

On the evolving nature of EU research funding:

H2020 interim evaluation and directions towards the next framework program (FP9) in an increasingly diverging Europe

Portugal's Position Paper

(as defined after public consultation in the period February-April 2017)

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Summary

Three years after launching the current EU Framework Program for Research and Innovation, Horizon 2020, and after a decade hit by recession and economic and budgetary problems, together with the emerging debate associated with the impact of BREXIT, research and innovation policy formulation in Europe must take into account countercyclical measures to adequately **strengthening knowledge-based cohesion platforms across Europe, promoting opportunities for pre-competitive research, together with European added value.**

Collaborative research and innovation in all branches of knowledge must be promoted all over Europe in an effectively inclusive way and oriented towards the continuum of knowledge production and diffusion processes, encompassing all stages from curiosity-driven to market-oriented research. The EU Framework Program for Research and Innovation should also act against the unidirectional migratory flows of skilled people from the peripheries to the center of Europe, promoting brain circulation, the advanced education and employment of skilled human resources all over Europe.

In particular, the promotion of scientific employment all over Europe, together with knowledge-based European added value, requires persistent actions to foster pre-competitive collaborative research and innovation, together with multi-national and fully European collaborative research laboratories involving public and private stakeholders all over Europe, as well as further internationalizing knowledge and innovation networks.

Overall, this will require that further drawing of funds from the H2020 budget to finance other European Programs are avoided and that the funding level of the next EU Framework Program for Research and Innovation is enlarged and oriented towards pre-competitive research with European added value. This should clearly be assessed on the basis of **research excellence, research openness** and effective **institutional collaboration** at a European level.

Six main issues should be considered to guide the successful continuation of Horizon 2020 (i.e., for 2018-2020) and to help designing the next EU Framework Program for Research and Innovation (i.e., FP9; 2021-2027), as follows:

1. **Scope - Collaborative, bottom-up and pre-competitive research and institutions towards European added value:**

- Adequately strengthening pre-competitive research and knowledge-based cohesion platforms across Europe, together with European added value;
- Complement national strategies and funding schemes, instead of replacing them, by strengthening collaborative, cross-border bottom-up pre-competitive research and innovation across Europe;
- Avoid a hierarchical division and the potential dichotomy between fundamental academic research and market-driven applied research oriented by large companies. Instead, foster the continuum of knowledge production and diffusion processes, encompassing all stages from curiosity-driven to market-oriented research, involving small, medium and large firms together with research institutions and intermediaries in transdisciplinary cooperation all over Europe;

- Actively act to decrease the internal divergence of research intensity across Europe, by promoting inclusive approaches all over Europe. This requires clear incentives to increase funding levels for research in European peripheries and effectively build a fully inclusive *European Research Area (ERA)* and *Innovation Union*;
- Stimulate joint European collaborative research laboratories, as multi-national and fully European research organizations involving public and private stakeholders all over Europe;
- Further improve the integration of Social Sciences and Humanities into Societal Challenges;
- Enlarge and promote the COST program for cooperation networks (that currently involves only about 4,000 researchers across Europe) and use its experience to launch and promote the *European Innovation Council (EIC)* to foster Europe-wide pre-competitive research among all SMEs, as well as small and micro enterprises.

2. **Re-Focus - The skilled human resources dimension:**

- Act against the unidirectional migratory flows of skilled people from the peripheries to the center of Europe, taking effective actions to, instead, promote brain circulation;
- Promote scientific employment all over Europe, namely by offering better career opportunities for young researchers and “double-appointments” across European institutions, as a way to better promoting knowledge-based European added value;
- Engage institutions and promote linkages between industry, research institutions and higher education institutions, fostering the advanced education and employment of skilled human resources all over Europe, with an emphasis on younger people;
- Further increase the funding for the *European Research Council (ERC)*, but target a higher share of the overall funding for the participation of young researchers, that have so far generated a very significant and higher European added value;
- Promote new research skills in “data science”, towards an effective engagement of researchers in “Open Science” all over Europe, including the manipulation of large data sources (“i.e., “big data”) as well as the promotion of “open access”;
- Create a *Rapid Response Mechanism for Research and Higher Education in Emergencies*, to fund a fast track entry point for the students and scholars refugees from communities and/or countries at risk in need of humanitarian assistance. In addition, a long-term plan to help building research capacity in conflict regions in the Middle East should also be considered.

