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COMMISSION STAFF WORKING DOCUMENT

INTERIM EVALUATION

of the

Joint Undertakings operating under Horizon 2020

{SWD(2017) 339 final}

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EXECUTIVE SUMMARY

Joint Undertakings (JUs), launched under article 187 of the Treaty on the Functioning of the European Union, are a special legal instrument of implementing Horizon 2020 through a public-private partnership (PPP) in key strategic areas. Their aim is to implement research and innovation activities to enhance competitiveness and to tackle the grand societal challenges with the active engagement of Europe's industry.

The seven JUs currently in operation implement specific parts of Horizon 2020 in the areas of transport (CleanSky2, Shift2Rail and SESAR), transport/energy (FCH2), health (IMI2), bio-economy (BBI) and electronic components and systems (ECSEL). For the duration of the framework programme, they will manage around 10% of the global Horizon 2020 budget and, through the leverage effect, will mobilise additional resources from the private side of each JU.

The legal framework of each of the JUs foresees an interim evaluation to be carried out with the assistance of independent experts. The Commission is required to prepare a report - a Staff Working Document (SWD) - which addresses the conclusions of the evaluations and the related observations by the Commission services. The report should also take into account the findings and conclusions reached by the independent experts in the final evaluations of the six JUs that operated under FP7, namely, SESAR, ARTEMIS, CLEAN SKY, ENIAC, FCH and IMI.

During the period from October 2016 to June 2017, a total of 39 independent experts working in seven groups evaluated the progress realised until the end of 2016 by the seven JUs operating under Horizon 2020; this work also covered the six JUs that operated under FP7.

This SWD presents the Commission services' view on the performance of the seven JUs under Horizon 2020, based on the findings of the seven expert groups, the outcomes of the public consultation of stakeholders and the survey of project coordinators.

The overarching conclusion is that the JU-based PPPs under Horizon 2020, while it is still early for most of them to demonstrate tangible project outputs, have demonstrated efficiency improvements in comparison to FP7. They have also effectively managed to engage the major actors in research and innovation in the respective industrial sectors and have shown their potential as important drivers for strengthening Europe's competitiveness and helping to respond to major socio-economic challenges. The private funding leveraged by the JUs is shown to be well on track against the targets defined in the respective legal frameworks.

The industrial sectors addressed by the JUs are not only of high economic relevance for Europe, but also areas where well-identified market risks require a long-term concerted research and innovation effort. Taking into account the needs of the specific sector, JUs are fostering synergies by linking activities across the innovation cycle, from research outcomes to closer-to-market activities and facilitating the creation of an internal market for innovative technologies, products and services.

The Commission services' view, shared by the vast majority of the stakeholders who participated in the open public consultation, is that the JUs are on track to deliver against the set objectives, despite a number of identified shortcomings that need to be addressed by the JUs and the Commission services in order to improve their functioning, ensure delivery of solid output and objectively assess impact.

Strengths

The evaluations, supported by the views of the stakeholders involved in the consultation, confirmed the **continued relevance** of the seven JUs in contributing directly to competitiveness and EU policy goals. The key strength of the JUs is their **ability to engage major, strategic industry partners** in priority areas of the Union, across borders and business sectors and lead a step change in comparison to standard research. This effect has been observed in all JUs. The JUs have also **managed to overcome the fragmentation** in their respective sectors, bringing together competing or even previously unrelated stakeholders and creating long-lasting collaborative networks. While the definite amount of **leveraged funding** will only be known at the end of the JU operations, current Commission estimations point to private sector funding that already equals or exceeds the set targets in four out of the seven JUs, whereas for the remaining three it is closing in to the target.

Regarding openness, it is generally agreed that, in comparison to the first generation, the second generation JUs have developed more **open and straightforward policies regarding membership** of the private entities, which are described clearly, along with the eligibility criteria, in the respective Council regulations. JUs implement the programme with small teams, focusing on research priorities that are, to a large extent, **coherent** with the corresponding Horizon 2020 activities. They are **lean, efficient structures**, most of them benefiting from a simplified and more uniform application of rules and processes in Horizon 2020. Performance indicators such as time-to-grant, time-to-inform and time-to-pay, are all observed to be within the set targets. As a result, the JUs achieved a **very high stakeholder satisfaction** for their services (more than 90%).

