

VERA WP 4

**VERA Deliverable 4.1: ERA Critical Issues Report**

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## PRESENTATION

The project “Visions of the European Research Area” (VERA) was set up to provide relevant strategic intelligence for the future governance and priority-setting of the European research and innovation system. Since the beginning, it was conceived to have a dual focus: a geographic focus on European-level research and innovation activities; and a political focus interested in the governance of these activities. Therefore, the central movement we consider is on-going shifts in the European research and innovation system of both the activities themselves, policy definition and implementation around specific priorities and the modes (and degrees) of Europeanisation. The assumption is that the European Union has been and is generating a unique situation worldwide dealing both with research and innovation activities and policies whereby the creation of a “European Research Area” has been used to qualify both the future world aimed at and the transformation processes towards this new world (Hooghe & Marks 2001; Majone 2009, Edler et al. Behrens 2003; Borrás 2004).

With this in mind, WP1 carried out an in-depth stocktaking of research and innovation system forward looking activities in Europe and internationally. WP2 delivered a thorough review of trends and drivers of long-term change of European research and innovation systems and governance, and WP3, on the basis of these insights, endeavoured to develop four scenarios describing potential evolutions of the European research and innovation system . WP4 focused on making explicit the critical issues for the ERA’s future capabilities emerging from these scenarios, and explored subsequent issues for policy discussion today.

In this framework, we developed the backcasting exercise in three steps from the scenarios: a) explore their implications for the research and innovation landscapes (extended/lensed scenarios); b) from this extension/lensed view, we derived a set of 55 policy and institutional features (see supra); and c) based on these features, we identified key policy issues, features that are present in more than one scenario reflecting issues that emerge as key in very different social and political contexts. As a result, we identified three types of policy issues: a) institutional issues, b) framework conditions’ issues, and c) direct interventions’ issues.

This document builds the second part of WP4 of the VERA project. Its ambition is to ‘backcast’ from the 2030 scenarios to elicit the policy / governance questions they raise for research and innovation policies at the European level. In order to do so we had to make a methodological development, which we labelled as a ‘policy lensing approach’ expressing scenarios in terms relevant for policy discussion. The ambition of such an approach is to identify the changes in the key governance features and policy priorities. This drove to a comparative analysis of scenarios and to a synthesis of what we consider the key questions raised that policymakers should consider when discussing institutional changes at the European level.

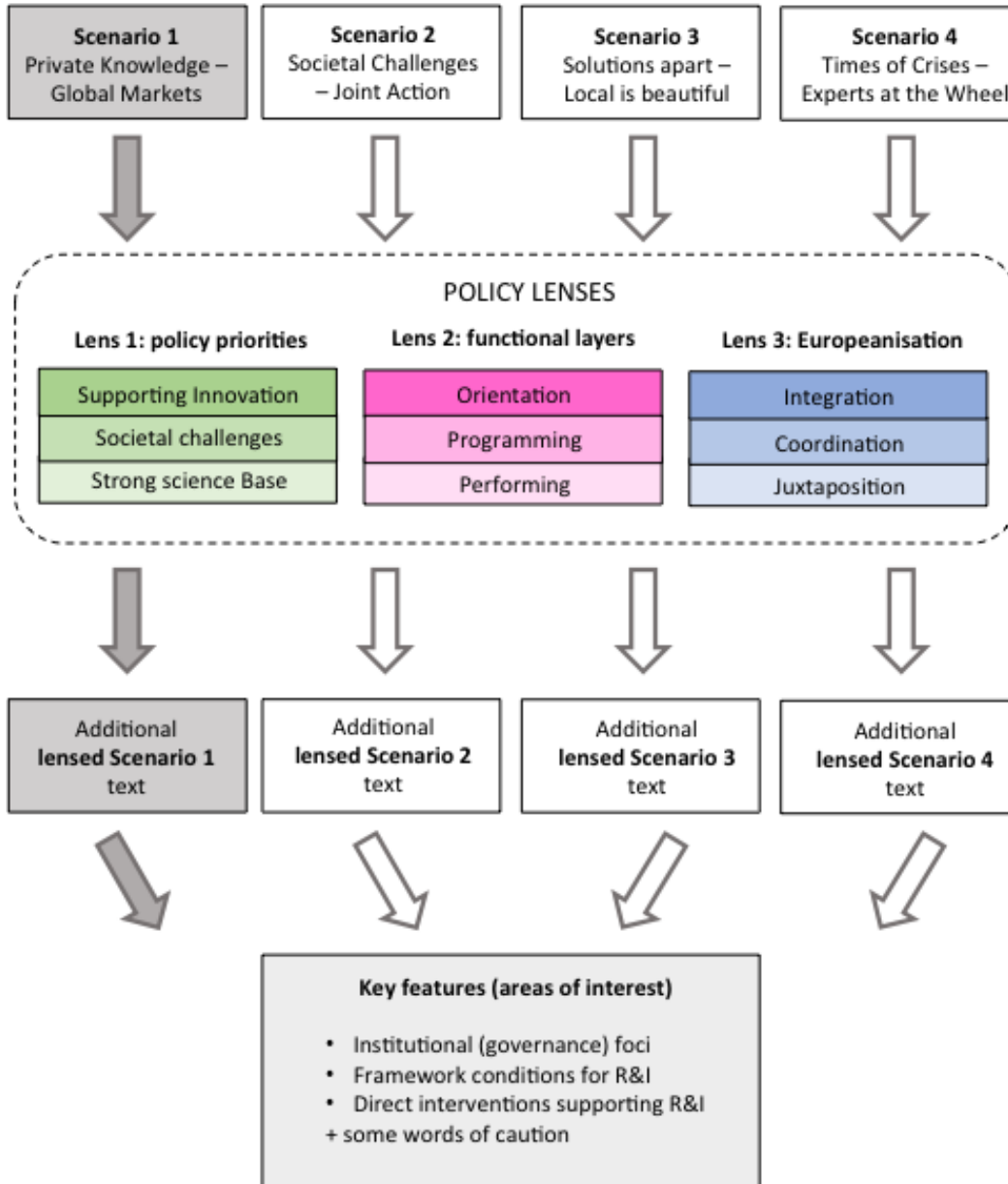
A companion document presenting the full methodology has been produced and presented at the FTA conference. It is attached to this report but is also available as an autonomous article on the website of the FTA conference. The first step of the methodology has been to develop ‘research and innovation landscapes’ in 2030 corresponding to each scenario. Applying this framework in a systematic way for each scenario enables us to characterise scenarios along dimensions that correspond to the ways

policies are being discussed, evidence is being framed and implementation structures being developed and operated. The framework has two dimensions: one deals with the overarching policy priorities for research and innovation policies organised along three main lines as they have been since the 1960s: developing a friendly environment to support innovation at the firm level, developing the science base, and addressing Government / collective / societal missions. The second dimension deals with the ways in which research and innovation policies are defined and implemented combining two elements: policy functions (orientation, programming, performance), and the mode of Europeanisation (federalised, integrated, coordinated and juxtaposed) for each of the policy functions.

Each landscape is 5-6 pages. These developments have enabled to identify 55 key features (between 12 and 15 per scenario) that are presented at the end of each scenario. This background material is presented in part II of this document. Table 1 synthesises this process.

Part I presents the comparative analysis we have made (mostly a table – table 2 - comparing the 4 scenarios along the lines set out) and the synthesis we have derived by looking at policy issues shared by at least two scenarios, even if the reason why they share the issue and the direction proposed differ. In one word, this process helps us to identify key current policy problems that these scenarios help us identify.

RAW SCENARIOS



## PART 1 - Issues for policy discussion in view of the 4 scenarios

We start by a synthetic view comparing the 4 scenarios in term of institutional arrangements at the European level. We first consider the three functions underlined by Barré (2013) and changes expected in the orientation layer (how are priorities defined), at the programming layer (with 4 questions: existence of an encompassing FP or not, sectorialisation of RDI activities, main mode of EU activities for societal challenges and – an outcome from our inquiry – specific role of communication programmes). We then address the performance level with two main aspects: the role of large firms, and the S&T base (considering the role of PROs and the orientation of universities). One of the results of the characterisation of the R&I landscape at the horizon 2030 has been to highlight the importance of the innovation ecology in most scenarios but with very different orientations: we address these around 4 aspects: IP, standards, procurement policies and start-up ecology.

The table shows how much scenarios differ in most lines, some scenarios (especially 2 and 4) being nearer to one another. This table serves as a background to the overall synthesis we propose about the questions the 4 scenarios raise. Our analysis distinguishes three main types of policy issues: institutional, framework conditions, and direct interventions. We define and address these in turn and we conclude with a consideration of several assumptions that underlie most current policy practice and which are questioned under several of our scenarios and thus emerge as topics for policy discussion.

