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European Commission

Mission-Oriented Research and Innovation Policy

A RISE Perspective

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Mission-oriented Research and Innovation Policy: A RISE Perspective

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EUROPEAN COMMISSION

Mission-Oriented Research and Innovation Policy

A RISE Perspective

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INTRODUCTION

RISE is the Research, Innovation and Science Expert high-level group[1] advising the European Commissioner for Research, Science and Innovation, Carlos Moedas. In autumn 2017, the Commissioner asked RISE to provide policy insights on mission-oriented research and innovation(R&I) policy at EU level. The RISE working group on missions participated in a meeting with Commissioner Moedas on December 5 2017 to discuss the topic. This builds on the earlier work of RISE outlined in their book Europe's Future: Open Innovation, Open Science and Open to the World.[2]

ESIR is an expert group on the Economic and Societal Impact of Research and Innovation[3], which advises the European Commission. ESIR also spent autumn 2017 developing policy insights around a mission-oriented approach to R&I at EU level. To ensure coherence between the work of the groups, a member of ESIR, Andrea Renda, worked with the RISE group on the topic.

This policy brief is the outcome of those reflections on mission-oriented policy at EU level.

The concept of mission-oriented research and innovation is a fundamental pillar of public programmes in fields such as defence, agriculture and space exploration but the term is used quite generally. For example, it does not have a formal definition in the OECD Frascati Manual[4] and was not mentioned in Vanevar Bush's Science the Endless Frontier.[5] The most classic reference is by Henri Ergas in which he classified technology policy into a typology of mission-oriented versus diffusion-oriented and went on to contrast countries in the first group such as France, UK and the US which pursued 'big problem' issues in defence and health with a second group including Germany, Switzerland and Sweden who focused on making the best use of technology.[6] Today it can be recognised that both approaches are needed simultaneously with missions creating markets and addressing societal issues while diffusion policies build capacity and improve productivity of firms. In this note, some issues in the implementation of mission-oriented policy are discussed.

Mission-orientation has been less visible in European Framework Programmes despite regular calls for a more programmatic approach. For example in 2006 the Aho Group called for large scale strategic actions in key sectors to provide an environment in which supply-side measures for research investment can be combined with the process of creating a demand and a market.[7] In 2007, the ERA Rationales Group proposed structuring programmes around Grand or Societal Challenges.[8] Horizon 2020 moved in this direction with the introduction of Societal Challenges and Innovation Partnerships but

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[1] https://ec.europa.eu/research/openvision/index.cfm?pg=expert-groups-rise

[2] https://publications.europa.eu/en/publication-detail/-/publication/527ea7ce-36fc-11e7-a08e-01aa75ed71a1

[3] https://ec.europa.eu/info/research-and-innovation/strategy/expert-groups/esir_en

[4] OECD (2015) Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, Paris: OECD

[5] Bush, V. (1960) Science, the endless frontier; a report to the President on a program for postwar scientific research, Washington D.C.: United States. Office of Scientific Research and Development

[6] Ergas, H. (1986) Does technology policy matter? in BR Guile , H. Brooks (Eds.) , Technology and Global Industry: Companies and Nations in the World Economy , National Academy Press , Washington, DC

[7] Aho, E., Cornu, J., Georghiou, L. and Subirá A.,(2006) Creating an Innovative Europe: Report of the Independent Expert Group on R & D and Innovation Appointed following the Hampton Court Summit- 2006 - EUR-OP

[8] Georghiou L, Europe's Research System Must Change, *Nature* 452, 935–936 (24 April 2008) https://www.nature.com/articles/452935a

these have not achieved the level of coordination or the sense of purpose needed to have a transformative impact on Europe's economic and social goals. In the current debate, the Lamy group[9] has taken a lead in proposing a mission-oriented, impact-focused approach to address global challenges. The central role of a rationale based upon market creation in mission-orientation, as opposed to one of addressing market failures, has been highlighted by Mariana Mazzucato.[10]

In this note we consider the characteristics of a mission-based approach in the context of Europe's needs, discuss what is involved in the selection of missions, set out an approach to engage citizens and propose an approach to governance and embedment of missions in the landscape of EU policies and instruments.

[9] http://ec.europa.eu/research/evaluations/index.cfm?pg=hlg

[10] Mazzucato, M. (2016) From market fixing to market-creating: a new framework for innovation policy, *Industry and Innovation Vol. 23* , Iss. 2,2016

1 Characteristics of a mission-based approach to achieve results

The consensus in commentaries on mission-oriented policy today are that it has three main themes:

i. A challenge-based approach;

ii. Creation of markets; and

Integration of supply and demand-side policies.

