or according to a single, general plan. It will be built through concrete achievements, which first create a de facto solidarity.

Europe founding on intergovernmental agreements. The 1965 "Luxembourg crisis", promoted by the French president Charles De Gaulle, showed the resistance of national sovereignties and stimulated a new, «intergovernmentalist», reading of EU integration, which was strengthened by the creation in 1974 of the European Council, a regular meeting of the EU heads of states and governments. During the '80s, after a period of stagnation, the integration process was relaunched, and new theories were developed: on one side, a new «liberal intergovernmentalism» combined the features of liberal preference formation inside nations and intergovernmental bargaining at EU level, with European institutions viewed as providers of credible commitments for member governments. Alongside this theory, a new interest in the role of institutions and EU rules to influence political outcomes was promoted by «new institutionalist» schools, distinguished according to their prevailing research approach: «rational-choice», «historical» and «sociological institutionalisms». While the first two shared with the intergovernmentalists a prevailing rationalist approach – where collective behaviour is seen as determined by the behaviour of individuals, each of them taking decisions on the basis of an informed, cost-effective balance among the different available options – sociological institutionalism shared with constructivist approaches a wider definition of institutions, including informal norms and habits, and positing that institutions can shape individual choices in ways that rationalist approaches cannot understand. Constructivist approaches highlighted the role of the social environment and its shared systems of meaning. It was in the constructivist arena that a new interest in ideas, identity and discourses was promoted.

A complex physiognomy and the democratic deficit. There is no common position among scholars also on the essential nature of the European Union, whether it should be studied as an international organization or a nation-like political system, or a different and new polity: a "governance without government". The literature on the «governance» approach, emphasizing the EU's capability to mobilize large and complex institutional and informal networks of actors, has promoted an assessment of the issue of an EU «democratic deficit», referring to the fact that the European Union's increasing intervention in domestic governance is allegedly mining national autonomies, without empowering citizens' participation to decision-making through the construction of a robust, completely democratically legitimate, institutional structure. This crisis of legitimation has been obviously sharpened by the rise of Eurosceptic movements and by the strict fiscal austerity imposed by EU institutions to face the Euro-zone crisis. The main arguments supporting an EU democratic deficit have focused on «the distant and opaque nature of EU decision-making; the strong role of indirectly elected officials in the Commission; the weakness of the EP and the second-order nature of its elections; and the bias in the treaties in favour of market liberalization over social regulation» (Pollack, 2014). Scholars identify three possible paths of reform: constitutionalization – the establishment of overarching rules to ensure transparency and public participation –, parliamentarization – a more ambitious process,

aiming at an overall strengthening the powers of Parliament as the institution that more directly represents the citizens' preferences – and deliberation, a third way particularly interesting for this analysis. Building on the work of Habermas on communicative action, the literature on the «deliberative turn» concentrates on political actors' discussions and assumes that they engage in sincere confrontations, are open to the power of the best argument, and collectively research the best shared option, basing not only on power balance or cost-effective rationalization, but also taking into consideration the dynamics of beliefs and ideologies, and maintaining a certain willingness to change. Crucially important in this approach is the existence of a shared lifeworld, and the personal opening and capability to acknowledge and discuss the conceptual frameworks underlying the political positions.

The European institutional structure. The current European asset reflects the historical evolution of the debate on EU self-understanding: different coexisting integration visions can be recognized underlying many EU institutional features.

The principal bodies of the present asset are the Council, the Parliament and the Commission.

The Council of the European Union was created, as we have seen, to emphasize the intergovernmental nature the Community: it is where national ministers from each EU country meet to coordinate policies and promulgate laws. It is organized with a multitude of specific groups, preparing and discussing deliberations, in complex interaction with each other, with the national governments and with the other EU bodies. The Council has been the main lawmaker on EU policies for the most part of its history, until the recent enhancement of the Parliament's powers: now that decisions are taken within the frame of the "Ordinary Legislative Procedure" the system is moving towards a certain bicameralism. Alongside the Council of the European Union, another intergovernmental assembly is highly influential on European policies, although having no legislative power: the European Council, composed by the heads of states and governments and in charge of setting the strategic policy lines of the Union. Some of the crucial decisions affecting EU scientific policy, like the Lisbon strategy, have been agreed and launched in European Council meetings[39].

The relevance of the European Parliament in the EU institutional landscape has changed considerably since its establishment: from a non-elected, simple consultative organ in the '50s, it has acquired increasing relevance during the '70s, attaining direct European elections in 1979; with successive Treaties reforms, in the '80s and '90s it gained the legislative power. It is nowadays one of the two EU legislative bodies, counterpoising the member states' representations in the Council and controlling the Community interest in Commission's initiatives.

[39] Along this thesis, and especially in the bibliographic notes, the Council of the European Union will be shortened with the acronym "CEU", while the European Council will be referred to simply as "Council".

Although the Council and Parliament play an important role in the development and use of conceptual frameworks in policy strategies, it is the Commission that enacts the pivotal actor with regards to their setting and elaboration.

The European Commission, in fact, retains the «right of initiative» for new legislative proposals – even if it is often asked to develop projects along the political lines established by the Council –, it practically organizes the collection of the information base and realizes the draft documents to be debated in the Council and in the Parliament. The Commission's powers are very variable in relation with the policy domain: depending on the issue at stake, hence, the Commission can play the role of a real executive agency – e.g. in competition policies – or of the "agenda-setter", proposing new legislations; it can negotiate on behalf of the EU – e.g. for what concerns the external economic relations – or it can be responsible of comparing and coordinating national policies, and of building extensive cross-EU networks to establish technical reference standards; in intergovernmental areas it acts as a simple observer.

The Commission is a complex structure, counting around thirty thousand staff officers[40], organized into Directorates General (DGs) in charge of specific policy areas (Table 17 reports the current Commissioners college and their mandates); however, the distinction is not very neat, and many are the overlapping domains. The Commission is composed by a 'college' of Commissioners – from 2007 one per member state, nominated by national governments, endorsed by the Council and approved by the Parliament – and it is chaired by a President, chosen by the Council and approved by the Parliament (cf. Fig. 11).

The responsibility on the policies on science, in the Commission structure, have historically been two-headed, influenced by both the Commissioners for research on one side and for industrial development on the other, hence by the respective DGs (with the contribution of the education department, mainly for long-term strategies, like the "Europe of knowledge"); these departments and political roles have had different names (cf. Table 18 and Table 19) and in the current configuration the number of DGs and Commissioners connected with the policies on science has multiplied consistently (also to make it possible the appointment of 28 Commissioners, cf. Table 17 and Fig. 11): for example, the budget of Horizon2020 is shared among 8 Directorates (cf. Fig. 29) – Research and Innovation (RTD), Communications Networks, Content and Technology (CNECT), Education and Culture (EAC), Energy (ENER), Internal Markets, Industry, Entrepreneurship and SMEs (GROWTH), Mobility and Transport (MOVE), Migration and Home Affairs (HOME), Agriculture and Rural Development (AGRI).

The position of the Commission, given its multifaceted activity and its dual role – administrative secretariat on one side and political proto-executive and agenda-setter on the other – is challenging, also considering the continuous efforts to maintain its influence in spite of the other EU institutions and national governments.

[40] 32 546 staff officer at 1.1.2017 (EC, 2017d)

Because of the exceptional history of the European institutional asset, and following the differentiate distribution of responsibilities between EU and the member states, the European policy-making landscape is characterized by different coexisting policy models, applying each to different domains.

The European policy-making models

In addition to the controversies connected to European integration, the scientific field experienced also fragmentation in policy coordination, since scientific research was not included in the founding Treaties among the areas of communitarian action, and science became a legitimate, legally based, field of European intervention only with the Single European Act in 1986: a single unified decision-making process was never really developed for European science. Rather, there have been many single cases of science-related topics for which specific processes have been developed and used: for example, research in the areas of agriculture, environmental issues and biotechnologies were all managed according to different models of policy-making.

We find in European history and practices several different and in some cases contrasting policy methods. Scholars recognize at least five different models (Wallace, 2005), spanning from those more suitable to politically centralized approaches to others close to the intergovernmental understanding of the EU structure.

The traditional community model. The so-called «traditional community method» has been considered for a long time the candidate for an emergent unified European policy-making method. It was developed in the early years of the Community and was applied to one of the first shared community policies: the Common Agricultural Policy. In this model, aiming at an active integration of policies, the powers are clearly delegated to a central institution, the Commission, which acts as the policy designer, broker and executer, while the strategic negotiations are conducted by the Council of Ministers. National agencies are hierarchically considered as subordinated operating arms and the funds are gathered on a collective basis. This policy model puts a substantial distance between the policy-making level and the influences of elected Parliaments at the national level, and even the European Parliament has only limited opportunities to intervene. The traditional community method was applied sparsely along the European integration history, but a very recent example can be the single currency introduction, with the difference that in this case the powers have not been delegated to the Commission but to a function-specific agency, the European Central Bank.

The regulatory model. By the mid-'80s, while Europe was shifting to the competition regime and developing the single European market, an alternative policy model emerged, based mainly on an architecture of regulations orchestrated by the Commission. In comparison with the preceding model, this «regulatory mode» has been referred to as a form of "negative integration", for it is built upon a legal framework instead of active policy initiatives. In this configuration, the Council acts as a forum for the national governments to agree on the minimum standards for harmonization, and the stakeholders, especially the economic ones, have extensive opportunities to influence the (often market-related) rules. The

surveillance role on the application of the rules is assigned to the European Court of Justice, while the European Parliament is the place to discuss the non-economic factors (environmental, social, etc.), but retains little power to influence the implementation of the regulations. The regulatory policy-making mode was applied first to the development of the single market, and it is often used for economic issues, like competition or industrial policies. It is sometimes applied, at least in the earliest stages, to other non-market related sectors, like the social affairs and the environment: for example, the European policies on biotechnologies have considerably been managed through a regulatory approach.

Funding distribution. Another relevant way to apply policies at the European level is to allocate substantial financial resources to sectors, regions or countries. Distributing funds is occasionally associated with wider policy implementation (as it happened for the Common Agricultural Policy, where funds were distributed in the frame of a centralized policy on agriculture), while other times it is a policy mode *per se*: a significant example is the distribution of funds to scientific research through the Framework Programmes. The Commission in this case is the policy-designer, bearing also the workload of extensive consultations of stakeholders, as well as the management of the funds distribution. The overall budget for the policy is agreed by the governments' members in the Council, who are influenced by the pressures exerted by stakeholders and local authorities.

The European Parliament in this schema acts as a controller, representing the preferences of territorial politics. While for previous models governments were the only mediators of the interplay with Brussels, the introduction of this policy mode opened for the first time to more direct interplay between European officers and non-governmental national levels (e.g. the National Contact Points or the Universities in the Framework Programmes asset can interact directly with the involved Commission officers, bypassing the national level).

The policy coordination model. A softer way to implement common strategies in Europe consists in the voluntary coordination of policies, on the model of what has been happening since the early '60s in the forum of the OECD. The Commission acts, in this frame, as the developer of a Network of experts and stakeholders, while the Council is the convenor of high-level groups, focusing more on the discussion of contents than on the diplomacy issues; the European Parliament is sometimes included in the process through its specialist committees. The high involvements of knowledge experts and brokers makes this model the most prone to a technocratic policy-making approach, and the multiplication of policy actors disperses political responsibilities. An important example of the "policy coordination" mode was the coordination of macroeconomic policies of the member states at the time when the single currency was introduced. The adoption in the Lisbon strategy of the "Open Method of Coordination" as the prevailing policy technique draws largely on the method of «policy coordination», making wide use of "soft" policy incentives, not legally binding, in the sectors where the EU lacks strong powers of intervention, like employment or the national investments in R&D.

Intergovernmental negotiations. Finally, regarding the most sensitive policy areas involving the countries' sovereignty, like foreign policy and international security, decisions are normally taken through intensive intergovernmental negotiations among the member states, and specifically involving a distinct circle of key national policy-makers. Consequently, in this «intensive transgovernmental» mode, the most important policy actor is the European Council, engaged in setting the overall political strategy, and the Council of Ministers, active in consolidating the cooperation, while the Commission plays only a marginal role and the European Parliament is even excluded. It represents clearly the opaquest policy mode, both from the point of view of national Parliaments and of the citizens.

The EU decision-making process(es) for scientific research

As aforementioned, the field of scientific policy in EU is not managed with a single legislative process, but with issue-specific procedures.

Open Method of Coordination and regulatory policy-making. A special mode in this respect is the application of the «Open Method of Coordination» to the field of the investments in research. Initially designed as a soft, non-binding, method to drive the Member States towards common policies in areas which fall under the States' competences – employment, social protection, education, youth –, the «Open Method of Coordination» was applied in 2000 to the implementation of the 3% GDP target of the Lisbon strategy and set in 2003 as the method to be used for coordinating the EU countries' investments in R&D. It is based on the common identification of objectives and measuring instruments (like indicators and guidelines) in the frame of the Council, followed by a benchmarking work carried out by the Commission. The Scientific and Technical Research Committee (CREST) was asked to review and sustain the coordination process: given the deep embedding of the 3% GDP objective within the economic growth strategy and the focus on the financial dimension of enhancing the investments in research, the group produced mainly economy-oriented recommendations on the harmonization and reform of national policy strategies, fiscal regimes, public-private links and intellectual property[41].

The planning of investments in research, though, is regulated through the «Open Method of Coordination», apparently intergovernmental in essence; other scientific domains, also for their intrinsic delicacy, have been and still are particularly affected by regulatory policy-making: e.g. biotechnology, food safety, embryo research are affected by EU regulations influencing the development of their scientific domains (e.g. the Council Directive 90/220/EEC on the deliberate release of genetically modified organisms and the subsequent repealing in the EU Directive 2001/18/EC, or the regulation 258/97/EC concerning novel foods and novel food ingredients[42]).

[41] A detailed description of CREST work to sustain the application of «Open Method of Coordination» to the management of the 3% GDP target can be found in the (archived) webpage on the Commission website (EC, 2008).

[42] For a detailed account of the European approach towards the introduction of GMOs, in comparison with the US attitude, see (Jasanoff, 2005).

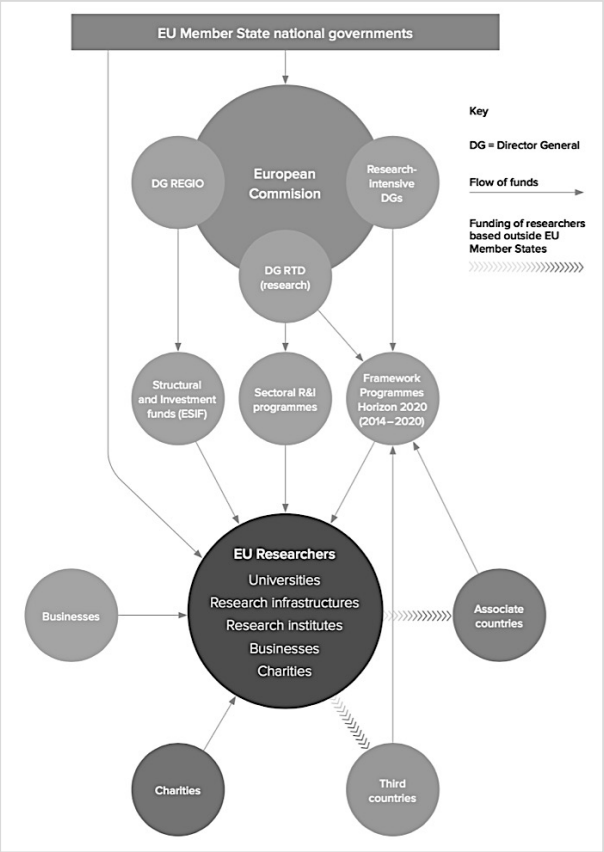
Funding research: the distributional mode of policy-making. The field of scientific research at the European level, however, is mainly administered by means of the distributional mode: the relevant scientific fields are selected at the EU level[43], and their development is supported with the allocation of funds.

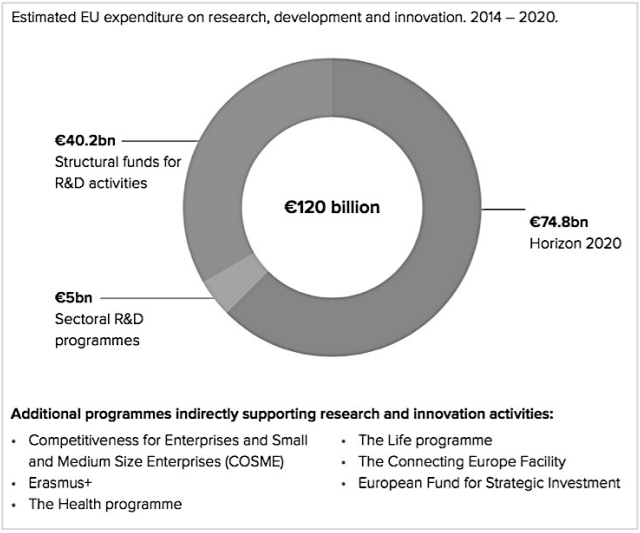
Fig. 4 summarizes the flow of research funding in Europe and the breakdown among the different Programmes. Most of the resources are distributed by structural funds – the European Structural and Investment Funds (ESIF), devoted to stimulate the least economically developed regions of the EU and focused on research infrastructures, technology transfer, businesses and skills programmes –, by sector-specific research programmes – like Euratom, ITER, or the Copernicus and Galileo satellite programmes – and the Framework Programme, which plays the major role, in terms of contributions[44]. Moreover, as shown also by the European research policy history, the Framework Programmes are the instruments presenting a clearer conceptual orientation: they are not sector-specific but multidisciplinary, their legitimation involves rationales linked not only to concrete economic or technologic targets, but also to the construction of the European polity and the betterment of its society; they are hence the most open to the development of conceptual frames and consequently particularly interesting to the scope of this analysis.

[43] With the exception of some programmes, like the ERC, which don't fix the relevant fields and accept bottom-up proposals (see *Regaining the autonomy of the scientific community: the rise of the ERC*).

[44] In addition to the main sources of funding, described in the text, in the picture figure also COSME – a programme aimed at supporting SMEs and targeted also at developing their R&D potential –, Erasmus+ – geared to student mobility –, the Health Programme – supporting healthcare structures, like research hospitals –, the Life Programme – fostering environmental research for policy development –, the Connecting Europe Facility – including funding for communication infrastructures. The contribution of such programmes to R&D, although present, is difficult to separate from the other targets of funding.

Fig. 4: The flow of research funding in Europe and the breakdown budgets, as depicted by the Royal Society in a 2015 report concerned with the effects of "Brexit" referendum on UK science *(Frenk et al., 2015)*.





The legislative iter for the design and adoption of Framework Programmes. The legislative procedure underlying the design and promulgation of the Framework Programmes has been, at least since the '90s, the most "communitarian" EU method: the «Ordinary Legislative Procedure» – former called the «Co-decision» process –, consisting of a complex interplay among the main EU institutions, including as an important actor, and recently as co-legislator, the European Parliament.

Table 11: The legislative procedures adopted to design and establish the Framework Programmes (source: European Parliament Research service *(EPRS & Reillon, 2015)*)

Framework programme	Period	Legislative procedure
FP1	1984-1987	Consultation procedure[45]
FP2	1987-1991	Consultation procedure
FP3	1990-1994	Consultation procedure
FP4	1994-1998	Co-decision procedure
FP5	1998-2002	Co-decision procedure
FP6	2002-2006	Co-decision procedure

[45] The «Consultation Procedure» was, before the Single European Act (1986), the prevailing method to legislate in the Economic Community: in this frame, the Council can adopt a law, based on a proposal developed by the Commission, without the consent of the Parliament. The Council is, however, bound to consult the European Parliament. This procedure is still in use after the Lisbon Treaty as a special legislative procedure, an exception to the rule of the «Ordinary Legislative Method», for a limited number of policy areas, such as internal market exemptions and competition law, as well as financial topics and aspects of intellectual property and administrative issues.

Framework programme	Period	Legislative procedure
FP7	2007-2013	Co-decision procedure
Horizon 2020 (FP8)	2014-2020	Ordinary Legislative Procedure

The «Ordinary Legislative Procedure», introduced with the Maastricht Treaty, was established as the prevailing EU law-making procedure by the Lisbon Treaty in 2007, and applies to the great majority of policy fields – excepted those most delicate for the intergovernmental supporters: foreign and defence policy, institutional reforms, tax policy, a share of social policies and a part of the areas in the field of justice and home affairs.

According to this procedure (cf. Fig. 13), the Commission has the «right of initiative» to start the process[46], and develops a legislative proposal to be submitted to both the Council and the Parliament. The Parliament takes a first read and may accept it, in which case the act is adopted, or it can amend it. The Council can accept the Parliament's position, ending the process, or return it with its own amendments to the Parliament for a second read. The majority of proposals is adopted at this stage, since dense negotiations are informally carried on among the institutions before the process formally starts; however, the Parliament has at this point the right to propose further changes or to reject it, in which case the law is withdrawn. If the Council, at this moment, doesn't accept all the amendments, a Conciliation Committee, composed of an equal number of members of the Parliament and of Council representatives, is convened in order to reach an agreement on a joint text, that is subsequently sent to the Parliament and the Council for approval, without the possibility to modify it further. If they both approve it, the law is adopted; on the contrary, it is rejected.

Horizon 2020's formal legislative *iter* (coded 2011/0401(COD), cf. Table 12) was launched in November 2011, when the Commission published the proposal for a regulation concerning the new Framework Programme, consisting of a brief introduction, the legal text itself, and complementing it with a series of working documents describing the expected impact of the Programme. As a result, two parallel debates were opened in the Parliament and in the Council, leading two years later, in December 2013, to the final approval, ratified by a parliamentary vote, to the Council's agreement and to the final signature on the act. The Council was convened, as traditionally happens for decisions in the field of research funding, in the «Competitiveness» configuration – concerned of Internal Market, Industry, Research and Space, whose mandate is to «enhance competitiveness and increase growth» (CEU, n.d.). During the debate process, the text has undergone a series of adjustments: the review was coordinated by the Parliamentary Committee on Industry, Research and Energy (ITRE), and realized both with internal confrontations and with the

[46] In some special cases, also other institutions can launch the process, like the European Central Bank, the European Investment Bank or the Court of Justice, provided the issue pertains to their area of concern. In addition, a quarter of the member states can initiate the process, when the proposal regards judicial cooperation in criminal matters or police cooperation, and since 2007 also the citizens (European Citizens' initiative), if one million of signatures from 7 countries can be presented to support the initiative.

incorporation of contributions from the other concerned Committees[47]. In addition to these inputs, five European countries – United Kingdom, Germany, Italy, Portugal and Czech Republic – submitted their positions on the proposed legislation for the new Framework Programme. As a final result, the rapporteur Teresa Riera Madurell[48] presented to the Parliament the amended text, that was subsequently debated (EP, 2011a) and approved. After the approval by the Council, the law was adopted and published on the Official Journal of the European Union (EP & CEU, 2013).

Table 12: Horizon 2020 legislative procedure, coded 2011/0401(COD): key events and related published documents, listed on the European Parliament website *(EP, 2013)*

Horizon 2020 legislative procedure (2011/0401(COD)) – key events and related documents		
30/11/2011	Legislative proposal published	COM(2011) 809 final, with the complementary working documents SEC(2011)1427 and SEC(2011)1428
13/12/2011	Committee referral announced in Parliament, 1st reading/single reading	
20/02/2012	Debate in Council	
30/05/2012	Debate in Council	
10/10/2012	Debate in Council	
28/11/2012	Vote in committee, 1st reading/single reading	
10/12/2012	Debate in Council	
20/12/2012	Committee report tabled for plenary, 1st reading/single reading	A7-0427/2012
18/02/2013	Debate in Council	
30/05/2013	Debate in Council	
20/11/2013	Debate in Parliament	
21/11/2013	Results of vote in Parliament	
21/11/2013	Decision by Parliament, 1st reading/single reading	
03/12/2013	Act adopted by Council after Parliament's 1st reading	
11/12/2013	Final act signed	
11/12/2013	End of procedure in Parliament	
20/12/2013	Final act published in Official Journal	Regulation (EU) No 1291/2013

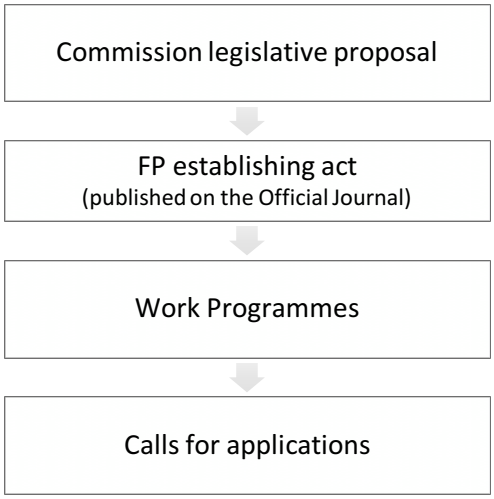
The legal text establishing the new Framework Programme, consisting of an introductory part with the legal provisions and the general principles and purposes of the Programme and a following extended section with the details of the disciplinary issues to tackle (see the devoted paragraph *The Framework Programmes and the ERC establishing acts*), constitutes the general terms of reference of the multiannual programme for research funding. After the publication of the establishment act, the Commission is due to prepare topic-specific «Work Programmes» (WPs), explaining in detail the requirements of the calls for applications that will be later opened by the Commission, and introducing the formal lingo that will be used for the selection procedure: for Horizon 2020 WPs the calls description is articulated around the headings of

[47] Agriculture and Rural Development, Culture and Education, Development, Legal Affairs, Foreign Affairs, Transport and Tourism, Fisheries, Women's Rights and Gender Equality, Environment, Public Health and Food Safety, Regional Development, Budgets.

[48] Member of the European Parliament from 2004 to 2014, in the Socialist Group; member of the Committee on Industry, Research and Energy (ITRE). Other information available on Madurell's history of parliamentary service webpage (EP, n.d.-b).

«specific challenge», «scope», «expected impact» and «type of action» and indicates the appropriate budgets for proposals (see, for example, EC 2017a).

Fig. 5: The principal steps in the elaboration of Framework Programmes: each of these steps is focused around the elaboration and publication of a group of policy documents.

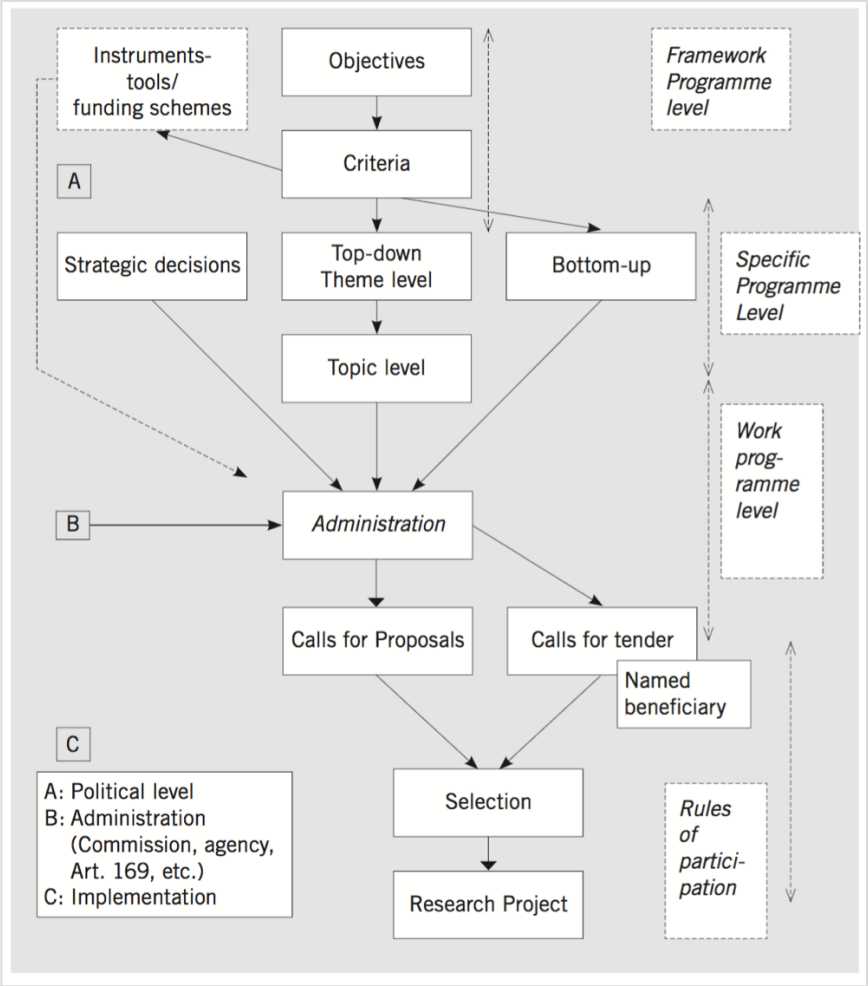


The preparation, approval and management of the Framework Programmes spans through several years – usually the launch of a Programme overlaps with the beginning of the preparation of the following: for example, discussion on FP5 (1999-2002) started as early as 1996 and already in 2000 a first discussion paper for FP6 (2003-2006) was circulated; the preparation for FP7 started in 2004 and the Programme was launched in 2007. The process normally starts with the circulation of an informal discussion document by the Commission, drafted about six months before the formal proposal is presented, launching the official *iter* of decision-making (Andrée, 2009).

The FPs design process. While the approval of the Programme involves the whole EU institutional structure, the previous preparation and the following administration phases are responsibility of the Commission.

Dan Andrée, a Swedish officer of the Ministry of Education and Research and adviser to the Commission for the Framework Programmes and the ERA policies, describes the process of priority setting and the selection procedure as follows:

Fig. 6: Framework Programme priority setting and selection procedure, as represented in *(Andrée, 2009)*. The "A" phase refers to "Political decision", "B" stands for the "Administration" phase and "C" for the "Implementation".



Andrée distinguishes three phases: a first articulated one, concerning the "Political decisions", a second one regarding the "Administration" of FPs and concerning the drafting of Work Programmes and calls for applications, and a third one considering the "Implementation" through the actual mechanism of selection. In the political phase, the most relevant for the elaboration of conceptual frameworks, decisions are taken at a high hierarchical level on objectives, criteria and priority-setting, and the top-down structure of the Programme is defined; the scientific contents in this moment are defined broadly, while they are specified down to the level of topics only in subsequent phases. Alongside this main stream of Programme structuring, eventual strategic decisions may influence the priority setting, or other instruments or funding schemes may be defined – e.g. the Joint Technology Initiatives, or the European Research Council (ERC), which uses a different, bottom-up, selection procedure.

The political preparation stage, entailing principally the moments of agenda-setting and policy formation, is comprehensibly a very sensitive moment for what concerns the elaboration of imaginaries. There is no formal procedure to define how this stage should be managed, and the Commission is a highly fragmented structure where policy advocates, interested in influencing the shape of a policy proposal, can enter. Moreover, unlike the Parliament, the Commission has no obligation to meet and deliberate in public

and policy officers' memoires are almost totally absent: consequently, the negotiations of interests and positions in the preparation stage are also difficult to trace. In order to explore the policy preparation stage in the Commission I've based both on a few existing documents and on a group of testimonies I collected by means of interviews.

As explained in the chapter *How does European scientific policy-making work? Pilot interviews to stakeholders and policy-design actors*, during my PhD period, spending most of the time at CERN in the frame of a European project and frequenting the Universities of Bologna and Milano Bicocca, I've had the chance to meet a diverse group of people who have provided their experience on the process of policy shaping in Brussels, their institutional activity being closely related to EU research funding frameworks: research organization's or University's EU projects officers, National Contact Points for Framework Programmes and a senior scientist engaged in research management. Their accounts, sharing the feeling of a complicated and multifactorial mechanism of policy-building taking place in the Commission offices, shed light on some blind spots of the Framework Programmes development process, as experienced from the standpoint of actors working "outside Brussels".

Complementary sources of information on the work of proposals drafting, from inside the Commission offices, are the *ex-ante* assessments of the two last Programmes, especially the one prepared for FP7 (CEC, 2005a), enriched and published in 2006 for Springer under the title *A New Deal for an Effective European Research Policy - The Design and Impacts of the 7th Framework Programme* (Muldur et al., 2006), and the 2012 *ex-ante* assessment of Horizon 2020 *The Grand Challenge. The design and societal impact of Horizon 2020* (EC, 2012c), both drafted by the policy analysts that in DG Research have been concerned with the design of the Programmes. Since 2003, in fact, every legislative proposal drafted by the European Commission has, by law, to be complemented with a detailed impact assessment, explaining in detail the rationales of the proposal, «involving rigorous analysis of all the evidence and a careful consideration of all policy options» (EC, 2012c). Although clearly these documents were produced to account for the Commission's activity, and have to be considered *ex-post*, ordered and finalized, descriptions (and this oriented effort is from time to time visible[49]), we can anyway read them as first-hand descriptions of the Commission's standpoint on the Programmes' preparation phase and we can extrapolate some information on the process of proposals drafting.

Exploring the preparation phases of the Framework Programmes at the European Commission is challenging. In addition to the lack of detailed documentation of the Commission's work, as opposed to what is common in the Parliament, the elaboration of scientific policies is a complex procedure involving a number

[49] As it happens when, in the 2006 book, the authors – belonging to the Commission – describe the legislative procedure involving the other two EU institutional bodies, the Council and the Parliament, as particularly intricate and unpredictable, and adds: "At the end of this complex and unpredictable process, how is it that co-decision regularly produces a strong and viable Framework Programme? This is probably because there is a large political agreement that research and innovation must be supported and that the Commission's proposals are generally pointing in the right direction" (Muldur et al., 2006, p. 227)

of different Directorates (DGs), as well as other formal and informal bodies – it is not rare, for example, that a crucial policy development is discussed at conferences or fora organized to explore other topics (e.g. the first spring of the proposal for a European Research Council, debated at a series of conferences in 2000-2001, cf. König 2016).

The landscape of actors, interest groups, politicians or others, intervening in policy shaping is wide and diverse: these "policy entrepreneurs" are interested and skilful in framing the policies in ways that are politically meaningful, depicting them inside acquired strategies or sets of norms, or linking them to shared concerns or contemporary crisis events (Young, 2014). When the issues at stake are technical, the involvement of scientific expertise is particularly broad and relevant, and consequently epistemic communities play a crucial role in defining the problem and suggesting the favourable policy options. Epistemic communities, nonetheless, don't behave like providers of neutral technical knowledge, but share with policy-makers also their peculiar worldview, their set of beliefs, their criteria to establish the relevance of the issues and, not least, their specific agenda. If different epistemic communities are called to express on the same topic – as it happens for example on environmental or economic problems, or, as in the object of this study, on the directions of scientific research – these different framing of the issues and, ultimately, these different worldviews lead fairly inevitably to some frictions.

The construction of 'policy networks' is another relevant way by which the Commission shapes policy proposals: policy networks are clusters of institutions and groups, both formal and informal, that show an interest in a policy development and implementation and which are consulted and involved by the Commission in the policy preparation phase. The inclusion or exclusion of members into these networks has naturally significant impact on the framing of the issues and on the development of policies. The Commission makes large use also of "High profile experts' groups", naturally for the most part drawn from established policy networks, to which the elaboration of policies is increasingly committed, both in the policy preparation and evaluation moments. The expected outcome of policy networks' work is the minimization of policy alternatives in favour of a prevailing proposal, that is subsequently included in the Commission's drafts proposals.

The Commission is even more concerned with organizing a comprehensive and cohesive procedure of policy preparation since the elaboration of *ex-ante* assessments have become compulsory. The 7th Framework Programme was the first to be prepared with an *ex-ante* assessment, and the expectations in terms of transparency and effectiveness were high (Muldur et al., 2006, p. xxiv):

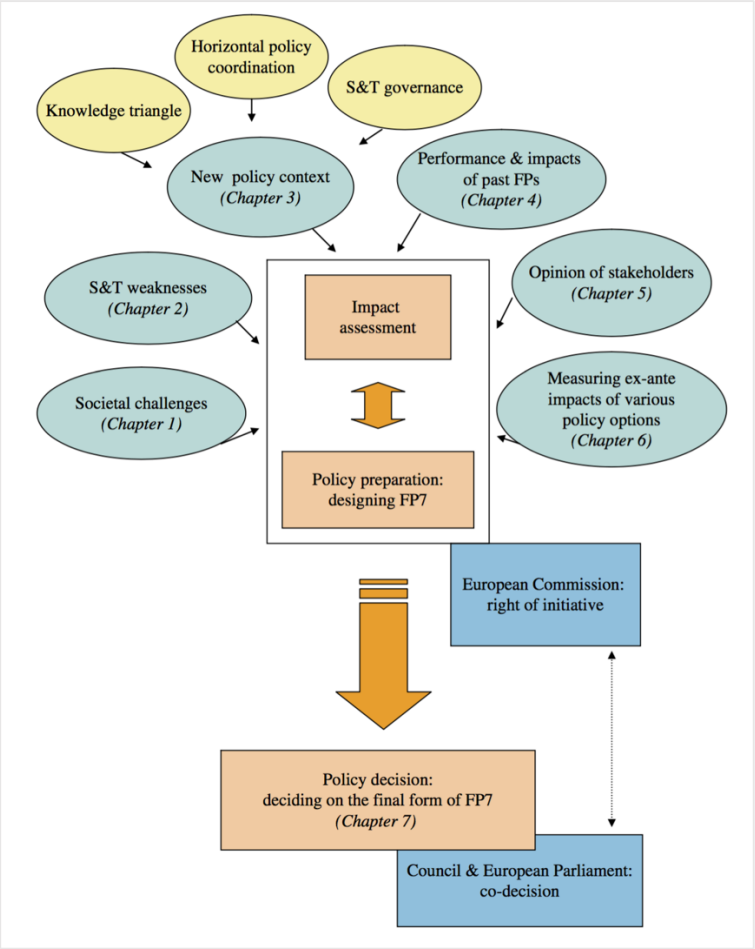
> *The originality of the book lies in its perspective, its transparency and its objectivity. It is the first to present, from a viewpoint inside the European Commission, the nuts and bolts of how EU research policy is actually constructed. It also provides a comprehensive analysis, on the basis of factual evidence, not only of the positive impacts of EU research, but also of the various criticisms that have been made of the Framework Programme.*

> *This degree of openness and objectivity is the direct result of another innovative aspect of the book: It represents the first fruits of a new approach towards policy-making, based on ex-ante impact assessment – a structured, evidence-based method of evaluating policy options and their expected impacts. The 7th Framework Programme was the first to be accompanied by an impact assessment report, and the material presented here draws extensively on this work.*

However, the promise to present the «nuts and bolts of EU research policy» was not completely fulfilled in the book, not in the sense of an intra-institutional account of how the Framework Programme was shaped and the proposal was developed. The description presented detailed analyses of the Commission's point of view on the European landscape in which S&T developed in the past, its weaknesses and strengths, its interplay with the productive sphere and the legitimation of the proposed paths for positive future developments. In addition, the book offers a discussion on the deliberation procedure realized in the Council and in the Parliament, including interesting details on the political dynamics, but fails to report the same for the Commission's preparation process, limiting to an essential review of the impact assessment preparation, structured as a logical, politically neutered, tree of contents (Fig. 7). The authors describe as well the FP7 *ex-ante* assessment phases (Muldur et al., 2006, p. xxiv), that can be summarised as:

1. Identify the problems and set the main objectives:
    - economic, social and environmental challenges;
    - structural weaknesses;
    - political context (failure of Lisbon).
2. Policy-design stage:
    - experiences from past Framework Programmes;
    - consultation of stakeholders;
    - assessing concrete policy options.

Fig. 7: The ex-ante impact assessment schema of FP7 reported in the book *A New Deal for an Effective European Research Policy - The Design* and *Impacts of the 7th Framework Programme (Muldur et al., 2006)*: the book itself follows the steps of the impact assessment for the Seventh Framework Programme. The original caption is «View of the policy-making process of FP7 - Source: DG Research»



The main political objective of *ex-ante* assessments is to prove the legitimacy of the Commission's proposal, through extensive analyses of the political-economic literature supporting it, frequent references to analogue studies conducted by other world-relevant institutions (see for example Fig. 17) and the depiction of the stakeholders' consultations phase, that is particularly important here to shed light on the Commission's preparation process.

The need of broad consultations is explained in the FP7 *ex-ante* assessment book acknowledging the relevance of the process to increase «the openness and transparency of policy-making», to strengthen «the quality of the policy itself», «to improve the dialogue between European science and its stakeholders», to create «ownership of the policy process», to «tackle a perceived "democratic deficit" of the EU», to meet «the growing stakeholders' expectation that their views are taken into account», to increase «acceptance» and finally «to make it easier to find consensus during the formal institutional decision-making process». Therefore, according to the authors, consultations serve at the same time the purposes of refining policies, enhancing democratic participation, precociously building consensus and – not least – enhancing the Commission's position with respect to the formal legislative bodies, the Parliament and the Council, by means

of the presentation of the stakeholders' consultations as the Commission's peculiar way of obtaining democratic legitimacy (Muldur et al., 2006, p. 144):

> *Both the Council, representing Member States, and the European Parliament, representing EU citizens, possess democratic legitimacy. However, this formalised institutional interaction does not exclude direct contact between the Commission and its stakeholders. In fact, it is one of the Commission's obligations according to the Amsterdam Treaty (…)*

The stakeholders, according to the policy officers, are not a pre-defined set of actors, but are identified according to the «problem at stake and the purpose of the policy action» (Muldur et al., 2006, p. 145); these are «researchers in the field, policy makers, users of research results, or interested individuals», coming from a variety of sectors including «public administrations, research institutes, universities, large companies, SMEs, international organisations» (Muldur et al., 2006, p. 143); «innovation agencies, industries, universities, NGOs, intermediary associations», «Member States and associated countries, regional governments, national research councils and a number of European representative organisations» (EC, 2012c, p. 11). The consultation methods are as well plural: Eurobarometers, Green Papers, online consultations, workshops, conferences and seminars; expert groups are also significantly involved in order to facilitate the exchange of information between the stakeholders and the Commission (Fig. 18 shows the consultation tools employed for FP7 and Horizon 2020). Broad stakeholders' consultations however, the FP7 policy officers argue, don't automatically lead to clear conclusions or better decisions (Muldur et al., 2006, p. 147):

> *Policy-makers must make a conscious decision to what extent they want to base their policy decision on expressed needs and/or its policy proposals. The wide spectrum of policy objectives and public budget constraints often imposes compromises in which not all comments or suggestions can be taken into account. But it would be wrong to evaluate consultation processes only in terms of the "direct" impact on decision-making. They can also have an "indirect" impact by stimulating communication or debate, setting the political agenda, removing a blockade within the policy process, contributing to an informed decision-making process or testing the acceptance of draft policy actions. So, even if no direct impact can be discerned or no real representative sample of opinions was gathered, dialogue and participation still contribute to a valuable culture of problem-solving, for example by changing attitudes within stakeholder groups.*

Not all the stakeholders, moreover, have the same impact on decision-making (Muldur et al., 2006, p. 147):

> *The opinion of advisory groups, government bodies, industry associations, or well- organised lobby groups may carry more weight than the opinion of unorganised minorities, while the views of a large multinational may have more influence than those of a small unknown company or of an individual citizen.*

Notably relevant is also the stage in the policy definition process in which a specific stakeholder is involved: the influence in very early stages, or at the moment of defining the overall structure, can be much deeper and far-reaching than the contributions inserted later, "fine-tuning" the proposal. The interviewee from the EU support office at CERN distinguished between the first discussions on the physiognomy of the Framework Programmes and the beginning of more formal consultations, through Green Papers, open calls, workshops etc., highlighting the different weights of the contributions:

> *"The grey area is in the very early stages, when people informally start discussions in Brussels; I hear that already now[50] in Brussels there are some informal consultations of these think-tanks people (…) My experience and my opinion was that the thing was already cooked when it was on the table ready for discussion. So, the interesting part is how they take the decisions to arrive to what I call the "raw", let's say, proposal. Then it's amended, shaped etc., but the butter already is there…*
> *The commission people decide initially the content, the priorities. Of course, they do talk to the Parliament in advance, they do talk to the Council, they don't make a proposal if they have not consulted broadly the people (…) the final decision is of course this tripartite[51] complex decision (…) I wouldn't say there are minor only amendments but (…) the biggest things were already there and it stayed there."*

CERN was requested to give an input to both the Commission, in the first phase of the H2020 consultations, which it provided as an individual organization and collectively through the EIRO forum partnership (gathering eight European international scientific facilities[52]), and to the Parliament, during the subsequent period of law-making. Some of the positions expressed by CERN were taken on board, according to the interviewee, but these were more on the distribution of budget or the refinement of the disciplinary details, rather than on the core structuring of the framework, that is developed in his experience by a group of Commission officers and their trusted think tanks, whose identity is not open, it's «secretly guarded»:

> *"I think they are people from the Commission mainly that start thinking already about the next Framework that will be starting in five years from now[53], and of course they have their own ideas, their identity is secretly guarded, so I don't know who they are, you can't talk to them."*

The interviewee's experience of the Commission's process to build the broad lines of the strategy and the organizational structure, hence, is very clear: a first, crucial, stage when some Commission officers shape the fundamental configuration of the Programme, gathering inputs from a selected group of reference experts, and the subsequent phase of formal consultations, much broader and comprehensive but less able to formulate influential changes:

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[50] The interview was realized in December 2015.
[51] He is referring here to the Ordinary Legislative Procedure (described above), involving the three European institutions: Commission, Council and Parliament.
[52] CERN, EMBL, ESA, ESO, ESRF, European XFEL, EUROfusion, ILL. More details on EIROforum website (EIROforum, 2017)
[53] cf. note 50.

> *"(…) they could have done the other way, they first collect input from the community on how the program could look like and what the priorities are, and all this, and then they could make a proposal… but in fact (…) at least for the Horizon Programme they had already in mind the structure, the priorities and all that, so they kind of present their idea and then they collect of course input, but the thing was already cooked."*

A different perception of the process was conversely depicted by the senior scientist at CERN I interviewed, engaged since the '90s in the support and organization of his research field:

> *"officially Europe does not decide, it's a real democratic scheme: Europe requires some inputs from the different countries – it's a bottom-up approach – (…) the role of the PCN[54] is to have the contact with the national communities and to say: 'Ok, bring ideas, and I will forward it to the European Commission. What do you want to do, what do you think should be the priority in the next five-ten years?'. So, this information is coming up and then, at the European level there are people who are trying to sort this information and to set up a list of priorities (…)*
>
> *I think it's a democratic scheme: there is information coming up, there are people responsible to clarify this and say 'Ok, apparently, there is general consensus that we should do that first, put in this amount of resources on that, etc..'. And this is the way the calls are organized: each call has a number of topics to be addressed which results from this analysis."*

He reverses the scheme, underlining as critical, in his experience, the role of the National Contact Points (NCPs), the network of reference organisations chosen by governments to offer country-specific practical information and assistance on the participation to Horizon 2020: each topic is committed to a devoted NCP expert, and these can be gathered in a single organization or belonging to different institutions – like in the French case, where the experts are distributed among several institutes. According to the scientist, National Contact Points are crucial to promote the flow of information between the country and Brussels, and to enhance the ability of researchers to «react quickly» in response to funding opportunities. The interviewee depicts what he calls «a real democratic schema», where Commission officers play a technical role, sorting the information and opinions shared by stakeholders and composing the Programme's proposal according to the emergent consents.