	Scenario 1	Scenario 3	Scenario 2	Scenario 4
Orientation layer	No change in the way MS negotiate priorities – focus is on compromise between national executives	S&T policy is no longer an objet of negotiation – ERA as driving compromise making has disappeared	Radically changed institutional process for defining societal challenges – central role of parliament (with new procedures to interact with national parliaments)	Crisis drive alignment – no need for change at the orientation layer
Programming layer				
Existence of an encompassing FP	NO	NO	YES Encompassing FP (large increase in resources compared to H2020)	NO
Sectorialisation of RDI activities	YES (with constrained overall EU budget, at best in line with present H2020)	YES (but remain marginal overall)	NO	YES (rather important)
Main modes of EU	PPP with large	None as such –	Large	Multiple targeted

activities for societal challenges	<p>firms on those challenges that may generate economic activity</p> <p>All other challenges are 'orphan' and taken care of by CSO</p>	only intermediation activities between local initiatives	programmes the ESA way, with similar coverage of downstream aspects, key role of 'real size experiments' (driving to multi-level arrangements)	programmes in all departments of the EC addressing all aspects of life styles, mixing technology and social developments, focused on experiments where local environments play a large role (both cities, regions and CSO)
Specific role of communication programmes	YES (mostly driven by the circulation of goods)	YES (mainly focused on internet platforms)	YES (as one of the societal challenge – the internet society)	YES (mostly driven by the need to reduce carbon footprint)
S&T base – respective role of PRO and orientation of Universities	Focused on excellence / strong EU agencies for breakthrough S&T / vast differentiation – hierarchisation of universities	Not a EU level priority anymore (mostly handled at regional/local level with a large variety of approaches)	Key role of PRO as solution integrators (may witness domain-base EU consolidation). Universities well off with a large spread of activities (linked one way or the other to the variety of challenges)	Idem for PRO as in scenario 2 But very different for universities – changing balance between fields and changing equilibrium between excellence and relevance
Role of large firms	Central (represent 80% of world industrial R&D) / are in the driving seat with ppp	Not an issue (again may be critical in some local environments)	Present as a key actor, sharing with CSO	More in a solution provider role under control of programmes
Innovation ecology				
IP	Integrated system with integrated enforcement system to better protect firms	Not decisive	Multiple innovations in the ways to channel IP as an incentive to invest in the right sectors / public research adopts open	Multiple innovations in the ways to channel IP as an incentive to invest in the right sectors / public research adopts open



			framework	framework
standards	Support the international shaping of markets in a favourable way for firms	Important to promote values shared transversally (thanks to platforms) / strong regulatory activity (the REACH way)	Key instrument in developing incentives towards products that meet the challenges	Key instrument in developing incentives towards products that foster adaptation
Procurement policies	Provide initial markets and early references to innovative products	No common framework at EU level any longer	Idem as for standards	Idem as for standards
Start-up ecology	NTBF seen as a demonstrator of new developments (acquisitions the main mode, some rare case of new large firms) – covers the whole range of activities (incubator, seed & venture capital, adequate IPO market) with EU/state guarantees about risk taking	No framework at EU level, important variety between regions	Present / not central / more focus on adaptation capabilities of existing SME	Present / not central / more focus on adaptation capabilities of existing SME

The different scenarios represent different problem perceptions, different forms of dominant policy action, and different roles for the European institutions. Our scenarios highlight profound differences in the political and social priorities that underpin the way in which problems are defined. Such differences result in varying understandings of the role of science and technology in society, and of the institutions involved in generating and applying new knowledge. It is important, therefore to *think twice*, to question our current assumptions on the context, drivers and objectives of research policies. Despite the diversity of the scenarios, there are some issues emerging in more than one scenario; that is, issues that are important in very different economic, social and political contexts. To *act wisely* current policy design should address these key issues.

The scenarios let us also anticipate that the *institutional context* under which European research and innovation policy will be defined and implemented within two decades is likely to be substantially



different from the situation we are experiencing today. Yet, to a large extent, our current decisions will shape such context; what we are doing today opens and closes options for the future.

In this regard, a major value-added of the VERA policy-lensing approach lies in the opening up of policy spaces, of choices and their potential consequences in the different political and societal contexts as defined by the scenarios. This is complementary to the outcome of the VERA stakeholder debate, a systematic synopsis of stakeholder views on the future of the European research and innovation system, informing the current discussion about priorities for the European Research Area (ERA) (see VERA WP5).

## **1. Think twice**

The scenarios illustrate how future societies may regard the role of science and technology in diverse, even divergent, ways. The role of science in society is evolving and several directions of changes are open. Therefore, some of our implicit or explicit assumptions underpinning current science, technology and innovation policy may prove, in the long term, inadequate. We revisit these assumptions, recognizing that we face policy choices that are profoundly political, rather than a consensual ground towards which societies will necessarily converge.

### **1.1. The role of European institutions**

Often, in policy discussions, the institutional architecture of the EU is taken for granted. But, as the scenarios show us, this situation can change. We cannot assume that there is a natural evolution towards, for instance, European-wide institutions. The role of the European Union and its institutions differs across scenarios. In Scenario 1 public sector institutions are generally weak and fragmented, national authorities have struggled to retain a degree of influence over the political process and of control over economic resources, and the EU institutions have seen their remit limited to setting regulatory structures and other framework conditions. Scenarios 2 and 4 present a very different situation. In them, the EU and its institutions have become a key player, growing in size and legitimacy, and taking over responsibilities that currently are the remit of national and regional authorities. Yet, the political configuration of the EU institutions will depend on the political context. In scenario 2, European societies come together to deal with policy problems whose solution exceeds the capacity of any single State. This transfer of authority to supranational organisations comes accompanied by the development of instruments of democratic oversight at European level: a strong European Parliament provides the source of democratic legitimacy. In scenario 4 the EU and its institutions are also playing a key role but there is a focus on a single set of problems leading to a less diversified political environment. Finally, scenario 3 is dominated by local and regional interests, and the role of the EU institutions is limited to that of a facilitator, supporting policy learning and information sharing across policy and scientific communities.

What is the future role we envisage for European institutions? The evolution of the ERA, and of the role of the EU in an evolving European research and innovation system can take differing paths, and such paths are associated with the development of different European governance structures. The balance among the policy levels is subject to big uncertainties: The regional level is, together with the local, the central locus of science, technology, and innovation policy in scenario 3, and it is also important for the

experimentation and eventual deployment of innovations in scenario 4. European institutions are dominant in scenario 2 and national governments have retained a degree of influence and relevance against the general retrenchment of the State in scenario 1. There is therefore a choice among different institutional architectures and this choice is not neutral in relation to political objectives. For instance, a strong role for European institutions fits with a scenario in which national authorities have agreed to pursue a variety of societal goals requiring international coordination, but cannot be sustained by a scenario characterised by budgetary restriction in the public sector and a focus on private firms as the engine of competitiveness and economic growth.

#### 1.2. A single ERA or a common, yet diverse and open area

It is an implicit assumption of most European policies, that a “common area” will, and should, deliver a single and integrated European research and innovation system. This, the argument goes, is a precondition for more efficient and effective research systems. Free mobility of resources in a single integrated system is the best way to allocate resources, as in any other “market”. In many scenarios, however, system integration is replaced by different forms of connectedness. Often the scenarios focus on policy approaches that fit with local conditions and in the development of capacities that can deal with the local and regional qualities of more general social challenges (like for instance in Scenario 3). The nurturing of local capacities and their fit with the local contexts and needs is unlikely to be served by an unrestrained focus on objectives that do not take this diversity into consideration. *The policy challenge for today lies in balancing the development of both, a research area that is inclusive of and relevant to all European regions and the support for research capabilities allowing Europe to become a hub in global knowledge networks.*

#### 1.3. The pursuit of excellence

One of the beliefs at the centre of many current policies is that the promotion of “excellence” should be the natural overriding objective of research policy. Clearly, it is difficult to argue against excellence. Yet, except for Scenario 1, the highly selective ethos of this approach is not present in any of the other scenarios. Instead, the concern with systemic effects and the application of research to address societal problems are the overriding concern in two of the scenarios. *Therefore, the policy challenge we are facing in 2015 is how to balance this pursuit of scientific excellence with the other functions of research organizations that make them, for instance, relevant to their local and regional contexts.*

From a higher education perspective, many of the current practices (from funding mechanisms to the popularity of some ranking systems) are based on the implicit assumption that universities should aspire to excellence by improving their research capacity and outputs. Yet again, the role of universities varied across scenarios. This is a reflection of the increasingly different functions that universities play in our societies. Scenario 3 for instance focuses on the local role of universities and their teaching function. *The policy challenge we are now facing is how to help Higher Education find a proper balance among its different functions.*

#### 1.4. The role of science in supporting social progress and welfare is undisputed

It is a widely shared belief among policymakers and stakeholders that ‘science’ plays a crucial role in modern societies. Modern technology and the improvements in the human condition it has made

possible could not have taken place without the knowledge generated by scientific research. Yet the societal attitudes towards the various sciences (natural, technical, social) are far from homogenous, and the scenarios illustrate situations where scientific goals are considered secondary to other social objectives. In scenario 1, science is purely seen in an instrumental way rather than an activity that is valuable in itself. Scenario 3 presents an environment that is more concerned in harnessing current capabilities for welfare than in supporting scientific research. In all scenarios academic science is only one element among diversifying modes and actors of knowledge production and innovation. *The current policy challenge is to define how European policies can help in the experimentation and establishment of flexible but robust modes of distributed knowledge production.*

## **2. Some areas for action (but act wisely)**

Reconsidering our assumptions can modify the way in which we define policies, but there are specific policy areas that need attention, in all circumstances. In our scenario analysis, when an issue appeared in more than one scenario we consider it a warning sign of the existence of a policy problem that would be relevant in very different contexts. An important (and somewhat unexpected) outcome of this analysis is the importance that framework conditions (such as intellectual property rights, standards, regulatory activity focused on public procurement) and communication infrastructures have in most scenarios.