1.1 Taxonomy of challenges

The idea of a challenge has become firmly-rooted as a means to guide innovation and other policies. It has the dual advantage of forming a *coordination envelope* to align a series of measures and instruments, which may have diverse governance, and the provision of a *channel of communication* with stakeholders including the wider public. It is possible to categorise challenges by whether they are economically, socially or scientifically driven but in reality most combine elements of all three.

A common confusion in current taxonomy exists between challenges and missions with the terms used interchangeably dependent upon the country or agency concerned. For the purpose of this note, a challenge will refer to the wider problem, aim or benefit that is faced while a mission will describe a specific package of measures and activities that can deliver a verifiable result, which successfully exploits, resolves, mitigates or makes defined progress against the challenge. That progress would normally mean meeting verifiable objectives on a planned timescale.

Conceptually the challenges that precede missions fall into two main categories:[11]

> Type A) those which are potentially solvable and can therefore relatively easily be reduced to discrete or verifiable goals; this includes the moonshot (to be clear, under the definitions used here the aim to put a human on the moon was a challenge and the Apollo Programme was a mission) and more recently the development of the Ebola vaccine; in the extreme a Type A challenge reduces to a mission; and
>
> Type B) those where solutions are unknown and the problems are 'wicked' and escape simple definition – here the historical archetype is Nixon's War on Cancer but wider societal problems such as sustainability or migration also come into this category.

It is often the case that the challenges which are of greatest social or economic importance fall into the second category but this is not reason not to seek progress. A key step in moving from a macro-level challenge of this nature to a workable mission is the need to establish a level of *granularity* which remains clearly traceable to the high level goal (and hence remains meaningful at a political and societal level) but also allows resources to be directed and coordinated towards a set of measurable goals. Both the challenge and the mission must be expressed in terms that relate to and engage citizens. Achievement of granularity and focus will by definition exclude parts of the constituency (particularly the parts of the scientific community not covered) and needs courage. While the scientific granularity of a mission may be narrow, it should have broad public meaning.

[11] The distinction between discrete challenges with a clear endpoint and complex challenges which are broad and open-ended is discussed by Eise Eisenhardt, K.M., Graebner, M.E., Sonenshein, S. (2016) Grand Challenges And Inductive Methods: Rigor Without Rigor Mortis, Academy of Management Journal 2016, Vol. 59, No. 4, 1113–1123as part of an insightful exploration of the use of inductive methods to address these challenges.

This implies a sequence of identification and articulation during which policy tools that extend participation, such as foresight, play a key role[12]. This approach was explored extensively during the design phases of the Joint Programming Initiative and summarised in the Voluntary Guidelines on Framework Conditions for Joint Programming, which also proposed a cyclical approach.[13] A caution is that challenges may be captured by fashion in terms of which issues rise to the top of the agenda and hence a rigorous process of evaluation is needed to ensure continuing relevance and commitment. An example of an issue that rose to the top of the agenda and then subsided was the perceived threat from Avian Flu (which may of course return). Somewhat paradoxically, the eventual missions derived from challenges need an element of flexibility that allows them to evolve in the light of changing opportunities and demands.

1.2 From challenge to mission

Possibly the most extreme way to focus innovation resources on a mission is through prize competitions, based on the historic Longitude Prize. It is currently being applied to search for successful approaches to antimicrobial resistance. Missions are most easily defined when they are couched in terms of a scientific or technological target which is inherently quantitative – for example an efficiency level for photovoltaic conversion or the storage capacity to weight ratio of a battery. With Type B missions the option exists to find partial solutions that represent real progress towards the challenge but only address elements of it that are reducible to missions. This is commonly referred to as establishing the correct granularity. An example in the cancer domain is a mission-based approach on prevention and early diagnosis or particular cancers, which could be a combination of research on biomarkers and a roll-out campaign to encourage at risk groups to take tests in the workplace or other non-hospital locations. In Annex 2, we discuss some of the institutional requirements for a cancer mission.

However, as noted above socio-economic challenges are by their nature more complex (or messy) and may involve parallel progress on a number of fronts including, but going far beyond, technology to include infrastructural and behavioural change. Environmental analysts have couched this in terms of sustainability transitions. See for example the framework established by Geels and Schott (Figure 1). While this is specific to sustainability transitions the general principle may be extended to other areas where there is a substantial infrastructural and behavioural element, in other words most of the Type B challenges.