His view, compared to the previous CERN EU projects officer's one, may be determined by their different engagement in influencing Brussels' science policies. Actually, the scientist did have the experience of being consulted on the disciplinary contents of the Programme, and he was committed to support his scientific community by means of lobbying activity, invoking politically resonating geopolitical arguments:

> *"I was participating in some of the programs which were proposed by the European Commission, and therefore, through this link, I have been asked to provide some input about my experience and perhaps sometimes about my wishes, but (…) you have to understand with Europe this kind of things happen*

[54] He was using the French acronym for National Contact Points.

not necessarily, and this is not always the most efficient way, through the official links, so Europe works on the base of lobbying, so what matters is that you get networks of relationships at different levels of the European Commission and then you discuss with these people in a semi-official way, and this is generally the most effective way to have your ideas get through.(…)

CERN and the European Commission can work together to take benefit of the community (…) that we are working with (…). It's about eight hundred people in the world, so it's a real task force, to say: 'Ok, we are this community, since many years we try to work together, we organized a number of events, we organize a number of common projects, this is a chance for Europe, to take the leadership, compared to what happens in the States and in Asia'. Well, there are a lot, a number of actions going on, but we have a unique chance here that we have the potential to structure ourselves on a large scale because European Commission only exists in Europe, and covers many countries and also with good relationships with the rest of the world."

From her observatory at the Unit for the support of research and third mission (ARIC) at the University of Bologna, the third interviewee insisted on the multiplicity of consultations to which the University participated, especially in the Work Programmes preparation phases: WPs, in her words, are built as «little Frankensteins», containing not only the inputs of the concerned Commission's Directorates, but also from all the National Delegates, as well as from big industries, academic alliances (like LERU, the League of the European Research Universities), advisory boards and lobby groups, of which she acknowledged the different weights. During all these consultations, she recognized, the Universities' efforts are typically concentrated on pressuring to obtain an appropriate valorisation of their research issues: they watch primarily over the presence of subjects that are relevant for their research groups, and they discuss the adequacy of related budgets, while they are less concerned, at least at her University level, with the overarching political structure. Her supposition was that the Programme configuration was decided by the Commission on the basis of the analysis of the EU situation and of the previous Programmes assessments; besides, she didn't recognize in Horizon 2020 any drastic change, but a general reorganization of themes already present in FP7.

The disciplinary National Contact Points, in the Italian case, are all belonging to a same no-profit organization, the Agency for the Promotion of European Research (APRE), that since 1989 is working to support and assist public and private bodies, favouring their participation to European Research funding programmes. The National Contact Point I could interview described the NCP work mainly as, on one side, an intense communication activity – organization of events and realization of informative materials on the Framework Programmes, their structures, their rules and the calendar of the calls – and on the other as a support work to potential participants, helping them to write the proposal, finding possible partners and assessing the budgetary aspects of the projects.

As for the preparation phase of the Framework Programmes, she emphasized the role of the National Delegates, who are entrusted by the Governments with the mandate to express the National position on a

specific issue to be inserted in the Work Programmes, i.e. their task is to represent effectively the interests of the national communities pushing, within the Commission's pre-established boundaries, for the development of calls able to reflect the national scientific landscape in that field. In this sense, she argued, National Delegates, have a more political role than National Contact Points and can actually influence the Commission:

> *There are two different figures: the Delegate representatives of the Member States and the National Contact Points; in practice, we are the operatives, the labourers, while the others are those who set the lines, the strategies that are inserted afterwards into the Work Programmes.*

Summing up the testimonies of the interviewees, whose standpoints belong to different institutions, participating in various ways to the Framework Programmes' definition, we can certainly observe that the consultation activities realized by the Commission are intense and important, and that the consulted organizations spend a considerable share of their time in discussing and elaborating the inputs to submit: although there is no fixed procedure to follow and there are no institutional accounts on the Commission's work, from the interviews we can understand that the stakeholders' consultation process is well known and its mechanisms are shared among the actors. On the other hand, the clearest part in their opinion is the one concerning the Work Programmes delineation, rather than the FPs overarching strategy, objectives and structures design, that comes pre-defined to the stakeholders' discussion tables: the initial design process remains a «grey area», and it is exactly in this phase that the policy narratives are developed and embodied in the strategies.

The budget negotiations. Finally, additional insights on the FPs development can be obtained by the accounts on the budget negotiations, which involved the Council, the member States and the Parliament, as well as the Commission, and give significant indirect clues on the tensions that arose around the issues of science policy among the relevant actors[55].

The discussion on the budget for FP7 happened in the midst of the negotiations for the overall Multiannual Financial Framework of the Community (MFF 2007-2013), and was affected by the conflictual political climate. The first budget proposal elaborated by the Commission dates back to 2004, when the Lisbon Strategy had just undergone the mid-term review, and was still very high in EU agenda: the Commission proposed an increase in the spending for research of a factor two, and the figure of 73 billion euros was proposed for the Seventh Framework Programme in 2005. The research community and the Parliament welcomed the Commission's proposal, while the Council, representing the national interests, showed a mixed reception: the political support for the Community had just suffered a setback with the rejection on the Constitutional Treaty in France and in the Netherlands, and there was already concern regarding the insufficient progress of the Lisbon Strategy. In 2003 six European countries – Germany, France,

[55] The accounts of budgetary negotiations in the next paragraphs are mainly based on the devoted sections of (Muldur et al., 2006) and (EPRS & Reillon, 2015).

UK, the Netherlands, Austria and Sweden – had declared in a letter to the Commission President Prodi that they wouldn't have accepted any significant increase of the EU budget, fixing the ceiling at the 1% of the Gross National Income (GNI). Despite this, the Commission's proposal for the new MFF was 1,21% of GNI, with the part devoted to "Competitiveness for Growth and Employment" (of which more than half was foreseen for R&D) representing the 12.2% of the total. The reaction was polarized into two blocks of member states, identified by media coverage with the "Blair vs. Juncker" expression (see for example Smith, Watt, & Temko, 2005): the first, with the support of Sweden, the Netherlands, Spain and Finland, argued for a reduction of the budget share devoted to agriculture in favour of more Lisbon-related topics, including research; the second group – among which relevant countries were France, Poland, Spain, Germany and Luxembourg – conversely supported the "traditional" budget prevalence of agriculture (see Fig. 19). The polarization was enhanced by the fact that during 2005 Luxembourg and UK shared the Council Presidency: at the end of the first semester Prime Minister Juncker presented a compromise proposing an overall budget of 1.06% of GNI – closer to the 2003 six countries' request – at the expense, among the others, of the R&D, cut by more than 40% with respect to the Commission proposal, while agriculture was increased by 3%; the succeeding Blair Presidency, despite the declarations against the large share of budget devoted to agriculture, was unwilling to renounce to the UK rebate – obtained by Prime Minister Thatcher in 1985 precisely in the backdrop of the expenses for agriculture, at that time set at around 70% of the budget – and ended up with a proposal largely following Juncker's lines. The Council agreement – 1.04% of GNI – resulted in a budget proposal for FP7 of 47 billion euros for the seven years of the Programme, instead of the 73 billion considered necessary by the Commission.

The Parliament and the research community showed their disappointment by means of official declarations[56] and petitions[57]. However, the final deal between the Parliament and the new Austrian Presidency was only slightly higher, accounting for FP7 for no more than 338 million euro extra. With the final decision, the contributions to agriculture represented about the 80% of the overall EU budget, while the funds for R&D stopped at 5.5%; however, albeit reduced, the budget for the Framework Programme was significantly increased from previous FP6 (see Fig. 9).

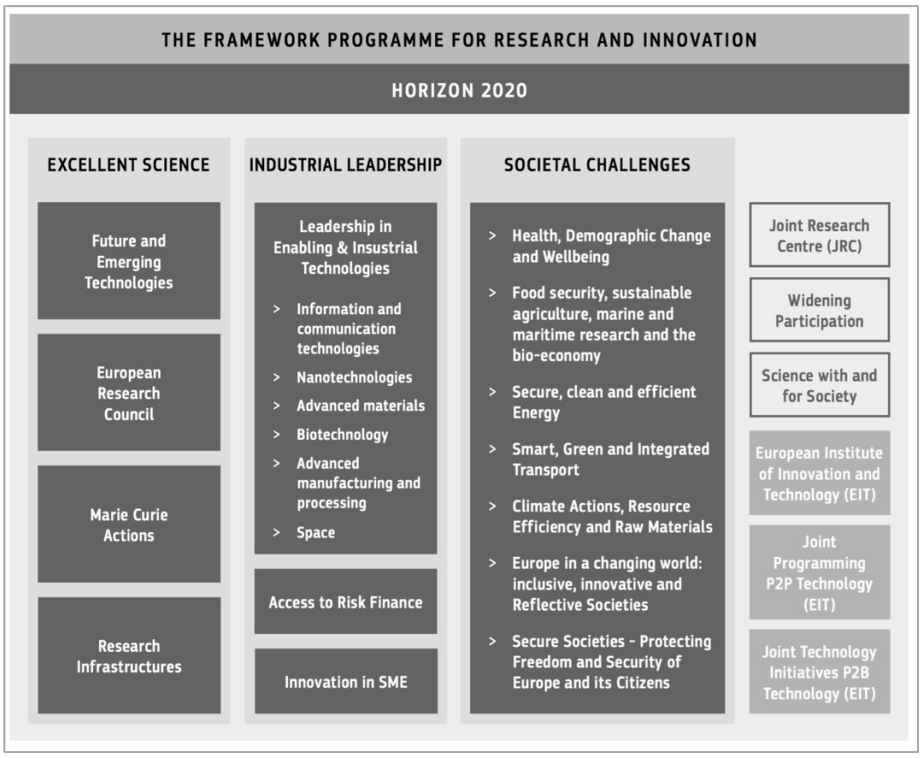
The discussion of the budget to be devoted to Horizon 2020 showed similar dynamics – Commission, Parliament and scientific community very favourable to a relevant increase of funding, Council reluctant to expand the budget – but didn't experience a drastic cut like FP7.

[56] "it is essential to stress that only by preserving the original level of financing, as indicated by the European Commission and the European Parliament, will it be possible to guarantee a realization of the objectives mentioned below. Any cuts in FP7 budget are against the Lisbon Strategy and in disagreement with all the declarations of European Union leaders. Thus, a clear vision and strong leadership are necessary. We expect both of these features to emerge in the European Council decisions." (Buzek report, Buzek, 2005).

[57] E.g. the "European Petition for Research and Innovation" ("MEPs and research personalities petition European Council for more funds to support European competitiveness | Times Higher Education (THE)," 2006).

Horizon 2020 was conceived to represent a discontinuity from the previous Programmes, perceived as too complex, bureaucratic and fragmented; the new Programme was designed to integrate all streams of research funding[58] in one instrument, operated with a unique set of rules, and it was intended to implement the new Europe 2020 strategy, published in 2010 to succeed to the previous Lisbon approach. Horizon 2020 is based on a new architecture with three pillars – "Excellent science", "Industrial Leadership" and "Societal Challenges" –, complemented by two specific objectives – "Spreading Excellence and Widening Participation" and "Science with and for Society" – (see Fig. 8)[59].

Fig. 8: The structure of Horizon 2020 (source: *(EC, 2017c)*)



The initial proposal of Horizon 2020, published by the Commission in November 2011 (EC, 2011b), set the necessary budget to 87,7 billion euros. Deciding the overall budget allotted to the different issues in the Multiannual Financial Framework, as we have seen, is a Council's responsibility, and the figure committed in the 2013 MFF to Horizon 2020, for its seven years of duration, was reduced to 79,4 billion euros.

The European Parliament, which a couple of months earlier proposed for H2020 a budget doubling the FP7 one (EP, 2011b) – 100 billion euros –, couldn't achieve its ambitious target, but managed anyway to influence the shape of the Programme: the two specific objectives "Spreading Excellence and Widening Participation" and "Science with and for Society" were added on a Parliamentary committee ITRE proposal,

[58] The Programme incorporates some parts of the Competitiveness and Innovation Framework Programme (CIP), as well as the European Institute of Innovation and Technology (EIT), funded in 2008 – on the model of MIT in the US – to work on the integration of the "Knowledge Triangle" dimensions: higher education, business, research and technology. It finances "Knowledge and Innovation Communities" (KICs), which are able to «bring ideas to market, turn students into entrepreneurs and, most importantly, (…) innovate» (EIT, 2017).

[59] The comparison between Fig. 15 and Fig. 16 shows how the sectors of FP7 were re-organized in Horizon 2020.

together with the addition of "Secured Societies" as a distinct societal challenge; the Parliament insisted also on funding for SMEs, introducing the Fast Track to Innovation initiative[60].

In 2015, the so-called Juncker Plan (European Fund for Strategic Investments, EFSI), aimed at encouraging the European economic recovery by encouraging private investments, allocated 16 billion of the EU budget, thus reducing the budget for Horizon to 74.8 billion; the Parliament tried again to defend the budget for research programmes, but only managed in reducing the contribution to EFSI from Horizon and to defend the share for ERC. The scientific community, that since the beginning had supported the Commission's request and the Parliament's position, expressed concern for the cuts to Horizon, publishing an «ERA Stakeholders Joint Statement on the European Fund for Strategic Investments (EFSI)» (CESAER, EAERTO, EUA, LERU, & Science Europe, 2015).

The need for a deeper understanding of the research policy design stage

The analysis of the factors influencing the European Union's scientific policy lines elaboration and the policy design process returns an involved landscape.

On one side, the historical evolution of a communitarian scientific policy has followed – or in some cases even anticipated – the ups and downs of the European integration. Different models of research policy were realised by European institutions, and the current one – based on innovation – appears as a transitional model where diverse visions of research objectives and methods are engaging in a not-yet completed confrontation.

On the battlefield of R&D, not only the visions and understandings of science policy were at stake, but also some diverse visions of integration were tested, and this is still visible in the co-existence of different approaches to decision-making, according to different scientific issues, and in the specific roles and behaviours of the European institutions involved in law-making.

Nonetheless, a prevailing method for scientific policy-making has emerged: the multiannual Framework Programme schema, which is currently by far the prevailing method for EU to exert influence in the landscape of European scientific research.

The Framework Programmes are not only technical procedures of funding distribution, but incorporate as well theories of economic, social and political order and, finally, visions of European future. Throughout the law-making process, the most sensitive part with regards to the building of reference conceptual frameworks is the initial conception of the Framework Programmes in the Commission offices, before the start of the formal *iter* of consultations and institutional debates, as it is confirmed by the testimonies of selected European institutional actors, whose work put them in close contact with the EU research frame. However, the very initial phase of policy elaboration is also the least accessible from outside

[60] A pilot project to fund close-to-market initiatives with no pre-defined topics.

the Commission, to the point that even a high level officer in an important research institution defines it as a «grey area». Moreover, as the Parliamentary debate and the interviewees accounts on the stakeholders' consultation show, it is very difficult to touch the broad, overarching policy structures in the successive phases of law elaboration.

It is thus particularly interesting to investigate the conceptual frameworks underlying the strategies on research, as expressed in policy discourses, in order to reconstruct the features and origins of the basic ideas and narratives on science and the European society that are undergoing confrontation in the current research programmes, and set the basis for a deeper understanding of the decisions taken in the very first phases of policy elaboration, that prove to be so significant for the development of the current and future EU research policy.

Frames and narratives in EU policy discourses on science

«Era l'alba quando disse:

-Sire, ormai ti ho parlato di tutte le città che conosco.

- Ne resta una di cui non parli mai.

Marco Polo chinò il capo.

- Venezia, - disse il Kan.

Marco sorrise.

- E di che altro credevi che ti parlassi?

L'imperatore non batté ciglio.

- Eppure non ti ho mai sentito fare il suo nome.

E Polo:

- Ogni volta che descrivo una città dico qualcosa di Venezia.»

(Italo Calvino, Le città invisibili, 1971)[61]

Introduction

With Horizon 2020, for a bright future!

The concluding sentence of the Horizon 2020 introductory video (EC, 2014e), published in 2014 at the launch of the Programme, sums up the dense web of expectations and projections into the future embedded into the Framework Programme for research funding.

Dealing with research programmes doesn't only mean describing the procedures, or explaining the available lines of funding: it entails expressing the visions that underpin research policy, its orientation, motivations, actors, values, issues. In other words: it involves conveying and representing the concerned conceptual frames.

Master frames and narratives always imply explanations of the past and visions of the future, which they contribute to shape. In the case of Framework Programmes – analysed here as the prevailing instruments of European research policy of the last three decades – the historical roots date back to the very inception of the Community research policy, and are deeply entangled with the dynamics of European

[61] I owe this citation to U. Felt, in (Jasanoff & Kim, 2015).

integration: the idea of a European coordination of national policies appeared feasible only in the '70s, and a real affirmation of the FPs was achieved in the '90s. Since the launch of the first Programme in 1984, Europe witnessed the end of the bipolar world order, transformed itself from an economic community into a proper polity, saw the rise of new important actors on its political scene (citizens, engaged scientists), launched major strategies in the knowledge fields (Lisbon strategy, ERA, Bologna process), implemented an internal reform of the governance, opened to the largest enlargement in its history, failed the project for a Constitution and had to face the consequences of the economic crisis. All these events marked a stamp in how research policies have been conceived and implemented.

Alongside contemporary events, long-term cultural reflections and more recent developments in academic thinking about the role and orientation of research funding have influenced the development and employment of the conceptual frames recognisable in research policy discourses. These different perspectives developed side by side, although they were not necessarily harmonious, in the context of an overarching orientation towards economic growth, clearly stated in policy discourses.

In the European scenario, the tensions among different visions of science policy have represented, and they may as well do so in the future, a fruitful debate arena for confrontations on the very nature of the Union; indeed, the friction points revolve around the issues of democracy, transparency, orientation choice, funding distribution criteria: all critical matters for the definition of the Union political physiognomy at large.

Furthermore, each position implies a specific and diverse vision of the «bright future» promised by the H2020 introductory video, and envisions different instruments to achieve it. The debate about which one to choose, or which alternative vision of future to pursue is still ongoing: due to the weakness of the political debate at EU level, a clear choice is not likely to happen soon in the European institutional bodies.

Consequently, it is even more necessary to unravel the discourses on research policy in order to identify and expose the relevant conceptual frames and what their features imply for future developments.

The story told by the Framework Programmes establishing acts

During the last three decades, the Framework Programmes have been the major instruments of European research policy.

The Framework Programmes establishing documents[62], as mentioned, are particularly relevant to the objectives of this research, since they are at once active instruments of policy-shaping and detailed descriptions of the communitarian science policy. On one hand, they are the legal instruments by means of which the analyses, consultations and decisions taking place in the Union policy-making offices materialise in concrete actions, exerting influence on the European scientific – as well as economic, social and cultural – landscape; on the other hand, they concretely consist in lengthy documents describing – from the

[62] See paragraph *The Framework Programmes and the ERC establishing acts* for a detailed introduction.

perspective of the European institutions – the aims, foundations, concerns and projects to modify the scenario in the interest of the Member States and of the European citizens.

In other words, FPs establishing acts are situated at the border between science and society, where both co-produce each other: they are thus especially meaningful for the analysis of socio-technical (and political) conceptual frameworks.

Their first part in particular, explaining the Programmes' base principles and describing the characterising features that such research should have, is particularly interesting to understand the frameworks shaping and grounding EU science policy.

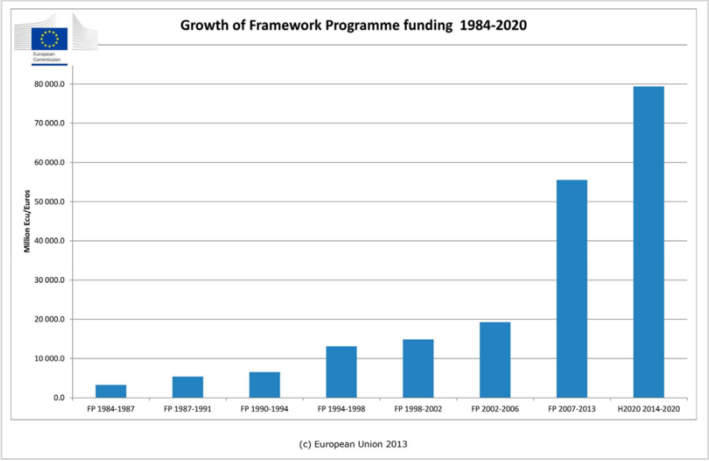
Moreover, the establishing acts are the documental result of the previous intensive and protracted negotiations among the policy actors, and bear the signs of the different voices and of the historical events that contributed to shape EU politics in the last three decades.

The evolution of Framework Programmes. Indeed, the Framework Programmes objectives, structures, themes, budgets and discourses changed significantly over time, even without ever distorting, testifying the evolution of the European strategies on research.

The Programmes are running since 1984 and had a duration of approximately four years up to FP7, which was extended to seven years in order to coincide with the Multiannual Financial Framework[63] and avoid the burden of multiple, asynchronous, budget discussions; the allocated funds increased regularly in absolute terms, following the increase in the total EU expenditure (Fig. 9), although sometimes undergoing harsh negotiations[64].

Fig. 9: The Framework Programmes, their period of activity and the evolution of Framework Programmes budgets in absolute terms *(source: EC, 2013b)*; for the increase of the funds devoted to research in terms of share of the total EU expenditure see Fig. 3.

Framework Programme	Period
First (FP1)	1984-1987
Second (FP2)	1987-1991
Third (FP3)	1990-1994
Fourth (FP4)	1994-1998
Fifth (FP5)	1998-2002
Sixth (FP6)	2002-2006
Seventh (FP7)	2007-2013
Horizon 2020	2014-2020



[63] The Multiannual Financial Framework (MFF) is a legally established entity since the Treaty of Lisbon in 2007, and the current one, running from 2014 to 2020 is the first with this name; however, since 1988 European institutions agree on Interinstitutional Agreements (IIA) for multiannual financial perspectives.

[64] See the accounts on budget negotiations for FP7 and H2020 reported in section *The EU decision-making process(es) for scientific research*.

A fundamental turning point in the Framework Programmes history was the development and launch of the European Research Area (ERA), around the year 2000, that opened to a much stronger integration between the European level and the nation states, and complicated the Commission's task to prepare the Programmes. Nevertheless, it was in the same years, with the valorisation of research as the base for the knowledge economy in the Lisbon strategy, that research policy acquired the current relevance in the European agenda (Andrée, 2009): scientific research is currently considered – and this is frequently reflected in policy discourses (CEC, 2005b; e.g. Juncker, 2014) – one of the main drivers of growth and employment in Europe.

The first Framework Programmes. The first Framework Programme was conceived at the beginning of the '80s as a pilot initiative to promote a reorganization of the confused and scattered landscape of the European research-promoting initiatives, each of them requiring a specific effort of legitimation in front of the Council, a body that is traditionally reluctant to accept any communitarian initiative. Up to the Single European Act, in 1986, there was formally no legal mandate for research policy in the Treaties, therefore it was necessary to legitimize each communitarian intervention in that field. The debates on the "technological gap" with the US during the '60s and the '70s had frequently underlined the need to strengthen the ties between research and industry, hence it appeared a natural choice to ground[65] research policy to the existing communitarian aim of economic development (Guzzetti, 1995): the preamble of the first Framework Programme establishing act (CEU, 1983) echoed the Article 2 of the Rome Treaty[66], which paired the objectives of economic development and of the rising in the standards of living, adding to it the need to promote a «balanced scientific and technical development»:

> *Whereas Article 2 of the Treaty establishing the European Economic Community assigns to the Community the task, among others, of promoting throughout the Community a harmonious development of economic activities, a continuous and balanced expansion and an accelerated raising of the standard of living;*
>
> *Whereas it is important to promote balanced scientific and technical development within the Community;*

The «scientific and technical objectives» of the Programme focused on the competitiveness of the agricultural and industrial sectors, on the management of raw materials and energy resources, on the

[65] Via the article 235 of the Treaty establishing the European Community (CEU, 1987, p. 6): "If action by the Community should prove necessary to attain, in the course of the operation of the common market, one of the objectives of the Community and this Treaty has not provided the necessary powers, the Council shall, acting unanimously on a proposal from the Commission and after consulting the European Parliament, take the appropriate measures."

[66] Article 2: "The Community shall have as its task, by establishing a common market and progressively approximating the economic policies of Member States, to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increase in stability, an accelerated raising of the standard of living and closer relations between the States belonging to it." (Guzzetti, 1995)

improvement of the living and working conditions and on a better effectiveness of the European scientific and technical potential (Fig. 20)[67].

The "Article 2" rationale, updated with the evolvements in the European Treaties, was to represent the ground for all the subsequent Framework Programmes. The Second Programme included, in fact, the same paragraph in the preamble, and complemented it with a series of new elements, expanding and enriching the motivations for action (CEU, 1987):

> *(…) in order to encourage the development of the international competitiveness of European industry, it is necessary to promote scientific research and technological development at Community level in order to strengthen the scientific and technological basis of its industry, thereby complementing the activities carried out in the Member States;*
>
> *(…)*
>
> *(…) it is necessary to promote the overall harmonious development of the Community with a view to strengthening its economic and social cohesion; (…) it is intended that the implementation of common policies of the Community, and its strategy for research and technological development, shall contribute to this objective;*

Already in this early Framework Programme, it is possible to recognize the polarization of the objectives around two main orientations: on one side, the logic chain connecting the reinforcement of research to the strengthening of the S&T basis for the industry, which in turn was intended to boost the European international competitiveness; on the other side, the target of «cohesion» was inserted – i.e., in the EU lingo, the aim of reducing the social and economic differences among the European regions – and the specific theme «quality of life», including the health and environment fields, was better defined as a contribution to «a European concept of the quality of life in those aspects which are most clearly perceptible to each individual»[68]. For the first time in this Framework Programme, after the official procedure introduced by the single European Act in 1986, the Parliament could influence the Council's decisions, and pushed for more resources to be devoted to "market-pulled"[69] industrial research, to be coupled with the social objectives (Guzzetti, 1995); cohesion was also added to the Riesenhuber criteria[70] as a justification for communitarian involvement.

The Second Framework Programme was not yet completely developed when the new Commissioner Pandolfi[71] decided to prepare and launch a third one, inaugurating the scheme of successive overlapping

[67] All the funded themes and the breakdown of the total budget is described in the Annexes to the FP1 establishing act, reported in Fig. 20.

[68] Purpose of the health sector (CEU, 1987), representing also the opening of the objectives concerning the «Quality of life» headline (see Fig. 21).

[69] The expression "market pull" refers to the development of technology according to the requests of the market, while "technology push" to an evolution led by the internal dynamics of the technological endeavour.

[70] See the paragraph *Which science for which Europe?*.

[71] Filippo Maria Pandolfi was Commissioner for Science, research, development, telecommunications and innovation, and the Joint Research Centre (January 1989 - January 1993); see Table 18 for the list of all the Commissioners to research.

multiannual Programmes. This Programme, that faced fierce battles on the budget[72], confirmed the increasing importance that the information and communication technologies were beginning to represent in the eyes of the European scientific politicians and officers: while in FP1 the greatest budget share was devoted to energy (47.2%), followed by industrial competitiveness (28.2%), FP2 assigned 42.2% of the funds to information and telecommunications (grouped under the heading «Towards a large market and an information and communications society»), 21.7% to energy and 15.5% to the «Modernization of industrial sectors» (see Fig. 20 and Fig. 21). In FP3 the ICT accounted for the 38.5%, energy for the 14.5% and «Industrial and materials technology» for the 15.5% (see Fig. 22).

Maastricht and the broadening of FPs scopes. The «six major concerns» guiding the elaboration of the Third Framework Programme reflected an evolution in the political reflections on the role and nature of the European research policy: these went beyond the traditional strategic positioning of Member States and Community – the Riesenhuber criteria were a clear product of this approach –, including references to longer term strategies like the Single Market and acquiring a clearer European political dimension, involving also social and environmental aspects. The «concerns» were (CEU, 1990):

> *- improving industrial competitiveness whilst maintaining the pre-competitive nature of Community activities;*
>
> *- meeting the challenges linked to the attainment of the large market as regards norms and standards by strengthening prenormative research;*
>
> *- modifying industrial operators' attitudes in the direction of further transnational initiatives;*
>
> *- introducing a European dimension into the training of scientific research and technological development staff;*
>
> *- increasing economic and social cohesion whilst ensuring the scientific and technical excellence of research projects;*
>
> *- taking into account environmental protection and the quality of life.*

These developments would have been sanctioned in the Maastricht Treaty in 1992, where a clearer political dimension was added to the previous economic physiognomy of the Community: a European citizenship was established, a social policy was introduced and the communitarian areas of interventions were expanded. In the field of science, «all the research activities deemed necessary» were promoted by the Treaty, thus widening the fields of European intervention and opening for the Framework Programmes expansion.

FP4, in fact, included this broadening of perspective both in the evolution of the subjects, among which for the first time «Targeted socio-economic research» appeared (although with a very small share of the budget, 1.5%), and in the description of the general principles orienting the research activities, where,

[72] Commission's initial proposal was 7.7 billion ECU, Parliament's one was 8.23 billion, while the Council reached a consensus on the figure of 5.7 billion (Muldur et al., 2006, p. 73ss.).

alongside the usual emphasis on industrial competitiveness, new importance was assigned to quality of life, sustainability and employment – all dimensions related to social objectives and citizenship (EP & CEU, 1994):

> *(…) the purpose of Community RTD in accordance with the objectives laid down in the Treaty should be to foster a prosperous Community based on industrial competitiveness, quality of life and sustainable development; whereas it is also desirable that it contributes to supporting economic growth and a high level of employment; (…)*
> *Activities should contribute to meeting the general objectives of the Community, such as promoting sustainable development and improving the quality of life of the Community's citizens.*

The turning point: ERA and Lisbon. As mentioned, the turn of the Millennium has to be considered a turning point for Framework Programmes, and FP5, active from 1998 to 2002, is the transition Programme.

The intellectual background of the Fifth Framework Programme was constituted by the considerations on the shift from periods in which research was oriented prevailingly to military or industrial objectives towards a «third phase», «pairing innovation and society». The policy officers responsible for the development of R&D policies wrote (Caracostas & Muldur, 1998):

> *With the dawn of the 21st century, the main challenges for the European Union (EU) are the need to complete its economic and monetary integration, rediscover a pattern of lasting and sustained growth and reduce levels of unemployment and social exclusion. It must achieve this, furthermore, without sacrificing its social model and its cohesion against a background of growing globalisation which is prone to foster a rise in national and regional self-interest rather than solidarity and co-operation.*

FP5 showed various new elements: in the establishing act for the first (and only) time societal problems were placed among the objectives before competitiveness and industrial development (EP & CEU, 1998):

> *(…) the Community's research and technological development policy should address, as a matter of priority, problems of society, improving the international competitiveness of Community industry, sustainable development, job creation, the quality of life and globalisation of knowledge, contributing to the development and implementation of the Community's policies and the role of the Community in the world as a focal point of scientific and technological excellence;*

The developments in the Union policies of the '90s, with the establishment of the new European policies in the social, educational and cultural areas, led to a series of important changes on the positioning of research in the European political strategy and in the significant broadening of the objectives of the Programmes. As we will see below, academic and political reflections on the role of knowledge and innovation had increasingly acquired relevance, leading to the reformulation of the European policies on knowledge: the Bologna process and the launch of the European Research Area renovated the higher education and the R&D sectors respectively, and the Lisbon agenda positioned research at the heart of the

European growth strategy. In the same years a series of protests, particularly focusing on scientifically-related issues, led to the emergence of the citizens as non-negligible actors of the European political scene.

The Lisbon strategy originally was conceived with the input of «coupling innovation with the preservation of social cohesion and this as a compromise between market liberalization and a social democratic approach under the umbrella of a Schumpeterian vision of innovation» (Boyer, 2011). «Social objectives» of research – among which employment, health, quality of life and environment – were explicitly listed among the FP5 criteria for funding research, alongside the traditional subsidiarity arguments and the techno-economic development rationales; also the «expectations and concerns of (…) citizens» were mentioned (EP & CEU, 1998):

> *In application of the foregoing principles, the framework programme shall be defined on the basis of a set of common criteria, divided into three categories:*
>
> - *Criteria related to the Community 'value added' and the subsidiarity principle*
>
> *(…)*
>
> - *Criteria related to social objectives*
>   - *improving the employment situation,*
>   - *promoting the quality of life and health,*
>   - *preserving the environment,*
>
> *in order to further major social objectives of the Community reflecting the expectations and concerns of its citizens.*
>
> - *Criteria related to economic development and scientific and technological prospects*
>   - *areas which are expanding and create good growth prospects,*
>   - *areas in which Community businesses can and must become more competitive,*
>   - *areas in which prospects of significant scientific and technological progress are opening up, offering possibilities for dissemination and exploitation of results in the medium or long term,*
>
> *in order to contribute to the harmonious and sustainable development of the Community as a whole.*

An attentive eye was kept throughout the document on the citizens, often described as the end beneficiaries of the policies, and thereby legitimating the actions; ethical aspects of research[73] and equal opportunities were also inserted among the prescriptions for research projects. A «key action» on the improvement of the «human research potential and the socioeconomic knowledge base», with a limited but relevant share of the 9.4% of the budget, was created, with a three-folded aim: fostering human capital, promoting socio-economic and cultural development and providing the knowledge-base for S&T policies. The action included support to training and mobility of European researchers with the establishment of training

[73] Although the attention to ethical aspects of research had already been introduced in FP4 for the first time, in FP5 they are stated more vigorously: «it is necessary to take into account the ethical aspects of advances in knowledge and technologies and their application and to conduct research activities in compliance with fundamental ethical principles and with the protection of privacy».

networks and Marie-Curie fellowships, and described socio-economic research on one side as «the base for employment-generating social, economic and cultural development and for building a European knowledge society», and on the other side as necessary to «support the development of the specific knowledge base needed by policy-makers and other users on European science and technology policy issues» (EP & CEU, 1998).

The Sixth Framework Programme developed and expanded the same approach on the inclusion of socio-economic research, multiplying the funding lines (the share of budget increased from approximately 9% to 14% of the total budget[74]), and distinguishing the dimensions of citizenship and society: two specific thematic streams were established on «citizens and governance in a knowledge-based society» and «science and society»[75] (EP & CEU, 2002):

> *(Citizens and governance in a knowledge-based society) The activities carried out in this area are intended to mobilise in a coherent effort, in all their wealth and diversity, European research capacities in economic, political, social sciences and humanities that are necessary to develop an understanding of, and to address issues related to, the emergence of the knowledge-based society and new forms of relationships between its citizens, on the one hand and between its citizens and institutions, on the other.*
>
> *(Science and society) The activities carried out under this heading are intended to encourage the development of harmonious relations between science and society and the opening-up of innovation in Europe, as well as contributing to scientists' critical thinking and responsiveness to societal concerns, as a result of the establishment of new relations and an informed dialogue between researchers, industrialists, political decision-makers and citizens.*

At the same time, FP6 marked a shift towards institutionalization: it was the first Programme explicitly aimed at structuring the European Research Area, embracing the Lisbon agenda on the knowledge-based economy, and merging it with the «European model of society»:

> *At the European Council in Lisbon in March 2000, the European Union set itself the ambitious objective of becoming "the most competitive and dynamic knowledge-based economy in the world, capable of sustained economic growth providing more and better jobs and greater social cohesion". (…)*
>
> *Europe's transition towards a knowledge-based economy and society, and its sustainable development in the interests of the quality of life of all citizens will be all the easier if it takes place in a way which is properly understood and managed. This requires a substantial research effort concerning the issues of integrated and sustainable economic and social progress based on the fundamental values of justice and solidarity and cultural diversity which characterise the European model of society, as well as*

[74] cf. the breakdown budgets of FP5 and FP6 in Fig. 24 and Fig. 25-Fig. 26, keeping into account that in FP5 the «Fourth activity» included both human resources and socio-economic research, and consequently it is necessary to compare the devoted budget with the correspondent research lines in FP6 (including as well human resources, which in FP6 compare as a separate heading).

[75] With a limited share of budget: respectively 1.5% and 0.5% of the total (see Fig. 25 and Fig. 26); however, unlike for FP5, human resources and knowledge-base for the policies had devoted lines of funding and were not merged with these ones.

research on issues relating to entrepreneurship and the setting up, growth and development of small enterprises.

To the «European model of society», aimed at an «integrated and sustainable economic and social progress», a set of fundamental values were ascribed – justice, solidarity, cultural diversity – that usually pertain to the socio-democratic political space. In 2004 – two years after the launch of FP6 – the head of the Commission changed political area, and the centre-left president Romano Prodi was succeeded by José Barroso from the centre-right European People's Party, who would have remained in office for two mandates, until 2014.

The rise of innovation. FP7, developed from 2004 and 2006 (Andrée, 2009), after the political turnover, and launched around the mid-term review of the Lisbon strategy (2005), went further in the strategical characterization of the Framework Programmes as key instruments of the communitarian strategy: the establishing act preamble was re-written – it had remained very similar since the first Framework Programmes – and the ERA, the Lisbon agenda and the triangle of knowledge were inserted among the reference strategies for the Programme (EP & CEU, 2006b):

> *The Community has the objective, set out in the Treaty, of strengthening the scientific and technological bases of Community industry, thereby ensuring a high level of competitiveness at international level. (…) Through its support for research at the frontiers of knowledge, applied research and innovation, the Community seeks to promote synergies in European research and thus provide a more stable foundation for the European Research Area. This will make a positive contribution to the social, cultural and economic progress of all Member States.*
>
> *The central role of research was recognised by the Lisbon European Council of 23- 24 March 2000 which set the European Union a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. The triangle of knowledge — education, research and innovation — is essential for achieving this goal, to which effect the Community aims to mobilise and strengthen the necessary research and innovation capacities.*

The traditional rationale – research aimed at strengthening industrial competitiveness – was complemented with the Lisbon and ERA objectives; however, while in FP5 the two poles – the problems of society and the industrial competitiveness – had been presented side by side, in FP7 a causal relation is established between the second and the first: strengthening the S&T basis for industry, thus boosting its competitiveness, is supposed to achieve «a positive contribution to the social, cultural and economic progress» of the Union; furthermore the socio-economic disciplines saw a shrinking in budget[76].

[76] Approximately from 4% to 2%. These figures refer to the share of budgets devoted to socio-economic research FP6 and FP7, which can be computed separately from the funding for human resources, as opposed to the case of FP5 (see Note 74).

Hence, while since FP5 there had been a steep broadening in FPs scope, especially in the sense of widening the political grounding of research to the dimensions of quality of life and citizenship, with FP7 a new reordering of objectives was set up, re-establishing economic competitiveness as the prevailing target for the communitarian research policy. This tendency was parallel to the rise in importance of the concept of innovation, which has become the key concept of the current Framework Programme, Horizon 2020, defined on the Commission website as «the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness» (EC, 2014e).

The concept of innovation had appeared in all the establishing acts[77], mainly with the meaning of novelty or associated with the capacities of small and medium enterprises (SMEs) to give fresh inputs to the European industrial landscape; however, it began being framed as an important policy axis in the Fifth Framework Programme, where a «horizontal theme» on the «promotion of innovation» was introduced (EP & CEU, 1998):

> *Innovation is a key factor in industrial competitiveness, sustainable social and economic development and job creation. (…) Promotion of innovation and SME participation, although not synonymous, are closely linked. (…)*
>
> *General objectives*
>
> *(a) Promotion of innovation*
>
> - *to help implement innovation policies in the European Union, in particular by contributing to the creation of an environment conducive to innovation,*
> - *to enhance public awareness of the benefits of innovation,*
> - *to improve the economic and social impact of framework programme research activities by ensuring better dissemination and exploitation of their results, as well as the transfer and dissemination of technology from various sources, taking account of the needs of customers and users,*
> - *to facilitate access of programme participants (particularly SMEs), through provision of information and advice, to instruments which support innovation.*

The vision of innovation was framed in a systemic perspective, highlighting the dimensions connected to the creation of an innovative «environment», the involvement of actors (SMEs, the public) and the networking and dissemination activities.

In FP5 and FP6 the term innovation began appearing more frequently, often coupled with «research» in the compact expression «research and innovation» (R&I), which gradually became customary, also in common language, in place of «research and development (R&D)». In FP6 «innovation» was added to the

[77] Excepted the First, but as mentioned FP1 was relevant mainly as a political pilot enterprise.

title of the establishing act[78] and it was declared as «one of the most important elements throughout this programme» (EP & CEU, 2002). In 2007 a separate programme expressly focused on innovation was founded: the Competitiveness and Innovation Framework Programme (CIP), running in parallel to FP7 and devoted to support SMEs with the «access to finance», «business support» and «a better take-up and use of information and communication technologies (ICT)» (EC, 2014a).

However, Horizon 2020 represented the real leap towards innovation – as shown by the steep rise in the occurrences of the words with the root "innovat" in the establishing act (see Fig. 30). H2020 was conceived as a break from the past (EC, 2011a), oriented to the building of an Union based on innovation: the objectives laid down in the foreword of the document as usually reprise the elements of the previous Programmes – ERA, knowledge society, industrial competitiveness –, but the focus on innovation is evident, and innovation comes first in the list of policies useful to Union industry, followed by research and technological development (EP & CEU, 2013):

> *It is the Union's objective to strengthen its scientific and technological bases by achieving a European Research Area ("ERA") in which researchers, scientific knowledge and technology circulate freely, and by encouraging the Union to advance towards a knowledge society and to become a more competitive and sustainable economy in respect of its industry. (…)*
> *It is also the Union's objective to ensure that the conditions necessary for the competitiveness of Union industry exist. For this purpose, action should be aimed at fostering better exploitation of the industrial potential of policies of innovation, research and technological development. (…)*

The political positioning in the new, post-Lisbon, strategy Europe 2020 – aimed at setting the vision for «Europe's social market economy for the 21st century» (EC, 2010a) – influenced the conceptual framework of research:

> *The Union is committed to achieving the Europe 2020 strategy which set the objectives of smart, sustainable and inclusive growth, highlighting the role of research and innovation as key drivers of social and economic prosperity and of environmental sustainability (…)*

On one hand, in fact, the social dimension of research policies is re-affirmed stronger than in FP7, where it experienced a drop[79]; on the other, the overall rhetoric, when compared to the previous Programmes, is noticeably bent towards a market-oriented approach, with a recurrent encouragement to a research closer to commercial exploitation:

> *Horizon 2020 focuses on three priorities (…) in order to respond directly to the challenges identified in the Europe 2020 strategy by supporting activities covering the entire spectrum from research to*

[78] «Decision No 1513/2002/EC of the European Parliament and of the Council of 27 June 2002 concerning the sixth framework programme of the European Community for research, technological development and demonstration activities, contributing to the creation of the European Research Area and to innovation (2002 to 2006)».

[79] See the relative increase in the occurrences of the socio-democratic family of words in Fig. 31.

market. Horizon 2020 should support all stages in the research and innovation chain, including non-technological and social innovation and activities that are closer to the market, with innovation and research actions having a different funding rate based on the principle that the closer to the market the supported activity is, the larger the additional funding from other sources should be. Activities closer to the market include innovative financial instruments, and they aim to satisfy the needs of a broad spectrum of Union policies by placing emphasis on the widest possible use of knowledge generated by the supported activities up to the commercial exploitation of that knowledge.

Three decades of evolution. The contents and rhetoric of the Framework Programmes establishing acts are good mirrors of the last three decades of evolution in the EU policy on research, and of major background European changes. The changes in the FPs focuses and themes, as we have seen, rarely implied the exclusion of older topics, and the Programmes grew in scope and scale, adding new matters, since their inception; however, the shifts in principles, objectives, and supporting argumentations show the evolution of the overall conceptualization of European science policies and involve notable changes in the understanding of the issues at stake and of the instruments of research.

If the first Programmes, developed before Maastricht and in the frame of the common market strategy, were mainly aimed at strengthening the S&T basis for the European industry, in order to boost its competitiveness, from the 1992 signature of the Treaty on, with the inclusion of new areas among the European policies, the Programmes physiognomy changed considerably, particularly for the inclusion of social and political objectives – quality of life, health, environment, citizenship. At the turn of the Millennium a big effort was spent in the development of policies supporting the European knowledge society, but the Lisbon strategy slow progress opened to a shift towards the concept of innovation as the driving force of the research system.

Analysing the occurrences of key words in the Framework Programmes establishing acts[80] (Fig. 31), the immediately visible feature is the steep rise of the terms related to "market", led by the explosion of the concept of innovation in Horizon 2020 (from 0,22% in FP7 to 1,20% in H2020, relatively to the total document words number). It is also possible to verify the gradual increase in the terms related to the "socio-democratic area", which started in the years of Maastricht and peaked in FP6, with a sudden drop in FP7 and a new rise in Horizon 2020. The terms related to "industry", conversely, seem to counter-balance the increases in the "socio-democratic" area – the first group shows a reduction in coincidence with the Programmes where the second group of terms was more present – suggesting an anti-correlation of the two perspectives. If the

[80] The Framework Programmes establishing acts have been analysed with the web-based text reading and analysis environment Voyant (Sinclair, Stéfan and Geoffrey Rockwell, 2016. Voyant Tools. Web. http://voyant-tools.org/), and further elaborated by the author. More details in section *The Framework Programmes and the ERC establishing acts*.

The terms considered are: for the "market" family: market*, business*, commerc*, econom*, financ*, competitiv*, growth*, innovat*, entrepreneur*, capital; for the "socio-democratic" family: social*, socio*, responsibl*, participat*, citizen*, governance, right*, value*, equity, societ*; for the "pure-science" family: frontier*, excellen*, peer*, science base, basic research; for the "industry" family: industr*, manufacturing. The symbol * at the end of the words denotes that all the possible word endings are taken into account.

conceptual frameworks focusing on industrial competitiveness and on economic growth are clearly contiguous, in the European research policy the first represented more clearly the key orientation of Programmes in the pre-Maastricht period, while from the Lisbon strategy onwards the anchor concept was the economic and financial wealth of the European market, and the attention was shifted from the big industries to the small and medium enterprises and to a better integration of all the other economic actors in the European "system of innovation". Although the themes and structures of Horizon 2020 are complex and diversified, and include different conceptual components, the overarching orientation of the research Programme is firmly innovation, with a particular emphasis on the exploitability of ideas in the market.