3. **Funding:**

- Avoid any drawing of funds from the R&D budget to finance other European Programs and actions and enlarge the next EU Framework Program, providing a significant increase in the R&D budget relative to H2020. This requires a mobilizing action throughout Europe oriented to guarantee that the next Multiannual Financial Framework (MFF), to be adopted by early 2018, strengthens the role of research and innovation for the future of Europe. MFF will pave the way for designing the FP9 and it is of critical importance that pre-competitive research for European added value is fully considered with an appropriate ambition;
- Any trends to turn the EU Framework Program for Research and Innovation in a system to sponsor large European firms, namely through Joint Technology Initiatives (JTI), must be refused. Instead, the EU Framework Programmes for Research and Innovation should guarantee opportunities for bottom-up collaborative and pre-competitive research for a large range of institutions, including universities, research institutions and SMEs, based on clear criteria of research excellence, research openness and institutional collaboration;
- Guarantee that research grants are not replaced by loans, which should be reserved for market-oriented research as a means of complementing grants. The use of alternative funding mechanisms, including reimbursable funding instruments, should be carefully assessed and should not affect grant-based research funding;
- Access to equity capital and loan-based financing should be made accessible all over Europe, but appropriately established for low-risk, market driven knowledge valorization, research and

innovation. On the other hand, high-risk and European wide collaborative research and technological development requires a firm commitment of public funding throughout Europe and the EU Framework Program using grants;

- Guarantee a revised complementary, efficient and compatible regulatory framework among the various EU funding mechanisms, particularly for the EU Framework Program for Research and Innovation (i.e., H2020 and FP9), COSME and European Structural and Investment Funds (ESIF).
- Ensure that most of the funding in FP9 is devoted to collaborative S&T actions involving international teams from several European countries.

4. **Governance:**

- An effective coordination between the European Commission and national research agencies and councils should be guaranteed, in a way to avoid the current situation of rather competing and conflicting schemes. This requires coordination procedures and mechanisms to ensuring that MS/AC have a more important role in the setting of work programs and priorities as well as revisiting the scope and quality of data provided from implementation;
- Co-funding mechanisms (including ERA NETs, EJPs, Flagships, Articles 185, ECSEL and Teaming) should be fully re-evaluated and guarantee an inclusive and collaborative approach among the European Commission and national research agencies and councils. Streamlining, rationalising and setting a cap on current co-funding instruments must also be considered;
- Joint Programming (i.e., "JPIs") must also be revisited, to avoid duplications with Framework Program actions. JPIs must remain strictly voluntary collaborative actions among groups of MS/AC with common special interests and they thus should not preempt nor replace FP research priorities, with separate governance schemes;
- Strengthening the performance and scope of European research infrastructures requires clarification and a revised collaborative governance of the European Strategy Forum of Research Infrastructures (ESFRI) with the possibility of access to funding from the European Structural Funds, in close cooperation with national research agencies and councils;
- Establishing an *European Innovation Council* (EIC) should encompass a new orientation for the SME Instrument in a way to broaden the scope of innovation and support activities beyond disruptive innovation, promoting a context favorable to "Open innovation" across the whole of Europe. EIC should guarantee fully bottom-up and pre-competitive schemes, accessible to all SMEs and micro enterprises across Europe in a way to guarantee funding opportunities for pre-competitive research and innovation for all SMEs and small and micro businesses across Europe. In addition, EIC should also consider:
 - Better integrating the *European Institute of Technology* (EIT) and related "Knowledge Integrated Communities" (KICs) in the European R&I landscape. EIT must change its priorities and methodologies to provide equal opportunities for research and innovation to European SMEs and Universities across the entire Europe, to compensate its current strong bias towards the stronger EU economies.
 - Promoting fully-european intermediaries in the form of *European Collaborative Laboratories* to be established across member states, with a view to facilitating risk-sharing partnerships between governments, industry and academia with a multinational and fully European nature and status.
- Promoting clinical and translational research in the health sciences to foster a large societal engagement to improve public health and health systems across entire Europe should consider establishing an *European Health Research Council* to guarantee additional and specific funding and assessment schemes of collaborative ventures between hospitals, health related research institutions and schools of medicine, nursing and health technologies.