[12] Georghiou L and Cassingena Harper J , From priority-setting to articulation of demand: Foresight for research and innovation policy and strategy Futures Vol 43, Issue 3, April 2011, Pages 243-251https://doi.org/10.1016/j.futures.2010.11.003

[13] http://ec.europa.eu/research/era/docs/en/voluntary_guidelines.pdf (p.24)

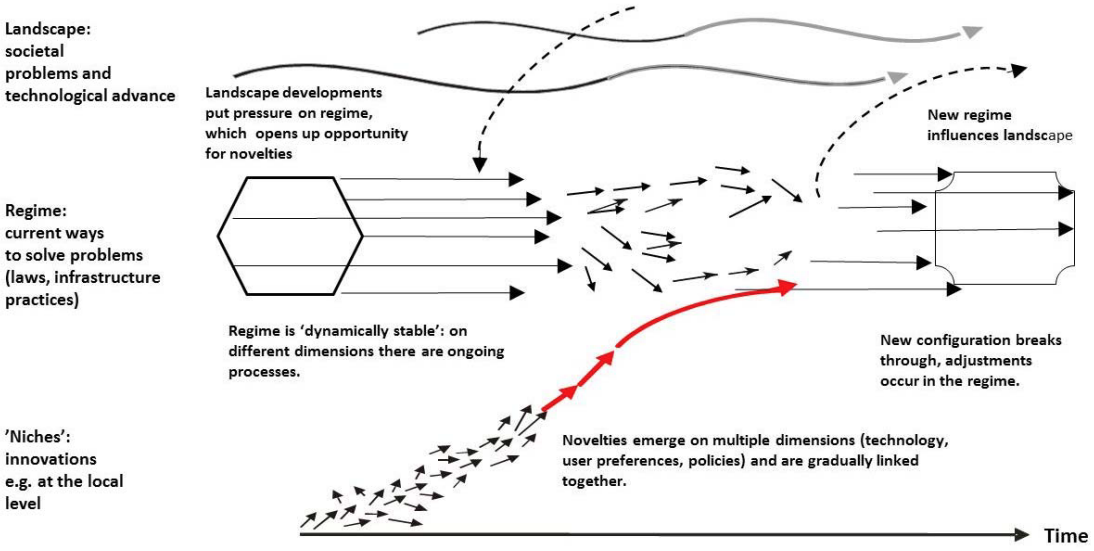

Figure 1. Multilevel Perspective to Socio-Technical Change Source: Geels and Schott[14]

1.3 Creation of markets and complementary measures to integrate supply and demand

In practical terms, this analysis takes us to the other two elements of challenges, market creation and the integration of supply and demand. There are few if any Type B challenges that can be resolved by RTD measures alone. Some examples of dependencies are in Table 1 below using example missions.

Historically lead markets such as wind power in Denmark and fax machines in Japan have derived from a combination of favourable innovation conditions (e.g. technological competence and business competition), heightened need (e.g. nuclear opt-out or difficulty of transmitting Japanese characters creating scale in demand) and a supportive regulatory environment (initial premium pricing or early telecoms regulatory reform). Many of the options presented offer similar opportunities for Europe but will only be realised if the full power of a single market for innovation is brought to bear. Public procurement may provide an additional accelerant in many cases.

[14] Geels, F. and Schott, J. (2007) Typology of sociotechnical transition pathways *Research Policy Volume 36*, Issue 3, April 2007, Pages 399-417

Table 1 Dependencies on Complementary Measures

Challenge	Mission	Complementary Measure
Zero Waste Households	Fully recyclable packaging technologies that increase shelf life & minimize use of plastics	Regulation to ensure take-up by producers. Economic or behavioural incentives for consumers to increase recycling. Public/private investment in recycling infrastructure
Cyber-safe Navigation	Innovative cybersecurity technologies based in Europe	Substantial training initiative to benefit from technologies. Parallel work in psychology and culture of security. Systemic approach to eliminate points of failure outside scope of technologies.
Water-stress free regions	New membrane technologies	Complementary infrastructure notably renewable energy. Procurement initiatives to accelerate take-up beyond the normal slow replacement rate for infrastructure. Conservation measures to reduce demand.

2 Principles to underpin the selection of missions

2.1 Building a policy narrative

A 'mission' gives both a sense of urgency and a sense of meaning. The first is positive since Europe needs to innovate faster. The second is also positive since Europe needs to innovate better. Through a 'mission'- a policy can express values that citizens care for: sustainable growth, green growth, inclusive growth, balanced growth, growth based on fairness.

To build a new policy narrative based on 'missions' it will be necessary to set out the ambition and the dream. It should resonate with what Europeans aspire to and describe how research and innovation can help them achieve this ambition. The challenge is how to address, communicate and convince Europeans - as diverse a population as possible in terms of nationalities, generations from 'silver surfers' to millennials, political advocates from nationalists to immigrants. A mission shows an ambition based on underlying values. It requires a strategy to get from where we are now to where we want to be in the future. A mission must meet the aspirations of the citizens and needs of society with a pull from a market and a capacity to execute it. In this context, the way missions are set out from the design to the implementation is critical to avoid a mismatch between what should be done and what can be achieved. For R&I policy, this formulation must especially resonate with the dreams of citizens who are to implement these missions: researchers, innovators of all sorts, students and all of their communities.