Challenges

Despite the general acceptance that the JUs operating under Horizon 2020 are on track to achieve their objectives, the seven groups of experts identified a number of issues that need to be addressed in order to reap the maximum of their potential and impact. As each JU has its own specific features, only a handful of these challenges are common to all.

Even though it is generally acknowledged that most of the key players in the respective industrial sectors are already engaged actively, many expert groups call for the inclusion of a **wider range of stakeholders** either in the governance structures or in submitted proposals. The **limited interaction** between the **Governing Boards** and their **advisory bodies** is another issue where possible improvements should be explored. Additional efforts are also needed to further **align** JU activities with **policies at EU, national and regional level**.

The choices of the **Key Performance Indicators** (KPIs) used to measure JU-specific impact are criticised by several expert groups. They propose to **re-visit and re-define** the whole set of KPIs by including indicators related to global competitiveness of the relevant industrial sectors and, also, to couple the indicators with baseline metrics showing progress over time.

Experts report **uneven SME participation rates** that, on average are lower than those observed in Pillars II (the LEIT part) and III (Societal Challenges) of Horizon 2020, a finding which might be linked to cost considerations and long term commitments. Similarly, the **participation rates of the EU-13** Members States, while they have improved over those in FP7, are still overall lower than the already low rates of Pillars II and III. Finally, there is a need to **improve** and enforce **communication activities** and, in particular, to ensure effective **dissemination** of project results.

1. INTRODUCTION

The framework programme Horizon 2020 may be implemented through public-private partnerships (PPPs) when the research and innovation activities are of strategic importance to the Union's competitiveness and industrial leadership or to addressing specific societal challenges. Where there is a sufficient scale and scope and other forms of partnership would not fulfil the objectives or generate the necessary leverage, the option chosen is a Joint Undertaking (JU), established under Article 187 of the Treaty on the Functioning of the European Union.

Seven JU-based PPP initiatives were launched under Horizon 2020, building on the experience gathered with the six JUs operating under the seventh framework programme (FP7). Since PPPs are one of the key instruments of the current framework programme, the interim evaluation of these JUs supports and feeds into the Horizon 2020 interim evaluation[1], which three years after its launch assesses the overall progress towards achieving its objectives.

The individual Council Regulations[2] require the Commission to carry out, with the assistance of independent experts, an interim evaluation for each of the JUs, the results of which should be communicated by the Commission to the European Parliament and the Council not later than 31 December 2017. The set of the seven JU evaluations, covering their implementation until end of 2016, provides a critical look on whether they are fit for purpose and whether this PPP instrument can deliver in an optimal way the desired outcomes. They also shape a solid evidence base for designing future initiatives in strategic industrial sectors.

Each JU evaluation focuses on the evaluation criteria prescribed in the better regulation framework, notably efficiency, relevance, coherence, effectiveness and EU added value, with an additional concern on openness and transparency, as required in the Horizon 2020 regulation.

This Commission Staff Working Document (SWD) presents the views of the relevant Commission services based on a wide range of sources comprising the expert group evaluation reports, results from the common open public consultation and the seven surveys of JU project coordinators.

It concentrates on the more generic issues identified, and provides the related views from the Commission services and some conclusions in relation to the JU-based PPP instrument. The more specific results of each individual evaluation can be found in Annexes E and F, together with the final evaluation of the JUs established under FP7, which was performed in parallel by the corresponding expert group.

The results of this SWD will provide input to the forthcoming Commission Communication on the results of the Horizon 2020 interim evaluation.