5. **Attractiveness and administration:**

- The rate of success of EU funding has deteriorated due to oversubscription (around 1:8 in H2020, against 1.5 in FP7) and must be considerably improved. The evidence is that such low success rates

are increasingly associated to a large extent with random decisions. The use of “two-step” application processes should be fully implemented, making use of “fast track” mechanisms oriented towards decreasing “time-to-grant”. An increased FP9 budget for the most oversubscribed themes should also contribute to increasing the success rate.

- The current “funding model” should be stabilized, but further simplification of application processes, together with managing contracts should be guaranteed, also in a way that promotes the direct participation of researchers and SME’s and reduces the requirements for third parties and intermediaries;
- Application procedures should be further simplified, together with methods of internal cost allocation, staff costs and depreciation of equipment.
- FP9 and ERDF rules and regulations should be harmonized for research and technological development, simplifying their understanding and utilization by the stakeholders and facilitating synergies.

6. **Internationalization:**

- Foster a effective internationalization strategy towards an Europe “Open to the world”;
- Promote strategic linkages outside Europe, in a way to effectively foster European added value in key geographical areas, including, but not limited to:
 - The Mediterranean, particularly through the guarantee of the effective implementation of PRIMA (Partnership for Research and Innovation in the Mediterranean Area);
 - South and North Atlantic, including extending the *Galway Declaration* to southern Atlantic countries through the “*Belém Declaration*”, as expected for July 2017, and the promotion of a research and innovation agenda addressing critical societal challenges such as those concerning climate change by intertwining space, ocean and energy systems. This should consider promoting new funding opportunities for a innovative agenda on “Atlantic Interactions” and establishing an “Atlantic International Research Center, AIR Center”, in the form of an intergovernmental organization, as presented to the European Commission over the last few months;
 - Sub-Saharan Africa, by promoting the advancement of local scientific and innovation capacity;
 - India, by promoting advanced research networks with leading institutions in a way to guarantee establishing “Knowledge Integrated Communities” between Europe and India with impact in both zones;
 - China, by promoting advanced research networks with leading institutions, promoting the mobility of young researchers and establishing long-term collaborations and joint institutions with impact in the two zones.

1. The context and scope

The current level of European economic and technological development requires a major and sustained effort of public funding of R&D across all of Europe and this must be achieved in close interaction with the evolution of the EU Framework Program for Research and Innovation (i.e., Horizon 2020 until 2020 and FP9 beyond 2020). This should contribute to fostering scientific employment, but also, directly and indirectly, to fostering demand and economic growth. This is the path that regions and countries with high levels of R&D and a large percentage of business R&D have followed. The faster Europe, at large, addresses this challenge, the quicker it will be kept up with.

Above all, the evolution of the EU Framework Program for Research and Innovation for the coming decade should be enlarged to consider active public policies to attract and retain qualified human resources all over Europe, as well as considering public actions towards promoting new markets. For the economic fabric to gain greater competitiveness and access to external markets, it may be necessary to enhance the degree of internationalization of scientific communities and encouraging international knowledge and innovation networks.

International competition for qualified human resources for S&T is a critical strategic issue requiring the adoption of consistent and comprehensive national and EU actions for the increase of the attractiveness of S&T for the new generations, as well as on the capacity of Europe's R&D public and private institutions to make Europe attractive to youngsters, knowledge workers and related investments. The globalization of our economies and the rapidly increasing numbers of highly skilled people moving across the globe have completely changed the profile of migration: the ratio between the migration of people with lower skills and the migration of high skilled people, which is no longer an elite and relatively restrained type of migration, is much more equilibrated than in the past.

Overall, analyses suggests that further drawing of funds from the H2020 budget to finance other European Programs and actions should be avoided and Europe must enlarge the next EU Framework Program. This requires a mobilizing action throughout Europe aimed at guaranteeing that the next Multiannual Financial Framework (MFF), to be adopted by 2018, strengthens the role of research and innovation for the future of Europe. MFF will pave the way for designing the FP9 and it is of critical importance that pre-competitive research for European added value is fully considered and with an appropriate ambition.

