



European  
Commission

# Ex-post Evaluation of the direct actions of the Joint Research Centre

UNDER THE SEVENTH  
FRAMEWORK PROGRAMMES  
2007-2013

July 2015



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# Chairman's introduction

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Every 7 years the European Commission arranges for ex-post evaluations of the research framework programmes in some detail. I had the honour to chair a Panel of independent external experts, who conducted the evaluation of the direct actions of the Joint Research Centre under the Seventh EC and the Euratom Framework Programme from 2007-2013.

In our final report we came to a broadly positive assessment of the performance of the JRC in its functions as the Science Service of the European Commission. In addition to our direct observations and judgements, we have had independent and objective evidence of the quality of the science and the effectiveness of the service.

The JRC has evolved in parallel with the growth and needs of the EU, from its nuclear mission of more than 50 years ago to its broad policy-support mission of today. We may now have reached an important point in this evolution. As our report was being prepared, the Commission formulated a new structure for scientific advice to policy – the Science Advisory Mechanism (SAM). It proposes a structured relationship with the best of European national scientific institutions. This runs parallel to our observation in this report that the JRC should broaden its own interaction with national academies and research institutions. The proposed SAM also provides the Commission with a context for implementing our recommendation to look again at the JRC's governance, including its advisory structure and governing board.

Because of the JRC's policy-support mission, most of its work is directed to issues of current concern. Nevertheless, we believe there is scope to undertake a strategy exercise to map a programme based on the JRC's knowledge and competences beyond the immediate demands of current EU policy for a longer period ahead.

Because of its position within the Commission, the JRC and its research work are less visible to the outside world than they merit. Both the EU and the JRC would benefit from wider recognition of its work. This calls for rebranding and perhaps even giving the organisation a more appropriate name. In my personal view this would go well together with the creation of an advanced-studies structure to focus the Commission's own specialists with the talents of external experts on some of the major challenges facing society.

I greatly enjoyed working with so many distinguished colleagues on the Panel and I would like to thank them for their commitment, their work, and at times their patience. On their behalf, I want to thank Pieter van Nes for his constant support, and to say how much we appreciated the help and efficient preparations for our task by Director General Vladimír Šucha and his colleagues in the JRC.

Patrick Cunningham

# The Evaluation Panel

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# Executive summary

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Between November 2014 and June 2015 a Panel of external experts conducted the ex-post evaluation of the JRC's direct actions<sup>1</sup> under the Seventh EC and Euratom Framework Programmes (FP7, 2007-2013). The evaluation report which follows presents the Panel's observations and comments together with a number of key recommendations and suggestions. While the Panel could rarely address individual research actions, it has managed to come to a balanced assessment of the overall activities during the reporting period and an outlook for further improvement of the organisation.

## The performance of the JRC under the Seventh Framework Programmes (2007-2013)

As a primary observation, the Panel wishes to emphasise the unique nature of the Joint Research Centre as a research body wholly dedicated to the purposes of the European Union.

Based on the collected evidence, the Panel concludes positively on the effectiveness of the JRC as the Commission's Science Service in support of Euratom and EU policies.

The Panel also concludes that the JRC has a respectable scientific performance in its areas of competence. In particular, the JRC standard is high as regards the scientific quality and impact of its publications according to independent analysis.

Beyond these important and positive conclusions about the past performance of the JRC, the Panel has identified a range of issues for the JRC where further progress can be made. The report therefore also makes recommendations that should lead to improvements, accompanied, where necessary, by some restructuring in the organisation.

## Issues to be addressed for incremental improvement of the JRC

### *The programme*

The nuclear-research part of JRC's programme (about 25% of the total) is more autonomous and consistent than the non-nuclear, policy-support-oriented parts. With several nuclear experts among its members, the Panel is confident of its judgements on nuclear and related research. The work-programme structure for other areas is very varied and has been changed several times during FP7. In some cases this conceals the full strengths and competences of the JRC. Performance has thus been more difficult to assess in the non-nuclear parts of the programme.

To facilitate the next ex-post evaluation of the direct actions under Horizon 2020, the Panel recommends that the JRC should plan for focussed systematic evaluation of sectors, making sure that the full programme is reviewed in sections at least once per framework-programme cycle.

The great majority of the JRC's current research programme is geared to the immediate needs and demands of the European Commission policy departments. This is as it should be. However, the JRC should also undertake a wider range of anticipatory and proactive research under the Horizon 2020 umbrella of Responsible Research and Innovation (RRI). The Panel is encouraged by the JRC's impressive entry into analysis and modelling of financial systems. Similar initiatives could be taken in areas where significant transformative changes are happening or expected, particularly in the fields of digital markets, climate, energy and transport.

The Panel is of the view that the JRC should undertake further collaborative, scientifically ambitious research that crosses the boundaries of disciplines, institutes and sectors, while strengthening the involvement of social sciences. In particular, the JRC should do more to exploit the many opportunities for cross-fertilisation between its own teams. Challenges from the geographical spread of the organisation can be offset by modern communication tools. Management should enhance incentives and processes to achieve this goal. Initiatives already undertaken in this direction align well with the cross-cutting issues set out in the FP regulation of Horizon 2020.

The Panel recommends the JRC to embrace the Horizon 2020 principles on Responsible Research and Innovation (RRI), which also implies strengthening the involvement of social sciences and better exploiting its large potential for interdisciplinary work.

Specifically for the nuclear research under the Euratom framework programme, the Panel advises the JRC to establish coordination mechanisms to connect more closely with the activities in the Member States. Although the Council Regulation for the Euratom Programme (2014-2018) stipulates that direct and indirect actions of the Euratom Programme shall be subject to separate evaluations, the Panel is of the opinion that the European Atomic Energy Community would benefit from a synthesis of these evaluations.

The JRC should continue working on an inventory of nuclear research facilities in the EU to identify overlaps, redundancies and possible gaps, and to suggest more efficient sharing of operation and use. The implemented solutions should be an issue for the interim evaluation of the Horizon 2020 Euratom programme that is to be concluded in the first half of 2017.

The Panel recommends that the upcoming interim evaluations for the Euratom Programme (2014-2018) should address the combined effects of the direct and indirect nuclear-fission-research actions in the Programme.

### *Human resources, infrastructure and external income*

The Panel notes with approval the Commission's new staff policy, which provides for temporary contracts of up to six instead of three years, and the extent to which this is used in the JRC. This ensures a good balance of visiting and career scientists. The Panel encourages a policy of redeployment and mobility of staff, including middle management.

The Panel recommends that the JRC should pursue a recruitment policy aimed at achieving an overall gender balance and diversity of JRC staff, particularly at senior and middle-management level. With due regard to the need to recruit the best talent the JRC should actively seek the appointment of women and nationals from the new Member States (EU13) to fill vacancies in both research and management positions.

The Panel sees the need to further enhance and optimise the sharing of expensive infrastructure, both internally and in partnership with Member States.

Undertaking paid contract work can create situations with a perceived or real conflict of interest for the JRC. Currently, the JRC has neither formal procedures to recognise such situations, nor rules to manage them effectively.

The Panel recommends that the JRC should adopt a corporate conflict-of-interest (COI) policy that prescribes rules and (ethical) standards of conduct applicable to its various contractual engagements with the necessary procedures to ensure the observance of the standards.

### *Recognition and branding*

Whereas the JRC is a significant contributor as a scientific institution, it generally does not receive corresponding recognition for its contributions. A clear identity in the world of science is challenged by its wide remit, its historical and evolving mission, its name, and its geographical dispersion.

While the Panel has no specific recommendations in this regard, it believes that both the EU and the JRC would benefit from initiatives to improve the recognition of the science and service roles of the JRC.

The Panel appreciates the progress with the JRC's web presence via its Science Hub. It should use its presence in all key social media to strengthen outreach of its research results and to highlight the strengths of its different institutes.

The Panel recommends that the JRC should actively promote awareness of its achievements and raise the profile of its activities through its web presence, including on social media.

### Issues to be addressed with a view to transformative development of the JRC

Significant change and reorganisation can be difficult and disruptive and should be undertaken only with clear goals and vision. To develop the JRC, giving full acknowledgement to its role as the Science Service of the European Commission, the Panel suggests the development of a JRC strategy that, with the support of the Commission, should be implemented with the help of an appropriate governance structure.

#### Strategy

Developing a strategy with a long-term vision has been an issue for the JRC since the 2008 ex-post FP6 evaluation. The European Union is part of an increasingly complex, interconnected and technically dependent world. The current climate in the Commission is favourable to new initiatives aimed at strengthening the role and relevance of the JRC in the evolution and delivery of EU policies that meet these demands.

The Panel's strong recommendation for the future of the JRC is to establish a long-term strategy before the mid-term evaluation of the Horizon 2020 framework programme in 2017.

In the Panel's view a successful strategy for the JRC as the Science Service of the European Commission rests on reliability, integrity, scientific quality and relevance of the work undertaken. The report itself gives further suggestions for important elements of the strategy.

#### Governance and Relationships

The JRC is a service of the Commission that has a Board of Governors with representatives from Member States and Associated Countries.

Developing and maintaining constructive relations with the Member States is important for the JRC. The Panel acknowledges the central role of the Board of Governors in this context. Considering the significant changes in the EU, the Commission and the JRC since the inception of the Board in 1984 and the few adaptations made to the JRC's governance since then, the Panel has some concern about the effectiveness of the historical mandate and structure of the Board. As the JRC further develops its function as the Science Service of the Commission, there is a need to address this as well as the JRC's interaction with the scientific community in the Member States.

The newly established Scientific Advice Mechanism (SAM) of the Commission provides a context for constructive engagement of the JRC with the wider science communities in the EU. Such engagement could add strength to the proposed Knowledge Centres. It could also add substance as well as visibility to the work of the organisation. The JRC already has the structure and the resources to create a focus for effective collaboration with the best of European science.

The Panel recommends that the Commission should task a Group of eminent personalities to put forward options for JRC governance, adapted to its functions of the future. These include scientific support, research, scientific advice, and knowledge management in partnership with the Member States.

# 1

## Introduction

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The Joint Research Centre (JRC) is the Science Service of the European Commission. Most of its activities are financed in seven-year cycles through the EU research framework programmes. This report provides an ex-post evaluation of the JRC's direct actions<sup>2</sup> during the Seventh European Community (EC) and the Euratom Framework Programmes from 2007-2013 (FP7). It has been prepared by independent external experts, referred to as the Evaluation Panel (hereafter 'the Panel'), as requested by the Council and the European Parliament in the legal texts of both programmes.

This introductory Chapter sets the stage for the evaluation with some background information, including the mission of the Evaluation Panel. It provides a historical perspective to understand how the JRC has evolved, followed by the evaluation methodology and some definitions of the terminology in use.

Chapter 2 presents horizontal issues, i.e., general observations on scientific and organisational performance and operations. Chapter 3 presents the observations in the different non-nuclear evaluation areas, with a separate Euratom section in Chapter 4. In Chapter 5 the report presents a synthesis of the findings, identifying a number of strategic issues for the JRC as a whole, with a look forward to Horizon 2020 and beyond.

Annex I covers the terms of reference of the evaluation. To help place this evaluation in its context Annex II presents key facts and figures related to the JRC's operations while Annex III explains the ensemble work distributed over the five evaluation themes and the JRC sites and institutes. Annex IV presents some thematic commentary from the evaluation hearings.

### 1.1 Mission of the Evaluation Panel

In late 2014, the Panel accepted the task to evaluate the direct actions of the JRC under the EC and Euratom FP7. The evaluation process was aimed at improving the efficiency and effectiveness of the JRC. In addition, there were general evaluation issues such as relevance, EU added value, sustainability and a longer-term outlook for the JRC and its programmes. The terms of reference for this task contain a long list of evaluative questions, adding up to an assessment of the performance to purpose of the JRC.

In refining its mission, the Panel considered the resources (in terms of time and labour) provided for under the terms of reference. It also considered the JRC's internal assessments regarding the quality and the effectiveness of its work. Hence the Panel concentrated its attention on the bigger issues and took as its mission: to conduct a qualitative, high-level peer review of the JRC's performance over the period 2007-2013 with an outlook for the remaining part of the decade.

### 1.2 Evaluation methodology

#### *The Joint Research Centre in context*

Set up 60 years ago as a research body inside the European Commission, the JRC is wholly dedicated to the purposes of the European Union. It is thus unique as regards its functioning, structure and institutional positioning. With an annual budget of close to EUR 400 million, the JRC accounts for approximately 3% of the annual Horizon 2020 framework-programme budget, this in turn represents less

than 10% of the total public spending on research in the EU Member States.

The main data for the JRC during FP7 are assembled in 'JRC's facts and figures', which is included as Annex II of this report. These data are rather complete concerning the situation today, but should be viewed in conjunction with the historical evolution of the organisation.

From the beginning of the evaluation it was clear that some basic insight into the history of the JRC would help the Panel's understanding of the current situation. The timeline on page 15 lists some of the milestones in the JRC's history, showing a nuclear research organisation in 1957 expanding into other areas towards a mission '... to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle' in 1998 and anchored in EU legislation today.

The evaluation of the JRC's performance during the Seventh Framework Programme has to be set against this history and its current statement of purpose.

### *Background material and self-study*

For a general view of the organisation and initial insights into its achievements, the Panel conducted desk research studying the legal bases, programme documents, activity reports, organograms and the organisation's public websites.

Desk research included an analysis of the JRC's scientific productivity and performance reports. These were based on data from Thomson Reuters' Web of Science as well as Elsevier's Scopus, both widely acknowledged as the leaders in citation and bibliometric data. A customer satisfaction survey<sup>3</sup> in the early part of FP7 complemented the background information presenting the perspective of the beneficiaries of JRC output at that time.

The JRC prepared a special brief to explain the five evaluation themes (see Annex I and II), the ensemble of the approximately 110 actions and the seven JRC institutes where the actions are carried

out. Since the Panel found this particularly helpful to understand the subject to be evaluated, the brief is also attached to this report as Annex III.

During the evaluation, the Panel received information about the internal JRC system for annual performance and efficacy monitoring of the various actions<sup>4</sup> in the work programmes 2007-2013. The existence of such an instrument and the useful statistics provided, allowed the Panel to focus on the main issues while being confident about the effectiveness of JRC's performance management process.

Later in the exercise, to verify preliminary findings, the Chairman interviewed three Directors General who are heading Commission policy departments that make intensive use of JRC science services.

### *The fact-finding mission*

The fact-finding mission consisted mainly of a series of thematic hearings organised for the Panel to facilitate its assessment of the overall work and achievements in the various areas. The themes followed the definition in the terms of reference, which proposed using the programme structure of the JRC with around 110 actions distributed over five thematic areas. A delegation of four to six Panel experts attended each thematic hearing, of whom two or three were appointed rapporteurs. Their draft key observations for each relevant evaluation theme for the Panel were discussed and adopted.

The hearings were held at the various JRC establishments in Geel, Karlsruhe, Petten, Seville and Ispra. These site visits gave an overview of the JRC's research and laboratory infrastructure. They also exposed the Panel to the reality of the geographical spread of the JRC.

Two short meetings with the JRC top management were held at the beginning and the end of the fact-finding part of the evaluation process. They served as a check point for preliminary findings and to hear an update on developments at the JRC.

## Timeline: Mandate and mission of the JRC

- 1957** France, Germany, Italy, The Netherlands, Belgium and Luxemburg created the European Atomic Energy Community – Euratom, which provided them with: an instrument of industrial policy, energy policy; a scientific and technical research organisation in the nuclear sector – the JRC (article 8 of the Treaty); establishments around nuclear facilities in four of the founding Member States (Belgium, Germany, Italy and The Netherlands).
- 1971** Confronted with a waning interest for nuclear research the Commission reorganised the JRC. The idea that the JRC could be involved in non-nuclear research was accepted in principle at the First Summit Conference of the Enlarged Community of 1972 in Paris. The Summit allowed the Commission to start working towards a European policy for research.
- 1973** Council adopted the first JRC research programme for the European Economic Community (EEC) in parallel to the JRC's research programme for Euratom. The JRC began studying the effects of air pollution on citizens, the effects of chemical substances on the environment and started developing the use of satellite data from space, e.g. for monitoring agriculture and natural resources.
- 1984** Decisions from the 1972 Paris Summit matured into the First Framework Programme for Research, adding Community funding for research in the Member States ('**indirect research**') to the funding for the '**direct research**' by the JRC. A Commission Decision on the JRC set up the Board of Governors as it operates today.
- 1989** Council decided that 'the Commission may place the installations, equipment or expert assistance of the Joint Research Centre at the disposal of third parties whether public or private, as appropriate, against payment'.
- 1996** The last Commission Decision on the reorganisation of the JRC, including the functions of the Board of Governors.
- 1998** Council approved the JRC's current policy-support mission in the legal text of the Fifth Framework Programme for research and technology development. Nuclear research remains the JRC's single largest area of technological competence.
- 2013** From this year onwards, the Commission formally approves the JRC's Work Programmes on an annual basis, reflecting the importance the Commission places on the JRC's projects.

The JRC's mandate stems both from the European Atomic Energy Community with the Euratom Treaty (1957 – never amended as to substance) and from the Treaty on European Union (2007).

The Treaties and the derived multi-annual research framework programmes determine the JRC's mandate and mission.

### Looking for comparators

Within the above-mentioned constraints, there are comparators for the JRC regarding different parts of its mission, but not for the JRC as a whole. Notably the JRC has comparators for the science it has produced or the technologies, standards and test methods that it has developed.

When it comes to standards and test methods, the US National Institute of Standards and Technology (NIST) is one of the better comparators. The JRC itself identified a number of comparator organisations, which are shown in Table 1.

However, the JRC operates within the European Commission, the executive body of the European Union. None of these comparators operates from such a position.

The Panel found it useful to note similarities with another in-house service, the Information and

Technical Solutions service of the World Bank Group. Work of the JRC on the agri-food theme shows similarities with activities of the CGIAR<sup>5</sup>, a global partnership with a network of institutes engaged in research for a food-secure future. This latter partnership provides evidence-based knowledge with the whole world community as beneficiary.

In any case, valid comparisons can be made in the output and quality of the science produced, since this is generally published through the open, international and very competitive scientific literature. These reputable journals are subject to editorial judgement and peer review. Both quality and significance of the results can then be measured with some degree of objectivity. These measures can be compared against the performance of comparator organisations worldwide. For this comparison the Panel used the reports made available in this respect by the JRC (cf. Section 2.1).

Comparators for the JRC (Science and technology)
Argonne National Laboratory, USA
Austrian Research Centre, Austria
CEA – Commissariat à l’Energie Atomique et aux énergies alternatives, France
CIEMAT – Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Spain
Fraunhofer Gesellschaft, Germany
Helmholtz Institutes, Germany
National Physics Laboratory, UK
NIST – National Institute of Standards and Technology, USA
Oak Ridge National Laboratory, USA
PTB – Physikalisch-Technische Bundesanstalt, Germany
TNO – Netherlands Organisation Applied Science Research, The Netherlands
VTT – Technical Research Centre, Finland

Table 1. Comparators for the JRC (science and technology)

### Incorporation of previous evaluations

The recommendations in the FP6 and mid-term FP7 evaluations provided good reference points for the Panel's work. In particular:

- their focus on strategic recommendations; the extension of the evaluation to an excessive level of detail was neither feasible nor useful
- the opportunity to repeat recommendations from these previous evaluations, should they still be found to be valid.

### Intervention logic

To clarify the JRC's objectives and to translate them into a hierarchy of intended effects, the Panel adopted a graphic illustration of the JRC's intervention logic given in Figure 1. It gives a comprehensive view of the relationships between

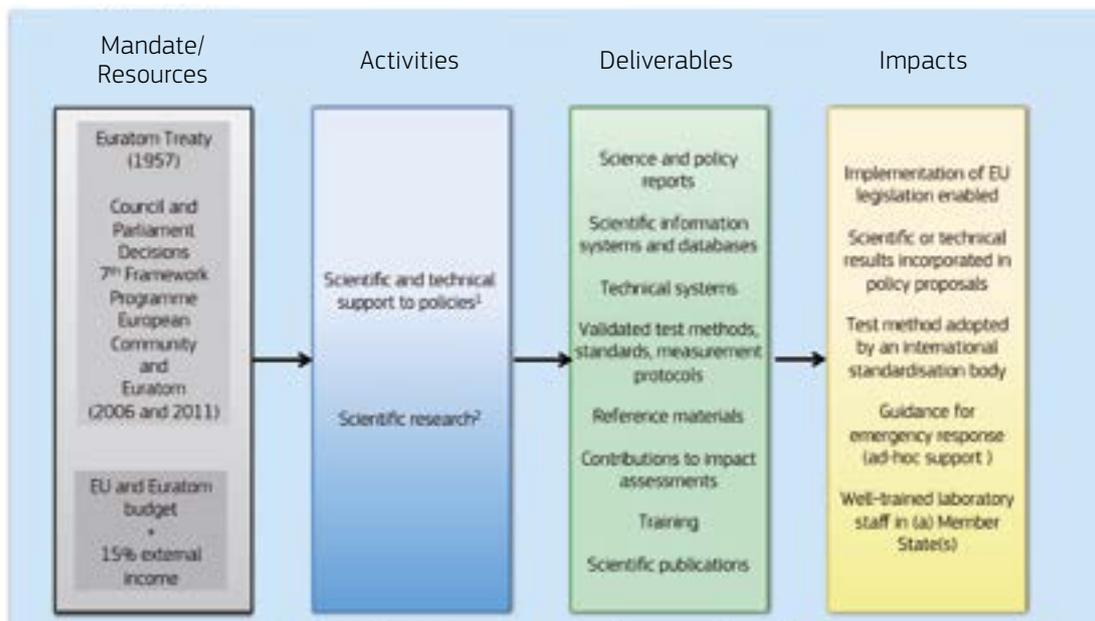
the JRC's mandate as specified by the Council and the European Parliament, its activities and the desired effects thereof (i.e. output/deliverables and impacts), the objectives that the JRC works to and the purpose of the JRC as a whole in the EU.

This simplified view provides a background for the evaluation. The intervention logic highlights that the JRC has two main activities: scientific support to EU policies, and related scientific research. This focused the Panel's attention on the importance of the right balance between giving support and doing research.

### Depth of assessment for nuclear and non-nuclear activities

According to the terms of reference the evaluation should devote separate attention to the Euratom activities, mainly because they have a separate legal basis. From the beginning of the evaluation

High-level intervention logic for the JRC



<sup>1</sup> Support in all parts of the policy cycle (conception, development, implementation, monitoring, evaluation); Foresight; Standardisation and harmonisation; *Ad-hoc* support; Support to specific countries/regions

<sup>2</sup> Experimental and theoretical investigations, innovative methods, tools, standards; Facilitating and coordination of networks, training and mobility; Exploratory research; Provide access to large facilities

Figure 1. Intervention logic JRC

it was clear that the range of the JRC's activities in the nuclear field is more sharply defined than the range of non-nuclear activities. This has led to somewhat different levels of assessment for each type of activity as in Chapters 3 and 4, respectively.

The non-nuclear activities cover research and support to policies with deliverables and impacts in a broad range of fields in science and technology. Over a period of seven years the JRC produced thousands of deliverables, many of which were directly addressed to policy-making Commission departments. It would have been interesting, but physically impossible, to evaluate all, or even a majority of these within this general review. Moreover, the variety of deliverables is too broad for a few experts to exercise detailed judgement on all. The Panel therefore relied on its expertise and familiarity with part of the output, results and impacts.

By contrast, the nuclear experts in the Panel were in position to exercise peer judgement on most aspects of the JRC's Euratom programme. This programme is the result of an evolution of almost 60 years of research in a well-established field. It forms an essential part of the nuclear safety and security research activities in the EU.

### 1.3 Terminology

The evaluation led the Panel to learn about an extensive vocabulary and terminology specific to the organisation. Several common words are used in an unusual sense in the JRC. The following words are used in official (legal) texts.

**Competitive** – The JRC carries out 'competitive work' and generates 'competitive income'. This gives the impression that contracts are won in competition. However, most of what the JRC calls competitive work is under direct assignment from the European Commission. A clearer alternative terminology is: the JRC carries out work under contract and generates external income.

**Customer** – Usually a customer purchases or buys a product or a service. The JRC's customers often do not (have to) pay; the services are part of JRC's work programme financed through its institutional budget. That the majority of the JRC's beneficiaries receive services free-of-charge<sup>6</sup> also sheds a particular light on 'customer-driven', a concept to which the JRC is committed by the framework programmes<sup>7</sup>. Alternative terminology for customer could be: user, partner or beneficiary.

**Action** – In the JRC context this term is used in two instances:

- The framework-programme texts<sup>8</sup> identify the JRC activities as 'the direct actions of the JRC'. The term is a contraction of 'direct research' and 'action'. It contrasts with indirect (research) actions (see endnote 1).
- An 'action' as an element of the JRC work programmes under FP7 identifies a series of parallel and/or consecutive projects (see endnote 4). The JRC work programme no longer uses this word under Horizon 2020.

**Non-nuclear** – In European research non-nuclear usually means: not part of the Euratom Research and Training Programme. Horizon 2020 still formally identifies JRC activities as the 'non-nuclear direct actions of the JRC'. This is a remnant from the days when nuclear research was the dominant part of the JRC's work programme. Non-nuclear is an indistinct identifier for the relevant JRC activities under Horizon 2020.

The Panel advises the JRC to amend this terminology and to present itself, its programmes and its results using accessible language.

