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Evolution of approaches to impact from FP5 to Horizon 2020

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This paper supports the presentation given to the COLUMBUS Blue Society Conference on 7 November 2017 in Brussels. The Conference was about 'Knowledge Transfer' and optimizing impact in marine and Blue Growth research areas.

First the historical reflections:

What do we mean by 'knowledge transfer', especially publicly funded knowledge transfer? And at this point, I have to 'out' myself as being rather skeptical of some approaches.

We can certainly look quite a long way back to examine approaches to linking research and innovation in agriculture. The faculty of agricultural science that I became a student of in 1978 had the mission to produce generators and especially transferers of agricultural science knowledge for Ireland. Until that time, the largest recruiter of its graduates was the Irish agricultural advisory services. These services could be traced back to mid-1800s. Indeed it can be said that the world's first centrally organized public agricultural extension service emerged in Ireland out of the Potato Famine of the mid-1800s. It was founded in the Royal Agricultural Improvement Society of Dublin directed by the British government in 1846 to appoint 'itinerant lecturers' or 'practical instructors in husbandry'. Some of the thinking can be traced back The Society for the Diffusion of Useful Knowledge established in Oxford about twenty years earlier, and the establishment of the (Royal) Dublin Society before that in 1731.

This idea of public investment in linking knowledge sources to users was reactivated under the Agriculture and Technical Instruction Act of 1899. It's a remarkable fact that there are still agricultural advisors working today in Ireland who were recruited under the arrangements made more than one hundred years ago.

With a mission to train advisors, the university I attended very rigorously insisted that all its students obtain practical farming experience and so we were sent into the countryside to get some agricultural sense. One of the consistent senses I got was a combination of farmers' great curiosity and interest in acquiring knowledge and one of skepticism about public advisory services. And the literature evidence available to us now confirms that was a problem across Europe with regard to the perception and even resentment of public agricultural knowledge transfer services.

With embargoes on public recruitment, the public advisory services and research generally were in decline in the mid-1980s in Ireland. So I got involved in a completely new approach to linking knowledge generation and use/innovation: the North of England Arable Centre based at the University of Newcastle upon Tyne. State applied farm research and advisory services were still free to farmers so the University's initiative was regarded as having little chance of success. But based on a combination of highly participatory approaches and rigorous field experimentation (which the farmer-members appreciated), we established an information service that fostered understanding of basic crop physiological processes underlying decision-making. We supported farmers' active acquisition of knowledge and most importantly understanding. This was designed to be empowering. We did not call it 'knowledge transfer', and we explicitly avoided referring to the service as 'advice'. Within seven years, the North of England Arable Centre grew to be the most important independent agricultural knowledge services businesses in the region. It is one of the precursors to the NIAB-TAG Group that is now England's leading provider of applied agronomic research and information services.

The North of England Arable Centre was in tune with the time: Margaret Thatcher was Prime Minister. To an extent that we could hardly have predicted in 1985, Thatcher's government was winding down government involvement in applied agricultural research and the provision of related services to farmers. It greatly reduced the funding of so-called 'near-market' research in the late 1980s and withdrew from the provision of key technologies, such as in the privatization of (very successful) publicly-owned plant breeding programmes.

We can wind forward to today to discuss 'knowledge transfer', especially in the context of optimizing the impact of Framework Programme research for Societal Challenge2 (Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy). The relevance is this: whatever the circumstances in the marine or Blue Growth area and whatever approach is considered, we are likely to have relevant examples and studies in the agricultural area. The EU's Standing Committee on Agricultural Research has been particularly active in assessing these. They include the remaining publicly funded advisory services, including some of those that the Scientific Committee on Agricultural Research 2nd Foresight Report (2008) found many to be *"locked into an old paradigm based on linear approaches and conventional assumptions*". We have the semi-state farmer-funded applied research and information services provided by the Levy Bodies in the UK, and corresponding services in for example France. There are other state services focused on helping farmers with compliance and providing public goods. And there are of course demand-led private services, and a wide range of knowledge interaction activities that go with the supply of farm inputs.