Taking the goal to adapt and mitigate climate change. To this end, one possible formulation of a mission could be 'to make all public buildings in Europe zero CO2 emission by 2030'. This would be simple, convincing and easy to become a common mission for diverse groups. But is the public sector ready to take the lead on such a mission, act on what such a mission would advocate and help implement it? Or, to take the emerging challenge of digital illiteracy, leading to social exclusion, poverty and segregation. Let us imagine what possible missions in this area could be and how interdisciplinary research and social innovation could respond to it?

We cannot promote all possible missions. We need focus. How to choose which mission to promote? Which criteria to use? In addition to classic criteria for policy making (e.g. market failure), the peculiarity of mission-oriented policies is their focus on societal benefit. We cannot therefore state that one mission is "better" than another, because missions cannot be put on a scale of performance. They are not technically commensurable. We can instead state that a mission is "more meaningful" than another. By "meaningful" we mean that it fulfils the aspirations of "all those concerned". It is a judgment of values that cannot be measured technically but only gauged through engagement.

Stakeholders groups and citizens will want to understand why the proposed missions have been selected and thus are considered more important than others. They will challenge any selection unless there is an organizing principle, a rationale, a well-understood vision. The proposed list of missions should not be very long so that it can be memorized, hence easily communicated.

2.2 Examples of missions

The likely initial number of missions is likely to be between five and ten given the available resources. To gain widespread support a portfolio will be needed covering key socio-economic domains. Those chosen will need to be missions where innovation policy is a substantial part of the solution but complementary measures in areas such as regulation, procurement, training and public investment will be needed. Existing and planned activities have strong mission-oriented elements but may need greater clarity and focus to become missions. It is not the role of RISE to select missions but we present two examples in the Annex to illustrate how the above criteria may be applied. In both

cases they offer the opportunity to extend the openness agenda through scientific diplomacy and illustrate that missions can be built on the foundation of existing activities:

- PRIMA – the focus on nutrition, water and migration highlights important challenges but an example of a mission in this area would be provision of clean water through desalination at the same price as existing sources. This would have particular resonance in the South of Europe and would underpin Science Diplomacy in the Mediterranean region.

- Cancer is a societal challenge but it is important to define within a mission based on increasing long-term survival with a clear rationale for the target of three out of four patients and the need to ensure that the approach is inclusive across all Member States.

3 Engagement of Citizens

3.1 Scope of engagement

As indicated above, a mission as conceived here requires public support at a level only possible if it engages citizens. Such engagement is most effective when they are actively involved in the design of a mission. This is preferable to polling or social dialogue. Engagement by co-design for a mission requires converging engagement around a basic proposal put forward by policymakers. The public role is one of 'texturing' the mission ('IKEA effect"). Digital technologies and social games offer innovative ways to structure this engagement.

In contrast with technology-push policies, mission-driven policies focus on the outcome for society. They encompass not only action on technologies, but on a complex and multifaceted set of systems (markets, regulations, organizations, processes, services, and not least, culture and values). Achieving a mission therefore requires the concerted action of a wide array of players: not only scientists and technologists, but also manufacturers, users, public institutions, policy makers at all levels. In short, a mission-oriented policy requires engagement of all levels of society. Given a mission, whatever it is, and however narrow, we will be unlikely to find a sector of society not affected by it: missions are meant to have large impact. Hence, when we mention the engagement of all levels of society, we do not mean the engagement of representative actors. A mission touches everyone, every person. Engagement therefore does not pass through "representation" but through direct engagement of "all" those concerned.

3.2 Towards engagement by design

The two considerations above imply that, in mission oriented policies, engagement is far more complex than in traditional technology push policies, first, because of the number of players to be engaged and their heterogeneity and second, because of the elusiveness of the selection criteria (meaningfulness). When dealing with mission-oriented policies we need to be creative in the way we engage all the stakeholders. There are three possible ways to engage:

- Engagement by social dialogue: The policy makers (or a few representatives) identify a few possible missions and then communicate them to the public. The public is then engaged into a dialogue, animation, collecting opinions, feedbacks, and updates on progress. This implies for example use of social media.

- Engagement by polling: in addition to social dialogue, policy makers engage the public early on in the process of selecting the possible missions, through for example mechanisms of digital polling and voting.

- Engagement by design: Policy makers engage the public earlier, in the process of designing possible missions.

There is emerging evidence that the most powerful way to engage people in missions is the third one, i.e. through participation. People love what they contribute to make. Which implies, that people will contribute to missions only if they will have a part (however small) in designing it. Hence, the best approach to engagement in mission-oriented policies is engagement by design. This is not simply communication or engaging people through social media. Nor is it voting. It is active participation in shaping the mission (everyone with their own role, of course).