Framework conditions play an important role, but they do so in very different ways depending on the scenario. IPR, for instance, is prominent in scenario 1 as a condition for greater competitiveness of firms, and this scenario foresees the achievement of a full system covering ‘one stop shop’ for granting patents and a European-level enforcement system. In contrast, scenarios 2 and 4 are characterised by large public investments to address societal problems and here IP policies seek to ensure that the results of such research are publicly available. There are similar differences for standards: they serve the opening of markets for firms in scenario 1, while they are an instrument to reduce the environmental impact of goods and services in scenario 4. Similar differences in focus apply for regulations surrounding procurement policies.

Although these issues are often seen as a purely technical matter, the scenarios alert us to their importance and to their profoundly political nature. In other words, *the framework conditions posed by IPR regulations, standards, and procurement regulations are in need of further development, which will be aligned with specific political objectives.*

Another theme calling for both regulatory and direct intervention is the *need to develop a comprehensive and efficient communications infrastructure, both in terms of physical transport and internet-based telecommunications.* The transfer of physical goods is anticipated to be a central concern when the position of Europe in global supply networks is of paramount importance (scenario 1), whereas the notion of what can pass for an “efficient” mode of communication will rely more heavily on telecommunications and internet infrastructures in the remaining scenarios.

There are additional interventions noted in our scenarios, but these are unique to each kind of scenario. The pursuit of economic competitiveness in scenario 1 focuses the limited budgets available for public research on the conduct of frontier research and technology. In this scenario investments are to be carried out in partnership with the private sector; the *spread of Public-Private Partnerships in research and technological development will require a redefinition of the competition rules*, as private investors will seek assurances that their R&D investments will be rewarded through guaranteed access to sufficient markets for the resulting products and services. When the driving focus is on addressing societal problems (scenarios 2 and 4), research programmes are system-oriented; that is, they see the application of new knowledge within a complex social system as one of the main challenges of research. *This requires special attention to be paid to experimentation, real size demonstrators and “bottom-up” stakeholder participation.*

### **3. Anticipate institutional change**

All scenarios anticipate shifts in the institutional architecture underpinning research and innovation policies. First, the *importance of agencies* will grow. Agencies are semi-autonomous public sector organisations that contract for a service with a government organisation. They are ad-hoc structures to implement specific policies and are designed specifically for the purpose for which they have been created. European agencies are already present in today’s ERA strategies; the management of research programmes is being transferred to specialised agencies like the European Research Council Executive Agency and the Research Executive Agency. So far, their role has been instrumental, offering a way of carrying out policy implementation tasks without drawing on European Commission functionaries. Our scenarios describe a broader and differentiated view of agencies: they deal with specialized activities, but can also be a flexible tool to implement policies at the local and regional levels accounting for the specific local context of application. The flexibility that can be afforded by national and regional agencies fits an environment where the main policy lines and objectives are set at European level, but national and sub-national actors play key programming and performing functions. This will lead to a *proliferation of smaller agencies with limited geographical scope* with the EU helping in their coordination, further developing current instruments like ERA-Nets, Joint Programming Initiatives, and Article 185 initiatives.

We also anticipate the growth in the research arena of Civil Society Organisations (CSOs: foundations, NGOs, learned societies, university associations, etc.). CSOs are gaining influence within the policy processes and becoming an avenue of quasi-democratic representation. They are proposing research directions and starting to contribute to the programming and even performance of research. *CSOs will become a central set of actors* to add to government institutions and private sector firms. Yet, our scenarios caution us that the functions they will perform are not predetermined and can evolve into different directions. Private philanthropic organisations can cover some of the gaps left by the reduction in public sector interventions (scenario 1), can form part of a broader collection of public and private bodies performing research (scenario 2) or can complement the research programming and performing roles of the public sector (scenario 4). CSOs are going to be engaged in more direct and operational

ways than merely being the interlocutors in a diffuse “dialogue with society” and this will require changes in policy practice.

#### **4. Challenge your assumptions**

The VERA analysis reveals that the landscape of actors and institutions of European research and innovation will change in the coming decade, and quite likely it will become more complex. Policymakers today need to *anticipate such changes* and to reflect about the assumptions underlying present-day research and innovation policies (ERA and otherwise). Dimensions, concepts and approaches currently taken for granted can rapidly become irrelevant.

## Part II - The Research and Innovation landscapes and key features of the scenarios through the policy-lensing process

### *Scenario 1 - Private knowledge – Global markets*

#### Step 1 – Policy Priorities

In this scenario, economic growth (seen mostly as revolving around private sector investment) is the main force driving policy design and implementation. The world is increasingly globalised and thus competitiveness is the central motive driving policies both at European, national and regional levels in Europe. The focus on economic competitiveness and growth has become even more pressing given that Europe has been slow to get out of the crisis and that the need for budgetary restraint is still a major constraint for most national and regional public authorities. Consequently, the private firm becomes the main locus for research and innovation. Research and Innovation policy focuses on supporting the innovation capabilities of private firms. At the European level this means ‘framing’ an environment that supports innovation in the firms. The development of the science base become subordinate to this main objective: a strong science base is seen as a way, even a requirement, to enhance the breakthrough capabilities of large firms (that are all global and represent the core of world industrial R&D<sup>1</sup>) and to nurture a rich and lively ecology of ‘new technology based firms’<sup>2</sup>. Similarly the dominant way to address societal issues is through public private partnerships that can harness the capacity of the private sector to address social challenges through the creation of new products and services, and the generation of new new business models..

#### *Supporting innovation at the firm level*

The focus in this scenario is on the creation of a friendly environment for innovation at the firm. A crucial element of this environment is the existence of common European rules: IP, standards, innovation-based procurement, shared approaches to support for “new technology based firms”. All these “intangible” dimensions are complemented by a tangible one: the communication infrastructures that link and articulate the European market, thus helping mobilise Research, Development and Innovation efforts at European level, and support the economic exploitation of its results. All other classical ‘market failures’ interventions – for a strategic sector or for supporting SME – remain ‘national’ or ‘regional’. The following paragraphs develop these points.

Europe has been able to develop a common innovation ecology based on common shared rules and practices. A key feature of it is a completely **integrated approach to IP and patenting**: a single application will cover the whole of European countries thanks to an integrated process associating all existing offices (multiple options are possible), but also through a specific enforcement structure (in particular with the development of a European Patent court). Common European practices have also

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<sup>1</sup> The 200 largest R&D spending firms represent half of world industrial R&D and the first 2000 over 80% (source: IPTS scoreboard).

<sup>2</sup> We use this term rather than start-up firms (many are not technological) and spin-off firms (many do not come out of universities)



developed for (i) **standardisation** with European standards bodies becoming dominant vis-à-vis a minor role for national offices and a unified participation into international standardisation offices); and (ii) **public procurement** with public sector markets open to European-wide competition thanks to more encompassing directives effectively translated into national legislation and practice, and a shared definition of entities considered as ‘public’.

A second dimension of the friendly environment for private sector innovation is the existence of an efficient and comprehensive European **communication infrastructure**. This extends to both physical transport and telecommunications. There has been long-standing work to explain the role these infrastructures play in the competitiveness of firms. Private firms have been key in setting and operate up this infrastructure supported by public sector investment and regulation, including substantial R&D expenditures, which have been used to support a strong technological base in communications and a sound regulatory environment. Understood in this broad sense, “communications” will have become the main beneficiary of public R&D expenditure at European level.. The resulting infrastructure articulates a space that represents 40% of the world market, with the existence of strong firms both in equipment and operation.

Other public interventions will target ‘market failures’ and the local support of small / mid-sized firms. The latter will remain national or regional adapted to local problems and being therefore very varied in their volume, modalities and direction

### ***Societal missions***

The possibilities to implement the lasting discourse on the need to orient research and innovation to the solution of societal problems remain heavily constrained by the limited financial means at the disposal of Governments. Organised actors, other than government organisations have come to play a central role in the launch of research initiatives to address societal problems. There are three main types of organisations behind the funding and implementation of such initiatives:

- **‘collective experiments’** bringing together interest groups, local associations, and at times, local government developing new approaches to fund and organise R&D initiatives, placing very limited demands on the public funding system;
- **philanthropic organisations**, some of them very large and of international scope ( following the Bill & Melinda Gates Foundation “model”);
- **‘public private partnerships’**, where public authorities co-invest with large firms with the view that the solutions developed will generate new market opportunities.