To conclude, **Europe must thus enable FP9 with a suitable significant growth in budget relative to H2020.**

2. R&D funding levels and the human resources dimension

The need to increase human resources for science and technology in Europe should be continuously stressed and the attractiveness of Europe for highly qualified scientists from other regions of the world boosted. This is the time to call for a common approach to science, innovation and migration and call on all stakeholders to work together in the development of a comprehensive set of actions to attract human resources for knowledge and foster brain circulation for all.

Why is it not trivial to understand that investing in S&T creates jobs and exports and is indispensable for long run growth in modern economies and societies? This question is increasingly relevant because while some priority has been given to encouraging greater convergence of the R&D investment levels of some European countries and regions with average EU levels, these efforts have been insufficient¹. In addition, the accumulation of that investment in many European regions and countries is still very low, if compared to more industrially developed regions, particularly in the USA.

¹ see, for example, M. Heitor (2015), "Science Policy for and increasingly diverging Europe", Journal of Research Policy and Evaluation, 2.

² See, for example, Luc Soete (2015), "From the old ERA to a new era of "Open Knowledge Creation in Europe", European

Analysis shows levels of accumulated investment per researcher in Europe to be about 50% lower than in the USA and that the average investment in R&D per citizen in Europe has decreased comparatively to that in USA. Recent data also shows that only those European nations that have increased investments in S&T and managed, at the same time, to diversify their economic structure have fully guarantee the necessary absorptive capacity to foster the impact of S&T in economic development. The implications for Europe is obvious and call for an increase in the budget allocated to R&D all over Europe with measures oriented towards technological diversification and intensification of the industrial base across different sectors.

In short, increasing expenditure on R&D carried out in universities and firms is not inevitable, but a choice. European citizens at large and their governments must make this choice, and it is important that they are aware that if we do not continue to grow in those areas, it will be difficult to encourage technological innovation and economic competitiveness. In order to achieve these objectives, **it is paramount to mobilize and employ more PhD graduates throughout the whole Europe, foster research in higher education, strengthen the relationship between higher education institutions and society at large, and guarantee scientific and technological relationships with the leading institutions worldwide.** And this can be only achieved if we simultaneously stimulate both supply and demand with respect to the capacity to undertake R&D.

2.1 Balancing brain circulation and intra-European migratory flows of skilled people

Research mobility is an important element for social and territorial cohesion at a European scale. Hence, a healthy distribution of the R&D personnel may play an important role in decreasing the gap between Europe at large and other advanced regions. The recent financial crisis had a number of far-reaching implications for the European Union, and one of these has been the way it has impacted intra-EU mobility of researchers and skilled workers. Although precise numbers have not been registered yet, there are clear indications that crisis-hit European countries have been experiencing significant emigration flows.

The outflow of highly-skilled individuals faced particularly by Southern and Eastern European countries in the last years may have significant negative long-term implications for Europe at large. Current migration trends – with remittances tending to fall and mobility of the highly skilled rising – widen the gap between core and peripheral European regions, due to the net and systematic losses of highly skilled and especially young people by the periphery. This means working together in policies to invigorate the attractiveness of investments in education, research and innovation institutions in the periphery, which are systematically facing the centrifugal forces affecting their current and potential human resources. These policies should be a concern at the EU level, since the ‘brain drain’ process among Member States – which systematically transfers resources from economically less developed to more developed regions – is not a process that individual countries with persistent losses can or should face on their own and that, if left unchecked, will lead to structural imbalances that will have to be later compensated, somehow, with a much higher cost.

Beyond the systematic provision of official data on migratory flows of highly skilled human resources among EU Member states as well as between Member states and third countries, **the evolution of the EU Framework Program for Research and Innovation should consider mechanisms to foster brain circulation between Member States, with a view to balancing internal EU migrations,** as well as finding ways to boost the attractiveness of Europe for highly qualified scientists, making use of European Structural Funds.