[1] Commission Staff Working Document SWD(2017) 221

[2] Council Regulations 560/2014 (OJ L 169, 7.6.2014, p. 130–151), 557/2014 (OJ L 169, 7.6.2014, p.54), 558/2014 (OJ L 169, 7.6.2014, p.77), 561/2014 (OJ L 169, 7.6.2014, p. 152), 559/2014 (OJ L 169, 7.6.2014, p.108), 642/2014 (OJ L 177, 17.6.2014, p. 9), and 219/2007 (OJ L 64, 2.3.2007, p.1) amended by Council Regulations 1361/2008 and 721/2014

Figure 1: Overview of the seven JU-based PPP initiatives under Horizon 2020.

The **Clean Sky 2 JU** develops new environmentally-friendly technologies for the commercial aviation under Horizon 2020.

Clean Sky was created in 2008 as a PPP between the EU and the aeronautics industry, and it developed under FP7 break-through technologies for the civil aircraft market.

The current initiative aims to increase fuel efficiency and to reduce emissions and noise compared to the reference aircraft that uses current state-of-the-art technologies.

Clean Sky 2 involves 16 industry leaders. In addition, already 136 Core Partners and more than 400 partners were selected through open calls for proposals.

The **IMI 2 JU** is a PPP between the EU and the EFPIA Association. Its main objectives are to remove bottlenecks and improve the efficiency, effectiveness and quality of the drug development process, helping produce safe, effective and innovative medicines more rapidly.

It builds on the success of a JTI established during the first years of FP7. The scope has been expanded to cover all areas of life sciences research and innovation which are of interest for health, as identified by the World Health Organisation.

The initiative brings together a broad range of partners from different sectors (biomedical imaging, medical information technology, diagnostic, etc.) and of different types (academic organisations, SMEs, industries, regulatory agencies, patient organisations, etc.)

The **Shift2Rail** Joint Undertaking is a public-private partnership in the rail sector, pursuing research and innovation activities in support of the achievement of the Single European Railway Area and improving the attractiveness and competitiveness of the European rail system.

The initiative was launched in 2014, with ambitious objectives of cutting the life-cycle cost of railway transport, increasing capacity, reliability and punctuality.

Railway undertakings, infrastructure managers and public transport operators will also benefit from innovations that drastically reduce infrastructure and operating costs. This should also help to reduce the subsidies paid out by national authorities.

The **SESAR** JU, established in 2007 to concentrate and coordinate all air traffic management (ATM) R&D efforts in the EU under the development phase of the SESAR project is the technological pillar of the Single European Sky (SES) initiative launched in 2004.

The SES is expected to enable a 3-fold increase in capacity, improve safety performance by a factor of 10 and reduce the cost of ATM services by a half.

The **Fuel Cells and Hydrogen** JU has among its objectives the development of a strong, sustainable and globally competitive fuel cells and hydrogen sector in the EU. Although this sector is small, it is of strategic value due to its potential knock-on effect on other areas.

The FCH JU is building on the previous implementation under FP7. In Horizon 2020, it is aiming to develop a portfolio of clean, efficient and affordable fuel cells and hydrogen technologies to the point of market introduction and to help secure the future international competitiveness of this strategically important sector in Europe.

Environmental and socio-economic benefits in the area of the bio-based economy are the key objectives of the **BBI** JU, set up under Horizon 2020.

A strong European bio-based industrial sector will significantly reduce Europe's dependency on petroleum products, help the EU address the challenge of the climate change, and lead to greener and more environment friendly growth, also increasing employment in particular in rural areas.

The **ECSEL** JU is a merger of the ENIAC nanoelectronics and the ARTEMIS embedded systems JTIs set up in 2008. ECSEL focuses on embedded/cyber physical systems, nanoelectronics and smart systems.

The main aims of the PPP are to grow semiconductor and smart system manufacturing capability, while developing a strong and globally competitive electronics components and systems industry in Europe and to underpin next generation digital technologies.

2. BACKGROUND

2.1. Context

Around the turn of the century, European industry was increasingly hindered by an inadequate technological base, arising particularly from lack of specialisation in high technology sectors[3]. This unfavourable environment was further weakened by inadequate funding and lack of scale to focus on key strategic projects that have high downstream industrial potential.