In one word, reflecting the budgetary situation, Government plays a very limited role in the choice of problems to be addressed and the definition of priorities. Following this logic, at European level, research funds available through the European institutions have remained constrained. The European institutions continue to develop and implement research and innovation policies to address societal problems, but the instruments used seek to stimulate and coordinate the contributions of other actors. This will entail more ‘à la carte’ participation and a de facto layered Europe.



When looking at the different challenges being discussed today (2014) we see two of them as having been taken up at European level in a significant way:

1. **Energy transition** continues to be a research priority, supported through PPP. Special attention is being paid to energy production (including decentralised production technologies) and transport. Other fields of research like low energy consuming equipment and devices are being driven by different actors and through mechanisms similar to today's Forestry stewardship council. This will also apply to a range of products associated with climate change and the search for lower carbon footprints; mostly supported by concerned citizen's groups.
2. **Health issues**, remain important mostly those associated with ageing and lifestyle (obesity, diabetes...). This is a field with scope for PPP articulated through instruments like new JPIs mostly focused on the development of new treatments (drugs, vaccines...). These are societal problems that offer also potential for firms to generate profits: co-investment between the public sector and large firms has become very common practice<sup>3</sup>.

Firms are active in these two areas, as they constitute important and growing markets. Other societal missions, offering lesser scope for the generation of commercial profits have remained the remit of collective experiments or philanthropic organisations, and are not the subject of large coordination between governments.

### **Science base**

The core motivation for investing in the science base is to support competitiveness and economic growth. Excellent science is important for these goals, but is concentrated in a few large leading research organisations (mainly universities) offering an able counterpart to large firms. These strong scientific research nodes are very important for both supporting the long-term research of large firms and for nurturing a lively ecology of new technology based firms. They thrive at the frontier of science and technology and have access to the substantial funds necessary to support such research. They receive substantial private funding, but also public support. As overall public resources to support scientific research remain stagnated, the backing of such centres of excellence means a concentration of research funding and a reinforcement of funding at the European level for responsive **frontier science and technology**.

Two important outcomes of this scenario are (i) a stronger **concentration** around key science 'clusters' in Europe, and (ii) a greater **dualisation of Universities**, with a vast majority of universities focusing on professional/vocational education (with probably a greater role of life long learning) and a small group of

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<sup>3</sup> This may happen under a new form of PPP where large firms co-invest in initial stages of developments and the creation of start-up firms, against a priority to buy them at a later stage. Such developments are clearly linked to a reinforcing of the oligopolisation of the pharmaceutical industry, and the ability to retain large European players

research-led elite universities. The former are oriented to serve local actors and the local industry, whereas the latter act as global actors in global knowledge markets.

## Step 2 – Europeanisation mode

What governance is implied by this priority on competitiveness? We consider the three policy functions in turn and within them we focus on what happens at the European level and how. In a nutshell, this scenario does not involve any major change in the ways priorities are set and political compromises built at the European level. There is however a breaking up of the overarching approach to implementation (the Framework programme-type of intervention no longer exists) and a ‘sectorialisation’ of research & innovation interventions. The different DGs are in charge of developing and implementing their R&I policies (on the US model). “Horizontal” activities like the support for basic research and the implementation of IP policy is carried out by powerful autonomous agencies. The limited funding capacity of the public sector is counter-balanced by the rising role of NGO and philanthropic organisations that, even though often very specialised (e.g. on an orphan disease), collectively cover a wide range of domains.

The following paragraphs elaborate this state of affairs for each policy function.

The **orientation** function at the European level does not attempt to cover the whole spectrum of research and innovation activities; instead it focuses on institutional aspects linked to competitiveness and the development of a friendly innovation-ecology (IP, standards, rules for procurement). This represents a clear change from today’s core debates on policy orientation with its focus on the resources and priorities given to the common R&D support programme (for many year called Framework programme). The **programming** function has also changed significantly, with this common, all-encompassing programme disappearing, and R&I interventions being developed and implemented by the different DGs in a “sectorialised” context. Only some horizontal activities, like the support of basic research are conducted by agencies. These agencies have been reinforced and have gained autonomy. Two important agencies have witnessed substantial transformation:

- An agency in charge of the development and implementation of all IP policies; integrating a single European patenting office, trademark office, and all activities related to the protection of other Intellectual Property Rights. An EU-level enforcement system is in fact being implemented through this single agency.
- A single agency, following on the steps of the European Research Council, will be responsible for the support of basic research at European level.

Within this context, some of the core policies in the current EU innovation policy landscape have undergone important changes. First, the support of SME’s innovation capabilities remains high in the agenda but given the budgetary constraints, interventions are channelled either through sectorial policies or through dwindling structural funds. The outcome is a diversity of instruments, many of limited size and targeted to specific sectors or activities. Such fragmentation compounds the difficulties that SMEs face to follow these instruments and access the limited funding available.

Second, the role of “societal challenges” as a major dimension of current European discourse has all but disappeared. “Societal challenges” must be distinguished from the pursuit of government missions, as understood by the OECD terminology. The terminology of societal challenge warrants the recognition of an important problem that cannot be handled with the usual departmental processes and means. Specific ways of defining the problem, the new knowledge required to address it and the ways to conduct the efforts have to be identified and put in action and involve a variety of actors (different ministries and agencies, different scientific disciplines, many social groups and stakeholders). Thus, a policy to address a “societal challenge” goes beyond ‘business as usual’. In the current scenario, Governments have limited means to address them and the sectorialisation of European policy (in part triggered by squabbles over dwindling funds) means that coordinated inter-departmental approaches can no longer be implemented. The importance of such broad societal challenges continues and is still recognised, but policy discourse has transferred the responsibility to tackle them to “bottom-up” initiatives coordinating different societal stakeholders. It is the “new society” that organises itself to address societal problems without relying on bureaucratic State organizations. It is the co-investment of societal actors – both in defining the directions and shaping the ways to address them - that is expected to be sufficient to address the societal challenges. In so doing, three groups of actors play a central role: large firms with capabilities to invest on long-term R&D entering public-private partnerships to address societal problems and creating new markets on the way; ‘concerned groups’ (to follow Callon’s terminology) mostly organised by NGO with clear foci (e.g. a given disease) and looking for solutions to it; and targeted groups of public authorities, including national governments that consider an issue so important (in political terms) that they need to address it. Although the rethoric is compelling, orchestrating and coordinating such a diversity of groups within a context that is driven by private actors following growth strategies, means that very few ‘challenges’ have been addressed by such co-investment initiatives. Instruments such as JPI have survived over the decades but are used sparingly. When they do, the operationalization of such bottom-up, broadly based, international initiatives have mostly relied on joint programmes articulating funding agencies in an ERA Net-like fashion with NGOs, and large private firms. Inter-governmental co-operation has thus become an important element when addressing societal challenges and the EC role, when it exists, is limited to that of ‘another member’ rather than an overseeing and orchestrating member. Instead, the role of NGOs as become important in pushing issues to be considered “societal challenges” and bringing together different actors in a flexible and constantly changing architecture.

NGOs role has also become more important in fields like sustainable fishing or forestry through their contribution to stewardship councils. In this scenario, they have also replaced the role of Governments in standard-setting, and are playing a central role in the implementation of strong certification policies, at times embedded in enlarged ISO processes (as is being the case today for the 26000 series on social responsibility).

Concerning the **performance** function, the role of the public sector has also seen a marked reduction when compared to today’s (2014). **Universities** are the key feature of the public sector in this scenario. These have undergone increasing differentiation, with ‘excellent science and technologies’ being concentrated in a small number of universities. Around these leading universities, a rich ecology of new

technology/science based firms and of research centres of large firms has developed. In contrast to these few, leading universities and their surrounding “ecosystem”, the majority of universities address the regional needs for skilled and knowledgeable workforce. The vast majority of universities are therefore teaching-led and focus on professional/vocational education. They do undertake research activities, but these will mostly be problem-driven and oriented towards helping local economic actors. This type of research will seldom be frontier research, but rather will seek to adapt and further develop knowledge to provide solutions to well-defined technical problems.

## SCENARIO 1 – KEY FEATURES

### Policy priorities

- 1- Development of a common, integrated Europe-wide **Intellectual Property** system including a European patent system.
- 2- European **standards**. Increasing the role and scope of European standardization bodies (CEN, CENELEC,...) vis-à-vis national bodies (DIN, BSO,...)
- 3- Enforce **public procurement** regulations opening national, regional and local procurement to European competition across sectors
- 4- Development of strong European-wide **communication infrastructures** (both physical transport and ICT), including R&D funding.
- 5- Supporting **scientific research** in a reduced number of outstanding research universities, through European funding **agencies** like the European Research Council.

### Institutional foci

- 6- Development of **Public-Private Partnerships** tools to implement European STI policies. These involve large firms and address areas with market potential (e.g. Energy transitions and ageing) (implemented in the scenario).
- 7- Important “programming” role of private **philanthropic organizations**.
- 8- **Agencies** in charge of specific aspects of STI (like the European Research Council) are powerful within their areas of activity and operate with autonomy.
- 9- STI support policies are **fragmented** and implemented across all types of European institutions.