Finally, "pure-science" is a relatively new entry in the Framework Programmes and, although gradually increasing (the budget share devoted to ERC in Horizon 2020 is the 17% of the total, see Table 20), particularly through the growth in relevance of the target of «excellence» in research – i.e. the funding of projects without any other criteria than scientific relevance –, from the establishing acts it is possible to verify that the "pure-science" perspective is still not completely integrated in the Programmes conceptual foundation, that was oriented for most of its history towards applied research and technological development and still pursues prevailingly that objective.

From Knowledge society to Innovation Union: a paradigm-shift

As mentioned, a fundamental nexus point in the EU contemporary research policy was the focus on knowledge-based development in the early 2000 and the following shift towards the current innovation-based framework. These two conceptualizations have been so important to filter in the common reference ideas and language of the people involved with European research (or education) also at the lower local levels, configuring them as real policy paradigms, able to shape the world-view of the people concerned with them.

The origins of the conceptual frameworks. The two theories diffused in the political arena in the same years, the beginning of the '90s; they are somehow connected, sharing a re-thinking of the interplay of knowledge, society and economic life, but show important differences, able to influence relevantly their outputs, especially when adopted to frame public decisions.

The economists' reconsideration of the idea of innovation came, at the end of the '80s, to a systemic conceptualization: systems of innovation involved knowledge-producing institutions like universities and laboratories in crucial positions, together with governments and industries, and the wealth of the systems was ascribed to the effectiveness of the actors' interplay, rather than to the individual performances (Metcalfe, 1995; OECD, 1997b):

> *(National Innovation Systems are) that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it*

is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies.

On the other side, the sociological studies of science had showed the essential rooting of scientific knowledge production processes in the social and institutional context, and reflections on the same nature of knowledge were developed, with the common denominator of establishing knowledge production deeply in the dynamic interaction among institutions and societal actors (Cerroni & Simonella, 2014). New models of science policies (triple helix, third mission of the Universities) were developed according to this new perspective[81].

If the main idea of both approaches was the need not to consider knowledge in the void, but to position knowledge production robustly in the societal context, the developments were different. On one side, economic analyses argued for more embeddedness in the market, while on the other socio-critical reflections insisted for a better integration of science in society, mainly in relation with the enhancement of the citizens' democratic participation to the definition of policies. The European frame of science policy was influenced by both the approaches, although to a different extent.

As an additional factor, the '90s saw the emergence of information and communication technologies as key new dimensions of social and economic life, changing the labour market, leading to the creation of new professional roles based on knowledge and shedding light on the identification of knowledge as a relevant form of capital. The traditional apprehension for a European economy lagging behind in the growing international competition grew, and the theories on systemic innovation opened for new understanding of the low European performance (Godin, 2002). The utilisation of traditional forms of capital like labour and land were no more seen as convenient against the disproportion with the developed and rising countries, hence analysts and politicians identified in the exploitation of knowledge one of the possible exit strategies (Moore, Kleinman, Hess, & Frickel, 2011; e.g. CEC, 1993).

The European uptake. These developments were taking place in the busy European political scenario of the beginning of the '90s – the fall of the Berlin Wall in 1989 and the Maastricht Treaty in 1993 –, sparking a rethinking of the boundaries and identity of the Community.

The 1993 *White Paper on Growth, Competitiveness and Employment* (CEC, 1993b) showed to uptake the ongoing debate about the contribution of science and technology to growth, identifying in new technologies and S&T development the possible solutions to the lack of European competitiveness, and setting the base for subsequent policies. The *White Paper* was developed on an initiative of the Commission President Delors, at his third mandate, in the scenario of a rising disappointment by the member states for the growing unemployment[82], despite the political success of Maastricht and the future enlargement perspective. The *White Paper* acknowledged the lack of competitiveness as the main reason for

[81] See the introductory section *The evolving nature of science.*
[82] The document opens with the sentence «Why this White Paper? The one and only reason is unemployment».

unemployment, and nearly a decade before the launch of the Lisbon Strategy, identified the target of 3% GDP for research funding, advocating the need to exploit «the competitive advantages associated with the gradual shift to a knowledge-based economy» (CEC, 1993b):

> *The wealth of nations is increasingly based on the creation and exploitation of knowledge. (…) The key elements in competitiveness that are now of greatest importance are no longer confined to the relative level of the direct costs of the various factors of production. They include in particular the quality of education and training, the efficiency of industrial organization, the capacity to make continuous improvements in production processes, the intensity of R&D and its industrial exploitation, the fluidity of the conditions under which markets operate the availability of competitive service infrastructures, product quality and the way in which corporate strategies take account of the consequences of changes in society, such as improved environmental protection.*

The *White Paper* also analysed the role of education and training in «a society based far more on the production, transfer and sharing of knowledge than on trade in goods»:

> *There can be no doubt that education and training, in addition to their fundamental task of promoting the development of the individual and the values of citizenship, have a key role to play in stimulating growth and restoring competitiveness and a socially acceptable level of employment in the Community. However, it is essential to grasp the nature, extent and limits of this role. Given the economic and social problems they are facing today, which are cyclical in certain cases and essentially and more profoundly structural in others, our societies are making many pressing and sometimes contradictory demands on education and training systems. Education and training are expected to solve the problems of the competitiveness of businesses, the employment crisis and the tragedy of social exclusion and marginality – in a word, they are expected to help society to overcome its present difficulties and to control the profound changes which it is currently undergoing.*

Notwithstanding the focus on economic growth through the increase in competitiveness, the *White Paper* insisted frequently on the need of pairing growth with solidarity in order to mitigate the failures of the market, and Delors acknowledged in his preamble a possible tension between the «ideals» of Europe and the «requirements of economy»:

> *we are faced with the immense responsibility, while remaining faithful to the ideals which have come to characterize and represent Europe, of finding a new synthesis of the aims pursued by society (work as a factor of social integration, equality of opportunity) and the requirements of the economy (competitiveness and job creation). (…)*
>
> *These options show how the dynamism of the market can help boost growth. Experience has also shown, however, that the market is not without its failings. It tends to underestimate what is at stake in the long term, the speed of the changes it creates affects the different social categories unequally, and it spontaneously promotes concentration, thereby creating inequality between the regions and the*

towns. Awareness of these insufficiencies has led our countries to develop collective solidarity mechanisms.

The 1995 *Green Paper on Innovation* (CEC, 1995), basing on the 1993 *White Paper*, emphasized especially the link between competitiveness, employment and innovation:

> *(…the)* firms' capacity for innovation, and support for it from the authorities, were essential for maintaining and strengthening this competitiveness and employment. This Green Paper makes use of, adds to and extends that work[83] with a view to arriving at a genuine European strategy for the promotion of innovation. *(…)*

The *Green Paper on innovation* is considered the turning point in EU policy towards the new paradigm centred around innovation, conceived as a system:

> *There is no hermetic seal between the innovative firm and its environment, by which it is influenced and which it helps to transform. It is the sum total of firms in an industry, the fabric of economic and social activities in a region, or even in society as a whole, which makes up the "innovation systems", whose dynamics are a complex matter.*

When dealing with a definition of the term, the document distinguishes between innovation as a process or as a product, and highlights the adoption of the wider meaning of the concept:

> *The term "innovation" is somewhat ambiguous: in common parlance it denotes both a process and its result. According to the definition proposed by the OECD in its "Frascati Manual", it involves the transformation of an idea into a marketable product or service, a new or improved manufacturing or distribution process, or a new method of social service. The term thus refers to the process. On the other hand, when the word "innovation" is used to refer to the new or improved product, equipment or service which is successful on the market, the emphasis is on the result of the process.*

The new EU political agenda was explained in the *First Action Plan for Innovation in Europe*, published in 1997 (CEC, 1997b) as a follow-up of the *Green Paper* and centred around three main drivers: «fostering a genuine innovation culture», «setting up a legal, regulatory and financial framework conducive to innovation» and «gearing research more closely to innovation»:

> *In knowledge-based economies, the efficient systems are those which combine the ability to produce knowledge, the mechanisms for disseminating it as widely as possible and the aptitude of the individuals, companies and organizations concerned to absorb and use it. The crucial factor for innovation is thus the link between research (the production of knowledge), training, mobility, interaction (the dissemination of knowledge) and the ability of firms, particularly SMEs, to absorb new technologies and know-how.*

[83] The reference is to the aforementioned White Paper on Growth, Competitiveness and Employment, and to the 1994 communication on "An Industrial Competitiveness Policy for the European Union" (Kok et al., 2004).

Although described system-wise, listing all the actors of the knowledge production environment, the mechanism is ultimately conceived linearly in a three-steps schema of production, dissemination and absorption.

The reference institution for the definition of innovation in the Green Paper was the OECD: the concepts of "National Systems of Innovation" and of "knowledge-based economy", as shown by Godin (Godin, 2006a), were particularly present in political discourses in the 1990s under the input of the Organisation for Economic Co-operation and Development, which had always been concerned with scientific and technological policies, and in the late '80s and beginning of the '90s it was particularly promoting the two concepts, also with the appointment of the most relevant scholars on the issues (B.-A. Lundvall worked as Deputy Director of the Directorate of Science, Technology and Innovation at OECD from 1992 to 1995, D. Foray was consulting for OECD from 1994 to 1996). The OECD long-standing series of publications on the methodology and indicators for R&D, the *Frascati Manual* (Godin, 2006a; Sharif, 2006), resulted particularly suitable for the benchmarking of the different nations' innovation systems, and in 1992 also the first edition of the *Oslo Manual* on the measurement of technological innovation (OECD, 1992) was issued. OECD continued developing the concepts with several contributions published from 1995 to the end of the decade (OECD, 1995, 1996a, 1996b, 1997a, 1999, 2000) in a form that was particularly suitable for policy makers' needs (Godin, 2006a).

The Lisbon strategy. The European Community embraced the scholarly developments on knowledge economy and innovation: the end of the '90s saw the development of the new master strategy for growth, the Lisbon strategy, precisely based on knowledge production and exploitation.

Agenda 2000, the communitarian action programme drafted in 1997, stated the need of «putting knowledge at the forefront», referring mainly to the ICT boom, and referencing the "knowledge triangle" (CEC, 1997a):

> *The key feature of today's world economy is a rapid shift towards globalisation and information and communication technologies. These technologies determine the global competitiveness of all economic sectors and foster the emergence of new immaterial goods.*
>
> *In order to derive the maximum benefit from this process in terms of growth, competitiveness and employment, special attention must be paid to the development, dissemination and use of these immaterial goods. Knowledge policies - research, innovation, education and training - are therefore of decisive importance for the future of the Union.*
>
> *In response to the challenges of technological development and innovation coming at a time when Europe's competitors are stepping up their efforts significantly, it is vital that the Community research and technological development effort be given new impetus.*

The two key sectors for knowledge production and circulation – education and research – were separately object of European-scale projects: in 1999, the Bologna accords asked for a rethinking of the national higher education systems, with the aim of ensuring their compatibility, and in early 2000 the

Commission launched the "European Research Area" (ERA), an initiative intended to reduce fragmentation of European R&D, boosting the free circulation of researchers and promoting more effective funding distribution and infrastructures use.

The Lisbon strategy, launched at the European Council in March 2000, merged these initiatives in the knowledge sectors with the economic targets of competitiveness and innovation and the goal of «modernising the European social model» (Council, 2000):

> *The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion.*

The strategy, developed in a period perceived as the «best macro-economic outlook for a generation», included macro-economic policy measures aimed at sustaining the «healthy economic outlook and favourable growth prospects», and was oriented to:

- *preparing the transition to a knowledge-based economy and society by better policies for the information society and R&D, as well as by stepping up the process of structural reform for competitiveness and innovation and by completing the internal market;*
- *modernising the European social model, investing in people and combating social exclusion;*

The Lisbon plan, hence, was on one hand oriented to economic policies, with a particular emphasis on the development of ICTs and research, and on the other it promoted the building of an active welfare state, in order to ensure that «the emergence of this new economy does not compound the existing social problems of unemployment, social exclusion and poverty».

Indeed, the turn of the Millennium was an especially favourable period for the development of new political frameworks: debates were open on the understanding of knowledge policies and different perspectives were confronting, even co-existing in the same institutions.

In the education policy domain – in the EU organization separate directorates govern education[84] and research, with different habits and policy frames (Elken, Gornitzka, Maassen, & Vukasovic, 2011) – the "Europe of Knowledge" was portrayed as a process linked to the economic and social dimensions (CEC, 1997c; Chou & Gornitzka, 2014):

> *Economic competitiveness, employment and the personal fulfilment of the citizens of Europe is no longer mainly based on the production of physical goods, nor will it be in the future. Real wealth creation will henceforth be linked to the production and dissemination of knowledge and will depend first and foremost on our efforts in the field of research, education and training and on our capacity to promote innovation. This is why we must fashion a veritable 'Europe of knowledge'.*

[84] The Directorate in charge of education is the DG "Education and Culture", and the Commissioner portfolio has had different denominations: the current commissioner is responsible for "Education, Culture, Youth and Sport".

Knowledge policies were planned to become «one of the fundamental pillars of the Union's internal policies», through the creation of an open educational area linked to the «enhancement of citizenship» and the development of «employability through the acquisition of competencies» (CEC, 1997c):

> *This educational area will facilitate an enhancement of citizenship through the sharing of common values, and the development of a sense of belonging to a common social and cultural area. It must encourage a broader-based understanding of citizenship, founded on active solidarity and on mutual understanding of the cultural diversities that constitute Europe's originality and richness.*

The Europe of knowledge was seen as characterized by «intellectual, cultural, social and technical dimensions» (*Sorbonne Joint Declaration*, 1998):

> *The European process has very recently moved some extremely important steps ahead. Relevant as they are, they should not make one forget that Europe is not only that of the Euro, of the banks and the economy: it must be a Europe of knowledge as well. We must strengthen and build upon the intellectual, cultural, social and technical dimensions of our continent.*

On the research side of the European knowledge policies, the Fifth Framework Programme was designed, as we have seen above, against the background of reflections on the new role of research in society, centred on pursuing «the marriage of society and innovation» (Caracostas & Muldur, 1998, p. 21). The study *Society, the endless frontier*, produced by the Commission Directorate for Strategy and Coordination, analysed in detail the developments in science policy theories, and put forward the need to shift to a new model, where research is geared towards social objectives by means of innovation. Given the European «failure to exploit its investment» in research, the changing nature of the scientific endeavour – especially with regards with the soaring cost of research – and the fast obsolescence of products and knowledge in the globalised competition context, it proposes to build on the new understanding of innovation as a system, coupled with the «new theories of the "learning economy", endogenous growth and the social shaping of technology» to redirect science polices towards a policy of «public support for users with an eye to new markets», i.e. (Caracostas & Muldur, 1998):

> *(…) towards the intensification of measures to disseminate knowledge by encouraging co-operative networks, towards policies of "lifelong training" and support for organisational innovation, needed to help Europe cope with and benefit from technological change.*

Even though referring to the «society of knowledge» in the Commissioner Cresson's preface, and describing the OECD approach to the «knowledge-based economy» and the various dimensions of knowledge, the study preferably refers to the «learning economy», as the theoretical basis for the valorisation of knowledge in the economic process:

> *(…) continuous innovation is now a prerequisite of survival for companies which implies interactive learning at every level both inside and outside the firm.*

The role of public policies in this context, they conclude, is «to foster interaction between players in the collective learning process».

Following documents were written in the same spirit: in 2000, the programmatic document on the construction of the ERA, *Towards a European research area* (CEC, 2000), although positioning research in the wider social realm and underlining its importance for the overall European development, referred to research as «one of the principal driving forces of economic growth, competitiveness and employment» (CEC, 2000; Chou & Gornitzka, 2014):

> *In the final years of the XXth century we entered a knowledge-based society. Economic and social development will depend essentially on knowledge in its different forms, on the production, acquisition and use of knowledge.*
>
> *Scientific research and technological development more particularly are at the heart of what makes society tick. More and more, activities undertaken in this domain are for the express purpose of meeting a social demand and satisfying social needs, especially in connection with the evolution of work and the emergence of new ways of life and activities.*
>
> *By creating new products, processes and markets research and technology provide one of the principal driving forces of economic growth, competitiveness and employment. They are the best way of modernising European companies, which Europe must do to improve its competitive position. In overall terms, both directly and indirectly, they help to maintain and develop employment.*

From knowledge to innovation. The dynamic interplay between knowledge- and innovation-based discourses was indeed evolving further in those years. The periodic reviews of the Lisbon strategy were particularly influential in this respect[85], promoting a gradual drop of the knowledge society conceptual frame in favour of the innovation one: the policy documents increasingly underlined the role of scientific research as a support for public policies and as an instrument to increase competitiveness and growth.

As soon as the healthy economic outlook mentioned in the Lisbon strategy document, favoured by the "Internet bubble", collapsed (almost in the same months of the strategy launch), the policy analyses acquired less optimistic tones and were characterised by an increasing feeling of urgency.

The *Sapir report* (Sapir et al., 2003) represented a first evaluation of the Lisbon Strategy, also in view of the forthcoming wave of enlargement in 2004[86]; it was carried out by an expert group composed of academics, policy advisers and bankers[87] and chaired by André Sapir, economic adviser to the Commission

[85] As attested by EU Commission's science policy officers themselves, in the already mentioned 2006 book on the design and impacts of the Sixth Framework Programme (Muldur et al., 2006).

[86] Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia accessed simultaneously on May 1, 2004, to which added Bulgaria and Romania in 2007.

[87] The complete list of the experts' affiliations, as reported in the first pages of the document, is: André Sapir (Chairman), Université Libre de Bruxelles and Group of Policy Advisers, European Commission; Philippe Aghion, Harvard University; Giuseppe Bertola, Università di Torino and European University Institute; Martin Hellwig, Universität Mannheim; Jean Pisani-Ferry, Université Paris-Dauphine; Dariusz Rosati, Szkola Glowna Handlowa w Warszawie and Narodowy Bank Polski; José Viñals, Banco de España; Helen Wallace, Robert Schuman Centre for Advanced Studies, European University Institute, and Sussex European Institute; rapporteurs: Marco Buti, Mario Nava and Peter Smith, Group of Policy Advisers, European Commission.

President Prodi. The report combined economic and political arguments to realize a complex analysis of the previous two decades of European economic and political development. The report judgement was neat:

> *The Group views Europe's unsatisfactory growth performance during the last decades as a symptom of its failure to transform into an innovation-based economy.*

In fact, building on the study of the European economic policies – remote and recent – and reflecting on the economic governance models and on the background European integration issues, the expert group could conclude that:

> *Contrary to the post-war period where growth and catching-up with the US could largely be achieved through factor accumulation and imitation, once European countries had moved closer to the technology frontier and also with the occurrence of new technological revolutions in communication and information, innovation at the frontier has become the main engine of growth (…).*

In the first thirty years after World War II (the «trente glorieuses»), the document reported, Europe could establish, thanks to the rapid economic growth, a high-level welfare state, that remained as the trait of the «European model»; the sustainability of such model started to deteriorate in the 70s, with the "oil shocks" and the profound changes due to the demographic transformations (the aging population), the technological breakthroughs (the ICT revolution) and the rise of globalisation:

> *By the mid-1980s, Europe was stuck in a negative spiral: lower GDP growth and employment rates meant increasing public expenditure, which required increasing public revenue, which in turn implied higher social contributions (these increased by nearly five points of GDP between 1970 and 1985) and higher direct taxes (with an increase of nearly three points of GDP between 1970 and 1985), thereby reducing the incentive to work and to invest, hence further reducing the prospects for output and employment growth.*

To break the «negative spiral», in the groups' opinion, Europe had to focus on innovation as the «driver of economic growth». However, the authors' representation of the strategy, contrary to mainstream policy documents on innovation, is not messianic: the innovation process, they argue, can show negative consequences if it is not properly managed with appropriate governance adaptations:

> *Innovation and change will continue to open the prospect of higher productivity, higher wages and improved living standards. But they will also continue to be disruptive, displacing workers, making some skills obsolete and possibly creating more pressure towards income inequality.*

In the same year, a communication was issued from the Commission, sanctioning the transition towards an innovation-centred approach from the very beginning, in the title – *Innovation policy: updating the Union's approach in the context of the Lisbon strategy* (CEC, 2003a):

> *With three years already passed of the ten set by the Lisbon timetable, the Union must review its attitudes and approaches to innovation.*

The document reviewed different types of innovation[88] – technological, organisational, business model, presentational – and analysed the challenges and opportunities of the European context. The analysis was especially addressed to enterprises, describing them as the main actors of the innovation process and it was the entrepreneurial sector, rather than the research compart, to be depicted as the real value-creator:

> *Since it is through enterprises that the economic benefit of the successful exploitation of novelty is captured, the enterprise is at the heart of the innovation process. Innovation policy must have its ultimate effect on enterprises: their behaviour, capabilities, and operating environment. (…)*
> *While research is a major contributor to innovation, if there is no entrepreneurial action there is no value creation. It is the enterprise that organises the creation of value. With the shortening of product cycles, enterprises face the need for more capital-intensive investment and must put more emphasis on the ability to react quickly. For enterprises, innovation is a crucial means to create competitive advantage and superior customer value. Except for certain types of technology-based enterprises, the focus is not on technological aspects of new product development, but on innovative ways to improve their position in the market.*

A following experts' report (Kok et al., 2004), published in 2004 and meant to contribute to the Lisbon strategy mid-term review, presented no particular novelties in the argumentation, focusing on the recommendation to boost growth in order to reduce unemployment and to sustain the European social model, but conspicuously emphasized the overall feeling of urgency, justified by the rising competition with North America and Asia (Kok et al., 2004):

> *The arguments supporting that strategy are no less compelling today — indeed more so. Europe needs to innovate on its own behalf. The strength of its knowledge industries and Europe's capacity to diffuse knowledge across the totality of the economy are fundamental to its success and are key to lifting its growth of productivity to compensate for falling population growth and pay for its social model. Lisbon should be understood as a means of transitioning the European economy, from structures in which it essentially caught up with the world's best, to establishing economic structures that will allow it to exercise economic leadership.*

Confronted with the previous *Sapir report*, the line of reasoning presented in this document is narrower, specifically centred on the analysis of economic indicators and addressing political issues mostly from the side of better and more coherent organization and practical suggestions. Besides, the composition of the expert group was different, including less scholars than the Sapir group and more people from the business and administration sectors[89].

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[88] As for the definition, the document explicitly repeals the 1995 Green Paper on Innovation: «A concise definition of innovation is "the successful production, assimilation and exploitation of novelty in the economic and social spheres"».

[89] «The Task Force was composed of the following members: Mr Wim Kok (Chairman), former Prime Minister of the Netherlands; Mr Romain Bausch, President and CEO, SES Global (Luxembourg); Mr Niall FitzGerald, Chairman of Reuters, Chairman of the Trans-Atlantic Business Dialogue; Mr Antonio Gutiérrez Vegara, Member of the Spanish Parliament; Mr Will Hutton (rapporteur), Chief Executive of the Work Foundation; Ms Anne-Marie Idrac, Chairwoman of the Régie autonome des transports parisiens (RATP); Ms Wanja Lundby-Wedin, President of the Swedish Trade Union Confederation (LÖ); Mr Thomas Mirow, former

The relaunch of the Lisbon strategy in 2005 – *Working together for growth and jobs – A new start for the Lisbon Strategy* –, developed by the newly established Barroso Commission, put innovation at the centre of the stage, largely building on *Kok report* recommendations. One of the pillar actions planned was denominated «Knowledge and innovation for growth», pairing in a compact expression the two concepts we are examining, and describing knowledge in a distinctly market-oriented frame, typical of the concept of innovation (CEC, 2005b):

> *[Knowledge and innovation for growth] In advanced economies such as the EU, knowledge, meaning R&D, innovation and education, is a key driver of productivity growth. Knowledge is a critical factor with which Europe can ensure competitiveness in a global world where others compete with cheap labour or primary resources.*

The *Aho report*[90] – *Creating an Innovative Europe* (Aho, Cornu, Georghiou, & Subirà, 2006) – represented the vertex of the climax, presenting an analysis that appeared strongly concentrated on the promotion of innovation and notably imbued with urgency:

> *This report presents a strategy to create an Innovative Europe. Achieving this requires a combination of a market for innovative goods and services, focussed resources, new financial structures and mobility of people, money and organisations. (…)*
>
> *Our central recommendation is that a Pact for Research and Innovation is needed to drive the agenda for an Innovative Europe. This requires a huge act of will and commitment from political, business and social leaders. Current efforts towards the revised Lisbon Agenda should be continued and reinforced but are not enough. In addition, simultaneous and synchronous efforts are needed (…).*

This document thoroughly incorporated the shift from a discourse prevalently centred on knowledge to the one focused on innovation, recalling and pushing further the need of «fostering a genuine innovation culture» as one of the pillars of a strategy for innovation.

Between 2005 and 2006, approximately after this report, the transition to the innovation frame appears to be completed: new documents showed to take for granted innovation as the centre of gravity of growth strategies, and devoted to the stabilization of this paradigm and to its enrichment with new articulations.

Hamburg State Minister, Senior Business Advisor; Mr Bedrich Moldan, Chairman of the Environment Centre (Charles University, Prague); Mr Luigi Paganetto, Professor of international economics (Rome-Tor Vergata University); Mr Dariusz Rosati, Professor of economics, Member of the European Parliament since June 2004; Mr Veli Sundbäck, Senior Vice-President of Nokia, Finland; Mr Friedrich Verzetnitsch, President of the Austrian Trade Union Federation (ÖGB), Member of the Austrian Parliament».

[90] The members of the expert group were: Mr. Esko Aho (Chairman), Former Prime Minister of Finland & President of the Finnish national fund for research and development (Sitra); Dr. Jozef Cornu, Chairman of the Information Society Technologies Advisory Group of the Commission (ISTAG), former President and COO of Alcatel Telecom, board member at Alcatel, KBC Group, AfgaGevaert, Barco & Arinso; Prof. Luke Georghiou (Rapporteur); Associate Dean for Research, Faculty of Humanities, Professor of Science & Technology Policy and Management, and Director of PREST, Manchester Business School - University of Manchester; Prof. Antoni Subirá - Former Catalan Government Minister of Industry, Trade & Tourism, Professor at the IESE Business School (Barcelona), Chairman of the Advisory Board of the competitiveness institute TCI and Member of the Advisory Boards of Mercapital and Air Products.

In 2007 the «free movement of knowledge and innovation» was introduced as a «fifth freedom» of the EU Single Market – complementing the previous four: free movement of people, goods, services and capital. In the Commission document *A single market for the 21st century Europe* (CEC, 2007a), where the concept is introduced, knowledge and innovation are presented most of the times coupled, as the two faces of a single phenomenon; they represent the «new frontiers» of the «knowledge-based, service-oriented economy»:

> *The single market originally conceived for an economy reliant on primary products and manufactured goods has to adapt to foster openness and integration in a knowledge-based, service-oriented economy. (…)*
>
> *Further efforts are needed to promote free movement of knowledge and innovation as a "fifth freedom" in the single market. The single market can be a platform to stimulate innovation in Europe. It encourages the spread of new technologies across the EU. It lends itself to networks - virtual and real - and fosters the development of a sophisticated logistics sector allowing for integrated management of the flows of goods, energy, information, services and people. It facilitates exchange of knowledge through the mobility of workers, researchers and students.*

Knowledge, hence, in this document is no more presented as the denominator of the knowledge society that Europe was planning to become in 2000, but rather as a means to build a new Europe based on innovation.

It is no surprise, then, that the new growth agenda Europe2020 – launched in 2010, at the closure of the Lisbon Strategy – put innovation «at the heart» of its vision, as an «overarching policy objective» to which all policies need to orient (EC, 2010b):

> *(…) innovation has been placed at the heart of the Europe 2020 strategy. (…) Perhaps the biggest challenge for the EU and its Member States is to adopt a much more strategic approach to innovation. An approach whereby innovation is the overarching policy objective, where we take a medium- to longer-term perspective, where all policy instruments, measures and funding are designed to contribute to innovation, where EU and national/regional policies are closely aligned and mutually reinforcing, and last but not least, where the highest political level sets a strategic agenda, regularly monitors progress and tackles delays.*

Innovation, aimed at turning ideas «into products and services that create growth and jobs», is also described as «the only answer» to the most concerning social, economic and environmental challenges (EC, 2010b):

> *How will we tackle growing societal challenges like climate change, energy supply, the scarcity of resources and the impact of demographic changes? How will we improve health and security and sustainably provide water and high-quality, affordable food?*
>
> *The only answer is innovation, which is at the core of the Europe 2020 Strategy agreed by Member States at the June 2010 European Council, underpinning the smart, sustainable and inclusive growth*

the Strategy is aiming for. The "Innovation Union" is one of the seven flagships announced in the Europe 2020 Strategy. It aims to improve conditions and access to finance for research and innovation, to ensure that innovative ideas can be turned into products and services that create growth and jobs.

The "Innovation Union", hence, was set as the new target vision underpinning the development of Europe for the decade 2010-2020, and research was committed to play a key role in building it: as mentioned, Horizon 2020, the current Framework Programme is depicted as «the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness» (EC, 2014e).

Two interrelated but different frameworks. The two frames – knowledge society and innovation union – are evidently not completely secluded: they both put a high premium on the rethinking and valorisation of knowledge in the wider societal context. However, in economic and political speaking, the broad and multifaceted meaning of "knowledge society" is often projected on the narrower understanding of "knowledge economy", which refers fundamentally to the opportunity of taking advantage in terms of profit, and consequently economic growth, from the development of knowledge-intensive scientific and technological sectors: ICTs, biotechnologies, neurosciences, genetic engineering etc. (the humanities, although undeniably knowledge-intensive, are not usually implied in the discourse, unless they serve achieving the competitiveness target). In common political language, and in particular in European public discourses, the expression "knowledge society" is then frequently used as a synonym for "knowledge(-based) economy", and carries with it the collection of ideas, norms, actors and values implied by the second expression.

Nonetheless, the two concepts are different, and in fact when dealing with social and cultural issues it is more likely to find in the discourses the expression "knowledge society", rather than its economic formulation: when the project of building a knowledge society is examined in the perspective of the European identity and citizenship it appears straightforward to build on the wider, and consequently more open, conceptualization (see for example the aforementioned CEC, 1997b, 2003b; predominanly pertaining the policies on education); in the mentioned Sorbonne Joint Declaration, the Europe «of the Euro, of the banks and the economy» is even marked in opposition with the «Europe of knowledge», built on «intellectual, cultural, social and technical dimensions» (*Sorbonne Joint Declaration*, 1998).

The concept of "knowledge" indeed retains a broad, multidimensional, meaning, and reflections on the "knowledge society" were not only carried out in the economic community, but were matter for the social studies. The expression was introduced in the '60s and then diffused by the scholars Daniel Bell and Nico Stehr (Bell, 1976; Cerroni, 2006; Drucker, 1969; Lane, 1966; Stehr, 1994), to describe the "post-industrial" society where knowledge has taken the place of industrial machines as the basis of social, political and economic life.

"Knowledge" is a complex and multidimensional concept: it refers clearly to the intellectual, linguistically expressed, knowledge of professors, but also to the practical know-how of craftsmen or, again, to the social understanding of communities; "knowledge" is information content, useful for the development of sciences, but cannot be reduced to information only; it is encapsulated in new technological objects as well as in old tools, inherited from the past; it is the cultural base for people's education, personal development and participation to the *polis*; it is finally also a rising form of capital in the economic system and an instrument of competence-building aimed at reducing unemployment (Cerroni, 2006, 2013). Knowledge, in the expression "knowledge society", can be understood as a common good, as an instrument for the individual development and fulfilment, as a tool to inform citizenship, or as an economic capital.

"Knowledge-based economy" may be thought as a bridge-concept, narrowing the field of "knowledge society" to its economic dimension and hence bringing it closer to the notion of "innovation union". The expressions "knowledge-based economy" and "innovation systems", in fact, both rely specifically on a prolific creation of ideas as the basis for the generation of new capital, able to boost the economic growth. The distinction between the two approaches indeed reflects the two different scholarly perspectives present in the analysis of the systemic dimension of the process, the first more focused on the conceptualization of knowledge and on the learning activity, and the second more attentive to the institutional actors and to the national performances (Godin, 2009).

The idea of "innovation", in the meaning of public discourses on socio-economic development, properly belongs to the economic field: it is defined in the most recent edition of the OECD Oslo Manual (OECD, 2005) as «the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations». In European documents it is defined as «the successful production, assimilation and exploitation of novelty in the economic and social spheres» (CEC, 2003a) and one of its crucial feature is the capability to open up new markets, sustaining growth (CEC, 1995):

> *In brief, innovation is the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply and distribution; the introduction of changes in management, work organization, and the working conditions and skills of the workforce.*

It follows that anchoring knowledge policies to the concept of innovation ultimately implies linking R&D and education to their exploitability in the market economy, finally minimizing the non-economic dimensions of the concept and consequently excluding the related interpretive realms from the debates underlying political choices.

The economic connotation is indeed the most glaring difference between the two models. Conceptual frameworks are primarily defined by their content: "knowledge society" refers to a social system whose internal dynamics – social, cultural, political and economic – are predominantly determined by

exchanges of knowledge, while "innovation union" suggests a political organization based on the valorisation of new ideas by means of the transformation into products, able to open up new markets and develop the economy; in the innovation frame, hence, it is through the economic valorisation that a better quality of life will be achieved.

Moreover, while "knowledge" is – complex as it can be – properly a content, an object, "innovation" is a property of an idea, and it refers to a method, a criterion of discrimination relatively to other ideas. It doesn't really prescribe anything on the output content – although it actually implies, in the common political language, that any innovation is good *per se*. "Innovation" thus, rather than suggesting a different object for the creative process, works as a tool to reduce the openness of the knowledge creation possibilities, suggesting as preferable the choice of the most marketable ones.

Table 13 summaries the different connotations acquired by knowledge in the two frames.

Table 13: a summary schema of the different features acquired by the concept of "knowledge" in the "knowledge society" and in the "innovation union" frames.

Knowledge in the "knowledge society"	**Knowledge in the "innovation union"**
Cultural, social, economic understandings; knowledge as a common good.	Economic understanding; knowledge as a commodity.
Functions: personal development, social emancipation, construction of shared social understanding, economic capital.	Function: when turned into a product, open up new markets, boost competitiveness and contributing to economic growth.
Problem-setting as well as problem solving tool.	Problem-solving tool.
Actors: all the actors of society[91].	Actors: SMEs and industries, financial actors; university and higher education as oriented knowledge suppliers.
Actors' interplay: in society, as a whole.	Actors' interplay: in the market.

The shift to the innovation-centred frame doesn't only denote an ideal positioning, but has practically influenced the shaping of the European research policy: as examples can be regarded the evolution of the research funding on citizenship and democracy and the family of requirements on the acceptance and evaluation of research projects. The first, as we have seen above regarding the structures of the Framework Programmes, appeared among the funding lines in the period between Maastricht and Lisbon (in FP5), when the reflections on the Europe of knowledge were developing and affirming, and in FP6 a specific separate research theme was included – "Citizens and governance in a knowledge-based society" (see Fig. 25); this theme was subsequently dropped in FP7, developed in the immediate post-2000 years, in coincidence with the strengthening and prevailing of the innovation frame. As for what concerns the evaluation of the research projects, increasing importance along the years has been devoted to the demonstration of the "impact" of the project – the payback of proposed research to economy and society – and considerable relevance has been paid to measurable deliverables, like the number of patents and publications, and to the output of the

[91] Knowledge can even be embodied in objects, cultural heritages, landscapes.

project in terms of "outreach", pushing on the realization of a quantity of promotion products; on the other hand, other possible, but less innovation-oriented, criteria, like the production of new knowledge on a topic or the quality of citizens' engagement in outreach effort haven't been taken into account[92].

The shift from "knowledge society" to "innovation union" was therefore not just a change in political buzzwords, but implied a real subtle reshaping of the Programmes.

The innovation frame, however, although currently prevailing in EU discourses on scientific research, is not monolithic, showing articulations and sources of internal dynamism. These are particularly – plastically – visible in the tripartite organization of Horizon 2020.

Horizon 2020: three priorities for three visions of the role of research

The Commission has outlined a three-pillars structure for Horizon 2020, providing for the first time in the history of Framework Programmes a plastic representation of the three principal distinct views that contribute to shape the European policy of scientific research.

The declared key priorities on which to focus resources in H2020 are «Excellent Science», «Industrial Leadership» and «Societal Challenges», corresponding to three distinct understandings of the research activity and knowledge production aims. The Commission 2011 communication on Horizon 2020 (EC, 2011a) describes the three priorities as follows:

> *(1)* ***Excellent Science.*** *This will raise the level of excellence in Europe's science base and ensure a steady stream of world-class research to secure Europe's long-term competitiveness. It will support the best ideas, develop talent within Europe, provide researchers with access to priority research infrastructure, and make Europe an attractive location for the world's best researchers. (…)*
>
> *(2)* ***Industrial Leadership.*** *This will aim at making Europe a more attractive location to invest in research and innovation (including eco-innovation), by promoting activities where businesses set the agenda. It will provide major investment in key industrial technologies, maximise the growth potential of European companies by providing them with adequate levels of finance and help innovative SMEs to grow into world-leading companies. (…)*
>
> *(3)* ***Societal Challenges.*** *This reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere. A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This will cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake. (…)*

The three conceptual references can be identified in the visions of research articulated around the ideas, respectively, of scientific freedom and scientific community-based evaluation of science, of economic

[92] On the critical points of the rise in "impact" requests in European funds applications see, for example: (Kelly, 2017a). See also on the same issue the paragraph *«Real things!»: measurability and impact.*

competitiveness and innovation, and of societal relevance of research (Ulnicane, 2015). This three-polar setting defines not only the research policies founding values and orientations, but also the different prominence ascribed to societal actors, in particular scientists, entrepreneurs and citizens. The three-pillars structure was actually envisaged according to «who sets the agenda: the scientific community for excellent science, industry for industrial leadership and society for addressing societal challenges», as stated in an expert group's report in preparation of FP9 (Lamy et al., 2017).

However, a deeper analysis of the discourses on research policy, reported in the following sections, shows how the EU understandings of the different reference frames is not straightforward and monolithic, but multifaceted and sometimes including conflicting visions.

More specifically, not only the three approaches show friction points with each other, but also, internally to each pillar, different interpretations struggle to prevail, and the confrontation is frequently conducted on the ground of re-framing arguments and issues.

Different visions for knowledge. As argued by Luciano Gallino (Gallino, 2007), the nature of Global Public Good (GPG) of scientific knowledge – i.e. its feature of being non-rival and non-excludable[93], while at the same time being available for all groups and populations of the world – is critically influenced by social, political and economic decisions. Scientific knowledge is nowadays treated prevailingly as an «intermediate» or «instrumental» public good, namely it is meant to serve other objectives or produce other goods, eventually public themselves. Rarer, according to Gallino, are the denotations of science as «final» or «primary» Global Public Good, whose production carries benefits *per se*, in the forms of people's intellectual development, new argumentations, cultural and social cross-fertilization with other fields (Gallino, 2007).

In the Horizon 2020 articulation, the «Industrial Leadership» and «Societal challenges» priorities are clearly belonging to the first class, treating knowledge as an instrument to accomplish the targets of, respectively, economic competitiveness and social betterment. «Excellent science» appears nearer to the second model, although, for its same positioning inside H2020, it is as well bounded to the overall objective of innovation, in so doing compromising the nature of knowledge as 'pure' final good.

The tension between the two visions of science, guided by autonomy and creativity or oriented towards strategic purposes, is not recent (Borrás, 2012; Turner, 2008) and it was well-reflected in the debate, started in the UK of the '40s, between J.D. Bernal, theorizing an essential social purpose for science, and M. Polanyi, arguing for a completely autonomous organization and orientation of science.

The first, in its 1938 essay on *The Social Function of Science* (Bernal, 1938), described the «socialized integrated scientific world organization»:

> *Science, conscious of its purpose, can in the long run become a major force in social change. Because of the powers which it holds in reserve, it can ultimately dominate the other forces. But science*

[93] In economics, a good is rival if its consumption prevents someone else from consuming the same good; and it is excludable if it is possible to exclude people from its consumption, if they have not paid for it.

> *unaware of its social significance becomes a helpless tool in the hands of forces driving it away from the directions of social advance, and, in the process, destroying its very essence, the spirit of free inquiry. To make science conscious of itself and its powers it must be seen in the light of the problems of the present and of a realizable future. It is in relation to these that we have to determine the immediate functions of science.*

According to Bernal, science, without a clear conscience of its social function may destroy «its very essence, the spirit of free inquiry». Consequently, he supported the mobilization of state resources in order to achieve planned socio-economic goals.

The position of Polanyi, in *The Republic of Science* (Polanyi, 1962), was radically different:

> *I appreciate the generous sentiments which actuate the aspiration of guiding the progress of science into socially beneficent channels, but I hold its aim to be impossible and indeed nonsensical. (…)*
> *Any attempt at guiding scientific research towards a purpose other than its own is an attempt to deflect it from the advancement of science. Emergencies may arise in which all scientists willingly apply their gifts to tasks of public interest. It is conceivable that we may come to abhor the progress of science and stop all scientific research, or at least whole branches of it, as the Soviets stopped research in genetics for twenty-five years. You can kill or mutilate the advance of science, you cannot shape it. For it can advance only by essentially unpredictable steps, pursuing problems of its own, and the practical benefits of these advances will be incidental and hence doubly unpredictable.*

Polanyi's view was that a social orientation of science is «nonsensical», because «any attempt at guiding scientific research towards a purpose other than its own» can only slow it or even destroy it.

The two views sprang apparently also from the authors' political belief: Bernal was a Marxist, a strong supporter of Soviet planned economy, while Polanyi was radically a liberal; also, in arguing about the nature and orientation of science, they cannot refrain from establishing comparisons between science and their preferred political organization. Polanyi in particular refers to Adam Smiths' «invisible hand» guiding the market as the model for science:

> *What I have said here about the highest possible co-ordination of individual scientific efforts by a process of self-co-ordination may recall the self-co-ordination achieved by producers and consumers operating in a market. It was, indeed, with this in mind that I spoke of 'the invisible hand' guiding the co-ordination of independent initiatives to a maximum advancement of science, just as Adam Smith invoked 'the invisible hand' to describe the achievement of greatest joint material satisfaction when independent producers and consumers are guided by the prices of goods in a market.*

These two visions for knowledge – autonomous or oriented – imply two different rationales for science policy, whose roots were set immediately after WWII in the USA[94]. Before that moment, most of the

[94] The following paragraphs on the description of the Bush/Steelman visions are based mainly on the accounts of (Cerroni & Simonella, 2014; Tallacchini, 2010).

US scientists considered public funding of research an unacceptable attack to their autonomy. However, the decisive contribution of scientific research to the outcome of the war led to a rethinking of the social contract among science, government and industry. The path was paved by a couple of reports concerning the changing physiognomy of science policy, drafted in 1945 and 1947: the Bush and Steelman reports. The first, *Science the Endless Frontier: A Report to the President on a Program for Postwar Scientific Research* (Bush, 1945), was prepared by Vannevar Bush, the mathematician and engineer who headed the US Office of Scientific Research and Development (OSRD), the office coordinating wartime R&D efforts (including the early development of the Manhattan Project); it focused on the need to publicly support scientific research if the national interest and prestige are at stake, because private funds cannot sustain appropriately the development of science. However, this support must not become political control: Bush conceived the idea of an agency funded with public money but run in complete autonomy by the scientists (Bush, 1945):

> *Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown. Freedom of inquiry must be preserved under any plan for Government support of science (…)*

The new "National Science Foundation", proposed by Bush, would have been accountable to the President and to the Congress, but had to work autonomously, and the government had to refrain from controlling it, excepted for the setting of the broad substantial orientation of research lines.

The report was received with mixed feelings, both by whom was suspicious with the public intervention in science and by those who conversely asked for more control. When the report was published, President Roosevelt was dead, and the new one, Truman, didn't accept the idea of the total absence of democratic control over the agency: he stopped the "National Science Foundation Act" and assigned to a new committee, headed by the sociologist and economist John R. Steelman, the task of rethinking the proposal. The new report, *A Program for the Nation* (Steelman, 1947), agreed with the previous one on the point that science had to figure among the strategic resources of the United States, but didn't agree with the privileged position accorded to science with respect to the other public sectors, and proposed for the government an active role of coordination and guidance. Steelman believed that all the fields contributing to the development of a liberal society had to be financed, including the social sciences – that Bush didn't esteem – as instruments of equal re-distribution of the scientific and technologic benefits on the population.

The two visions, hence, can be regarded as models of interaction between the governments and the scientific community and imply a different status for knowledge: in the "Bush model" the positive development of science is seen as only possible within the scientific community, administered with its consolidated specific methods, and would be endangered by any external intervention; the decision on the directions of research has to be taken inside the community – even with a weak orientation provided by the government on the strategic priorities to pursue –; the "Steelman model", conversely, puts a high premium on the contribution of science to national and societal objectives, and advocates political control over the

administration and the orientation of research. In 1950, the National Science Foundation was founded on the principles put forward by Steelman.

Table 14: a summary comparison of the "Bush" and "Steelman" models of science policy.

	Bush model	**Steelman model**
Agenda setting	Scientific community, by means of the confrontation among peers.	Government, on the basis of the national priorities.
Vision of knowledge[95]	Final. The positive contribution to national objectives will be a necessary consequence of the free development of science.	Instrumental. Knowledge has to serve national and societal objectives.
Administration	Scientists.	Government bureaucracy.
Funding criterion	Excellence.	Politically set criteria.

As mentioned, in the European research funding system, it is possible to recognize the features of both models. The overall setting views research as undoubtedly finalized to communitarian objectives, with the current two pillars «Societal Challenges» and «Industrial Leadership» mirroring the two-poles orientation developed in the contemporary history of European integration, and with the distribution criteria taking into account political *juste retour*[96] principles; however, how to exert the democratic control advocated in the Steelman perspective is subject to different interpretations, ranging from technocratic views to the complete engagement of citizens advocated by the Science and Society reflections[97]. Moreover, the recent inception of the European Research Council, embedded in Horizon 2020 under the pillar «Excellent Science», inserts in the scenario a conflicting view of research policy, nearer to the orientation of the Bush model: an autonomous institution, funding bottom-up proposals of research with the sole criterion of excellence and by means of peer evaluation.

Distinct, yet mutually reinforcing? The European research policy landscape is nowadays much more faceted than it was two decades ago, when the Framework Programmes were prepared essentially in Brussels, without the burden of negotiations of the post-ERA period (Andrée, 2009), and without the increased importance ascribed to research in strategic terms. Different visions of the role of science coexist, and concern not only the objectives of research, but also the very rationale of public support to knowledge production in the European system. The context is thus rich of potential tensions, that can lead either to conflicts or to constructive confrontations and to the establishment of new equilibria.