Before the EU considered potential partnerships with industry to support European research, some Member States had already begun funding parts of their research activities through public-private partnerships, an approach which saw a significant increase between 1998 and 2002, focusing on selected strategic areas.

The importance of innovation to growth and jobs was explicitly acknowledged in the December 2006 Council Conclusions on a broad-based innovation strategy[4], which recognised the support for innovation as an essential part of the Lisbon Strategy. The Council Conclusions set out the strategic priorities for innovation action at an EU level and included the launch of Joint Technology Initiatives (JTIs) among its key actions.

The JTIs were public-private partnerships in industrial research at European level which were implemented through Joint Undertakings (JUs), launched under Article 187 of the Treaty on the Functioning of the EU (TFEU). They were set up in 2007-2008 under the Seventh Framework Programme (FP7) in five strategic areas - aeronautics and air transport (Clean Sky), health (IMI), fuel cell and hydrogen technologies (FCH), embedded computing systems (ARTEMIS), and nanoelectronics (ENIAC). The SESAR JU (not launched as JTI) was also setup to coordinate all air traffic management (ATM) research at EU level, as the technological component of the broader Single European Sky initiative aiming to modernise and harmonise ATM systems in the EU.

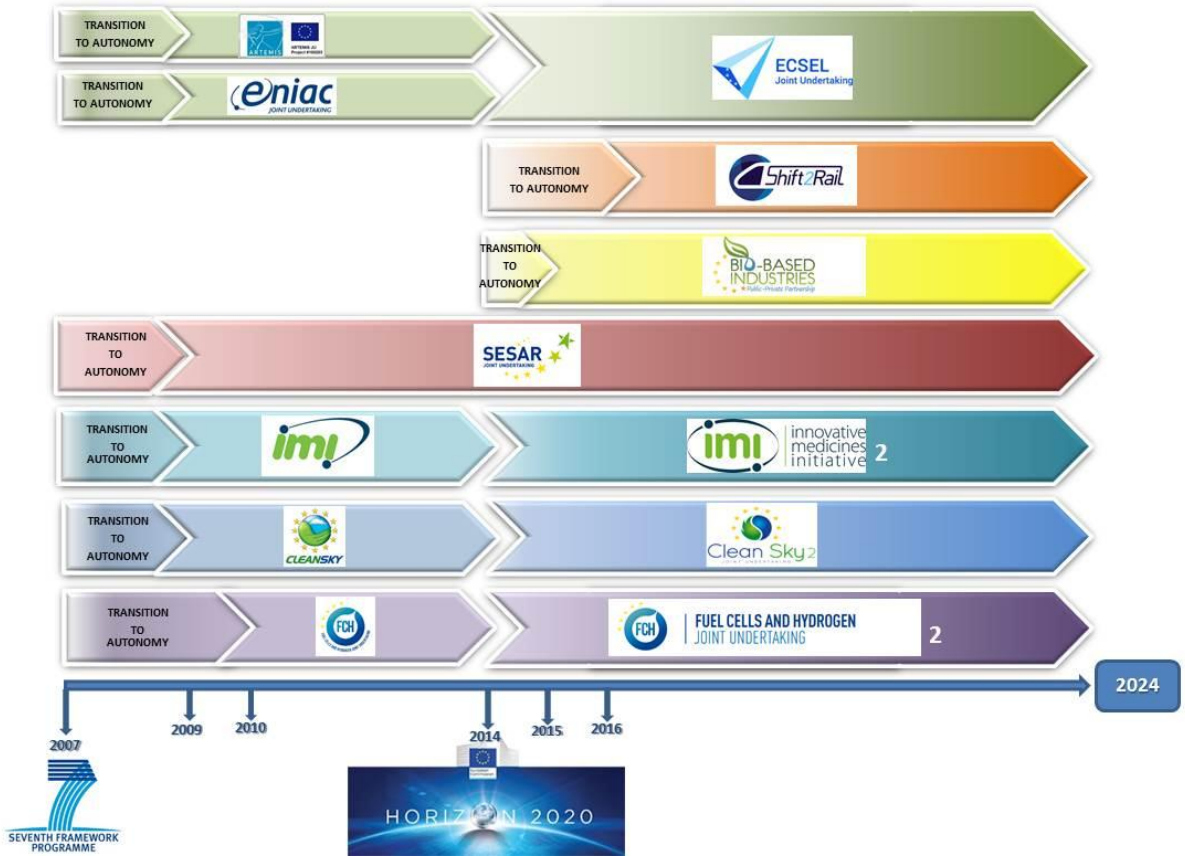
Article 25 of the current framework programme Horizon 2020 regulation addresses the implementation of parts of the programme through public-private partnerships for research and innovation activities of strategic importance. Two possible forms are considered: financial contributions from the Union to Joint Undertakings established pursuant to Article 187 TFEU or the signing of contractual arrangements with the relevant industries specifying objectives, commitments, Key Performance Indicators (KPIs) and outputs to be delivered (contractual PPPs)[5].