# 2

## Broad observations

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### 2.1 General performance

The ex-post evaluation of the direct actions of the JRC during FP7 is different from more conventional assessments of research bodies, due to the unique nature of the organisation as the Science Service of the European Commission. A general assessment needs to address the effectiveness and the quality of both the science and the services.

The output and quality of the scientific work of the JRC can be evaluated from its publications during the period under review. For this purpose, the JRC had commissioned independent analyses of the assembled evidence from both Thomson Reuters' Web of Science and Elsevier's Scopus databases. Based on this analysis of the impact of the JRC scientific papers published<sup>9</sup>, the JRC ranks well among its scientific peer institutions (cf. section 1.2). The publication rate is modest compared to some academic institutions, but as good as or better than those of many comparators. With more than 16% of its peer-reviewed publications among highly cited publications<sup>10</sup>, the JRC performs to a high standard.

Impressed by these results, the Panel is of the opinion that the JRC has a respectable scientific performance in its areas of competence. This is the first time that the JRC has provided a systematic analysis of its scientific performance. The Panel encourages the JRC to repeat such analyses in the future.

The JRC's service role cannot be evaluated quite as objectively. In its five centre visits and in the presentations by and discussions with JRC staff, the Panel was impressed that there is a strong sense of the service mission throughout the organisation.

This was also evident in the accounts the Panel received of the close contact that exists between JRC staff and the Commission services that they relate to. These impressions were confirmed in structured interviews with the Directors General of three Commission departments.

An important part of the JRC's service role is its work in European standardisation and harmonisation. Its level of performance in this area compares well to that of the National Institute for Standards and Technology (NIST) in the USA. However, the Panel could not identify a reasonable comparator for the JRC in its main task of scientific support to policies with a pan-European dimension.

The JRC published three impact reports<sup>11</sup>, which demonstrate substantial achievements in the areas addressed. In addition, an internal system for annual performance and efficacy monitoring provides statistics that reassured the Panel about the effectiveness of the JRC in its support activities. The Panel also received high-level feedback from the main beneficiaries of JRC services within the Commission and took note of the JRC Customer Satisfaction Survey (see endnote 3) from the early period of FP7.

Based on these different sources, the Panel concluded positively on the performance of the JRC as the Commission's Science Service in support of Euratom and EU policies.

## 2.2 Training, education, research infrastructure

### Training, education

The JRC has been the host of extensive ongoing training activities. This aspect of the work has proven satisfactory. Training and education are clearly requested by the Council and the European Parliament specifically in the Euratom programme for research and training, but also in the non-nuclear parts of the JRC work. The JRC plays a substantial – and sometimes crucial – role in the training of national safeguard inspectors and various kinds of specialised analysts.

The JRC employs around 600 researchers at post-doctoral level, working on JRC projects as temporary staff member or as a grant-holder. Every year the JRC also employs at least 70 on-the-job trainees for a period of a few months. On average the JRC hosts 30-50 grant-holders who carry out work for their PhD thesis. Some unpaid trainees prepare a thesis for a university diploma at various levels.

The JRC organised around 185 educational or training events per year in the period under review. This concerns short courses, summer schools and university lectures given by JRC staff. The total number of participants in these events is on average 3 000 attendees per year.

The Panel suggests that the JRC could give more visibility to its activities and achievements in training and education and their good quality.

The Panel recognises the value of training provided by the JRC in raising its profile in the European research community. It believes that there is further room to expand its training role, particularly in developing relationships with universities and research institutes in the EU, considering not only regular lecturing, but also *ad-hoc* individual presentations delivered by the researchers. This would enable JRC work to benefit from the expertise of relevant scholars brought in to contribute to specific JRC programme or research themes.

### The research and laboratory infrastructure

The JRC currently holds an up-to-date inventory of research and laboratory infrastructure on its premises. Today, it hosts 156 facilities; more precisely 40 large-scale physical infrastructures and 116 digital infrastructures. During the evaluation period, the JRC started pilot projects in association with the ESFRI (European Strategy Forum on Research Infrastructures) Roadmap that give access to its infrastructures through a Memorandum of Understanding (MoU). Three large-scale infrastructures are available for transnational access under the ESFRI networks of FP7: JRC's particle accelerators (Van de Graaff and GELINA), the European Laboratory for Structural Assessment (ELSA) and the European Solar Test Installation (ESTI). An advantage of providing such access is that it attracts external scientists to work on the JRC's premises to the benefit of the JRC's own research programme.

The Panel sees the need to further enhance and optimise the sharing of expensive infrastructure. Access should not only be extended to academia and public research institutes (via free access), but also to industry (via full-cost access), if there are no conflicts of interest.

## 2.3 Follow-up to previous evaluations

When the Panel examined progress in the list of recommendations from previous evaluations, it observed that the JRC has followed them up extensively. However, it is noted that the follow-up does not always have the same degree of success across the board. Furthermore, some accomplishments happened relatively late, i.e. after the completion of FP7, and were prompted by the new JRC management.

Examples of successes include a move towards central management of all nuclear activities, and introduction of internal review and quality assurance processes for publications. Another positive example is the creation of an inventory of research facilities and infrastructure (see Section 2.2).

The JRC has performed a systematic yearly update of this inventory. Further progress stems from the introduction of ongoing horizon-scanning activities in conjunction with the Commission's various policy departments. This step has been combined with an upgrade of the ICT system via the introduction of contemporary knowledge-management tools. These elements have facilitated an exploratory research programme involving a revived JRC Scientific Committee. The JRC also involved external experts to conduct a broader impact analysis on some of its successful activities and one specific analysis of its contributions to GMO-regulation (see endnote 11).

While the implementation of many recommendations from earlier evaluations has led to improvements, the JRC has not (yet) successfully dealt with some recommendations with more of a strategic character, e.g.:

- Different work-programme structures have been proposed and introduced with varying degrees of success.
- The ultimate rolling strategy with a more stable programme structure is still on the drawing board.
- 'Bringing down silo walls in the organisation' stays on the agenda.
- 'Taking an integrated, multidisciplinary approach to JRC tasks' remains a challenge for the coming period.

## 2.4 Programming, monitoring, evaluation

The current evaluation refers to a structure with six themes set out at the end of FP7 and extended into Horizon 2020. These themes are quasi-constant because they became 'key work orientations' derived from Commission priorities, with the arrival of the new Commission in 2014. Nevertheless, the changing structure of the work programme during FP7 has been an obstacle to assessing the programme as a whole. The nuclear research part of the programme is more autonomous and consistent. This is visible in the different level of depth with which the Panel has been able to assess the nuclear and the non-nuclear parts of the programme.

The JRC's activities are manifold and they have, as a rule, some link to policy. The JRC's management and staff are very conscious that there are some dated tasks and activities in its programme based on formal assignments. These may concern a Commission decision or EU legislation in the past that identified the JRC as being the body responsible for the relevant work.

The Panel encourages the JRC to identify tasks that are deemed no longer compatible with its mission. If stopping this work requires a change in legislation, then the JRC should bring the corresponding issue to the attention of the Commission.

It is worth noting that the JRC has developed a culture of internal reporting, monitoring and evaluation, which is concerned with ensuring constant quality improvement thanks to systematic recording and reviewing output, deliverables and impact. Further efforts could be invested in developing this system so that it can present results and impact to the outside world.

Nonetheless, regarding quality assurance for scientific work the Panel emphasises the great benefits of independent peer review. The JRC has no systematic or structured approach to external peer review of its research and scientific work. Chapter 5 includes practical suggestions to address this issue.

To facilitate the next ex-post evaluation of the direct actions under Horizon 2020, the Panel recommends that the JRC should plan for focussed systematic evaluation of sectors, making sure that the full programme is reviewed in sections at least once per framework-programme cycle.

## 2.5 Human resources

A summary of how human resources have evolved is available in Annex II. Since the Commission has the obligation to reduce its staff by 5% over the period 2013-2017, the JRC needs to reduce its permanent staff over the same period, i.e. as of 2013 by 1% per year. Meanwhile, the ratio of administrative

support and coordination staff over operational staff has evolved from about 1 in 3 in 2009, to almost 1 in 4 by the end of 2013; a ratio that compares favourably to international standards.

In parallel, the JRC distinguishes permanent staff and temporary staff with various kinds of status (statutory staff, seconded national experts, grant holders, trainees). The existence of temporary contracts gives a good throughput of visiting scientists. The Panel commends the Commission's new staff policy involving temporary six-year contracts. This contract duration matches requirements for productive scientific visits better than the previous maximum duration of three years. Staff redeployment and mobility of staff are important for motivating permanent staff in an organisation like the JRC. Systematic rotation of middle management will provide the additional advantage of helping to spread knowledge and good practice throughout the organisation.

One of the key aspects of human resources during the study period concerns gender and diversity. Over the lifespan of FP7 the JRC gradually employed more women. The Panel commends the JRC for the improved gender balance with 37% of staff being women in 2014. This compares well with numbers in other research and technology organisations. However, it is still far from the overall gender balance in the Commission<sup>12</sup>. At senior and middle-management level, women hold slightly less than 20% of the positions, which is amongst the lowest ratios in the Commission.

The Commission has achieved ambitious recruitment targets for nationals from the new Member States (EU13), but not within the JRC. In particular, for middle-management positions the numbers are far from meeting these targets. In addition, the JRC needs to manage, develop and leverage diversity actively, not only for its internal effectiveness, but also for its diversity of skills. Such approach also positively influences the effectiveness of working with partner organisations and the end-users of the knowledge and technologies that the JRC develops.

The Panel recommends that the JRC should pursue a recruitment policy aimed at achieving an overall gender balance and diversity of JRC staff, particularly at senior and middle-management level. With due regard to the need to recruit the best talent the JRC should actively seek the appointment of women and nationals from the new Member States (EU13) to fill vacancies in both research and management positions.

## 2.6 Work under contract

The JRC finances most (~85%) of its activities with its own budget allocated through the framework programmes (see Annex II). It also works under paid contracts for Commission departments and third parties, and in cooperation with research partners in indirect actions of the framework programmes. With these contracts the JRC generates an external income of up to 15% of its total budget, but there are implications.

Contractual relationships could potentially compromise the JRC's ability to provide impartial assistance or advice. Besides, when entering into a framework-programme call for proposals with other research organisations the JRC might be seen as having an unfair competitive advantage. The same applies if the JRC were to participate in a tender procedure for services to the Commission. The JRC is aware that certain contracts may raise a conflict of interest (COI), and it has sought the Panel's opinion (cf. Annex I – Terms of reference).

Irrespective of the complexities of all COI situations that may occur for the JRC, the Panel (a) confirms that the generation of external income may create COI situations for the JRC, and (b) it takes note that the JRC has no measures or procedures in place to recognise and manage such situations.

Therefore, supplemental to its general Code of Conduct, the JRC should adopt a corporate COI policy that prescribes rules and ethical standards

of conduct applicable to its various contractual engagements. This policy should:

- ensure integrity, transparency and fairness in all contractual arrangements of the JRC;
- avoid any unfair advantage, or the appearance of it, with respect to possible competitors.

In the Panel's opinion such a policy would also benefit from a review of the arrangements for engagement in indirect actions to further the level of transparency.

The implementation of a corporate COI policy requires procedures and/or an authority to clear the way well before the JRC enters into a contract. They should determine on a case-by-case basis whether the signature of a contract creates a direct or a potential future COI for the JRC. If this is the case, then it should take action to avoid, neutralise or mitigate the potential, apparent or actual COI.

Undertaking paid contract work can create situations with a perceived or real conflict of interest for the JRC. Currently, the JRC has neither formal procedures to recognise such situations, nor rules to manage them effectively.

The Panel recommends that the JRC should adopt a corporate conflict-of-interest (COI) policy that prescribes rules and (ethical) standards of conduct applicable to its various contractual engagements with the necessary procedures to ensure the observance of the standards.

## 2.7 Recognition, visibility and branding

### *Recognition and branding*

The Panel observed that the general visibility and recognition of the JRC as a brand is low. This is in spite of many noteworthy and, at times crucial, contributions the JRC makes to specific policy processes, standards and measurements, or sensitive areas like non-proliferation, nuclear forensics and intelligence gathering for the EU foreign and security policy.

The JRC is definitely known among research teams in areas where it operates. However, outside these circles the JRC is rarely seen as a scientific institution (even though it is one), but at best as a part of the overall EU administration (which it also is). A clear identity in the world of science is challenged also by its wide remit in science, its historical and evolving mission, its name, and its geographical dispersion.

The JRC itself is less concerned about recognition as such. As a Commission department, it complies with the unwritten rule that none of the Commission departments is to gain a high profile under its own service name. The brand attached to successful JRC performances is that of the Commission.

The Panel deliberated whether the JRC should do more on branding and having its name associated with its role as the Science Service of the European Commission. While the Panel has no specific recommendations in this regard, it does believe that both the EU and the JRC would benefit from initiatives to improve the recognition of its science-and-service role.

### *Communication, dissemination, web presence*

The European Commission achieves a fair coverage of the JRC in the press. This is generally considered sufficient, but every additional effort from a public service to reach the citizens is welcome. In the Panel's view the JRC should be vigilant about its web presence. On the one hand, it needs to serve an expert audience interested in using JRC's results at the highest level. On the other hand, it also needs to cater for the curiosity of European citizens towards its work. In this respect, the Panel commends the JRC's online Science Hub, launched just before this evaluation started.

This new portal should facilitate open access to the JRC's research and reports. The Science Hub is also designed to provide a consistent view of its different institutes, including the names of the research leaders, information related to research, selected featured publications, blogs and pictures. It features all key social media (Twitter, Facebook, YouTube, etc.), which the JRC should use to strengthen the

outreach of its research results and provide a consistent view of the organisation. It has, however, exhibited some teething problems<sup>13</sup> and will require thorough quality checks. Furthermore, the present design and presentation is rather static and conventional; considering the addition of more contemporary, dynamic and innovative features may attract more advanced web audiences. Once the site has been fine-tuned, this new format will help showcase the breadth of expertise and work variety it has been involved in to a broad audience.

The Panel recommends that the JRC should actively promote awareness of its achievements and raise the profile of its activities through its web presence, including on social media.

With more than 16% of its peer-reviewed publications among highly cited publications the JRC performs to a high standard. The overall publication rate is modest by academic standards, but as good as or better than those of many comparators. This is the first time that the JRC has provided a systematic analysis of its scientific performance and the Panel encourages the JRC to repeat such analyses in the future.

Impressed by these results, the Panel is of the opinion that the JRC has a respectable scientific performance in its areas of competence. Based on the quality and the quantity of work delivered during FP7, the JRC achieved a very satisfactory position as the Commission's Science Service in support of Euratom and EU policies.

The Panel recognises the value of training provided by the JRC and suggests that the JRC could give more visibility to its activities and achievements in training and education and their good quality.

The Panel sees the need to optimise the sharing of expensive infrastructure. Access should not only be extended to academia and public research institutes (via free access), but also to industry (via full-cost access), if there are no conflicts of interest.

The Panel encourages the JRC to identify tasks that are deemed no longer compatible with its mission.

If stopping this work requires a change in legislation, then the JRC should bring the corresponding issue to the attention of the Commission.

The Panel recommends that the JRC should pursue a recruitment policy aimed at achieving an overall gender balance and diversity of JRC staff, particularly at senior and middle-management level. With due regard to the need to recruit the best talent the JRC should actively seek the appointment of women and nationals from the new Member States (EU13) to fill vacancies in both research and management positions.

Undertaking paid contract work can create situations with a perceived or real conflict of interest for the JRC. Currently, the JRC has neither formal procedures to recognise such situations, nor rules to manage them effectively.

The Panel recommends that the JRC should adopt a corporate conflict-of-interest (COI) policy that prescribes rules and (ethical) standards of conduct applicable to its various contractual engagements with the necessary procedures to ensure the observance of the standards.

The Panel recommends that the JRC should actively promote awareness of its achievements and raise the profile of its activities through its web presence, including on social media.

# 3

## The direct actions of the JRC under the Seventh EC Framework Programme

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This Chapter addresses the JRC's activities under the Seventh Framework Programme of the European Community<sup>14</sup> for research, technological development and demonstration activities (EC FP7). The JRC Specific Programme (2007-2013) describes them as: 'the non-nuclear actions of the Joint Research Centre, providing customer-driven scientific and technical support to the Community policy-making process, ensuring support to the implementation and monitoring of existing policies and responding to new policy demands'.

The JRC implemented the direct actions endowed with a total of EUR 1.868 billion for the seven years under review<sup>15</sup>. This is about 3% of the total budget of EC FP7.

According to the FP7 text the JRC's non-nuclear activities should place particular emphasis on areas of key concern for the Union:

- 'Prosperity in a Knowledge Intensive Society'
- 'Solidarity and the Responsible Management of Resources'
- 'Security and Freedom'
- 'Europe as a World Partner'

The JRC started FP7 with its actions organised along these four lines and a fifth line for its nuclear work under the Euratom programme. Halfway through FP7 and following recommendations of the previous ex-post evaluation panel, the JRC changed these areas into more policy-oriented themes followed by another change in 2012. The result was a list

of many actions that shifted in a moving set of themes. The actions cover a broad range of fields in science and technology with research and policy support related to: energy, transport, environment, climate, economy, single market, agriculture, fisheries, food security, public health, food safety and security, regional development including the many aspects of foreign policy of the EU.

This contrasts with the nuclear actions, which are delineated in scope, in a structure that has been stable throughout FP7 and indeed throughout the history of Euratom research. Therefore, the nuclear experts in the Panel could well exercise peer judgement on most aspects of the JRC's Euratom programme, whereas the Panel was less in a position to assess the quality and relevance of the non-nuclear actions. With thousands of deliverables over a period of seven years from around 110 actions in a floating structure, the variety is too great for a few peers from outside of the Commission to exercise good judgement on all aspects including the usefulness inside the Commission. This accounts for the different depths of assessment between the Chapters 3 and 4, respectively the non-nuclear and the nuclear evaluation chapters.

The intervention logic of the JRC shows two main activities: scientific and technical support to policies, and scientific research. It is an ongoing challenge for the JRC to strike the right balance between these activities. Scientific research is a prerequisite for good policy support, but the balance between the two may differ in time and per activity.

The Panel supports the JRC's general aim for a subdivision between research projects respectively for core business, improvement of core business, and exploratory research split in a ratio of 70:20:10.

However, the primary purpose of the JRC is not to produce scientific publications but to produce reliable reports to reach and influence policy. Delivering such reports is not so much based on a proactive research strategy, but instead, on requests and needs expressed by various end-users. Responding to requests seems to have prevailed over the planned agenda in the work programmes under FP7. Few examples showed a strategic or forward-thinking ambition for proactive knowledge building. Earlier evaluations stressed that the JRC should give more room to proactive subjects related to new, improved and holistic policy developments. The trend has not been in that direction.

In the Panel's view, maintaining a mainly reactive approach to research will in the long run compromise research excellence in the organisation. This is associated with strategic issues discussed in Chapter 5.

### 3.1 Thematic challenges

Conscious of the breadth and depth of topics covered under non-nuclear JRC research, the Panel has identified below some aspects and challenges, which appeared noteworthy during the thematic hearings at the different JRC sites. Annex IV gives some detailed commentary from these hearings.

This situation may point to the need, in future evaluations, to select at intervals a specific subject or an entire thematic area. This approach would favour a more in-depth evaluation while allowing the reviewers to provide a more detailed and informed analysis on each theme.

The thematic challenges are often linked to the nature of the themes under study. However, the Panel wishes to note that a number of good thematic areas, outlined below, sometimes require further work to enhance their impact.

The first in the list is 'Economic and Monetary Union, Single Market, Growth, Jobs and Innovation', which would benefit from more structured and conscious exploratory work. Indeed, it currently enjoys an emerging demand from Commission departments, which, in turn, creates new needs and opportunities for research. This includes, for instance, financial system modelling to assess policy options for the European banking market. The JRC is introducing new ideas in this work and it has the freedom to organise and network as it considers best.

However, a strong demand pull may reduce freedom to work on unexplored subjects and also the potential to break new ground. Such pressure often means carrying on with routine work rather than embarking on the development of new products. Nevertheless, individual researchers and research teams do have anticipatory/exploratory activities, sometimes running well ahead of their peers. In such cases, the JRC has demonstrated enough flexibility to change the focus of research. This is the case, for example, in the field of Digital Transformation – including e-health, e-education, skill mismatch, privacy, consumer protection – where transformative changes are taking place. This requires quick reactions and a proactive research agenda that is not dependent on politics but rather on the rapid advance of industrial technology and its impact in society.

The Panel is encouraged by the JRC's impressive entry into the analysis and modelling of financial systems. The Panel is of the view that the JRC's capability to provide a proactive-research approach should be extended to all areas where significant transformative changes are happening or expected, particularly in the fields of digital markets, climate, energy and transport.

Indeed, being able to be proactive in research is not sufficient. The JRC also needs to acquire the ability to focus on transformative research. This applies strongly to the second theme 'Low-Carbon Economy and Resource Efficiency', which requires transformative – as opposed to incremental – changes in our energy, climate and transport

systems, to address the grand challenges of transition to a low-carbon economy.

The fundamental need for such a transformation has been evident for many years. JRC activities related to transport are narrow and often technology-oriented. They do not play a key role for strategic policy-making in this broader theme. The JRC provides scientific support to the proposals for a renewable energy directive and a fuel directive, and it would be interesting to evaluate the value of the JRC's contributions in these fields.

Furthermore, in the subfields of Environment and Climate Action, the Panel challenged the JRC with the question: The science is good but, given the existence of a large number of laboratories focusing on such issues internationally, is it needed? Finding the answer may need to be the subject to an extensive review, involving scientific peers and users.

Whether there is room for a more international role of the Commission's direct research on environment and climate, is one of the questions to be answered there. In any case, JRC's research would benefit from a strategic focus aimed at introducing transformative changes, particularly in the field of Climate, Energy and Transport.

In parallel, effective relations with relevant players and fruitful collaboration with partners from academia are crucial for the JRC to maintain and develop critical mass in research under the third theme 'Agriculture and Global Food Security'. This applies in particular, when the JRC enters into new sub-themes, keeping in mind the need to involve social and economic scientists to investigate the challenges of such themes.

Once a critical mass is achieved, the JRC could carve out a greater, proactive role in shaping future research agendas. Under the 'Agriculture and Global Food Security' theme the multidisciplinary area of the Bioeconomy can offer important new opportunities. The existence of a JRC taskforce on Bioeconomy is a positive development in this regard. It can further raise the JRC's profile within the Commission. More opportunity for blue-sky

research could help generate creative ideas in relation to influencing current H2020 as well as tomorrow's agendas.

The Panel is of the view that further enhancing collaborative research, including with social scientists, would open opportunities for the JRC to be more proactive in performing exploratory research, as suggested from experience with the 'Agriculture and Global Food Security' theme.

There is a need to set clear borderlines for deciding when to use in-house research capacity or when to outsource research efforts. This general need for the JRC is particularly strong under the fourth theme, 'Public Health, Global Safety and Security'. Examples like air traffic security research and characterisation of nanomaterials are relatively new in the JRC's research agenda, but already advanced in industry and academia.

In addition, there is a need to introduce mechanisms for joint planning and funding of research efforts to avoid unnecessary duplication with activities in the Member States. This approach should be tested and a feasibility study could look at ways of establishing collaboration with nationally funded institutions and funding agencies. With regard to interactions with European industry, a more proactive policy might be needed, among others, by outlining transparent rules for know-how/technology transfer to commercial entities.

By increasing collaboration with various European institutions and industry, the JRC may also improve its visibility in the new Member States. Despite the efforts already made the impact of the relevant activities undertaken can be significantly improved, for example through joint planning and funding with nationally funded institutions and domestic funding agencies.

### 3.2 Prioritisation and coherence

The grouping of the activities under each theme and the way in which they were presented in the thematic hearings probably reinforced an impression of

fragmented activities throughout large parts of the work programme. Completely different subjects like food safety, airport security, container tracking, and alternatives to animal testing, were covered under one theme during one hearing. By comparison, in a potentially more coherent theme like agrifood, the degree of consistency was still low.

Undoubtedly, the reactive nature of the JRC is part of the reason for such a state of affairs. In the Panel's view, acceptance of a great variety of requests for policy support without a proper selection scheme plays an important role in creating such a situation. There should be a higher level strategy to set priorities and guide the response to demand.

Geographical dispersion of research units may play a role too. Being located in different sites and reporting to three different directors might not be the optimum way of organising a thematic area or indeed any piece of work. This is an additional challenge for the programmatic organisation. The wide scope covered and the primary focus on processes rather than on substance may lead to fragmentation of effort. The evolving agendas of policy and the shifting demands from the policy level for support activities tends to promote a short-sighted view on research. The question was raised as to whether the nature of funding could be responsible for some of the fragmentation of effort observed. In part, this issue is an unavoidable consequence of the JRC's central mission to serve Commission policy development and implementation.

The JRC needs a strategy that could serve as a guide to prioritise the work to be performed among the many demands from the various Commission departments. It could also ensure that an appropriate balance is reached between research and consultancy-like tasks.

### 3.3 Organisational transparency and cross-fertilisation

The Panel is of the opinion that the JRC should exploit the many opportunities for cross-fertilisation between its own teams. The geographical

spread of the organisation is a hampering factor for cross-fertilisation, but modern communication tools can largely eliminate this obstacle. It is the responsibility of the management to improve internal communication and raise awareness of the need to serve the corporate interest. Management should create institutionalised processes and platforms for related and relevant research at the different JRC units to fertilise each other.