Notwithstanding the Commission's effort to stress the compatibility of the Horizon 2020 three priorities – described as *distinct, yet mutually reinforcing* (EC, 2011a) –, these inevitably show multiple points of friction: why should a "pure scientist", educated to the freedom and autonomy of scientific research,

[95] In reference to the aforementioned Gallino's distinction.

[96] In the European context, this principle states that the Member States receive from the UE in proportion of their contribution to the budget.

[97] For this reason, in the following I will name "economic Steelman" model the research funding in the innovation frame, and "mixed Steelman" the model of the societal frame, whose control and orientation is established by means of mixed and contrasting instruments: technical, political and democratic. See summary Table 16 and note 116.

accept to work for the solution of a politically-chosen societal challenge, or for the improvement of European industry? What if environmental aims and industrial priorities don't coincide? How to fit basic, inherently non-applied, blue-sky research, into the pragmatic frames of both Industrial Leadership and Societal Challenges?

In the following sections the policy discourses on research are analysed and the features of the three conceptual frames, in the EU understanding, are described.

Although, as shown, the EU vision is by large dominated by the innovation framework, other perspectives are gaining relevance, causing an internal labor in the European system.

The dominant narrative: the Innovation frame, or "knowledge for growth"

As mentioned, the European Community possesses a long-standing tradition of anchoring investments in scientific research to their contribution to economic growth.

A specific European reason, linked to its same foundational identity, is that the Community itself was born – functionalistic-wise – primarily as an economic community, and even in scientific intensive collaborations, like Euratom, the prime aim was to build an internal market for the nuclear industry, and the R&D dimension was only secondary (Guzzetti, 1995). The original economic focus has naturally influenced the policies features and orientations. The establishment of the European Union as a polity is very recent, when compared to the 40-years long history of economic aggregation; as mentioned, before the Single European Act (1986), the coordination of research policies was not even listed among the competences of the Community, and these were therefore promoted with reference to economic development, the main objective of the Economic Community.

However, the European case is not singular: it is part of a general trend observable in Western countries. Governments have always strived to find justifications for the funds devoted to R&D, and, naturally, they have always been concerned with the economic balance between public expenditures and returns (Godin, 2009); however, science policy rationales, in the first post-war decades, were not principally revolving around the anticipated economic benefits: in the '70s, when the argument framing science as an undisputable engine of progress weakened (with the rise of the environmental awareness, e.g.), a new vision of science emerged, depicted in public discourses as embedded in society, with strengthened ties to industrial development first, and later, in the '90s, working as the driving force for vibrant markets (Slaughter, 1993).

A fundamental role in this paradigm shift was played by the evolution of economic thinking, fuelled by internal disciplinary dynamics, but also by a conspicuous rise in resources devoted during the '70s and '80s to the study of what is currently called the STI (Science, Technology and Innovation) field (Freeman & Soete, 2009). Economic schools of thought, initially not particularly concerned with the contribution of R&D to national growth, began differentiating during the second half of the XX century, and a relevant share

started assigning an important role to technical progress. While neo-classical models of growth treated technology as an exogenous variable, new theories – endogenous growth theory, evolutionary economics, neo-schumpeterian economics – emphasized the role of knowledge production, technological change and innovation as central to economic growth, and contributed to a great degree to the expansion of the literature on science policies and innovation studies (Martin, 2012). Moreover, some of the proponents of these new theories spent part of their careers at influential international organisations, contributing to position research policies high in national political agendas – e.g. Christopher Freeman's work at OECD, starting in the '60s (see below), but also the numerous contributions of scholars belonging to his and related schools[98] as experts for European policy documents. Their inputs supported the shift in public policies of science towards the valorisation of research as functional to economic growth and oriented the choices on the kind of research to promote: from basic to applied, and directed to key technological fields. In the '90s, they contributed to the development of the innovation frame adopted by EU: the foundational *Green Paper on Innovation* (CEC, 1995) made explicit reference to the new economic theories, when dealing with the role of politics to promote growth by means of knowledge policies:

> *The new theories of growth (known as "endogenous") stress that development of know-how and technological change - rather than the mere accumulation of capital - are the driving force behind lasting growth.*
>
> *According to these theories, the authorities can influence the foundations of economic growth by playing a part in the development of know- how, one of the principal mainsprings of innovation. The authorities can also influence the "distribution" of know-how and skills throughout the whole of the economy and society, for instance by facilitating the mobility of persons and interactions between firms and between firms and outside sources of skills, in particular universities, but also by ensuring that competition is given free rein and by resisting corporatist ideas.*

In Europe, the debate about a coordination of scientific policies entered the political arena during the '70s, against the background of the incipient economic crisis, announced by the succession of oil crisis, and the rise of economic liberalism; the debate focused on the "technological gap" of EU with respect to USA and Japan, and the research policies were anchored to the development of strategic industries in the most promising fields, like electronics, computer science, energy and, later, biotechnologies, with an emphasis on the development of leading-edge technologies (Caracostas & Muldur, 1998; Guzzetti, 1995).

If, in the '80s and early '90s, this translated in the science policy documents into providing the European industry with the scientific and technological bases to increase their competitiveness[99] (CEC, 1997a):

[98] E.g. the economists coming from SPRU and Maastricht University schools.

[99] See also the paragraph *The story told by the Framework Programmes establishing acts* in the analysis of the first Framework Programmes declared objectives.

> *The Union must focus research activities on improving the competitiveness of the European economy, thereby promoting the creation of new jobs. It is particularly important that Europe should be able to transform scientific and technological breakthroughs into industrial and commercial successes.*

In the late '90s the same objective was re-formulated in terms of innovation (Caracostas & Muldur, 1998):

> *Inevitably, of course, a policy of this kind*[100] *will be centred on innovation, the preferred instrument of economic and social change. The advantage of the paring of society and innovation is that public policies can be revitalised without earlier objectives being abandoned. Industrial competitiveness will no longer be an objective but a means of increasing the contribution of science and technology to growth, employment and the rapid dissemination of innovations. Likewise, investing in science and technology becomes a means of increasing the innovative capability of the economy.*

The shift from industry-led to innovation-oriented research policy reflects a corresponding change of focus in the STI academia: in the words of two main innovation scholars, C. Freeman and L. Soete, «'Innovation' began to receive far more attention and the definition of industrial R&D was increasingly criticised as being too restrictive» (Freeman & Soete, 2009).

Indeed, in Horizon 2020, "Industrial Leadership" is listed as one of the three priorities contributing to the building of the innovation Union – and not the other way round – as proposed in the aforementioned early study of the Commission Directorate Strategy and Coordination (Caracostas & Muldur, 1998): industrial competitiveness and innovation thus, although with changes in the respective hierarchical positions, belong to the same framework, legitimizing public funding of research as an instrument to achieve economic growth.

The roots of the innovation conceptual framework and of its development into European scientific and economic policy have already been described in detail in the paragraph above on the affirmation of the innovation policies in Europe: although intertwined with the frame of the "European knowledge society", the innovation frame, with its clear market orientation, has represented the backbone of post-Maastricht policies.

Europe 2020 – the current overarching strategy, including the Innovation Union at its core – is the mature output of this evolution. It is aimed to economic growth, albeit with the qualities of being «smart, sustainable and inclusive»; the betterment of the economic situation is set as the final target of the priorities, as described in the very first paragraphs of the 2010 Commission document *Europe 2020 – A strategy for smart, sustainable and inclusive growth* (EC, 2010a):

> *Europe 2020 sets out a vision of Europe's social market economy for the 21st century.*
>
> *Europe 2020 puts forward three mutually reinforcing priorities:*
>
> *– Smart growth: developing an economy based on knowledge and innovation.*

[100] The policy of pairing society and innovation, as explained in the 1997 study of the Directorate Strategy and Coordination of the Commission *Society, the endless frontier* (Wynne, 1992) (author's note).

– *Sustainable growth: promoting a more resource efficient, greener and more competitive economy.*

– *Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.*

The Innovation Union from the Commission's perspective: the innovation frame and its sub-narratives.

The features of the innovation frame are particularly visible in the communication products realized by the Commission at the launch of Horizon2020, in 2014, conceived as concise descriptions of the contents of the research Programmes, embodying the effort to promote the values of the programme and to prove its relevance to a wider audience than the policy-makers' community; this kind of media, moreover, are notably interesting for what concerns the identification of conceptual frameworks, for their positioning at the sensible border between science, policy and society (Jasanoff & Kim, 2015).

The introductory video to Horizon2020, *What is Horizon 2020?* (EC, 2014e), was the communication product intended to briefly describe and promote the programme; as such, it offered a panorama of the strategy, depicted from the Commission's point of view, and could not refrain from resorting to legitimizing arguments, able to motivate and position the funding of knowledge production in front of the public. The video represents thus a useful exemplary communication of the innovation discourse, presented with a set of sub-argumentations or sub-narratives accompanying and justifying the policy orientation; the communication product, in other words, is particularly interesting because it 'condensed' the argumentations and narratives recurrently appearing in European research policy documents.

The video opened with the words:

> *Knowledge is power, they say. But in today's global economy knowledge is more like a currency: the trick is to make it work for you.*

Among the different possible understandings of knowledge production and circulation, the Commission communicators chose to adopt the equations knowledge-power and knowledge-currency: the production of knowledge through scientific research was framed linking knowledge to the exercise of power, and immediately after it was valued through an economic metaphor. Like a currency, knowledge should be exchanged to serve one's interests in a competitive scenario – «today's global economy». The whole process is portrayed as a «trick»: not a long, difficult learning effort or a consuming intellectual endeavour, but a stratagem, a «cunning act intended to deceive or outwit someone»[101], ultimately geared to a utilitarian advantage.

Horizon2020 was defined in the video as the instrument developed and implemented by the EU to shift the focus of the European growth strategy towards innovation:

> *That's why we want to turn the European Union in an Innovation Union, the plan to get good ideas to market faster, to boost the economy, create jobs and improve lives.*

[101] Oxford British and World English Dictionary: http://www.oxforddictionaries.com/definition/english/trick (accessed June 13, 2016).

The objective, in this statement, looked more ambitious than is the purpose of an economic strategy: Europe should be «turned» into a different kind of Union, its very political identity being questioned and reinterpreted here. The new identity, the "Innovation Union", was defined as the strategy aimed at reinforcing the conversion of ideas into market products, in order to «boost the economy». The images accompanying this statement were particularly telling: the sentence on the improvement of lives was pronounced against the scene of a family at the supermarket, happily engaged in buying the products that were manufactured, in the cartoon's plot, in a factory assembly line; the boxes were depicted as directly coming from the brain of the researcher, a materialization of his ideational work, represented as a chain of mechanical sprockets (see the pictures in Fig. 34).

The narrative implied by this statement, and reinforced by the pictures, is a linear causative relation between economic growth, creation of new jobs and improvement of the Europeans' lives. Elsewhere in the same video, people were represented laying on the grass of a big lawn surrounded by pines, or engaged in playing outdoor sports, while «knowledge» was «working for» them. The linear vision of the contribution of R&D to quality of life, via the incorporation of ideas in the market and the economic growth, is a peculiar and recurrent sub-narrative in the innovation frame.

Another argument frequently associated with the push for innovation in policy documents is the need to take action rapidly; we find in the video a particular emphasis on the speed of the research-to-market process (EC, 2014e):

> *Investing in excellent projects and people, anywhere and in any way that delivers innovation from the lab to the market much faster than anyone dreamed possible in Europe: that's a real Innovation Union and now Horizon2020 makes it really simple.*

The feeling of urgency is a pervasive feature of the Commission's discourses about research and innovation, since at least the turn of the Millennium, mainly justified by the fears of losing ground to US and to the Asian countries in the economic race. Often, in the documents proposing and describing growth strategies, the arguments are justified on the basis of crisis scenarios, and Europe2020 makes no exception, as is visible in the words of the document proposing it in 2010 (EC, 2010a):

> *Europe faces a moment of transformation. The crisis has wiped out years of economic and social progress and exposed structural weaknesses in Europe's economy. In the meantime, the world is moving fast and long-term challenges – globalisation, pressure on resources, ageing – intensify. The EU must now take charge of its future.*

The discourse is clearly not only describing the *de facto* situation of financial crisis (honestly very recent at the time of writing), but it is relying on a urgency narrative – "there is no more time, it is necessary to act now before it is too late". The feeling of urgency was an increasing feature of European policy documents – especially fuelled by the experts groups reports – that had significant consequences in terms of debate spaces, issues to tackle and choice of the instruments of action.

Finally, the third sub-narrative that is often employed in research policy discourses, especially the Commission's ones, is a between-the-lines negative judgement of non-tangible actions, like reflections or speculations, in favour of more concrete (and urgent) challenges:

> *Horizon 2020 (…) focuses on challenges we urgently need to address, like clean energy and recycling, caring for the elderly, health care, food safety and our oceans: real things! (…)*

The Horizon2020 overview video describes the challenges as «real things», directly affecting peoples' lives, apparently in opposition with some less funding-worth scientific wanderings. This anti-intellectual approach can be highlighted in discourses in connection with the rising importance of measurability and impact of research performances, traceable to an evidence-based turn in public policies due, among the other factors, to the absorption of New Public Management theories in Western public administrations and, more in general, to the general shift towards neo-liberal political-economic theories.

The pervasive use of urgency discourses, an increasing trend towards pragmatism and measurability invoked in the political discourses, the economisation of quality of life are relevant sub-discourses of the Innovation frame, contributing to a general foreclosure of the alternative political paths.

«…before it is too late»: the urgency discourse

The urgency rhetoric is a recurrent feature of contemporary EU discourses on growth strategies.

As aforementioned, the feeling of urgency increased particularly after the turn of the Millennium, and it is significantly visible in the reports on the development of the Lisbon strategy (Aho et al., 2006; Kok et al., 2004; Sapir et al., 2003), where we can recognize a steep rise of an anxiogenous rhetoric. The language of such narrative reflects a connotation of fear, and of the need to act rapidly in order to avoid dangerous consequences: words in the semantic families of "threat", "failure", "danger", "urgency", "fast", "necessary", "imperative", "late" abound, as well as expressions like "time is running out", and verbs linked to determination of action, as "must", "need", "want" etc.

In 2000, the European Research area was proposed against the backdrop of a «worrying situation»: «Europe might not successfully achieve the transition to a knowledge-based economy» (CEC, 2000). The statement is particularly relevant in consideration of the fact that the document was published *before* the presentation of the Lisbon strategy, centred on the realization of the knowledge-based economy, launched only a couple of months later. Even so, the situation was connoted as «urgent»:

> *The situation is urgent. Without a co-ordinated impulse and a determined effort to increase and better organise the European research effort, Europe might compromise its chances of taking full advantage of the potential offered by the transition to a knowledge-based economy and society. This will not be without its negative impact on growth and employment.*

The group of experts chaired by André Sapir warned President Prodi, in its 2003 report presentation, of the threats menacing the sustainability of the «European model»:

> *Faster growth is paramount for the sustainability of the European model, which puts a high premium on cohesion. Sustainability is under threat from rapid developments in demography, technology and globalisation, all of which increase the demand for social protection. Failure to deliver on the commitments of the Lisbon Agenda would endanger the present European contract and could lead to its fundamental revision, thereby threatening the very process of European integration. Fortunately, however, technology and globalisation, like enlargement, also hold the potential for faster growth throughout Europe.*

The urgency of the situation, according to these analyses, didn't allow to lose time in «complacency» (Kok et al., 2004):

> *The Lisbon strategy is even more urgent today as the growth gap with North America and Asia has widened, while Europe must meet the combined challenges of low population growth and ageing. Time is running out and there can be no room for complacency. Better implementation is needed now to make up for lost time. (…)*
>
> *Improved economic growth and increased employment provide the means to sustain social cohesion and environmental sustainability. (…)*
>
> *The view of the High Level Group is that Lisbon's direction is right and imperative, but much more urgency is needed in its implementation — and more awareness of the high cost of not doing so.*

The Aho report, in 2006, emphasized the feeling of urgency alerting the Europeans of the «threat» that was menacing «their way of life» if they didn't support research and innovation:

> *Europe and its citizens should realise that their way of life is under threat but also that the path to prosperity through research and innovation is open if large scale action is taken now by their leaders before it is too late.*

The very recent "Lamy report", developed in 2017 (more than a decade after the Aho report) in preparation of FP9, shows to maintain the same momentum on the «urgency of global challenges» (Lamy et al., 2017):

> *(…) the rate of technological and economic change and the urgency of global challenges continue to outpace Europe's response and reforms.*
>
> *It is imperative for Europe to act, to act now and to act decisively. (…)*
>
> *The EU's substantial knowledge assets, based on science and research, need to be faster and more intensively turned into innovations, in the form of new products, processes, services and business models, which generate value for economy and society.*

The warnings in all these discourses relate to the social aspects of the citizens' experiences: «sustainability», «cohesion», «way of life». In other words, in order to show the necessity of economic growth, the reports put forward fears on the failure of the European «way of life».

The urgency repertoire in EU documents shows a recurrent narrative structure: a relevant example can be the preface to the Europe 2020 proposal, personally signed by the Commission President Barroso (EC, 2010a):

> *2010 must mark a new beginning. I want Europe to emerge stronger from the economic and financial crisis.*
>
> *Economic realities are moving faster than political realities, as we have seen with the global impact of the financial crisis. We need to accept that the increased economic interdependence demands also a more determined and coherent response at the political level.*
>
> *The last two years have left millions unemployed. It has brought a burden of debt that will last for many years. It has brought new pressures on our social cohesion. It has also exposed some fundamental truths about the challenges that the European economy faces. And in the meantime, the global economy is moving forward. How Europe responds will determine our future.*
>
> *The crisis is a wake-up call, the moment where we recognise that "business as usual" would consign us to a gradual decline, to the second rank of the new global order. This is Europe's moment of truth. It is the time to be bold and ambitious.*
>
> *Our short-term priority is a successful exit from the crisis. It will be tough for some time yet but we will get there. Significant progress has been made on dealing with bad banks, correcting the financial markets and recognising the need for strong policy coordination in the eurozone.*
>
> *To achieve a sustainable future, we must already look beyond the short term. Europe needs to get back on track. Then it must stay on track. That is the purpose of Europe 2020. It's about more jobs and better lives. It shows how Europe has the capability to deliver smart, sustainable and inclusive growth, to find the path to create new jobs and to offer a sense of direction to our societies.*
>
> *European leaders have a common analysis on the lessons to be drawn from the crisis. We also share a common sense of urgency on the challenges ahead. Now we jointly need to make it happen. Europe has many strengths. We have a talented workforce, we have a powerful technological and industrial base. We have an internal market and a single currency that have successfully helped us resist the worst. We have a tried and tested social market economy. We must have confidence in our ability to set an ambitious agenda for ourselves and then gear our efforts to delivering it.*
>
> *The Commission is proposing five measurable EU targets for 2020 that will steer the process and be translated into national targets: for employment; for research and innovation; for climate change and energy; for education; and for combating poverty. They represent the direction we should take and will mean we can measure our success.*
>
> *They are ambitious, but attainable. They are backed up by concrete proposals to make sure they are delivered. The flagship initiatives set out in this paper show how the EU can make a decisive contribution. We have powerful tools to hand in the shape of new economic governance, supported by the internal market, our budget, our trade and external economic policy and the disciplines and support of economic and monetary union.*

The condition for success is a real ownership by European leaders and institutions. Our new agenda requires a coordinated European response, including with social partners and civil society. If we act together, then we can fight back and come out of the crisis stronger. We have the new tools and the new ambition. Now we need to make it happen.

José Manuel BARROSO

Filled with words relating to urgency and determination of action, the narrative comprises the following steps:

1. Declaration of intents in a short form;
2. Emphasis on the crisis: the current situation comprises several problematic elements; economic lags trigger social failures; the situation is very severe;
3. Europe's resources: despite the severe situation, EU possesses the resources to overcome the crisis;
4. Urgency of action: however, no exit is possible if all the actors take immediate actions;
5. Policy proposal: luckily, EU has a policy proposal to solve the crisis;
6. Final call to engage and re-emphasis of urgency: if we act together we can overcome the crisis, but we need to do it now.

An analogous structure can be found in diverse other policy documents (Aho et al., 2006; CEC, 2000); for example, the 2010 Commission document on the Innovation Union opens with:

At a time of public budget constraints, major demographic changes and increasing global competition, Europe's competitiveness, our capacity to create millions of new jobs to replace those lost in the crisis and, overall, our future standard of living depends on our ability to drive innovation in products, services, business and social processes and models. This is why innovation has been placed at the heart of the Europe 2020 strategy. Innovation is also our best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing, which are becoming more urgent by the day.

Europe has no shortage of potential. (…) In a rapidly changing global economy, we must build on our strengths and decisively tackle our weaknesses (…)

Innovation Union sets out such a bold, integrated and strategic approach (…) Business-as-usual equals gradually losing our competitive advantages, and accepting Europe's steady decline. (…)

This, in essence, is what Innovation Union is all about. The benefits will be significant (…)

With Innovation Union, we have a vision, an agenda, a clear distribution of tasks and robust monitoring procedures. The European Commission will do what is necessary to make the Innovation Union a reality.

In the urgency narrative, the «weaknesses» of the European system are not only described, but emphasized to varying degrees in order to form the legitimation of the proposed actions.

Even if rhetorically effective, this is not the only possible argumentative structure to achieve persuasion, nor it was the rule in European discourses before the turn of the Millennium: for example, the 1993 *White Paper on Growth, Competitiveness, Employment* (CEC, 1993b) described the problems of the Community in a more nuanced way, not indulging to the urgency rhetoric, but invoking «sensitivity and caution»:

> *Why this White Paper? The one and only reason is unemployment.*
> *We are aware of its scale, and of its consequences too. The difficult thing, as experience has taught us, is knowing how to tackle it. (…)*
> *The European Commission is aware of the difficulty of the task. For if the solutions already existed, our countries would surely have applied them; if there were a miracle cure, it would not have gone unnoticed. With national situations being so different, any proposal has to be presented with sensitivity and caution. That being so, the Commission does share the view, expressed by many Member States, that joint responses would strengthen the hand of each player, and therefore of the European Union.*

Another possible presentation of new policies can be found in the document *Towards a Europe of knowledge*: although mentioning «two major preoccupations» (related to the realization of the knowledge society and to the employment policies), it didn't frame them in a negative manner, but gave space to the proposals to overcome them (CEC, 1997c).

The overall tone of the urgency-based discourses is concerned and alarmed, as if a major turmoil had just happened. However, the appeal to urgency arguments doesn't appear necessarily correlated to historical events, excepted for the 2008 financial turmoil, which had the effect to increase significantly the rhetorical level of anxiety already present in previous documents (e.g. EC, 2011a); for example, the mentioned 2000 document on the ERA was published in a period that would have been defined, only a couple of months later and by another important policy document, as characterised by the «best macro-economic outlook for a generation» (Council, 2000).

The narrative structure resembles the argumentations used during conflict periods, like war-time speeches[102]; after all, the concept of competitiveness, abundantly adopted by the EU, is in itself an agonistic

[102] cf., for example, Churchill's May 13, 1940 speech at the House of Commons (Churchill, 1940):
I beg to move,
That this House welcomes the formation of a Government representing the united and inflexible resolve of the nation to prosecute the war with Germany to a victorious conclusion. (…) To form an Administration of this scale and complexity is a serious undertaking in itself, but it must be remembered that we are in the preliminary stage of one of the greatest battles in history, that we are in action at many other points in Norway and in Holland, that we have to be prepared in the Mediterranean, that the air battle is continuous and that many preparations, such as have been indicated by my hon. Friend below the Gangway, have to be made here at home. In this crisis I hope I may be pardoned if I do not address the House at any length today. (…) I would say to the House, as I said to those who have joined this government: "I have nothing to offer but blood, toil, tears and sweat." We have before us an ordeal of the most grievous kind. We have before us many, many long months of struggle and of suffering. You ask, what is our policy? I can say: It is to wage war, by sea, land and air, with all our might and with all the strength that God can give us; to wage war against a monstrous tyranny, never surpassed in the dark, lamentable catalogue of human crime. That is our policy. You ask, what is our aim? I can answer in one word: It is victory, victory at all costs, victory in spite of all terror, victory, however long and hard the road may be; for without victory, there is no survival. Let that be realised; no survival for the British Empire, no survival for all that the British Empire has stood

metaphor: it depicts a scenario where the players fight to win the race, in a winner-takes-all game. The economist Paul Krugman, criticizing Delors' emphasis on competitiveness, (Krugman, 1994) highlighted the consequences and motivations of basing economic policies on competitiveness, which can actually become a harsh confrontation among countries, and lead to the perception of economy as a race against competitors, analysed as if they were simple companies and not complex nation states. Trusting the competitiveness «obsession», he argued, serves different purposes: first, competitive metaphors are exciting, motivating – as was the case for the space race between USA and the Soviet Union –; secondly, positioning the problem 'outside' the national systems is convenient for politicians, who can, in so doing, avoid facing difficult internal problems – like what Delors did, according to him, with the 1993 White Paper, where he put forward the lack of competitiveness as the reason for unemployment, while he should have faced the complex European taxes and regulation system, combined with its expensive welfare, and the difficulties related to the European monetary system against the costs of the German reunification –; finally, he considered that the competitiveness language represents a very useful rhetorical tool for politicians as a leverage to justify hard choices.

The urgency frame, hence, can be regarded as a by-product of basing economic policies on a conflict metaphor like competitiveness. Even if the roots of the competitiveness rationale are deeply entrenched with the historical and conceptual development in the understanding of the role of science in public policies, it is unavoidable to underline that resorting to arguments based on fear, highlighting the difficulties of the situation in order to emphasize the proposed initiatives, also inevitably obtains the effect of downplaying critical voices, closing up the spaces for further discussions. In European documents the more frequent is the use of urgency terms, the narrower becomes the path to the solution: the non-compulsory nature of the policies appears vanishing against the presentation of solid arguments in favour of a one-way track. The use of terms referring to determination and need contributes to the presentation of political *imperatives* in place of *options.*

«Real things!»: measurability and impact

We have already mentioned above how, in the video realized by the Commission to introduce Horizon2020, pressing societal challenges were presented as «real things», and later on, when dealing with the apparent conflict between emphasising concreteness of objectives and promoting basic science, the speaker again insisted on Horizon «getting closer to real every day needs» (EC, 2014e).

Such insistence in the communication product on a peculiar feature of the research programme – the practical orientation and the impact on «every day» lives – can be regarded as evidence of an underlying shared positive judgement on concrete, output-oriented activities, or, conversely, expresses the will of the

for, no survival for the urge and impulse of the ages, that mankind will move forward towards its goal. But I take up my task with buoyancy and hope. I feel sure that our cause will not be suffered to fail among men. At this time I feel entitled to claim the aid of all, and I say, "come then, let us go forward together with our united strength".

Commission to position against time- (and money-) wasting research activities, whose results are not immediately visible as tangible improvements.

This unspoken judgement is part of a wider conceptual framework assigning a positive value to practical, tangible spill-overs while at the same time unfavourably judging research activities with opposite features. The consequences of such an evaluation are diverse: a focus on results rather than on the process, a devaluation of intangible achievements, the rise of an «accountability»-based model, an emphasis on measurability, efficiency, performance, impact.

This framework is not specifically European: a shift towards accountable, results-oriented policies can be identified in Western countries since the '60s, and it descends from a corpus of new schools of thought in the political and economic sectors, sharing the common feature of emphasizing measurement of results and evaluation of the systems performances.

Measuring research. The works of Godin (Godin, 2006c, 2009) trace the evolution of accounting exercises, making use of statistical standards to measure the performances of the national R&D systems, and identify in the OECD the 'propellant' institution, with the development of the *Frascati manual on the measurement of scientific and technologic activities* (OECD, 1963). This manual was not a simple econometric exercise: it was developed as an answer to «early policy demand for statistics», coming from governments in search of funds allocation criteria and looking for a connection between scientific research and economic growth. The effect of the manual, and of the underlying economic culture, was the diffusion of a representation of science as «research accounting», evaluable by the indicators of efficiency, performance and impact, by means of input-output models.

The European Commission was actively involved with this OECD effort during the '70s – the period when it was first developing its own coordinated science policy – and it contributed to the collection of data on the socioeconomic objectives of government-funded R&D, with the aim of studying the political goals of research policy (Godin, 2009, p. 86).

The publication of the second wave of OECD Manuals in the '90s (Oslo, Canberra, jointly realized by OECD and Eurostat, and the family of related manuals[103]) reflected the evolution of the economic academic community reflections on innovations, and answered to the need of new «STI output indicators». Again, the new set of measurements was not a neutral instrument, but an active influencer of the scholarly debates, as confirmed by the economists Cristopher Freeman – one of the 'fathers' the *Frascati Manual*, and among the leading scholars in the innovation studies – and his colleague Luc Soete: «As in the case of the development

[103] To be exact, the 5th edition of the Frascati Manual and Godin (Godin, 2009; OECD, 1993) identify the following main series of Manuals in the «R&D family»: *The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Development* (Frascati manual, first edition in 1962), *R&D Statistics and Output Measurement in the Higher Education Sector - Frascati Manual Supplement* (1989), *Proposed Standard Practice for the Collection and Interpretation of Data on the Technological Balance of Payments* (first edition in 1990), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data* (Oslo manual, first edition in 1992), *Data on Patents and Their Utilization as Science and Technology Indicators* (first edition in 1994), *Manual on the Measurement of Human Resources in Science and Technology* (Canberra manual, first edition in 1995). Stats Canada and Eurostat undertook analogous measurements, and/or participated to OECD effort (Freeman & Soete, 2009).

of harmonized industrial R&D statistics within the Frascati Manual, we would claim that the development of harmonized, innovation-output indicators within the framework of the Oslo Manual was a central factor behind both a better understanding of the science and technology system and the changing nature of the innovation process itself» (Freeman & Soete, 2009).

From administration to management. Another important international trend, whose founding values influenced (and were influenced by) political thinking, was the rise of the «New Public Management» (NPM) theory on public administration, i.e., according to the science policy scholar Aant Elzinga, a «shorthand for applying private sector or market-based techniques to public services» (Elzinga, 2010).

NPM was developed during the '70s and '80s from previous theories of public administration; initially applied in the UK of Margaret Thatcher, in New Zealand and in Australia, it was subsequently adopted, with national variations, by most OECD countries. The theory was based on a departure from the traditional models of public administration, based on the compliance to a set of rules and on the respect of a strict hierarchical organization, in favour of a flexible approach to management, inspired by the private sector and by the «logic of economics» (Keating, 2001). The main features of New Public Management are the focus on objectives, the imitation of market mechanisms and a reduction of control in favour of accountability; statistics and benchmarking, hence, play a significant role also for NPM. According to Elzinga (Elzinga, 2010), the New Public Management approach is based on:

- *More for less*
- *Marketization (including creation of quasi-markets in administrative organizations)*
- *Commoditization of health care services, welfare benefits, teaching packages and research results (also those generated by publicly funded institutions)*
- *Inducing competition between task performers*
- *Turning citizens into consumers and clients (this goes for students too)*
- *Agencification (contractification)*
- *From administration to management (fostering the entrepreneurial bureaucrat)*
- *From input to output/outcome control*
- *Performance-based management (and funding), Performativity metrics (accountingization)*
- *Reputation and image management (PR & branding)*
- *Entrepreneurialism*
- *Partnering*

The reform of the administration in the European Union – initiated by the Santer Commission in 1995 and finalized, after the mass resignation of the Commission in 1999, by the Prodi Commission (CEC, 2001; EC & Kinnock, 2000) – included various features aligning the Commission to the NPM approach, in the management of human resources (Knill & Balint, 2008), but also in the criteria related to agenda-setting: accountability, efficiency, focus on results, externalization of non-core activities, performance-oriented working methods (EC & Kinnock, 2000) were included in EU management procedures.

Since no policy output is independent from the process that produced it, it is not surprising to find the criteria to define a 'good management' translated to the evaluation of 'good policies'.

The general neoliberal political-economic climate. There is no one-way path from political-economic frameworks to real processes (or vice versa), and any idea diffuses in complex ways, influencing and being influenced by actual realizations. However, it is possible to recognize in the new economic theories, in the diffusion of statistical indicators and in the rise of New Public Management the influence of the political-economic neoliberal theory, with its valorisation of markets mechanism and private actors at the expense of public interventions. All these components composed the mainstream political-economic discourses that, although seldom patently cited in documents, contributed to the definition of the current European policies on science.

Neoliberal theories emerged as a response to the economic crises of the '70s ad '80s, and were characterised by the belief that «human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices» (Harvey, 2005). Important tenets of neoliberalism are the preference accorded to markets over governments as policy instruments and the expectations from economic development to produce an increase in the standards of living rather than redistribution (Moore et al., 2011).

The European vision. Notwithstanding the fact that the European Community has not expressed a political choice in favour of the one or the other model – given also the weaknesses of its system of representative democracy – it is possible to recognize in the European policies on research a shift towards some features of the described political-economic visions.

The original concern of the '70s first attempts of European science policies was the lack of coordination of national programmes, and the ERA project was especially designed to overcome the «compartmentalisation of public research systems» (CEC, 2000):

> *It cannot be said that there is today a European policy on research. National research policies and Union policy overlap without forming a coherent whole. If more progress is to be made a broader approach is needed than the one adopted to date. (…) Essentially, the non-existence of a European research area is due to the compartmentalisation of public research systems and to the lack of coordination in the manner in which national and European research policies are implemented. Much needs to be done in this area, without, however, putting unwieldy mechanisms in place. At the same time the barriers must be lifted between different disciplines, along with the barriers that curb the movement of knowledge and persons between the academic and the business worlds.*

However, in the same years of ERA, research policy discourses contained an increased emphasis on the effectiveness, performance and impact of research, conceived as the «next step» for science policy (Caracostas & Muldur, 1998, preface by Commissioner Cresson):

> *By focusing on increasingly specific objectives and subjects, this Union policy[104] has created a real "European scientific and technological area", built on numerous network of co-operation and exchange.*
>
> *The next and vital step is to adapt this policy to the new emerging scenario, notably by improving its impact on the economy and society.*

A few years later, in the preparation of the 7th Framework Programme policy officers advocated for a «New Deal» for research, based on the benchmarking of national programmes and the comparison of «hard evidence of the impact of research policies», in order to maximise the output/input ratio (Muldur et al., 2006):

> *(..) 7th Framework Programme is only a first tentative step towards a new governance model for European research policy. What is really needed (…) is a "New Deal" for research, based on sharing and comparing hard evidence of the impact of research policies at regional, national and EU levels. Only in this way will Europe be able to identify what is done best at each level, and how to get the most out of the public resources it invests.*

FP7, besides, was prepared in the years 2004-2006 (Andrée, 2009) in the new regulatory frame asking for in-depth impact assessment reports to accompany every legislative proposal of the Commission, compulsory since 2003 (Muldur et al., 2006):

> *Impact assessment is a new approach for improving the transparency and quality of policy design. It informs decision-makers of the likely consequences of policy choices by answering a common set of questions. It assesses the issues at stake and the objectives to be pursued by the policy proposal. It examines the views of the main stakeholders that will be affected by the policy. It identifies the main policy options for achieving the objectives, and analyses their likely economic, environmental and social impacts.*

In the shift from the political objective of enhancing coordination among national research systems to the emphasis on achieving the maximum impact, we can recognize the influence of the measurement and efficiency models of public policies evaluation and legitimation. The brochure *Horizon 2020 – two years on*, published by the Commission in 2016, graphically depicts the «key performance indicators» by which Horizon 2020 «success is measured» (EC, 2016g):

> *To make sure every euro is spent effectively, the Commission has introduced a performance reporting mechanism.*

[104] European research (note of the author).

Among the indicators (see Fig. 33) appear the number of publications and patents published in high-impact journals, the number of collaborations established among research institutes and other innovation actors, but also the «number of occurrences of tangible specific impacts on European policies» (an indicator of the JRC performance) and the «total investments via debt financing and venture capital investments» (to measure the success of the objective "Access to risk finance for investing in research & innovation"). The measurement effort is described as oriented to «accountability and transparency», and ultimately realised to the benefit of the citizens:

> *The Performance framework provides EU decision makers and citizens with a clear picture of the progress towards expected results to be achieved with the money invested at the EU level.*

Another notable approach of the current policy is a generally critical attitude towards «diagnosing the problem», in favour of «remedies» – unless reflecting on the problem, by means of «indicators», serves to emphasize the urgency to act (Aho et al., 2006):

> *There is a large gap between the rhetoric of a political system that preaches the knowledge society and the reality of budgetary and other priorities that have shown little shift in preparing to engage with it. Our emphasis is on remedies not diagnosis but we must also recognize the magnitude of the problem. There are many indicators both of insufficient effort to innovate and of the consequences of not doing so (…)*

The emphasis on problem solving, coupled in this quotation with a trenchant position against the rhetorical preaching of the political system, is best embodied by the current inclination towards challenge-based programmes. The formulation of policy objectives in terms of «challenges», where the issues are presented to researchers as problem-oriented puzzles to solve, stimulating their interest as well as their agonistic spirit, is not specifically European, but it's part of a common Western rhetorical trend focusing on the need of effective solutions at the expenses of the confrontation on the definition of the problem and on the desired outcomes (see the paragraph on *Solving Grand Challenges* below). This focus on problem-solving, instead of agenda-setting, may be referred as well to the general discourse promoting 'real', measurable and tangible outcomes of research.

The researchers themselves, indeed, are asked to cultivate entrepreneurial skills: already FP5, in 1998, introduced the hybrid term «enterprising researcher», able to produce innovation (EP & CEU, 1998):

> *(encourage) the emergence of a new generation of enterprising researchers with innovative ideas;*

FP7 (2006) advocated for the researchers to receive training in a broader spectrum of skills, «including those relating to technology transfer and entrepreneurship» (EP & CEU, 2006):

> *Initial training of researchers to improve their career perspectives, in both public and private sectors, inter alia through the broadening of their scientific and generic skills, including those relating to technology transfer and entrepreneurship, and attracting more young people to scientific careers.*

Horizon 2020, coherently with its insistence on the need of marketing ideas as fast as possible, posited for the EIT (European Institute of Technology) the objective of promoting «entrepreneurial education», oriented to the creation of spin-offs and start-ups (EP & CEU, 2006):

> *The EIT should foster entrepreneurship in its higher education, research and innovation activities. In particular, it should promote excellent entrepreneurial education and support the creation of start-ups and spin-offs.*

Also the very recent "Lamy report", developed in preparation of FP9 and focused on «maximising the impact of EU Research & Innovation Programmes» (Lamy et al., 2017), emphasises the entrepreneurial «reform» that should be promoted in European education, based on the promotion of «self-confidence» and tolerance towards «failures»:

> *A fundamental reform of the role of education should systematically embed innovation and entrepreneurship in education across Europe, starting from early stage school curricula. Schools should foster a culture that boosts self-confidence; society should build an environment that allows for failure of new ventures and continuous life-long-learning. In the future, everybody in society should be stimulated to be creative, from children to elderly, from employees to employers, from civil servants to start-ups.*
>
> *Europe's universities need urgent renewal, to stimulate entrepreneurship (…)*

The shift from coordination of policies to efficiency and impact, the emphasis on problem-solving and results, and the promotion of entrepreneurship of researchers, position EU innovation frame in the general Western shift towards the valorisation of practical, tangible research outputs and characterisation, favoured by the rise of neoliberal thinking, the OECD-promoted emphasis on S&T measurement and benchmarking, and the New Public Management approach to public administration. The same political-economic climate influenced the portrayal of quality of life as strictly connected to wealth production.

Innovation is the answer: a linear path from wealth to happiness

The Horizon 2020 introductory video (EC, 2014e) presented the improvement of lives against the picture of a family scene at the supermarket (see above and Fig. 34), and rhetorically identified the logical chain leading to that result as:

Good ideas → marketization → boost of the economy → creation of jobs → improvement of lives.

The envisaged measures of H2020, the so-called «Flagship Initiatives», are described mostly in terms of their contribution to innovation or to the market, with marked accents on the efficiency and performance of the systems (EC, 2010a):

> *– "Innovation Union" to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs.*

– "Youth on the move" to enhance the performance of education systems and to facilitate the entry of young people to the labour market.

– "A digital agenda for Europe" to speed up the roll-out of high-speed internet and reap the benefits of a digital single market for households and firms.

– "Resource efficient Europe" to help decouple economic growth from the use of resources, support the shift towards a low carbon economy, increase the use of renewable energy sources, modernise our transport sector and promote energy efficiency.

– "An industrial policy for the globalisation era" to improve the business environment, notably for SMEs, and to support the development of a strong and sustainable industrial base able to compete globally.

– "An agenda for new skills and jobs" to modernise labour markets and empower people by developing their of skills[105] *throughout the lifecycle with a view to increase labour participation and better match labour supply and demand, including through labour mobility.*

– "European platform against poverty" to ensure social and territorial cohesion such that the benefits of growth and jobs are widely shared and people experiencing poverty and social exclusion are enabled to live in dignity and take an active part in society.

Each priority, even those belonging to the social care and education sectors, are ultimately legitimized by economic factors: education systems need to increase their «performance» in order to speed up the entry in the labour market, and so the acquisition of new skills is geared to the empowerment of people, portrayed as workers – the cultural and civil contribution of education are here not mentioned; high-speed internet needs to be boosted in order to increase the firm's competitiveness; poverty is framed as a problem of missed access to the benefits of economic growth. Finally, research and innovation need to be financed in order to «turn» innovative ideas into «products and services that create growth and jobs».

The tendency to identify market-based solutions to social and political issues is a recurrent trait of EU research policy documents, particularly visible in its most recent developments, like the last few Framework Programmes establishing acts – where we noticed an evolution from a parallelism of social and economic objectives to a causal relationship between them (i.e., economic wealth as the source of social value, see above) – and the documents related to Europe 2020 and the Innovation Union (EC, 2010c):

At a time of public budget constraints, major demographic changes and increasing global competition, Europe's competitiveness, our capacity to create millions of new jobs to replace those lost in the crisis and, overall, our future standard of living depends on our ability to drive innovation in products, services, business and social processes and models. This is why innovation has been placed at the heart of the Europe 2020 strategy. Innovation is also our best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing, which are becoming more urgent by the day.

[105] *Sic.*

Innovation is proposed in this document as the crucial driver of «our future standard of living»; it is identified as the main instrument to address issues like climate change, health, ageing and resource scarcity, which belong to different realms, and are subject to multiple understandings: climate change is a complex environmental problem, related to scientific, technical, political, economic and social factors; health and ageing are significantly value-based subjects, as well as medical, social and administrative; resource scarcity may be treated as an engineering, geological, political and economic problem.

This approach shows a double simplification: on one side, the discourse is based on the belief that the marketization of ideas, through the focus on innovation, will be able to solve complex problems; on the other hand, in the specific context of research policy, the community leans principally on scientific ideas to address the issues at stake. Scientism and economism, deeply intertwined with each other, are hence two critical features of the EU discourses on science policy, particularly in the innovation frame.

This approach is not free of tensions: in 2006, the Aho report could perceive a friction between «what is distinctive about European values» and «a market-led vision» if it bothered to justify it, and advocated for a «reformed social model conducive to innovation» (Aho et al., 2006):

> *A market-led vision does not mean an abandonment of what is distinctive about European values but rather the use of the force of the market to preserve them, both by harnessing innovation to engage with public services and by creating the wealth necessary to finance the equality, health, social cohesion and common security that our citizens desire. Investments in education, science, research and innovation should not be seen as alternatives to investments in the welfare society in Europe, but as necessary though not sufficient means to ensure its sustainability, albeit through a reformed social model conducive to innovation.*

The report, focused on «creating an innovative Europe», promoted the «use of the force of the market» to «preserve» the European values, highlighting financial wealth as a necessary condition for equality, health, social cohesion and security. Again here we spot the reference to the neoliberal discourse on economic prosperity as the basis not only of a secure and comfortable life, but even of personal fulfilment (Moore et al., 2011).

Moreover, the report includes the citizens in the argumentation, using their «desires» as the ultimate legitimising reason for action. However, the same citizens, elsewhere in the same work, are described as alarmingly reluctant to change, and are suggested to adapt to the proposed innovation-oriented actions if they want to maintain their «way of life». The reduction of the complex dimensions of citizenship to the function-wise definitions of the Europeans as «users» or «consumers» (see below for a detailed description) is another consequence of the economisation in the understanding of policies, included scientific policies (EC, 2011a):

> *Europe's taxpayers have a right to know how their money is invested. Because research and innovation are vital to people's futures, it is important to bring the research and innovation*

> *activities funded through Horizon 2020 to the attention of the general public, showing in particular the added value of Union level action. This will generate better public understanding, engagement and debate.*

This quote from the Commission's communication on Horizon 2020, even while advocating for more public participation, cannot hide a pre-set orientation of the debate towards the acknowledgment of the importance of R&I, and of the Commission's efforts to support them. Moreover, the need to engage them is motivated in first instance with the right of the «taxpayers» to know «how their money is invested», and not by their right of citizens to transparency.

It appears likely that the approach grounding quality of life on innovation will be maintained in the next Framework Programme: Pascal Lamy, former EU Commissioner for Trade and director-general of WTO (World Trade Organization), chairman of the experts group on "maximising the impact of EU Research & Innovation Programmes», states in the preface to the report *Lab, Fab, App: investing in the future we want* (Lamy et al., 2017):

> *We need to get rid of the notion that research and innovation is not relevant to society. To shape our future together, we need to imagine, invent and create. We need research ("Labs"), innovation (competitive fabrication ("Fabs") and applications for the benefit of all ("Apps"). Hence the title of our report: Lab, Fab, App: investing in the future we want.*
>
> *I hope we will succeed in convincing public opinion and decision-makers that further EU investment in research and innovation and maximising its impact is probably the best option that Europe has to deliver solutions and future well-being for its citizens.*

The Innovation frame as a political instrument

The European choice to base R&D funding to innovation, although historically and conceptually motivated by a tendency shared by most of the Western countries, presents distinct features that mark the use of the innovation frame as a political instrument.

As shown, indeed, relying on innovation is not a neutral, technical, choice, but it proves, at least implicitly, the adherence to a political and economic vision of Europe – with many features in common with neoliberal theories – and it has far-reaching consequences.

The innovation frame qualifies 'good' science by means of performance and effectiveness indicators, excluding considerations on its contribution to the advancement of knowledge, or to the citizens' cultural development. It favours the vision of knowledge as a commodity, that can be sold and bought on the market, and as an instrument of wealth and power. It weds with the enhancement of entrepreneurship in the administration, research and education sectors. Finally, it focuses on problem-solving, downplaying the importance of problem-setting.

Often, especially when in conjunction with the rhetoric of urgency, it obtains the effect of foreclosing alternative paths, reducing the space for political confrontation (Stirling, 2015).