It is also mentioned that these PPPs shall be identified and implemented in an open, transparent and efficient way, and that their identification shall be based on: added-value at Union level, scale of impact, long-term commitment, scale of resources involved, clear definition of roles and KPIs, and complementarity with other parts of Horizon 2020.

[3] As shown by the 2002 value of the share of high-tech industries in manufacturing value-added (based on data from the Groningen Growth and Development Centre), see Commission SWD SEC(2005) 800
[4] 2769th Competitiveness (Internal Market, Industry and Research) Council meeting, 4 December 2006
[5] http://ec.europa.eu/research/industrial_technologies/ppp-in-research_en.html

Based on the experience gained during FP7, the European Commission prepared a series of proposals for Council regulations on public-private partnerships under Horizon 2020. In May 2014, the Innovation Investment Package was officially adopted setting up a new generation of JU-based partnerships.

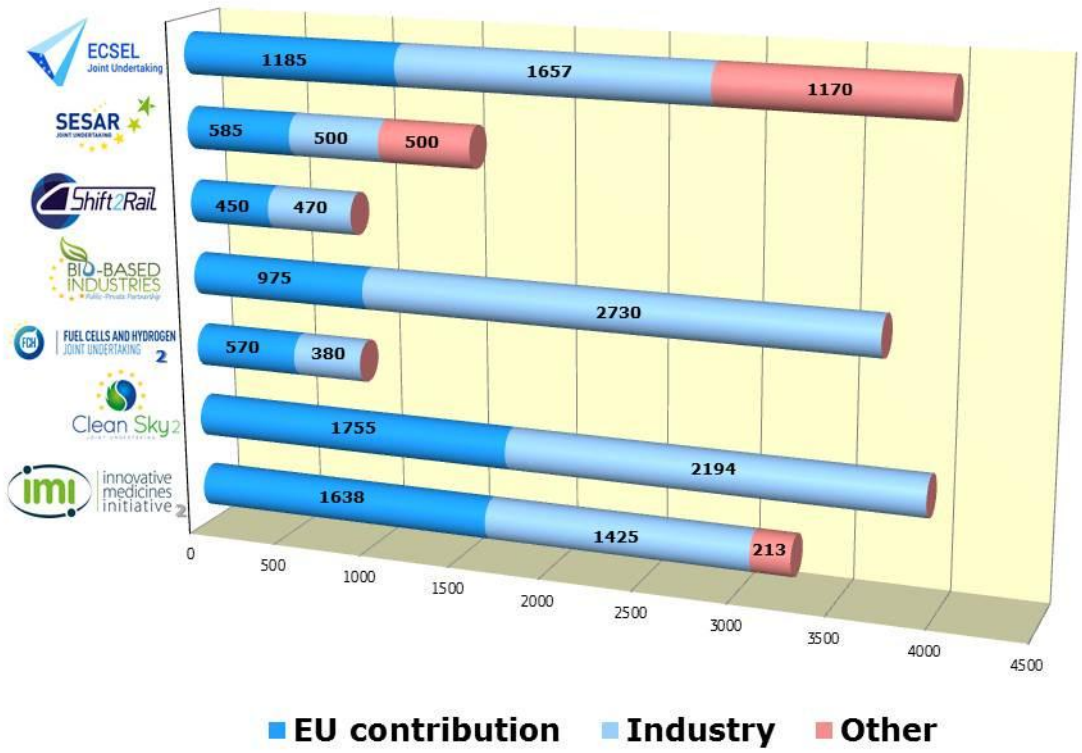
Figure 2: Lifetime of the JUs



Source: EC based on the Council Regulations establishing the JUs

The package includes seven JUs that organise their own research and innovation agenda and award funding to projects on the basis of competitive calls. Among these, three JUs are active in the transport sector, one in the energy / transport sector, one in the field of health, one in the bio-economy and one in electronic components and systems. Two new initiatives have joined those launched during FP7 – the Bio-Based Industries (BBI) and the Shift2Rail (S2R) JUs. The pre-existing ARTEMIS and ENIAC initiatives were merged into the new ECSEL JU, with updated joint objectives.

Figure 3: Financial contributions during Horizon 2020 set in the respective Council Regulations



Source: EC calculation based on the Council Regulations establishing the JUs

The overall Union contribution to the seven JUs during the duration of Horizon 2020 is EUR 7.25 billion or approximately 10% of the budget of the framework programme, which will be matched by the private side of each JU-based partnership as described in the corresponding Council Regulation. ECSEL JU also has EUR 1.17 billion provided by the Participating States and SESAR JU has EUR 500 million from EUROCONTROL. Up to EUR 95 million could additionally be contributed by the EU to FCH2 JU to match private contributions.

2.2. Objectives and intervention logic