2.2 Science in Europe and the refugees: Research and Higher Education in Emergencies

In recent years, a massive inflow of refugees from conflict regions was directed into Europe. Refugees have mainly been channeled towards the Southern countries as their entry point, and their number largely increased, leading to almost two million asylum claims by mid-2016.

Apart of the difficulties of handling the recent wave of migration, it should be acknowledged that there are particular opportunities for win-win policies and results related to those highly skilled human resources that arrive in Europe. These opportunities are easier to produce in Europe due to its culture of tolerance, which enables to embrace and work with diversity. Many of these refugees are young women and men who were forced to interrupt their studies and/or research in their countries of origin and seek to pursue their advanced education and thereby improve their initial career prospects. International mobility cooperation and exchanges are integral to the academic system. European Research and Higher Education Institutions are used to host foreign students and scholars and are able to develop emergency academic responses. Channeling highly skilled refugees to European education and research institutions will contribute to assisting refugee integration. This should be a priority policy for Europe.

On the other hand, the European experience in setting up SESAME in Jordan suggest that there may be further actions to promote the unique role that European scientists and their institutions, together with science diplomacy, can play in fostering research capacity and science for peace in conflict regions in the Middle East.

The Commission, member states and the European academic and research communities must be encouraged to work together in the development of a contingency plan to help continue research and education through the establishment of a solidarity instrument which will facilitate a dynamic and swift relocation process, ensuring that the refugees will have reception and integration support in line with international and European standards, as well as to start planning long term strategies to help building research capacity in conflict regions.

To conclude, **the EU Framework Programs for Research and Innovation, both the remaining part of H2020 and the future FP9, should thus consider a *Rapid Response Mechanism for Research and Higher Education in Emergencies*, in order to create and fund a fast track entry point for the specific target group of refugees, students and scholars who belong to communities and/or countries at risk in need of humanitarian assistance.** In addition, a long-term plan to help building research capacity in conflict regions in the Middle East should also be considered.

3. Funding levels and governance of research and innovation towards European added value: a European dimension, balancing action diversification with policy integration

Enlarging the funding level of next EU Framework Program for Research and Innovation and guaranteeing its orientation towards pre-competitive research with European added value requires a major mobilizing action across Europe and European Institutions. This should clearly be assessed on the basis of **research excellence, research openness** and effective **institutional development and collaboration**.

It should be noted that innovation is a shared goal of countries within the European Union and even beyond. This unified goal requires policies that are designed in an integrated and systemic way, but can be implemented via diversified actions and are relevant to territories with diverse characteristics. "Policy integration" should occur across a "portfolio dimension", since innovation policies require coordination across several areas linking sector-specific policy interventions in science and education, social care and health, the environment and industry, employment and market regulation. However, the implementation of policies designed in an integrated way needs, in a multi-country and multi-

cultural context, to consider differences across countries, regions and cultures, thus requiring differentiated actions. In fact, balancing action diversification with policy integration involves significant problems that extend into the very systemic nature of the relationships between country governments and the role and mission of multi-national political institutions, in addition to specific regional and local contexts.

Many academic contributions in recent years have confirmed the perception that the success of developing systems of innovation, either at national or regional levels, depends on the creation, dissemination and accumulation of knowledge, which *per se* are fundamental factors for the promotion of economic growth. The concept of a “learning economy” eloquently describes the way in which knowledge contributes to economic development, promoting innovation. It takes into account the dynamics of the process - dynamics that are very close to Schumpeter’s concept of “creative destruction”, which is a standard description of the innovation process. Innovation is associated with creativity, with the generation and use of new ideas, but also with initiative and risk-taking. Innovation entails bringing new ideas to fruition in the marketplace, satisfying existing demands or creating new needs, in a process that improves aggregate welfare. Overall, it is always associated with the creation of new markets. And, given that the EU aims to become an “Innovation Union”, the importance of the foundational idea that knowledge creates markets should not be underestimated², particularly in the following dimensions:

- Innovation and competence building for Europe. The need to look at competence, as the foundation from which innovation emerges, and which allows many innovations to be enjoyed. In other words, competence contributes both to the “generation” of innovations (on the supply side of the knowledge economy) and to the “utilization” of innovations (on the “user” side of the knowledge economy). Competence is also fuelled by innovation itself. Competence is associated with skills and capacities, both individual and collective. When we consider competence, we focus on “higher order skills”. These generic skills include higher levels of formal and informal education, but also capacities that are more cross-cutting and more widely applicable, such as creativity, risk-taking, entrepreneurship and initiative. Overall, it requires research practices to be generalized to the education system, in a way that contributes to the building of systems of innovation and competence building.
- Innovation and economic diversification. Analysis suggests that only those European nations that have increased the investment in S&T and managed, at the same time, to diversify their economic structure have fully guarantee the necessary absorptive capacity to foster the impact of S&T in economic development. The implications for southern and eastern European countries are notorious and call for the need to combine an increase in the budget allocated to investment in R&D with measures oriented towards technological diversification and intensity of the industrial base.

3.1 From a conceptual framework to practical implementation in Europe

The evolution of the EU Framework Program for Research and Innovation should consider **innovation “with” more research, not “instead of” research**. The technical literature is full of examples that clearly suggest the absolute need to consider the co-evolution and increasingly shared values of innovation and research.

In other words, Europe must guarantee the success of developing innovation together with the sustainable creation, dissemination and accumulation of knowledge across Europe. In this regard, two main observations are necessary, as follows:

² See, for example, Luc Soete (2015), “From the old ERA to a new era of “Open Knowledge Creation in Europe”, European Commission, RISE Policy Brief, June.

- First, as already mentioned, the accumulated investment per researcher in Europe over the last three decades is 50% lower than in the USA. In addition, the average investment in R&D per citizen in Europe has decreased comparatively to that in USA.
- Second, the quasi stagnation of public R&D investment in Europe over the last decade, which now accounts for about 2.0% of EU's GDP (for comparison, GERD in the US is about 2.8% of GDP), hides a major trend of internal divergence inside Europe itself. For example, in the year 2000, Germany and France displayed similar national R&D budgets; today, Germany outpaces France by 50%. Italy's budgets have declined since 2007, and in real terms are 15% lower than in 2000. And, most small countries have slowed down, or cancelled, previous increases in R&D budgets. This trend has emerged as a result of the deep international crisis that has been affecting Europe and to which many analysts, scientists and scientific organizations have turned their attention, in several European regions, with special emphasis on southern European countries.

The implementation of new policy actions in Europe should, of necessity, consider critical needs, giving top priorities to:

- i) Employment growth, by promoting and addressing new markets;
- ii) New players, with capacity to foster innovation dynamics and contribute to the restructuring of European economies;
- iii) Engaging youth, so as to facilitate processes of generational change and promote new belief and confidence in the future;
- iv) Strengthen social cohesion in Europe.

Above all, each generation should not only be endowed with the skills appropriate to the exploration of new horizons, but should also have the opportunity to do so in practice. This will require considering a diversified, territorially-relevant, flexible and inclusive approach to start-ups and fast growing SMEs, together with a range of "intermediary institutions" in the form of risk-sharing schemes. The ultimate goal should consider the need to increase the density of new innovation players throughout European regions.

3.2 Making it operational: a new experimental approach addressing new capital markets to enlarge funding levels for innovation in Europe.

The evolution of the EU Framework Program for Research and Innovation and the potential creation of the European Innovation Council (EIC) should be considered by identifying three levels of distinct issues:

- i) What has already been done that should be improved, namely under the existing H2020;
- ii) What has not been done in Europe; and
- iii) What is reasonable to be done through EIC.

Evaluating and assessing these three issues will clearly allow the mission of the EIC to be more clearly defined, and its potential scope clarified. Examples include the existing "SME Instrument" and other innovation-related programs considered under the current scope of H2020, which do require to be improved (e.g., the need to correct current deficiencies such as budget constraints, overly lengthy bureaucratic procedures that prevent new innovation players from accessing EU funding). Overall, EIC should focus on distinct issues and open new opportunities for innovation in Europe.