The innovation frame resembles to some extents the progress narrative: conceptually, it champions novelties *per se*, despite their meaning or orientation, likewise progress backed the most recent at the expense of the old. Both narratives, moreover, rely on simplifications and linearization of complex phenomena, working as a tool to realize value-based judgements on new phenomena or developments.

From this perspective, the innovation frame has to be regarded as a political tool, with distinct features and orientation.

However, despite the fact that, as shown, innovation represents the backbone of research policy framing, discourses on science in Europe are complex and multifaceted, include different voices, possess internal dynamics that cannot be reduced to a single totalitarian mind-set, as the existence and relevance of the competing social and pure-science frames show.

Social orientation of knowledge, or the "knowledge for society" frame

The effort to couple growth and social model is a peculiar and distinctive trait of European policy, at least since the first '90s, when the Maastricht Treaty added social objectives among the areas concerned by communitarian policies. The «European social model» was described in the 1994 *White Paper on European social policy* (CEC, 1994) as based on a set of shared values and constituted by the pairing of «competitiveness» and «solidarity»:

> *The contributions to the Green Paper*[106] *confirm that there are a number of shared values which form the basis of the European social model. These include democracy and individual rights, free collective bargaining, the market economy, equality of opportunity for all and social welfare and solidarity. These values (…) are held together by the conviction that economic and social progress must go hand in hand. Competitiveness and solidarity have both to be taken into account in building a successful Europe for the future.*

The interplay between «economic and social progress», however, has been interpreted in different ways, according to which of the two concepts leads, and which one follows. The current European social policy has been described by the scholars in European studies as «multi-tiered», i.e. realized concurrently at different levels – ranging from the European to the national levels – and the resulting policy «results less from the ambitions of Eurocrats to build a welfare state than from spill-overs from the single market process, which has invaded the domain of social policy» (Leibfried, 2015). Often, as a consequence of the constraints resulting from such a complex architecture on the central policy, the Court of Justice of the European Union plays a relevant role in shaping, regulatory-wise, the policies.

As mentioned, an analogous effort towards coupling competitiveness and quality of life is visible in the policies on science, and in the prevailing innovation conceptual frame the leading role has been assigned

[106] The previous Green Paper on European social policy (CEC, 1993a).

to economic development, while the benefits for society are believed to come as a natural consequence. Governments need to foster this chain by acting as «partners of industry» (Caracostas & Muldur, 1998):

> *Governments will always act as partners of industry, not to help companies maximize their profits, but to help them market those innovations which are most beneficial to society.*

In this perspective, scientists are asked to tune their activities towards more practical, market-ready products, but also towards established «societal challenges».

The economic frame didn't receive, however, the full consensus of the European citizens, who expressed their concerns in the public debate and through protest events. The apprehension regarding a good integration of scientific developments in the European society, from its very conception to the final outcome, has been among the most contested issues in the previous Framework Programmes, and continue to be disputed also in Horizon2020.

The aforementioned H2020 introductory video puts forward H2020's position in this regard:

> *Horizon 2020 will also be more in tune with science's role in society, so it focuses on challenges we urgently need to address, like clean energy and recycling, caring for the elderly, health care, food safety and our oceans: real things! (…)*

Science's role in society, however, is a complex and multifaceted subject, involving value-related, political, social and ethical reflections; the history of the disputes around this topic is recent but lively, including debates about the rights to a "scientific" form of citizenship for the people living in democratic states (Elam & Bertilsson, 2003; Goven, 2006; Irwin, 2001, see also the following paragraph).

In Horizon2020, the main instrument to «tune» science with society is represented by a special focus on a set of "Grand Challenges", belonging to the environmental and social fields and valued as particularly important for citizens' concerns. The choice among relevant and non-relevant issues, and the definition of the dimensions of the problems are not considered the first line of research, while the emphasis is set on problem-solving.

Another device of inclusion of citizens' concerns to science policies design is represented by the ongoing lively debate on «Responsible Research and Innovation» (RRI), which was integrated in Horizon 2020 as the most updated stage of the reflections on «Science and Society», emerged at the beginning of the Millennium and developed in EU research policies through the successive steps of «Science in Society» and «Science with and for Society» (the current denomination); the concept of RRI, as inserted in H2020, however, incorporates also other lines of thought, mainly centred on the ethical evaluation of research and on social equality in the field of science.

The following paragraphs will describe and analyse in details «Science and Society», «RRI» and «Societal Challenges» as instruments of citizens' inclusion, on the background of the emergence of the public interest in the modes and orientations of science, the EU's portrayal of citizenry, and of the reflections on the interplay between science and society.

The citizens' place in EU democracy

The EU witnessed in the late '90s the emergence of a new political actor: European citizens began claiming a new and more active role in the definition of scientific policies. This new sensibility in European society was elicited mainly by two main scientific-related crises: the BSE (Bovine Spongiform Encephalopathy) outbreak in the mid '90s and the "GM Wars" on genetically modified food at the end of the century.

An epidemic of Bovine Spongiform Encephalopathy diffused in the late '80s in the UK; the disease could infect also humans, and in 1996 UK authorities admitted that the human variant of the BSE, called nvCJD (new variant of the Creutzfeldt-Jakob Disease), had made the first victims. The government had for a decade heavily underestimated the risk related to the disease and misinformed the public, as the BSE Inquiry, published in 2000, established. When, in 1996, contrary to previous governmental assurances, the problem was acknowledged, the public in Britain and Europe was shocked. British beef imports were banned for two and a half years and the confidence in the public authorities experienced a complete breakdown. The transmission of the disease, it was later discovered, had been caused by a series of human interventions in the livestock farming industry, aimed at reducing the costs and augmenting profits, and it had proved possible because of political support. The Inquiry found that the British health and safety experts acted as a closed community, protecting the farmers and industrial interests and being «reluctant to display any uncertainty to a public they saw as irrational and prone to panic» (Jasanoff, 2005; Sturloni, 2006).

The second science-related crisis reached its apex in 1999, when a Greenpeace truck dumped tons of genetically modified soy beans in front the residence of Britain's Prime Minister. The conflict on GMOs (Genetically Modified Organisms) dates back to the mid '80s, with the emergence of biotechnology as a promising scientific field in the United States and in Europe. The first genetically modified beans were grown in the US in 1996 by the agro-chemical company Monsanto, and easily passed the controls for the importation into Europe. In the EU, however, the unregulated introduction of genetically modified organisms ignited a growing public opposition, that caused a u-turn in European policy: no new authorizations for GM foods were issued and a de-facto moratorium was started, leading to a dispute in front of the World Trade Organization (WTO) tribunal between US, Canada and Argentina on one side and Europe on the other (Winickoff, Jasanoff, Busch, Grove-White, & Wynne, 2005).

It appears clear how these two crises, centred on the superficial management of science-related issues by the authorities and resulting in the generation of public health risks, affected citizens' sensibilities, changed their attitude towards scientific research and the control authorities, and helped triggering the so-called "public unease with science" that European institutions started perceiving at the end of the '90s.

The troubled interplay between science and the public. The troubled relations between science and the public in Europe date back to the '80s, when a Royal Society Report titled *The Public Understanding of Science* was published in UK (Bodmer, 1985):

> *More than ever, people need some understanding of science, whether they are involved in decision-making at a national or local level, in managing industrial companies, in skilled or semi-skilled employment, in voting as private citizens or in making a wide range of personal decisions. In publishing this report the Council hopes that it will highlight this need for an overall awareness of the nature of science and, more particularly, of the way that science and technology pervade modern life, and that it will generate both debate and decisions on how best they can be fostered*

The report identified the flaw related to the lack of scientific understanding in contemporary society, and underlined the need to fill it order to foster science and technology. Indeed:

> *Science and technology play a major role in most aspects of our daily lives both at home and at work. Our industry and thus our national prosperity depend on them. Almost all public policy issues have scientific or technological implications. Everybody, therefore, needs some understanding of science, its accomplishments and its limitations.*

The narrative on S&T as an important factor of every-day lives, and its contribution to «national prosperity», resembled the European policy documents argumentations:

> *Hostility, or even indifference, to science and technology, whether by shopfloor workers, by middle or senior industrial management or by investors, weakens the nation's industry.*

The document identified the main reason of the changing attitude towards science – from trust to diffused concern – in the scarce quality of people's scientific knowledge, which would prevent them from fully understand the complex scientific issues at stake, in case of, for example, the control of weight, vaccinations, smoking, personal hygiene or safety. The report emphasised also the importance of understanding science in order to take proper decisions in public consultations on scientific-related issues. The proposed solution centred on initiatives to fill the knowledge deficit through scientific alphabetization campaigns, in schools as well as on the media.

Since the '80s, then, scientific vulgarisation campaigns were launched, and surveys and analysis were realized to measure the increase in public understanding of science – or, conversely, their residual ignorance.

The "Public Understanding of Science" (PUS) model has been widely criticized, at different levels. First, the surveys actually managed to show that more scientific knowledge implies a more positive vision of science in general, but failed to find the same good disposition when narrowing the spectrum to specific technologies or research fields: in other words, the more scientific details a person received, the more controversial the answers became. The survey method itself was criticised, because the questions proposed, reporting high rates of incorrect answers, were presented out of context: people tend to show a much better competence when dealing with contextualized topics rather than with 'yes or no' tests.

Deeper criticism was directed towards the PUS' representation of the public, depicted as a passive and anonymous receiver of knowledge, totally excluding any every-day, pre-acquired knowledge that was not measurable through the surveys. On the contrary, some scholars showed peculiar situations in which a

"local", every-day competence had been more suitable to solve a scientific issue than scientists' formalized and systematic knowledge[107]. Furthermore, when educated, people tend to retain only what is meaningful or useful for them: in other words, only the parts of knowledge in which they can have an active role, and this is not usually the case of science vulgarisation programmes.

In the '90s it appeared to scholars that the "Public Understanding of Science" programme had failed: no significant change in the attitude of the public towards science was visible by then, notwithstanding the efforts to fill the public information deficit. Further studies developed alternative strategies, abandoning the top-down vision, re-examining the publics and its abilities and engaging the citizens in communication activities. The Royal Society itself in 2002 published a new Report, acknowledging the inadequacy of the "Public Understanding of Science" approach to the new scientific and social context.

The European portrayal of citizens in the Framework Programmes. The European institutions' vision of the public was influenced by this debate.

During the '80s, in the first two Framework Programmes, the citizens – of the single nations but not yet European citizens – had a marginal role, and were mainly considered «consumers», coherently with the focus on the contribution of research to competitiveness.

In the Third and Fourth Frameworks Programmes (1990-1998) the citizens appeared, and acquired a better status. First, the research topics were increasingly designed taking into account the needs of the «users»: the public was no more considered completely passive, with the only task to fit as final consumer into the production process, but began participating in that process; nonetheless, citizens were still only considered as part of a procedure.

The terms related to «citizenship» began to appear significantly only in the Fifth and Sixth Framework Programmes (1998-2006, see Fig. 32), but then experienced a drop in the Seventh, where the document referred overall more often to «users» and «consumers» than to «citizens». Horizon 2020 increased the reference to «citizens», although without reaching the FP6 frequency, while diminished the mentions of «users».

The development in linguistic references reflected the changes in research themes: particularly meaningful to understand the relations science-society is the aforementioned appearance of lines of research on socio-economical themes, with the aim of «strengthening the interface between science, research and society» and increasing the «public understanding of science» (EP & CEU, 1994):

> *The latest developments in the Community also indicate an increasing need for public understanding of science and for strengthening the interface between science, research and society.*

[107] E.g. the case of the Cumbrian radioactive sheep, after Chernobyl disaster (Wynne, 1992): the farmers, basing on their experience on local soils and waters, had correctly judged the incidence of the radioactive fallout, while experts tended to minimise the risk.

It is possible to recognise the "Public Understanding of Science" influence in the top-down approach to the issue; in the Fifth and Sixth Programmes these lines of research were enforced and a new one on «Citizens and governance in a knowledge-based society» was inserted, showing a greater concern for the critical issues of the European citizenship. However, the Seventh Framework Programme reversed the trend, reabsorbing again the reflection on citizenship and European institutions in the socio-economic research line.

On the ground of the role of citizens, we recognize in FP7 a reversion to positions similar to a decade earlier – people don't support science policies because they don't understand science (EP & CEU, 2006):

> *The influence of science and technology on our daily lives is becoming increasingly profound. Products of social activity and shaped by social and cultural factors, science and technology nevertheless remain a remote domain far from the daily concerns of a large part of the public and of policy decision makers, and continue to be the subject of misunderstandings. Contentious issues relating to emerging technologies should be addressed by society on the basis of well informed debate leading to sound choices and decisions.*

The need to intensify the «dialogue between science and society» was acknowledged, provided the output remained fixed at «reinforcing public confidence in science» (EP & CEU, 2006):

> *the dialogue between science and society in Europe should be intensified in order to develop a science and research agenda that meets citizens' concerns, including by fostering critical reflection, and is aimed at reinforcing public confidence in science.*

Horizon 2020 didn't substantially modify the approach, the target being «to generate and sustain public support for Horizon 2020» (EP & CEU, 2013):

> *With the aim of deepening the relationship between science and society and reinforcing public confidence in science, Horizon 2020 should foster the informed engagement of citizens and civil society in research and innovation matters by promoting science education, by making scientific knowledge more accessible, by developing responsible research and innovation agendas that meet citizens' and civil society's concerns and expectations and by facilitating their participation in Horizon 2020 activities. The engagement of citizens and civil society should be coupled with public outreach activities to generate and sustain public support for Horizon 2020.*

«Fostering a genuine culture of innovation». While before Maastricht, as we have seen, the Europeans were addressed in Framework Programmes documents as «consumers», «workers», «users», after 1993, with the enlargement of the agenda to include the quality of life and social objectives and with the rise of the debate on European governance and science-society interplay, the portrait of the citizens acquired more nuanced, democracy-oriented dimensions.

The policy documents, however – especially those connoted by an economic orientation – since the earliest years of the elaboration of the innovation frame, showed to be worried by a problematic attitude of

the public, characterised by «resistance» against the promoted changes, and they pushed for the development of «an innovation culture» in Europe (CEC, 1995):

> *According to the dictionary, the opposite of innovation is "archaism and routine". That is why innovation comes up against so many obstacles and encounters such fierce resistance. It is also why developing and sharing an innovation culture is becoming a decisive challenge for European societies.*

The *First Action Plan for Innovation in Europe* (CEC, 1997b), argued for the need to foster «a genuine culture of innovation», whose features were described as:

> *Innovation requires, first and foremost, a state of mind combining creativity, entrepreneurship, willingness to take calculated risks and an acceptance of social, geographical or professional mobility. Being innovative also demands an ability to anticipate needs, rigorous organization and a capacity for meeting deadlines and controlling costs.*
>
> *An innovation mentality needs to be promoted, and neither legislation nor short-term measures will be of any use here!*

The report acknowledged the need of «changing the culture and the mentality of a people» in order to promote the innovation «state of mind»; to achieve the desired compliance with the change, it suggested to make use of participatory processes:

> *It is easier to make innovation acceptable and hence successful in the long run if citizens, industry, and their representatives are involved in the debate on the major technological choices to be made and if employees, users and consumers take part in the process.*

The PUS approach is visible in the portrayal of a citizenry in need of explanations about the necessity of the reform, not being able to understand the «dry economic indicators», as described in the Kok report (Kok et al., 2004):

> *The need for reform has to be explained especially to citizens who are not always aware of the urgency and scale of the situation. 'Competitiveness' is not just some dry economic indicator that is often unintelligible to the man in the street; rather, it provides a diagnosis of the state of economic health of a country or a region. In the present circumstances, the clear message must be: if we want to preserve and improve our social model we have to adapt: it is not too late to change. In any event the status quo is not an option.*

The need to nurture a «cultural shift» towards innovation was particularly highlighted by the Aho report, arguing that (Aho et al., 2006):

> *further steps need to be taken to (…) foster a cultural shift which celebrates innovation and a desire to possess innovative goods and experience innovative services, such that Europe develops as a natural home for innovators. At the core of our recommendations is the need for Europe to provide an innovation-friendly market for the creative outputs of its businesses and to gear the Internal Market in*

this direction. This needs (…) a cultural shift which celebrates innovation, using the media and other means to encourage citizens to embrace innovative goods and services.

The new culture, according to the experts group, would have been characterised by the celebration of innovation, and by the desire to possess innovative goods; it's a culture favourable and functional to the market. Further on, the report advocated an oriented use of the media, in order to promote a consumeristic attitude in the citizens.

The combination of the visions about a passive, unaware and innovation-resistant citizenry and of the urgency to change the people's culture in order to foster innovation depicts a problematic point in the EU consideration of its citizens. Since the late '90s, a better involvement of the public was advocated in policy discourses, however, mainly from the side of the economic analyses, the aim of such participatory experiments was not open to collective, democratic-wise, shaping of political actions, but they were meant as instruments to convince the public of the pre-set orientation towards innovation, and to obtain their complacency.

This perspective reveals an inherent tension in the EU visions about citizenry: paraphrasing the words of Sheila Jasanoff about the PUS approach, this passive, ignorant and change-adverse public «would not be capable of carrying out the housework of democracy» (Jasanoff, 2005); moreover, envisaging a process to change people' «mentality», in order to promote the approval of policy lines previously established by political authorities, appears conflicting with the role of public institutions in democracies. Apparently, the two approaches are intertwined: the need to direct people's attitude stems from the perception of a passive, misinformed and oppositional citizenry.

In the EU context, however, different positions find place as well, focusing on the re-thinking of the framing of both society and the institutions, and of the processes that relate the two.

"Tricks" and inclusive processes

In the Horizon 2020 introductory video, the interaction of knowledge with society is defined as a «trick»: the smart approach to knowledge – defined as an instrument of power, and a currency in the global economy – is to make it «work for you». The portrayal of a complex dynamic as a «trick» reveals a conceptual orientation towards reducing a difficult process, involving in a crucial position the dimension of public participation, to a smart stratagem. Such reduction represents a critical point at the heart of a democratic institution.

In spite of not having a long history of political union, Europe has a recent but lively record of debates and protests regarding its democratic functioning and legitimacy. Some features of the European political structure – distant and intricate policy-making process, strong role of Council and Commission non-elected officers, weakness of the Parliament and inclination of the Treaties in favour of market liberalization over social regulation – have led scholars to argue about a "democratic deficit", arising from the combination of

an erosion of national sovereignty through legal decisions and regulations (particularly relevant in the financial field) with the weakness of the citizens' participation in EU decision-making (Pollack, 2014).

At the turn of the Millennium a rethinking of the EU decision-making process and institutional functioning was set as a priority by the Prodi Commission, leading to the publication in 2001 of the *White Paper on Governance* (CEC, 2001), articulated on the needs of improving openness, participation, accountability, effectiveness and coherence of action. Especially in the participation domain, the document acknowledged the democratic core of the governance reform:

> *reforming governance addresses the question of how the EU uses the powers given by its citizens. It is about how things could and should be done. The goal is to open up policy-making to make it more inclusive and accountable. A better use of powers should connect the EU more closely to its citizens and lead to more effective policies*

However, the White Paper also recognized that the EU multi-level structure does not help in favouring direct citizens' involvement (very often mediated by regional and national institutions), and advocated more prominence of the European Parliament and an increased involvement of the civil society organizations in the consultations.

As mentioned, the earlier institutional approach to the issue of the citizens involvement in science focused on the scientific illiteracy of the public and consequently on the requirement to educate the citizens, before admitting them in the debate about science and technology policies (the PUS approach); the Eurobarometers of the 1990 and 1993 on *Europeans, science and technology* devoted significant space to the assessment of the public understanding of science, in order to determine the Europeans' attitudes towards science (CEC, 1990; INRA, Report International, & CEC, 1993).

The document proposing the European Research Area (CEC, 2000) addressed the issue of the Europeans' negative perception of science, inspiring «as much anguish as hope»:

> *Europe is not only investing less and less of its richness in progress in knowledge, the image that Europeans have of science is also less positive than it was. Scientific progress seems to inspire as much anguish as hope, and the gap between the scientific world and the people at large is growing.*

The debate – and funding line – on "Science and Society" was launched against this background.

In the meanwhile, however, the academic debate on the subject was changing. An expert group, asked by the Commission to explore the concern of the «public unease with science», disassembled the same concept of a real "unease" with science, and recognized it as part of a more complex and subtle issue related to policy-making: it didn't appear to exist an indiscriminate disaffection with science, but rather a «*selective* disaffection in particular fields of science, amidst wider areas of acceptance – even enthusiasm» (Wynne et al., 2007). Public unease, if any, is not caused by scientific developments, but rather by how these are managed, and by the behaviour of the institutions in charge of regulating new technologies and of shaping science-related policies. When public engagement activities are played as «a way of addressing the impacts

of technology – be they health, social, environmental or ethical – rather than helping to shape the trajectory of technological development» (Wilsdon, 2007), or when they are used to head-off controversies before their very rising, people feel ruled out from policy definition, and they lose their confidence in the authorities.

From «Science *and* Society» to «Science *with* and *for* Society». In 2000 the Commission launched the debate on the topic with a working document on *Science, society and the citizen in Europe* (CEC, 2000a), which led to the publication of the first *Science and Society Action Plan*, published at the end of 2001 (CEC, 2002). The purpose was double-fold: «how to implement research policy around the real aims of society» and how to «fully involve society in seeing through the research agenda». In this document, the issues pertaining to the critical interplay of science and society were recognized in risk management and the implications of the precautionary principle, in the ethical consequences of technological progress, in freedom of research and access to knowledge, in the use of expertise in policy making and in the underrepresentation of women in S&T (CEC, 2000a).

The legitimation for introducing the subject of Science and Society in the public policy debate was explicitly articulated with reference to the developments in the nature of S&T and of its impacts – rapid changes, affecting social relations, generating new needs and challenging the «basic values and principles of social life» – in addition to the changing awareness of the European citizens regarding science – their oscillation between confidence in science and fear of technological risks, together with the advances in the «capacity among the better-informed and better educated members of the public to apply their critical faculties to developments they regard as being imposed rather than desired, together with the erosion of confidence in political authority» (CEC, 2000a). Finally, the document introduced the innovation-oriented rationale, arguing for a «full commitment of society» (in partial tension with the previously stated concern about the public feeling of «imposed developments»):

> *New relationships are needed that fit the new mould of science, technology and society. These have to change because of the impact of science and research on competitiveness, growth and jobs and on the quality of life in Europe. All the more so, given the central role they play in the knowledge-based economy and society that the European Union committed itself to building at the Lisbon European Council. (…) the Lisbon objectives will be achieved only by an economy geared to innovation and a society fully committed to it.*

The *Action Plan* politically positioned the topic of Science and Society at the intersection of the three pivotal Community strategies of the beginning of the Millennium: building a knowledge-based economy (Lisbon strategy), realizing a European Research Area (ERA) and reforming the European governance (*White Paper on Governance*). The key lines of activity were identified in the improvement of scientific education, in the assessment of the ethical dimension of science and technology, including risk governance and the use of expertise, and in the promotion of public engagement, involving the citizens as «partners in the debate on

science, technology and innovation» through consultations, participatory procedures, establishment of gender equality and the contribution of human, economic and social sciences.

The «Science and Society» topic was included for the first time in the Sixth Framework Programme (2002-2006) with a budget of 88 million euro.

A further development in the understanding and governance of the issue in the EU context was realized in preparation of the Seventh Framework Programme, when a shift was promoted from the label of «Science *and* Society» to «Science *in* Society», and such denomination was adopted for the funding line included in FP7 (Stirling, 2006, emphasis as in the original):

> *The process of 'science and governance', is therefore not just one of linking separate arenas of 'science and society'. It is much more one of governing 'science in society' – recognising that research and innovation are not autonomous, but are contained within, and subject to wider economic, cultural and political processes.*

The concept was set up during the 2005 "Gover'Science" seminar, organized by the Governance and Scientific Advice Unit of DG Research, focussing intensively on the role of public engagement: the idea was to move away from an idea of engagement as an effective process of information transfer, mainly from scientists to citizens, towards a two-ways communication, and further arguing for the elimination of the division into two secluded groups – science and society, the first composed of scientists and experts and the second of common people, with no scientific competences – for a more complex understanding of the ways in which scientific knowledge and technological innovations are produced. According to this vision, research activities should incorporate inputs from a wide variety of social actors and should tend to a «new style of 'co-operative research'» (Stirling, 2006):

> *It is emphatically not about second-guessing the technical expertise of scientists and engineers. Rather, it is about acknowledging the fact that science and innovation are social, cultural and institutional – as well as technical and specialist – activities. As such, public engagement offers a way to be more accountable for the particular values and interests, which underpin both the governance of science and the general use of science in governance. What are the priorities and purposes, which justify the allocation of resources to different areas of innovation or lines of enquiry? What are the assumptions that inform the interpretation of scientific advice, concerning the behaviour of institutions or technologies in the real world?*

Understood in this way, public participation should be fostered throughout the whole process, but especially at the beginning, in setting the landscape, the aims and the priorities of public research:

> *In short, public engagement is about the 'framing' of scientific evidence and technological projects, not about the details of specialist methods or technical analysis.*

As mentioned, in parallel to this debate the Commission established an Expert Group on Science and Governance in order to shed light on the occurrence of the "public uneasiness with science" and with the

aim of "restoring public trust in science". The final report (Wynne et al., 2007) of the Group, whose members were mainly STS scholars, was an extended analysis of the science-society interplay, ranging from the evaluation of the framing of research as innovation, to the exploration of the other master narratives that are used to legitimize public funding of science; from the debate on risk-governance, reconsidered here as innovation-governance since «the concerns which citizens express can be seen to be about innovation and its social purposes and priorities», to the over-use of expert recommendations in EU policy-making, especially critical for what concerns ethical issues; from the evolution of the public understanding of science framing towards public engagement, to the exploration of new «regimes of collective experimentation». The 'public unease', they argue:

> *is not so much based on the outcomes of science and technology in the form of innovations, but much more on how these developments are shaped, and about the behaviour of the institutions primarily in charge of innovation, and risk regulation, and public engagement.*

They conclude suggesting that policy making should not be tempted by «simple or mechanical solutions», but should address «Europe's rich democratic and scientific tradition», especially considering the recent formulation of the European Knowledge Society.

The most up-to-date elaboration of the debate on the science-society interplay, included in the current Horizon2020 Framework Programme, is the «Science *with* and *for* Society» approach, where the new change in the prepositions underlines the need to deepen the social relevance of science, through an «ethical, inclusive, democratic and equitable» identification of the targets for innovation – Science *for* Society – and the further deepening of the dimension of co-production of science and society, though an «iterative, continuous and flexible process of adaptive learning» – Science *with* Society (Owen, Macnaghten, & Stilgoe, 2012).

Responsible Research and Innovation. A parallel and linked approach currently goes under the label of «Responsible Research and Innovation» (RRI), articulated in the «keys» of public engagement, gender equality, science education, open access and ethics, all grouped under the umbrella concept of governance (EC, 2012b, 2014i; Owen et al., 2012).

A seminal work by the EC policy officer Von Schomberg, circulated in 2011, attempted a definition of RRI (Von Schomberg, 2013):

> *Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).*

Although the subjects of RRI are approximately the same contained in the 2002 Action Plan, and so the concerned activities, the transition from the interplay of science and society – whatever the prepositions – to the responsibility dimension of the scientific activity reveals a shift in focus from the engagement of the

citizens to the ethical evaluation of research, and from the issues related to the process to the puzzle of defining clear and comprehensive conceptual bases (see van den Hoven et al., 2013; Von Schomberg, 2013). On the other side, the schematic science-society polarization is abandoned in favour of the embedding of societal contributions in the re-definition of the understanding of research.

The general RRI landscape is set in wide-enough terms to be interpreted with different anchor points. For example, a 2011 report on Responsible Research and Innovation developed the concept mainly around «the consistent, ongoing involvement of society, from the beginning to the end of the innovation process» (Sutcliffe, 2011), while a 2013 Expert Group report, although elaborating on multistakeholder participation, devoted considerable space to the economic desirability of RRI (van den Hoven et al., 2013):

> *Taking ethical concerns and societal needs better into account brings considerable economic benefits. Ethics is often seen as an impediment to economic growth, but it can serve as a driver for new areas in research and innovations, creating jobs, increasing social welfare and helping to avoid risks of misallocation of R&D funds, as the growing economic importance of green technologies across Europe shows.*

The problem, argued the document, is that both the innovation and the research system fail to sufficiently consider social and ethical aspects, and this causes an «inefficient use of R&D funding» (see Fig. 35).

In the same document, as well as on the Commission website and on the promotional videos and leaflets, RRI is presented with the metaphor of the alignment of science and society (EC, 2012b, 2014, 2015d), re-proposing the conceptualization of the two secluded social spheres:

> *Responsible Research and Innovation (RRI) implies that societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society.*

In the 2015 video *Responsible Research and Innovation: aligning R&I with European society* (EC, 2015d) citizens' engagement is listed after ethics, science education and open access as one of the dimensions of RRI; moreover, despite the richer understanding presented by the interviewed scholars, engagement is presented as a matter of access to the data, geared to pooling everyone's resources in the generation of new ideas – the background images to this concept are computer cables and electronic circuits –, while the open discussion on research instruments and orientations is less underlined.

In media and policy documents, RRI appears very often paired with the concept of Societal Challenges, the one presented as the European 'ability' to solve the second, while at the same time ensuring research efficiency (EC, 2012b, 2015d; van den Hoven et al., 2013): the two models are currently the main strategical instruments through which the EU endeavours to include the citizens' contribution in scientific governance.

Similarly to the case of Societal Challenges, the debate about the 'responsibility' dimension of research and innovation activities shows a diverse landscape, including visions leaning towards different objectives: the utilitarian framing of RRI as an early neutralizer of future time- and money-wasting conflicts; the democratic argument advocating the involvement of the citizens' deliberation about values in the policy-making process; the pragmatic approach of building an online repository of RRI experiences, to act as an operative reference for all the stakeholders, framed as «the RRI toolkit» (RRI Tools, 2014).

Solving Grand Challenges

The emphasis on the definition of "Grand Challenges" instead of abstract political strategies, in order to focus the efforts and stimulate public support, has particularly grown in recent years, both globally and in Europe. In the EU, this rhetoric has gradually emerged during the years of the Lisbon Strategy as an alternative narrative to competitiveness for the research and innovation activities (Ulnicane, 2016).

As early as 1995, the task force on research and industries identified research priorities of key importance to European industry and society, and FP5 was designed and articulated around «key actions», focusing (Caracostas & Muldur, 1998):

> *(…) on all manner of bottlenecks (scientific, technological and socio-economic) which hamper the resolution of problems common to all fifteen Member States*

However, the subsequent concentration on strategical reforms (the ERA and Bologna processes, and the Lisbon Strategy) shifted the FPs focus towards supporting the structural adaptation of the research system (especially in FP6).

In 2004, in the context of rethinking a compelling political project for Europe, the *Strauss-Kahn Report* (Strauss-Kahn et al., 2004) reoriented the attention towards a challenge-based reasoning: it identified seven internal and external issues for Europe to address – economic change, social change, demographic challenge, environmental change, democratic distrust, globalisation, post 9/11 strategic reality – and underlined the role of research and education in tackling them.

The 2006 book on the design and implementation of FP7 (Muldur et al., 2006) mentioned the report and adopted the challenge-based description to position and legitimate research in the European context. The chosen issues, in this analysis, compared to the Strauss-Kahn's ones, appear to have evolved towards a more pragmatic characterisation: slow economic growth and feeble competitive position, unemployment, poverty and inequality, fertility decline and ageing, lifestyle and communicable diseases, and the environmental challenges: water, climate change and biodiversity. It is particularly interesting to notice the challenge-identifying method reported in the book, regarding the environmental priorities: the authors describe a benchmarking process of the Eurobarometers, the previous EU strategies, and a number of international publications from various bodies, some of them environment-related, like the United Nations Environment Program, and some other belonging to the economical and strategical domains like OECD,

World Bank and even the CIA (see Fig. 17). All these institutions were in the same period adopting a challenge-based approach; each one, however, with regards to its own specific field and political objectives, which not necessarily coincided with the EU R&D policy aims.

The recommendation of focussing R&D programming on the identification and solution of complex challenges was introduced in EU official documents with the 2007 Green Paper on ERA, proposing the concept of grand challenges as an instrument to facilitate the involvement of a wider spectrum of stakeholders in the research agendas definition process (CEC, 2007c):

> *Such a process would allow European, national and regional research priorities to be based on the systematic identification of major societal challenges. Common foresight and technology assessment exercises carried out in close collaboration between national organisations and involving the participation of stakeholders and citizens could help structure and enrich such an approach.*

The "Grand Challenges" were in this document named «Societal Challenges», in contrast with the «topics arising from business interest»: the process of challenges identification, initially employed as a device to motivate the community around shared concerns, overcoming disciplinary and national boundaries and building public consensus, was indeed evolving in the European context towards being considered a political answer to societal pressures.

A key document in shaping the European political use of Grand Challenges was the 2008 follow up to the ERA Green Paper consultation, *Challenging Europe's Research: Rationales for the European Research Area (ERA)*, prepared by an expert group chaired by Luke Georghiou (who previously co-authored the Aho Report in 2006). Acknowledging the need for a «European Research Area that has a clear purpose which is meaningful to Europe's citizens and political leaders and relevant to its key actors», the report recommended to structure the European Research Area around the concept of Grand Challenges (Georghiou et al., 2008):

> *The central means to achieve this is to engage the research system in Europe's response to a series of Grand Challenges which depend upon research but which also involve actions to ensure innovation and the development of markets and/or public service environments.*
>
> *Challenges may be rooted in economic, social or scientific goals but share a need to demonstrate their relevance at the European level, their feasibility in terms of Europe's capability to engage with them, and a clear research dimension such that they gain the commitment of the research community and pull-through the necessary improvements in its efficiency and effectiveness.*

For the expert group, Grand Challenges need to share the features of being related to both research and innovation sectors and, no matter the content (economic, social or scientific), their relevance should appear self-evident. Moreover, they should be feasible for Europe and appropriate to gain the commitment of the research community, in order «to capture political and public imagination, create widespread interest through scientific and business communities and NGOs and inspire younger people».

However, the selection of such challenges is not straightforward, the report acknowledged, and has to be realized applying a checklist based on the criteria of attractiveness and feasibility (Georghiou et al., 2008, emphasis as in the original):

> *Prioritisation of Grand Challenges is also likely to prove a stumbling block in terms of whether to opt for more society-driven, education-driven, industry-driven, innovation-driven or research-driven challenges. Two broad sets of criteria (…) underpin the selection of the Grand Challenges, namely:* ***attractiveness*** *(broken down into relevance and the presence of a clear research dimension) and* ***feasibility****. Each criterion requires in-depth consideration in order to address its constituent elements and issues of appropriate balance between potentially conflicting ideals/principles (European vs. global, scientific vs. social priority; doability vs. ambition).*

Interestingly enough, even if the challenges were seen as answers to pressing societal needs, no reference was made in the report to the option of asking the citizens to express on their identification; these were counted as «actors in the research-friendly ecology», with the role of being informed about the issues at stake: their inclusion in the process was described as «tied to communication, training and education»:

> *Our comments on the role of citizens as stakeholders in ERA will be brief and to the point. These are to endorse the Green Paper's statement that ERA requires that European citizens are well informed about all the issues at stake, and that there should be a spread of "research approaches geared towards society's needs and aspirations and of a culture and spirit of innovation throughout society as a whole." This is seen as an issue tied to communication, training and education. All of these we endorse but the central thesis of this report is that citizens are much more likely to form a positive engagement with research if it is clear to them that research is a key component in meeting society's economic and social challenges. To do this we propose the Grand Challenge model for ERA.*

The ultimate goal of focusing on Grand Challenges was presented in this report (Ulnicane, 2016), as in the following year Lund Declaration, as the increase of the funds available to research and innovation sectors (Lund Declaration, 2009):

> *Europe needs to mobilize substantially increased investments in research and innovation targeting Grand Challenges, as this is required to meet the rapidly increasing global competition and other threats to our well-being and in order to take part in the widening and deepening global cooperation. We must build trust with society so the required resources are made available to the research and innovation sectors.*

A subsequent document (Soete et al., 2009), explicitly based on the 2008 Georghiou Report, provided a broader understanding of the concept of Grand Challenges, recognizing it as a multi-purpose instrument, enabling Europe to profit economically from possible new markets together with triggering intra-European policy coordination. Moreover:

addressing Societal Challenges seems a sensible response to the increasing social demand for relevance and impact of research, as well as for global justice for all. The approach can increase the legitimacy of science and technology and investments therein, and foster better relations between the scientific communities and the public opinion.

Although the document was largely an economic analysis, the democratic argument for the definition of the challenges was particularly stressed in the Appendix *On society's need for research*, where the expert group discussed the political legitimation of public investments in research. The economic rationale usually invoked was questioned with respect to the democratic one, based on the right of the citizens to be involved in defining the decision on science and technology:

The problem of finding the right justification for public policy action has become even more crucial in recent years particularly after it became evident that the expansion of State intervention was, and is likely to continue in the future even more so, to be in contradiction with the upper limits to public expenditure (the so-called fiscal crisis of the State). Since public policy involves the allocation of scarce resources, it has become standard practice to invoke an economic justification, usually associated with theories that predict a relation between expenditure and desirable outcomes. (…)

But one also needs to take into account an important democratic component. Today, the role of science in society is fully accepted in modern liberal democracies. The sometimes uneasy relationship that arises around the imagined or real risks associated with scientific-technological developments is acknowledged and serious efforts are undertaken to include citizens' participation in deliberative ways. In a pluralistic society in which differences in values cannot be simply reduced to those held by a majority and where public discourse often juxtaposes 'values' to 'science', one should not forget that science itself is based on a deeply held, societal value: that of free inquiry into what is yet unknown. In this sense, science and democracy are completely aligned today. Investing into research is itself based on a profound societal value.

Moreover, grounding R&D to societal relevance was presented as a path to overcome political short-termism, linked to electoral cycles, in favour of long-term visions than can improve public support; the difficulties connected with the process of agenda setting were also recognized.

The increased attention to the instrument of Grand Challenges during the years 2007-2010 played a key role in the preparation of the Europe 2020 strategy and especially of the new Framework Programme Horizon 2020, where tackling societal challenges is one of the three main priorities[108].

A number of instruments were developed in the same years by the EU with a peculiar challenge-based approach: Joint Technology Initiatives, European Technology Platforms, Joint Programming Initiatives

[108] The challenges are identified in H2020 as: «health, demographic change and wellbeing», «food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy», «secure, clean and efficient energy», «smart, green and integrated transport», «climate action, environment, resource efficiency and raw materials», «Europe in a changing world - inclusive, innovative and reflective societies», «secure societies - protecting freedom and security of Europe and its citizens».

(JPIs), European Innovation Partnerships and Knowledge and Innovation Communities. However, the interplay among these platforms was not clearly defined, sometimes raising the same expert groups' concerns (Hunter, Hernani, Giry, Danielsen, & Antoniou, 2016).

With Horizon still ongoing, negotiations have started for the preparation of the next Framework Programme, and it appears that the Grand Challenges approach will be maintained also in FP9; furthermore, the debate is open on a conceptual remodelling of the metaphor in the case of the FET (Future and Emerging Technologies) "flagships" – now conceived as «visionary, science-driven, large-scale research initiatives addressing grand Scientific and Technological (S&T) challenges» (EC, 2014). The Human Brain Project and the Graphene flagship, financed with one billion euro each, are the two currently running flagships. The Commission is now thinking about enhancing the result-oriented nature of flagships, transforming them into «missions», i.e. from "understanding human brain" to "curing Alzheimer"; the reference models, according to Commissioner Moedas, are the US goals of landing on the Moon and curing cancer, launched respectively by Kennedy in 1961 and Nixon in 1975: indeed the metaphor of «moonshots» to identify flagships is emerging in public declarations (Kelly, 2017b, 2017c). Discussion are focusing on a number of 10 moonshots to be inserted in FP9; however, the process of challenges definition, although underlined as critical by the previously mentioned reports, is not yet defined. It is clear, conversely, the Commissioner's objective: instil a sense of urgency and obtain the support of the unaware citizens (Kelly, 2017b):

> *We don't feel the same sense of purpose as we did in the past. We say we will invest more in materials or in renewables but people in the street don't understand much of that. If I talked to my mother or my grandmother about mapping the brain, they will wonder why. People will connect more with a goal, such as creating an all-electric plane.*

Grand/Societal Challenges as political instruments. The concept of Grand/Societal Challenges, used as a strategy to reorganize R&D resources and improving its impact, in the European discourse wavers between a democratic understanding, favouring the inclusion of the citizens' concerns in the R&D agenda, to an instrumental one, in which it is used as a rhetorical tool to promote research and obtain the people's positive engagement with science.

The evolution from the challenges identified in the Strauss-Kahn's 2004 report to the H2020 documents shows a development from a strategical, political, institutional as well as societal framing to a more pragmatic, techno-scientific definition: e.g. from «economic and social change» to «health, demographic change and wellbeing»; from «ecological imbalance» to «climate action, environment, resource efficiency and raw materials»; from «post 9/11 strategic reality» to «secure societies - protecting freedom and security of Europe and its citizens».

The process of gradual reduction of the social and political meanings for the emphasis on the technical possibilities of science in solving the challenges contributes to cause a parallel evolution from a focus on the complexity of agenda-setting – related to the democratic inclusion of a wide representation of

stakeholders, citizens included – to an emphasis on problem-solving, and the consequent request to the R&D community to contribute with techno-scientific fixes, rather than with political, social, ethical ideas, to the solution of the challenges. We have seen how the same identification of the common issues is proposed, in the Georghiou report, to be realized via a checklist of questions, and with the guiding criteria of feasibility and attractiveness; on the other hand, other documents show that the interpretation of the grand-challenges approach is not unique and the debate is still open to different framings, e.g. exploiting it at the service of societal concerns, as an instrument of citizens' inclusion. However, also this interpretation implies that the deliberative moment is postponed, and it is exposed at the risk of working as a surrogate of public participation, substituting it instead of facilitating it.

The social orientation of knowledge in EU science policy

An articulated landscape emerges from the historical tracing of the European social orientation of knowledge and from the analysis of the most relevant conceptualizations.

EU discourses in this respect range between opposite positions: on one side, the vision centring on the democratic right of citizens to take part in policy shaping; on the other, the idea that science needs to be promoted for strategic reasons and that society has to adapt. Crucial distinguishing element is the conceptualization of citizens: active actors in the political confrontation, carriers of values and able to take decisions on the future on one side; passive figures, whose deficit of scientific knowledge prevents them from being able to make sound and appropriate choices on the other. In the first case, participation processes are envisaged in order to ameliorate decisions, and to take into account value-related aspects; in the second, the involvement of the citizens is reduced to information and education programmes, in order to obtain people's approval on the political choices. Consequently, on one side the citizens' participation is advocated during the agenda-setting stage, on the other, at the moment of problem-solving, in order to appraise the envisaged initiatives.

The features of the two approaches are schematically summarised in Table 15.

Table 15: A summary of the approaches identified in the analysis of the social orientation of knowledge in EU scientific policy discourses.

Adult-citizen frame	**Child-citizen[109] frame**
Citizens: active actors, carriers of values, able to take decisions	Citizens: passive actors, knowledge deficient, inadequate to take decisions
Involvement: participation to policy shaping, with the aim of ameliorating the proposals	Involvement: information and communication activities, with the aim of complying to the decisions
Involvement stage: agenda-setting	Involvement stage: appraisal of problem-solving

[109] The reference here is to the denominations used in the studies of education policies to define the traditional conservative or democratic positions: people are/are not children, people can/cannot be philosophers, as described in (Manacorda, 2015) to describe Gramsci's position.

The overview of the social orientation of knowledge in EU discourses reveals primarily that, here more than anywhere else, arguments and issues are framed in different, even opposite, manners, contain different interpretations and finalizations of the same instruments, and consequently include diverse seeds of confrontation and possible evolutions of the democratic debate.

Pure science, or "knowledge for knowledge itself"

The third «key priority» of Horizon 2020 is «Excellent Science», geared «to reinforce and extend the excellence of the Union's science base» (EP & CEU, 2013) and articulated in the four subsections of European Research Council (ERC, with the maximum budget share, 17% of the total budget, see Table 20), Future and Emerging Technologies (FET), Marie-Skłodowska-Curie Actions and European research infrastructures. All the activities, according to the Programme stablishing act, share a «forward-looking», «long-term» orientation and pay a special attention to the support of talented researchers.

The funding under the «Excellent Science» priority is qualitatively different from the other H2020 lines: the scientific contents are proposed bottom-up, and chosen with the scientific community's specific methods (EP & CEU, 2013):

> *In view of their science-driven nature and largely 'bottom-up', investigator-driven funding arrangements, the European scientific community will play a strong role in determining the avenues of research followed under Horizon 2020.*

The inclusion of funding lines with differentiated methods of content setting and evaluation was prompted by the foundation and rise of the ERC in the European research funding landscape, introduced in the Seventh Framework Programme in 2007. The debate about the shaping of the ERC elicited questions regarding basic research, research finalization and research excellence in the European science policy.

As mentioned, a major distinction can be drawn between research funding models assigning the agenda-setting role to governments, on the basis of strategic priorities, and models in which the scientific community chooses among the different proposals, basing on its proper internal dynamics (previously defined «Steelman model» and «Bush model», see Table 14).

The «Excellent Science» priority ideally belongs to the second category, however its positioning in the frame of Horizon 2020 'forces' the "ivory tower" vision into the innovation oriented frame – and, indeed, the H2020 establishing act frames its contribution as functional «to make the Union's research and innovation system more competitive on a global scale» (EP & CEU, 2013). A friction emerges also in communication products, when dealing with the uncomfortable positioning of basic research in the economy-led innovation frame (EC, 2014e):

> *Getting close to real every day needs like these doesn't mean basic research is out in the cold. That's the beauty of coupling science and innovation: it covers a much wider range, from research to retail and all forms of blue-sky thinking and innovative approach that make this possible.*

Basic research or blue-sky thinking, in the vision of the Commission's H2020 introductory video, are advocated and supported, provided they are innovative in approach: however, the concept of innovation is closely related to the exploitation of ideas in the market, and an innovative approach can be difficult to reconcile with the inherent features of basic research, whose practical outputs, if any, are often visible only decades after the ideas were conceived.

The European approach to basic research. The traditional European approach to research favours, with the relevant examples of the big laboratories established in the post-war period, applied and competitiveness-oriented research. However, the debate around the creation of the European Research Council triggered a reflection of the role of basic research in the European context.

