



SCIENCE Position paper on the ninth EU Research Framework Programme (FP9)

With this position paper, University of Copenhagen, Faculty of Science (SCIENCE) wishes to contribute to the formation of the coming EU research framework programme 2021-2027 ('FP9'). The paper is prepared by a task force on behalf of the SCIENCE research board.

The paper focuses on the following key messages:

- FP9 should have a clear *long term* added value and impact for Europe.
- Excellence should be a core principle in all aspects of FP9, in basic as well as applied, interdisciplinary research.
- More funding should be invested in technology readiness levels 3-4 and less in the close-to-market activities.
- Universities play a key role in innovation. This should show in EIC.
- Open science is paramount to societal impact, legitimacy and democratisation and should thus be pursued. Applicants should be evaluated accordingly.
- Research infrastructure financing is vital. Distinguish between small, medium and large scale infrastructure.
- Defence research should be kept separate from FP9.
- Funding should go to more, but smaller consortia, with fewer restrictions on partners. Two stage applications should be maintained with strict, scientifically based selection in stage 1, to enable a success rate of around 40 % in stage two.

These key messages are detailed below:

In the long term FP9 should impact and add value to Europe as a whole

The ultimate focus of the European Framework Programme for Research and Innovation is to ensure current and future jobs, growth and welfare in the EU by addressing the grand societal challenges of our time, to ensure a globally competitive standing, and to strengthen the quality and capacity of European research as a means to enable these aims.

Strategic research programmes, e.g. Horizon 2020, have focused on short-term impact, close-to-market activities, technology readiness and the creation of large multi stakeholder cross-disciplinary consortia, spanning from fundamental research to implementation of the created knowledge in industrial innovation or tools for other end-user organizations.

There is a need to balance investments in, on the one side, an output-based research approach with pre-defined specific outcomes, focused on support of private companies in the EU and solutions of societal challenges that the European community and the individual member states are faced with today, and, on the other side, the type of research that is needed to maintain the leading position in future international competition frontiers, and coping with the societal problems of tomorrow.

For the next research framework programme, we recommend the following:

- To genuinely re-address ‘societal’ challenges to include not only business and industry but also civil society, and thus Europe as a whole. Accordingly, the impact should not only affect growth and job creation but also people’s everyday lives. Thus, policy makers, public services, civic organizations and NGOs should be equally important beneficiaries of EU research programmes. This will allow for more holistic approaches to complex challenges, e.g. climate change mitigation, lifestyle changes for better quality of life and health, implementing circular economy or transforming European industry technically and socially to industry 4.0. Furthermore it will increase the overall legitimacy of EU research as perceived by citizens.
- To also invest in interdisciplinary projects that take a starting point in citizen challenges and cut across scientific issues, as a supplement to the dominating research programme approach with topics and issues that are defined by the scientific disciplines and fields of research (‘silos’).
- To invest in the ground-breaking fundamental research with long-term perspectives for game-changing innovation and ensuring the highest level of knowledge in the populations to meet unforeseen future challenges. What industries constantly request from the universities is fundamental research with potential for radical innovation, chances of accidental discoveries, serendipity, and creation of new value chains. Thus, EU should support this mutual interest by stimulating early stage fundamental research, the development of cutting-edge research capacity and creative innovative research environments developing, which eventually will benefit European economy, enterprise and trade.
- To invest more in technology readiness levels 3-4 and less in the close-to-market activities, for the following reasons: Research funding programmes with a narrow focus on late stage innovation and ensuring a high return of investments, and the requirement for university-businesses collaborations, hold some problems for both parties. Private companies are often reluctant to engage in collaborations within their core interest as this may compromise competition in terms of confidentiality and patent opportunities, which conflicts with researchers’ need for publishing and the increasing demand for Open Science. On the other hand, companies are less inclined to invest in-house capacity, time and money on projects of

more peripheral interest to them. Moreover, close-to-market activities are unattractive for universities, researchers striving for, and being measured on, blue-sky research and scientific research progress.

- Calls to refrain from targeting the entire value chain in strategic research programmes. In some Horizon 2020 calls, consortia are urged to test implementation of strategies concurrently with research to provide evidence of efficiency of potential strategies - *i.e.* proof of concept alongside the development of the concept. This fails to take into account the time it takes to conduct a proof of concept. Another approach could be to have a longer time frame for such projects with go/no go steps between basic research, concept development and implementation.
- Open Science should be fully supported, *i.e.* publicly financed research results should not only be published in traditional scientific journals, but should be of immediate value for the public as a democratic information instrument and the greater good of society, *e.g.* by open access publishing and sharing of data by use of common databases. This should be an integrated part of all relevant programmes. To urge project participants to pursue this, evaluating measures to enhance open science should be in place.

Excellence should be a core principle in all aspects of FP9

Excellence should be a governing principle throughout the FP9 program. FP9 must express a reasonable balance between basic research, applied research and innovation, stimulating R&I investments across Europe, while always maintaining R&I excellence as the cornerstone objective and evaluation criterion. This is essential to keep Europe able to compete worldwide and deploy measures that mutually benefit all parties involved:

There must be a major synergy between activities and projects across the pillars of FP9 and along the knowledge chain, ensuring coherence between the pillars of Excellent Science and Societal Challenges, and a dominating focus on high quality research and innovation in all three pillars.