Integration of some of the highly knowledgeable and skilled research units into larger – albeit possibly loose – frames could provide major integrative and innovative benefits. Further, conscious efforts towards more targeted cross-fertilisation of research areas that are not directly related (such as energy and economic modelling, regional modelling, innovation research and regional economic modelling, etc.) could yield valuable results.

The phenomenon of smaller groups placing their own interests before corporate interests also occurs occasionally in the JRC. It creates unnecessary competition and duplication of efforts while reducing the effectiveness of collaboration. The need to break down silo walls had already been flagged as an issue. Although independent sections have a proven ability to work autonomously, the Panel recognises that in an age of interdisciplinary research, it is essential that more cross-fertilisation occurs between various JRC institutes and with third party research institutions. It is therefore essential that incentives for researchers to work across institutes, departments and disciplines are put in place.

Furthermore, fostering communication is paramount. The Panel observes ongoing efforts from the current management to create an environment where all information is available to everyone in the organisation via seminars, open meetings and enhanced web tools for internal communication. This approach has more chance of leading to better output based on the best ideas from all scientists, creating an environment with serendipity and new opportunities. It also enables expertise to be leveraged across the entire organisation.

The JRC needs to introduce changes in the organisation to help tackle the silo mentality, stimulate cross-institute collaboration and interdisciplinary research. Enhanced operational transparency in the organisation is one remedy. The Panel recognises ongoing efforts to improve transparency and cross-fertilisation in the organisation as a good start in that direction.

### 3.4 Interdisciplinarity, social sciences, Responsible Research and Innovation

The thematic hearings raised three issues about which the Panel felt that the JRC has room for improvement: interdisciplinarity (i.e. contributing to or benefiting from two or more disciplines), Responsible Research and Innovation (RRI), as well as social sciences. All three are specifically mentioned under 'Cross-cutting issues' in the FP regulation<sup>16</sup> of Horizon 2020. The Council and the European Parliament have addressed the need to implement linkages and interfaces across and within research priorities and the Panel believes that these issues have not received enough attention during FP7.

#### *Interdisciplinarity and social sciences*

To bring scientific disciplines together in new ways, it is essential to work across all thematic areas. The many aspects of JRC's knowledge base and skills offer excellent opportunities for work on the interface between different disciplines.

The Bioeconomy agenda is a prime example of where the JRC could exploit its interdisciplinary skills for some distinctive contributions. Interdisciplinary work would benefit renewal in the field of agriculture and global food security. The JRC could link its agriculture-and-food theme to nutrition and health, similar to the successful link that it made between agriculture and the environment (sustainable agriculture, greening of agriculture and climate smart agriculture). There are further links with social vulnerability, unemployment and economic growth both within Europe as well

as globally. Eventually most issues will need to be addressed in an integrated approach.

The JRC has a lot to contribute as owner and processor of much data and with expertise in the field of geo-information, modelling, big data (soil, climate etc.) and data harmonisation. Activities in the different fields of energy, transport, environment and climate have many points of connection, where the JRC could look for new solutions.

The Panel encourages the development of interdisciplinarity between various research teams of the JRC and with third party research institutions.

Amongst the many issues addressed in the JRC programme, some have large societal implications. The need to involve social scientists and not solely economists was an issue in practically every thematic hearing. As the JRC moves on towards 2020, it is crucial to strengthen its social sciences research capacity. It is also essential to integrate the societal, behavioural and justice dimensions into the research on virtually all of its actions.

Technology research that is appropriately embedded in social, societal and behavioural understanding may bring significantly more success than work that is essentially driven by a technology-centric worldview. Social sciences rightly receive a major emphasis in Horizon 2020. Therefore, this discipline needs to be included in JRC research strategies to stay at the forefront of research.

The Panel believes that more engagement with social sciences is important enough for the JRC to warrant some re-prioritisation of resources.

#### *Responsible Research and Innovation (RRI)*

RRI anticipates and assesses potential implications and societal expectations with regard to research and innovation as well as the active engagement of society in research and innovation processes and data collection pertaining to science. The objective is to build effective cooperation between science and society, to recruit new talent for science and

to pair scientific excellence with social awareness and responsibility.

Integrating RRI concepts for the JRC means that it should be innovative in supporting policy-making:

- a) through a multidisciplinary approach, i.e., combining or involving several separate disciplines;
- b) by engaging with all societal stakeholders (researchers, citizens, policy makers, business, civil society organisations, etc.).

This approach can help align the process and the outcomes of its research with the values, needs and expectations of European society. In doing so, it fosters the creativity and innovativeness of European societies to tackle the grand societal challenges that lie before them, while at the same time pro-actively addressing potential side-effects.

The Panel recommends the JRC to embrace the Horizon 2020 principles on Responsible Research and Innovation (RRI), which also implies strengthening the involvement of social sciences and better exploiting its large potential for interdisciplinary work.

### 3.5 Open access

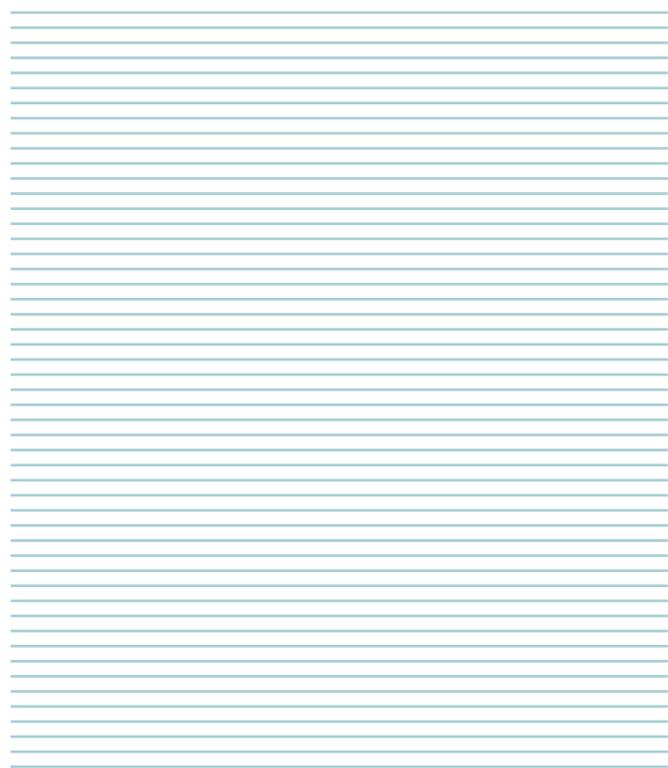
A significant part of the JRC's activities is related to the communication of knowledge. This is done effectively in some cases with modern tools and thinking, less so in others. The need to extend the open access policy to all the knowledge produced by the JRC is a concrete matter, which arose repeatedly in the discussions.

The Horizon 2020 Regulation<sup>17</sup> laying down the rules for participation and dissemination of research results excludes the direct actions carried out by the JRC. Nevertheless, in accordance with the new open-access policy for scientific publications under Horizon 2020, JRC articles in peer-reviewed publications will be freely and publicly available whenever JRC staff members are first or corresponding authors. This will mean that most JRC scientific results will be accessible online.

In fact, from 2010 onwards, many JRC scientific research results have already been made publicly available in PUBSY, the JRC's Publications Management System. Opening access to all scientific articles is one more step in broadening the JRC's Open Access policy. JRC researchers are now expected to publish in journals that are compliant with the updated policy.

The JRC runs large databases with primary data, modelling equations and analytical tools. The majority is open access, but not all. The explanations for limited access were partly due to confidentiality and partly due to fear the system may be abused by researchers who are not sufficiently familiar with the data. Another concern was that there was a risk that open access of incomplete or wrong data obtained with JRC methodologies could affect the reputation of the organisation.

The Panel commends the JRC's open-access policy strategy. While recognising the need for exceptions, the Panel is of the view that the JRC should keep these to a minimum.



The Panel is encouraged by the JRC's impressive entry into analysis and modelling of financial systems. The Panel is of the view that the JRC's capability to provide a proactive-research approach should be extended to all areas where significant transformative changes are happening or expected, particularly in the fields of digital markets, climate, energy and transport.

Further enhancing collaborative research, including with social scientists, would open opportunities for the JRC to be more proactive in performing exploratory research, as suggested from experience with the Agriculture and Global Food Security theme. More engagement with social sciences is important enough for the JRC to warrant some re-prioritisation of resources, the Panel believes.

By increasing collaboration with various European institutions and industry, the JRC may also improve its visibility in the new Member States. Despite the efforts already made, the impact of the relevant activities undertaken can be significantly improved for example through joint planning and funding with nationally funded institutions and domestic funding agencies.

The JRC needs a strategy that could serve as a guide to prioritise the work to be performed among the many demands from the various Commission departments. It could also ensure that an appropriate balance is reached between research and consultancy-like tasks.

The JRC needs to introduce changes in the organisation to help tackle the silo mentality, stimulate cross-institute collaboration and interdisciplinary research. Enhanced operational transparency in the organisation is one remedy. The Panel recognises ongoing efforts to improve transparency and cross-fertilisation in the organisation as a good start in that direction.

The Panel encourages the development of interdisciplinarity between various research teams of the JRC and with third party research institutions.

The Panel recommends the JRC to embrace the Horizon 2020 principles on Responsible Research and Innovation (RRI), which also implies strengthening the involvement of social sciences and better exploiting its large potential for interdisciplinary work.

The Panel commends the JRC's open-access policy strategy. While recognising the need for exceptions, the Panel is of the view that the JRC should keep these to a minimum.

# 4

## The direct actions of the JRC under the Seventh Euratom Framework Programme

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This Chapter presents the Panel's evaluation of the direct actions of the JRC under Euratom's Seventh Framework Programme for nuclear research and training activities (Euratom FP7) taking into account their interface with the indirect actions. This programme follows from the Treaty establishing the European Atomic Energy Community (EAEC or Euratom) in 1958, which made the Commission responsible for promoting and facilitating nuclear research in the Member States (indirect actions) and for the implementation of Community research and training programmes (direct actions). The Euratom Treaty maintains a legally distinct personality from the EU, although it has the same membership and is governed by the EU Institutions.

The Joint Research Centre implemented the direct actions endowed with a total of EUR 768 million for the seven years under review<sup>18</sup>. This is about two thirds of the nuclear fission research in Euratom's FP7 programme. The other third is attributed to indirect actions (see endnote 1).

The objectives of the JRC's nuclear research programme were 'to provide customer-driven scientific and technical support to the Community policy-making process in the nuclear field, ensuring support to the implementation and monitoring of existing policies while flexibly responding to new policy demands'.

The latest JRC specific programme (2012-2013), much like the preceding ones, encompassed the following thematic areas:

- Nuclear waste management, environmental impact and basic knowledge;
- Nuclear safety of reactor systems of relevance to Europe;
- Nuclear security (including nuclear safeguards, non-proliferation, combating illicit trafficking and nuclear forensics).

For the Panel's evaluation, the JRC provided the activity reports of the 26 actions in the Euratom programme, plus an inventory of its nuclear research and laboratory infrastructure. The programme accounts for around 23% of the JRC's human resources. This and other background material has been subject of a thematic hearing on the JRC's nuclear activities in Karlsruhe with additional information received during the visit to Ispra.

The general assessment of the JRC's activities under Euratom FP7 is discussed in the next section, followed by three sections with some observations regarding the three thematic areas its nuclear-research programme.

### 4.1 Overall assessment of JRC's activities under Euratom FP7

The JRC's research in the field of nuclear-energy technology is implemented independently of national and private interests. It plays an essential role in the future of nuclear power in the EU with respect for the different opinions of the Member States.

The Panel is of the opinion that JRC activities in the field of nuclear fission have the right long-term orientation and focus, leading to applicable results. The evidence provided shows high-quality research results, novelty and achievements with significant impacts.

The JRC generally aims for a subdivision of research activities between different kind of projects – core business, improvement of core business, and exploratory research (70:20:10). The Panel supports this approach also for the nuclear field.

#### 4.1.1 Governance of the JRC's nuclear actions

The JRC's nuclear activities constitute the lion's share of all Community-funded research in the field of nuclear fission (67%). Previous evaluation reports identified a number of issues pertaining to the governance of JRC's nuclear actions. They need an effective governance (a) externally, regarding coordination and alignment of the direct actions with the activities in the Member States (indirect research and national activities) and (b) internally, i.e. regarding management and prioritisation of JRC's nuclear activities in three different JRC Institutes at four different JRC sites.

Regarding coordination and alignment of the direct actions with the activities in the Member States, the Panel observes that there were no documented procedures or mechanisms in place to achieve this under FP7. The situation under the Horizon 2020 programme has somewhat improved, but the JRC should activate coordination mechanisms to make its direct research fall in line with Europe's needs in an open and transparent manner. The direction of its research and development should be clarified in interaction with the Euratom Scientific and Technical Committee (STC).

In addition to the Council's request that direct and indirect actions of the Euratom Programme shall be subject to separate evaluations<sup>19</sup>, the Panel is of the opinion that the European Atomic Energy Community would benefit from a synthesis of both evaluations showing the combined effects of the direct and indirect actions of the nuclear-fission research in the Programme.

Regarding the internal management, the Panel found that the JRC has substantially followed up the relevant previous recommendations, although this has been relatively late, mainly after the completion of FP7. In 2014 the JRC created an internal Euratom steering committee composed of all Institute Directors with responsibility for nuclear activities and headed by the Director General of the JRC. This steering committee strengthens a corporate approach in the Euratom part of the JRC programme and visibly enhances collaboration between 'the nuclear institutes'.

The effectiveness of the implemented solutions should be an issue of the interim evaluation of the Horizon 2020 programme that has to be concluded by May 2017.

The Panel recommends that the upcoming interim evaluations for the Euratom Programme (2014-2018) should address the combined effects of the direct and indirect nuclear-fission-research actions in the Programme.

#### 4.1.2 Policy support and scientific productivity

The policy-support concept that fits so many of the JRC activities is less suited for its nuclear activities. For instance, providing large nuclear research infrastructure for high-precision nuclear-data measurement is a critical element of the JRC's Euratom Treaty task and the JRC's well-maintained particle accelerators in Geel are now among the last of their kind in the world. Nevertheless, the operation of a particle accelerator poorly fits the concept of policy support.

The JRC's internal monitoring and evaluation approach uses three main criteria: policy impact, policy support, and scientific productivity. In retrospect, the Panel agrees that all actions met at least one of these criteria. The following observations relate to these criteria.

**Policy impact:** Many of the actions meet the policy-impact criterion, but the nature of the impact is generally unclear with many impact statements

being 'contributes to'. Both a clearer statement of specific policy goals or outcomes, and a clearer description of the specific contribution are needed to perform a meaningful evaluation using this criterion.

**Policy support:** A significant number of the actions also meet the policy-support criterion, but the strength of the demand is often unclear. In addition, the nature of the work varies considerably. Some actions, which involve providing technical services and performing coordination activities, can be aligned with policy needs. For actions with more fundamental research this is less obvious. Improvements in the specification of the criteria, as well as in the description of the contributions, would improve assurance that actions provide effective support to policy.

**Scientific productivity:** The scientific productivity criteria are clearly addressed at the JRC level. Nevertheless, it is worth mentioning that 'Nuclear science and technology' has been the second most productive area in terms of scientific publications by JRC staff during the FP7 period<sup>20</sup>, with a high productivity in custom-defined areas of 'nuclear waste and decommissioning' and 'nuclear safety'. The JRC's normalised productivity in the nuclear area (in terms of scientific articles per scientist) is comparable to that of its peers: CEA, Oak Ridge Laboratory and Argonne National Laboratory. The studies on JRC publications do not provide specific information on the scientific impact in the domain of nuclear science and technology.

#### 4.1.3 Responding to needs

The customer base for the JRC's actions under the Euratom programme lies largely outside the European Commission. The activities are primarily directed towards international organisations like the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD), towards nuclear research programmes in the individual EU Member States as well as internationally e.g. with the US, Russia and Japan. There is a modest but growing policy-support element relating to EU policies for Energy; Research and innovation; and External relations & foreign affairs<sup>21</sup>.

It is worth recalling that previous evaluations advised the JRC to enhance the transparency, effectiveness and efficiency of its nuclear activities through improving and recording formal customer consultations. This remains an issue, as the strength of the customer demand for much of the completed work still is hard to establish.

Identifying this demand for research directions is easier for the safeguards and security-related activities than for the nuclear-safety work. In part, this is because of the nature of the activities, which concern the provision of technical services rather than research. In the absence of a single customer for nuclear safety the JRC has adopted NUGENIA/SNETP<sup>22</sup> as a proxy to determine customer demand.

Considering the need to produce a Nuclear Research Index for Europe, the Panel suggests including alternative proxies to align future programmes, e.g. research organisations in individual Member States or outside the EU. This could also redress the geographical balance of the programme by involving organisations from Central and Eastern Europe more.

#### 4.1.4 Education and training

The safety of nuclear installations depends critically on well-trained people. There is a need for education with hands-on experience in nuclear infrastructure. This need is fulfilled by partially operating nuclear sites as user laboratories, as demonstrated during the thematic hearing in Karlsruhe. It allows researchers and university students to gain access to expensive infrastructure.

During FP7 the JRC started the implementation and day to day management of a **European Human Resources Observatory** for the Nuclear Sector (EHRO-N) following ideas within the European Nuclear Energy Forum (ENEF). This observatory manages a quality-assured database on the short-term, medium-term and long-term needs for human resources in the nuclear sector, identifies gaps and deficiencies in the European nuclear education and training infrastructure, and drafts recommendations for remedial actions and optimisation.

The Panel commends the European Human Resources Observatory for the Nuclear Sector for serving as a flagship of JRC's Euratom task for training and education.

#### 4.1.5 Strategy (including infrastructure)

The Panel observes some progress regarding the development of 'an ambitious Vision 2030 and associated strategy for its nuclear activities...' as suggested in the interim FP7 evaluation of the JRC's Euratom activities in 2010. Yet, much more progress is needed to see a strategy and the vision, which are crucial to guiding management decisions.

Compared to five years ago, the outlook for future activities today relies much more on developing joint programming, internally and externally (e.g. joint programme on nuclear materials by the European Energy Research Alliance (EERA), on a better alignment with international organisations (IAEA, OECD-NEA) and on joint strategic programming with Member States in a multilateral approach. In addition, the Panel considers that the strategy should:

- focus on the JRC's position in relation to Euratom and national research in the Member States;
- identify the critical areas in which the JRC needs to be active to stay competent and credible;
- include a stakeholder engagement plan to identify and pursue the most valuable relationships;
- build on partnerships with key stakeholders for mutual benefit.

The JRC operates expensive infrastructure and the costs of meeting the safety and security requirements of National Regulatory Agencies in the host countries can be substantial, particularly for older facilities built to earlier standards. Several elements of a long-term strategy are embedded in decisions on the future of the nuclear infrastructure: refurbishing of old facilities (Techno-Hall at Petten), upgrading and renovating of part of the buildings in Karlsruhe, grouping facilities in Ispra and Geel, building new facilities in Karlsruhe and decommissioning obsolete facilities. Consequently the Panel contemplated whether the JRC should try to concentrate its nuclear activities at one JRC nuclear site in the EU.

Since there is currently no reason to close any of the operational nuclear facilities, the Panel concluded that the JRC should consider the long-term availability of operational support as a key criterion when selecting a site for any new nuclear facility. In other words, the JRC should take the strategic decision not to build new nuclear infrastructure on a site where remaining nuclear facilities are being dismantled.

Furthermore, the JRC needs to plan for the operation of new infrastructures in conjunction with the Member States to optimise the use of limited resources and avoid building infrastructures that can be built and operated equally or more effectively by individual Member States. Here, the JRC should also set the example and be more active about sharing facilities, including its own, as widely as possible with the European nuclear research community.

In the Panel's opinion the JRC has the position to promote greater clarity in terms of nuclear research capabilities to maximise the efficiency of Europe's effort in this field. It should continue its work on an inventory of nuclear research facilities in the EU to identify overlaps, redundancies and possible gaps and suggest for which facilities it would be more efficient to share operation and use.

## 4.2 Nuclear waste management, environmental impact and basic knowledge

With some focus on the back end of the nuclear fuel cycle, the JRC worked on reducing uncertainties associated with long-term behaviour of spent fuel and waste forms, to develop effective solutions for the management of high-level nuclear waste. The JRC carried out a basic actinide research programme to enhance understanding and modelling of the physics, chemistry and fundamental properties of actinide materials for waste minimisation and safety of new reactor developments.

The JRC supported Member States in implementing the new waste directive<sup>23</sup> specific to the EU for the management of irradiated fuel and radioactive waste so as not to impose excessive constraints on future generations.

As a matter of policy support, the JRC assisted the Commission in the development, implementation and evaluation of more than 150 projects aimed at improving nuclear safety (see Section 4.3) and radioactive waste management in countries outside the EU, in particular neighbourhood countries and pre-accession countries. More generally in this field, the JRC interacts with Commission departments, Member States, IAEA, NEA and international partners.

Under this heading the JRC also produced high-accuracy nuclear data with the help of the JRC's Van de Graaff and GELINA linear accelerators. This provides the international community with reference data for safety assessments of nuclear energy systems and nuclear data standards.

In the area of radiation protection, the JRC further developed: (a) the European-wide environmental radioactivity monitoring systems (routine and emergency situations); (b) environmental models of radioisotope dispersion; and (c) monitoring tests in environmental radioactivity to help harmonising the national monitoring processes. This year (2015) the European radiological data exchange platform (EURDEP) celebrates 20 years of service and the IAEA selected the JRC's system as the technical basis for implementing the international radiation monitoring information system (IRMIS). This is an example of a JRC data system's achievement, but it is also an example where the Panel encourages the JRC to ask the question whether it should continue the provision of this kind of long-lasting routine operational services.

The interim evaluation found an inconsistency in the assignment of an element of support to medical applications to this programme under the section 'nuclear waste'. The evaluation report suggested using a different designation for this activity. In the execution of its Horizon 2020 programme the JRC contacted industry to bring this work under

another contract, with the intention to transfer the work to the pharma-industry.

Finally, it is noted that the area of nuclear waste and environment may need to be strengthened, since a large part of the current nuclear power plants in Europe are heading towards decommissioning. This should help to maintain the EU at the top in the world market with its expert knowledge and skills in the field.

### 4.3 Nuclear safety of reactor systems relevant to Europe

The Euratom Treaty is not specific about the Community's (and the Commission's) mandate in nuclear safety. Over the years this has remained the domain of national authorities and regulators rather than Euratom. Therefore the JRC has been working more on the topics related to the fuel cycle facilities, environmental sampling and integrated safeguards and prevention of illicit trafficking of nuclear and radioactive materials, comprising also nuclear forensics.

Nevertheless, in accordance with political and public awareness of nuclear safety, the JRC also runs a well-known and acknowledged programme on nuclear-reactor safety, nuclear-fuel safety in power reactors operating in the EU, and the safe operation of advanced nuclear energy systems. JRC actions cover crucial subjects in this area, focussing on: (a) existing and innovative fuel cycles – e.g. safety of nuclear fuels under normal/off-normal operating conditions (b) nuclear materials – e.g. structural materials performance and component integrity, and (c) the safety of current nuclear reactors and of new reactor designs – e.g. operating experience feedback, severe accident analysis and mitigation.

In addition, the JRC supported and coordinated the European contribution to the Generation IV International Forum R&D initiative (GIF), which relates to future nuclear power generators based on fast neutron technology with a closed fuel cycle. The Panel finds that the JRC should maintain a strong engagement with the GIF, especially in areas related to safety and where the JRC has some exclusive capabilities.

The JRC also provided the secretariat and professional support for the EU ‘stress tests’ requested by the Council following the Fukushima nuclear accident and organised under the umbrella of ENSREG<sup>24</sup>.

Furthermore, there is a need for more knowledge about nuclear power plants’ behaviour beyond design-basis accident conditions and for new assessments of their safety margins under extreme situations resulting from extraordinary triggering events like earthquakes and floods. In response to this, the JRC undertook activities to underpin research and to develop more expertise in these areas (e.g., nuclear severe-accident modelling, stability of damaged and molten core materials during severe accidents – namely addressing leaching of fission products and actinides, microstructural changes, etc.).

The JRC’s choice of activities related to nuclear safety has exhibited some in-built flexibility. During the evaluation period, some areas of the programme have undergone significant change due to new priorities. For example, new capabilities such as the EU Clearing House – constituted of a network of nuclear safety experts from both national organisations and the JRC – has been set up quickly. It was able to support the Commission in relation to the Directives on Nuclear Safety and Radioactive Waste, for example. The JRC publishes all reports and deliverables from this activity on the EU Clearinghouse website.

The JRC’s work in nuclear safety could be further developed. This echoes the FP7 interim evaluation suggesting (a) the need to increase awareness that the JRC’s work has a vital role in helping to ensure safe and sustainable nuclear energy and (b) to recognise that much of the JRC’s scientific work is of a very high standard, which is internationally recognised at the highest level.

A recent advisory report to the JRC on its nuclear safety research activities pointed out that – given the differences in national approaches – the relatively low level of recognition of the JRC’s work

also implies an increased risk that EU will base its decisions concerning the development of nuclear technologies on political considerations rather than on scientific requirements.

#### 4.4 Nuclear security

This area encompasses nuclear safeguards, technical assistance for the implementation of the Additional Protocol (with the aim of preventing undeclared nuclear operations), and collection of open-source information on nuclear non-proliferation in collaboration with IAEA and Member State authorities. It also includes combating illicit trafficking of nuclear materials, for which the JRC established the European Nuclear Security Training Centre (EUSECTRA). This centre trains front-line officers, coaches and experts how to detect and respond to illicit trafficking of radioactive materials.