The 2004 document *Europe and basic research* (CEC, 2004) acknowledged such debate and situated EU's view in the frame of the «emerging knowledge-based economy and society» and of the European Research Area, describing the European vision against the historical background of the conceptualizations of basic research – an approach that is very uncommon for Commission's communications:

> *During the years immediately after the Second World War, when research policies originated and developed in Europe and the USA, the emphasis was on basic research.*
> *This is well illustrated by what Vannevar Bush, President Roosevelt's scientific adviser, wrote in 1945 in his famous report "Science: the Endless Frontier": "Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown").*
> *During the decades which followed and in view of the importance of science for industrial competitiveness and its role in meeting social needs, this emphasis, and with it public funding, gradually shifted towards applied research and technological and industrial development.*
> *Today, the general value of increasing knowledge and the importance of basic research for economic and social development, tend to be fully recognised again.*

The report is structured in order to explain and legitimise the changing EU attitude towards basic research.

Basic research may be characterised, according to the Commission communication, «by reference to its ultimate purpose (research carried out with the sole aim of increasing knowledge); its distance from application (research on the basic aspects of phenomena); or the time frame in which it is situated (research in a long-term perspective)». The 2000 document *Towards a European Research Area* (CEC, 2000), had underlined in particular this last aspect of the time frame, although emphasizing the exceptional cases of rapid concrete applications:

> *Basic research (…) In some cases (…) can be translated fairly rapidly into concrete applications. This has been the case, for example, with breakthroughs in molecular biology and immunology in the field of health. It can also give rise to unexpected applications years later in fields somewhat removed from the ones they started out in .*

The definition chosen in the 2004 document on *Europe and basic research* (CEC, 2004) was very close to the one adopted by OECD in the *Frascati Manual*: it was defined as the activity carried out «with no direct link to a given application and, if not exclusively, in any case and above all with the objective pf progressing knowledge»[110].

Support for basic research, according to the report, was justified with its «indirect, but undeniable, impact (…) on economic competitiveness, growth and, more generally, well-being», with the rising cost of the infrastructure, which the private cannot afford, and with «the value of knowledge as "public property", which means that, in principle, there must be free access to it, this being easier to guarantee if there is public funding»; moreover, the documents highlighted the contribution of basic research to the training of researchers. Due to the compartmentalisation of national research systems and sometimes the lack of critical mass, the report argued, «there would seem to be a need for this public support to be given at a European level».

However, this document was apparently not sufficient to rule out the doubts about funding basic research, if in a 2009 ERA report (Soete et al., 2009) the authors discussed the nature and legitimation of basic research:

> *First, investing in basic research is in need of political justification. Second, whatever arguments are used, they reveal – often unintentionally – the inherent tension between investing into frontier, curiosity-driven research and the desired, economically profitable outcome.*

Whatever the choice of terminology, they argued, – basic, fundamental, frontier, scientific, blue sky, curiosity-driven research – all these activities involve the production of new knowledge, and «an open and an open-ended process in which serendipity, the accidental finding of interesting and relevant phenomena that one was not looking for, is often decisive»; the experts group's approach was thus slightly different from the Commission's one.

The choice of the denomination is not uninfluential, and it is linked to the friction among different research orientation frames in European science policy: the term «frontier research», instead of «basic research», was proposed, and adopted in subsequent Commission's accounts, by an ad-hoc expert group, committed to «provide, by collecting and analysing existing data, a clear indication of the types of effects and benefits that may be expected, and their scientific and economic significance». In fact, (Harris et al., 2005):

> *classical distinctions between 'basic' and 'applied' research have lost much of their relevance at a time when emerging areas of science and technology often embrace substantial elements of both. The report therefore adopts the term frontier research, rather than basic research, to reflect this new*

[110] The OECD definition was: «Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view» (OECD, 1993).

reality. Frontier research, because it is at the forefront of creating new knowledge, is an intrinsically risky endeavour that involves the pursuit of questions without regard for established disciplinary boundaries or national borders.

In other words, the concept of «frontier research» could identify fundamental research without excluding the creation of useful knowledge, and embrace both the domains of basic research and application-oriented activities (Luukkonen, 2014).

Not only a different orientation, but also a different rationale for research funding. Admitting the ERC idea at the EU-level political debate didn't only mean discussing on a different research orientation (production of new knowledge *per se*), but involved the development of a completely new rationale for justifying research funding: while the traditional one was targeted at 'pre-competitive' research, achieved through cooperation and mobility, the new one was focused on 'frontier' research, attained through competition; the added value was not transnational collaboration, but scientific excellence (König, 2016).

«Excellence» appears indeed to be the distinctive feature of the ERC model: it is the most promoted concept when the ERC is presented in relation to the other funding programmes and described to the public. Conversely, the establishing documents, designing the governance structure of ERC, focus much more on «autonomy» and «independence» as its peculiar features, and on the family of concepts related to moral integrity and reputation.

Regaining the autonomy of the scientific community: the rise of the ERC

During the '90s, the Framework Programmes 'format' developed and consolidated; however, the FP growing administrative burden involved also a significant institutional inertia, and it proved difficult to change its procedures, along with its rationale for research funding. The success of the Framework Programmes led to their broadening in scale and scope, but it prevented from changing the orientation and procedure of research policy[111].

During the '90s, different new actors entered the political stage of the European research policy; along with the citizens – whose influence, as seen, elicited a debate about the democratic enhancement of decision-making in the scientific field – also some representatives from the scientific community, concerned with the changing nature of research, began discussing about the need to re-affirm the autonomy of science. The debate focused on the flaws of the FP format, but in this first phase failed to show to EU authorities the need of a new independent body.

It was with the contribution of Keith Pavitt, experienced professor at the Science Policy Research Unit (SPRU) at the Sussex-University – one of the most influential think-tanks in the field innovation studies – that an intellectual synthesis able to breach the EU traditional narratives could be found. He emphasized the role

[111] This paragraph, excepted where referenced, is based on the account on the rise of ERC drafted by Thomas König, the former scientific adviser to the ERC President Helga Nowotny (from 2010 to 2013), in his 2016 book (König, 2016).

of academic research, opposing the mainstream diagnosis of the "European paradox", and the well-established remedy focusing on national systems of innovation: the low performance of EU research system, he argued, was not due to a weak uptake of high-quality academic knowledge by the production system, but to the fact that the firms were increasingly externalizing R&D to non-EU countries, especially in the USA. He showed that the superior performances of US science were due to the willingness to fund basic research without politically-established conditions on the content or on the envisaged applications. As Thomas König, scientific adviser to the ERC President Nowotny, described it (König, 2016):

> *he destroyed the core basics of the FP format: instead of foresight, 'in matching long-term technological opportunities with economic and social needs', the US was successful because of the 'unintended consequences' of massive spending in basic research; instead of demonstrating 'practical usefulness and user involvement at the project level', 'usefulness was defined in broad terms […] which allowed the development of both long-term, speculative and fundamental research programmes, and post-graduate training'; and instead of a "democratic" spread of funding to many regions', 'funding tended to be concentrated in relatively few elite institutions'.*[112]

Pavitt, hence, managed to combine the arguments of the FP critics and, most importantly, he expressed them in the EU innovation policy language.

His arguments created a counter-narrative that spread in the academic community tied to research policy, also by means of the numerous workshops and conferences organized around the launch of the Lisbon Strategy. However, it took two years before, in December 2002, the European Research Council Expert Group (ERCEG) was established, chaired by Federico Mayor, former UNESCO Director General, in order to study the possible options for creating an ERC. A few months later, what previously had been a movement of engaged scientists and research managers, was endorsed by the Commission (commissioner Busquin publicly stated his support to the ERC campaign in autumn 2003), probably in consideration of the slow progresses in the realization of the ERA, and of the incipient negotiations for the preparation of FP7.

The report proposed the building of a Council geared «to support investigator-driven research of the highest quality selected through European competition» (Mayor et al., 2003).

However, the focus on competition, instead of the traditional cooperation rationale, didn't find the approval of all the EU Member States, and in particular the Italian government was worried that competition would have led to the strengthening of scientific inequalities across Europe, disadvantaging the countries less investing in R&D; this represented anyway a minority positions, and the Council felt entitled to disregard it: henceforth the Commission could proceed on the basis of Council Conclusions[113] favourable to the ERC.

[112] The in-line quotes are from Pavitt's article *Why European Union funding of academic research should be increased: a radical proposal* (Pavitt, 2000).

[113] The Competitiveness Council held in December 2004.

A further expert group was set up in 2004 to study the contribution of the ERC to the Union's objective of competitiveness: the result was the report, issued in early 2005, proposing the adoption of the expression «frontier research» instead of «basic research» in order to hold together fundamental and oriented research (Harris et al., 2005).

The legal and administrative structure of the ERC represented a contentious issue between the ERC advocates and the Commission, the former in favour of a completely autonomous body, the latter supporting the model of an executive agency, formally independent but subject to the Commission as for the structure. Despite interested in setting up an executive agency, the Commission could not risk losing the approval of the ERC advocates, so it included many of them in the Scientific Council, the Steering body of the ERC, that was announced in July 2005. That move didn't diminish their opposition to the executive agency model, however it ended up representing the only viable option if the ERC had to be included in the 7th Framework Programme, launched in 2007: the ERC, conceived as a critical alternative to the FP format, modelled on the American NSF, was going to become part of the FPs themselves.

The European Research Council was officially launched in February 2007, as part of the 'Ideas Specific Programme' in FP7.

Fostering excellence, defending autonomy and promoting the reputation of EU research funding

As the account on the emergence and launch of the ERC has showed, the new research funding body entailed different significant changes to the EU traditional research policy vision.

Europe needs excellence. The first and most visible one revolves around the guiding principle of «excellence». Before the ERC, the term was used in policy documents but it didn't substantiate into concrete instruments (CEC, 2003b; Luukkonen, 2014):

> *Europe needs excellence in its universities, to optimise the processes which underpin the knowledge society and meet the target, set out by the European Council in Lisbon, of becoming the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.*

In the EU political universe, accepting to gear research towards «excellence» implied a radical rethinking of the role of science policy in the European integration process. Research funding at the EU level, as mentioned, was considered justified when a proven 'added value', with respect to national programmes, could be demonstrated (cf. the 'Reisenhuber criteria', see paragraph *Which science for which Europe?*), and «collaboration of research teams in different countries» was regarded as the most significant contribution of research policy to EU integration; with the focus on excellence, the 'added value' was redefined in terms of the opening up of the possibility for researchers «to compete with all other researchers on the basis of excellence» (Mayor et al., 2003):

> *In view of the importance of a strong research capacity for economic stability and growth, the Expert Group recommends a new European dimension for research funding.*
> *Until now European added value has been defined as the collaboration of research teams in different countries. It is now time to bring a new definition of added value, one that incorporates the principle of allowing a researcher in any European state to compete with all other researchers on the basis of excellence. Competition in order to achieve real excellence in research should become an essential part of a new, forward- looking definition of European added value.*

Hence, the focus on excellence involved a shift from collaboration to competition, i.e. a departure from the guiding EU objective of «cohesion», based on the redistribution of resources among the Member States, in order to reduce the national differences; in EU research policy lingo, mentioning «excellence» signaled the positioning in a sector of research funding where the *juste retour* criterion – the Member States receive in proportion to their contribution – was not considered (König, 2016). The choice of excellence entailed as well a shift from funding organizations to funding individuals, who are given by ERC grants the resources to form their team in a chosen institution.

The ERC was conceived with «excellence as the ultimate goal» (Mayor et al., 2003):

> *The mission of the European Research Council (ERC) is to promote excellence as a basis for social, cultural and technological progress throughout Europe by funding world class research.*

In order to establish the excellence of new proposals, the ERC scientific officers had to rely on the scientific community's well-established method, peer review:

> *It should base its funding decisions on scientific criteria and use a rigorous and transparent peer review process in deciding which research proposals to fund.* (Mayor et al., 2003)

> *Proposals for "frontier research" should be evaluated on the basis of the sole criterion of excellence as judged by peer review and should put the emphasis on inter- and multidisciplinary, high risk pioneering projects and new groups and new generation researchers as well as established teams* (CEU, 2006)

Relying on the peer-review method positioned the ERC patently under the 'jurisdiction' of the scientific community's norms and values, enforcing the original call of ERC advocates to re-establish them at the EU research policy level.

To this aim, when dealing with the organization of the funding body, an abiding – borderline obsessive – reference is made to the concepts of «autonomy» and «independence» (see, for example, (CEC, 2007b), with the different contributions highlighted in Fig. 36):

> *In designing the governance structure of the ERC it is imperative that it has full autonomy in research matters, granting decisions and funding policies (…)* (Mayor et al., 2003)

> *The Scientific Council should be composed of scientists, engineers and scholars of the highest repute, appointed by the Commission, and acting in their personal capacity, independent of any outside*

> *influence. (…) The Scientific Council shall operate in an autonomous and independent manner. (…) The Commission shall provide information and assistance necessary for the work of the Scientific Council allowing it to operate under conditions of autonomy and independence. (…) The Scientific Council shall independently select a Secretary-General (…) The composition of the Scientific Council must demonstrate that the Council can exercise scientific leadership which is authoritative and absolutely independent (…)* (CEC, 2007b)

The founding idea of the ERC, according to these citations, appears to reside more in the vision of the scientific community as autonomous and independent from extra-scientific influences, rather than in the principle of excellence. Indeed, independence from pre-established political orientation of research is the distinguishing feature of the "pure knowledge", 'Bush' frame, as opposed to the Steelman's idea of orienting the research towards strategic lines of research.

A third element of the ERC characterization relates to the dimensions of integrity and reputation, depicting them as indispensable features of the Scientific Council and of its members; even their «probity» is mentioned. The overall characterization appears belonging to the realm of the moral qualities: reputation, together with autonomy, is described as necessary to «earn» ERC's «credibility in the European research community and in society at large»:

> *The ERC must be able to operate independently in order to establish its reputation as a research funding institution of highest quality and thus earn its credibility in the European research community and in society at large. The decisions of the ERC on research priorities and funding issues must be protected from any undue outside intervention.* (Mayor et al., 2003)

> *The Scientific Council shall be composed of scientists, engineers and scholars of the highest repute and appropriate expertise, ensuring a diversity of research areas, acting in their personal capacity, independent of extraneous interests.* (CEU, 2006)

> *The Scientific Council shall exclusively act in the interest of achieving the scientific, technological and scholarly objectives of the Specific Programme 'Ideas'. It shall act with integrity and probity (…) Members of the Scientific Council must individually have an undisputed reputation as research leaders and for their independence and commitment to research.* (CEC, 2007b)

The attractiveness of the new funding body, and its capacity to influence the European research environment is indeed presented as an important point of the ERC model (EP & CEU, 2013):

> *Beyond this, the ERC has a significant structural impact by generating a powerful stimulus for driving up the quality of the European research system, over and above the researchers and projects which the ERC funds directly. ERC-funded projects and researchers set a clear and inspirational target for frontier research in Europe, raise its profile and make it more attractive for the best researchers at global level. The prestige of hosting ERC grant-holders and the accompanying 'stamp of excellence' are intensifying competition between Europe's universities and other research organisations to offer the*

> *most attractive conditions for top researchers. And the ability of national systems and individual research institutions to attract and host ERC grant-winners sets a benchmark allowing them to assess their relative strengths and weaknesses and reform their policies and practices accordingly. ERC funding is therefore in addition to ongoing efforts at Union, national and regional level to reform, build capacity and unlock the full potential and attractiveness of the European research system.*

The quest for credibility and attractiveness can be explained by the ground-breaking novelty represented by ERC in the European research funding landscape, and by the need to justify it adequately. Besides, as T. König notes in his first-hand account of the rise of the ERC, the new body's political aim was to "get the aura back" to European research policy, against the background of Frameworks Programmes that were considered by scientists a sort of «Loch Ness monsters of bureaucracy» (König, 2016).

The rise of the ERC appears to be built on a series of convergences of interests between a group of engaged scientists advocating for a new research funding mechanism, modelled on the scientific community, and a Commission in search of alliances among the societal actors to regain consensus and supports.

The ERC as a political instrument

According to the described representation in policy documents, the ERC appears framed in a double-face depiction: the documents describing it 'from outside', i.e. presenting it to the public, or inserting it in the overarching strategies, alongside the other programmes (e.g. in Horizon 2020 documents), tend to underline the production of high-quality science, leading Europe to achieving excellence in research; when dealing with the 'internal' characteristics of ERC, conversely, the documents greatly emphasize the dimension of autonomy and independence of the new funding body.

The rhetoric of excellence, based on competition, could not fail to attract consensus in the European political community, given EU's history of grounding research to competitiveness and growth; indeed, another key feature of the ERC, accompanying excellence, autonomy and transparency, was efficiency, and we have already seen how this concept resonates with measurability and accountability of research. That was not the only moment where the ERC advocates proved to be politically clever in formulating their proposal basing on EU established frames and interests, in order to facilitate their acceptance and insertion in the political agenda. The reformulation of the new policy orientation in terms of a European core concept as the 'added value' was another example, that allowed for the political negotiations to proceed towards an integrated European body, instead of an autonomous intergovernmental organization.

On the other side, from the perspective of the scientists, the new structure had to respect strictly the requirement of autonomy and independence to absolve its mandate and realize a communitarian funding body more respectful of the scientific community's principles.

The history of the ERC ideation and creation can hence be read as a successful story of clever framing, by two different communities, in order to show the attractiveness and feasibility of their project to each

other, and gain a win-win result: the establishment of a new body that was honestly unforeseeable only a decade earlier.

The newly established body, with its radically new rationale for EU, represented a major tension point in the research funding landscape, that added to the frictions among the different orientations for research of the innovation and social aiming frames.

Tensions in the European vision of scientific research

The 2014 introductory video on H2020 concluded with the promise of a «bright future», to be achieved with the contribution of the new Framework Programme (EC, 2014e).

Which possible futures are envisaged by European research policies? Conceptual frameworks and master narratives, alongside the interpretations on past and present events, always project visions of desired or feared futures.

«The knowledge future». A 2015 report by an expert group on foresight[114], mainly composed by academics and policy experts, reflected about the future of European knowledge policies, underlining the importance of the «knowledge engine» to transform ideas into reality and improve the European citizens' quality of life (Hudson et al., 2015):

> *How do ideas become reality? The whole process of transforming knowledge - creating it, sharing it, and using it - has become important to policy makers. They see it as connected somehow with how rich we are, how competitive Europe can be, how healthy or happy our citizens are, and how sustainable our world will be. This report to the European Commission, by a diverse group of academics, policy experts and private-sector representatives, looks at the future of this knowledge engine – towards the challenges of 2050. It recommends steps to ensure that, through maintenance of a robust system for transforming knowledge into action, Europe's citizens are better off, rather than worse off, in that distant future.*

The report, titled *The Knowledge Future: Intelligent policy choices for Europe 2050* projected two visions of «what Europe could look like in 2050 if it does, or doesn't, manage its system of knowledge transformation well» (Hudson et al., 2015):

[114] "Foresight on Key Long-term Transformations of European systems: Research, Innovation and Higher Education" experts group (KT2050).

Fig. 10: The two scenarios of Europe in 2050, according to the document *(Hudson et al., 2015)*.

Option A: European Success

It is 2050, and Europe and its knowledge economy are competitive. Clusters of well-funded, internationally renowned universities are thriving in many of Europe's important and growing cities, in strong partnerships with regional institutions. Education is 'in'; never before have so many wanted so much from teachers: new skills, new jobs, new capacity to cope with rapid change, new perspectives for leading fulfilled lives – from cradle to grave. This growing demand for continual education has prompted new efficiencies: course modules shared within university clusters, online and artificial intelligence-based teaching, specialisation within institutions public and private. Educational games, at which European designers excel, are a vast market segment. In business, open innovation is now the dominant mode: multinationals, SMEs, universities and many new actors – foundations, NGOs, individuals (many retired) - work together in fast-changing global networks to solve global problems. Europe's mega-cities, with their unique sense of community identity and involvement, are a focus for innovation; 'Paris original' – or Warsaw or Athens – has become a new kind of global brand. Meanwhile, automation and data-intensive science have changed the nature of doing research. We have moved from open science to radical open access: all kinds of new actors are rushing into the research game, especially in astronomy, ecology, climate and other fields that attract strong public interest. Europe's research infrastructures are the new cathedrals of this science: Open to all, supported by all. Frontier science is a competitive, EU-wide affair led by an enlarged European Research Council, while regional disparities in innovation capacities are countered through separately administered regional development funds. Indeed, EU institutions generally are strengthened; as the regions and cities have climbed in importance – Europe's growing laboratories of democracy – so the coordinating role of EU institutions has risen. Multinational tax avoidance is tamed, strengthening public treasuries everywhere. Where Europe once produced 30% of the world's ideas, it has more than held its own as Asia rose; it is moving towards 40%. Many of its industries are competitive, building on healthy SMEs. Its universities are strong, its citizens fulfilled – and its core values, such as equality, openness, social inclusion and environmental responsibility, are upheld.

Option B: Europe misses out

It is 2050, and Europe is a victim of megatrends beyond its control. Automation and globalisation have triggered mass unemployment, social exclusion, discontent. Service bots, machine learning, ubiquitous sensing – what's left for the humans to do? Inequality is higher than ever; new creative jobs are constantly evolving from new technologies, but they are only for the skilled few. Politically, Europe has fragmented into a coalition of rich and poor regions with minimal coordination. A Northern Arc has maintained free movement of goods, services, and people; other parts of Europe are isolated. Multinational companies, and wealthy individuals, use global markets and digital technologies to avoid tax. Public treasuries are impoverished; and universities and labs depend heavily on private funding – which means new ideas and talent are controlled by the wealthy and powerful. A few great universities dominate; many weaker, regional universities have closed or merged. Automation has also swept across the educational system, with online certifications normal and augmented cognition technologies starting to appear – and finding favour with big companies wanting fast, cheap graduates. In research, the top-cited scientists are in hot demand – often hired by multinationals in a kind of perpetual 'consultancy without borders.' These companies, on which public labs and universities rely for major funding, get early access to the real discoveries and use their influence to steer the remaining public funds towards their projects; that's what makes for jobs and growth, they argue. Asian research is stronger now, and an embattled US has thrown up new trade barriers to Europe. Mobility is diminished. A few European companies are rich and smart enough to stay global champions; but generally Europe's economic base has hollowed out, and the few innovators its universities produce quickly move abroad. Innovation is without borders; supply chains form and dissemble rapidly – making long-term regional development more difficult than ever. Europe looks inward, fears the future, and sees its values gradually discredited.

Although the experts insist on the purpose to «dramatise the importance of making wise policy choices, and to suggest what those choices might be», denying any real forecasting intention, the projected scenarios are very interesting for what they tell about their authors' frames about knowledge policies and, more in general, about the visions circulating in European research policy circles.

Indeed, it is possible to recognise in the proposed scenarios the elements of all the identified and analysed conceptual frameworks.

The innovation frame, based on the economic orientation of research, is patently applied since the first lines: a competitive knowledge economy is presented as the key of European success, and big cities are defined as «a focus for innovation».

Conversely, the failure to realize a competitive knowledge economy is described emphasizing a list of negative consequences on the quality of life – «unemployment, social exclusion, discontent» – ; warnings and threats over a deterioration of the «European way of life», in case of missed application of economic measures, were highlighted above as recurrent features of the urgency frame. In the success scenario, the situation is the opposite: «new skills, new jobs, new capacity to cope with rapid change, new perspectives for leading fulfilled lives – from cradle to grave». Furthermore, multiple references are made to the ability to cope with the fast-changing environment – again, the scenarios resort to the urgency frame – as the key to obtain results and solve problems.

The positive evaluation of practical, problem-oriented scientific activity emerges from the description of a «research game» focused on «fields that attract strong public interest» – we recognise here the same framing employed in H2020 for societal challenges.

The nerve of an insufficient democratic functioning of the Union – including the critical interplay of science and society – is addressed depicting a successful future where the regions and cities represent «Europe's growing laboratories of democracy» and are described as places of «community identity and involvement».

The areas pertaining to basic science and to the scientific community support – highlighted in the pure-science frame – are presented as Europe's leading research sectors: universities are «renowned», research infrastructures are «the new cathedrals» of science[115] and frontier science, administered by an «enlarged» ERC, is the leading research trend. The funding method is competitive, but the possibly arising inequalities are compensated through structural funds.

In the failure scenario, conversely, inequalities are dominating: between regions, skilled and non-skilled people, rich and impoverished citizens, public and private sectors, strong and weak universities, wealthy and poor companies, actors with and without access to data and discoveries.

[115] The clear reference here is to Weinberg's definition of Big Science realizations as the «Notre Dame» of the 20th century (Weinberg, 1961).

The overall result is, in the first option, a feeling of confidence in the future, based on the support to the «core values» of Europe: «equality, openness, social inclusion and environmental responsibility»; in case of "missing out", «Europe looks inward, fears the future, and sees its values gradually discredited».

The European knowledge system success is linked in the projected scenarios to the same future of European integration: the EU institutions' role of coordination is strengthened in the success case, while in the opposite only the «Northern Arc» has maintained freedom of movements, and Europe is depicted as fragmented and unequal.

Diverse frames in EU research policy. Table 16 summarizes the different conceptual frames identified and analysed in this work, with the respective dominant sub-discourses and the relative key concepts and features, as observed in EU policy discourses.

Each line of thought derives from a diverse cultural background, and emerged at a different moment in EU research policy history. Different frames imply different visions on research funding rationales, relevant actors and issues. Each frame materialised in specific funding lines inside Framework Programmes: technologies useful for industrial expansion, research in fields critically affecting the citizens' lives and support of the scientific community development.

The fabric of the current European research policy is woven principally with these threads, as the tripartite organisation of Horizon 2020 shows.

Table 16: A summary table with the dominant features of the three analysed frames and of the identified sub-discourses.

	Innovation frame ***knowledge for growth***	**Societal frame** ***knowledge for society***	**Pure-science frame** ***knowledge for knowledge itself***
Research funding model[116]	Economic Steelman model	Mixed Steelman model	Bush model
Rationale	research funding is legitimized by its contribution to economic growth	research funding is legitimized by science's power to solve problems relevant for society	research funding is legitimized by the increase of knowledge itself, which is a final good

[116] The reference here is to the models described above, in Table 14. However, a further specification is necessary for the Steelman model: the original Steelman approach to research funding established the need of a political control over the directions of research, that needed to be focused on national priorities and held democratically accountable (se paragraph *Horizon 2020: three priorities for three visions of the role of research*).

The same cannot be said for the Innovation and societal frames: as we have seen, the political control is often more formal than substantial: in the first, the choice of the research orientation is often established with reference to the objectives set inside the economic community; in the societal frame, as shown, different interpretations of democratic accountability coexist, and priorities are chosen by means of technical evaluations (e.g. benchmarking of international organisations' priorities), political objectives (including reflections on the strategic scientific fields to develop, or the articulation around grand challenges to structure the research funding programmes, inspire researchers and build consensus) and properly democratic mechanisms (the realisation of participative programmes to include the citizens' opinions in the technological assessments).

	Innovation frame ***knowledge for growth***	**Societal frame** ***knowledge for society***	**Pure-science frame** ***knowledge for knowledge itself***
Sub-discourses - key concepts and features	*«real things»*: preference for practical orientation. -measurability of R&D, accountability -performance, efficiency, impact -entrepreneurial skills	*«reinforcing public confidence in science»*: citizens' participation is finalized to consensus-building -the citizenry is not knowledgeable and oppositional: "child-citizens" -PUS approach to engagement	*«excellent science»*: the best ideas have to be supported, regardless of any other criteria -competition
	«before it is too late»: if we postpone economic action, we will lose in quality of life -short-termism -debate foreclosure	*«grand challenges»*: research efforts should focus on defined problems. -problem-solving -reduction of inclusion to trust in the scientific fix of societal issues	*«independent of any outside influence»*: autonomy of the scientific community -community self-governance based on peer-review
	«innovation is the answer»: quality of life grounded to economic wealth. -economic reductionism		*«probity and integrity»*: moral values to ground reputation and attractiveness -regain the 'aura' to EU research system
Advocate communities / discourses developers	Innovation studies scholars, OECD	Social studies (esp. STS scholars), socio-democratic activists	ERC advocates, scientific community
Prevailing actors	Private sector («businesses»: companies, SMEs, industries, financial sector), universities	Universities, private sector R&D	Universities, public research organizations
Relevant issues[117]	«key industrial technologies»: ICT, nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing, space	«major concerns shared by citizens in Europe and elsewhere»: health, demographic change; sustainable transport; sustainable energy; food security, sustainable agriculture, forestry, marine research, bioeconomy; climate action, environment and raw materials; (secure societies; reflective societies)	«best ideas»: science-driven research; researchers' training and mobility; future and emerging technologies; research infrastructures

[117] The quotes in this line refer to the description of the priorities in Horizon 2020 (EC, 2011a); the issues are mentioned in the H2020 establishing act (EP & CEU, 2013) as headers of the funding lines in the three priorities of «Industrial Leadership», «Societal Challenges», «Excellent Science» (adaptation of the author); with the exception of industrial technologies (the indicative breakdown

If, as shown, the roots of the three frames can be identified in long-standing intellectual traditions, the identified sub-narratives describe the specific EU understanding of the reference models, at times giving rise to problematic points; for example, the PUS approach to citizens' engagement or the articulation around grand challenges, as described, reveal a reductionist and instrumental conceptualisation of the societal relevance of research[118]. Although the Commission strived to cleverly distribute and group the issues inside FPs in order to organise funding along complementary channels, it cannot avoid the emergence of frictions among the different rationales and orientations, which are even more visible when analysing the frames' sub-discourses.

Indeed, a research topic oriented to industrial development may well be disrespectful of environmental precautions, or be reluctant to include the citizens at an early design stage to discuss the social acceptability of the innovation. Moreover, the aim of producing knowledge following the internal dynamics of science, obeying only to the needs of scientific development, can be regarded as an undue loss of time and money by an environmental activist, fighting to find remedies to the consequences of industrial pollution. Again, the bias towards practical and measurable research outputs is hardly consistent with the abstract nature of a big part of frontier science. The same research funding models – that we have named Bush and Steelman models, see Table 14 – are at odds, and in fact ERC advocates built their campaign along critical reviews of the FP finalized research format.

A critical point, as mentioned, is represented by the role of citizens, whose participation is frequently demanded, but seldom seriously incorporated in the research process; the same citizens are portrayed from case to case as consumers, users or taxpayers, and their engagement with the scientific activity is requested in order to build their support for science and EU research policy (see Table 15).

Analysing the historical and conceptual development of the research policy frames, it emerges that the different visions are not simple complementary perspectives, but ground on very different convictions on the political role of scientific research, on the value of knowledge for society, on the responsibility of public policies in supporting scientific developments and on the same nature of the scientific activity. As for the projected scenarios, decisions on the policies of knowledge concern the beliefs on the guiding values of societies and affect the future of political entities.

In such a diverse landscape, the European futures of success or failure may depend, rather than on the adoption of political-economic measures suggested by experts groups, on the capacity to deal with the tensions contained in EU research policy in a constructive way, open to a serious confrontation among all the societal actors and in search for a shared definition of the founding values of Europe, on which to ground a coherent and cohesive research policy.

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is not specified), the topics are listed in decreasing order of allocated funds, and the topics with less than 3% of the total budget are between brackets.

[118] See the paragraph *The temptation of reductionisms*.

Conclusion: critical points in EU science policy

> *Political freedom with these foundations*[119] *will not just have a formal meaning but a real meaning for all since citizens will be independent, and will be sufficiently informed as to be able to exert continuous and effective control over the ruling class.* (Spinelli et al., 1944)

The «free and united Europe» emerging from the defeat of totalitarianism needed to be based, according to the authors of the Ventotene Manifesto, on the realization of substantial – and not only formal – political freedom: citizens were envisaged to be independent, and to possess sufficient knowledge and understanding to «exert continuous and effective control over the ruling class» (Spinelli et al., 1944).

Reading between the lines of policy documents, identifying and studying the conceptual frameworks employed in the European discourses on science, was meant as a contribution to the quality of deliberative democracy: unspoken, prescriptive discourses need to emerge and their premises and orientations be discussed to set the basis for a real open confrontation among the different visions, before they transform into hardly questionable ideologies.

The analysis of the policy frames shaping European research policies led to the identification of the three described major understandings of the role of knowledge production: knowledge for economic growth, best incorporated in the current innovation frame; knowledge with social orientation; and knowledge for the advancement of knowledge itself (see Table 16). Moreover, this work recognised and described several features of the actual interpretation of these broad frames in the specific context of European research policies, identifying the respective conceptual background and highlighting the most critical points.

The innovation frame, developed by scholars in the political-economic academic field, was promoted principally by the OECD, and adopted by most Western countries during the '90s; in the EU context, it easily rooted on the communitarian economic orientation and on the focus on competitiveness and growth. The emphasis on innovation was developed in the first years after the turn of the Millennium thanks to a series of economic analyses, which identified in the lack of innovation the motivation of the insufficient growth

[119] The authors of the Ventotene Manifesto were referring here to these conditions: «a) Enterprises with a necessarily monopolistic activity, and in a position to exploit consumers, cannot be left in the hands of private ownership (…) b) Private property and inheritance legislation in the past was so drawn up as to permit the accumulation of wealth in the hands of a few, privileged members of society. In a revolutionary crisis this wealth must be distributed in an egalitarian way thereby eliminating the parasitic classes and giving the workers the means of production they need to improve their economic standing and achieve greater independence (…) c) The young need to be assisted with all the measures needed to reduce the gap between the starting positions in the struggle to survive to a minimum (…) d) The almost unlimited potential of modern technology to mass produce essential goods guarantees, with relatively low social costs, that everyone can have food, lodging, clothing and the minimum of comfort needed to preserve a sense of human dignity» (Spinelli et al., 1944).

performance and contributed imbuing the debate with a strong feeling of urgency. The target of innovation was set as a priority in the current Europe2020 growth strategy and the Framework Programme is built around the realization of an «Innovation Union». However, innovation, despite the term's openness of meanings, in the political lingo is properly denoting an economic target: the innovation frame, based on the contribution of R&D to growth, influences policy discourses, notably favouring practical, measurable research activities, promoting accountability and performance surveys and supporting the development of entrepreneurial attitudes to research; furthermore, it upholds an overall reduction of the dimensions related to quality of life to the achievement of economic wealth.

The societal frame emerged at end of the '90s, following the Maastricht Treaty political unification and the enlargement of EU concerned areas to social policies and citizenship; it strengthened in the wake of the science-related crises of the '90s, which eroded the citizens' trust in the public authorities' capacity of risk management. The EU approach to the inclusion of social instances in scientific policies was two-fold: on one side, a deep insight on the science-society interplay was promoted, especially by scholars from the social studies and STS fields, and devoted research lines were inserted in FPs. On the other side, the documents show a recurrent temptation to minimise societal engagement, reducing it to a matter of information and scientific education, finalizing it to consensus-building, or substituting deliberation on agenda-setting with a research focus on societal relevant issues.

Finally, the pure-science frame rose around the turn of the Millennium, when a group of engaged scientists began advocating the creation at European level of a research funding mechanism respectful of the long-established scientific community's method of self-management, especially for what concerns the autonomy from any outside influence on the orientation of knowledge. The project materialised in the creation of the European Research Council in 2006, aimed at funding investigator-driven frontier research, evaluated with the sole criterion of excellence by means of scientific peer-review. The ERC was embedded in the Framework Programmes, despite it shows not only a different orientation, but even a different research funding model: while the Innovation and Societal frames are conceived as functional to the strategic objectives of the Union, the ERC refuses to apply any EU-relevant criterion – like a cohesion-oriented distribution of funds, or the principle of *juste retour* – ; moreover ERC projects are selected by means of the peer-review mechanism, totally internal to the scientific community. From the analysis of the documents emerges that, while the ERC is promoted with an abiding reference to high quality, excellent science, the driving value of its organization is autonomy – a peculiar feature of the scientific community –, and the frequent references to moral qualities like integrity and reputation are linked to the objective of regaining, by means of the ERC, the attractiveness ('aura') of European research policy.

From the historical analysis, the years around the turn of the Millennium appear as a crucial moment for EU contemporary research policy: the launch of the Lisbon strategy, alongside the reform of the higher education system and the construction of the ERA, promoted knowledge policies at the top of the European

agenda. In that period, the understanding of knowledge in public policies was not univocal, and different perspectives coexisted in political discourses. The two paradigmatic expressions of the «European knowledge society» or of the «Innovation union» embody the two conceptual poles of the debate: the first including the cultural, social and economic dimensions of knowledge as a common good; the second aiming to emphasize the economic value of knowledge, and to promote its rapid transformation into products in order to boost growth (see Table 13). In the first years of the Millennium the confrontation between these two major orientations evolved towards the second conceptual pole, with the affirmation of innovation as the key overarching concept of research policy, the weakening of social and citizens' participation instances and the strengthening of the accent on efficiency and impact of the research system.

Although, however, the innovation frame can be currently identified as the principal axis of EU research policies, the other perspectives are still visible and incorporated in the organization of science funding, notwithstanding their points of tension, and they are engaged in an enduring struggle over the choice and framing of issues.

The temptation of reductionisms

The tripartite articulation of Horizon 2020 is the most visible effect of the struggle over the framing of European research policies. Defined by the Commission as «distinct, yet mutually reinforcing» (EC, 2011a), the three perspectives conversely show, as mentioned, multiple points of tension, originating from their diverse founding principles and promoted orientations.

Where the subjects lie at the intersection of multiple understandings – like the citizens' role and characterization, and the choice of societal concerns to be addressed by scientific research – critical points emerge. Specifically, it appears particularly evident in European policy discourses a tendency to rely on reductive arguments to reframe the issues in order to suit the prevailing orientation.

The representation of the citizens ranges between the two opposite visions of not knowledgeable, prejudicially oppositional, passive mass, on one side, and real co-producers of the research outputs, carriers of values and able to take sound decisions, ultimately able to bear the load of deliberative democracy on the other side (see Table 15).

As shown, in many documents the efforts to involve the citizens in the definition of research policies are reduced to a matter of scientific information (the "PUS" approach); engagement is frequently portrayed opportunistically as an instrument to build consensus for the planned initiatives since the earliest development stages. In Framework Programmes establishing acts, the participation of citizens is enhanced and advocated, provided the output is «reinforcing public confidence in science». To these double reductions – of responsible "adult-citizens" to unaware "child-citizens", and of participation to filling the information deficit and building consensus – adds the contraction of citizenship to the economic or functional behaviors

of people: a further reduction of citizens to consumers, users, workers, taxpayers, with their consequent repositioning in passive, end-of-process, roles.

The inclusion of citizens' concerns and expectations via the funding of research on societal challenges is another ambiguous instrument: on the one hand, it formally identifies society as the agenda-setter of the corresponding pillar; on the other hand, the choice of research subjects is not based on new processes of societal involvement, or on the opening of a debate over the European priorities, but on stakeholders' consultation, benchmarking of global institutions' positions and the opinions of experts. The challenge-based approach is promoted as an instrument to attract the interests of researchers and investors and to regain the attractiveness of EU research policy, while at the same time addressing societal concerns. The reduction of agenda-setting to problem solving, however, gets the effect of drawing the attention away from the crucial stage of policy design. The same procedure inside the Commission leading to the identification of priorities and to the design of research policies is not publicly traceable, as shown in this work.

Quality of life, in European discourses, is repeatedly connected with the generation of economic wealth: as mentioned, this long-standing position is enhanced in the innovation frame, and the complex interplay of social, cultural and economic factors affecting well-being and personal fulfillment is frequently reduced to the sole economic dimension. Performance, efficiency and impact are the evaluation criteria of R&D. Furthermore, economic analyses repeatedly invoke fears of social failures to support the proposed measures in the economic field, and the urgency frame is employed to emphasize the importance of the initiatives and legitimize actions.

Besides, while the societal and pure-knowledge frames are formulated in terms of their content or orientation, the concept of innovation denotes a feature of the research output, i.e. to be "innovative": it is intrinsically a criterion, an operational instrument to discriminate between different options. Since, as shown, innovation is properly an economic idea, the choice is naturally oriented towards economic outputs. Innovation, in other words, works as a reductionist tool in favour of profitable research orientations.

Against this background the scientific community, with the recent introduction of the "pure-science" funding line, insisted on the dimension of autonomy from any political and economic control exerted by EU institutions in the evaluation of projects, while with the focus on excellence, as judged by peer review, excluded any pre-set finalization of knowledge production.

The clash among the three conceptual frames, in other words, is being conducted by means of clever reframing of issues in order to neutralize the competing perspectives, or defending from the attempts to be incorporated by other visions.

A climate conducive to a democratic confrontation on European shared values

The temptation to rely on reductionist perspectives in European research policies, a symptom of "democratic fatigue"[120], is grounded to long-term historical and political roots.

First of all, the European Communities were primarily set as internal markets, in the respective sectors: against the reluctance of states to cede sovereignty, the founding fathers of Europe trusted that *de facto* collaborations, in fields perceived as politically neutral, would have led in the long term to complete political realisations. The confrontation between centralist and intergovernmental models of integration continued over the years, giving rise to the peculiar mixture of institutions of the European Union. The formal political unification in the Maastricht Treaty didn't conclude the process, although it represented a turning point for European policies, included, as seen, the field of knowledge production, from that moment on embedded in the wider realm of social and political, as well as economic, policies. Anyway, as mentioned, notwithstanding the emergence of the social and pure-science frames, the economic orientation set and developed in the previous four decades is still the prevailing one in EU research policies.

Secondly, we have shown how certain features of the innovation frame for scientific research have been influenced by the rising of new economic theories and by the new public management approach to public administration; more generally, the marks of neoliberal economic-political climate are recognisable in the emphasis on competitiveness, markets mechanisms and private actors at the expense of public interventions. Such influence certainly increased after the 1989 fall of the Berlin wall, with the general Western shift towards liberal politics, promoted also by economic institutions like the OCED. The far roots of the European inclination towards liberal and capitalistic policy models, also in the scientific field, can be ascribed, as argued by the historian John Krige, to the US inclination in post-war Europe to contribute to the reconstruction of science in Europe as a dimension of a wider strategy to «promote American values and interests in the post-war world», especially in conjunction with anti-Soviet interests (Krige, 2008). On the other hand, the conflict between liberal and social-democratic values is also reflected in the different visions of knowledge as based on competition over excellence, and oriented to individual realisation, or concerned with to social justice and personal emancipation. Due to the weakness of the political debate in the European context, values ascribed to political worldviews and incorporated in discourses appear particularly relevant to be identified and analysed.

The complexity of the institutional asset can be regarded as a further interpretive dimension of the European tendency of taking shelter in reductionist visions: the struggles between bodies representing intergovernmental and central positions, the continuous gap between national and communitarian levels in the design and implementation of policies, the distance between the elected representatives and the citizens undermine the realisation of a proper, comprehensive, democratic debate. In such a context, and the more

[120] I take this expression from the works of A. Appadurai.

so with the emergence of anti-EU political tendencies, European institutions are at risk of retreating in self-conservation, moving away the moment of open confrontation on political directions, or surrogating it with expert opinions, benchmarking of international policies or hiding behind procedural efficiency. For example, in the early 2000s, the concurrence of the Constitution rejection, the biggest enlargement to Eastern European countries, added to the change of Commission Presidency, may have favoured a concentration on bureaucratic issues at the expenses of the confrontation on values. Moreover, the current configuration of policy-making in the field of research does not help the establishment of a discourse taking into account all the appropriate dimensions of knowledge production: on one side, in fact, the prevalence of the distributional mode of policy-making implies that often clashes on political values are masked by conflicts on budget allocations, efficiency or impact of the distribution mechanisms. Moreover, the European tradition of detaching economic and social policies, the first decided at communitarian level and the second left to the states, inevitably complicates the incorporation of the social dimension into R&D policies.

Against this long-established political and historical background, the elaboration of a coordinated European R&D policy and the establishment of the EU political dimension appear recent developments, and are understandable as still *in fieri*. The same innovation frame, as argued in the historical section of this work, doesn't show the features of and authentic paradigm shift, if compared to the previous period focused on technology and industry, but could be understood as a transitional moment, bearing the influences of the previous period (especially the economic orientation) but marked by the emergence of new, competing frames.

Understood in this context, the laborious coexistence of different frames in the European policy on research may be regarded as a token of vitality in the debate about the role and features of science policy. If properly acknowledged and explored, the different visions may represent fruitful seeds of confrontation, leading to both sounder and more democratically grounded policies, provided that EU renounces to the temptation of reductionism, faces its critical points and creates the conditions for an open confrontation on the European shared values.

Acknowledgements

As described in the introduction, this work is built on my personal experience of being part of the European research environment and struggling to identify the conceptual references of both discourses and practices.

I would not have been able to unravel such an involved scenario without the invaluable guidance of my supervisors, to whom I am particularly indebted: prof. Andrea Cerroni, for his curiosity, his willingness to confront and his cultural depth; prof. Maria Carla Galavotti, for her experience and patient support throughout the whole work, and prof. Raffaella Campaner, for her recent but important contribution. I also want to thank prof. Maria Chiara Tallacchini and prof. Vincenza Pellegrino, for their influence in lighting up my interest and setting the discourses explored in this research.

I am also particularly grateful to Dr. Etiennette Auffray and to all the supervisors, colleagues and friends of the Lab 27 at CERN for the precious experience of working in such a unique and stimulating environment and for the frequent confrontations on the nature of science, on the role of research and on the value of scientific communication; I would also like to thank my PhD colleagues in Bologna for their friendship and the inspiring, although too rare, conversations.

I also wish to thank my family, and especially my husband, for his continuous support and willingness to move, both intellectually, across cultural worlds, and physically, across countries.

Part of this research project has been supported by a Marie Curie Early Initial Training Network Fellowship of the European Community's Seventh Framework Programme under contract number (PITN-GA-2011-289355-PicoSEC-MCNet); the research activity was prevailingly conducted at CERN, thanks to the Doctoral Student Programme.

However, the views and opinions expressed herein are those of the author and do not reflect the views of the Network, of CERN and/or of the European Commission.

Appendix

Fig. 11: Commissioners College structure, as depicted in a Commission infographics (Juncker Commission, 2014-2019) *(EC, n.d.)*.