### Other implications of the scenario

- 10- **Concentration of scientific and technological capabilities** around key science ‘clusters’ in Europe.
- 11- **Dualisation of Universities**, with a vast majority focusing on professional education (including life-long learning) and a small group of research-led elite universities.
- 12- **Public sector STI support is limited and fragmented**. Diversity of instruments, many of limited size and targeted to specific sectors or activities.
- 13- **Support to SME’s innovation** capabilities remains high in the agenda but given the budgetary constraints, interventions are channelled either through sectorial policies or through dwindling structural funds.

## **Scenario 2 – Societal challenges – Joint action**

### Step 1 – Policy Priorities

Two central dimensions explain the thrust of this scenario: (i) The global economy recovered from the crisis in the late 00s and early 10s, and Governments are no longer subject to strict budgetary constraints that characterised the early part of the Century. Therefore, they are able to invest substantial resources to address “grand societal challenges”. European Governments consider that an environment that supports innovation is a necessary condition to address these challenges. (ii) A political choice has been made to address these challenges collectively at European level. European initiatives are no longer the result of ad-hoc political compromises, but the outcome of pro-active choices that are shaping a new institutional setting at European level (see step 2 for its description).

We thus witness the emergence of a set of ‘large’ programmes to address societal challenges (we keep the old OECD wording to highlight their importance in the overall allocation of resources even though they widely differ in their origins, contents and management). They co-exist with active work at the European level on the development of an environment that is supportive to innovation. Compared to Scenario 1, there are important differences in the way this environment is conceived. In scenario 1 the focus was on developing a context that would support and provide incentives to private firms to engage in innovative activities; this included measures that facilitate the private exploitation of research results, and provide a “safe” context for firms to profit from investments in research and innovation. In Scenario 2, innovation is viewed in a broader sense to include “social innovations” and changes in the public provision of goods and services. As public funding of research is substantial, there is an active focus on open access to research results. Public investments in basic research, and higher education are a high priority and draw substantial funds. Also the resources available to the public sector enable active support measures to SMEs in all sectors of the economy.

The following paragraphs detail this scenario, starting with societal challenges, following by support to innovation activities and by policies on the science base.

### **Societal missions**

The choice for a collective approach to identified societal challenges has driven to the emergence of a set of new ‘large’ programmes at the European level, that constitute the core of public investments for R&I in Europe.

We use the terminology ‘large’ coming from OECD language from the 1970s because these programmes share a number of features with the case of space research in Europe: countries have succeeded in gathering their resources on a long-term basis, there is an overarching international agency in charge of conducting activities with a shared governance structure, and pluri-annual programmes are decided on the basis of a large consultation, based on competences and a will to distribute capabilities among participant countries (there is an allocation process that guarantees that all countries benefit from the activities developed). Finally, and this is a key change compared to the philosophy of European research programmes prevailing at the time of writing, European collaborative



programmes do not stop at the research level, but go ‘down’ to the development and test and experimentation of global solutions.

The selection of challenges that these programmes address is the outcome of a democratic process (as we explain in step 2). Their coverage is encompassing dealing with challenges that require different levels of investment, scope, duration and size. They are developed at European level, based on a pooling of resources. Resources available for these programmes are greater than the funds that had been available to address societal challenges under, for instance, Horizon 2020. In addition, other civil society organizations (like NGO and philanthropic associations) contribute both to the funding and the performance of these programmes; these organizations provide legitimation to the ‘challenge’ and play a role in the programming and performance through their substantial capabilities. A consequence of this is that we witness a variety of ways through which programmes come to being and a variety of ‘implementation structures’: agencies, foundations, etc. However they share in common that there is a central governance at European level.

### ***Supporting innovation at the firm level***

There is a common understanding that supporting innovation in firms was an important element in driving Europe out of the early XXth Century crisis. It is thus considered that strong, innovative firms are a prerequisite enabling the European Union to address societal challenges. Yet, there is also an understanding that the public sector plays an important role in funding and performing innovation, as well as steering R&I policy towards societal goals that transcend mere economic growth objectives. Some of the elements mentioned in Scenario 1 as key components of support to the innovative firm are also present here. For instance, the focus on communication infrastructures (both in term of priority and of implementation through integrated structures and agencies), and the support to the innovative capabilities of SMEs. Differently from Scenario 1, some of this support is channelled as part of wider programmes to address societal challenges and is therefore channelled through European organisations. The Programmes are larger and more coordinated than in Scenario 1, and benefit from substantial indirect support through enlarged structural funds.

A common, European IP policy is also a major building block of an environment that is supportive, not only of innovation at the firm, but of innovation in society at large. This is another important difference with Scenario 1: there is a single framework for IP policy at European level, but its goal is to ensure that the result of public investment can revert to society at large rather than being “privatised” by specific agents. The IP system organizes public open access to the results of publicly-funded research. Although, like in Scenario 1, the system also strives to provide a safe environment for private firms to be able to enjoy the results of their investment in Research and Innovation, its main objective is to ensure that societal goals can be addressed efficiently and that private actors cannot stand in the way of socially efficient exploitation of the results of publicly funded research. This is done by an organizational structure alike to the one we have described for Scenario 1 (a single European agency dealing with different aspects of IP regulation), but following different strategies. IP policy is just one of the elements of a broader set of strategies to use of standardisation and regulation to shape the direction of innovation to be more responsive to societal priorities. Areas like standardisation have become a more open, increasing the number of active players to include NGOs and other concerned stakeholders.

Standardisation is not only a tool to regulate markets, but a policy instrument that can be used to support innovation in a “socially responsible” and sustainable manner. In this scenario the public sector plays a key role as a funder, and to an extent also performer of research activities. Yet the private sector remains an important actor, and private firms receive more public funds to support their innovative activities than in Scenario 1. This investment has grown overtime and has enabled public investors to spread the coverage of activities to a variety of sectors, including labour-intensive services like the leisure and tourism industries.

The scenario is also characterised by a high degree of tax harmonisation at European level. As Europe struggle to emerge from the economic crisis of the early XXIst Century, measures were successfully implemented to avoid tax avoidance and tax optimisation; particularly by large, multinational firms. An aspect of tax harmonisation that directly concerns research and innovation policies is tax credits for R&D investments. These have progressively been harmonised at European level and focused on small firms.

### ***The science base***

In a far easier financial situation, both member states and the EC can implement ambitious research and educational agendas to raise the scientific and technological capabilities of their societies. For countries this means that both core and competitive funding have increased providing for a regular increase in activities, manpower and opportunities for researcher careers. Contrary to scenario 1, there has not been pressure towards a *hierarchisation* of universities. The regional and distributional implications of a model that concentrates “excellence” in a few poles are perceived as a problem to be addressed by policies seeking an even distribution of scientific and technological capacities. In practice, the availability of public funds has enabled many universities being in a position to have at least one discipline in which they excel. Thus public capabilities are more distributed even if clusters of “excellence” remain.

At the European level, the pursuit of frontier science and breakthrough technology continues to be a public sector priority, but this is explicitly and directly connected to addressing societal challenges. New specific programmes to develop major technologies are in place, as well as programmes to support basic research in areas considered relevant for the societal challenges being addressed (“strategically targeted fundamental research”). These policies are implemented by European agencies (like the European Research Agency) providing a scientific counterpart to the technology and innovation-oriented programmes. The connections they can establish by operating at the same European level, enable European research agencies to pursue targeted research programmes addressing the knowledge base of societal challenges.

The links between basic research and the societal challenges have placed European actors at the centre of research policy definition and implementation. Grand societal challenges require concerted European response, and research policy is seen as supporting this response. Although public funds are available it has become difficult for national and regional governments to develop their own, independent research policies, and they rather reproduce at a lower scale the priorities and instruments defined at European level.



## Step 2 – Europeanisation mode

This scenario witnesses a profound transformation of the **orientation** function. A new institutional framework is in place for the identification and selection of challenges; that is, those issues that require that Europe invests specific resources on them. This new institutional framework is there to get away from the ad-hoc compromises made at executive level (the council), and rests upon open processes of legitimation under the aegis of the European Parliament. The new institutional framework provides a European space where organised groups able to operate at European level can push their agendas, and build European societal platforms (on the model of European Technology platforms) to gather momentum and organise policy advocacy. Processes at the level of elected representatives (in the vein of the US hearings or processes) have developed in the European Parliament and become an important source for defining and selecting the “grand societal challenges” that the EU will address. The role of the executive (and in particular the European Council and its arm, the European Commission) is central for the allocation of resources and the structuring of implementation structures. One key feature, as opposed to Scenario 1, is the persistence of an encompassing programme for research and innovation along the lines of the Framework Programme and Horizon 2020. These programmes combine the support to the science base and the European-level funding of ‘large’ programmes. As one cannot anticipate the list of programmes over a 7-year span, the political decision has been to create within the new Programme a fund for societal challenges whose allocation is progressively decided as challenges unfold.