Of particular interest is a wide range of non-mainstream and more focused initiatives, for example around organic farming, with some very tightly linked to the relevant research base. Another example of this is Donau Soja which is a commodity (soybean) focused membership organization developing new protein value chains (including in aquaculture) based on European-grown soybeans and a European protein transition (*Eiweisswende*). In my experience, knowledge interaction programmes around a particular agricultural species or value chain can be very effective – for example sugar beet. Looking to the USA, we have the classical example of the land-grant universities (an innovation of the 1800s) where the

ethos of agricultural innovation penetrates backwards into the research effort, even to quite basic research.

We can conclude here that publicly organized agricultural “knowledge transfer” activity is one of the longest standing public activities or services in the west. It predates many of our public education services, sanitation, public utilities, and our public health services.

Even within the European Commission’s direct sphere of influence, there is quite a lot of activity. Research activity under Societal Challenge 2 is linked to the package of commitments to “to increase agricultural productivity by promoting technical progress of production” from Article 39 of the Treaty on the Functioning of the European Union. The Common Agricultural Policy therefore has always been associated with R&D and EU-funded agricultural research goes back to before the Framework Programmes. The current CAP ‘deal’ includes the commitment to investing 3.85 billion Euros in activity under Societal Challenge 2. In addition to funding research, this is implemented through the European Innovation Partnership for Agricultural Productivity and Sustainability.

In our recent examination of the SC2 relevant portfolio going back 20 years we noticed that the EU has consistently allocated about 10% of its R&D expenditure on communications and networking activity. While this includes activities not directly relevant to connecting research and innovation, combined with the dissemination and communications activities embedded in individual research projects.

What is impact?

My own definition for the purpose of this meeting is that impact is the effect of the use of research outputs outside the immediate environment of where the research was done, in the case of most Framework Programme projects, outside the project consortia. The analysis of the programme documents enables us to produce an intervention logic for each sub-programme and this identified impacts. At a more general level, the European Commission uses seven categories of impact: scientific and technological impact; impacts on innovation; economic and social impact; environmental impact, impact on EU and other policies, structural impacts on the European Research Area, and European added value.

From the experience of the impact assessment, there is consensus the group that did the interim evaluation of SC2 in Horizon 2020 that impact is very difficult if not impossible to measure. For that reason the European Commission asked us in early 2017 to explore how Framework Programmes going back to Framework Programme 5 (nearly two decades) have addressed SC2 using portfolio analyses and impact assessment and to investigate new approaches to evaluation.

Meeting Societal Challenge 2 – Summary of the report

Approaches to examining how Framework Programmes address Societal Challenge 2: Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy

Horizon 2020 invests in research, development, innovation and associated activities within three pillars, one of which addresses societal challenges. This report provides an account of investigations of how EU-funded projects in Framework Programmes running over two decades have served Societal Challenge 2 (SC2): Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy. The overall goal was to assess the impact of a large project portfolio related to SC2, including through the development of new approaches to programme assessment, also in in the context of development of research and innovation strategy in Societal Challenge 2.

Based on previous work, especially the Interim Evaluation of SC2 in H2020, this work started with the acknowledgement of the great difficulty in assessing programme impact. The links between EU investment in SC2 and societal outcomes are extremely complex, indirect, and subject to numerous factors other than those impacted on by EU Framework Programmes. Our three approaches were: surveying of project coordinators; impact mapping of the project portfolio to examine the connections between projects, direct users and their activities; and the surveying of the users of project outputs. This complements the statistical, indicator-based approach used by traditional programme evaluation. It used content-rich and expert-based enquiry into project content and links with change in society through the user communities and their activities, especially innovation. To our knowledge, this is the first portfolio assessment that systematically considers FP5, FP6 and FP7 and Horizon 2020 activities aligned to SC2 within a common framework. Delphi surveying was employed to explore the views of research users that are active in selected communities of innovators targeted by SC2-aligned research across the four Framework Programmes. The results showcase the potential and limitations for in-depth analysis provided by each approach in an attempt to validate the approaches developed.