The potential creation of EIC should allow complementing and extending the overall level of current funding for research and innovation in Europe, namely to provide new opportunities to fund and stimulate pre-competitive research across European SMEs. In other words, EIC should facilitate access to new and alternative funding sources for European SMEs to better perform and engage in pre-competitive research and should not compromise in any way the current levels of funding for collaborative research through H2020. This will definitely include, among others:

- Emerging forms of accessing capital markets, namely through EFSI and involving the EIB and EIF. The experience of the last few years on trialing alternative forms of financing innovation in Europe

should be effectively monitored and assessed in a way to better guarantee the use of EFSI related funds for innovation in the coming years. It clearly must contrast with the experience of using public funds for research under ERC and other research-oriented agencies.

- Simplify the access to EU structural funds at a European level, making them an effective funding scheme for research and innovation.
- Implementing new integrative schemes in Europe: problem-based, bottom-up, one-stop shop. The potential creation of EIC should consider a new identity and the introduction of new and alternative funding schemes in Europe oriented towards promoting pre-competitive research in SMEs. The combination of “problem-based” (i.e., the experience of the “DARPA-e” program in the USA) with “bottom-up” (i.e., with no predefined themes, topics or priorities imposed from above) should be considered, supported by a simplified “one-stop shop” approach. A stepwise approach might be considered for implementing EIC with a starting phase, then widening the scope via multiple funding schemes. This will require identifying a highly skilled European executive agency, with technically skilled project officers, following best international practices (including that of DARPA-e in the USA).

The potential creation of EIC should also consider lessons learned from the implementation of ERC in terms of a stepwise approach and the need to operationalize its strategy through a high prestige organization. But, in contrast with ERC, pre-competitive research and innovation in SMEs do require the continuous identification of local innovators throughout Europe and this may be accomplished by affiliating selected partners with specific local knowledge and competences across Europe. A selection process will need to be established to select those institutions, which should include existing national and regional innovation agencies across Europe.

In addition, the role of EIC to further open science and innovation policies to multiple public and private agents, namely SMEs, could be further promoted through two additional actions, as follows:

- Better integrating the European Institute of Technology (EIT) and related “Knowledge Integrated Communities” (KICs) across the whole of Europe. EIT must overall their current strong practice of concentrating their activities in the core of the most developed European economies and significantly extend their activities and scope to provide new opportunities for research and innovation to European SMEs and universities across the whole of Europe in equal terms and not in a supporting, subordinate role;
- Stimulating intermediaries in the form of European Collaborative Laboratories, regarding risk-sharing partnerships between government, industry and academia, as well as global research and innovation networks committed to the generation and consolidation of socio-economic resilience. The problem has been that many of these intermediaries tend to be entities of an exclusively national or regional nature, namely those established over the years in Germany (including the *Fraunhofer Institutes*), France (including the *Carnot Institutes*), UK (including the emergence of *Catapult Institutes* in the last decade), The Netherlands (including TNO), or Spain (including the IMDEA in the zone of Madrid), among others across Europe. The goal of EIC should include competitive funding sources for supporting multinational, “fully European”, Collaborative Laboratories to be established across member states. Among other objectives, a major aim of a future EIC should be concentrated concentrate on giving *Collaborative Laboratories* an effective EU-wide character and, through them, to foster a truly European innovation ecosystem, with more research.

3.3 Europe and our quality of life: a new experimental approach to foster new clinical and translational research

In addition to the analysis above, the evolution of the EU Framework Program for Research and Innovation should consider a large societal engagement fostering research to improve public health and health systems across entire Europe. Aging of population, together with the increasing requirements to better establishing routines for the treatment of cancer, cardio and neuro-degenerative diseases, as

well as non-communicable diseases (including diabetes) and new opportunities for implementing forms of personalized medicine, requires promoting clinical and translational research in the health sciences all over Europe.

It should consider establishing a *European Health Research Council* in a way to guarantee additional and specific funding and assessment schemes of collaborative ventures between hospitals, health related research institutions and schools of medicine, nursing and health technologies.

Promoting excellence on the collaboration of such diversified set of institutions, as they are very often strongly affected by paths of cooperative interests, requires establishing new horizons for clinical and translational research in Europe.