This institutional feature makes the transition with the **programming layer**. This is dominated by the set of large European programmes that have arisen from the political process mentioned above. The central instrument for putting them in action, and thus translating goals into organised action comes from the implementation work carried out by European institutions and agencies. As in the orientation function, there are instruments and practices (advisory bodies, expert groups, seconded experts, formal working groups, informal contacts) that allow interest groups and stakeholders (in particular large NGOs and philanthropic associations able to operate at international level) to provide an input into the definition and implementation of European interventions. This programming process occurs in parallel with the construction of implementation structures to conduct the large programmes. Scenario 2 is characterized by a large number of agencies enabling a greater professionalization away from bureaucratic constraints, and a better fit to each individual situation. Multiple solutions have flourished for such implementation structures, including periodic delegation to existing agencies and the creation of foundations at the European level that enable more easily the blending of financial resources from different sources.

Because of the size of its investments, and because of the European-level legitimation process, the European Commission plays a central role and is often the architect of such constructions. The agencification movement is also prevalent at European level and thus there is a clear separation between ‘programming’ and operation.

The **performance** function is driven by the availability of resources. Universities thus fare far better than two decades before, and are not subject to a sharp hierarchisation like in Scenario 1. As much funding is organised at European level and is competitive in nature, there is a process of differentiations with a

number of research-intensive universities (between 100 and 200 over the whole of Europe) playing an active role in European programmes and initiatives. There remains a more limited number of “excellence centres”, hubs where a variety of large firms, research centres and top research universities covering almost the whole range of research disciplines are brought together. Yet, there is not a chasm between these universities and the rest: a larger number of research universities (the 100-200 mentioned above) have also developed pockets of excellence and expertise in specific fields, and have developed their own ecosystems of local partners and collaborators. Even those universities without a clear research profile have thrived by supporting the needs of the knowledge-based society through advanced teaching and limited, teaching-linked, research and consultancy activities oriented to local needs.

One original aspect of this scenario deals with the nature of large programmes and their search for developing and testing global solutions. This gives a special role for Public Research Organizations as solution integrators (e.g. for new water management solutions) and as key actors in developing and maintaining the corresponding research infrastructures (e.g. Alzheimer databases or clinical testing facilities). This may drive to international mergers or at least lasting strategic alliances with shared institutes or facilities.

## SCENARIO 2 – KEY FEATURES

### Policy priorities

- 1- Addressing a considerable and **growing set of societal “challenges” and problems** through public support to R&D activities.
- 2- **Support to basic research in areas considered relevant to societal challenges** (“strategically targeted fundamental research”).
- 3- Development of a common, integrated Europe-wide **Intellectual Property** system including a European patent system focusing on ensuring open access to the results of publicly funded research.
- 4- Opening up European standardization to more societal players including NGOs and other concerned stakeholders. **Standardisation** is seen as an instrument to support innovation in a “socially responsible” and sustainable manner.
- 5- Development of strong European-wide **communication infrastructures** (both physical transport and ICT). This includes the funding of R&D programmes to develop new communication technologies.
- 6- **Tax harmonisation** at European level including common treatment of tax credits for R&D investments, focusing mainly on small firms.

### Institutional foci

- 7- Policy orientation rests upon open processes of legitimation under the aegis of the **European Parliament**.
- 8- **European Commission and other European bodies** are at the core of policy programming.
- 9- New political processes for legitimizing and agenda-setting of societal challenges have increased the **influence of organised groups able to operate at European level**. These are able to push their agendas, and build European societal platforms (on the model of European Technology platforms).
- 10- A **wide variety of organisations** (including national and regional public sector organisations, NGOs and philanthropic organisations) participate actively **in the performance function**.
- 11- **Public Research Organizations become solution integrators** and key actors in developing and maintaining research infrastructures. Some PROs have merged across borders or entered into international strategic alliances.

### Other implications of the scenario

- 12- IP governance focuses on different objectives than Scenario 1. While in Scenario 1 the main objective is to provide security for private investors and open the market to international competition, the main objectives in Scenario 2 are to ensure open access to the outputs of public R&D investments, and provide a regulatory common ground that contributes to tackling global challenges.
- 13- **Problem-driven orientation** permeates the definition of science policy priorities and the evaluation of its results
- 14- **Innovation is viewed broadly** to include “**social innovation**” and changes in the public provision of goods and services.
- 15- Substantial scientific and technological **capabilities are dispersed** across the majority of European regions. Universities are not subjected to sharp hierarchisation.

### **Scenario 3 – Solutions apart – Local is beautiful**

#### Step 1 – Policy Priorities

Scenario 3 is characterised by the very deep mistrust toward top-down centrally decided and high technology based solutions. The scenario emerges from a failure of government policies and EU policies to deal with a long-lasting economic crisis stretching well over a decade and other societal challenges. The EU and its institutions played an important role in devising EU-wide policies and coordinating national governments; the failure to deal with the crisis discredited established political parties and the EU institutions. The political culture that emerged as a response placed the emphasis on changing lifestyles rather than seeking new technology-based solutions to existing problems. This means that solutions revolve around the way in which citizens organize and live their lives, focusing on “soft” solutions related, for instance, to the design of cities, the deployment of “light” transport solutions (eg, electric trams without heavy infrastructures...), public health and preventive medicine, local small-scale energy production based on sustainable sources, and food production and distribution systems favouring local sources. In fact most of the technologies on which this scenario is based are already available today.

This drives to a complete redefinition of the ‘need for Europe’ (and indeed, in large countries, the ‘need for nations’). National and European policies deal with the conditions that transcend the local context and ‘frame’ the possibilities of local variety. Thus European-level intervention is restricted to coping with common infrastructures and the fora and platforms that foster exchange and learning, and act as a source of bottom-up based alliances between regions or cities on shared issues. There is thus a drastic reduction of the scope of European-level activities whatever policy dimension is concerned. This fits with the budgetary constraints public authorities (at all levels) face. To address public problems societies have to go beyond what governments can offer and seek new sources of funding, extending from the traditional recourse to NGOs to the use of newer tools like crowd funding).

A final key feature of this scenario is the way in which Europe at large and its components consider their world positioning. An analogy is that of Switzerland within Europe: having its own agenda, reluctant to intervene in any matter that is not of direct concern, and only developing ad-hoc relations when judged useful. In this approach European countries and regions focus on their own endowments, and take advantage of the fact others have different views and different ways of addressing issues (e.g. riding on the Asian tech wave, behaving as intelligent users, rather than willing to be producers of everything). In this scenario, Europe focuses on its local competitive advantages, and is increasingly viewed and valued as being a nice place to go, where to spend time and may be to retire (remember that Phoenix is a lively place built on retired people!).

This localised and distributed approach drives us to question the our analysis of policy priorities along the three dimensions. We however use them to deepen the key features just highlighted.

#### **Societal missions**

The notion of grand challenges (as defined previously) does not exist any longer. There are societal issues that are discussed at the global level but that are only addressed ‘locally’ even when considered

as global problems such as global warming. In this new approach, the central actors are 'proximity actors' (cities and regions). They are the ones that address the perceived societal challenges (whether specific or shared, local or global). This does not mean that there are no issues to address at the European level, but they are defined differently: they deal with the horizontal conditions that are needed to make local innovations to address societal problems possible, and allow their circulation in other spaces. The discussions about this very different scenario have highlighted four complementary needs for European-level activity.

(i) One is for a set of infrastructures that connect localities and enable circulation between spaces (the scenario is not one of closure and retains the existence and even importance of international flows of goods and services). The list of infrastructures is however different or in given domains shaped differently (like digital payment for the banking infrastructure or crowd funding for gathering resources). The internet is a major resource facilitating access to distributed knowledge and to local experiments and practices. The balance between physical communication infrastructures has strongly evolved in favour of low-energy consuming modes even if far slower and similarly local modes of energy production as well as decentralised energy networks prevail.

(ii) The second specific feature lies in the need for forums and platforms of exchange where local actors can exchange and learn from one another. These platforms are also the ways through which local actors (e.g. cities) learn that they share the same problems and have similar views about addressing them. They in turn supports bottom-up based alliances to develop solutions jointly. It is also through these forums and platforms that local actors learn about solutions developed in other places. Yet, for this learning to take place, local actors need to be satisfied that the policies developed elsewhere will work in their particular context. This links with the third distinctive need for Europe.

(iii) The third need deals thus with the assessment of policy responses to social problems. For local solutions to circulate and be taken up elsewhere, they need to be assessed so that other localities learn how these policies work, for whom and under what conditions.

(iv) Goods traded into or across Europe have to comply with dominant values in aspects like their environmental impact and the social conditions of production. The result is the development of new European norms and standards. Europe's role as a "regulatory state" grows and becomes its main "raison d'être". In a way REACH is a frontrunner of such an evolution, showing that a retraction in terms of direct R&D involvement can coincide with increased normative responsibilities at the European level.