The surveying of coordinators yielded valuable insights that enabled characterisation of the programmes' expected impacts and mapping of these onto some contemporary priorities. This builds on a similar analysis carried out in 2011.[1] However, the response rate was low. Ex-post surveying that relies on the voluntary participation of coordinators is not effective. It did not yield a powerful data set, especially for the two programmes that ended long enough ago to have fully realised impacts (FP5 and FP6). Coordinators' insights can contribute to programme evaluation but a much denser set of data is required gathered systematically through contractual obligations on coordinating organisations to supply impact information during the project implementation and after a suitable period has elapsed to allow project outputs and outcomes to be realised.

The impact mapping of the portfolio addressed four related questions: Who are the direct users of project outputs? What do they use outputs for? What type of organisations participated in and coordinated projects? What is the subject content of projects? This shows in a content-rich way how programmes generate impact via the programme processes, projects, participants and pathways. In short, it examines the programmes from the perspective of those upon whom impact depends: the users and innovators. This provided insights into changes in the portfolio over time in terms meaningful to users and innovators.

[1] Impacts of EU Framework Programmes (2000-2010) and Prospects for Research and Innovation In Food, Agriculture, Fisheries and Biotechnologies; Experts Report to the European Commission (2011)

‘Impact communities’ who operate in ‘impact areas’ and the corresponding sub-portfolios of projects can be identified by combining information on projects’ direct users and their activities. This provides a powerful way for probing the portfolio for impact in terms directly related to how impact is generated by users of specific sets of projects. The Delphi method was successfully used to generate robust and unique evidence about the views of six impact communities.

Even though it was provisional and dependent on expert judgement, the categorisation of project activity and content in the impact mapping provided useful indications of changes in emphases in the portfolio. Surprisingly, process engineering turned out to be a widely supported category of R&D activity. Also, the consistently high investment in projects aimed specifically at communications and networking shows that a disconnect between R&D activities and users is not due to a lack of investment in communication activities, especially considering that individual project consortia also invest in communications and knowledge or technology transfer activity.

Impact mapping information was linked to information on the corresponding project participants and coordinators. From 19,713 participations in 1,898 projects, strengths and weaknesses in pathways to impact embedded in the portfolio were identified. This insight into participation aligned strongly with evidence obtained from user communities. It strongly confirmed users’ perception of a profound disconnect between activities and drivers in the universities and research organisations that coordinate most of the projects and the needs of users.

While a comprehensive evaluation of the impact of H2020 was not the goal of this study, the work supports some relevant observations. Programmes have changed in line with EU priorities. Trends in portfolio development, especially the changes in emphasis on different types of direct users, confirm that H2020 SC2 is in general more focused on economic impacts compared with previous programmes. Furthermore, the programme has successfully combined economic, environmental and social objectives within projects, which is the essence of sustainable development and essential for alignment to contemporary societal priorities. The impacts identified support the higher level H2020 expected impacts and are well-aligned to the United Nations Sustainable Development Goals. In addition, projects have paved the way to FOOD 2030 and the recently published “Strategic approach to EU agricultural research and innovation”. We therefore conclude that in terms of the general direction of project activities, H2020 and its predecessors are well aligned to contemporary societal challenges. Our analysis uniquely traces this alignment back to FP5 which started in 1998. This indicates beneficial continuity in a number of areas at the programme level combined with growth of new areas and ‘sun-setting’ of others. This work did not extend to an analysis of the content and performance of projects, but the identification of impact areas and impact communities provides a rational framework for such targeted project content-based impact assessment. The portfolio impact mapping was able to pin-point effects of the expansion of the use of the SME instrument and the establishment of the BBI-JU in terms of participation, coordination, direct users and impact areas. This also shows very clearly that the target research and innovation community will respond well to the introduction of new types of project instruments aimed at innovators.