Participatory policymaking is not new, with experience especially from the areas of urban planning. In addition, the EU has recently promoted user-driven labs or "living labs" to support innovation development. These early attempts however have shown only partial (if not minimal) success. Their mistake has been to invert roles and expertise: asking citizens to become innovators of complex systems they rarely master. We do not talk

here of "call for ideas" about missions. Definitely, we live in a world overcrowded by ideas, so asking for additional ideas from everyone would simply create confusion, divergence and make everyone disappointed (including the citizens).

Mission oriented policies require instead converging engagement. We talk here of engagement at the right level: in the process of aligning around a mission that have been put forward as a sketch by policy makers, and where the general public designs by adding "texture". In the metaphor of the IKEA effect, IKEA does not ask people ideas for furniture. IKEA provides 90% of the work. We only add 10% (by personal assemblage and interior design), but this small level of personal design and making makes us feel engaged.

3.3 Platforms for engagement

There are nowadays digital technologies that can enable the engagement of large numbers of people by design (for some early example see: https://sidewalktoronto.ca, with the participation of Google). More research and understanding is required. Moreover, the EU, with its attention to inclusiveness, may pioneer innovation in the space of engagement technologies (which, by the way, are expected to have significant market in the future, to support collective decision-making).

We can envision already now an example of a pathway: the creation of digital engagement platforms, designed as social games – or sandbox games. In a social game, the policy maker put forward a possible mission, plus four starting scenarios on how this mission could be pursued. Then the public participates by adding texture (everyone from their level of capabilities and perspective, in terms of design details and, most of all, social behaviours) so that the scenarios become more robust and decision on where to go naturally supported.

4 Governance of missions

4.1 Leadership

A successful 'mission' - in any domain or frontier of science and innovation - is as much about leadership, teamwork and creativity as about excellence, lab infrastructure and funds. Europe excels in the latter; the former is more difficult to measure, more difficult to nurture, more challenging for policy makers to tackle. Tracking impact of people coming from different education institutions (alumni, dropouts, graduates, activists, etc.) and empowering leaders should become one of the mission-oriented policy.

However, mission-oriented policy can become a new narrative only if the Union and the States become authentic in embracing it as well. This would entice state bureaucracies to become innovators in their own rights, put focus on pre-commercial procurement, force e-government, digital cities infrastructure, and create demand and new markets for European innovations. Is the public administration ready to become a disruptor and an early adopter? What policy and form of governance could increase these qualities and incentivize change?

Missions will need a new governance to be able to align multiple mechanisms and domains at least at the level of the broader challenge. It is worth adopting the long-standing recommendation of the Aho Group, which saw the need for:

"the appointment of a senior individual of high standing and demonstrated independence with the remit to create a platform and orchestrate European action in the area across DGs, Member States and regions and to liaise between R&D performers, regulators, users and sectoral stakeholders."

The role of this individual would be to champion the mission as well as to drive it. The level would be a former senior minister or chief executive of a major company or NGO with the ability to pick up the phone on a peer-to-peer basis when barriers need to be overcome.

4.2 Multi-level governance and navigating the landscape of EU policies and instruments

Multi-level governance will be needed. While a new agility in management is necessary it is not realistic to devolve responsibility as far as is the case in DARPA. A framework for accountability and evaluation is needed with short, medium and long-term targets so that delivery is more than a promise. The power to stop unpromising activity and reallocate resources is essential. A new level of policy coordination is also likely to be needed which emphasises the cross-functional ownership and implementation of missions – see for example Figure 2.

All actors in the innovation ecosystem will need to be engaged. The aim should be to encourage corporate involvement and investment both by the major companies who anchor innovation ecosystems ad provide investment capacity, and by the disruptive scale-up firms who may challenge or even replace the incumbents. Where the mission is strongly socially oriented, the anchor role may have to be taken directly by government. In either case, the implementation approach will need to address all elements of the emergent innovation ecosystem.