Also, the convergence of different technologies as used for the development of bioengineering products may constitute a true opportunity to approach adjacent markets and create new spaces for the biosciences. A revisited strategy and regulatory framework is necessary to support market expansions and growth of companies operating within medical devices or biologics spaces. Significant public investment is still required to advance bioengineering after two decades of investment, once it is still difficult to demonstrate the economic benefit of developing new tissue engineering constructs. The clinical benefit of advancing this area is significant, as it promises new horizons for patients needing transplants.

Overall, clinical research is an essential part of the process of innovation in healthcare. Moreover, clinical research is key in establishing regional attractiveness to develop new products, supporting local pharmaceutical and bio-industries and ultimately providing a direct impact in the early access to breakthrough treatments. Regulatory practice has to be able to support advances in clinical research, within a suitable clinical trial framework.

It is in this context that the clinical trials framework in Europe is being reviewed to increase its attractiveness. The goal is to help: i) reduce administrative burdens for conducting clinical trials; ii) avoid redundancy of procedures at national and community levels; iii) maximize the level of harmonization in practices and interpretations at community level; and iv) expedite the evaluation of clinical trials for all Member States.

However, continuous articulation at European level requires specific actions, including: i) Infrastructures to support clinical research in complement to clinical trials; ii) adequate incentives to undergo clinical research; and iii) clinical research professional careers. These items should consider the main mission of a future *European Health Research Council*, to guarantee additional and specific funding and assessment schemes.

4. Attractiveness and internationalization: raising the international attractiveness of Europe

Our societies are entering critical times that require the creation of conditions able to strengthen institutions fostering change through knowledge-based international cooperation. This is well beyond the boundaries of “national systems of innovation” and requires people trained to act in quite diversified and global environments. Higher education and research institutions may play that role if their internationalization and specialization path is understood as a key element in a new era of international affairs, where governments and industry intervene through knowledge.

The next Framework Program should increase its visibility outside Europe and it should foster an effective internationalization strategy towards a Europe ‘Open to the World’. Current actions and measures promoted under H2020 have become significantly less attractive for researchers from outside

European borders and it is vital to change this perception and ensure that bureaucratic barriers do not prevent European researchers and institutions from fostering global consortia.

The focus should be placed on opening up and promoting strategic links, fostering real European added value through pre-competitive research with a global nature in key geographical areas, including:

- The Mediterranean, particularly through the guarantee of the implementation of PRIMA, and in a way that guarantees establishing “Knowledge Integrated Communities” between Europe and north African and Middle East countries, as well as to promote pre-competitive research networks with local impact in those regions;
- South and north Atlantic, including extending the Galway Declaration to southern Atlantic countries and the promotion of a research and innovation agenda addressing critical societal challenges such as those concerning climate change by intertwining space, ocean and energy systems. This should consider promoting new funding opportunities for an innovative agenda on “Atlantic Interactions” and by establishing an “Atlantic International Research Center, AIR Center”, in the form of an intergovernmental organization, as presented to the European Commission over the last few months;
- Sub-Saharan Africa, by promoting the advancement of local scientific and innovation capacity and building up effective EU-Africa research and innovation networks, with local impact;
- India, by promoting advanced research networks with leading institutions (Including the Tata Institutes of Fundamental Research and the Indian Institutes of Technology, among others) in a way to guarantee establishing “Knowledge Integrated Communities” between Europe and India with impact in the two zones;
- China, by promoting advanced research networks with leading institutions in a way to promote the mobility of young researchers and guarantee establishing long-term collaborations and joint institutions with impact in the two zones.

Our evidence is that a new paradigm of structured international research relationships is emerging as shaped by a new era of government and industry intervention in association with knowledge. It is driven by political and economic interests, but also by an increased perception of the growing perceived evidence of the potential benefits resulting from the economic appropriation of the results and methods of science by society. Analysis shows that structured international relationships may act as agents of change if associated with activities that are fundamentally different from the traditional role of higher education, involving, most of the times, capacity building and various forms of social and economic appropriation of knowledge. They also require understanding the nature of international cooperation beyond the exporting/importing of “academic or research services” in all the institutions involved. In addition, they clearly break traditional boundaries of “national systems of innovation” and bring new challenges in terms of the necessary institutional integrity academic and scientific institutions need to preserve and foster.