Nuclear security and safeguards are specialised fields that require continuous development and a guaranteed level of knowledge and experience. The JRC’s training activities disseminate the knowledge in this field. The JRC’s competences and skills can be used to take a coherent approach to nuclear safety and security issues to exploit the synergies between nuclear safety/security/safeguards, both from the point of view of competences/skills but also from the point of view of equipment/infrastructure.

It is noted that work in the nuclear security area is more customer-oriented than that in the nuclear safety area. It shows a healthy balance between policy advice, delivery of professional services and conduct of research, which provides a model for the nuclear safety area. Besides, there is a good record of direct interaction in the area of nuclear security between the JRC and the IAEA.

The Panel is of the opinion that JRC activities in the field of nuclear fission have the right long-term orientation and focus, leading to applicable results. The evidence provided shows high-quality research results, novelty and achievements with significant impacts.

Studies on peer-reviewed scientific publications from the JRC show that its normalised productivity in the nuclear area (in terms of scientific articles per scientist) is comparable to that of its peers: CEA, Oak Ridge Laboratory and Argonne National Laboratory. The studies do not provide specific information on the scientific impact in the domain of nuclear science and technology.

The Panel found that the JRC has substantially followed up to previous evaluations, although this has been relatively late, mainly after the completion of FP7. More progress is needed to show 'an ambitious Vision 2030' and associated strategies for JRC's nuclear activities and nuclear infrastructures; they are crucial to guiding management decisions.

The JRC's work in nuclear safety could be further developed. The Panel echoes the FP7 interim evaluation suggesting (a) the need to increase awareness that the JRC's work has a vital role in helping to ensure safe and sustainable nuclear energy and (b) to recognise that much of the JRC's scientific work is of a very high standard, which is internationally recognised at the highest level.

Considering the need to produce a Nuclear Research Index for Europe, the Panel suggests including alternative proxies to align future programmes, e.g. research organisations in individual Member States or outside the EU. This could also redress the geographical balance of the programme by involving organisations from Central and Eastern Europe more.

More in general, the JRC needs to activate coordination mechanisms (e.g. via the STC) to make direct research for Euratom fall in line with the

activities in the Member States (indirect research and national activities).

The Panel recommends that the upcoming interim evaluations for the Euratom Programme (2014-2018) should address the combined effects of the direct and indirect nuclear-fission-research actions in the Programme.

Like in other areas, the JRC should organise external reviews of specific research results in the nuclear field.

Previous evaluations recommended that the JRC should enhance the transparency, effectiveness and efficiency of its nuclear activities through improving and recording formal customer consultations. This remains an issue, as the strength of the customer demand for much of the completed work still is hard to establish.

The Panel commends the European Human Resources Observatory for the Nuclear Sector for serving as a flagship of JRC's Euratom task for training and education.

Since there is currently no reason to close any of the operational nuclear facilities, the Panel concluded that the JRC should consider the long-term availability of operational support as a key criterion when selecting a site for any new nuclear facility. In other words, the JRC should take the strategic decision not to build new nuclear infrastructure on a site where remaining nuclear facilities are being dismantled.

The JRC should continue working on an inventory of nuclear research facilities in the EU to identify overlaps, redundancies and possible gaps and suggest for which facilities it would be more efficient to share operation and use.

The effectiveness of the implemented solutions should be an issue of the interim evaluation of the Horizon 2020 programme that has to be concluded by May 2017.

# 5

## Strategic development

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### 5.1 Challenges

Throughout the hearings with the JRC, the Panel noted how committed management and staff were to the JRC's policy-support mission. However, within that mission, the Panel perceived that much of the goals and programme of the JRC appeared to be set by a combination of historical legacy and response to shifting current demand.

The Panel is convinced that the JRC needs to establish a strategy that clarifies vision, assets, goals, values and rules. The sooner this is done, the better. The challenge here is to develop the role as Science Service, facilitating the management of knowledge within the Commission and striking the right balance between science and services, between being reactive and proactive.

It emerges from the previous chapters that the organisation could benefit from changes, to bring down silos and to stimulate cross-institute collaboration and interdisciplinary research. Other challenges for the organisation that transpired from the hearings include: coping with the pressure on resources, and changing organisational structures so that scientists working on one and the same theme do not have to report to different directors.

Good governance can help the JRC to be successful with improvement processes. It should ensure appropriate management of the relations with the Commission, with the Member States and with the scientific community. The JRC needs to retain a considerable degree of research autonomy to maintain its credibility. In a move towards greater transparency, the relationship with Member States needs to be managed to ensure mutual awareness

of what is done by the JRC and what is done by the Member States. This could lead to multiple benefits through cooperative research initiatives, as well as to economies of scale in its effort. It could also facilitate feedback on societal developments and other issues arising at national level.

Some of the suggestions in this Chapter require full attention at the level of the Commission, which has to facilitate some of the recommended adaptations and improvements.

### 5.2 Strategy

Developing a rolling strategy with a long-term vision has been an issue for the JRC since the 2008 ex-post FP6 evaluation. Preliminary incomplete versions of such a strategy have not materialised, which means that the JRC has been repositioned since then, without an overarching review of its role. A JRC strategy adopted and endorsed by its stakeholders would help to create a common understanding of what the organisation is and what it is not, of what it does and what it does not do.

The current climate in the Commission is favourable to new initiatives aimed at transforming the JRC into an organisation that is still more relevant to policy makers, who have not, until now, taken full advantage of its services. In response, the JRC has already shifted part of its activities towards the priorities of the new Commission.

Without a clear strategy, it will be difficult for the JRC to decide whether and how it can cope with the full demand for more support from various Commission departments. Considering that the new Commission is geared towards greater

efficiency, the Panel believes that a JRC proposal for a long-term strategy may be well received.

The Panel's strong recommendation for the future of the JRC is to establish a long-term strategy before the mid-term evaluation of the Horizon 2020 framework programme in 2017.

In the Panel's view, a successful strategy for the Science Service of the European Commission:

- rests on reliability, integrity, transparency, scientific quality and relevance.
- outlines key sectors for the JRC to focus on, to prevent duplication of effort between the JRC and both national research efforts and industry research.
- engages in exploratory research in relevant fields as a proactive approach to offering new science services to policies (Regarding the scale, the Panel considers that committing 10% of the resources for such activities would be appropriate.)
- reflects that many of the JRC's clients see themselves as partners in the development of a final deliverable.
- includes criteria to decide whether support should be charged to the beneficiary or whether it is financed through institutional funding, in order to make choices based on strategy considerations, not on financial objectives.
- includes criteria to assess when a service is considered routine and proposes how then to outsource it to the private sector, or to EU and national agencies, or research organisations.
- includes and also affects the JRC's infrastructure policy and internal skills-development policy.
- helps the JRC to focus, while considering the advice of social scientists, on issues that are far-reaching, transformative, instead of dealing with issues that are transient or of marginal importance.

### *Knowledge and Competence Centres*

To underpin their policy work, several Commission departments have recently been showing increased and new needs for knowledge-management support from the JRC. In response to this surge in demand, the JRC has gradually been adapting methods to enhance policy-support services to the Commission.

Specifically, the JRC launched Knowledge Centres in a selected number of areas linked to the new political priorities of the Commission. By integrating all relevant information in a given field, the JRC hopes to make new and existing knowledge more readily accessible to all interested stakeholders both within the Commission and within the Member States.

This initiative featured in most of the future considerations during the thematic hearings and was discussed in more detail in the last hearing on horizontal issues in the JRC. The Panel sees advantage in this innovative approach to scientific support to policies, as it can build a bridge between the knowledge among all European stakeholders in a given area. As part of the new strategy, this targeted approach through Knowledge Centres allows the JRC to create the necessary internal pressures to prioritise activities and to discontinue less urgent ones.

The Panel endorses current proposals for Knowledge Centres and Competence Centres, but expresses some concern that managerial responsibility for the programme might be distributed across these structures. An important condition for success is that the JRC should set up Knowledge Centres only for a limited number of key subjects, without creating an additional layer in the organisation. The Knowledge Centres should facilitate – not complicate – management and organisational structures. Moreover, they should allow the JRC to maintain the necessary autonomy in its research activities. Additional advantages in the Panel's view are that a new form of organisation around Knowledge Centres can help to overcome constraints from the JRC's geographical spread.

### 5.3 Organisational aspects

In the context of reduced availability of resources – be they human or research funding resources – the JRC will need to address its own resource requirements to deliver its mission. Specifically, there will be a need to avoid spreading available resources by prioritising work areas, to remedy the increasing fragmentation of the work observed by the Panel.

To remedy such issues, the Panel has welcomed recent changes in the work organisation. After the end of the evaluation period, JRC management has created clusters of projects to help structure the work coherently.

The ongoing restructuring of the JRC's work and the planning process have yet to be finalised. Location, organisation, names of institutes are historically and culturally determined. They do not follow managerially sound principles of interaction between units, thus failing to exploit synergies in terms of management and governance.

Large organisations like the JRC benefit from periodic review and, where necessary, restructuring. However, the latter can be difficult and disruptive and should not be undertaken without clear goals and strategy. The Panel does not have sufficient analysis to justify specific proposals for radical change. Nevertheless, the historical structure and distribution of work across its seven institutes could benefit from revision.

#### 5.4 Scientific support and advice

In many fields the JRC has moved full cycle from research production to providing valuable services for policy shaping and for decision implementation. The JRC also meets important needs for knowledge and science-based advice in Europe.

A few times during the evaluation the Panel heard the claim that the JRC offers an independent viewpoint and that this is a premium asset. In the JRC's mission, 'independent' means free of national and private interests, but this does not mean independence from the leadership of the Commission. Indeed from 2013 onwards, the JRC's detailed work programme is formally approved at the level of the College of Commissioners. This procedural change underlines the importance of the JRC's programme and confirms the Commission's leadership.

Although the JRC work programme is subject to annual approval by the Commission, being part of the Commission should not influence the quality

or the veracity of the science produced by the JRC. The Panel believes that the independence, i.e. the objectivity and impartiality in the context of providing scientific support and advice to the European Commission, is not affected.

In the final stage of this evaluation, the President of the Commission announced<sup>25</sup> the setting up of a mechanism for high-quality, timely, independent scientific advice. This new Scientific Advice Mechanism (SAM) with independent external experts confirms the JRC's role in providing scientific advice to the EU, as part of the Commission services under the President and the College of Commissioners. The Panel notes that the SAM structure is built on the independent but coordinated input of each of its constitutive parts – the JRC, the High-Level Group of eminent scientists and the network of Science Academies in Europe. The Panel also appreciates the JRC's initiative in establishing direct formal collaboration with the Academies in recent years.

The JRC has built a solid reputation for the reliability, integrity and independence of its scientific advice to the EU. The Panel believes that the notion of independence is a positive aspect of the JRC brand that the Commission needs to promote and protect. While its broad programme is now to be approved annually by the Commission, the JRC should continue to have the responsibility and authority to guarantee the independence and integrity of its scientific work.

#### 5.5 Governance and Relationships

Well-defined and effective governance ensures that an organisation operates in line with its objectives and strategy. The JRC is a service of the Commission, but also has a Board of Governors with representatives from Member States and Associated Countries. It will also have relations with the new Scientific Advice Mechanism (SAM), though they have yet to be defined.

These 'channels of responsibility' are, to a considerable extent, complementary. The direct line

through the Commission ensures compliance with the internal norms in matters of finance, personnel and management and it determines the policy objectives of the JRC's work. The Board of Governors has roles in advising management, as well as being a primary agent for linking the work of the JRC to that in Member States and Associated and Candidate Countries.

The Panel considers the JRC's relations with the Member States a matter of priority and the central role of the Board of Governors in this, triggered the Panel's interest to look more closely into its background.

Since its inception the Board has quadrupled in size:

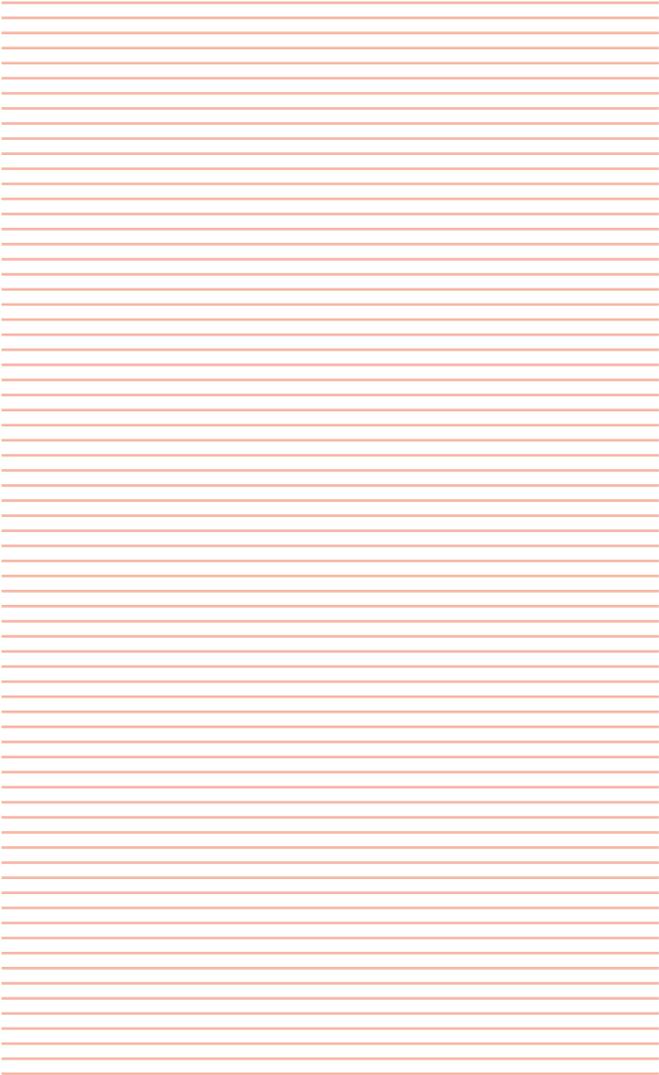
- It was set up in 1984 with 10 high-level representatives, one from each Member State, 'to be convened twice a year'.
- In 1996, when the Commission last decided on the governance of the JRC, the Board had 15 representatives from as many Member States, 'to be convened at least four times a year'.
- Today, the Board meets three times per year with 39 representatives, i.e., 28 from the Member States and 11 from countries associated to the Framework Programme.

Since the inception of the Board the JRC's mission has changed substantially. In 1984 the JRC programme was made up for 80% of nuclear research; today 75% of the work programme is focussed on the ('non-nuclear') mission of scientific support to EU policies.

These developments led the function of the Board to evolve from assisting the Director General and delivering opinions to the Commission, to mainly advising the JRC on how best it can deliver its mission. They also led to a great diversity in the Board members' positions in the Member States' administrations.

In light of this the Panel had some concern about the effectiveness of the Board's historical mandate and structure, which resulted in the idea that it would be timely to review the JRC's governance and relationships with the new SAM and with the Member States.

The Panel recommends that the Commission should task a Group of eminent personalities to put forward options for JRC governance, adapted to its functions of the future. These include scientific support, research, scientific advice, and knowledge management in partnership with the Member States.



The Panel is convinced that the JRC needs to establish a strategy that clarifies vision, assets, goals, values and rules. The sooner this is done, the better. Without a strategy, it will be difficult for the JRC to decide whether and how it can cope with the full demand for more support from various Commission departments.

The JRC needs good governance: to ensure appropriate management of the relations with the Member States to ensure awareness of what is done by the JRC and what is done by the Member States. This could lead to multiple benefits through cooperative research initiatives, as well as to economies of effort. It could also facilitate feedback on societal developments.

The JRC has built a solid reputation for the reliability, integrity and independence of its scientific advice to the EU. The Panel believes that the notion of independence is a positive aspect of the JRC brand that the Commission needs to promote and protect. While its broad programme is now to be approved annually by the Commission, the JRC should continue to have the responsibility and authority to guarantee the independence and integrity of its scientific work.

The Panel is not in a position to make specific proposals for radical change. However, it has observed that the historical structure and distribution of work across JRC's seven institutes could benefit from revision. It endorses the initiative on Knowledge Centres and Competence Centres, but expresses some concern about the way in which managerial responsibility for the programme will be distributed across these structures. The guiding principle should be that of 'form follows function'.

The Panel had some concern about the effectiveness of the Board's historical mandate and structure, which resulted in the idea that it would be timely to review the JRC's governance and relationships with the new SAM and with the Member States.

The Panel recommends that the Commission should task a Group of eminent personalities to put forward options for JRC governance, adapted to its functions of the future. These include scientific support, research, scientific advice, and knowledge management in partnership with the Member States.

# 6

## Concluding remarks

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The JRC has been and continues to be an important instrument of European integration. It has evolved over the years, adapting to the changing needs of a growing more integrated EU, steadily developing and promoting applications of new scientific knowledge and technologies in support of European legislation. It should continue conscious of its mission with an established strategy endorsed by the European Commission.

In concluding this report, an important observation of the Panel concerns evaluation of the JRC. In addition to giving Evaluation Panels the opportunity to speak to the JRC as a whole once every few years, the JRC should open its science to more in-depth evaluations in association with external and internal clients/partners and cooperating organisations.

Candidate areas for specialised in-depth reviews on impact and scientific quality are mentioned in passing in the report and would include: JRC's support to energy policy at large or in subsets (hydrogen, biofuel, photovoltaics), environment and climate, nanotechnologies, agricultural policies, food security, food safety or airport security.

In addition to this the Panel encourages the planned introduction of an internal ex-ante evaluation (impact assessment) of work proposals, which would also constitute a means to help focus the work and ensure a responsible way for the JRC to determine its own research agenda.

To ensure that research is at the cutting edge it needs to incorporate the comments from critical external peer review. The Panel is of the opinion that the JRC should introduce this through systematic external scientific review of its programme at two levels.

- First, through an external scientific advisory board that is part of the overall governance, as discussed in Section 5.5. This would be to ensure that the JRC's work is compatible with key long-term anticipated developments in both science and EU's policy needs.
- Second, through regular peer review, whereby each theme undergoes an external evaluation at least once in the seven-year period of the major JRC funding phases. Other *ad-hoc* peer review exercises may also be called upon for special needs, such as for publications or research proposals.

# Glossary

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<b>CEN</b>	European Committee for Standardisation
<b>CGIAR</b>	Consultative Group on International Agricultural Research
<b>CRM</b>	Certified Reference Material
<b>DG</b>	Directorate-General
<b>EC</b>	European Community
<b>ECHA</b>	European Chemicals Agency
<b>ECVAM</b>	European Centre for the Validation of Alternative Methods
<b>EEA</b>	European Environment Agency
<b>EERA</b>	European Energy Research Alliance
<b>EFSA</b>	European Food Safety Authority
<b>EIT</b>	European Institute of Innovation & Technology
<b>ELSA</b>	European Laboratory for Structural Assessment
<b>ENGL</b>	European Network of GMO Laboratories
<b>ENSREG</b>	European Nuclear Safety Regulators Group
<b>ERA</b>	European Research Area
<b>ESA</b>	European Space Agency
<b>ESFRI</b>	European Strategy Forum of Research Infrastructures
<b>ESTI</b>	European Solar Test Installation
<b>EU</b>	European Union
<b>EURL</b>	European Union Reference Laboratory
<b>FAO</b>	Food and Agriculture Organisation
<b>FP</b>	Framework Programme
<b>FP6</b>	Sixth Framework Programme
<b>FP7</b>	Seventh Framework Programme
<b>GDP</b>	Gross Domestic Product
<b>GIF</b>	Generation IV International Forum
<b>GM</b>	Genetically Modified
<b>GMO</b>	Genetically Modified Organism

<b>IAEA</b>	International Atomic Energy Agency
<b>ICT</b>	Information and Communications Technologies
<b>IGBP</b>	International Geosphere-Biosphere Programme
<b>IP</b>	Intellectual Property
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IPR</b>	Intellectual Property Rights
<b>KIC</b>	Knowledge and Innovation Communities (@EIT)
<b>MAWP</b>	Multi-Annual Work Programme
<b>NGO</b>	Non-Governmental Organisation
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>OP</b>	Publications Office of the European Union
<b>PhD</b>	Doctor of Philosophy
<b>PUBSY</b>	JRC Publications Repository
<b>R&amp;D</b>	Research & Development
<b>REACH</b>	Registration, Evaluation, Authorisation and Restriction of Chemical substances
<b>RTO</b>	Research and Technology Organisation
<b>SAM</b>	Scientific Advice Mechanism
<b>SNETP</b>	Europe's Sustainable Nuclear Energy Technology Platform
<b>S&amp;T</b>	Science & Technology
<b>UK</b>	United Kingdom
<b>UN</b>	United Nations
<b>UNDP</b>	United Nations Development Programme
<b>USA</b>	United States of America
<b>WHO</b>	World Health Organisation
<b>WMO</b>	World Meteorological Organisation
<b>WTO</b>	World Trade Organisation



# Annexes

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# Annex I – Terms of reference

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## 1. Background

This document provides the terms of reference for a panel of experts that will conduct the ex-post evaluation of the direct actions by the Joint Research Centre (JRC) from 2007-2013 under the Seventh Framework Programme of the European Community<sup>27</sup> (EC FP7) and the Seventh Framework Programme of the European Atomic Energy Community<sup>28</sup> (Euratom FP7). The Euratom FP7 has been extended for two years<sup>29</sup> to bring the effective duration of the programme into line with the seven-year period of the EC's Seventh Framework Programme for Research.

The direct actions of the JRC under the FP7 are detailed in a JRC Specific Programme<sup>30</sup> of the EC FP7 and in the JRC Specific Programme<sup>31</sup> of the Euratom FP7 and its extension<sup>32</sup>. These specific programmes are implemented through a multi-annual (2007-2013) work programme with a total seven-year budget of EUR 2.6 billion.

These specific programmes also stipulate that the JRC should 'generate additional resources through competitive activities; these include participation to the indirect actions of the framework programmes, third party work and to a lesser extent the exploitation of intellectual property'. In total the JRC generates an additional income of around 15% to the above-mentioned budget, including revenues from dedicated tasks at the specific request of other Commission departments under an administrative arrangement.

As the in-house science service of the European Commission the JRC has the mission to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy

cycle. Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

## 2. Legal basis for the evaluation

Both Article 7 of the decision concerning Seventh Framework Programme (FP7) of the European Community and Article 6.3 of the Seventh Framework Programme of the European Atomic Energy Community (the Euratom Framework Programme) ask for an external evaluation by independent experts of the programmes' rationale, implementation and achievements.

Moreover, the EC and Euratom decisions on the JRC Specific Programme both include a provision that the Commission should 'arrange in due course for an independent assessment to be conducted concerning the activities carried out in the fields covered by this programme'.

Specific inter-institutional and Commission requirements further frame this evaluation. The Commission's Internal Control Standard number 14 commits the Commission to evaluate all the different types of activities it undertakes. It requires that: 'Evaluations of expenditure programmes, legislation and other non-spending activities are performed to assess the results, impacts and needs that these activities aim to achieve and satisfy'.

The process and requirements for evaluation are further elaborated in the Commission's financial regulations<sup>33</sup> and associated rules of application<sup>34</sup>. In Chapter 7 (Principle of Sound Financial

Management) of the Commissions Financial Regulations, Article 30.4 states that ‘... evaluations shall be applied to all programmes and activities which entail significant spending and evaluation results shall be disseminated to the European Parliament, the Council and spending administrative authorities’. Details on the arrangements and scope of evaluations are provided in Article 18 of the Rules of Application.

### 3. Purpose of evaluation

The evaluation should help the JRC achieving the following high-level purposes:

- **Transparency and accountability:** by providing independent feedback to the budgetary and legislative authorities, and other stakeholders on the JRC activities in FP7.
- **Efficient resource allocation:** by (i) assessing the effectiveness, efficiency, coherence, EU-added value and relevance of the JRC activities and (ii) looking at results in the JRC Specific Programmes in relation to the budget spent.
- **Organisational learning:** by examining the follow-up given to previous external evaluations.

The evaluation should also provide a forward look with recommendations for further strengthening the JRC.

### 4 Scope and focus

#### *Scope*

The evaluation addresses all direct actions conducted by the Joint Research Centre in the context of both JRC Specific Programmes within FP7 EC and FP7 Euratom. These actions aim to provide scientific and technical support to the Union policy-making process, ensuring support to the implementation and monitoring of existing policies while flexibly responding to new policy demands. Actions under the Euratom programme aim in particular at the provision of scientific and technical support to the Union policy concerning nuclear energy and to meet the obligations of the Treaty.

The evaluation addresses the competitive activities to the extent of their effects on the operation of the JRC.

As an integral part of Horizon 2020 the direct actions of the JRC continue to provide evidence-based support to Union policies, driven by customer needs and complemented by prospective activities. The design of this new JRC programme falls within the scope of the evaluation.

#### *Focus*

The ex-post evaluation offers a transparent look at the work and the achievements of the JRC during the EC and the Euratom seventh framework programmes with a view to:

- Informing JRC budgetary and legislative authorities and stakeholders (European Institutions, Member States representatives in the JRC’s Board of Governors, policy makers) on the performance of the organisation and the use of the budget;
- Providing the JRC management with recommendations for a continued improvement of its science-based policy support;
- Assisting the JRC senior management with a forward look on the JRC’s detailed orientations under the Horizon 2020 framework programme.

The Panel has to ensure a double focus of the evaluation on the achievements under FP7 EC and FP7 Euratom and report its findings accordingly.