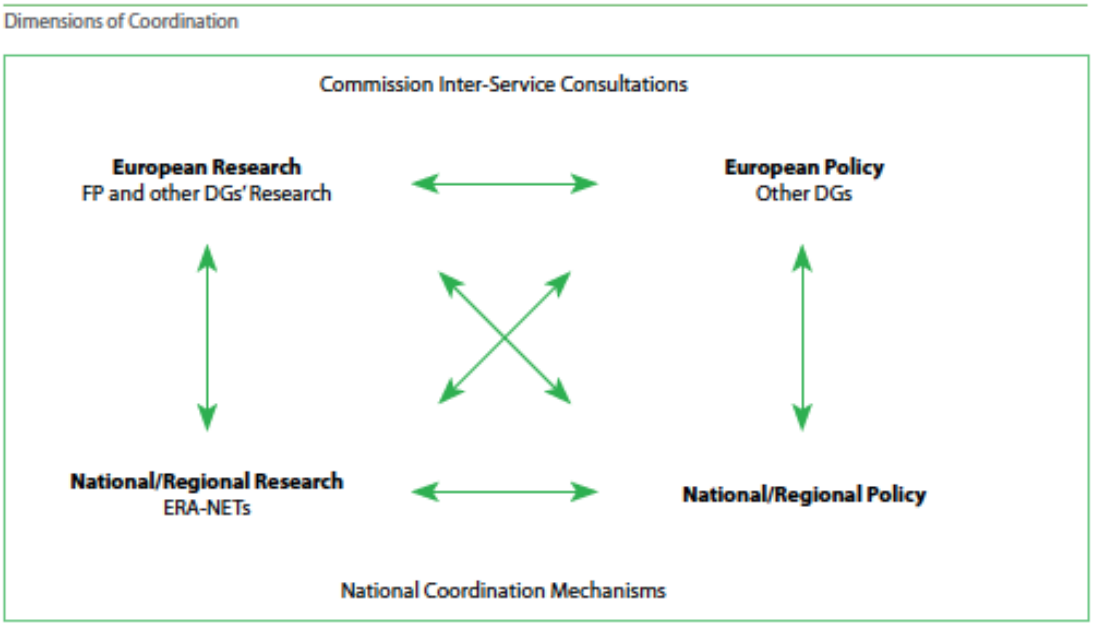

Figure 2. Dimensions of coordination Source: ERA Rationales Report[15]

There have been a vast number of policies, initiatives, programs to overcome the European paradox. Still it persists. One of the key drivers of this self-perpetuating paradox is that the bridges between research and innovation, and innovation and entrepreneurship remain too weak, too narrow, and too traditional to generate growth. This is due largely to the lack of entrepreneurial culture (in the broadest sense) and the lack of digital transformation, including of the public sector. It remains unclear how would mission-oriented policy tackle these shortcomings which are structural, organizational and cultural in their nature.

The EU has been experimenting with diverse policy instruments and the landscape is much too complex. Missions could be used as an organising tool to pull resources along value webs and build joints projects, create synergies. However, this requires a specific organisational set up which is actually embodied by the EIT KICs. These are trusted, interconnected networks of communities from research / education / industry / entrepreneurship across European innovation ecosystems. Their set up carries – by design – a potential for triggering exponential growth in the clusters where they operate. In the specific context of the EIT KICs, mission-oriented approach seems to leverage very well their approach based on "Grand Societal Challenges". Actually, the narrative of the 'Grand Challenges' may give continuity between current and the future Framework Programs in that the challenges are more universal broad issues and 'missions' are a set of concrete objectives how to tackle these challenges.

A possible visualization of the relation between Grand Challenges and a 'mission-oriented' policy approach is depicted in Figure 3.

[15] Challenging Europe's Research: Rationales for the European Research Area (ERA) – Report of the ERA Expert Group, European Commission 2008