However, there is clearly a great need to better connect the core research and technology development effort with users, especially innovators, who drive impact. There is evidence from a number of perspectives of a profound disconnect between academic research-based activity and innovators across most of the programme. For research and technical development projects, this disconnect has actually increased from FP5 to H2020. This is a substantial challenge.

The large effort in data curation yielded new insights into the long-term effects of past changes. The change from FP5 to FP6 in 2002 caused a substantial increase in the gap between research and innovation as indicated by data on participation and especially coordination. A marked decline in the involvement of non-academic organisations and innovators in coordinating projects between FP5 and FP6 was associated with the shift towards large projects. Ironically, the drive to large projects arose from efforts to support impact and innovation by integrating diverse research and innovation actors within projects, for example following the 'fork-to-farm' principle. However, this reduced the influence of innovators due to the increased complexity of setting up and leading such large and complex projects. Linked to this, the profile of coordination from FP6 onwards reveals remarkable stability in the types and location of coordinating organisations for projects focused on research and technical development, i.e., the core of the programmes. The domination of certain combinations of countries and academic organizations in participation and especially coordination, and the funding differences between countries, remained broadly similar despite the great changes in the EU over this period. Of the top 10 country/organisation type combinations, research organisations in France and institutions in the Netherlands are consistently prominent. This study did not address the issue of proposal success rate directly. However, it yielded users' views that confirm the problem of low success rates identified in the ex-post evaluation of FP7 and which is reported to have intensified in H2020.[2]

The portfolio mapping and the coordinators' survey offered strong indications that the SC2-aligned projects have been contributing to several elements of those FOOD 2030 across the FP, and a close correspondence between the SC2 major impacts and FOOD 2030 was traced. The 11 SDGs identified as related to the SC2 impacts offer a valid basis for the global discussion about EC-funded research and can become a chart onto which R&I activities can be mapped.

Pointers for future programme planning

In general, the FPs going right back to FP5 are relevant to current priorities. However, portfolio features point towards a deeply in-grained challenge in participation and coordination with respect to engaging and supporting innovators and other users. Previous studies[3] also indicated that programme planning does not have the benefit of a content/impact-oriented programming framework that allows specific scientific or technical targets to be identified early, resourced and pursued coherently in relation to the relevant

[2] Moran, N. et al. (2015). Horizon 2020. The insider's guide. Science Business Publishing.

[3] European Commission (2014). An ex-post evaluation of the rationale, implementation and impacts of EU Seventh Framework Programme (2007-2013), Cooperation Theme 2: Food, agriculture and fisheries, and biotechnology. Report to the European Commission.

impact areas and user communities. Related challenges for programme management can be summarised as: anticipating and articulating societal challenges and 'missions' into forward-looking strategic research targets; building effectively on existing programme outputs and resources; reducing barriers to access for a wider range of participants across Europe; and driving a profound change that connects research and technical development with users and innovators by supporting innovation-led R&D.

Although still a prototype that needs validation, the type of portfolio impact mapping framework described here can support programme managers in the very challenging task of articulating societal challenges or missions into cutting edge scientifically and technically coherent targets that relate better to targeted users and their activities.