Strategic research programmes should be based on excellence, wide use of basic research projects and extensive mobility among European researchers. It should be considered how to ensure more cohesion between the fundamental research conducted in the ERC and Marie Skłodowska-Curie Actions and the research and innovation actions within the other pillars, [1], still emphasizing the need for impact and implementation. It is important to be aware that the excellence-based frontier research funded by the ERC, and other excellence programmes, also have proven to have major effect on innovation in the EU.

Horizon 2020 expressed a shift towards a challenge-driven approach in terms of activities closer to market (Technology Readiness Levels, TRL 6-7) thus allowing more demand-driven approaches, but also implying the risk that enabling research, which could lay the ground for the development of new solutions to societal challenges, will not be sufficiently prioritized. A narrow focus on later stage innovation may obstruct the creative innovations and hinder solutions of a more ground-breaking nature to face Societal Challenges and Industrial Leadership.

FP9 must strengthen EU's excellence and attractiveness in research and innovation, as well as its economic and industrial competitiveness. To enable this, it is recommended that FP9 shifts back to a lower TRL level, inspired by the success of FP7.

The choice of partners in FP9 consortia should continue to be based on excellence and relevance to the project. The same must apply in subsequent decisions regarding funding. Geographical concerns should not be allowed to create confusion as to excellence being the fundamental funding criterion.

Doctoral training is an integral part of all basic science projects and of most strategic programmes. FP9 should continue with the current focus on enhancing the quality of doctoral training and the added value of collaborating on PhD programmes at the EU level. Mechanisms for ensuring post-project continuation of training elements from ITNs should be considered to enhance longer-term impact.

The importance of the European Research Council (ERC) for European research excellence must not be underestimated. The numbers of publications in top-rated scientific journals that acknowledge ERC funding, as well as the number of Nobel Prizes and Fields Medals received by ERC grantees, all demonstrate that ERC grants have become a hallmark of scientific excellence [2]. It is crucial to continue to build on the success of this grant-based scheme for FP9 and programmes beyond that. Bottom-up principles must be the dominating entrance toward research funding, to allow for the brightest ideas and the best consortia to be funded.

In addition, given the documented enhanced career prospects a Marie Skłodowska-Curie grant can bring to recipients, for example higher citation rates and improved success rates in the ERC programme [3], maintaining current funding rates and focus on excellence is imperative in ensuring the career development of younger researchers in the EU.

Within Horizon 2020, specific and targeted measures were introduced to help spread excellence and widen participation. This measure was based on a composite indicator of Research Excellence [4]. A similar measure may be used in FP9, but it is important that the criteria are well defined and transparent to applicants.

Research infrastructures (RIs) are pivotal for the wide ranges of research and innovation. Continuous funding of advanced European research infrastructures are critical to large parts of European research. We recommend structuring the infrastructure support in to tiers of size. This could eventually also be linked to the degree of multi-country collaboration, e.g.: (a) Larger shared research infrastructures should enable wider participation in the FP9, (b) Medium sized infrastructures can enhance regional collaboration and support the diffusion of research excellence to new research groups, (c) Smaller infrastructures for few-lateral collaborations and perhaps even to support capacity building in a regional perspective.

Many programmes have very low success rates. When highly rated proposals do not get funding, the motivation to invest time and resources in preparing and drafting new proposals may diminish.

If the low success rate continues, Europe will face a the problem that some of the best researchers may restrict their proposals to ERC and a few other programmes.

Universities play a key role in fostering innovation – this should show in EIC

Horizon 2020 has a strong focus on Technology Readiness Level (TRL) 1 through the ERC programme and on the later TRLs 6-10 through the societal challenges programmes, while ground-breaking and disruptive innovation at TRLs 2-5 has received little support. However, such early stage innovation is important for starting new value chains. Similarly, Horizon 2020 has focused on innovation as driven by individuals and/or small companies, as reflected in the SME instrument. In contrast, a systemic approach to innovation acknowledges that innovation is a result of complex interactions between the individual, companies and their socio-economic, cultural and political environment. In a systemic approach, universities are recognised to play a key role in enabling innovation in the short as well as long term. With the proposal for a European Innovation Council (EIC) in FP9, there is an opportunity to bridge the gap between basic research and close-to-market innovation and, cf. the systemic innovation perspective, universities play a potentially key role in bridging this gap through their strong position in basic research, and in education and training of the next generation of young researchers. Thus, the universities could help overcome current barriers to ground-breaking and disruptive innovation at TRLs 2-5. To achieve this goal, FP9 should allocate resources to ensure that universities can perform the following tasks at the EU level.

First, universities should be encouraged to collaborate across Europe to disseminate best practice for innovation and entrepreneurship to students and postdoctoral fellows. Innovation mobility grants could be established to allow students and postdoctoral fellows to experience innovation in another EU country.