### ***Supporting innovation at the firm level***

Supporting innovation and the firm, as a way to support the competitiveness of European firms in global markets has ceased to be a priority. First, there is an emphasis on the provision of goods and services at the local level and on issues like quality of life; "economic competitiveness" is no longer a concept that influences policy definition, and technological leadership in many fields has been contentedly left to other world regions. Second, the way in which societal needs are being addressed requires moderate levels of technological innovation. Many of the technologies that are required to support the local economies have been known for many years. What is considered a challenge is not the development of

new technologies, but the creation of the social and economic conditions conducive to the application of existing technologies in ways that are congruent with the dominant political objectives. Further, the regulatory role that Europe is playing with increasing force, is not seen as a tool to improve the competitiveness of European firms but as a way of supporting the development of congenial social and environmental conditions. There is no industrial type policy at EU or even national level, potential supports are only local, although some local firms may still retain global markets

### **Science base**

The notion that society is **knowledge-based** has remained, but the way in which this is understood has changed substantially from the early years of the Century. First there is no perception of a need for strong and continuing technological development, and knowledge is therefore no longer seen as condition needed to support technological innovation. The main applied needs for new knowledge revolve around issues like the effects of regulations and norms, the effectiveness of different policy strategies under different contextual conditions, and the social and economic organisation of new urban models. The core of applied research has moved to the social sciences. Yet, the way in which social science is understood and practiced has also changed: notions like “Responsible Research and Innovation” led to the development of models of research that sought the systematic contribution of a variety of stakeholders to the construction of new research. The generation of knowledge is no longer the sole remit of professional individual researchers and organisations. Policies seeking the generation of new knowledge are also designed at the local level, and taking into account local conditions and needs. The structure of research organisations and higher education institutions has therefore become highly fragmented, but it is not hierarchical. General notions of “excellence” that sought to be comparable across organisations and nations and that had become popular during the first two decades of the Century have been replaced by a variety of local definitions of what is good and relevant. In this environment, researcher mobility has become increasingly difficult, but this is not perceived as a problem.

### Step 2 – Europeanisation mode

At European level the idea of the ERA has lost not only its relevance but its meaning. The transversal Framework Programmes have disappeared, and what is left is mostly handled by a drastically reduced European Commission. There is thus no European role to be played at the orientation layer, not even a representation one in international organisations and forums where countries, regions and often cities participate individually.

The only ‘political’ role is a facilitating one based on supporting platforms and forums (see above), and, when ‘robust compromises’ are arrived at in these platforms, a delegation for new standards and regulatory frames is made by European countries on an ad-hoc fashion. In this scenario, European “success” is warranted by the number of platforms that arrive to horizontal views and push for transversal actions for the assessment of quality and for new regulatory organisations (the REACH way) when needed.

The main **programming** activities consuming European-level resources are the targeted R&D programmes addressing issues related to the redefined infrastructure, and the problems posed by the



development, implementation and assessment of new regulations and policies (see above). Therefore, activities that are still conducted at European level include platforms and forums for (1) sharing data and analysis about bottom-up activities, and (2) developing redefined indicators and markers of societal wellbeing and socio-economic development that can be applied in different local contexts. The latter can derive not only from the requirement to develop new European standardisation and regulatory frameworks but also the development of new measurement frames and quality assessment mechanisms

Universities remain at the core of the **performance function** for their key role in education and training (life-long learning being increasingly important). They have all gained higher degrees of autonomy from national government departments and agencies and national and international regulators. They are driven by local and regional needs and draw an increasing share of their budgets from regional and local governments. The balance between hard and soft science has dramatically evolved towards the latter. The drive towards scientific excellence has completely disappeared (vs. local relevance) and competitive funding has vastly reduced, and with it the role of national and European funding agencies (they remain but as secondary actors). In this movement PROs (especially the large academic oriented) have reduced their size or disappeared. Only those in line with the redefined 'need for Europe' have maintained their capabilities, and through a process of mergers they have become international (European) organizations. Finally, a new type of knowledge brokers has emerged; their role is to enable the capitalisation of local experiments and insure their circulation to other interested regions. Some early examples of this model emerged in the 00s, for instance in the field of biodiversity offsetting.

Innovation activities are as much the remit of firms as of bottom-up organised stakeholder groups, local communities and of networks bringing them together. There are no shared views about the role of firms (large and small) and this depends upon regional choices that can widely differ. Some regions may develop solutions to their societal issues that nurture firm competitiveness, but this is in no way a shared approach.



## SCENARIO 3 – KEY FEATURES

### Policy priorities

- 1- **European institutions act as a facilitator** for sharing the experiences of local and regional actors to foster exchange and learning.
- 2- Deployment of Europe-wide **communication infrastructures** (both physical and ICTs). Support communication technologies that are low consumers of energy.
- 3- Development of European norms and **standards** dealing with the environmental impact of traded goods and services and their social conditions of production.
- 4- **Evaluation of the effects of regulations and norms**, and of the effectiveness of different policy strategies **under different contextual conditions**.

### Institutional foci

- 5- The key governmental actors are '**proximity actors**' (cities and regions).
- 6- **European institutions narrow focus** on the programming of R&D funding to support redefined communications infrastructure, and to assess the problems posed by the development, implementation and assessment of new regulations and policies.
- 7- **Increasingly autonomous universities** focus on education and training (life-long learning being increasingly important).
- 8- Deployment of problem-based **forums and platforms for exchange and learning** among local and regional organisations.

### Key implications of the scenario

- 9- Public policy **addresses societal challenges in a decentralized manner** with little intervention at the European level.
- 10- Policy **focuses on changing lifestyles rather than seeking new technology-based solutions** to existing problems.
- 11- Supporting innovation at the firm as a way to support the competitiveness of European firms in global markets is not a priority.
- 12- Proliferation of **bottom-up mechanisms to fund local experimentation**, e.g. crowd funding
- 13- **PROs** have drastically **reduced** their size and some of them have disappeared altogether.

## *Scenario 4 Times of crises – Experts at the wheel*

### Step 1 – Policy Priorities

Scenario 4 is triggered by an environmental crisis. The global warming associated with the explosion of weather disasters and the disappearance of arctic ice have driven Europe to focus on mitigation and adaptation policies (prevention is no longer an option). This response and very focused way of addressing sustainability has given great power and responsibility to 'experts' that work in better

understanding environmental phenomena, anticipating dynamics and identifying their major driving forces. The role of these experts is not only scientific or technical, but it is explicitly linked to policy definition and implementation. As a consequence these experts are directly involved in political decisions and in processes of institutional change. In other words, an epistemic community that has emerged in the field of environment has become an “hegemonic” actor in the field of science, technology and innovation policy.

This hegemonic role extends to all levels – from the local to the global –, and shapes the definition of all priorities. The need to tackle environmental change has become the most important overall driver of all STI policies. This has driven to 4 key main features: the development of a set of research programmes each addressing a given domain of adaptation/mitigation; reorienting the innovation ecology (mostly through standards and regulation); developing a substantial collaborative programme along the EUREKA model to speed-up the innovation process in relevant areas; and focusing the support to the science base on research areas that can contribute to breakthrough solutions for adaptation to and mitigation of the effects of climate change.

The following paragraphs detail these key features along the three high level priorities.

### ***Societal missions***

There is only one overarching societal challenge, adaptation to the climate crisis. Yet, dealing with the effects of climate change means activities in very different domains, each becoming the objective source of a specific programme. The list of domains is long: urban management, energy provision, new forms of housing, mobility, food production and circulation, adaptation of maritime regions and seaside cities, re-design of capital and consumer goods (modular design, very long life, role of additive manufacturing in maintenance and upgrading, ‘intelligent’ recycling...). All aspects of our life styles are concerned including tourism, leisure and culture.

These programmes are aimed at finding solutions to specific, climate-related, problems and often revolve around the development of technology-based components and innovations. They also have another important dimension dealing with adaptation in practices and lifestyles and requiring collective experiments (often pushed by cities or given regions) testing new approaches, which in turn shape the type of technical solutions and systems required. This relationship between technical solutions and social and organization change leads to “multi-level” programmes addressing both technical problems and socio-economic issues. Some of these programmes deal with global problems, and are either themselves, global in nature, or support exchanges with research groups outside Europe.

### ***Supporting innovation at the firm level***

The main focus of STI policy is, as described above, the development of solutions to the problems posed by climate change. Many of the domains addressed by this policy involve private firms; typically as the producers of products and services that need to be adapted to the new environmental situation. We can distinguish two main types of instruments seeking to speed-up such adaptation by providing support or other forms of incentive to private firms:

(i) Instruments that provide a friendly context for firms to develop and introduce new products, services and systems that can help deal with the new environmental situation. For instance, public procurement has been adapted to favour co-development of innovative solutions between the public sector and firms. The public sector emerges as the buyer and therefore the lead users of these solutions, and keeps control of how these solutions are implemented (therefore these are not public private partnerships like the ones that evolved under Scenario 1). Another important tool that provides favourable conditions for firms to be innovative is the introduction of new standards and regulatory frameworks.

(ii) Direct financial support to the development and introduction of innovations. Financial support is being offered by regional, national and European authorities. This tools include collaborative arrangements following the EUREKA model that enable systematic but distributed joined-action.