Connecting sources of knowledge and technology with users and innovators in wider society is a very urgent goal. This has consequences for programme design, the formulation of calls and topics, the selection/design of instruments, and the support of knowledge and technology acquisition. More must be done to encourage leadership by innovators and other users. The disruptive effects of the SME and BBI-JU instruments show that change is possible if instruments that drive change towards innovation-led research (complementing research-led innovation) are used. With the exception of the SME and BBI-JU projects, the resilient dominance of a few member state/organisation-type combinations in participation and especially in coordination is remarkable. The Interim Evaluation report discussed the question of broad topics versus more focused topics[4] and drew attention to the consequences of different approaches to topics for participation. There is evidence from several sources that topic calls for large projects that have broad scopes and a broad range of project impacts favour coordination by large academic organisations. Project opportunities for small to medium-sized research and technical development projects offered to non-academic innovator-led consortia in response to good ideas (bottom-up) could make a big difference. These would support innovation-led collaborative R&D. Such an initiative would give innovators the opportunity to address the broad strategic priorities set out in work programmes with their focused ideas in a flexible way. Opportunities for re-submission of competitive unfunded proposals would reduce the proposal application 'all-or-nothing' risks and barriers that now greatly discourage non-academic leadership of consortia.

Our portfolio analysis shows that the EC has consistently invested about 8 to 10% of funds in networking and communication projects. This is in addition to the communication efforts within RD&I projects, which often account for a further 5 to 10% of project funds. Therefore, we conclude that communication of results has been well-resourced and the challenge is more to do with the nature and structure of their activities rather than their funding. The portfolio framework explicitly identifies impact areas and impact communities along with the corresponding projects. This can be used to prioritise, rationalise and professionalise this activity. This would move communication and networking activity from the project to the sub-programme and impact community level with the double benefit of reducing the complexity of RD&I projects and establishing more efficient mechanisms for supporting knowledge and technology acquisition by users and innovators.

[4] European Commission 2017. Commission Staff Working Document. Interim Evaluation of Horizon 2020. Annex 2 page 680

There are already some examples to work with. The Thematic Networks set up within the European Innovation Partnership (EIP) for Agriculture and Innovation[5] network research teams and users in specific thematic areas to generate knowledge outputs for the EIP. In the marine and maritime areas, the Columbus Project aims to capitalise on the European investment in marine-related research by ensuring accessibility and uptake of research outputs by end-users: policy, industry, science and wider society.[6]

More emphasis on content-oriented evaluation conducted by sector (thematic) experts is required to address the difficult task of impact evaluation. While previous evaluations each used different approaches, each commenced with the expectation that indirect, top-down, and statistical approaches would yield insights into links between programme investments and changes in society (impact) using for example bibliographic analysis, searches for references to the programme in literature on legislation, survey data, and auditing of patenting activity. The difficulty of assessing impact this way became evident as each evaluation progressed and each turned later to expert judgement. This study provides a framework for placing content-oriented evaluation at the core of the evaluation process from the outset. This will allow a wide range of probing investigations that focus directly on the links between who is leading and conducting projects, project contents, their users, and what their users do with results to generate impact. Reliable, curated data and information is a prerequisite for robust analysis of outputs, results and impacts that a subsequent assessment can rely upon.

A harmonization of the type and quality of impact-related data collected from consortia (coordinators) is important for future assessment and planning. The collection should be systematic and the provision of data should become a contractual obligation to ensure the continuum required for following the effect of evolving strategies in EU research funding. To this end, the European Commission's Continuous Reporting System already established for projects funded in H2020 can be used by the coordinators and the beneficiaries as early as the start of the project. Job creation within the consortium, performance of SMEs participating in the consortium, projects outputs and open sharing of data and other resources are already mandatory information collected through the Continuous Reporting System.

Lastly, in driving future programmes and supporting greater impact it is important to continuously remind all actors that the purpose of the programme is to address a societal challenge through collaboration across the EU, complementing national and EU funding that supports the basic sciences, and national research that also supports societal challenge targets. The programme is there to serve society; it is not the property of the academic research community. This position within the wider H2020 effort must be continuously recognised in programme planning and implementation.

[5] https://ec.europa.eu/eip/agriculture/en/about/thematic-networks-%E2%80%93-closing-research-and

[6] http://www.columbusproject.eu/aquaculture