The Commission will be informed on the outcome of the evaluation through the Panel’s final report and may communicate the report to Council and Parliament and register it for inclusion in the independent evaluation of the overarching framework programmes.

### 5. Evaluation questions

The evaluation needs to show the JRC’s achievements on the one hand under FP7 EC and on the other hand under FP7 Euratom. Mindful of this double focus, the final report should describe in a substantive way to what extent the JRC

responded to the following evaluation questions, grouped under the headings: rationale and relevance, implementation, achievements and performance level, and a forward look.

### *Rationale and relevance*

- Were objectives formulated and defined in line with users' needs?
- Were policy-support deliverables based on relevant, sound and innovative science results?
- Did policy-support deliverables have positive impacts for the customers and the policies concerned?
- Did the JRC create significant EU added value<sup>35</sup>?

### *Implementation*

- Has the JRC's funding as a whole been sufficient to achieve its FP7 objectives?
- Has the JRC attributed the funding to specific areas effectively (e.g. does the research in the specific area reach the status of scientific reference)?
- Has the JRC implemented its work programme in a cost-effective manner?
- Were the JRC's infrastructure and facilities appropriate for achieving its FP7 objectives?
- Are the JRC's provisions for planning, monitoring, reporting and evaluation appropriate, effective and transparent?
- Has the JRC followed the recommendations of the JRC FP6 ex-post evaluation and the interim FP7 evaluations?
- Considering that the generation of income through competitive activities may have an influence on the JRC's role in the area concerned, are current arrangements sufficient to distinguish and manage different roles (e.g. regarding a role in strategic programming for that area)?

### *Achievements and performance level*

Regarding the achievements of the direct actions, to what extents have they:

- Contributed to meeting the overall and specific objectives of FP7?
- Provided customer-driven support to European policy makers?

- Engaged in international cooperation essential to the implementation of the JRC programme?
- Promoted the integration of New Member States'/Candidate Countries' organisations and researchers in their activities e.g. regarding the implementation of the S&T components of the *acquis communautaire*?
- Created significant EU added value?
- Supported the creation of the European Research Area, e.g. through provision of access to JRC's facilities and contribution to the mobility and training of (young) researchers?

Regarding the performance level of the JRC, questions are to what extent it:

- Anticipated new scientific developments in its competence areas that became relevant for policy making;
- Participated in networking activities under the indirect actions of FP7 and what is the level of the network partners;
- Generated unintended effects through its activities

The relevant experts should give their judgement on how the JRC's work compares to top-class work in the various fields done elsewhere.

### *A Forward look*

The evaluation should be completed with a forward look in which the Panel should:

- Assess to what extent the JRC programme is aligned to contribute to the general objectives and priorities of Horizon 2020;
- Identify one or two key options to be explored for further strategic orientation of the JRC in the second half of the decade;
- Provide pointers and options for the future evolution of JRC's competitive activities.

## **6. Evaluation and Panel, method, deliverables and timetable**

The Panel will consist of twelve independent high-level experts including the Chair. It carries

out the evaluation according to these terms of reference, taking a thematic approach distinguishing the following five themes for which panel experts can be asked to be rapporteur:

- Economic and Monetary Union, Single market, Growth, Jobs and Innovation
- Low-carbon economy and resource efficiency
- Agriculture and Global Food Security
- Public Health, Safety and Security
- Nuclear safety and security (Euratom)

The JRC's Adviser for Evaluation and Scientific Integrity assists the Panel in organising all aspects of the evaluation, makes available a secretariat to the Panel and assists in establishing the final report.

The JRC Director General will select the Panel and its Chairperson from a list of independent external experts in consultation with the Board of Governors and nominate them through expert contracts. An appropriate panel composition requires a balanced representation of expertise in JRC areas of activity, a balanced spread over scientific, governmental, non-governmental and private sector organisations, a balanced geographical spread, and equal gender opportunity. A minority of experts with experience from earlier JRC evaluation is an asset.

The Panel will build its assessment largely on written information in background documents, activity reports, bibliometric analyses and impact analyses provided by the JRC. To help its judgement the Panel may want to complement its impressions from JRC presentations in the different technical and policy research areas with impressions from JRC site visits to investigate specific issues and from contacting beneficiaries of JRC activities.

The Panel may hold meetings using electronic means such as audio-video conferences and use other electronic media for discussions.

The ultimate deliverable is the final evaluation report, counting a maximum of 40 pages – including an executive summary, excluding annexes – with an analysis of findings and a set of conclusions and recommendations based on evidence. The JRC will make the final report available to its stakeholders and the public.

The final report shall address the achievements under the theme 'Nuclear safety and security (Euratom)' separately, as this represents the JRC's achievement under the Seventh Euratom Framework Programme. What is the best format for such a distinguishable presentation is left to the discretion of the Panel.

The evaluation should start with a first session in 2014 to create full understanding among the experts about their role in the evaluation. During this session, the Panel discusses and validates the applicable methodology and the management of its work. Subsequently, the Panel may meet as often as necessary to produce the final report and address it to the JRC in time (before summer 2015).

## 7. Available sources

Available data and written information consists of:

### *Reference Documents*

- Official documents that constitute the formal baseline against which the assessment shall be made (Framework Programme, Specific Programmes, Multi Annual Work Programme)
- General reports and Intermediate reports on progress (e.g. Annual report, Annual Activity Reports)
- EUROPE 2020, A strategy for smart, sustainable and inclusive growth
- Horizon 2020, the EU Framework Programme for Research and Innovation.

### *Specific evaluation data from the JRC*

- Ex-post FP6 evaluation of the direct actions of the Joint Research Centre
- Interim Evaluation Seventh Framework Programme of the European Community (2007-2013), Direct actions of the Joint Research Centre
- Interim Evaluation of the Seventh Euratom Framework Programme (2007-2011), direct actions of the Joint Research Centre
- Impact analysis of the Joint Research Centre and its direct actions under the EU Research Framework Programmes. Final report, August 2011

- Impact analysis of the Joint Research Centre's activities for the regulation of GMOs in the European Union
- Impact Analysis of JRC activities. Special Report for the 100th meeting of the Board of Governors; Brussels, June 2013.
- Scientific impact report (based on bibliometric analyses)
- Auto evaluation 2014 (JRC self-assessment/excellence report) with:
  - o Statistical information on the implementation of the research activities
  - o Factual information (e.g. staff tables, budget implementation) provided by the JRC
  - o Excerpts of action achievements during the reporting period
  - o Publication data from the JRC corporate publication repository (PUBSY)

## 8. Standards

The Commission's evaluation standards aim to ensure relevant and timely evaluations of high quality and that their evaluation results are communicated to decision-makers and other relevant stakeholders in a clear and transparent manner to facilitate the use of evaluation results.

The evaluation standards are an integral part of the Commission's Internal Control Standard number 14 on evaluation, which means that they are binding and that the way they are implemented may be audited on this basis.

# Annex II – JRC facts and figures

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## 1. General background

The Euratom Treaty of 1958 set up the Joint Research Centre (JRC) to carry out 'the research programmes and other tasks assigned to it by the European Commission'. Initially focusing on nuclear standards and measurements, the JRC research programme started to diversify soon in the late 1960s and by the time of the start of the First Framework Programme (1984-1987) the ratio of nuclear/non-nuclear research in the JRC was of the order of 4:1.

During the Third Framework Programme (1992-1995) the JRC non-nuclear programme became as big as its nuclear programme and under the Fifth Framework Programme (1998-2002) the nuclear/non-nuclear ratio levelled off to an actual value of 1:3. In this continued diversification the JRC strengthened its policy-support mission in a substantial non-nuclear programme with a very broad range of activities from standards, measurements and test method validations, via monitoring and verification services to support the implementation of Community legislation, to prospective studies, modelling and a broad variety of supporting statistical analyses.

The arrival of the framework programmes also gave birth to the direct and indirect research concept, characteristic for Community research. All direct research activities under the framework programmes are pursued by the Commission in the establishments of the JRC, whereas indirect research is conducted in research centres, universities or undertakings, with financial support from the Commission. While both direct and indirect research activities have a vital role to play in supporting EU policy, direct research carried out by

the JRC has a distinctive role in support to policy, because the JRC:

- operates independent of national, private or civil society interests;
- makes its intellectual property freely available;
- ensures continuity in support to policy, rather than for a limited period of a grant or contract;
- is able to respond more quickly to new priorities and changing policy support demands than indirect research tools or contracts.

Over the years the JRC reported to the successive Commissioners responsible for Research also during the Seventh Framework Programme. In the formation of the current Commission, President Juncker detached the JRC from the 'vertical' research policy portfolio and emphasised the horizontal character of this in-house scientific service by transferring the responsibility to the Commissioner for Education, Culture, Youth & Sport who also took the responsibility for another part of Horizon2020, the European Institute for Technology. The President highlighted that the JRC is supporting all Commission services with its knowledge and its expertise, sharing its result to a wide public.

Indeed the high-level duties behind the JRC's scientific activities are to provide support to EU policies at the relevant stages in the policy cycle, while the Euratom Treaty gives the JRC a mandate to carry out a Community<sup>36</sup> nuclear research and training programme. To deliver on these duties, the JRC established the following working objectives:

- To address key societal challenges in close cooperation with policy Directorates-General to provide them with robust and fit-for-purpose scientific and technical support;

- To maintain a strong anticipatory function, a strategic dialogue with customers and stakeholders and an appropriate research base;
- To foster excellence through internal quality control and external peer review, evaluation and benchmarking; strive for quality labels and certifications wherever appropriate;
- To stimulate innovation through working with key players worldwide on the global challenges facing our society, developing new methods, tools and standards, and sharing its know-how with its partners.
- To establish or maintain an acknowledged science and technology reference role in key areas of competence, where appropriate in cooperation with relevant institutions in the Member States.

The JRC differs somewhat from the typical Commission department where it concerns:

- **Financial resources:** In addition to its funding through the EU budget the JRC generates additional income through work under contract (to the amount of an additional ~15%).
- **Governance:** The JRC works with a Board of Governors made up of national representatives. No other department in the Commission has an external Board.
- **Geographical spread:** The research infrastructures and staff of JRC are spread over six different sites in five Member States: Belgium, Germany, Italy, the Netherlands and Spain.

Today's activities and the budget of the JRC are set out in two programmes of Horizon 2020, the Specific Programme implementing Horizon 2020 for non-nuclear direct research (under the Treaty on the Functioning of the European Union) and the Euratom Research and Training programme (under the Euratom Treaty).

These facts and figures are prepared for the mandatory external ex-post evaluation of JRC activities under the seventh framework programmes (2007-2013). A detailed description of the planned and executed activities for the programme duration can be read in the JRC's (multi)annual work programmes, management plans and annual

activity reports, as well as in the annual reports prepared for a wider public.

## 2. Stakeholders

Stakeholders, partners and customers of the JRC are amongst: (i) EU Institutions and agencies, (ii) Member States, Candidate Countries and Associated Countries, (iii) International Organisations, (iv) partner organisations from public and private sectors across Europe and the world

### 2.1 EU Institutions and agencies

Whereas the European Commission is JRC's key stakeholder and largest single user of scientific support and advice, the JRC interacts with many of the EU institutions and vice versa:

- The European Commission
- The European External Action Service (EEAS)
- The EU Council in several formations of the Council<sup>37</sup> and its Secretariat
- The European Parliament<sup>38</sup>
- The European Economic and Social Committee and the Committee of the Regions
- The European Central Bank (ECB) and the European Investment Bank (EIB)
- Many of the 37 decentralised EU Agencies<sup>39</sup> through the responsible Directorates General in the Commission, EEAS or Council

### 2.2 Member States, Candidate Countries and Associated Countries

The JRC provides support to Member States, Candidate Countries and Associated Countries through cooperation with national or regional authorities responsible for the implementation and monitoring of EU policy, e.g. national standardisation bodies, regulatory authorities or control laboratories.

In addition the JRC has established structured forms of cooperation and support in the context of EU's macroregional strategies, e.g. by helping decision-makers to identify the policy measures and actions for the implementation of the EU Strategy of

the Danube Region or for the Baltic Sea Region supporting the Priority Area on Energy through the Baltic Energy Security Research Platform. The JRC is also following the on-going preparations of the Strategy for the Adriatic and Ionian Region and is currently examining how it could best support the future Strategy for the Alpine Region.

Regarding Candidate Countries and Associated Countries, the JRC acts as a facilitator in the EU enlargement process, supporting the transposition of the *acquis communautaire* to national legislation, facilitating scientific and technological knowledge sharing and demonstrating through concrete action the benefits of European integration.

### *2.3 International Organisations*

The JRC works with a large number of international organisations and standardisation bodies. In the nuclear area it maintains strong ties with the International Atomic Energy Agency (IAEA). More in general it has standing relations with the United Nations (UN), its Food and Agriculture Organisation (FAO), the World Health Organisation (WHO), the Organisation for Economic Co-operation and Development (OECD) and the World Bank, as well as specific European intergovernmental organisations like the European Space Agency (ESA), or the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

The JRC supports international standardisation through e.g. the European Committee for Standardisation (CEN), the International Standardisation Organisation (ISO), or the 'Codex Committee on Methods of Analysis and Sampling (CCMAS)' of the Codex Alimentarius Commission, established by the FAO and the WHO.

### *2.4 Partner organisations from public and private sectors*

As a networked organisation the JRC cooperates with numerous partner organisations across Europe and worldwide. These cooperating partners range from research and technology organisations, universities, science academies, industrial companies and associations, to control laboratories,

standardisation bodies, regulatory authorities, national or regional authorities. Through more than one hundred networks and cooperating with an order of magnitude more research organisations worldwide, the JRC multiplies Commission influence among the global scientific community.

For instance the European Integrated Pollution Prevention and Control (IPPC) Bureau at the JRC in Seville is implementing the Industrial Emissions Directive involving more than 1200 experts in the technical working groups coming from the Member States, from other European countries (EFTA and Candidate and Accession Countries), from different services of the European Commission, industrial associations and environmental NGOs.

Through the European Technology Transfer Offices Circle (European TTO Circle) the JRC cooperates with organisations for the competitiveness of the European Union. The Circle connects the technology transfer offices of 24 public research organisations in Europe with about 130.000 researchers and support staff, aiming to share expertise, exchange best practices and develop synergies in the field of intellectual property (IP) and knowledge/technology transfer.

The JRC maintains close links with umbrella organisations of the European scientific community, including for example the European Academies Science Advisory Council (EASAC), the European Council of Applied Sciences Technologies and Engineering (Euro-CASE), the League of European Research Universities (LERU), the Conference of European Schools for Advanced Engineering Education and Research (CESAER).

At international level, the JRC cooperates with institutions in the USA, Brazil, China, India, Japan and Russia, ensuring access to global knowledge, enhancing the EU influence in the world. Partnerships with key institutions in the US contribute to transatlantic standardisation and interoperability via pre-normative research and help building a regulatory level playing field.

### 3. Organisational structure, governance and management

During the Seventh Framework Programme the responsibility for the JRC within the Commission resided with the Commissioner for Science, Research and Innovation. Internally, the JRC organises its work from its offices in Brussels with the Director-General, his deputy and two horizontal directorates for 'Policy Support Coordination' and for 'Resources'.

The other JRC directorates are spread over five Member States: Belgium (Geel), Germany (Karlsruhe), Italy (Ispra), Spain (Seville) and The Netherlands (Petten) with seven directorates with specific competences in different areas of research to provide science-based policy support. A third horizontal directorate focusses on 'Ispra Site Management' and keeps a JRC wide view of its infrastructure and buildings.

The Board of Governors provides an external element in the JRC governance. Member States and Associated Countries nominate their representatives and the Commission appoints the Governors. Associated Countries have an observer status in the Board. The Board meets three times a year and advises the Director General on matters relating to the role and the scientific, technical and financial management of the JRC and communicates back to the Member States and Associated Countries. The Board also gives an opinion on Commission decisions that have a direct impact on JRC programming including senior management appointments.

As one of the Commission's departments the JRC is subject to the Activity Based Management system introduced with the administrative reform of 2002. The Commission plans and reports on its work following an annual cycle known as the 'strategic planning and programming' cycle (SPP). Every year Commission departments (directorates-general) produce management plans (MP) showing how they will contribute to the Commission's priorities and setting clear objectives and indicators for monitoring and reporting. At the end of the budget year, all departments produce an annual activity report (AAR) on their performance in achieving their objectives. These departmental reports are collated

into a synthesis report to the European Parliament and the EU Council.

The JRC is fully integrated in the annual Commission's SPP cycle and subsequent JRC MPs and AARs (2007-2013) are the reference documents for the higher level planning and achievements of the organisation in the relevant year thus providing a formal and verified account of JRC activities.

In 2014 the Director-General re-established the JRC's Scientific Committee after several years of suspended activity. The Committee should help ensuring that the JRC achieves its mission, achieves scientific excellence and on that basis, maximises its scientific and technical support to European Union policy. In particular the Scientific Committee will support the Director General by providing advice on how to promote and achieve multi-disciplinary, cross-JRC collaboration and defining ways and means to assure the scientific integrity of the JRC.

In view of the need to deliver consistent and high-quality technical and operational results, the JRC pursues a quality management approach, where necessary backed up by external certification and accreditation (ISO 9001, ISO/IEC 17025, ISO 14000, OHSAS 18001, ISO Guide 34 and ISO Guide 43). This rigorous quality approach also facilitates the JRC's recognition as a reliable provider when it operates on the (commercial) market.

Inherent to this quality approach, the JRC is also committed to maintaining a high level of safety and security on its premises.

Following recommendations from earlier evaluations the JRC gradually developed corporate values aiming to operate with the highest standards of quality, efficiency and integrity regarding the society as a whole, its customers and its own staff. Just before the start of FP7 the JRC made a special effort to promote a high standard of integrity in its work by adopting guidelines<sup>40</sup> that should help the JRC 'to provide support and advice that is objective, sound in logic and based on scientific evidence'.

## 4. The JRC in the Framework Programmes

### 4.1 The Seventh Framework Programmes (FP7)

The preparations of FP7 started in 2005 when the Council and European Parliament adopted the EU Financial Perspectives<sup>41</sup> (2007-2013) that embraced a new political project for the Union. Through this project, the Union concentrated its action on three main priorities:

- Integrating the single market into the broader objective of sustainable growth, mobilising economic, social, and environmental policies to that end. The goals under this priority are competitiveness, cohesion and the preservation and management of natural resources.
- Giving more substance to the concept of European citizenship by completing the area of freedom, justice, security and access to basic public goods and services.
- Establishing a coherent role for Europe as a global player – inspired by its core values – in assuming its regional responsibilities, promoting sustainable development and contributing to civilian and strategic security.

The Seventh Framework Programme of the European Community and the Seventh Framework Programme of Euratom served the overriding goal of contributing to the Union becoming the world's leading research area. This required the Framework Programmes to be strongly focused on promoting and investing in world-class state-of-the-art research, based primarily upon the principle of excellence in research. Both programmes tasked the JRC to prolong its mission of providing customer-driven scientific and technological support for the conception, development, implementation and monitoring of Community policies. It should also continue to function as an independent reference centre for science and technology in the Union in the areas of its specific competence.

In response to these political priorities in 2005, the JRC specific programme evolved from a structure of four 'Core Areas' around thematic fields in FP6, to five 'Policy Themes' reflecting

the general political concerns in the EU at the time of the adoption of FP7:

1. 'Prosperity in a Knowledge Intensive Society'
2. 'Solidarity and the Responsible Management of Resources'
3. 'Security and Freedom'
4. 'Europe as a World Partner'
5. 'The Euratom Programme'

The JRC subscribed these policy themes in its Multi-Annual Work Programme 2007-2013.

### 4.2 The JRC Work Programmes under FP7

The annual JRC work programmes and management plans during FP7 incorporated priorities from the Framework Programme and needs from the policy DGs of the Commission expressed in regular meetings with the services. The JRC executed the subsequent annual work programme through around 120 direct research 'actions', where it should be noted that the typical JRC 'action' looks similar but is not the same as what is commonly known as a 'project', i.e. a specific task of investigation over a fixed period. Indeed a JRC action usually would pursue several objectives, through a number of parallel and/or serial projects in support of a certain policy, which is transparent on the policy goal or the customer than but less clear on the work involved. The approach changed under the new Horizon 2020 programme (see Section 4.4).

The JRC monitored and reviewed the execution of these actions at different organisational levels in an integrated review cycle at the level of scientific units in the Institutes, at the level of the Institutes and in an annual internal review at corporate level, named Periodic Action Review (PAR). To facilitate these reviews, scientific staff entered data concerning objectives, deliverables, impact and other performance indicators into a corporate database (SKM later PUBSY). The collected information was used to make an indicator-based peers' assessment of the EU policy support impact and the scientific output of each individual action in the JRC Work Programme.

In 2007 to start with, the annual JRC work programme followed the five 'Policy Themes' of the JRC Specific Programmes as adopted by Council and European Parliament (see 4.1 above). However, one and a half year into the Seventh Framework Programme the ex-post FP6 evaluation panel pointed out that the structure with these policy themes is quite unclear about the underlying science and the supported policy. Hence they recommended 'to develop a work-programme structure that reflects the core activities of the JRC [...] notably for the benefit of its positioning, planning and evaluation activities'. Subsequently, the JRC has been working with different programme and evaluation structures.

As of 2010 the JRC Work Programme distinguished seven 'thematic areas':

1. Towards an open and competitive economy
2. Development of a low carbon society
3. Sustainable management of natural resources
4. Safety of Food and Consumer Products
5. Nuclear safety and security
6. Security and crisis management
7. Reference materials and measurements

During the last two years of FP7 the work programme introduced in parallel six policy clusters that were going to be used under Horizon 2020. These clusters are named after major mid-term political goals of the EU and in view of continuity the ex-post FP7 evaluation uses these policy clusters, with the first two clusters merged into one:

- Economic and Monetary Union, single market, growth, jobs and innovation
- Low-carbon economy and resource efficiency
- Agriculture and global food security
- Public health, global safety and security
- Nuclear safety and security (Euratom)

### 4.3 Horizon 2020

As of 2014 the JRC is part of Horizon 2020, the successor of the Seventh Framework Programmes for Research and Technological Development. Horizon 2020 is the EU's financial instrument for implementing the Innovation Union, a flagship initiative of the Europe 2020 strategy<sup>42</sup> aimed at

securing Europe's global competitiveness. The European Council and the European Parliament agreed that research is an investment and put Horizon 2020 at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs.

Horizon 2020 is the biggest EU Research and Innovation programme ever with a seven-year budget of nearly EUR 80 billion on top of the private investments that this money will attract. Its main drivers are excellent science, competitive industry and a better society. Targeted, smart funding should help ensure that the best ideas are brought to the market faster.

The JRC is responsible for all direct research in Horizon2020, which sets out the overall objective for the JRC non-nuclear work as follows: to provide customer-driven scientific and technical support to Union policies, while flexibly responding to new policy demands. Therefore, the JRC contributes to Horizon 2020 general objective and priorities by, inter alia:

- Providing direct scientific support to the Commission's policy departments;
- Developing standards and providing references in support of European competitiveness;
- Upholding innovation and thus supporting the science agenda of relevant instruments;
- Helping bolster knowledge and technology transfer.

The JRC's nuclear work is funded through the Euratom Research and Training Programme under Horizon 2020 with the overall objective to pursue research, manage knowledge and training activities with emphasis on nuclear safety and security, while contributing to the transition to a carbon free economy in a safe, efficient and secure way.

### 4.4 The new Work Programme

In 2014, at the transition from FP7 to Horizon 2020, the JRC introduced a new structure of its scientific work programme, transforming around 110 actions of FP7 into several hundreds of 'projects' under Horizon 2020. Whereas the actions consisted of a variable number of projects which made their

lifetime usually undetermined, the projects have a fixed duration between one and three years. The finer granularity of these projects also connects the Commission's priorities and the ensuing needs for policy support better with the JRC's response and with more transparency.

These projects are structured around six key orientations, which resulted from an extensive consultation process with policy DGs and other stakeholders. Each key orientation represents a policy cluster, i.e. an area with various policies for achieving main mid-term political goals of the EU:

1. Economic and Monetary Union (EMU),
2. Single market, growth, jobs and innovation
3. Low-carbon economy and resource efficiency
4. Agriculture and global food security
5. Public health, global safety and security
6. Nuclear safety and security (Euratom Programme)

A further novel feature is the translation of the needs into a rolling multi-annual Work Programme with a 2-year time horizon, in line with the approach introduced throughout the Commission and with the timeframe of the Horizon 2020 work programme for indirect actions. This allows striking a better balance between the predictability of a multi-annual system and the flexibility to respond in a timely manner to unexpected developments.

This aligns the JRC's first multi-annual work programme for 2014-2015 with the EU priorities, overcoming the economic crisis, encouraging the use of renewable energy and tackling climate change.

The JRC Work Programme package 2014 – 2015 in its entirety included

- The Commission Implementing Decision for the JRC Work Programme 2014-2015
- The Key Orientations for the JRC Work Programme 2014-2015, a strategic political document providing the general context, objectives and guidance for the development of the detailed work plan. This is a rolling plan with a two-year horizon, updated annually. The Key Orientations are a comprehensive outline of the entire range

of JRC activities, covered by both institutional and additional resources. It identifies the main policy areas where the JRC scientific support is needed; therefore each scientific activity is related to a policy objective.

- The detailed annual work plan for 2014 – 2015 with projects and deliverables which the JRC intends to undertake to meet the policy objectives set out in the Key Orientations.