Second, universities should be enabled to nurture disruptive innovation and start-up companies by hosting innovation incubators, where students and young innovators from all over EU are provided with support, guidance and legal advice, and given access to the scientific expertise and research facilities that universities can offer. With the commissions' ambition for Open Innovation [5] it is particularly important that inexperienced innovators are given advice on IPR, which the universities can provide through their Tech-transfer units.

Third, universities should be enabled to provide expert advice to innovators based on their high quality basic research and network of international collaborators. The international networks of the universities can also facilitate access to EU markets during the growth of start-up companies.

While universities will continue to contribute to late stage innovation in FP9, we propose that more funding is allocated to early-stage disruptive innovation taking place at the universities and associated start-ups where private funding can be difficult to obtain due to the high risk associated with early stage innovation. However, it is important that funding is not taken from the existing research programmes, which suffer from over-subscription and low success rates due to budget constraints. Moreover, it is especially important for disruptive innovation that time from application to funding is short (3-6 months) because of the dynamic nature of young researchers, and that application procedures are kept simple to not deter young researchers from a career in innovation.

Defence research should be kept separate from FP9

On the grounds of the EU Global Strategy (EUGS), a number of EU initiatives and plans have evolved, including an Implementation plan for Security and Defence (SDIP) and the EU Commission's forthcoming European Defence Action Plan (EDAP). Based on these plans and initiatives, the European Defence Agency (EDA) has launched a small number of pilot research projects (2015-2018) and plans to provide a preparatory budget for defence research worth €90 M in 2019-2021, before launching a full program in 2021-2027 with a potential budget of €3.5B.

It is still an open question whether the budget for defence research will be an integrated part of the FP9 program. Horizon 2020 already solicits applications for funding "dual-purpose" research and innovation, involving defence research.

The initial pilot research projects launched by EDA are very focused projects that aim at demonstrating particular single-purpose innovation, such as sending robo-spiders into a building for identifying the location of hostile soldiers [6].

From the point of view of SCIENCE, it is paramount to separate the budget for defence research from the budget for traditional research as covered by FP9. This being for a number of reasons:

First, universities live by values that are based on strong international traditions celebrating openness, international collaboration and interchange of both students and faculty across continents. It is important for universities to maintain these values.

Second, SCIENCE can commit to the "three Os", Open Innovation, Open Access, and Open to the World, which will also become key values underlying the research conducted based on FP9 funding [7]. These values may not always be easy to adapt to with respect to defence research. It therefore seems natural, also for this reason, to separate the funding sources for ordinary research and defence research into two different funding sources. With these issues on openness and values in mind, researchers are often involved in horizontal research, which in its nature is multi-purpose and thereby can be of relevance both for civil and defence innovation. Such research can naturally include partners from the defence industry.

Undoubtedly, there will be areas of defence research relevant to Danish universities and, in particular, to SCIENCE; Danish universities already have a strong relationship to the Danish defence industry. For the reasons mentioned earlier, however, transparency is important. It is important for the individual research groups to identify clearly the source and purpose of external research funding. For the sake of simplicity with respect to application procedures and administration, it is important that such procedures and administration tasks are standardised as much as possible across FP9 research and defence research.

Third and finally, the Danish defence opt-out stipulates that "Denmark is unable to participate in EU military operations or in the cooperation on development and acquisition of military capabilities within the EU framework, nor will Denmark participate in any decisions or planning in this regard" [8]. From this text, it is unclear whether Danish universities will be able to work with other

European partners on defence research. Also for this reason, it is recommended to keep a potential defence research budget separate from FP9.

Administration: Smaller consortia, with less restrictions on partners, two stage applications

We suggest decreasing the numbers of required partners in a consortium, as (1) This will reduce project budgets, enable funding of more projects and thereby likely a higher success rate; (2) Smaller projects may be more focused compared to the larger projects. Large projects are often subdivided into smaller project parts, and will therefore not always obtain the expected synergy between all partners and unless an extensive amount of coordination; (3) Smaller projects require less administration.

Along with the reduction in project size, the requirement for involvement of SMEs should also be reduced. It can be a challenge to include several SMEs in the same project due to patent issues.

In the FP9, we suggest a less strict focus on the so-called “Multi actor approach”, i.e. the Horizon 2020 principle that all actors in a project should be involved from the very first stage. The problem is that it can be difficult to involve, e.g. the farmer that has to perform the final field trials in the very first molecular breeding design. Whereas it may be relevant to include the whole value chain in a project, it may be irrelevant that all partners are active at all stages.

We recommend continuing the two-stage application process also in FP9. We would, however, encourage an improvement of the scientific evaluation at stage 1. It is very time consuming to write a full proposal and this should be reflected in the success rate at stage 2. Therefore, the number of proposals invited for the second stage should be reduced to the point where approximately 40 % of stage two applications can get funding. We suggest extending and updating the scientific evaluation board, to ensure that reviewers are fully updated on the requirements and conditions of the current framework.

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