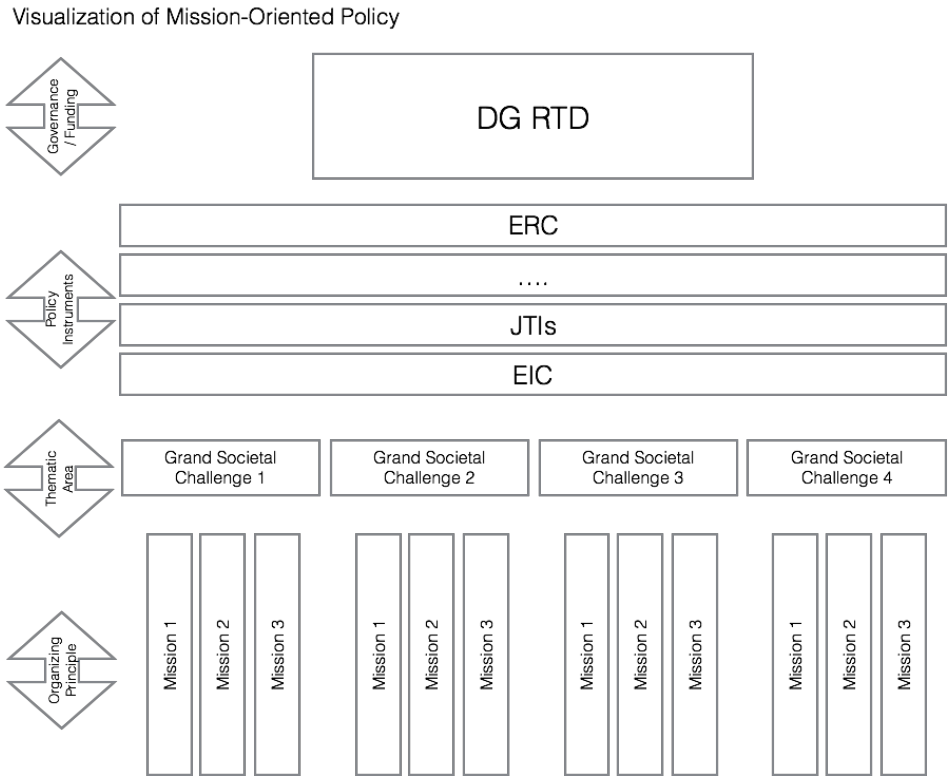

Figure 3. Visualisation of mission-oriented policy Source: Daria Tataj

The horizontal instruments / agencies – if looked upon as networks of participants and as a portfolio of interconnected projects - become in this diagram more aligned pulling funding towards selected missions. However, this would require a rethinking of the governance model of these instruments.

We can draw lessons from the governance set up of the EIT, which was designed through its governance model not as another funding agency but as a 'smart' investor or as an "Impact Investment Institute'. The pillars of this model are trust rather than control-based governance, investment logic rather than redistribution of taxes, financial self-sustainability of KICs as 'seed funding' policy of the EIT, funding of KICS based on maximizing returns of investment stimulating competition and putting resources to a better use. In this sense, the EIT is a Europe-specific embodiment of the thinking about the identity and role of the state as the 'entrepreneurial state' as referred to in Mariana Mazzucato's work.

The KICs, as trusted innovation networks, offer an organisational set up designed to bring exponential growth in terms of creation of new jobs though start-ups and scale-ups, university graduates better prepared for the needs of industry, and innovative solutions to societal challenges embraced by industry for mass markets. Furthermore, the EIT itself offers this, very novel for Europe, governance model with an entrepreneurial DNA. The data published by the EIT regarding its impact shows that the model seems to be working: Over the period 2010-2016, the EIT has led to the creation of 6000 jobs, and start-up companies nurtured in its ecosystem have raised 600 million EUR VC funding. Pulling the EIT under the DG RTD portfolio would, on the one hand, valorise it into the mainstream innovation policy giving it much needed leverage, and on the other hand, it could share some of its entrepreneurial governance model to reinvigorate the governance models prevailing at present. Pulling the EIT under the DG RTD portfolio would limit some of the confusion. It would also help make use of the EIT KICs as vehicles for implementation of the 'missions'.

5 Concluding remarks

Europe starts in a good place for implementing a mission-oriented policy approach with large-scale historical successes in areas such as space (ESA) and aircraft production Airbus) demonstrating what can be achieved with sufficient drive, leadership and broad-based commitment. From this short review, we conclude:

i. Missions have their origin in wider challenges but are distinguishable as a specific package of actions that makes defined progress against the challenge with verifiable objectives on a planned timescale.

ii. In focusing the challenge to a level of granularity that is addressable by a mission it is essential to keep traceability to the original challenge that connects to citizens' aspirations. The price of focus is exclusion of part of the scientific constituency for the challenge but normally the public will retain their sense of inclusion.

iii. A mission will normally require infrastructural and behavioural change in tandem with scientific and technological innovation, in other words a mixture of supply-side and complementary demand-side market creating measures.

iv. Engagement of citizens is most effective when they are actively involved in the design of a mission. This is preferable to polling or social dialogue. Engagement by co-design for a mission requires converging engagement around a basic proposal put forward by policymakers. The public role is one of 'texturing' the mission ('IKEA effect"). Digital technologies and social games offer innovative ways to structure this engagement.

v. Missions will need a new governance to be able to align multiple mechanisms and domains including the EIT, EIC and JTIs at least at the level of the broader challenge. A Chief Executive of personal high standing will allow doors to be opened for them (typically an ex-high-level corporate CEO or political figure) and to foster leadership, teamwork and creativity. Multi-level governance will be needed.

vi. While a new agility in management is necessary it is not realistic to devolve responsibility as far as is the case in DARPA. A framework for accountability and evaluation is needed with short, medium and long-term targets so that delivery is more than a promise. The power to stop unpromising activity and reallocate resources is essential.

vii. Missions will require a policy narrative that resonates with the dreams of citizens and builds on values that gives them meaningfulness.

ANNEX 1 USING A MISSION AS AN INSTRUMENT OF SCIENCE DIPLOMACY

While becoming an increasing practice and a resource for the European multilevel governance, Science Diplomacy within mission-oriented thinking contributes to facing the most pressing challenges of globalization: demographic and climate changes, pandemics, natural disasters, cybersecurity, nuclear proliferation among others. Relying on scientific knowledge and innovative technology, it supports the achievement of long-term development, in accordance with the Sustainable Goals (SDG) of the 2030 agenda.