#### 4.5 The JRC Science Hub

To enhance the dissemination of knowledge created in the JRC amongst an as wide as possible public, the JRC replaced its corporate website with 'The JRC Science Hub' at the beginning of Horizon 2020. The idea behind this make over is to bring together all information existing on technical websites, hosting JRC laboratories, facilities, scientific tools, databases, networks and bureaus and on other scientific activities and make it all accessible in one place. Eventually the JRC Science Hub should integrate and aggregate all scientific knowledge produced by the JRC and its institutes at one online platform.

The Science Hub is particularly suited to learn more about the JRC's large portfolio of policy-related science & technology research activities, the wide variety subject covered in the different science areas used to structure this information source. To structure the JRC activities more clearly for a general audience The Science Hub divided the JRC activities into ten science areas. The mapping of these ten science areas on the five evaluation themes is logical and unambiguous except one horizontal area, 'standards', which cuts across the full JRC programme.

The Science Hub also holds references to a large number of databases, software and modelling tools that the JRC developed and/or operates. Many of these sources are publicly available; some are shared with specific research groups, assisting scientists in their work.

## 5. Budget and staff figures: selected trends in FP7 (2007-2013)

### 5.1 Financial resources

The JRC's budget voted by the European Council and the European Parliament is referred to as 'institutional budget'. The major part of the JRC's institutional budget comes from the research framework programmes. From 2007-2013 the institutional budget through FP7 was EUR 2.636 billion of which 768 million through Euratom. This includes the contributions from the European Free Trade Association (EFTA) countries (EUR 43 million) as well as from Associated Countries (EUR 100 million for FP7 of which EUR 21 million for Euratom). This is summarised in Table 2 below.

In addition to these appropriations, the JRC received a special budget of EUR 202 million (total from 2007-2013) to carry out activities under the Euratom Treaty for decommissioning of plants on JRC sites that have been shut down. This part of the institutional budget is outside the framework programmes and is not considered in any further detail here.

Using its specific competences the JRC generates external revenues on top of its institutional budget, e.g. through additional work for Commission services, contract work for third parties, or as a participant in indirect actions of the Framework Programme by teaming up in consortia and expert networks. During FP7 the JRC generated additional income, equivalent to ~17 % of its institutional budget.

These competitive activities complement the tasks outlined in the JRC's own work programme and are seen as an essential tool for acquiring and transferring expertise and offering some of its unique experience. They also integrate the JRC in the European research landscape.

### 5.1.1 The JRC Framework Programme Budget executed during 2007-2013

Table 3, Table 4 and Table 5 present the evolution of the JRC's FP7 budget from 2007-2013 divided in into the following three parts distinguished in the budgetary execution:

- Staff expenses
- Means of execution, e.g. expenses for maintenance of buildings and equipment, electricity, insurances, consumables
- Operational expenses, i.e. expenses for scientific work, e.g. lab equipment, consumables.

The legal texts of the Framework Programme that the JRC's budget also covers some activities for general interest, such as the technology transfer and innovation promotion and the management of the Communities intellectual property rights. It also covers staff expenses for decommissioning general services. The expenses for these supplementary activities amounted to EUR 47 million for the seven-year period of FP7.

Therefore out of the EUR 2.636 billion total budget through FP7, the JRC spent EUR 2.589 billion on work in the five evaluation areas (= the six key orientations of the Work Programme later on in FP7).

### 5.1.2 Additional external income

The JRC generates additional income through work under contractual arrangement. Table 6 shows the value of contracts signed and inscribed in the seven years of FP7 for the three types of contracts: JRC's participations in FP7 indirect actions; Direct support to Commission services outside the Framework Programme; Work for third parties such as industry or regional authorities.

JRC Budget 2007-2013	EU budget	EFTA contributions	Suppl. Credits from Assoc. Countries	Total
FP7 EC	1746	43	79	1 868
FP7 Euratom	747	-	21	768
<b>Total</b>	<b>2 493</b>	<b>43</b>	<b>100</b>	<b>2 636</b>

Table 2. JRC Budget from 2007 to 2013 (round figures, million EUR)

EC programme	2007	2008	2009	2010	2011	2012	2013	Total
Staff expenses	147	152	156	163	168	175	178	1 139
Means of execution	49	51	52	56	59	61	64	392
Operational expenses	29	29	30	31	31	32	33	215
<b>Total</b>	<b>225</b>	<b>232</b>	<b>238</b>	<b>250</b>	<b>258</b>	<b>268</b>	<b>275</b>	<b>1 746</b>

Table 3. JRC EC 7th Framework Programme Budget (round figures, million EUR)

Euratom programme	2007	2008	2009	2010	2011	2012	2013	Total
Staff expenses	57	60	61	64	66	68	70	446
Means of execution	30	31	31	34	35	37	38	236
Operational expenses	9	9	8	9	10	10	10	65
<b>Total</b>	<b>96</b>	<b>100</b>	<b>100</b>	<b>107</b>	<b>111</b>	<b>115</b>	<b>118</b>	<b>747</b>

Table 4. JRC Euratom 7th Framework Programme Budget (round figures, million EUR)

EC + Euratom programme	2007	2008	2009	2010	2011	2012	2013	Total
Staff expenses	204	212	217	227	234	243	248	1 585
Means of execution	79	82	83	90	94	98	102	628
Operational expenses	38	38	38	40	41	42	43	280
<b>Total</b>	<b>321</b>	<b>332</b>	<b>338</b>	<b>357</b>	<b>369</b>	<b>383</b>	<b>393</b>	<b>2 493</b>

Table 5. JRC EC and Euratom Framework Programme Budget (round figures, million EUR)

Contracts signed during FP7	2007	2008	2009	2010	2011	2012	2013	Total
Indirect actions	3.2	14.4	19.3	13.0	19.1	17.1	15.7	101.8
Support to Commission services outside the FP	17.3	26.9	40.9	49.5	35.9	55.2	69.7	295.4
Third Party Work	11.7	4.4	6.4	9.3	11.0	9.9	8.5	61.2
<b>Total (contracts signed)</b>	<b>32.2</b>	<b>45.7</b>	<b>66.6</b>	<b>71.8</b>	<b>66.0</b>	<b>82.2</b>	<b>93.9</b>	<b>458.4</b>
Cashed income from competitive activities	47.7	48.5	66.4	62.5	63.9	68.8	72.7	430.6

Table 6. Additional external income during FP7 (million EUR)

## 5.2 Human resources

In its staff charts the JRC distinguishes (i) officials (statutory staff) and (ii) temporary staff (statutory and non-statutory staff: temporary agent, contract agent, seconded national expert, grant holder, other external, and trainee). Figure 2 displays the evolution of the staff table during FP7. The pie chart in Figure 3 shows the distribution of staff over the six different sites of the JRC.

The last four years the JRC has monitored the ratio of (i) administrative support and coordination staff over (ii) operational staff; while it was close to 1:3 in 2009, by the end of 2013 the JRC reduced the ratio to almost 1:4.

With the progressing of FP7 the JRC gradually employed more women, slightly shifting the gender

balance (see Figure 4). Yet the positive development is less pronounced for management positions (see Figure 5): at the end of 2013 women accounted for 18.8% of unit heads. However, whereas men filled all of the twelve senior management posts at the time of FP6, women filled two of these posts most of the time during FP7.

Since the JRC has to follow the Commission's obligation to reduce its staff by 5% over the period 2013-2017, the JRC permanent staff has to be reduced by 1% as from 2013. Furthermore, there is a redeployment exercise of permanent posts across all Commission departments. For the JRC this amounts to a 1% staff reduction for 2012-2013 and 0.5% for 2014.

Evolution of JRC staffing 2007-2013

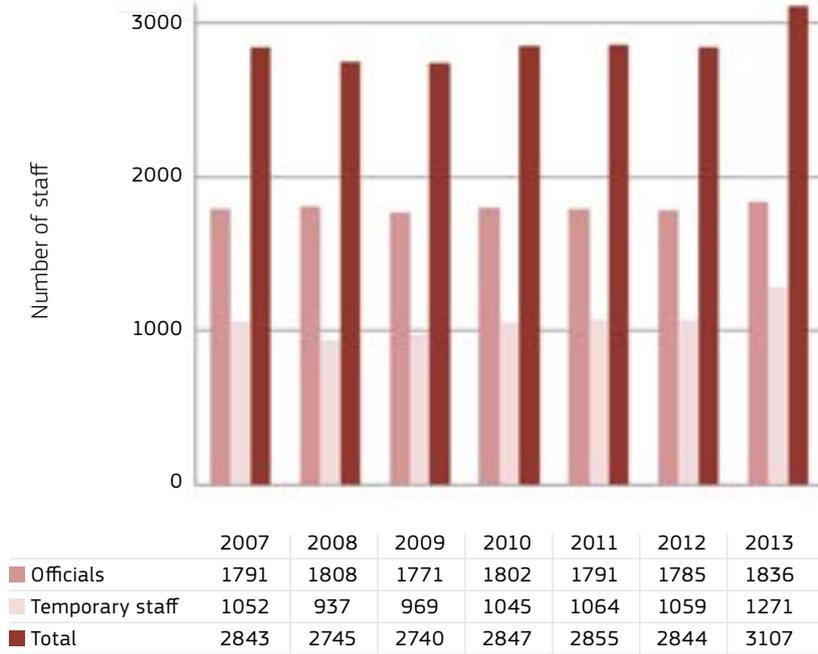


Figure 2. Evolution of the annual JRC staff number (persons on the job 31/12/20XX)

Staff distribution by site (in %)

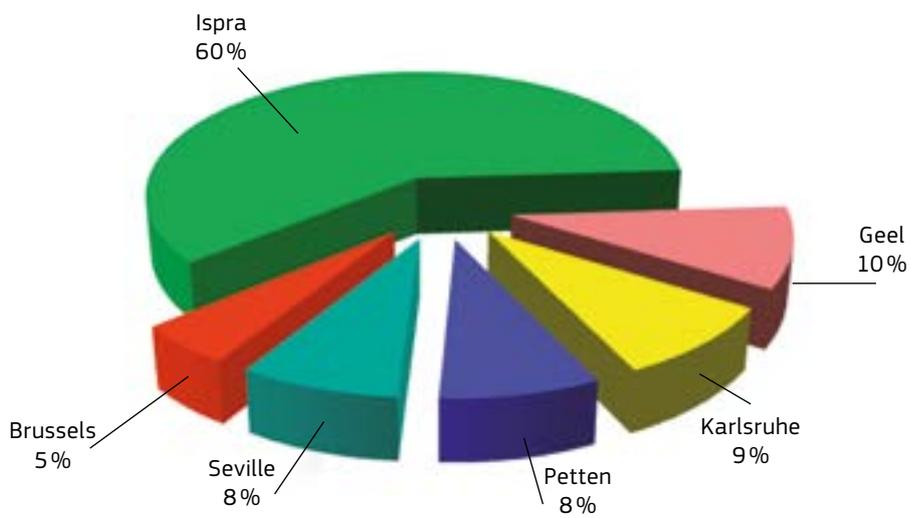


Figure 3. Staff distribution by site in December 2013 (in %)

### Gender balance among staff officials

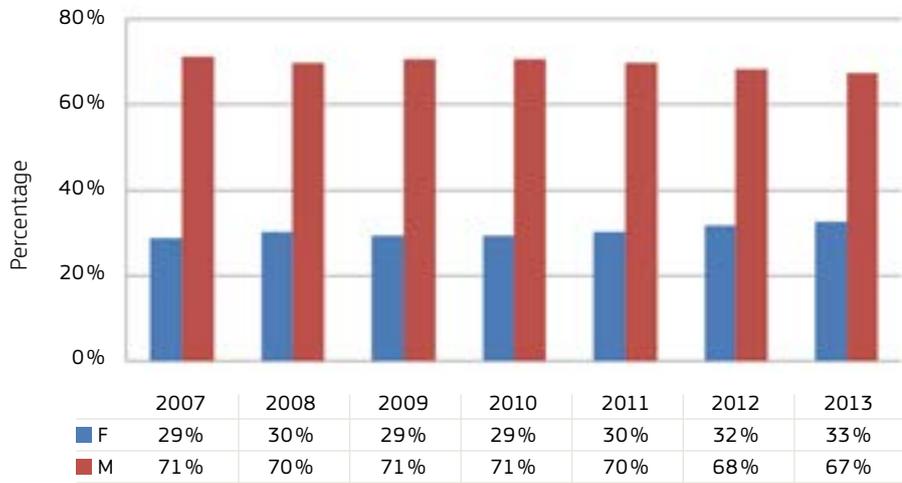


Figure 4. Gender balance among staff officials over the period 2007-2013

### Female representation in position of higher responsibility

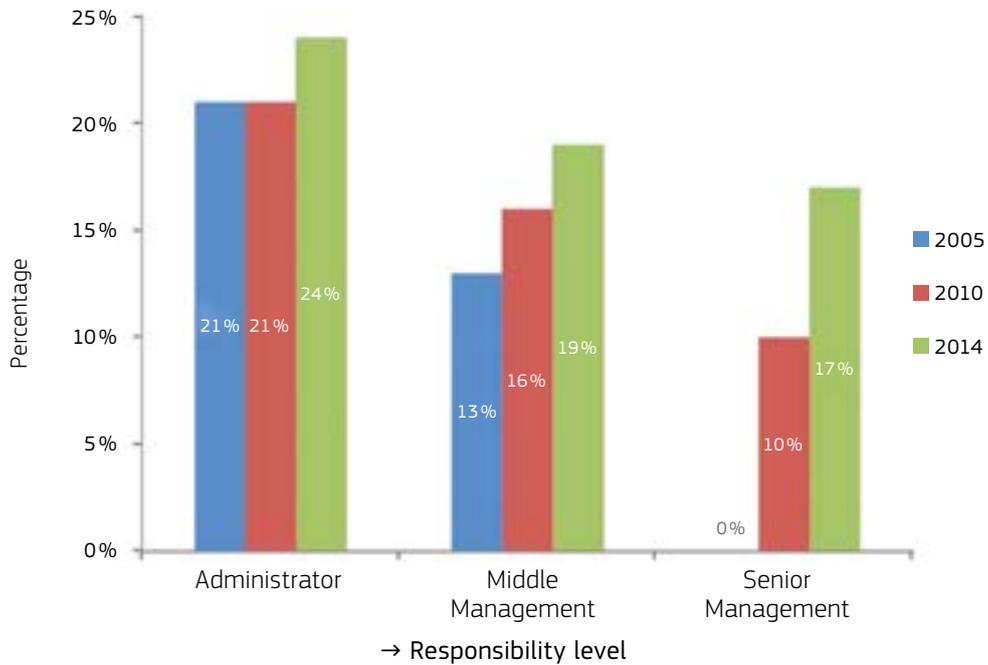


Figure 5. Female representation (administrator level and higher)

## 6. Output and impact during FP7

### 6.1 The five evaluation areas throughout the work programmes

The subsequent changes in the structure of the work programme caused a redistribution of input, output, impact and results over the different grids. However, continuity, i.e. a stable structure is required for an evaluation that addresses a seven-year programme. Therefore the evaluation function of the JRC embarked on the six key orientations of Horizon 2020 as soon as they were fixed (2012).

In the absence of a formal (read programmatic or budgetary) assignment of actions to key orientations, the evaluation function attributed all actions under FP7 to one of the six key orientations and calculated the total resources per key orientation during FP7. The results have been cross checked to provide consistent figures for input, output, impact and results in the various grids.

The pie chart in Figure 6 shows the average of the percentage of the specific budget and the percentage of human resources for an area; two percentages which usually are already very similar. Therefore this pie chart reflects the relative FP7

size of the five evaluation themes in terms of input, ignoring a possible difference in overhead which cannot be disentangled in the budget for the different themes.

### 6.2 Policy-support output during FP7

Production-related (output and impact) figures of the JRC behave as statistical regularities. During FP7 they fluctuate within a band width of plus or minus 10% and a one-year number is as telling as the average number over seven years. Since not every figure has been established for every year, this output section presents a seven-year average where possible, or it presents an established analysis of one recent year.

For planning, monitoring and evaluation purposes the JRC formalised different categories for its high variety of output/deliverables as in Table 7. JRC scientists recorded their deliverables in a corporate database during the whole of FP7, counted and verified on an annual basis.

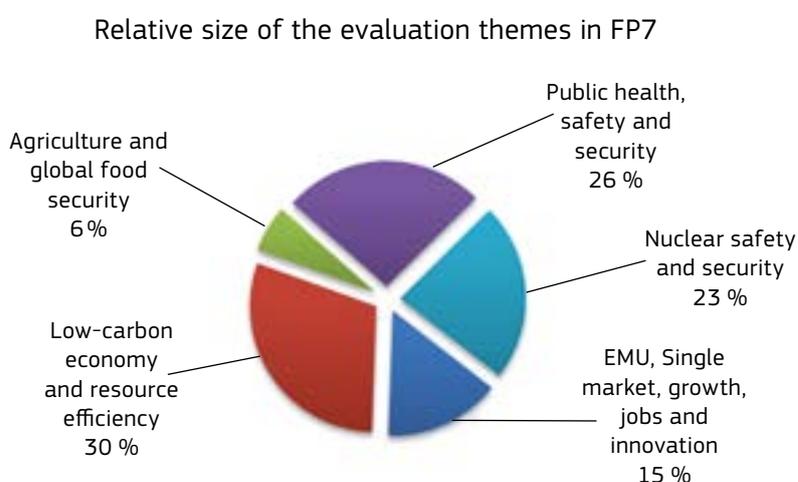


Figure 6. Percentage share in the five evaluation themes based on the combined resources

Categories of policy-support	
Scientific and policy reports	Training
Reference material	Scientific information systems and databases
Validated methods, reference methods and measurements	JRC contributions to policy documents
Technical systems	

In terms of productivity in 2013 the JRC recorded 1 244 policy-support deliverables linked to the JRC Work Programme. Figure 7 shows the distribution over the above-mentioned categories.

Distribution of 1244 policy-support deliverables in 2013

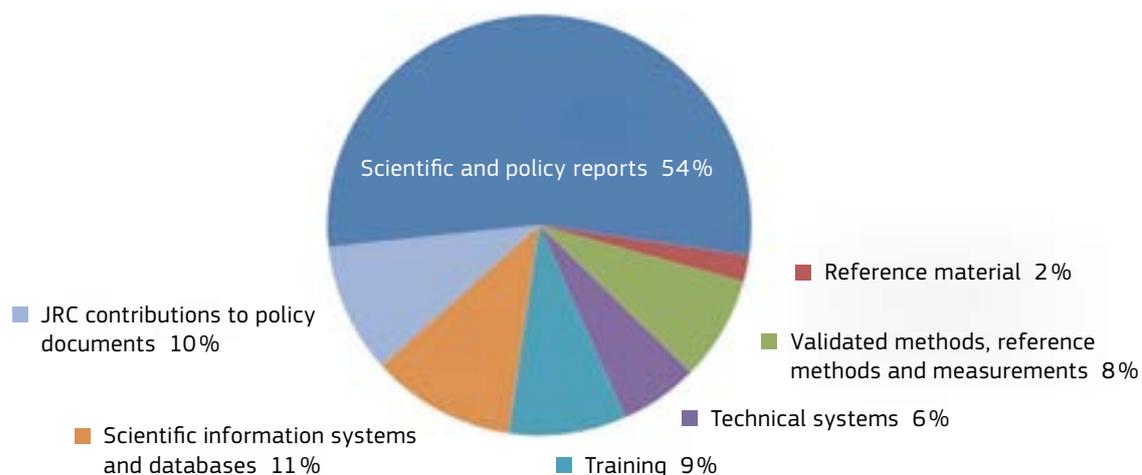


Figure 7. Distribution policy support deliverables per category (2013)

### 6.3 Policy-support impact during FP7

As a rule policy makers verifiably use JRC-research within some months after delivery, unlike academic research, for which impact usually takes much more time to transpire. For reporting, monitoring and evaluation purpose these impacts are divided in five categories as in Table 8.

JRC's systematic registration of all deliverables and the generated impact make it possible to link output

and impact information in order to verify productivity from the different categories of deliverables for policy-support (cf. Table 7) and for science (e.g. peer-reviewed publications, scientific reports).

This information gives insight in (i) how JRC activities have an impact on the conception, development, implementation and monitoring of policies and (ii) how the impact is distributed over EU-institutional, national, international or private customers.

Categories of policy impact	5-Y Average 2009-2013
• Impacts directly linked with the <b>implementation of EU legislation</b> (e.g. the JRC runs a bureau or a laboratory established by a Commission or EU decision)	24%
• Impacts directly linked with the <b>preparation of EU policies</b> in the conception phase of policy proposals (e.g. the Commission proposes an EU directive which incorporates scientific results from JRC research)	43%
• Impacts concerning <b>ad hoc support</b> (e.g. a situation assessment used for emergency response)	8%
• Impacts concerning <b>EU and global standardisation</b> (e.g. a JRC test method is adopted by an international standardisation body)	11%
• Impacts coming from <b>support to specific countries or regions</b> (e.g. training of laboratory staff to enable a new Member State to enforce regulations)	14%

Table 8. Impacts from JRC deliverable divided in five categories

### 6.3.1 Policy-support impact: categories

Comparison of the impact profiles for the different evaluation areas as in Figure 8 shows salient distinctions. For instance nuclear activities have the highest relative share of impacts in standardisation, support to countries/regions and international organisations. They generate less than 50% of their impacts on EU policies, whereas this is 60% for the other areas with more than 80% for the EMU/single market area. Impacts linked to policy implementation are dominant in all evaluation areas with values between 40 and 55%.

### 6.3.2 Policy-support impact: the recipients

Impact from policy support is distributed over the full range of JRC customers, beneficiaries and partners. Besides the Commission, other recipients of JRC deliverables are Member States (and Candidate Countries) authorities, EU agencies, international organisations and standardisation bodies, as displayed in Figure 9. In line with the JRC's mission most of the impacts happen within or through the Commission. This confirms a tight link of JRC work with EU policies and although there is no measure for the size of the collective impact, in the relevant EU policy processes it must represent a noticeable factor. Impacts purely outside the Commission largely come from work for Member States and Candidate Countries authorities.

### Distinct character of policy impacts in the five evaluation areas

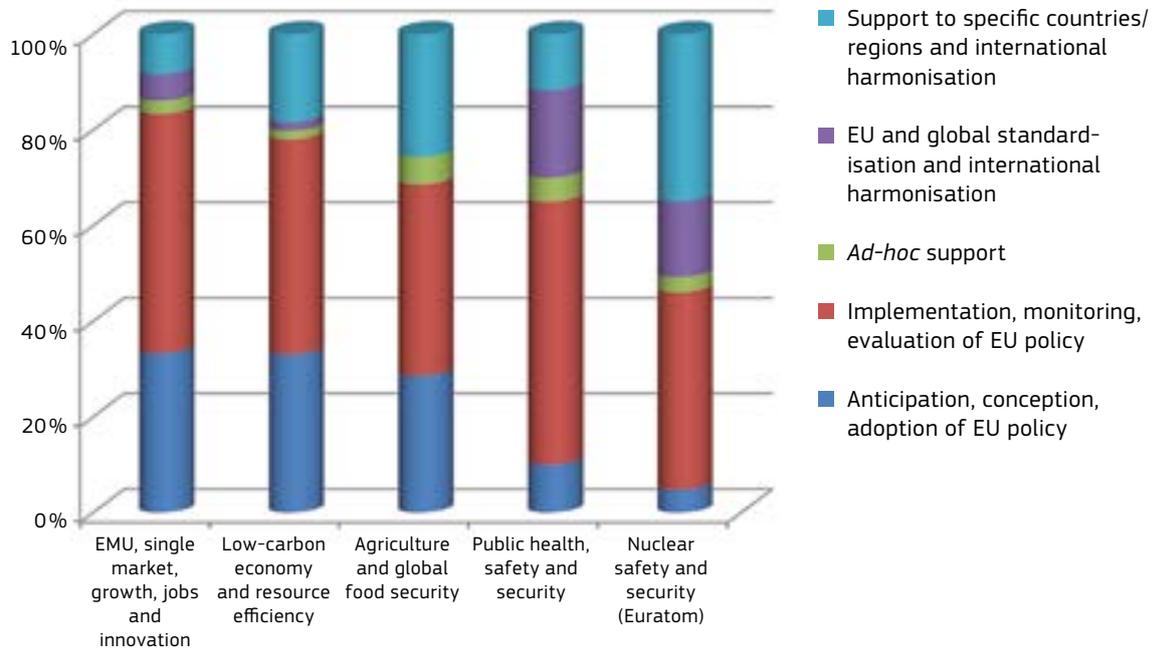


Figure 8. Distribution of policy support impact cases over the impact categories for the five evaluation areas

### Recipients of JRC deliverables with policy impact

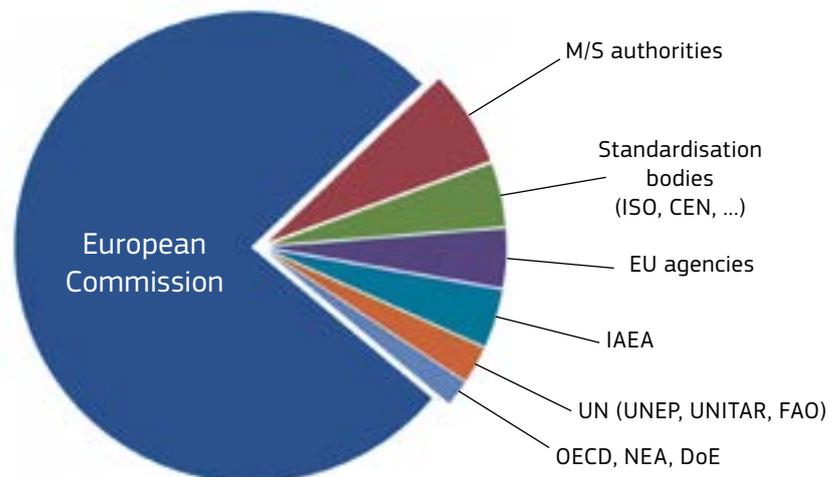


Figure 9. Pie chart of JRC deliverables with policy impact for the different prime customer (ref. endnote 43)

Figure 10 shows the registered impacts distributed over the various EU policies. Considering that some impacts relate to more than one policy the given percentages are best-estimates for the relative share in impacts from the JRC work programme. It is worth noting that impacts concentrate in policy areas where science plays an important role, i.e. with issues involving people’s health, people’s safety, security, the environment as well as the competitiveness of the European economy.