It must be noted that not all firms and sectors will be facing a supportive environment. The new rules, regulations and market conditions will lead to the reduction in the market size of some sectors, like, for instance, aerospace and air travel. The effects on tourism will be marked, with regions that had developed a model of tourism based on long-distance mobility being negatively affected and experiencing decreasing levels of welfare. Further, the degree to which the European context will help the global competitiveness of European firms will often depend on the extent to which other regions outside Europe adopt the environmental standards and regulations that have driven European innovation.

### ***The science base***

Scientists and technical experts play a crucial role in this scenario. Their new acquired political influence, and their capacity to define STI policies, is in part based on their capacity to anticipate the environmental crisis and the recognition that their warnings had for a long time been ignored. Now, science is widely recognised as being crucial for the understanding of the conditions that are causing the “grand challenge” that society faces, and as a foundation on which new solutions enabling adaptation will be built. There is a continuous increase of resources invested in scientific research but this are targeted to a narrow set of disciplines directly related with the “epistemic community” now controlling STI policy.

This investment has two components. One continues to be ‘breakthrough’ driven (for both science and technology) with a clear view of new knowledge needed to enable adaptation. There is a shared recognition that this has to be addressed directly at the European level. This reinforces the role of European-level agencies. The other is about the complex dimensions of the solutions and the deep integration they require between natural and social sciences as well as engineering. There is a need for cross-disciplinary collaboration and interaction with stakeholders. This has driven the emergence of new European level programmes supporting bottom-up unconventional initiatives promoted by societal actors in collaboration with researchers from a variety of disciplines.

This “federal” approach to knowledge production concurs with increased investment at national and regional levels, in a mix of direct support and competitive funding. This enables national and regional governments to address ‘more specific issues that a federal level has difficulties to cope with. It also

enables a variety of alliances and joint programmes to complement the federal level (at least 30% of national competitive funds are channelled through such 'joint programmes').

#### Step 2 – Europeanisation mode

At the **orientation function**, one central lesson from the multiplication of JPIs in the second part of the 2010s has been their huge transaction costs and limited flexibility. When facing the climate disasters, a clear political choice was made to simplify approaches, delegating to the European level the responsibility to shape and operate the set of domain-specific, problem-solving programmes. As responsibilities were transferred to the EU, the orientation and to a large extent also the programming functions took place within the decision-making structures of the European Commission. The complex “commitology” structure and procedures, developed over decades, are the framework through which the “epistemic communities” and “advocacy groups” involved on environmental issues, exercise their influence. This approach is flexible in that the individuals and organizations involved in decision-making through committees and advisory groups are specific to each domain. This enables the involvement of public authorities and key stakeholders (including NGO and philanthropic organisations), together with Commission officials in the governance of each policy domain.

The **programming function** is shared by the European Commission structures that dominate the orientation function and a set of European agencies and foundations that have been put in charge of policy implementation. Here “implementation” is understood in a broad sense, including the translation of the objectives and policies defined through the orientation function into specific programmes that the agencies and foundations are then in charge of operating. The agencies and foundations in charge of the programme implementation share a common characteristic: they have at their disposal a portfolio of instruments, e.g. for supporting city-level demonstrations, or pre-normative activities, or early-user investment<sup>4</sup>.

This is not a world without tensions. We see two tensions that may threaten the development of this scenario. One potential issue may come from co-ordination problems between agencies / foundations on transversal issues and of potential antagonistic solutions promoted. Another may come from the key role played by experts in this scenario. This runs the risk of generating a new divide between citizens and the local problems they face and ‘one size fits all’ solutions pushed forward by ‘far-away’ structures.

Both universities and PRO play important roles in the **performance function**. PRO play in most programmes the role of solution integrators, enabling the move from technology to demonstrations and collective experiments. As the most significant programmes have an European scope, and research groups increasingly specialise in specific domains, PROs that used to operate at the national level have started to engage in international mergers and change their governance structures, often moving from public to not for profit organisations). Universities, even the most research intensive, are experiencing an evolution of their thematic portfolios as they adapt to the demand for knowledge and training in areas

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<sup>4</sup> To have a better view, see the Manchester compendium of evidence on research and innovation policies. A specific report is dedicated to policy mixes and one situation deals with policy mixes within funding agencies.



relevant to the current research priorities. The growth of investments in the broad range of areas to climate change and the mitigation of its effects have provided numerous opportunities for careers and made of higher education and research attractive employment sectors for those trained in the relevant fields.

## SCENARIO 4 – KEY FEATURES

### Policy priorities

- 1- There is only **one overarching societal priority: the mitigation and adaptation to the climate crisis.**
- 2- Definition of **R&D programmes to adapt to and mitigate the effects of climate change in a variety of fields** including urban management, housing, energy provision, mobility, food production and circulation, endangered species, adaptation of maritime regions and seaside cities.
- 3- Use of **public procurement** to support co-development of new products, services and systems that can help deal with the new environmental situation.
- 4- Introduction of new **standards and regulations** to support environment-friendly development, manufacturing, use and disposal of products.

### Institutional foci

- 5- **Many orientation and programming functions have been transferred to the EU and its organisations.** Responsibility to shape and operate the set of domain-specific, problem-solving programmes lies in EU organisations.
- 6- Many programming functions take place within the decision-making structures of the **European Commission.**
- 7- Central role of European-level resources. Wider remit of activities: funds for research, experimentation and innovation
- 8- Complementary support offered by **regional, national and European organisations.**
- 9- Multiple complementary activities driven by **concerned groups and philanthropic organizations**, covering both programming and performing functions.
- 10- International **coordination and collaborative arrangements by national agencies** enabling systematic but distributed joined-action (along the lines of ERA-Nets, and the EUREKA model).
- 11- **Collective experimentation** involving actors **at different levels** (local, regional,...) are an important feature of the performance of STP programmes.
- 12- Evolving role of **PROs as solution integrators** (e.g. new water management solutions) and as key actors in shaping the necessary infrastructures for adaptation research, e.g. satellite monitoring.

### Other implications of the scenario

- 13- Important role of **environmental expert community**, going beyond the provision of scientific and technical, to become directly involved in political decisions and in processes of institutional change.
- 14- Emergence of new **European programmes supporting bottom-up** initiatives promoted by societal actors in collaboration with researchers from a variety of disciplines.



## FINAL REMARKS ON THE LENSING APPROACH

The policy lensing approach has helped us go further with scenarios that were initially developed through desk research, expert engagement and a clear FTA scenario methodology. By looking at these worlds from the view of (a) policy goals, (b) policy action spaces (in terms of functional layers) and (c) modes of Europeanisation, we have further developed and analysed the research and innovation worlds described in the four scenarios.

This further development enables a next step, the extraction of “Issues for policy discussion today”, when backcasting from these future worlds to today’s research and innovation choices. We have made this step, and the full text on “issues for policy discussion” is provided in this report.

The policy-lensing approach as we have described it, is not focused on building consistent scenario-worlds per se, but focuses on interpreting and fleshing out these worlds to inform policy decisions today. This means the analyst undertaking policy lensing, retains the tools and skill sets of an FTA analyst whilst placing him or herself in a position of a policy shaper, applying various lenses.

Between the authors of this paper, we have discussed whether the policy priorities and functional layers should have been included in the original scenarios. We concluded, and suggest this to our readers, that the policy lensing expands on the raw scenarios in a very structured policy-oriented manner, drawing on theory to help us derive policy interpretations and conclusions; yet if we had constructed the scenarios guided by such policy frames these may have been more constrained and would not have explored plausible future contexts and developments in the way they now do. We propose that there are two specific contributions of policy lensing as an independent activity after the development of policy endogenous scenarios:

(1) Policy practice oriented refinement i.e. fleshing out the scenarios with respect to relevant operational policy categories (lens 2). Interpreting the scenarios for the three layers provides a real added value as it bridges from the general policy factors to the operational lens of the policy context. This is something that cannot be done in the collective process of scenario building as it is not accessible to the non-policy participants. In short, it can be a further step in tailoring scenario output into usable intelligence for policy action.

(2) Normative Assessment i.e. assessing the scenarios vis-a-vis acknowledged policy goals of today. This is visible in lens 1. We feel that this approach yields very valuable insights like, for example, in the raw scenario where “challenge orientation” is no longer high on the policy agenda, through the lensing we could see that there is a potential for progress towards it. Both aspects are well in line with the notion of adaptive foresight which suggests a special sense making phase for each actor group and in particular policy.

Finally, we argue that this positioning of the FTA analyst in the hot-seat of a policy shaper requires the development of “robust lenses”. Our interest in this project was on the European research and innovation landscape and aspects of Europeanisation (cf. European Research Area). What is key is that the lenses are constructed in a systematic and transparent way.



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## ANNEX 1: FTA PAPER

## ANNEX 2: PARTICIPANTS LIST IN THE VERA WORKSHOP HELD ON MARCH 10TH 2014 IN BRUXELLES (CENTRE BORSCHETTE)

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