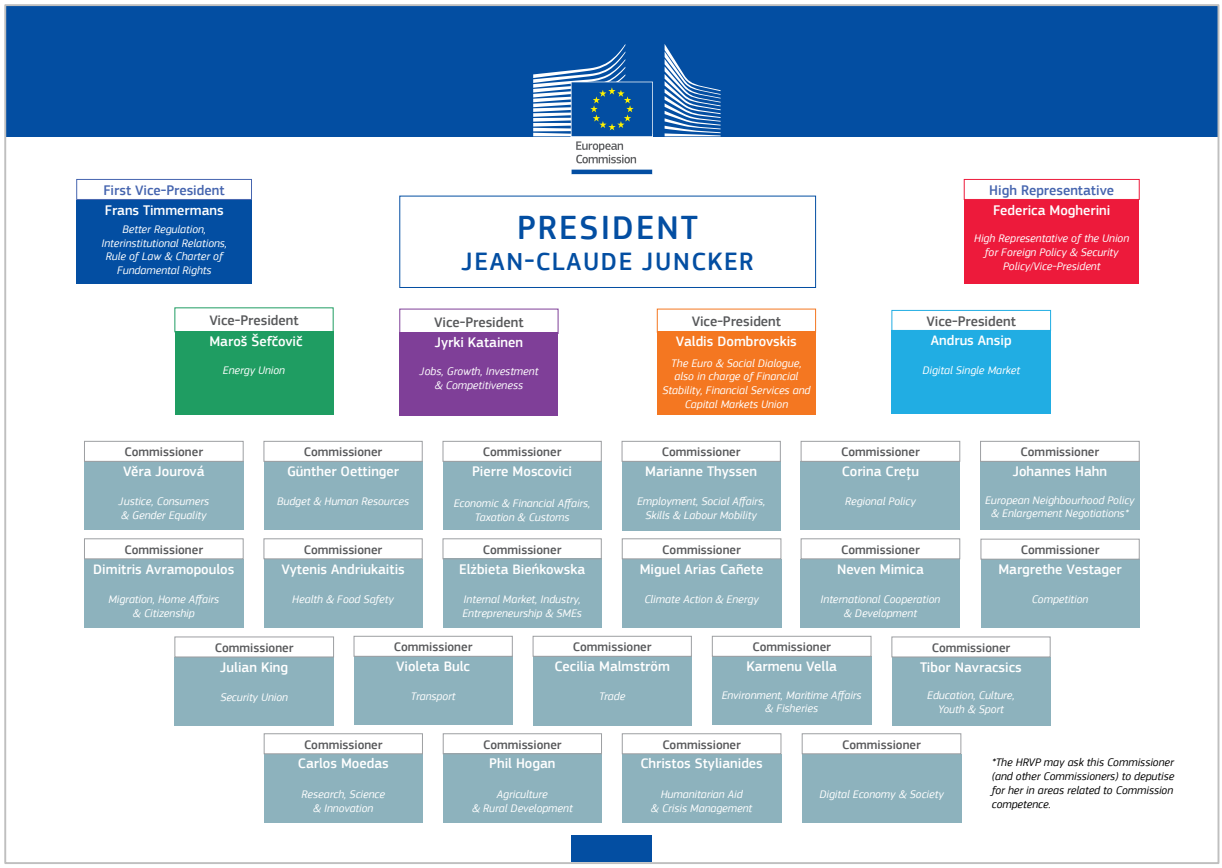


Table 17: The Commissioners and their responsibility over Directorates and Services, 2017 (EC 2014b and links therein; EC 2014a); some Vice-Presidents don't have a direct leadership on specific DGs[121]; their mandate is here summarised, but the document *(EC, 2014c)* reports the details and exceptions of their tasks. The Commissioner to research is highlighted in light grey.

Commissioner	**DGs and Services**
President *Jean-Claude Juncker*	Secretariat-General (SG) Legal Service (SJ) DG Communication (COMM), including the Spokesperson's Service (SPP) Bureau of European Policy Advisors (BEPA)
First Vice-President, in charge of Better Regulation, Inter-Institutional Relations, the Rule of Law and the Charter of Fundamental Rights	Internal Audit Service (IAS)

[121] One innovation of the Juncker Commission is the creation of "project teams", each of which is led by one of the seven Vice-Presidents. Each Commissioner is either full member or associated of a project team (EC, n.d.; EP, 2016). See Fig. 12

Commissioner	DGs and Services
Frans Timmermans	
Vice-President and High Representative of the Union for Foreign Affairs and Security Policy *Federica Mogherini*	European External Action Service Service for Foreign Policy Instruments (FPI)
Vice-President: Digital Single Market *Andrus Ansip*	Communications Networks, Content and Technology (CONNECT) Informatics (DIGIT)
Vice-President: Energy Union *Maroš Šefčovič*	
Vice-President: Euro and Social Dialogue, also in charge of Financial Stability, Financial Services and Capital Markets Union *Valdis Dombrovskis*	Financial Stability, Financial Services and Capital Markets Union (DG FISMA)
Vice-President: Jobs, Growth, Investment and Competitiveness *Jyrki Katainen*	
Commissioner: Agriculture & Rural Development *Phil Hogan*	Agriculture and Rural Development (DG AGRI) The relevant parts of the Research Executive Agency (REA)
Commissioner: Climate Action & Energy *Miguel Arias Cañete*	Climate Action (DG CLIMA) Energy (DG ENER) The Euratom Supply Agency (ESA) The relevant parts of the Executive Agency for Small and Medium-Sized Enterprises (EASME) The relevant parts of the Innovation and Networks Executive Agency (INEA)
Commissioner: Competition *Margrethe Vestager*	Competition (DG COMP)
Commissioner: Economic and Financial Affairs, Taxation and Customs *Pierre Moscovici*	Economic and Financial Affairs (ECFIN) Taxation and Customs Union (DG TAXUD)
Commissioner: Education, Culture, Youth and Sport *Tibor Navracsics*	Education & Culture (DG EAC) Joint Research Centre (JRC) The relevant parts of the Education, Audiovisual and Culture Executive Agency (EACEA) The relevant parts of the Research Executive Agency (REA)
Commissioner: Employment, Social Affairs, Skills and Labour Mobility *Marianne Thyssen*	Employment, Social Affairs and Inclusion (DG EMPL) Eurostat - European statistics (DG ESTAT)
Commissioner: Environment, Maritime Affairs and Fisheries *Karmenu Vella*	Environment (DG ENV) Maritime Affairs and Fisheries (DG MARE) The relevant parts of the Executive Agency for Small and Medium-Sized Enterprises (EASME)
Commissioner: Humanitarian Aid & Crisis Management *Christos Stylianides*	European Civil Protection and Humanitarian Aid Operations (DG ECHO) The relevant part of the Education, Audiovisual and Culture Executive Agency (EACEA)
Commissioner: European Neighbourhood Policy & Enlargement Negotiations *Johannes Hahn*	European Neighbourhood Policy and Enlargement Negotiations (DG NEAR)
Commissioner: Health & Food Safety *Vytenis Andriukaitis*	Health and Food Safety (DG SANTE) The relevant parts of the Consumers, Health and Food Executive Agency (CHAFEA)
Commissioner: Budget & Human Resources *Günther H. Oettinger*	DG Budget (BUDG) DG Human Resources and Security (HR)

Commissioner	DGs and Services
	European Anti-Fraud Office (OLAF) DG Translation (DGT) DG Interpretation (SCIC) The office for the administration and payment of individual entitlements (PMO) The office for infrastructure and logistics in Brussels (OIB) The office for infrastructure and logistics in Luxembourg (OIL)
Commissioner: Internal Market, Industry, Entrepreneurship and SMEs *Elżbieta Bieńkowska*	Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) The relevant parts of the Executive Agency for Small and Medium-Sized Enterprises (EASME) The relevant parts of the Research Executive Agency (REA)
Commissioner: International Cooperation & Development *Neven Mimica*	International Cooperation and Development (DG DEVCO)
Commissioner: Justice, Consumers and Gender Equality *Věra Jourová*	Justice and Consumers (DG JUST) The relevant parts of the Consumer, Health and Food Executive Agency (CHAFEA)
Commissioner: Migration, Home Affairs and Citizenship *Dimitris Avramopoulos*	Migration and Home Affairs (DG HOME) The relevant parts of the Research Executive Agency (REA)
Commissioner: Security Union *Julian King*	Migration and Home Affairs (DG HOME)
Commissioner: Transport *Violeta Bulc*	Mobility and Transport (DG MOVE) The relevant parts of the Innovation and Networks Executive Agency (INEA)
Commissioner: Regional Policy *Corina Crețu*	Regional and Urban Policy (DG REGIO)
Commissioner: Trade *Cecilia Malmström*	Trade (DG TRADE)
Commissioner: Research, Science and Innovation *Carlos Moedas*	Research and Innovation (DG RTD) The relevant parts of the Research Executive Agency (REA) The relevant parts of the European Research Council Executive agency (ERCEA) The relevant parts of the Innovation and Networks Executive agency (INEA) The relevant parts of the Executive Agency for Small and Medium-sized Enterprises (EASME)

Fig. 12: The memberships of the various Commissioners in the "project teams" led by Vice-Presidents in Juncker Commission

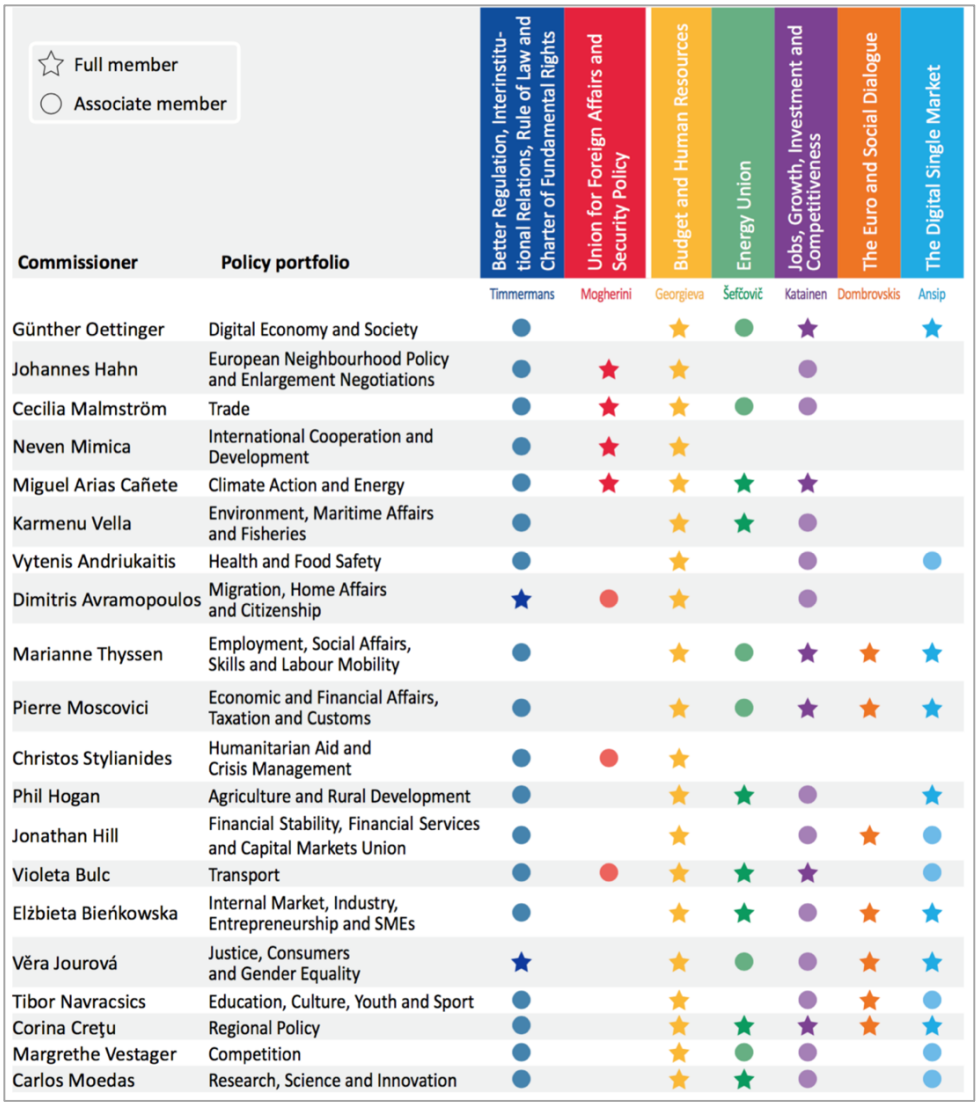


Table 18: The Commissioners responsible for the "Research" portfolio, under its various denominations (in the period 1970-1973 Altiero Spinelli was Commissioner for Industry and Technology, cf. Table 19)

Commissioner	Nationality	Commission	Period	Responsibilities
Fritz Hellwig	West Germany	Rey Commission	1967 – 1970	Research and Technology JRC, Distribution of Information
Ralf Dahrendorf	West Germany	Ortoli Commission	1973 – 1977	Research, Science, Education JRC, Statistical Office, S&T Information
Guido Brunner	West Germany	Jenkins Commission	1977 – 1981	Research, Science Energy, Euratom Supply Agency, Education, Scientific Information, JRC
Étienne Davignon	Belgium	Thorn Commission	1981 – 1985	Research, Science JRC, Industrial Affairs, Energy, Euratom Supply Agency
Karl-Heinz Narjes	Germany	Delors Commission I	1985 – 1989	Research, Science Information Technology, industrial Affairs, JRC
Filippo Maria Pandolfi	Italy	Delors Commission II	1989 – 1993	Science, research, development

Commissioner	Nationality	Commission	Period	Responsibilities
				JRC, Telecommunications, information technology and innovation
Antonio Ruberti	Italy	Delors Commission III	1993 – 1995	Science, research, technological development JRC, Human Resources, Education, Training and Youth
Édith Cresson	Spain	Santer Commission	1995 – 1999	Research, Science and Technology JRC, Human Resources, Education, Training and Youth
Philippe Busquin	Belgium	Prodi Commission	1999 – 2004	Research JRC
Louis Michel	Belgium	Prodi Commission	2004	Research JRC
Janez Potočnik	Slovenia	Barroso Commission I	2004 – 2010	Science and Research JRC
Máire Geoghegan-Quinn	Ireland	Barroso Commission II	2010 – 2014	Research, Innovation and Science
Carlos Moedas	Portugal	Juncker Commission	2014 –	Research, Science and Innovation

Table 19: The Commissioners responsible of the "Industry" portfolio

Commissioner	Nationality	Commission	Period	Responsibilities
Guido Colonna di Paliano	Italy	Rey Commission	1967 - 1970	Industrial Affairs
Altiero Spinelli	Italy	Malfatti Commission Mansholt Commission Ortoli Commission	1970 – 1977	Industry and Technology Training and Education, JRC, Customs Union (1970-1973)[122]
Étienne Davignon	Belgium	Jenkins Commission Thorn Commission	1977 - 1985	Industrial Affairs Internal Market, Customs Union (1977-1981) Energy Euratom Supply Agency Research, Science Joint Research Centre (1981-1985)
Karl-Heinz Narjes	Germany	Thorn Commission	1981 – 1985	Industrial Innovation Internal Market, Customs Union, Environment, Consumer Protection, Nuclear Safety
Karl-Heinz Narjes	Germany	Delors Commission I	1985 – 1989	Industrial Affairs Information Technology, Research, Science, JRC
Martin Bangemann	Germany	Delors Commission II Delors Commission III Santer Commission	1989 - 1999	Industrial Affairs Internal Market, Relations with Parliament (1989-1993) Information Technologies and Telecommunications (1993-1999)

[122] during Ortoli Commission (1973-1977) Altiero Spinelli maintained the "Industry and Technology" portfolio, but the other responsibilities were re-assigned: Education and JRC went to Dahrendorf (cf. Table 18)

Commissioner	Nationality	Commission	Period	Responsibilities
Erkki Liikanen	Finland	Prodi Commission	1999 – 30 may 2004	Enterprise Information Society
Olli Rehn	Finland	Prodi Commission	12 July – 21 November 2004	Enterprise Information Society
Günter Verheugen	Germany	Barroso Commission I	22 November 2004 – 2010	Enterprise and Industry
Antonio Tajani	Italy	Barroso Commission II	2010 – 30 June 2014	Industry and Entrepreneurship
Ferdinando Nelli Feroci	Italy	Barroso Commission II	1 July 2014 – 31 October 2014	Industry and Entrepreneurship
Elżbieta Bieńkowska	Poland	Juncker Commission	2014 -	Internal Market, Industry, Entrepreneurship and SMEs

Fig. 13: The «Ordinary Legislative Procedure», as explained in the European Parliament website *(EP, n.d.-a)*

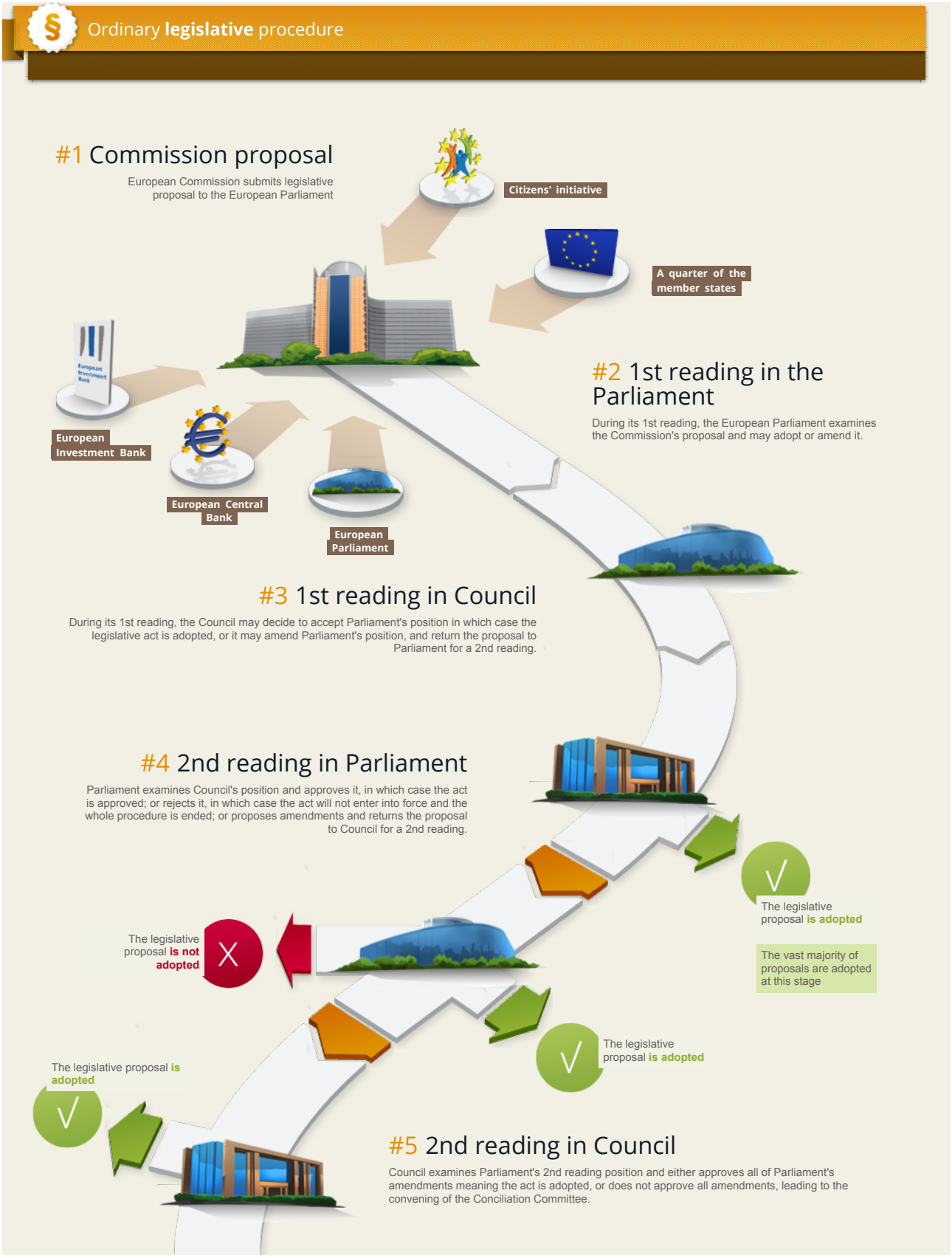


Fig. 14: The «Ordinary Legislative Procedure», as explained in the European Parliament website (continues from previous page) *(EP, n.d.-a)*

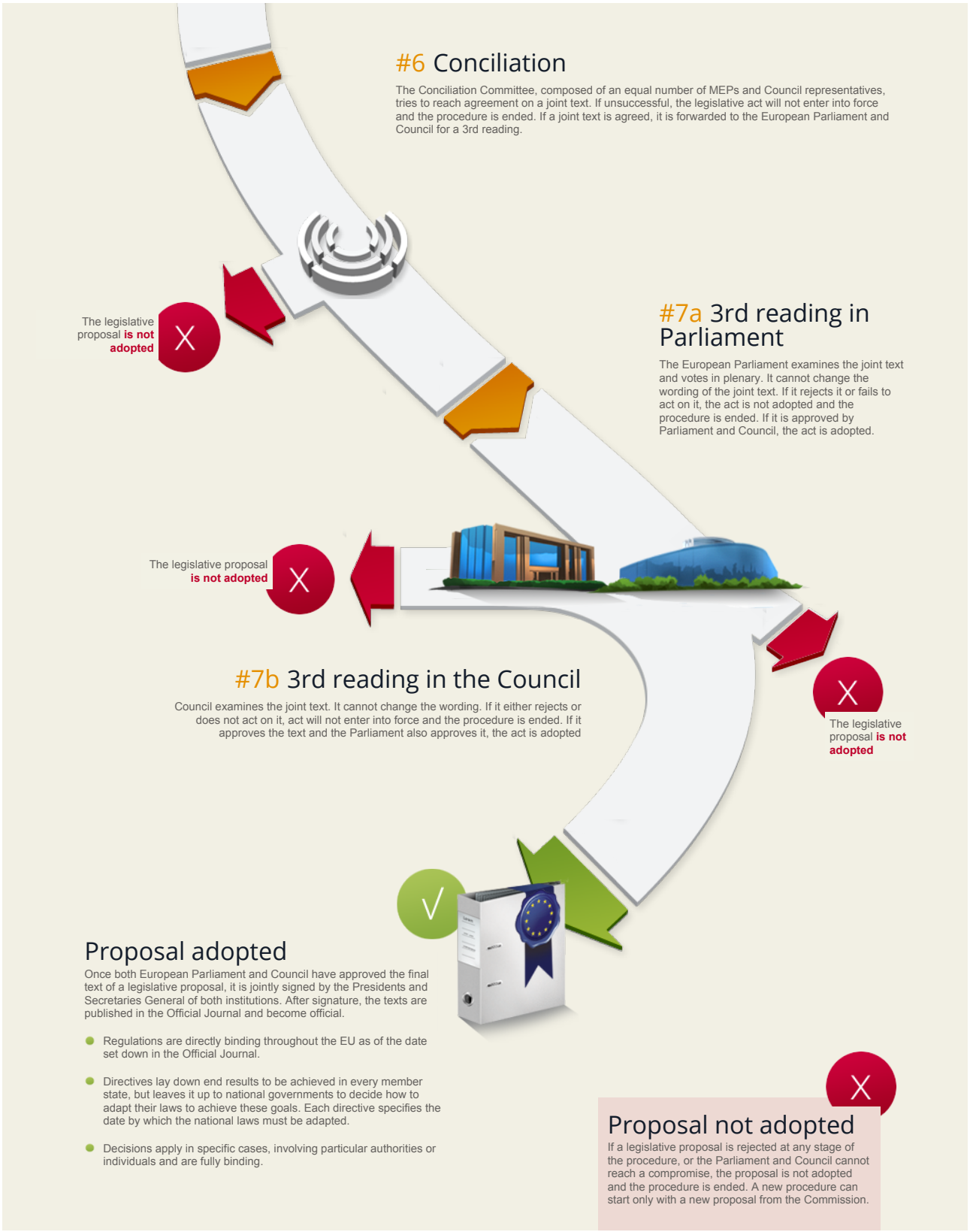


Fig. 15: The structure of FP7 (source: European Parliament Research service *(EPRS & Reillon, 2015)*)

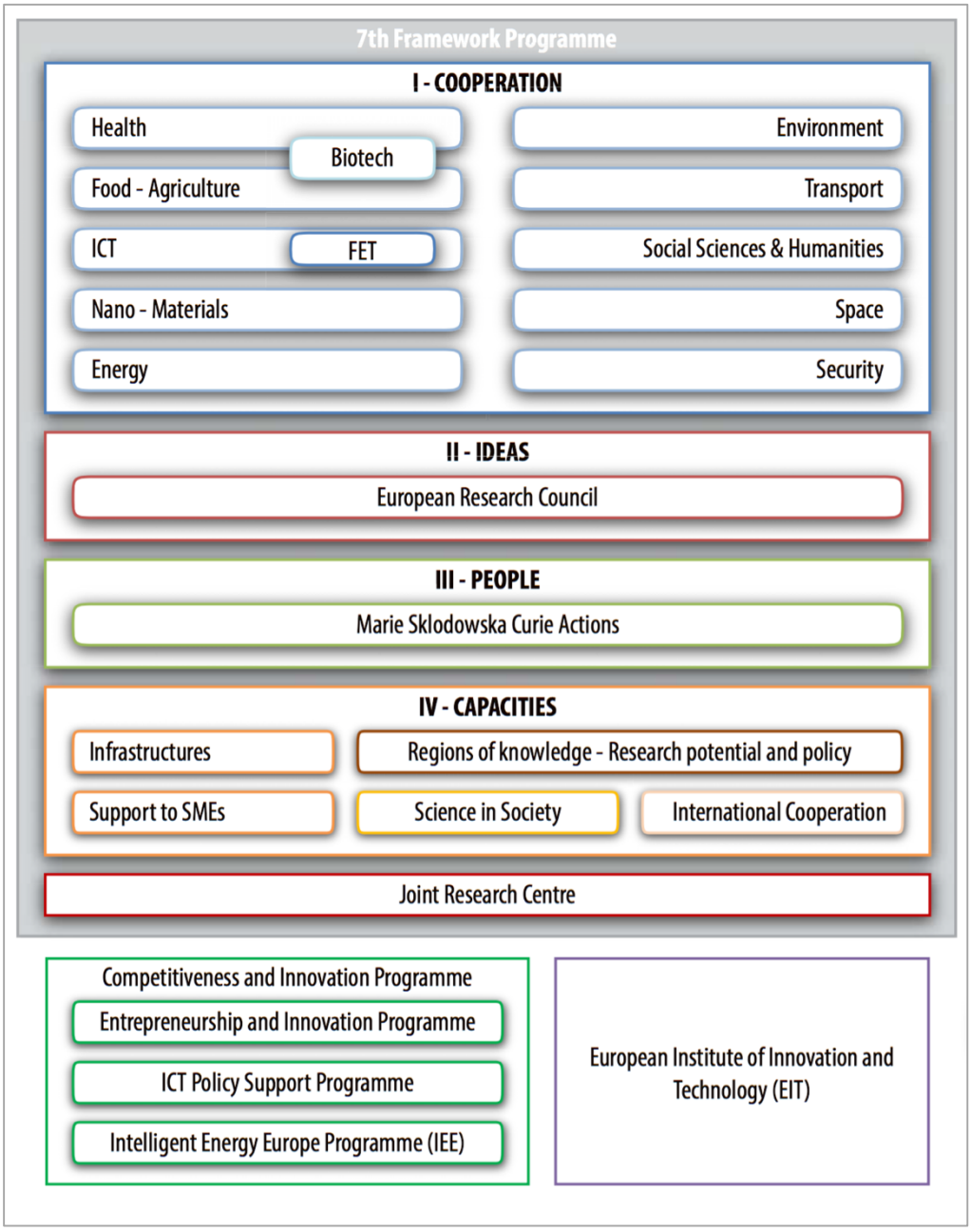


Fig. 16: The structure of Horizon 2020 (source: European Parliament Research service *(EPRS & Reillon, 2015)*)

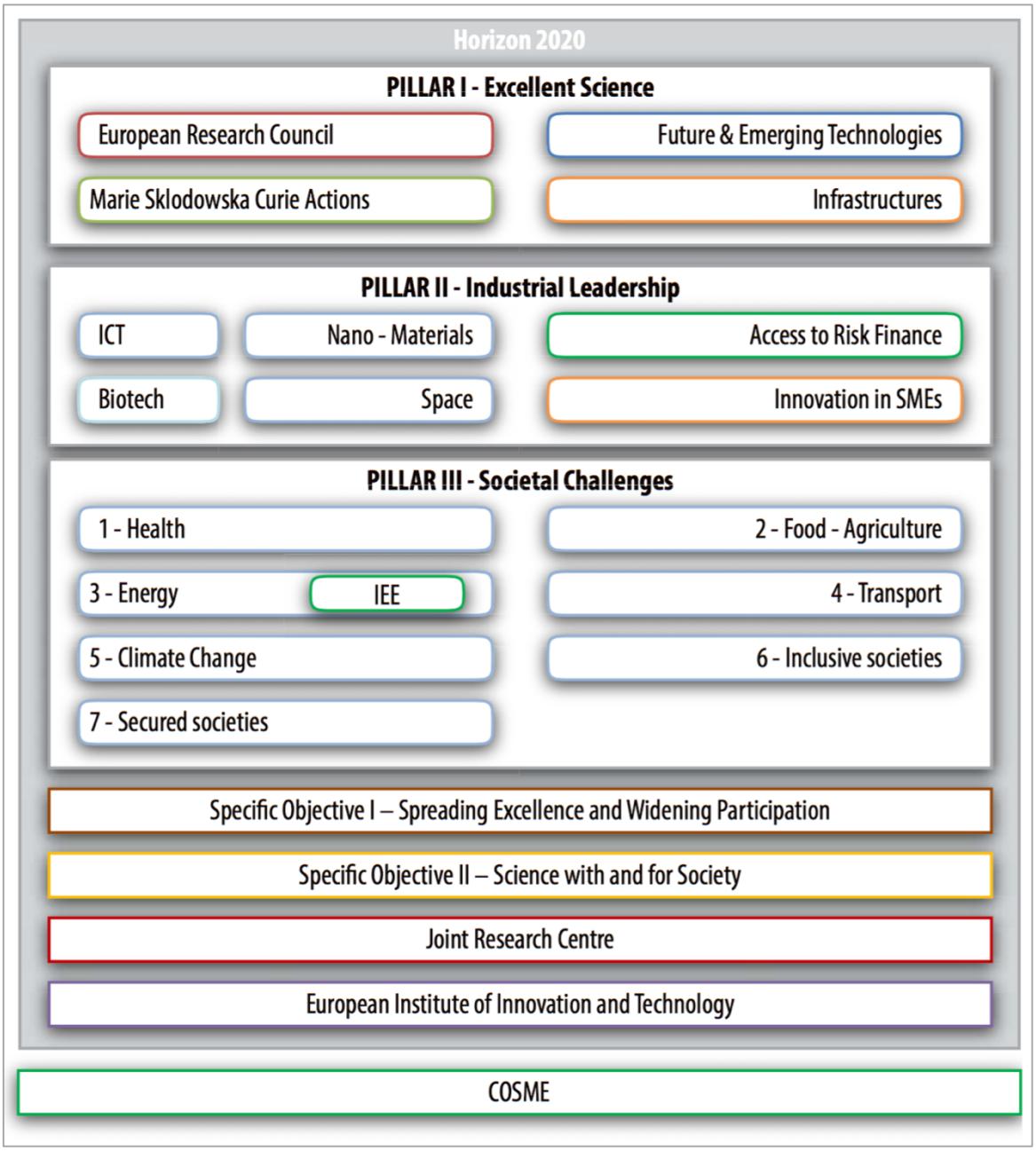


Fig. 17: The environmental challenges, as compared by a «2004 review of nine recent comprehensive analyses of global environmental problems», in a table reported in the 2006 book "A New Deal for an Effective European Research Policy" *(Muldur et al. 2006, pp.16–17, reference to the original paper at the bottom of the table)*

Table 1.1. What are the main environmental challenges?

Source	Major problems							
	Water quality and access	Climate change	Biodiversity	Indoor air quality	Air pollution	Food production/soil degradation	Over-fishing	Deforestation
World Resources Institute *et al.*, World Resources 2000–2001: People and Ecosystems. Washington, D.C.:WRI 2000.	■	■	■		♦	♦	♦	♦
Organisation for Economic Co-operation and Development, Environmental Outlook, Paris: OECD, 2001.	■	■	■		♦	♦	■	■
The World Bank. World Development Report 2003: Sustainable Development in a Dynamic World. New York: World Bank, 2003.	■	■	■		■	■	■	■
Ehrlich, Paul and Anne Ehrlich. One With Niveneh: Politics, Consumption, and the Human Future. Washington, DC: Island Press, 2004.	■	■	■		♦	♦	■	♦
Speth, James Gustave, Red Sky at Morning: America and the Crisis of the Global Environment. New Haven: Yale Univ. Press, 2004.	■	■	■		♦	♦	♦	
United Nation Environment Program. Global Environment Oultook: Past, Present, and Future Perspectives. London: Earthscan, 2002.	■	■	■			♦	♦	♦
Central Intelligence Agency, Global Trends 2015: A Dialogues About the Future with Nongovernmental Experts. Washington, D.C.: CIA, 2000.	■	■	■		♦	■		♦
National Advisory Council for Environmental Policy and Technology (NACEPT). The environmental Futures: Emerging Challenges and opportunities for EPA. Washington, D.C.: NACEPT, 2002.	■	■	■	■	♦			
Brown, Lester R. Plan B: Rescuing a Planet Under Stress and a Civilization in Trouble. New York: W.W. Norton, 2003.	■	■			♦	■	♦	♦

■ Problem is a serious threat to the global environment and continued economic development.
♦ Problem is a threat to the global environment.
Source: Robert L. Olson and Jessica Biamonte, New Global Agenda, 2004.

Fig. 18: The stakeholders' consultation tools, or methods, as summarised in *Muldur et al. 2006, p.150* for FP7, on the left, and in *EC 2012b, p.12* for Horizon 2020 on the right.

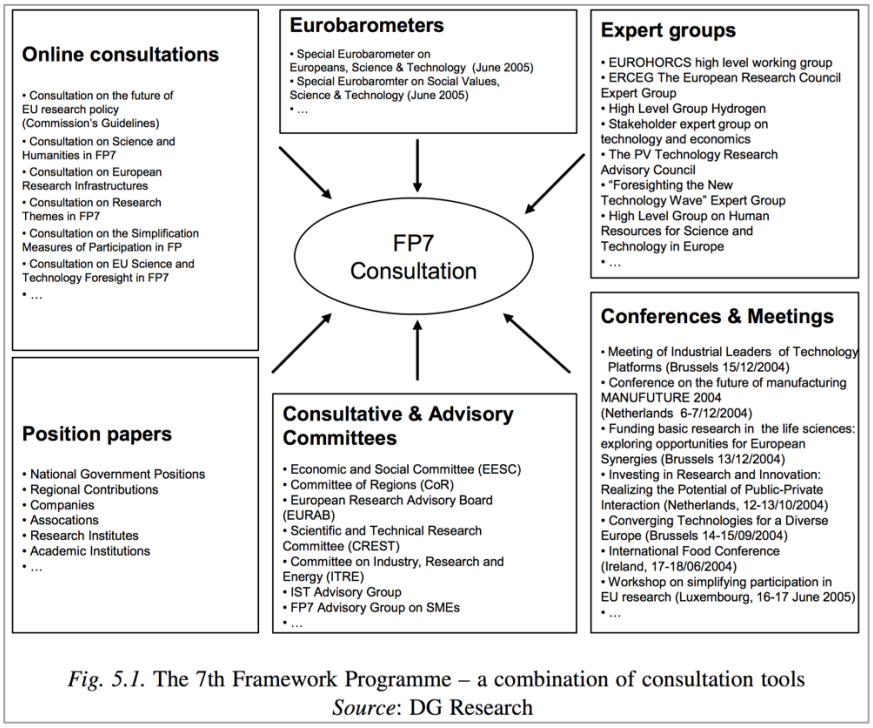


Fig. 5.1. The 7th Framework Programme – a combination of consultation tools
Source: DG Research

Fig. 19: The share of EU budget devoted to agriculture in the period 1985-2008 (source *(Lyon, 2010)*)

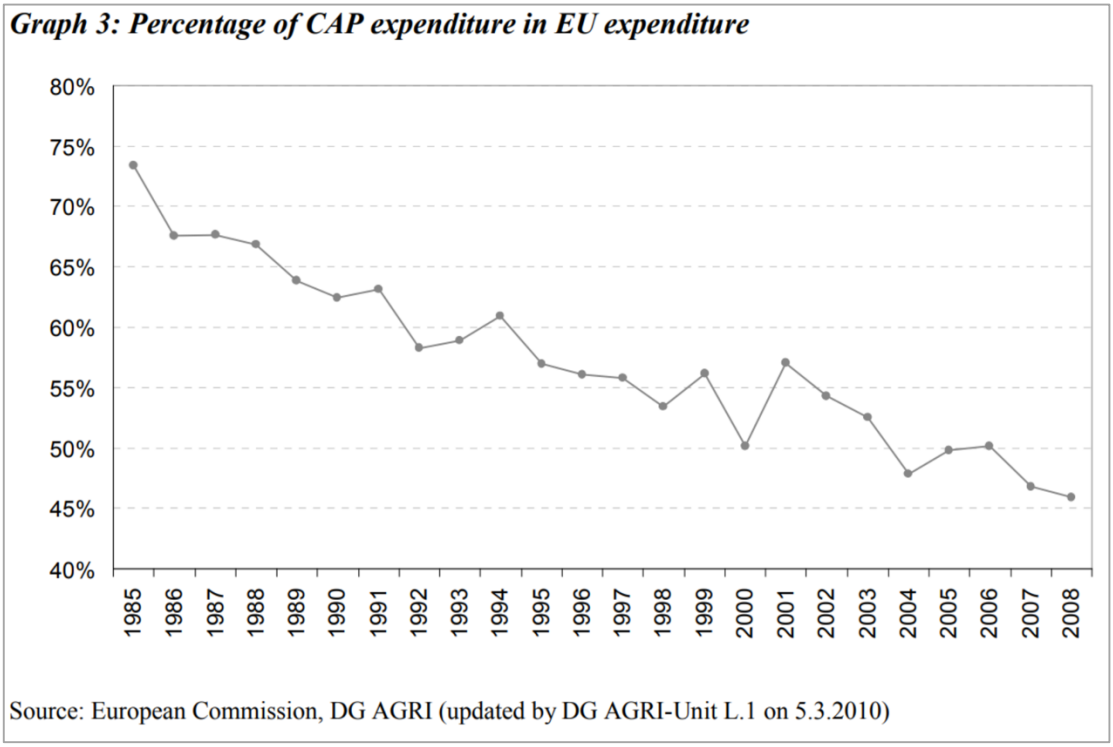


Fig. 20: The First Framework Programme objectives and budget breakdown (source: CEU, 1990)

ANNEX III

Financial indications by objectives (1984 to 1987)

	(million ECU (1))	*(%)*
1. Promoting agricultural competitiveness:	130	3,5
— developing agricultural productivity and improving products:		
— agriculture	115	
— fisheries	15	
2. Promoting industrial competitiveness:	1 060	28,2
— removing and reducing barriers	30	
— new techniques and products for the traditional industries	350	
— new technologies	680	
3. Improving the management of raw materials	80	2,1
4. Improving the management of energy resources:	1 770	47,2
— developing nuclear fission energy	460	
— controlled thermonuclear fusion	480	
— developing renewable energy sources	310	
— rational use of energy	520	
5. Stepping up development aid	150	4,0
6. Improving living and working conditions:	385	10,3
— improving safety and protecting health	190	
— protecting the environment	195	
7. Improving the effectiveness of the Community's scientific and technical potential:	85	2,3 (2)
horizontal action	90	2,4
	3 750	100,0

(1) At 1982 constant values.
(2) Corresponds to 5 % by the end of the period.

Fig. 21: The Second Framework Programme objectives and budget breakdown (source: EP & CEU, 1994)

ANNEX I

FRAMEWORK PROGRAMME OF COMMUNITY ACTIVITIES IN THE FIELD OF RESEARCH AND TECHNOLOGICAL DEVELOPMENT (1987 to 1991)

Breakdown of the amount deemed necessary between the various activities envisaged

		(million ECU)	
1.	**Quality of life**		375
1.1.	Health	80	
1.2.	Radiation protection	34	
1.3.	Environment	261	
2.	**Towards a large market and an information and communications society**		2 275
2.1.	Information technologies	1 600	
2.2.	Telecommunications	550	
2.3.	New services of common interest (including transport)	125	
3.	**Modernization of industrial sectors**		845
3.1.	Science and technology for manufacturing industry	400	
3.2.	Science and technology of advanced materials	220	
3.3.	Raw materials and recycling	45	
3.4.	Technical standards, measurement methods and reference materials	180	
4.	**Exploitation and optimum use of biological resources**		280
4.1.	Biotechnology	120	
4.2.	Agro-industrial technologies	105	
4.3.	Competitiveness of agriculture and management of agricultural resources	55	
5.	**Energy**		1 173
5.1.	Fission: nuclear safety	440	
5.2.	Controlled thermonuclear fusion	611	
5.3.	Non-nuclear energies and rational use of energy	122	
6.	**Science and technology for development**	80	80
7.	**Exploitation of the sea bed and use of marine resources**		80
7.1.	Marine science and technology	50	
7.2.	Fisheries	30	
8.	**Improvement of European S/T cooperation**		288
8.1.	Stimulation, enhancement and use of human resources	180	
8.2.	Use of major installations	30	
8.3.	Forecasting and assessment and other back-up measures (including statistics)	23	
8.4.	Dissemination and utilization of S/T research results	55	
	Total		5 396

Fig. 22: The Third Framework Programme objectives and budget breakdown (source: EP & CEU, 1998)

ANNEX I

BREAKDOWN OF THE AMOUNTS DEEMED NECESSARY TO IMPLEMENT THE VARIOUS ACTIVITIES ENVISAGED

(in millions of ecus)

	1990—92	1993—94	Total
I. ENABLING TECHNOLOGIES			
1. Information and communications technologies	**974**	**1 247**	**2 221**
— Information technologies	1 352		
— Communications technologies	489		
— Development of telematics systems of general interest	380		
2. Industrial and materials technologies	**390**	**498**	**888**
— Industrial and materials technologies	748		
— Measurement and testing	140		
II. MANAGEMENT OF NATURAL RESOURCES			
3. Environment	**227**	**291**	**518**
— Environment	414		
— Marine sciences and technologies	104		
4. Life sciences and technologies	**325**	**416**	**741**
— Biotechnology	164		
— Agricultural and agro-industrial research (1)	333		
— Biomedical and health research	133		
— Life sciences and technologies for developing countries	111		
5. Energy	**357**	**457**	**814**
— Non-nuclear energies	157		
— Nuclear fission safety	199		
— Controlled nuclear fusion	458		
III. MANAGEMENT OF INTELLECTUAL RESOURCES			
6. Human capital and mobility	**227**	**291**	**518**
— Human capital and mobility	518		
TOTAL	2 500	3 200	5 700 (2)(3)

(1) Including fisheries.
(2) Including ECU 57 million for the centralized action of dissemination and exploitation provided for in Article 4, drawn proportionally from each activity.
(3) Including ECU 180 million for 1990—92 and ECU 370 million for 1993—94 for the Joint Research Centre.

Fig. 23: The Fourth Framework Programme objectives and budget breakdown (source: EP & CEU, 1998, page 1/2)

ANNEX I

FOURTH FRAMEWORK PROGRAMME (1994 to 1998):
AMOUNTS AND BREAKDOWN

	Ecu million (current prices)
First activity (Research, technological development and demonstration programmes)	9 432 (1) (2)
Second activity (Cooperation with third countries and international organizations)	540
Third activity (Dissemination and optimization of results)	330 (3) (4)
Fourth activity (Stimulation of the training and mobility of researchers)	744
MAXIMUM OVERALL AMOUNT	11 046 (5) (6)

Indicative breakdown of the themes and subjects in the first activity		*ECU million (current prices)*
A. Information and communication technologies		**3 405**
1. Telematics	843	
2. Communication technologies	630	
3. Information technologies	1 932	
B. Industrial technologies		**1 995**
4. Industrial and material technologies	1 707	
5. Measurements and testing	288	
C. Environment		**1 080** (7)
6. Environment and climate	852	
7. Marine sciences and technologies	228	
D. Life sciences and technologies		**1 572**
8. Biotechnology	552	
9. Biomedicine and health	336	
10. Agriculture and fisheries (including agro-industries, food technologies, forestry, aquaculture and rural development)	684	
E. 11. Non-nuclear energy		**1 002**
F. 12. Transport		**240**
G. 13. Targeted socio-economic research		**138**
		9 432 (1) (2)

(1) Of which ECU 600 million for the operational budget of the JRC.
(2) Of which ECU 91 million for programmed scientific and technical support activities suited to a competitive approach.
(3) Apart from the funds allocated to the third activity, an average of 1 % of the total budget of the fourth framework programme will be allocated to dissemination and optimization of results in the framework of the first activity. Close coordination of dissemination and optimization activities carried out under the specific programmes of the first activity with those carried out under the third activity will be ensured.
(4) Of which ECU 37 million for *ad hoc* scientific and technical support to other Community policies which will be allocated on a competitive basis.
(5) A framework programme for research and training for the European Atomic Energy Community (1994 to 1998) is decided along with this programme, for a total of ECU 1 254 million, taking the total for Community RTD activity to ECU 12 300 million.
(6) With the possibility of an increase to ECU 11 641 million, in accordance with Article 1 (3).
(7) Environment-related research projects will also be conducted within several other lines of the first activity, in particular in the fields of industrial technologies, energy and transport.

Fig. 24: The Fifth Framework Programme objectives and budget breakdown (source: EP & CEU, 1998, page 2/2)

ANNEX III

FIFTH FRAMEWORK PROGRAMME (1998 TO 2002)

AMOUNTS AND BREAKDOWN

	ECU million (current prices)
Indirect actions:	
— First activity	10 843 (1)
— Second activity	475
— Third activity	363
— Fourth activity	1 280
Direct actions (2)	739
Maximum overall amount	13 700
(1) Of which 10 % on average for SMEs. (2) To be carried out by the JRC.	

	(in million ECU)
Indicative breakdown between the themes of the first activity:	
— quality of life and management of living resources	2 413
— user-friendly information society	3 600
— competitive and sustainable growth	2 705
— energy, environment and sustainable development	
— environment and sustainable development	1 083
— energy	1 042
	10 843

Fig. 25: The Sixth Framework Programme objectives and budget breakdown (source: EP & CEU, 2006)

ANNEX II

MAXIMUM OVERALL AMOUNT, RESPECTIVE SHARES AND INDICATIVE BREAKDOWN

The maximum overall financial amount and the respective indicative shares of the various activities as referred to in Article 164 of the Treaty are as follows:

(EUR million)

First activity (1)	13 800
Second activity (2)	600
Third activity (3)	290
Fourth activity (4)	1 580
Maximum overall amount	16 270

(1) Covering the activities carried out under the heading 'Focusing and integrating Community research', with the exception of international cooperation activities; research infrastructures, and the theme 'Science and society' carried out under the heading 'Structuring the European Research Area' and activities carried out under the heading 'Strengthening the foundations of the European Research Area'.
(2) Covering the international cooperation activities carried out under the heading 'Focusing and integrating Community research ', in the thematic priority areas and under the heading 'Specific activities covering a wider field of research'.
(3) Covering the specific activities on the theme 'Research and innovation' carried out under the heading 'Structuring the European Research Area' in addition to innovation activities carried out under the heading 'Focusing and integrating Community research'.
(4) Covering the activities concerning human resources and support for mobility carried out under the heading 'Structuring the European Research Area'.