**6.4 Scientific output during FP7**

The JRC’s achievements in policy support (Sections 6.2 and 6.3) require a broad knowledge base and rooted in scientific competences and research. To measure the quantity and quality of its research, the JRC used Thomson Reuters’ Web of Science

and Elsevier’s Scopus, both widely acknowledged as the world leaders in citation and bibliometric data.

Thomson Reuters analysed the scientific output of the JRC in the report ‘Evaluation of the JRC’s research performance during FP7’ with some results in this section. Elsevier’s Scopus/SciVal tool was used for an in-house impact-orientated analysis with some results given in Section 6.5.

Thomson Reuters final study report gives detailed insight in the quantity and quality of JRC scientific research publications during the FP7. The study applied a variety of methods including bibliometric analysis, benchmarking, topic clustering, patent analysis, identification of research fronts, social media analysis and advanced visualisation. It also compares JRC characteristics and performance in

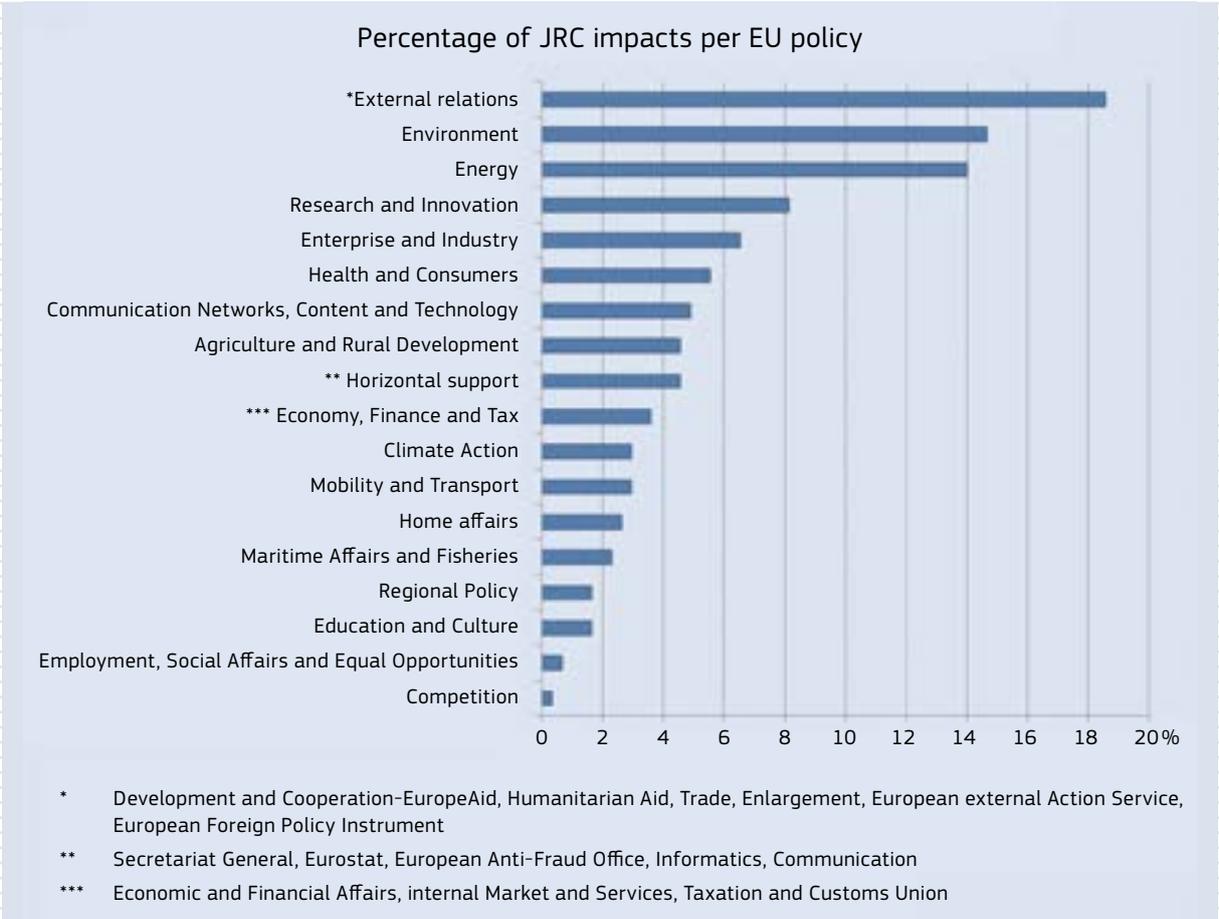


Figure 10. Customer policies of the EU and best-estimate percentage with which impacts occur in the respective areas in 2012 (Source: Impact analysis of JRC activities<sup>43</sup>)

several scientific research areas with a number of excellent peer institutions like e.g. NIST (USA), NOAA (USA), TNO (NL), VTT (FI) or Fraunhofer Gesellschaft (DE).

Amongst an array of bibliometric analyses and benchmarks with extensive graphics, the report presents some straightforward publications and citations counts. For instance for the period 2007-2013 the study counted the JRC's total number of publications and the number of highly cited publications<sup>44</sup>, year by year. The results are displayed in Figure 11.

Reason for comparing these two numbers, is that Thomson Reuters established this ratio (the number of highly cited papers during one year divided by the number of papers published in that year) as a reliable scientific performance indicator: exceeding the ratio 1:10 means above world-average performance. As shown in Figure 11 the JRC had 720 highly cited publications in the period 2007-2013 and a total number of 4436 publications for the same period. Hence the JRC's ratio of highly cited papers over the number of publications in the same period is almost 1:6, well above world-average performance (1:10).

### 6.5 Scientific impact during FP7

While the Thomson Reuters' report focused more on scientific output, the JRC made an in-house analysis of scientific productivity and the impact of JRC publications using Elsevier's Scopus database and the associated analytical tool SciVal. The aim of this exercise is to identify and map areas of excellence with a view to strategic work programme planning and in particular the design of a long-term JRC scientific strategy.

The SciVal analytical tool distinguishes scientific areas at three hierarchical levels, starting with health, life, physical and social sciences as the four overarching scientific areas (level 1), broken down in 27 scientific areas (level 2), further broken down into 334 scientific areas (level 3). These scientific areas are widely used, allowing the comparison and benchmarking of JRC scientific performance. The 'excellence-mapping' exercise focused on the 17 scientific areas (level 2) in which the JRC produced more than 100 publications between 2009 and 2013, the period currently covered by Scopus/SciVal. Depending on the scientific area, it compared the JRC with 3500-4700 organisations worldwide.

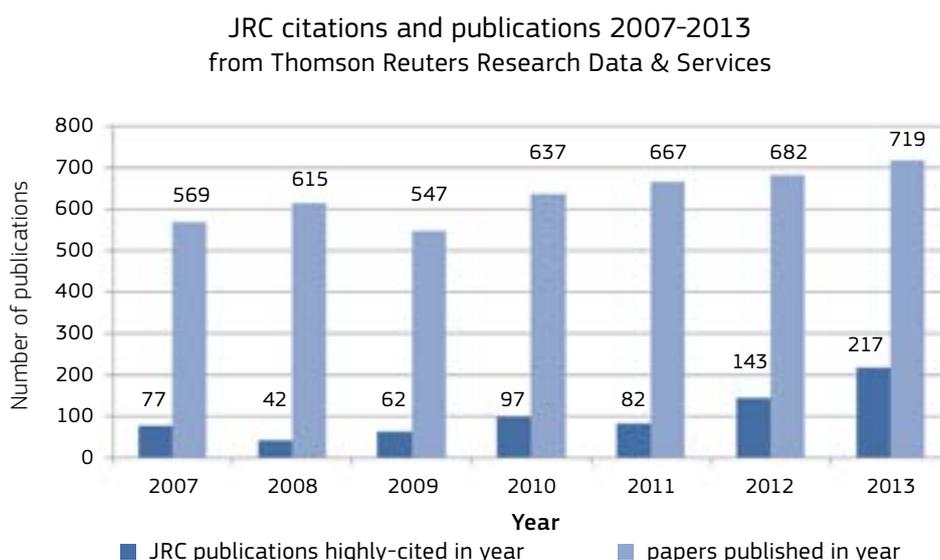


Figure 11. The number of scientific publications from the JRC highly cited in the year, next to the number of scientific papers from the JRC published in that year; evolution during FP7

Figure 12 displays one of the more straightforward results of the analysis at the level of scientific areas (level 2) in which the JRC produced more than 100 publications. It shows the ten most important JRC scientific areas in terms of absolute citations and the number of citations per publication in these areas. In all these ten scientific areas – and in fact for almost all scientific areas above the 100-publications threshold – the indicator for the JRC has a value in the area for organisations within the Top 15. The JRC value is above world mean value for all scientific areas.

For the benchmarking of JRC's publication impact, the mapping exercise used size-independent metrics<sup>45</sup> with five citation indicators: average number of citations per publication; cited publications (%); field-weighted citation impact; publications (%) in the top 10% of the most cited publications; publications (%) in the top 10% of the most cited journals.

The JRC's citation performance has been benchmarked based on the values of these five indicators against the world-wide Top-15 organisations with the highest number in a given scientific area and against the world average. This produced a wealth of interesting results. For example, in the scientific area of 'Pharmacology, Toxicology and Pharmaceuticals', the JRC produced 251 publications in 2009-2013, much less than the 3000 publications produced by the number-one organisation in the same period. However, the JRC ranks world number one in this field with 12.7 citations per publication (plotted in Figure 12), with 88.8 % cited publications, and also number one with 37.8 % of these publications in the top 10% of the most cited publications.

The excellence-mapping report is rich in information about areas where JRC science is highly referred to in world.

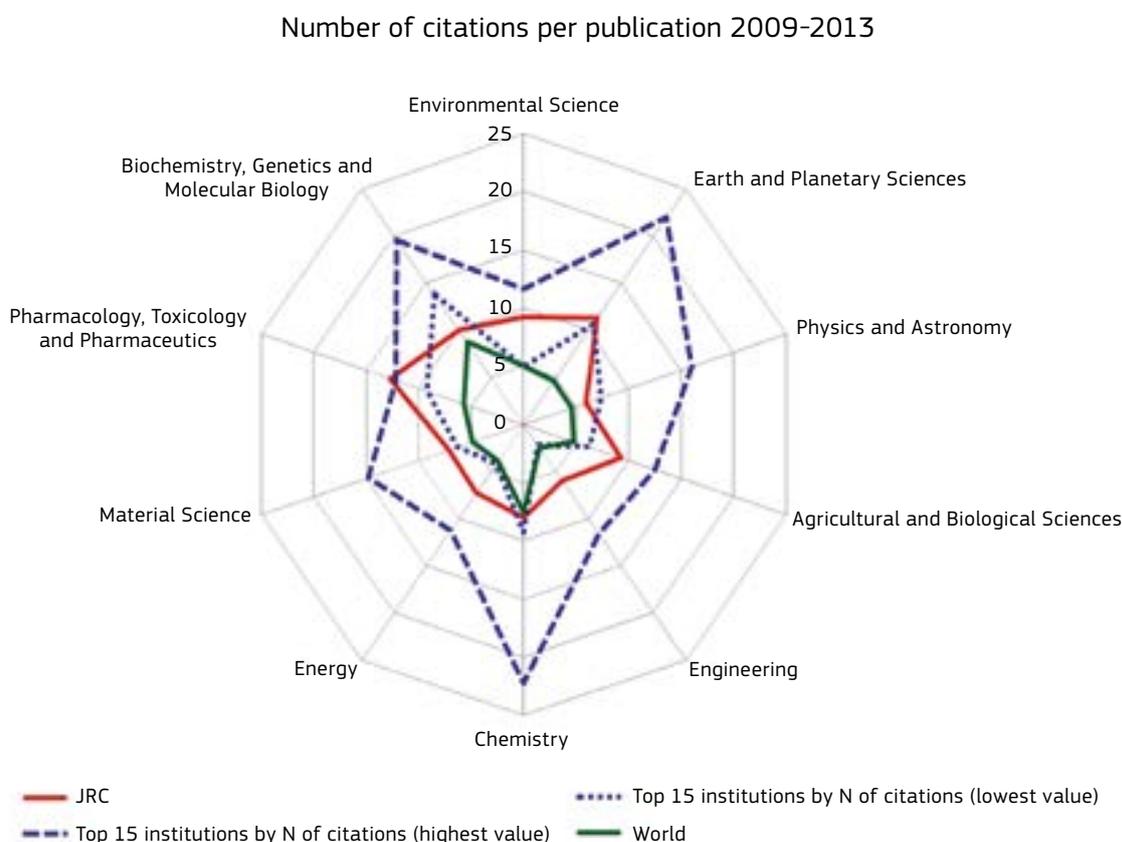


Figure 12. Average number of citations per publication in JRC's ten highest quoted scientific areas

# Annex III – Actions, institutes and evaluation themes

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The discussions of the Evaluation Panel on 17 November 2014 about JRC activities under FP7 underlined the complexity of the ensemble of the approximately 115 actions, the five evaluation areas

and the seven JRC institutes where the actions are carried out. The tables present the five evaluation areas and the seven JRC institutes.

Five evaluation themes
Economic and Monetary Union, single market, growth, jobs and innovation
Low-carbon economy and resource efficiency
Agriculture and global food security
Public health, global safety and security
Nuclear safety and security (Euratom)

Seven JRC institutes		
	Site	Country
Institute for Energy and Transport (IET)	Petten / Ispra	The Netherlands
Institute for Environment and Sustainability (IES)	Ispra	Italy
Institute for Health and Consumer Protection (IHCP)	Ispra	Italy
Institute for Prospective Technological Studies (IPTS)	Seville	Spain
Institute for Protection and Security of the Citizen (IPSC)	Ispra	Italy
Institute for Reference Materials and Measurements (IRMM)	Geel	Belgium
Institute for Transuranium Elements (ITU)	Karlsruhe /Ispra	Germany

A JRC Action in FP7 is typically more than a 'project', i.e. a specific task of investigation over a fixed period; it pursues a list of objectives in a number of parallel and/or serial projects in support of a certain policy. A JRC Action is the administrative entity with which the JRC organised its direct research work until the Horizon 2020 framework programme.

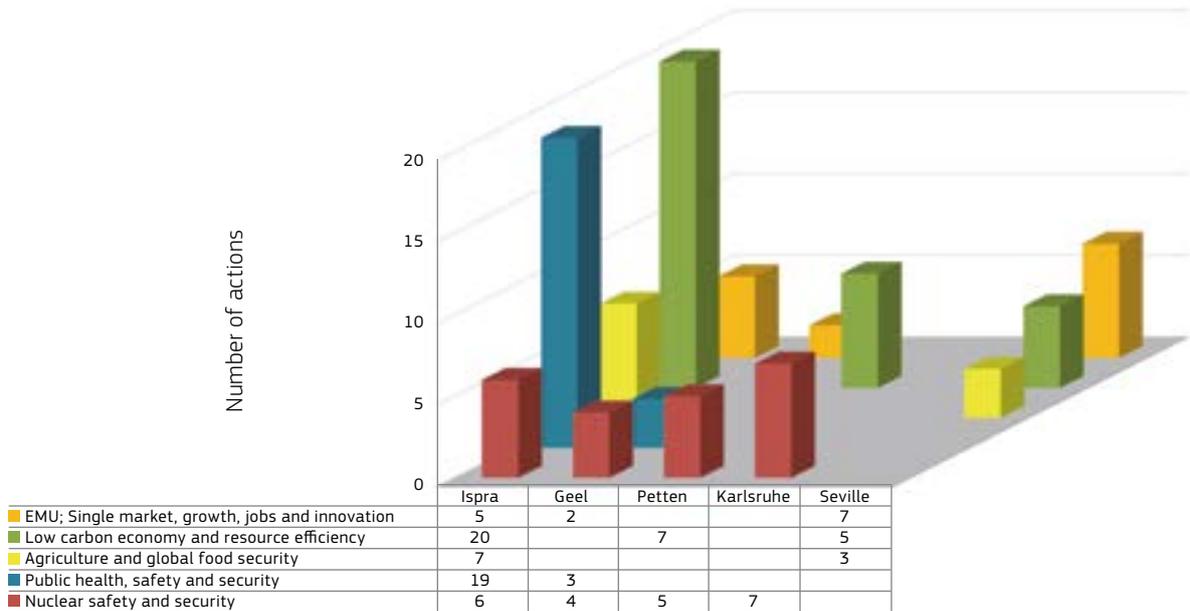
This briefing includes some JRC-Action infographics with a distribution of actions over the five sites, over the seven institutes, over the five evaluation themes and the same for the number of scientists (called: AD-or-equivalent staff in Commission grading system).

The 2013 snapshot is proposed instead of giving all so actions (~115) for each of the 7 years in the FP in a table with 805 entries. If necessary, such table can be easily constructed even from publicly available JRC-Work-Programme data in JRC's Project Browser: 'your gateway to JRC Work Programme Actions'. This provides open access to search through all actions included in the JRC Work Programme since 2004.

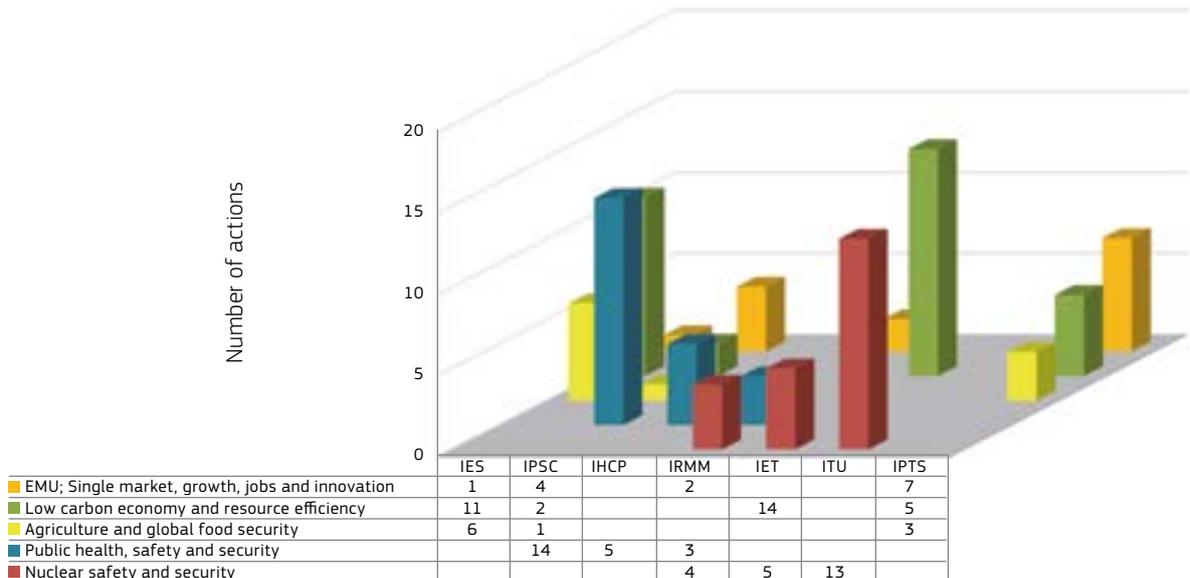
# Infographics

## JRC Actions, Themes, Institutes, Sites, Scientists

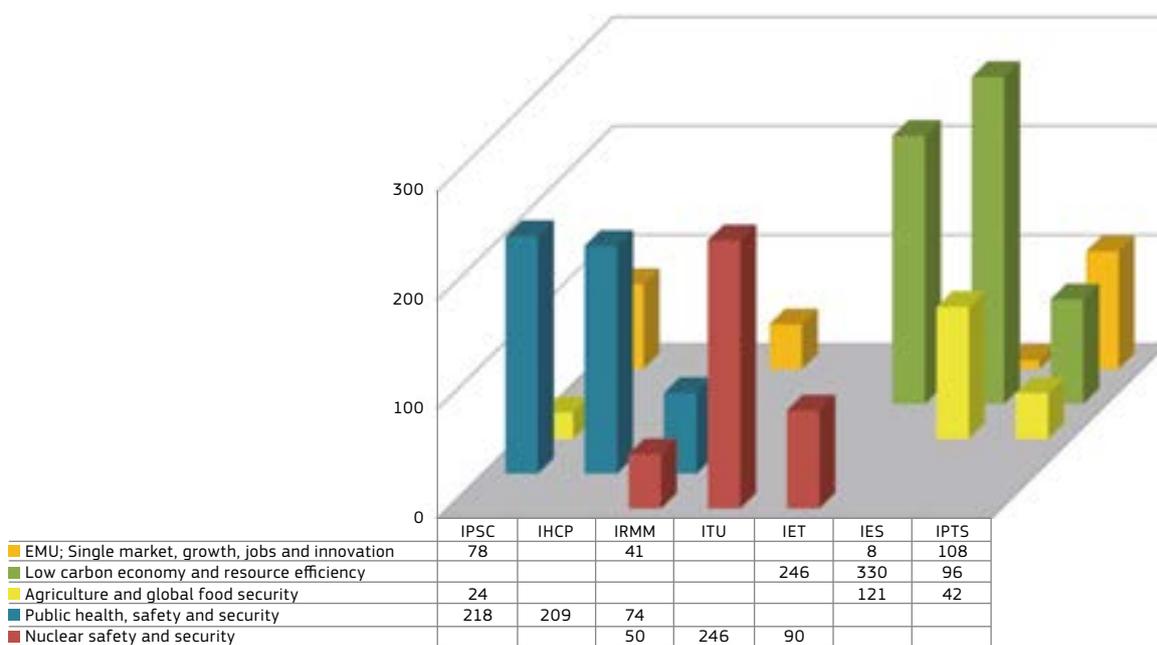
Distribution of actions over **JRC sites** according to evaluation themes in 2013



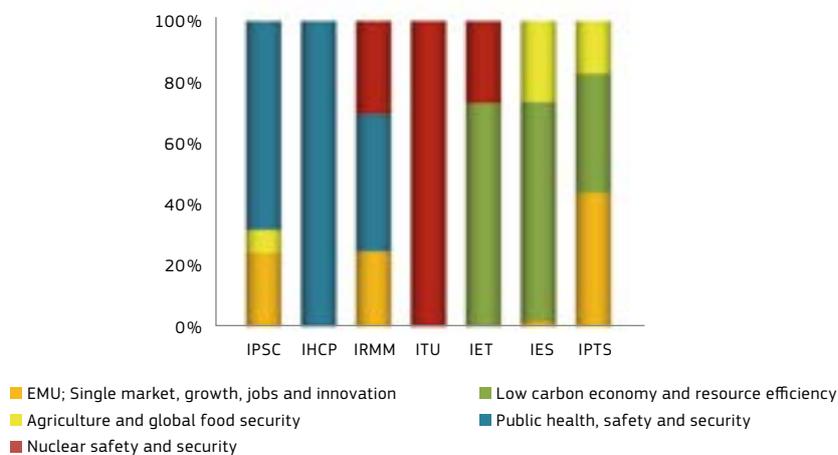
Distribution of actions over **JRC Institutes** according to evaluation themes in 2013



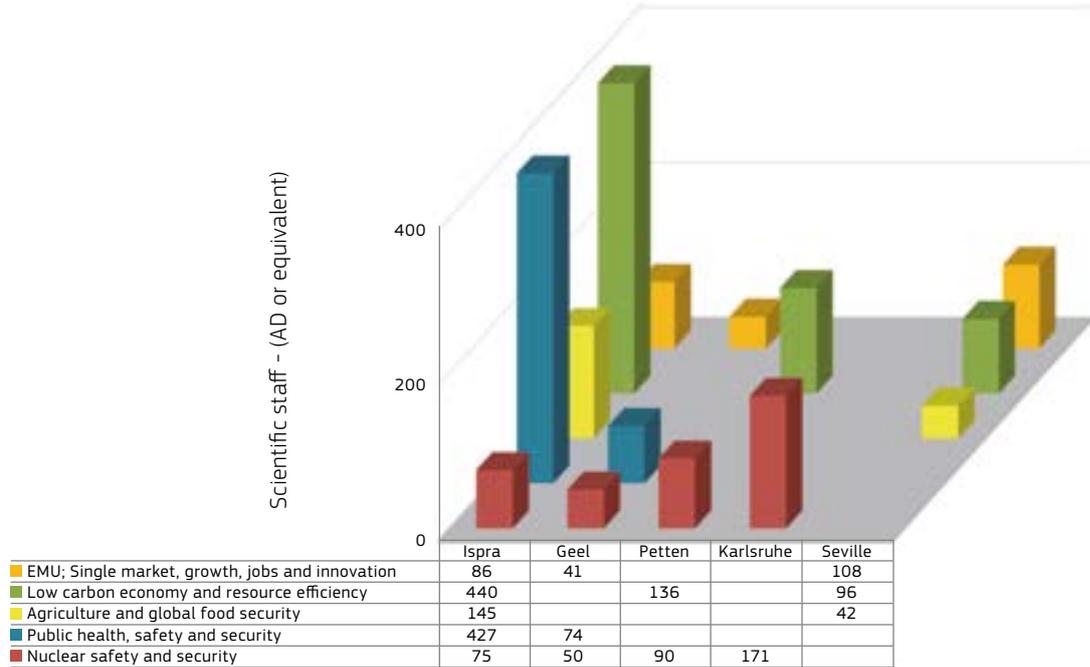
### Indicative distribution scientific staff over JRC Institutes and evaluation themes



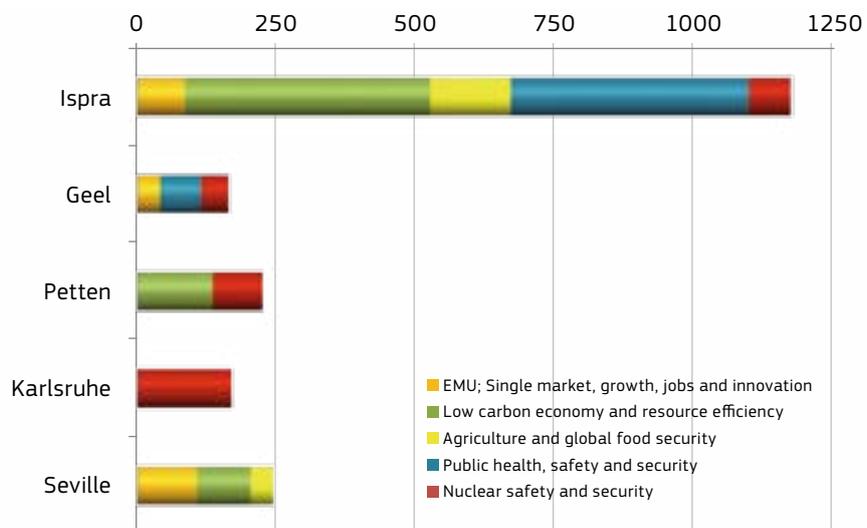
### Evaluation themes over JRC Institutes (Scientific staff)



Indicative distribution scientific staff over JRC sites and evaluation themes in 2013



Evaluation themes over JRC sites (scientific staff)



# Annex IV – Thematic commentary

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## Economic and Monetary Union, Single Market, growth, jobs and innovation

This theme encompasses 13 actions accounting for 15% of the human resources employed in the JRC. These actions supported EU policies for Economy Finance and Tax; Enterprise and Industry; Research and Innovation; Employment and Social Rights; Regional Policy; Competition; Information Society; Education and Culture. Other work is done in partnership with the OECD, the World Bank, WTO, etc.