Internationalization of science constitutes a powerful tool for growth. Open comparison and competition may lead to greater intrinsic quality, contributing, directly and/or indirectly, to economic development and growth. In spite of the economic crisis, Europe today is living a period of peace and stability. However, we must be strongly committed to promoting science and technology within international cooperation with third countries. The Middle East and Mediterranean area still face conflicts and wars, while most Sub-Saharan citizens still live in extreme poverty. In recent years, the agricultural sector in the Mediterranean has been suffering from severe water shortages and decreasing crop yields: 80 million people in the basin are currently considered 'water poor'. The lack of clean water and nutritious food has adverse effects on the health and stability of populations.

In this case, Europe is already offering a good instance of science diplomacy: a new Partnership on Research and Innovation in the Mediterranean Area (PRIMA). This will develop much-needed solutions for a more sustainable management of water and agro-food systems. The main objective of the ten-year programme (2018 – 2028) is to devise new R&I approaches to improve water availability and sustainable agriculture production in a region heavily distressed by climate change, urbanization and population growth. The partnership consists of 19 participating countries and is financed through a combination of funding from participating countries and a contribution from Horizon 2020.

Though preceding the current move towards missions, PRIMA is a good example of this approach. It is addressing a challenge (health and nutrition) which different countries may identify as a priority and tackling some specific problems related with the main issues (e.g. access to clean water and new desalination plants). It was top-down in vision and strategy, but it will be implemented by means of a bottom-up integrated process.

Matching challenges with a mission-based approach is crucial for ensuring a long-term sustainable and inclusive growth, according to the United Nations Sustainable Development Goals as well as the fundamental principles and goals of the ninth FP (cooperation, excellence, impact and openness). This kind of approach implies the governance of heterogeneous strategies, integrating a complex network composed of stakeholders with diverse nature and bearing various interests. In such a framework, the central role of Civil Society, inside and out of Europe, both in decision-making and in implementation of policies and actions, calls for promotion of consensus and collaboration in international relations, both public and private.

ANNEX 2 A MISSION-ORIENTED APPROACH TO CANCER

A policy brief on a "Mission-oriented approach to cancer in Europe: Vision/Mission 2030" has been prepared to identify the instruments and policies required for its implementation.16 The mission proposes that by combining prevention and treatment strategies in a sustainable environment, it will be possible by 2030 to achieve the long-term survival of three of four cancer patients in countries with well-developed healthcare systems and pave the way to handling the economic and social inequalities in countries with less-developed systems.

The mission differs from the Nixon "War on Cancer" and the recent Obama "Cancer Moonshot" initiative in the USA in some important aspects. First, the European cancer community has proactively organized itself during the last years to create the necessary critical mass of multidisciplinary expertise, patients, cutting-edge infrastructures, and resources that are needed to deal with the challenge. Second, the community has identified leaders, with proven record and commitment to cross-border collaborations of excellence that are ready to spearhead the fight against the disease.

At present, there are many hurdles to health research and care related to the main chronic diseases, and to overcome them it will be necessary to incentivise all the relevant stakeholders – researchers, clinicians, industry, regulators, healthcare providers, payers, patient organizations, and EU and national policymakers – to synchronize their actions and work in partnership to tackle the challenges. Moreover, sustainable infrastructures linking research with the healthcare systems will be instrumental in ensuring that in the future discoveries translate swiftly and efficiently into tangible healthcare outcomes that benefit patients and civil society across Europe.

Among the chronic diseases, cancer has already provided a notable example of how to build communities/ecosystems to address the disease(s) in partnership, using a bottom-up patient-centred approach and taking advantage of the opportunities created by personalised medicine. Together with the Commission and policymakers, the cancer community has worked pro-actively during the last 15 years to structure translational research, to avert fragmentation and to reduce the considerable burden imposed by the disease(s) on the healthcare systems. Two consortia, Cancer Core Europe and Cancer Prevention Europe form examples of how to create critical mass necessary to deliver innovation into European healthcare systems.

Building the mission is a work in progress that will be adapted constantly to incorporate the cutting-edge research required by the various components of the cancer research continuum and keeping a focus on innovations that benefit patients/potential patients.

[16] Celis, J. and Pavalkis, D (2017) A mission-oriented approach to cancer in Europe: a joint mission/vision 2030 Mol Oncol. 2017 Dec;11(12):1661-1672

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RISE is the independent Research Innovation and Science Expert high-level group advising the European Commissioner for Research, Science and Innovation. Following the invitation of the Commissioner, and a dedicated meeting with him in December 2017, members of the RISE working group on Mission-oriented R&I policy provided their perspective on how such a policy could work at EU level.

For their reflections, they were joined by a member of the Economic and Social Impact of Research (ESIR) high-level expert group to provide a bridge between the explorations of the two groups on mission-oriented policy.

Studies and reports