These activities will be carried out under the following headings (the indicative financial breakdown is set out):

(EUR million)

1. Focusing and integrating Community research			13 345
Thematic priorities (1)		11 285	
Life sciences, genomics and biotechnology for health (2)	2 255		
= Advanced genomics and its applications for health	1 100		
= Combating major diseases	1 155		
Information society technologies (3)	3 625		
Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices	1 300		
Aeronautics and space	1 075		
Food quality and safety	685		
Sustainable development, global change and ecosystems	2 120		
= Sustainable energy systems	810		
= Sustainable surface transport	610		
= Global change and ecosystems	700		
Citizens and governance in a knowledge-based society	225		

Fig. 26: The Sixth Framework Programme objectives and budget breakdown (source: EC, 2013b)

Specific activities covering a wider field of research		1 300	
Policy support and anticipating scientific and technological needs	555		
Horizontal research activities involving SMEs	430		
Specific measures in support of international cooperation	315		
Non-nuclear activities of the Joint Research Centre		760	
2. Structuring the European Research Area			2 605
Research and innovation	290		
Human resources	1 580		
Research infrastructures (4)	655		
Science and society	80		
3. Strengthening the foundations of the European Research Area			320
Support for the coordination of activities	270		
Support for the coherent development of policies	50		
TOTAL			16 270

(1) Of which at least 15 % for SMEs.
(2) Including up to EUR 400 million for cancer-related research.
(3) Including up to EUR 100 million for the further development of Géant and GRID.
(4) This amount of EUR 315 million will fund specific measures in support of international cooperation involving developing countries, Mediterranean countries including the western Balkans, and Russia and the New Independent States (NIS). Another EUR 285 million is earmarked to finance the participation of third-country organisations in the 'Thematic Priorities' and in the 'Specific activities covering a wider field of research', thus bringing the total amount devoted to international cooperation to EUR 600 million. Additional resources will be available under section 2.2 'Human resources and mobility' to fund research training for third-country researchers in Europe.
(5) Including up to EUR 200 million for the further development of Géant and GRID.

Fig. 27: The Seventh Framework Programme objectives and budget breakdown (see EC, 2017a)

ANNEX II

INDICATIVE BREAKDOWN AMONG PROGRAMMES

The indicative breakdown among programmes is as follows (in EUR million):

I. Cooperation (1) (2)	32 413
Health	6 100
Food, Agriculture and Fisheries, and Biotechnology	1 935
Information and Communication Technologies	9 050
Nano-sciences, Nano-technologies, Materials and new Production Technologies	3 475
Energy	2 350
Environment (including Climate Change)	1 890
Transport (including Aeronautics)	4 160
Socio-economic Sciences and the Humanities	623
Space	1 430
Security	1 400
II. Ideas	7 510
III. People	4 750
IV. Capacities	4 097
Research Infrastructures	1 715
Research for the benefit of SMEs	1 336
Regions of Knowledge	126
Research Potential	340
Science in Society	330
Coherent development of research policies	70
Activities of International Cooperation	180
V. Non-nuclear actions of the Joint Research Centre	1 751
TOTAL	50 521

(1) Including Joint Technology Initiatives (including financial plan, etc.) and the part of the coordination and international cooperation activities to be funded within the themes.
(2) The aim will be to enable at least 15 % of the funding available under the 'Cooperation' part of the programme to go to SMEs.

Special provisions concerning the Risk-Sharing Finance Facility (RSFF)

The indicative budgets for the 'Cooperation' and 'Capacities' programmes include contributions to the European Investment Bank (EIB) for the constitution of the RSFF referred to in Annex III. The Council decisions adopting the contributing specific programmes will establish, inter alia, the implementing arrangements under which the Commission will decide on the reallocation to other activities of the Framework Programme of the Community contribution to the RSFF and the income it generates that are not used by the EIB.

The Seventh Framework Programme will contribute an amount of up to EUR 500 million to the RSFF until 2010. For the period 2010-2013, there will be the possibility to release up to an additional EUR 500 million following the evaluation of the European Parliament and the Council in accordance with the procedure set out in Article 7(2) of this Decision on the basis of a report by the Commission containing information on the participation of SMEs and universities, the fulfilment of the Seventh Framework Programme selection criteria, the kind of projects supported and the demand for the instrument concerned, the duration of the authorisation procedure, the project results, and the funding distribution.

Table 20: The budget breakdown of Horizon 2020 (EC, 2013b).

Horizon 2020 (2014-2020)	Final breakdown	Estimated final amount in million euro (in current prices)
I Excellent science	**31,73%**	**24441**
1. The European Research Council	17%	13095
2. Future and Emerging Technologies	3,5%	2696
3. Marie-Skłodowska-Curie Actions	8%	6162
4. European research infrastructures (including e-Infrastructures)	3,23%	2488
II Industrial leadership	**22,09%**	**17016**
1. Leadership in enabling and industrial technologies	17,6%	13557
2. Access to risk finance	3,69%	2842
3. Innovation in SMEs	0,8%	616
III Societal challenges	**38,53%**	**29679**
1. Health, demographic change and wellbeing	9,7%	7472
2. Food security, sustainable agriculture and forestry, marine maritime and inland water research and the Bioeconomy	5%	3851
3. Secure, clean and efficient energy	7,7%	5931
4. Smart, green and integrated transport	8,23%	6339
5. Climate action, environment resource efficiency and raw materials	4%	3081
6. Europe in a changing world - Inclusive innovative and reflective societies	1,7%	1309
7. Secure societies – Protecting freedom and security of Europe and its citizens	2,2%	1695
Science with and for society	0,6%	462
Spreading excellence and widening participation	1,06%	816
European Institute of Innovation and Technology (EIT)	3,52%	2711
Non-nuclear direct actions of the JRC	2,47%	1903
TOTAL EU REGULATION	**100%**	**77028**

Fig. 28: The Horizon 2020 budget breakdown

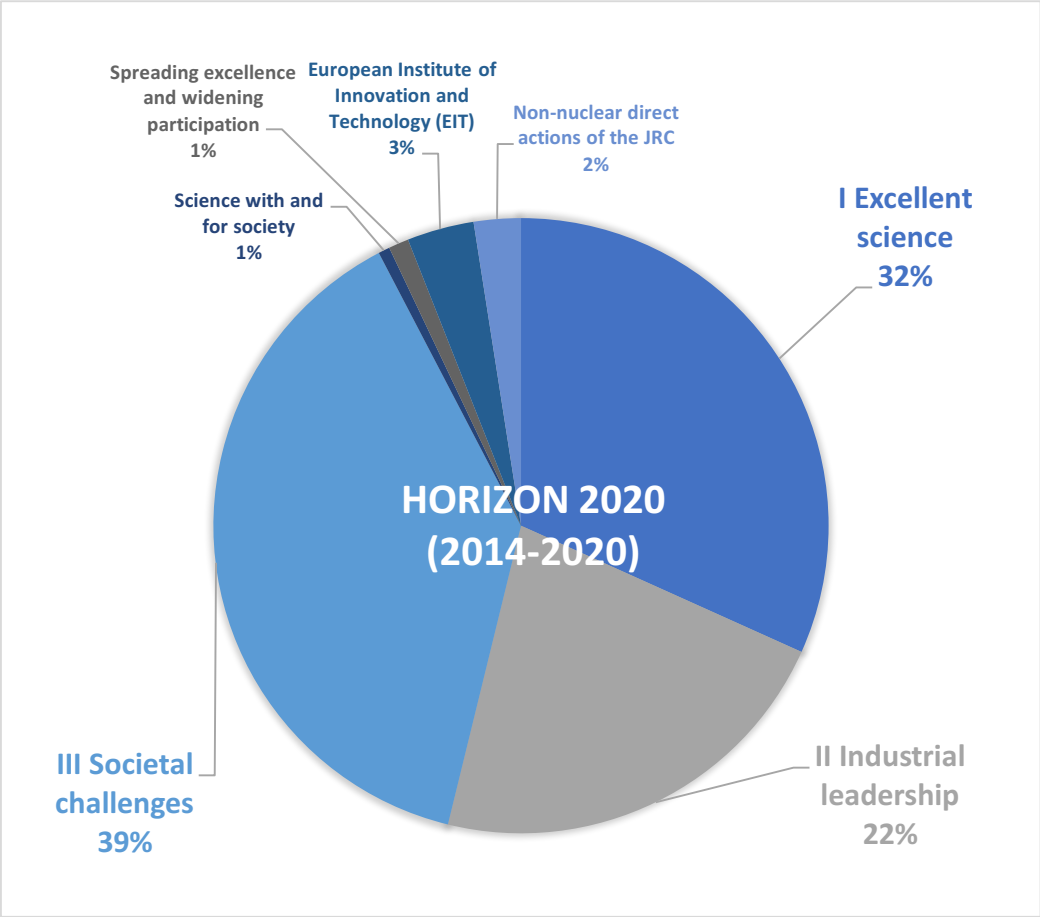


Fig. 29:The budget for Horizon 2020 shared by the different involved Directorates (source: *(EPRS & Reillon, 2015)*)

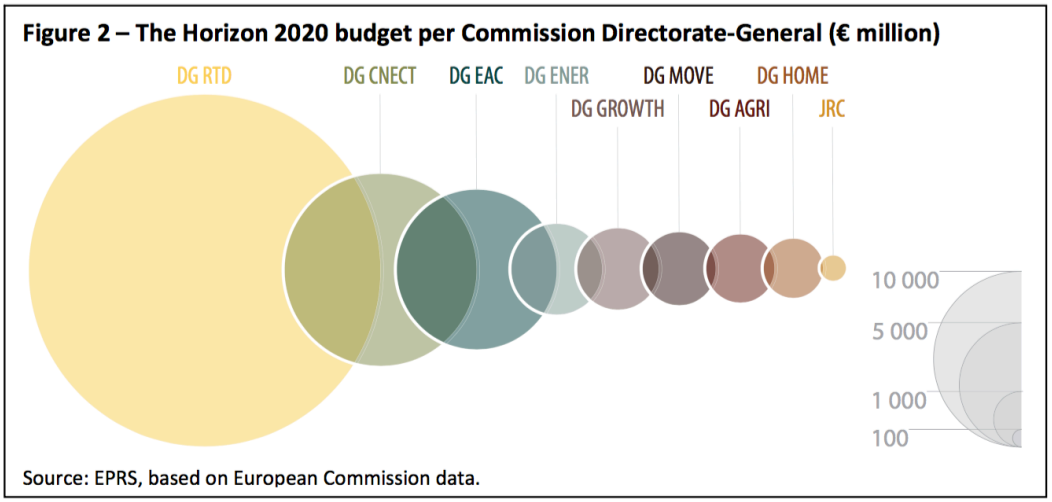


Fig. 30: The evolution in the Framework Programmes of the occurrences of the family of words related to innovation[123]. The occurrences are showed normalized to the total number of words of each document; the numbers in the horizontal axis refer to the FP number – 8 stands for H2020.

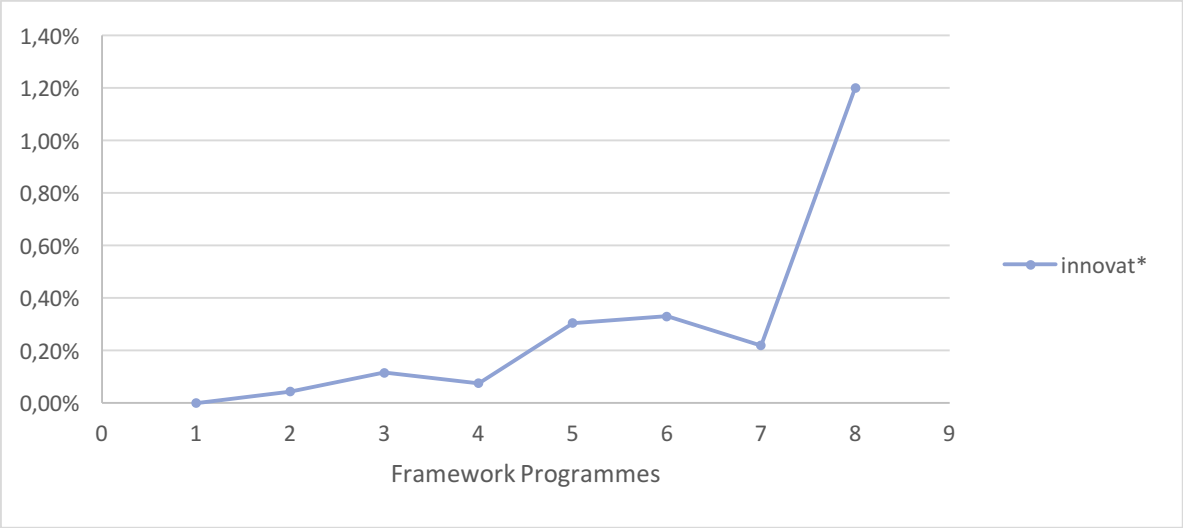
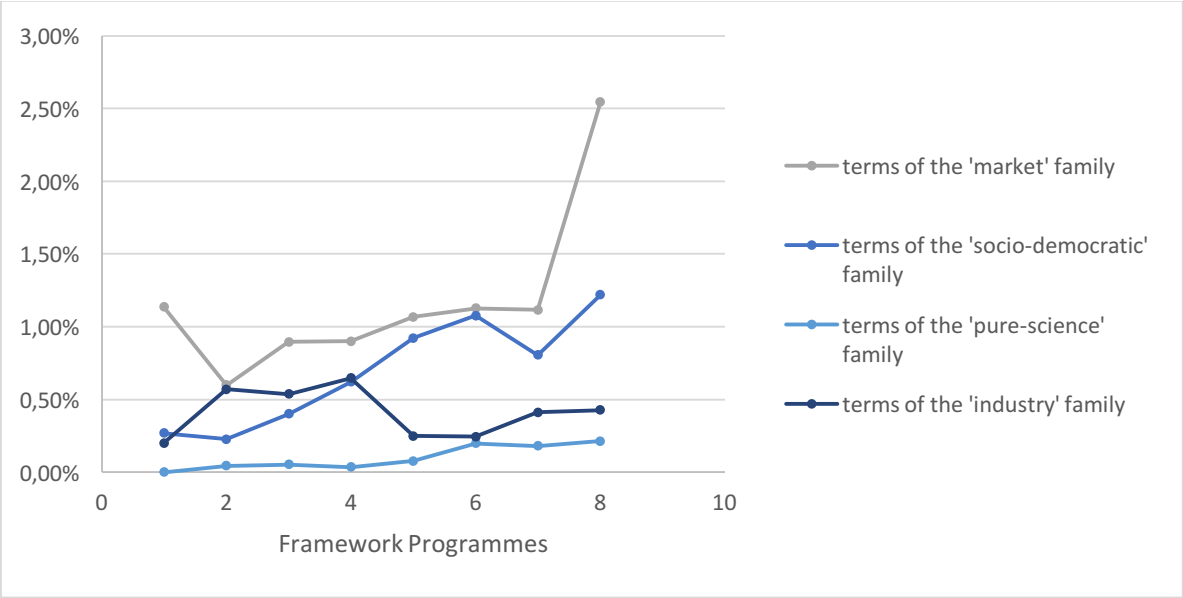


Fig. 31: The evolution, in the Framework Programmes establishing acts, of the "market", "socio-democratic", "pure-science" and "industry" families of terms; the occurrences are showed normalized to the total number of words of each document; the numbers in the horizontal axis refer to the FP number – 8 stands for H2020 (see footnote 80 for more details).



[123] The asterisk means that all the word endings are included.

Fig. 32: The relative frequencies of the terms "consumer", "worker", "user", and of the words referring to "citizen" in the Framework Programmes establishing documents.

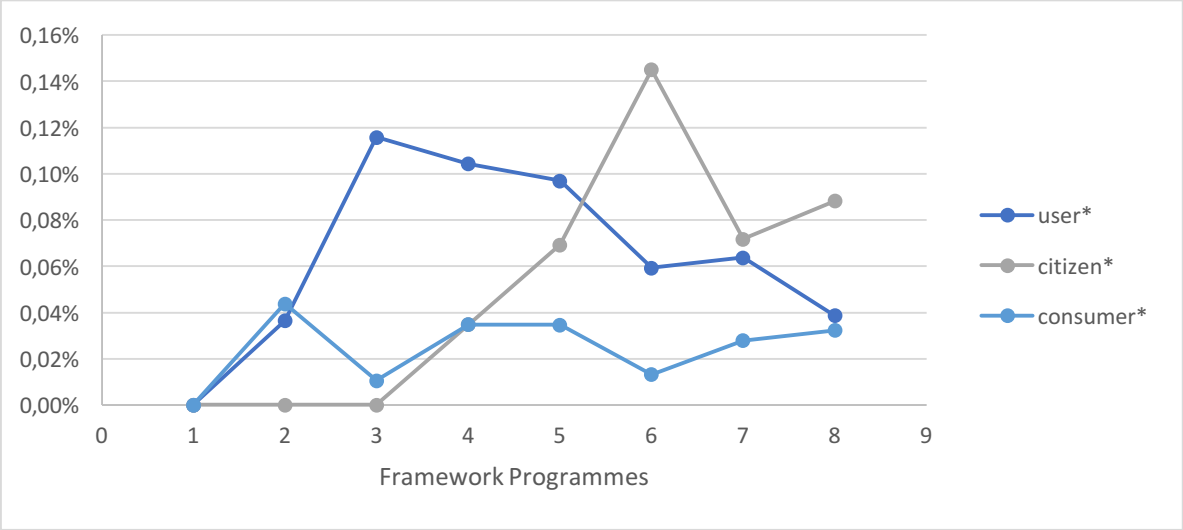


Fig. 33: Infographics on the «key performance indicators for Horizon 2020», from the Commission brochure *Horizon 2020 – two years on* (EC, 2016g).

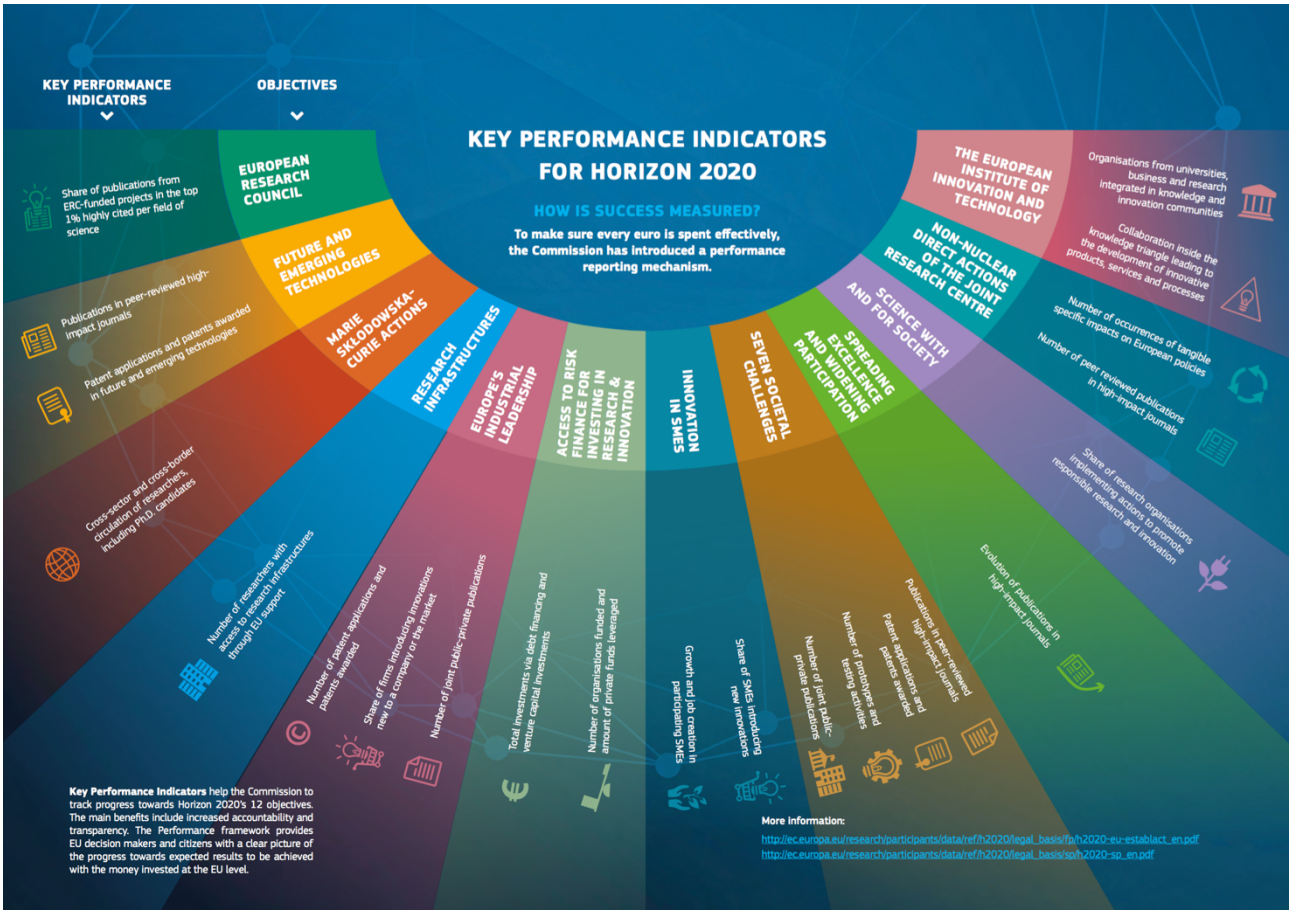


Fig. 34: The photograms associated with the sentence: «That's why we want to turn the European Union in an Innovation Union, the plan to get good ideas to market faster, to boost the economy, create jobs and improve lives» in the introductory video "Horizon2020 – General overview" *(EC, 2014e)*.

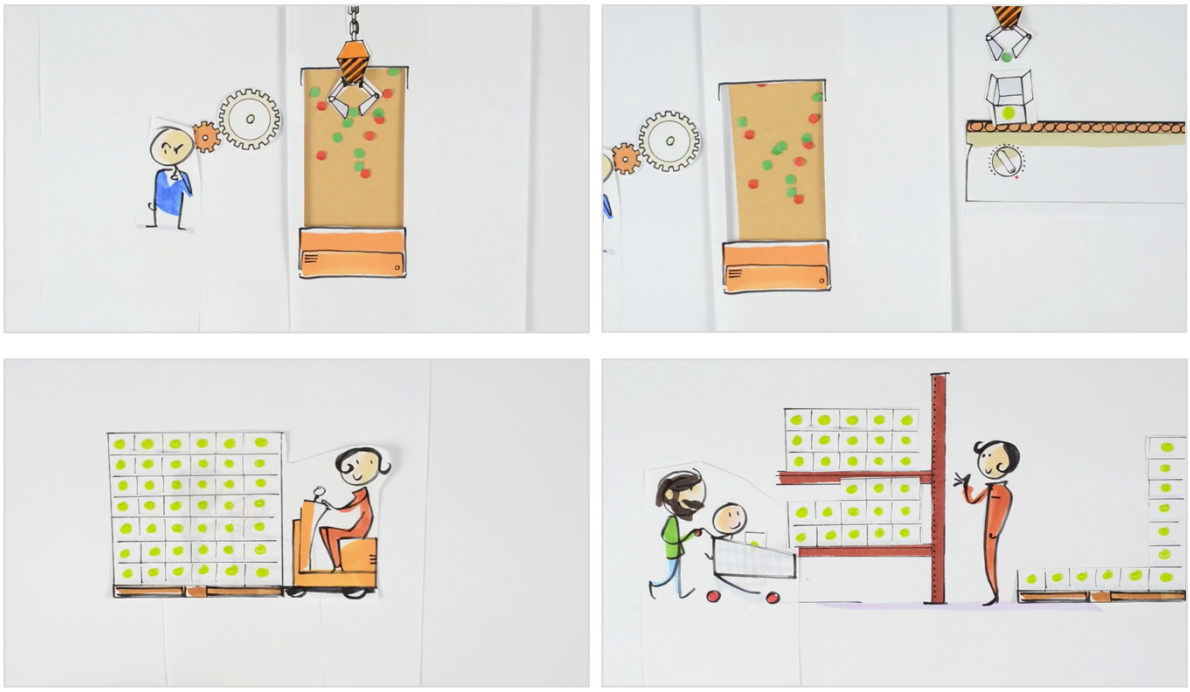


Fig. 35: The «underlying causes that lead to an insufficient consideration of ethical aspects and societal needs in research and innovation», in a graph taken from *(van den Hoven et al., 2013)*.

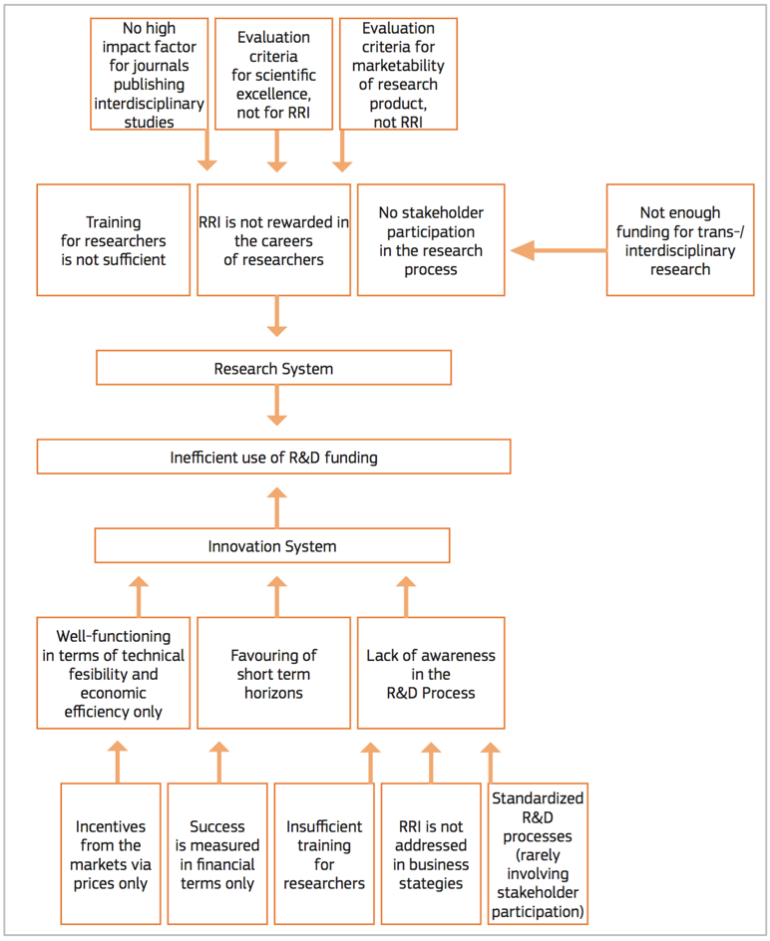
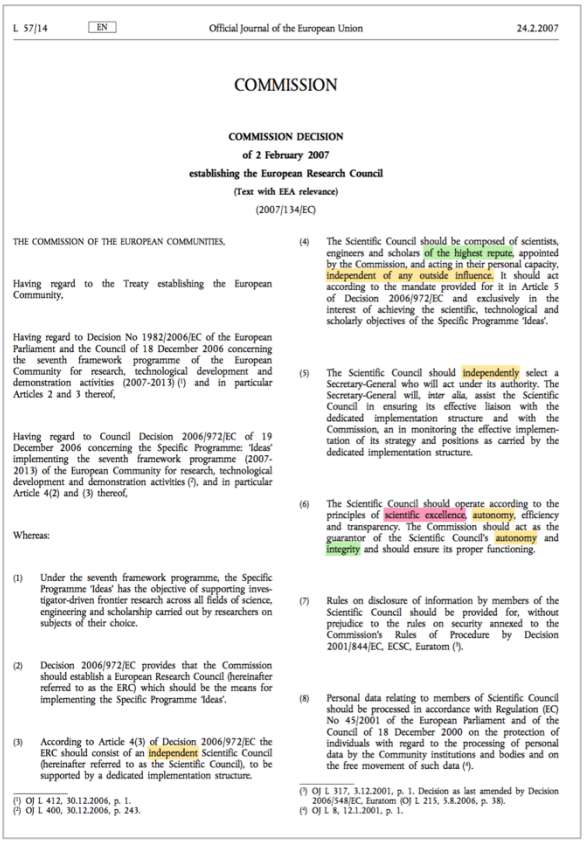


Fig. 36: The 2007 Commission decision establishing the European Research Council (CEC, 2007b); highlighted in yellow the terms connected to independency and autonomy, in pink the mention to excellence, in green the expressions linked to integrity and reputation.



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COMMISSION

COMMISSION DECISION
of 2 February 2007
establishing the European Research Council
(Text with EEA relevance)
(2007/134/EC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Decision No 1982/2006/EC of the European Parliament and the Council of 18 December 2006 concerning the seventh framework programme of the European Community for research, technological development and demonstration activities (2007-2013) [1] and in particular Articles 2 and 3 thereof,

Having regard to Council Decision 2006/972/EC of 19 December 2006 concerning the Specific Programme: 'Ideas' implementing the seventh framework programme (2007-2013) of the European Community for research, technological development and demonstration activities [2], and in particular Article 4(2) and (3) thereof,

Whereas:

(1) Under the seventh framework programme, the Specific Programme 'Ideas' has the objective of supporting investigator-driven frontier research across all fields of science, engineering and scholarship carried out by researchers on subjects of their choice.

(2) Decision 2006/972/EC provides that the Commission should establish a European Research Council (hereinafter referred to as the ERC) which should be the means for implementing the Specific Programme 'Ideas'.

(3) According to Article 4(3) of Decision 2006/972/EC the ERC should consist of an independent Scientific Council (hereinafter referred to as the Scientific Council), to be supported by a dedicated implementation structure.

(4) The Scientific Council should be composed of scientists, engineers and scholars of the highest repute, appointed by the Commission, and acting in their personal capacity, independent of any outside influence. It should act according to the mandate provided for it in Article 5 of Decision 2006/972/EC and exclusively in the interest of achieving the scientific, technological and scholarly objectives of the Specific Programme 'Ideas'.

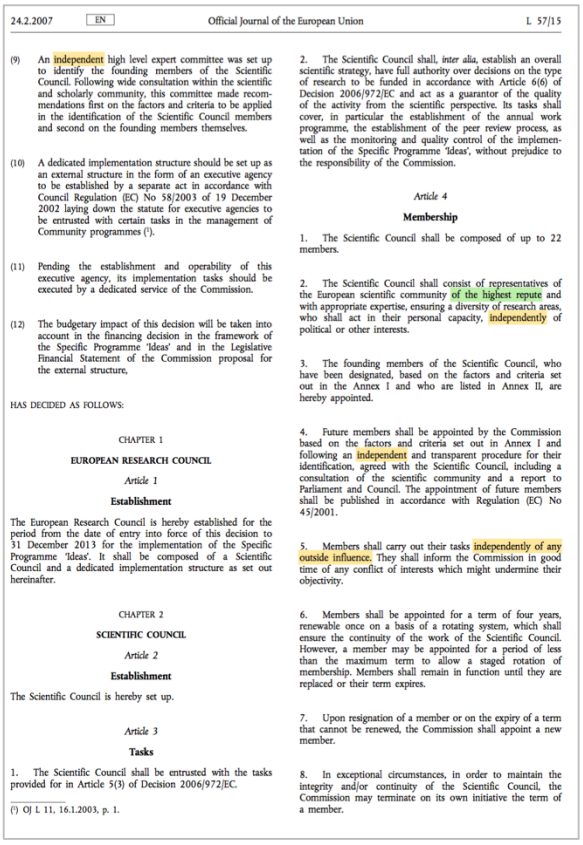
(5) The Scientific Council should independently select a Secretary-General who will act under its authority. The Secretary-General will, inter alia, assist the Scientific Council in ensuring its effective liaison with the dedicated implementation structure and with the Commission, an in monitoring the effective implementation of its strategy and positions as carried by the dedicated implementation structure.

(6) The Scientific Council should operate according to the principles of scientific excellence, autonomy, efficiency and transparency. The Commission should act as the guarantor of the Scientific Council's autonomy and integrity and should ensure its proper functioning.

(7) Rules on disclosure of information by members of the Scientific Council should be provided for, without prejudice to the rules on security annexed to the Commission's Rules of Procedure by Decision 2001/844/EC, ECSC, Euratom [3].

(8) Personal data relating to members of Scientific Council should be processed in accordance with Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data [4].

[1] OJ L 412, 30.12.2006, p. 1.
[2] OJ L 400, 30.12.2006, p. 243.
[3] OJ L 317, 3.12.2001, p. 1, Decision as last amended by Decision 2006/548/EC, Euratom (OJ L 215, 5.8.2006, p. 38).
[4] OJ L 8, 12.1.2001, p. 1.



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(9) An independent high level expert committee was set up to identify the founding members of the Scientific Council. Following wide consultation within the scientific and scholarly community, this committee made recommendations first on the factors and criteria to be applied in the identification of the Scientific Council members and second on the founding members themselves.

(10) A dedicated implementation structure should be set up as an external structure in the form of an executive agency to be established by a separate act in accordance with Council Regulation (EC) No 58/2003 of 19 December 2002 laying down the statute for executive agencies to be entrusted with certain tasks in the management of Community programmes [1].

(11) Pending the establishment and operability of this executive agency, its implementation tasks should be executed by a dedicated service of the Commission.

(12) The budgetary impact of this decision will be taken into account in the financing decision in the framework of the Specific Programme 'Ideas' and in the Legislative Financial Statement of the Commission proposal for the external structure,

HAS DECIDED AS FOLLOWS:

CHAPTER 1

EUROPEAN RESEARCH COUNCIL

Article 1

Establishment

The European Research Council is hereby established for the period from the date of entry into force of this decision to 31 December 2013 for the implementation of the Specific Programme 'Ideas'. It shall be composed of a Scientific Council and a dedicated implementation structure as set out hereinafter.

CHAPTER 2

SCIENTIFIC COUNCIL

Article 2

Establishment

The Scientific Council is hereby set up.

Article 3

Tasks

1. The Scientific Council shall be entrusted with the tasks provided for in Article 5(3) of Decision 2006/972/EC.

2. The Scientific Council shall, *inter alia*, establish an overall scientific strategy, have full authority over decisions on the type of research to be funded in accordance with Article 6(6) of Decision 2006/972/EC and act as a guarantor of the quality of the activity from the scientific perspective. Its tasks shall cover, in particular the establishment of the annual work programme, the establishment of the peer review process, as well as the monitoring and quality control of the implementation of the Specific Programme 'Ideas', without prejudice to the responsibility of the Commission.

Article 4

Membership

1. The Scientific Council shall be composed of up to 22 members.

2. The Scientific Council shall consist of representatives of the European scientific community of the highest repute and with appropriate expertise, ensuring a diversity of research areas, who shall act in their personal capacity, independently of political or other interests.

3. The founding members of the Scientific Council, who have been designated, based on the factors and criteria set out in the Annex I and who are listed in Annex II, are hereby appointed.

4. Future members shall be appointed by the Commission based on the factors and criteria set out in Annex I and following an independent and transparent procedure for their identification, agreed with the Scientific Council, including a consultation of the scientific community and a report to Parliament and Council. The appointment of future members shall be published in accordance with Regulation (EC) No 45/2001.

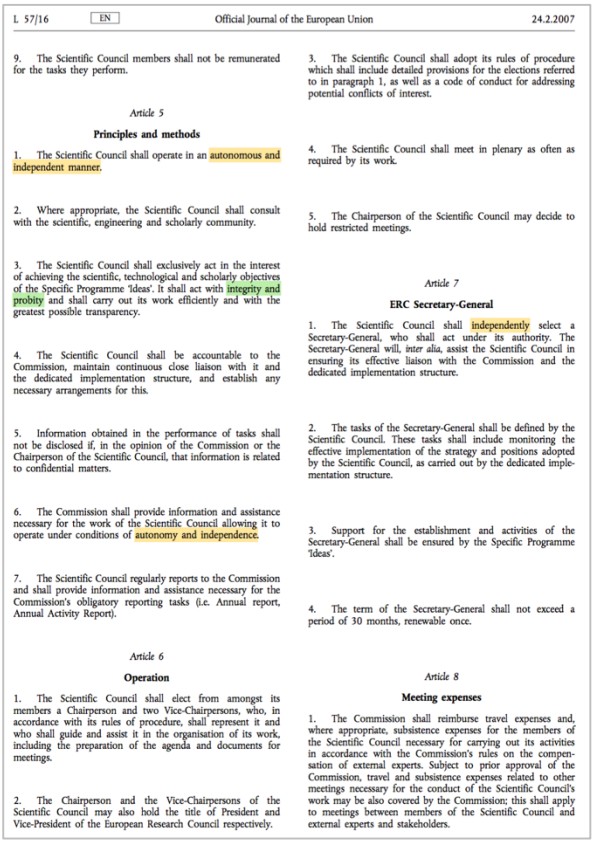
5. Members shall carry out their tasks independently of any outside influence. They shall inform the Commission in good time of any conflict of interests which might undermine their objectivity.

6. Members shall be appointed for a term of four years, renewable once on a basis of a rotating system, which shall ensure the continuity of the work of the Scientific Council. However, a member may be appointed for a period of less than the maximum term to allow a staged rotation of membership. Members shall remain in function until they are replaced or their term expires.

7. Upon resignation of a member or on the expiry of a term that cannot be renewed, the Commission shall appoint a new member.

8. In exceptional circumstances, in order to maintain the integrity and/or continuity of the Scientific Council, the Commission may terminate on its own initiative the term of a member.

[1] OJ L 11, 16.1.2003, p. 1.



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9. The Scientific Council members shall not be remunerated for the tasks they perform.

Article 5

Principles and methods

1. The Scientific Council shall operate in an autonomous and independent manner.

2. Where appropriate, the Scientific Council shall consult with the scientific, engineering and scholarly community.

3. The Scientific Council shall exclusively act in the interest of achieving the scientific, technological and scholarly objectives of the Specific Programme 'Ideas'. It shall act with integrity and probity and shall carry out its work efficiently and with the greatest possible transparency.

4. The Scientific Council shall be accountable to the Commission, maintain continuous close liaison with it and the dedicated implementation structure, and establish any necessary arrangements for this.

5. Information obtained in the performance of tasks shall not be disclosed if, in the opinion of the Commission or the Chairperson of the Scientific Council, that information is related to confidential matters.

6. The Commission shall provide information and assistance necessary for the work of the Scientific Council allowing it to operate under conditions of autonomy and independence.

7. The Scientific Council regularly reports to the Commission and shall provide information and assistance necessary for the Commission's obligatory reporting tasks (i.e. Annual report, Annual Activity Report).

Article 6

Operation

1. The Scientific Council shall elect from amongst its members a Chairperson and two Vice-Chairpersons, who, in accordance with its rules of procedure, shall represent it and who shall guide and assist it in the organisation of its work, including the preparation of the agenda and documents for meetings.

2. The Chairperson and the Vice-Chairpersons of the Scientific Council may also hold the title of President and Vice-President of the European Research Council respectively.

3. The Scientific Council shall adopt its rules of procedure which shall include detailed provisions for the elections referred to in paragraph 1, as well as a code of conduct for addressing potential conflicts of interest.

4. The Scientific Council shall meet in plenary as often as required by its work.

5. The Chairperson of the Scientific Council may decide to hold restricted meetings.

Article 7

ERC Secretary-General

1. The Scientific Council shall independently select a Secretary-General, who shall act under its authority. The Secretary-General will, *inter alia*, assist the Scientific Council in ensuring its effective liaison with the Commission and the dedicated implementation structure.

2. The tasks of the Secretary-General shall be defined by the Scientific Council. These tasks shall include monitoring the effective implementation of the strategy and positions adopted by the Scientific Council, as carried out by the dedicated implementation structure.

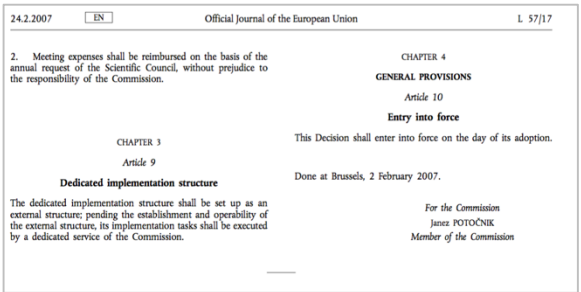
3. Support for the establishment and activities of the Secretary-General shall be ensured by the Specific Programme 'Ideas'.

4. The term of the Secretary-General shall not exceed a period of 30 months, renewable once.

Article 8

Meeting expenses

1. The Commission shall reimburse travel expenses and, where appropriate, subsistence expenses for the members of the Scientific Council necessary for carrying out its activities in accordance with the Commission's rules on the compensation of external experts. Subject to prior approval of the Commission, travel and subsistence expenses related to other meetings necessary for the conduct of the Scientific Council's work may be also covered by the Commission; this shall apply to meetings between members of the Scientific Council and external experts and stakeholders.



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2. Meeting expenses shall be reimbursed on the basis of the annual request of the Scientific Council, without prejudice to the responsibility of the Commission.

CHAPTER 3

Article 9

Dedicated implementation structure

The dedicated implementation structure shall be set up as an external structure; pending the establishment and operability of the external structure, its implementation tasks shall be executed by a dedicated service of the Commission.

CHAPTER 4

GENERAL PROVISIONS

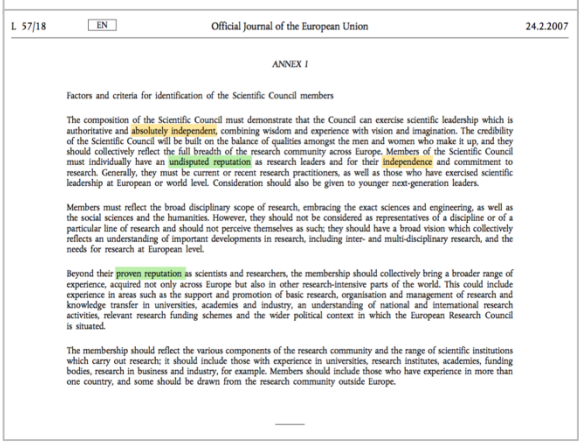
Article 10

Entry into force

This Decision shall enter into force on the day of its adoption.

Done at Brussels, 2 February 2007.

For the Commission
Janez POTOČNIK
Member of the Commission



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ANNEX I

Factors and criteria for identification of the Scientific Council members

The composition of the Scientific Council must demonstrate that the Council can exercise scientific leadership which is authoritative and absolutely independent, combining wisdom and experience with vision and imagination. The credibility of the Scientific Council will be built on the balance of qualities amongst the men and women who make it up, and they should collectively reflect the full breadth of the research community across Europe. Members of the Scientific Council must individually have an undisputed reputation as research leaders and for their independence and commitment to research. Generally, they must be current or recent research practitioners, as well as those who have exercised scientific leadership at European or world level. Consideration should also be given to younger next-generation leaders.

Members must reflect the broad disciplinary scope of research, embracing the exact sciences and engineering, as well as the social sciences and the humanities. However, they should not be considered as representatives of a discipline or of a particular line of research and should not perceive themselves as such; they should have a broad vision which collectively reflects an understanding of important developments in research, including inter- and multi-disciplinary research, and the needs for research at European level.

Beyond their proven reputation as scientists and researchers, the membership should collectively bring a broader range of experience, acquired not only across Europe but also in other research-intensive parts of the world. This could include experience in areas such as the support and promotion of basic research, organisation and management of research and knowledge transfer in universities, academies and industry, an understanding of national and international research activities, relevant research funding schemes and the wider political context in which the European Research Council is situated.

The membership should reflect the various components of the research community and the range of scientific institutions which carry out research; it should include those with experience in universities, research institutes, academies, funding bodies, research in business and industry, for example. Members should include those who have experience in more than one country, and some should be drawn from the research community outside Europe.

List of acronyms

I tried to keep the use of acronyms, very frequent in European institutions' lingo, at a minimum. However, both along the text and in the bibliography, it may have resulted useful or necessary to avoid the use of long denominations, substituting them with their acronyms, whose meaning may be found here below.

BRITE	Basic Research in Industrial Technologies
BSE	Bovine Spongiform Encephalopathy
CAP	Common Agricultural Policy
CEC	Commission of the European Communities (the denomination of the European Commission adopted until the Treaty of Lisbon enter into force in 2009)
CECs	Council of the European Communities
CERN	Conseil Européen pour la Recherche Nucléaire
CEU	Council of the European Union
CIP	Competitiveness and Innovation Framework Programme
COSME	Competitiveness of Small and Medium-sized Enterprises
COST	Coopération européenne dans le domaine de la recherche scientifique et technique
Council	European Council
CREST	Scientific and Technical Research Committee
EC	European Commission
ECSC	European Coal and Steel Community
EEC	European Economic Community
EFSI	European Fund for Strategic Investments
EIT	European Institute of Innovation and Technology
ELDO	European Launcher Development Organisation
EMBL	European Molecular Biology Laboratory
EP	European Parliament
ERA	European Research Area
ERC	European Research Council
ESA	European Space Agency
ESF	European Science Foundation
ESIF	European Structural and Investment Funds
ESO	European Southern Observatory
ESPRIT	European Strategic Programme for Research and Development in Information Technology
ESRO	European Space Research Organisation
EU	European Union
EURAM	European Research in Advanced Materials
Euratom	European Atomic Energy Community
EUREKA	EUrope REsearch Koordination Action
FPx	Framework Programme number x
GDP	Gross Domestic Product
GMO	Genetically Modified Organism

IIA	Interinstitutional Agreement
ITRE	Committee on Industry, Research and Energy of the European Parliament
JET	Joint European Torus
JRC	Joint Research Center
MEP	Member of the European Parliament
MFF	Multiannual Financial Framework
NCP	National Contact Point
NCP	National Contact Point
NSF	National Science Foundation
nvCJD	new variant of the Creutzfeldt-Jakob Disease
OECD	Organisation for Economic Co-operation and Development
OLP	Ordinary Legislative Procedure
OMC	Open Method of Coordination
PUS	Public Understanding of Science
R&D	Research and Development
R&I	Research and Innovation
R&T	Research and Technology
RRI	Responsible Research and Innovation
S&T	Science and Technology
SME(s)	Small and Medium Enterprise(s)
SPRU	Science Policy Research Unit
STI	Science, Technology and Innovation
TFEU	Treaty on the Functioning of the European Union (Treaty of Lisbon)
UN	United Nations
WPs	Work Programmes

List of Figures

List of Tables

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