Expert knowledge and skills are built up in Seville, Ispra and Geel. The work has gained in importance during FP7 because of the financial crisis. The work undertaken is recognised as being of high quality. Work on financial sector modelling, regional modelling (interesting and promising, although it still has to get established) and part of the digital economy and information society research areas is ground breaking with significant networking and coordination effects for the EU as a whole. There are significant results with high impact both in terms of academic publications and in terms of policy advice to Commission and the Member States. In some areas dissemination activities are models for knowledge diffusion.

Teams in this particular area put strong emphasis on pan-European excellence, networking and training, which proves the relevance of their activities for progress in the Member States. They work with academia and industry to stay at the forefront of knowledge. These strengths have contributed to increasing demand from the Commission, which, together with financial and organisational constraints, produce a number of challenges for the future that needs to be addressed early to avoid unwanted repercussions, if delayed.

Work on Economics of Industrial Research and Innovation has produced standardised reports based on analytical work, which have become a benchmark for policies and academic research. Dissemination via conferences and publications is well-organised and the background database and increasing value added operate well.

In support of ERA policies the JRC runs a monitoring service to the Commission (substituting a previous consultants' network) and an Information and Intelligence System (substituting a previous in-house activity by a Commission department) with value added through foresight and extensive partnering with the Member States and the academic community.

In the field of regional economic modelling the JRC performs new testing and good organisation of a network (close to basic research), which is in an experimental phase and would benefit from more visibility.

Furthermore the JRC has a big effort on a Regional Smart Specialisation Platform, not found anywhere else; its merit is in extensive monitoring and support to the Commission's department for Regional Development as well as the Member States.

The JRC has a long experience in standardisation. Systematic work on training for the Member States contributes to early adoption of new methods and effective regulation. Areas with specific laboratories have synergy agreements with Higher Education Institutions/Research Performing Organisations; programmes to train scientists from new Member States in implementing specific standards. Measurement of standards for engineering and environment is well developed.

Regarding Financial and Economic Analysis the JRC is supporting the Commission's Directorate General for Economic and Financial Affairs with exploratory and experimental work. This includes financial-system modelling to assess policy options for the European banking market. The JRC is introducing new ideas in this work and it has the liberty to organise and network as it considers best. It also conducts Member-States modelling in the Stability & Growth pact and on the country-specific recommendations, which includes efforts for more and better evidence in the context of the Economic and Monetary Union (EMU) and crisis prevention.

Under the heading Econometrics and Applied Statistics the JRC works on Statistical Indicators for Policy Assessment Generic methodology development in line with new tools for policy assessment (education, employment, innovation) derives from the need to streamline already existing efforts. Sensitivity Auditing for Impact Assessment refers to work undertaken in the context of better regulation.

Digital Transformation needs quick reactions. Topics include e-health, e-education, skill mismatch, privacy, consumer protection. A proactive research agenda is required. The action comes more from some companies than from politics. The JRC has shown enough flexibility to change fast the focus of research.

The theme enjoys an emerging demand from Commission departments with new opportunities. However, a strong demand pull may reduce freedom to work on unexplored subjects and cut the potential to break new ground. Such pressure often invites to continue with routine work rather than embark on the development of new products.

Nevertheless, individual researchers and research teams do have anticipatory/exploratory activities, sometimes running well ahead of their peers. This evaluation theme would benefit from a more structured and conscious exploratory work.

Despite great efforts to develop investment based in Central and Eastern Europe, the JRC's own publication on 1 000 R&D investors based in the EU

does not feature more than a handful from the new Member States.

## Low-carbon economy and resource efficiency

This theme covers 32 actions and accounts for about 30% of the human resources. JRC's activities under this theme provide support to EU policies for Energy; Environment; Climate Action; Mobility and Transport; Enterprise and Industry.

This theme shows a proliferation of observatories, databases, knowledge centres related to environment, climate, energy and transport issues. The comprehensive, well-organised, transparent and accessible data provide a service like no one else not only to European and Member States' policy processes, but also to research. A large proportion of the above areas of research started after 2004. The research portfolio has grown fast in a relatively short period time, into a diverse, but comprehensive mix of often strategically structured actions.

Regarding energy, the JRC's non-nuclear energy research has been strengthened considerably in the last decade. Examples of success stories include the conversion of some material science research in the Petten site into energy-efficiency research. Herewith the JRC shows flexibility to adapt to changing priorities.

However, some of the research considered as progressive in the early phases of FP7 may need to be refocused and reoriented. That is the case, for example, with Energy Service Companies and green buildings designed to save small percentages of energy. These approaches typically offer a lock-in risk. This means that some changes in infrastructure prevent more fundamental, deeper changes later than would have been necessary for reaching the EU's ambitious mitigation targets by mid-century.

In light of this the JRC could refocus its energy efficiency research in the direction of policy-led and game-changing implementation of solutions and behavioural changes commensurate with

the ambitious goals linked to energy efficiency. Examples of such solutions include the in-house development of a transparent EU energy-forecasting model, which will be a fundamental service to the Union. However, it is crucial that these models fully benefit from the research at JRC – and elsewhere – and fully integrate detailed and sophisticated demand-side energy models, such as those of demand for mobility, for household and commercial energy services, etc. Equally, systems level research should be fed into these models to be able to well capture a broad diversity of solutions by modelling beyond just supply-side solutions.

The description of JRC's research work in this area fails to address the need for transformative – as opposed to incremental – change to our energy and transport systems. This contrasts strongly with the fact that frontier and even mainstream research – including FP7-funded research including transition initiatives, transformative social innovation, smart cities etc. – for many years accepted the fundamental need for such a transformation.

There is ample scope for cross-fertilisation between activities in the fields of energy, transport, environment and climate. There are many points of connection, where the JRC could look for new solutions.

Activities related to transport are narrow and often technology oriented. They do not play a key role for strategic policy-making in this broader theme. Nevertheless, biofuels research needs to be noted for having raised important, albeit inconvenient, questions on policies. It thus contributed to a fundamental learning process of the EU and the world. By focussing 'smart, green and integrated transport' only on fuels and light-duty-vehicle technologies the JRC provides no answers to the broader mobility questions. Similar to JRC's approach to energy, in this theme it could broaden its focus on three key pillars: demand, supply and systems.

Several key issues could be integrated into the research portfolio. These include mobility services, alternative mobility, electronic services replacing mobility; optimisation of shipping in the age of big

data; modal shift towards non-motorised and public transport; urban and regional planning; behavioural and cultural issues – or at least a selection of these. At the same time, the JRC should reconsider whether some of its research activities on hydrogen are policy or infrastructure driven. In the latter case there is scope for phasing it out.

In this respect it is worth considering creating a forum for discussing alternative models for energy (to avoid lock-ins) rather than capture the energy-modelling market.

Integrating these into larger albeit loose frames could provide major integrative and innovative benefits. For instance, the energy systems research connecting with the energy efficiency research to explore the new opportunity frontiers opened by big data potentially coming from consumer devices, or the European energy-economic model better capturing the granule and JRC's knowledge on European energy demand in its model both provide some real opportunities for breakthrough research. Or, how much could European energy security benefit from a broadly proliferated efficiency improvement? As there are major institutional and geographic boundaries between these research elements, a proactive and institutionalised canalisation may be necessary for such and further similar cross-fertilisation processes.

In spite of regular discussions and good relations with EIT, the JRC is marginally involved in activities of the European Institute of Innovation & Technology (EIT)'s Knowledge and Innovation Communities (KIC), notably the InnoEnergy KIC and the Climate KIC. Moreover in the domain of low-carbon energy the JRC could take a better profit more from links with the joint programmes of the European Energy Research Alliance (EERA). Further integration with existing pan-European research activities would be beneficial.

In the fields of environment and climate action, the JRC has to respond to the challenge: The science is good but is it needed? Many services are good but are they needed? It would be useful to submit this work to an extensive review, involving scientific peers and users. Whether there is room for more

global role of the Commission's direct research on environment and climate, is one of the questions to be answered there.

## Agriculture and global food security

This theme is the smallest of the five evaluation areas. It accounts for about 6% of the human resources and covers 10 actions with key words including: geo-information management and control methods, interactions between agriculture and the environment, forest modelling, fisheries, agronomic and socio-economic impact of new technologies, support to agricultural trade and market policies, crop production forecasts and climate change impact.

The activities support EU policies for Agriculture and Rural Development (in terms of budget largest policy of the EU); Maritime Affairs and Fisheries and; External relations & foreign affairs (see endnote 21).

The main policy drivers were the increasing integration of environmental protection into sectorial policies, concerns about food security and, since 2010, the EU2020 goals of smart, sustainable and inclusive growth. JRC also contributed to international trade negotiations and to the implementation of the EU policies regarding the UN Millennium development goals. It also contributed to the dissemination of information, training, and knowledge transfer in developing and transition countries.

Regarding agriculture, the JRC programme supports rural development, agriculture and fisheries policies. It focusses on three aspects of the common agricultural policy (CAP), namely its implementation, environmental aspects and economic impact of agricultural policies as well as the CAP Health Check and its reform of 2013. Some of the most significant upfront impacts of JRC's work in this area relates to geo-information, harmonisation, greening of agriculture, modelling and support to individual Member States. One important outcome of the JRC's work is linked to input to agri-subsidies (field size/maps with geo-satellites) and harmonisation of the data between the Member States.

As regards fisheries, it focusses on the environmental protection of the marine environment and the sustainable development of fishing and aquaculture, the safety of seafood products and the IUU (Illegal, Unregulated, Unreported) Fisheries and Enforcement. This work is taking place amid the background of the Marine Strategy Framework Directive (2008), promoting environmental sustainability of the marine sector. The revision of the common fishery policy (CFP) in 2011 (in force since 2014) put increased emphasis on the environmental, social and economic sustainability of the sector, addressing in particular the issue of overfishing.

Food security: As regards food security, the EU has committed to contribute to the Millennium Development Goals, including the goal of the eradication of poverty and hunger. The EU is implementing the relevant actions (Food Security Thematic Programme) under the Development and Cooperation Instrument.

The JRC's strengths relate to production and availability of food. Fewer efforts have been put into to the three other dimensions of food security, which are food access, stability and utilisation.

Regarding JRC's ambitions related to food security in Africa, there already are many suppliers of food-security knowledge and information systems. This applies to areas of JRC's strengths, like crop forecasting, geo-information, big data, modelling and harmonisation. Therefore, the JRC should carefully identify what could be its niche to ensure its added value.

Extensive collaboration with relevant actors and academic environments working within the field of agriculture and global food security in the world is of crucial importance for maintaining and developing critical mass. In particular, when JRC enters into new themes, critical mass will depend upon fruitful collaboration with other partners.

This thematic field, agriculture and global food security including fisheries (blue growth) and forestry, has a high potential as regards the Bioeconomy. The JRC could carve out a greater role in shaping future research agendas by some more

proactive behaviour under this theme e.g. in relation to Bioeconomy. It would further raise the JRC's profile within the Commission. More opportunity for blue-sky research could help generating creative ideas in relation to influencing current H2020 as well as tomorrow's agendas. The existence of the current JRC taskforce on Bioeconomy needs to be mentioned as a positive contribution in this regard.

Food security challenges in Europe are taken on board to a limited degree. They include obesity and unhealthy diets; vulnerability to food insecurity due to finance problems and unemployment; food insecurity among immigrants and refugees, agriculture, food systems and food safety, food waste and sustainability.

Social science for agriculture and global food security needs to go beyond agricultural economists. More social scientists need to be involved to investigate the thematic challenges related to agriculture and global food security, for instance regarding the Bioeconomy and food systems in Europe and globally.

## Public health, global safety and security

This most diverse theme in the JRC work programme covers 27 actions accounting for 26% of the human resources employed in the JRC. Work is organised under a variety of headings like: chemicals, nanotechnologies, food and feed, health and nutrition, transport, maritime, infrastructures, digital world and anti-fraud.

The activities provide support to EU policies for Health and consumers; Enterprise and industry; Home affairs (civil protection) and, External relations & foreign affairs (see endnote 21).

The research intensity within this theme varies strongly. Some of the research is of high-quality and provides results extremely useful for academia and industry. This applies in particular to the fabrication of samples used as standards in nearly all fields of science and technology in which such standards play an important role. A good example is standard nano-sized silica particles, which are of importance

for Research and Development and Innovation projects in various fields of nano-technologies. Another example is the variety of standards developed for food industry, both in the context of consumer protection and also for the benefit of food and feed industry. The JRC runs several EU Reference Laboratories in this domain.

In general the activities of JRC related to standards and measurements deserve a high opinion and should be maintained or even expanded under Horizon 2020.

The nature of the work performed under this theme consists in large part of brokerage activities, to bring together producers of new knowledge and technology, with builders of databases and various support tools, hosts of workshops and reference groups and with policy shaping experts in the Commission and from other interested parties. A primary mission is to facilitate the transfer of science-based knowledge to those that may need this to shape policy or to implement decisions. The staff then mainly draws on research that has been conducted by others inside or outside JRC. In this theme area the essential elements of a Knowledge Centre are already in place and contribute significantly to the service function of the JRC.

By comparison to other parts of JRC, this theme is less focused towards producing research results and more about a broad portfolio of dispersed activities that are research-based. For example, the emphasis on developing standards, providing testing facilities and building data sets involve less research or technology producing work. However, these useful activities are heavily dependent on such a knowledge foundation.

There is a need to set clear guidelines to choose between the option of using in-house research capacity versus the option of outsourcing research in collaboration with Member States research organisations and European industry. This is a general need for the JRC but particularly strong in this area. Such activities are new in the agenda of the JRC – but already advanced in industry and academia. For example, this is the case with air traffic security research and characterisation of nanomaterials.



## Endnotes

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- 1 From the early days of the European Community the research programmes have distinguished **direct** research actions, carried out by the European Commission's Joint Research Centre (JRC), and **indirect** research actions carried out at research centres, universities or enterprises, with partial financial assistance from the EU or Euratom. The JRC's direct actions accounted for approximately 3% of the total FP7 budget.
- 2 See endnote 1. The direct research actions accounted for 85% of the JRC programme in FP7 (the other 15% being work under contract).
- 3 [JRC Customer Satisfaction Survey 2008](#), Final report, European Policy Evaluation Consortium (EPEC).
- 4 During FP7 an 'action' was the smallest administrative entity for implementing the JRC programme. Each action had its own set of objectives and associated resources. In this setting an 'action' may read like 'project' (i.e. one specific task of investigation), but it should be noted that actions typically encompass more than one project and change content over time.
- 5 The CGIAR Fund is administered by the World Bank. Since 2008 CGIAR is no longer the 'Consultative Group on International Agricultural Research', but kept its name.
- 6 See JRC Customer Survey, endnote 3.
- 7 Lately in [Horizon 2020 Regulation \(EU\) No 1291/2013](#) of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020): 'The Joint Research Centre (JRC) shall contribute to the general objective and priorities of Horizon 2020 with the specific objective of providing customer-driven scientific and technical support to Union policies'.
- 8 Most recently in Article 2(2) of [Horizon 2020](#).
- 9 [Thomson Reuters' study on the research performance of the Joint Research Centre of the European Commission during the Seventh Framework Programme \(2007-2013\)](#).
- 10 Thomson Reuters defines highly cited papers as: in the top 10% of world papers by citation impact, taking into account field and year of publication.
- 11 [Impact analysis of the Joint Research Centre and its direct actions under the EU Research Framework Programmes](#) EUR 24942 EN – 2011  
[Impact analysis of the Joint Research Centre's activities for the regulation of GMOs in the European Union](#), EUR 25967 EN – 2013  
[Impact analysis of JRC activities - Special report for the 100th meeting of the Board of Governors](#), EUR 26031 EN – 2013.
- 12 Gender balance in the Commission is at 51.4% of women in total workforce and as many as 43.5% of women in the non-management administrator categories, offering a large pool of skills for the future.
- 13 During the fact-finding stage of the evaluation a significant number of searches for original research and scientific reports ended in dead links. This needs to be addressed with a rigorous quality assurance procedure on this new JRC Science Hub.
- 14 The name European Community ceased during FP7 when the Lisbon Treaty entered into force in 2009.
- 15 This includes contributions from the European Free Trade Association (EFTA) countries (EUR 43 million) as well as from Associated Countries (EUR 79 million).
- 16 [Horizon 2020 Regulation \(EU\) No 1291/2013](#) Article 14 sub (c), (d) and (l) states that 'interdisciplinarity', 'responsible research and innovation', as well as 'social and economic sciences and humanities' are cross-cutting issues and as such, particular attention shall be paid to their implementation across and within the priorities of H2020.
- 17 Article 1.4 of [Regulation \(EU\) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in Horizon 2020- the Framework Programme for Research and Innovation \(2014-2020\)](#).
- 18 This includes EUR 21 million contributions from the Associated Countries.
- 19 [Article 22.2 of Council Regulation \(Euratom\) No 1314/2013 of 16 December 2013](#).
- 20 Environmental Sciences was highest, see [Thomson Reuters'](#) report endnote 9.
- 21 External relations and foreign affairs policy encompass:
  - Common foreign security policy (CFSP), i.e.: civilian crisis management, conflict prevention, development and developing countries, enlargement, European neighbourhood policy, European Union in the world, external cooperation programmes, peacekeeping operations;
  - Emergency assistance, i.e.: humanitarian aid and civil protection (ECHO); and
  - Foreign policies (relations with third countries and international organisations), i.e.: international trade and trade agreements (external trade).
- 22 NUGENIA is an association dedicated to the research and development of nuclear fission technologies, with a focus on Generation II and III nuclear plants (NUclear GENeration II & III Association), and SNETP stands for Europe's Sustainable Nuclear Energy Technology Platform.

- 23 [Council Directive 2011/70/Euratom of 19 July 2011](#) establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.
- 24 ENSREG: European Nuclear Safety Regulators Group.
- 25 [Commission press release 13 May 2015](#), President Juncker ... discusses role of science in competitiveness and announces new mechanism for scientific advice.
- 26 CEN is the acronym for the French 'Comité Européen de Normalisation'.
- 27 [Decision No 1982/2006/EC of the European Parliament and of the Council of 18 December 2006](#) concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013).
- 28 [Council Decision 2006/970/Euratom of 18 December 2006](#) concerning the Seventh Framework Programme of the European Atomic Energy Community (Euratom) for nuclear research and training activities (2007-2011).
- 29 [Council Decision 2012/93/Euratom of 19 December 2011](#) concerning the Framework Programme of the European Atomic Energy Community (Euratom) for nuclear research and training activities (2012-2013).
- 30 [Council Decision 2006/975/EC of 19 December 2006](#) concerning the specific programme to be carried out by means of direct actions by the Joint Research Centre under the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013).
- 31 [Council Decision 2006/977/Euratom of 19 December 2006](#) concerning the specific programme to be carried out by means of direct actions by the Joint Research Centre implementing the Seventh Framework Programme of the European Atomic Energy Community (Euratom) for nuclear research and training activities (2007 to 2011).
- 32 [Council Decision 2012/95/EU of 19 December 2011](#) concerning the specific programme, to be carried out by means of direct actions by the Joint Research Centre, implementing the Framework Programme of the European Atomic Energy Community for nuclear research and training activities (2012-2013).
- 33 [Regulation \(EU, Euratom\) No 966/2012 of the European Parliament and of the Council of 25 October 2012](#) on the financial rules applicable to the general budget of the Union.
- 34 [Commission Delegated Regulation \(EU\) No 1268/2012](#) of 29 October 2012 on the rules of application of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council on the financial rules applicable to the general budget of the Union.
- 35 European added value is a key criterion for spending at EU level. In general terms, it is the additional value resulting from an EU intervention compared to the value that would have been otherwise created by Member-State action alone, Commission Staff Working Paper 'The added value of the EU budget', [SEC\(2011\) 867 final](#).
- 36 'Community' is here the European Atomic Energy Community (Euratom).
- 37 Mainly the Working Party on Research, the Joint Working Party on Research/Atomic Questions, the Working Party on Atomic Questions.
- 38 The JRC-EP Interface Working Group to inform parliamentarians of the JRC's activities and to understand the Parliament's position on policy issues and there is regular exchange of information and collaboration with the EP Science and Technology Options Assessment (STOA) panel.
- 39 For example the European Environmental Agency (EEA), the European Food Safety Agency (EFSA), the European Chemicals Agency (ECHA), the EU Satellite Centre (EUSC), the European Agency for the Management of Operational Cooperation at the External Borders of the EU Member States (Frontex).
- 40 CA(06)55, 'JRC Robust Science for Policy Making: A guideline towards integrity and veracity in scientific support and advice', endorsed by the Management and the Board of Governors of the JRC.
- 41 The Financial Perspectives of the EU provide the multi-annual budgetary framework of the Union's seven-year political project.
- 42 [COM\(2010\)2020, the EU's strategy for smart, sustainable and inclusive growth](#). The overall strategy and its targets were discussed by the European Parliament and endorsed at the meetings of the European Council respectively in March and June 2010.
- 43 [Impact analysis of JRC activities. Special Report for the 100<sup>th</sup> meeting of the Board of Governors](#) Brussels, June 2013, ISBN 978-92-79-31202-1 (pdf).
- 44 'Highly cited publication' are in the top 10% of the world's most frequently cited papers, taking into account year of publication and field.
- 45 Size-independent metrics enable the comparison of small and large organisations, small and large journals etc.

## **Ex-post Evaluation of the direct actions of the Joint Research Centre under the Seventh Framework Programmes 2007-2013**

European Commission  
Joint Research Centre  
<https://ec.europa.eu/jrc>

### **Abstract**

The ex-post evaluation in this report provides the independent assessment requested in the Council Decisions concerning the specific programmes to be carried out by means of direct actions by the Joint Research Centre implementing the Seventh Framework Programmes (2007-2013) of the European Community and of the European Atomic Energy Community (Euratom). The evaluation has been conducted by a panel of independent external experts under the chairmanship of Professor Patrick Cunningham.

In this report the Panel concludes positively on the effectiveness of the JRC as the Commission's science service in support of Euratom and EU policies. It also concludes that the JRC has a respectable scientific performance in its areas of competence. In particular, the JRC standard is high as regards the scientific quality and impact of its publications.

Besides a number of recommendations for incremental improvement of the JRC the Panel also flags two issues with a view to transformative change of the JRC. To begin with the JRC should establish a long-term strategy before the mid-term evaluation of the Horizon 2020 framework programme in 2017. As the JRC further develops its function as scientific service of the Commission, there is a need to address the JRC's governance as well as its interaction with the scientific community in the Member States. In light of this the Commission should task a Group of eminent personalities to put forward options for JRC governance, adapted to its functions of the future. These include scientific support, research, scientific advice, and knowledge management in partnership with the Member States.

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## JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

*Serving society*  
*Stimulating innovation*  
*Supporting legislation*



**JRC Science Hub**  
<https://ec.europa.eu/jrc>