The Commission adopted in 2011 a Communication on "Partnering in research and innovation"[6] that summarises the aims of partnerships as follows: build critical mass to ensure the scale and scope required, facilitate joint vision development and agenda setting, contribute to the evolution to a programming approach in European R&I, and provide for flexible structures that facilitate the size and scope of a partnership, depending on its nature and goals. The launch of JTIs was considered well justified on the basis of identified market failures, the long term nature of the required activities and the scale of the commitment needed to achieve the necessary breakthroughs.

[6] COM (2011) 572 final

Regarding the need for EU public-private partnerships in research and innovation, the Communication adopted in 2013 on "PPPs in Horizon 2020: a powerful tool to deliver on innovation and growth in Europe"[7] explains that "research and innovation are high risk activities and there is no guarantee of success. If the risk of failure is too large, the private sector may be unwilling to invest, even if the economic and societal returns could potentially be very large. In addition, the economic benefits of research investments may be captured by others, meaning that individual firms will be unwilling to invest, or there may be compelling policy reasons which limit the size of the market and therefore the potential return (e.g. when developing new antibiotics where microbial resistance is a growing concern)".

According to this Communication, "these general market failures provide a strong rationale for public support to private research and innovation activities. However, in a number of cases, the importance of the sectors, the complexity of the challenges and technologies, the long time periods involved and the scale of investment needed are such that public support to individual projects is not effective. It is for these cases that structured partnerships are needed between the public and the private sector to jointly develop, fund and implement ambitious research and innovation agendas. For sectors that operate at European and international levels, and where the scale of the investments is beyond the means of the individual Member States, the most effective approach was considered to be to establish such PPPs at EU level".

The newly created JUs have been designed to help the Commission reach the overarching Union priorities, not only in the research and innovation domain, but also regarding major EU policy objectives under the Europe 2020 strategy.

The diagram below shows the main features of each JU and their objectives. Due to the large number of individual intervention logics followed by the expert groups, this summary has been prepared to give a more accessible overview across all the JUs.

[7] COM (2013) 494 final

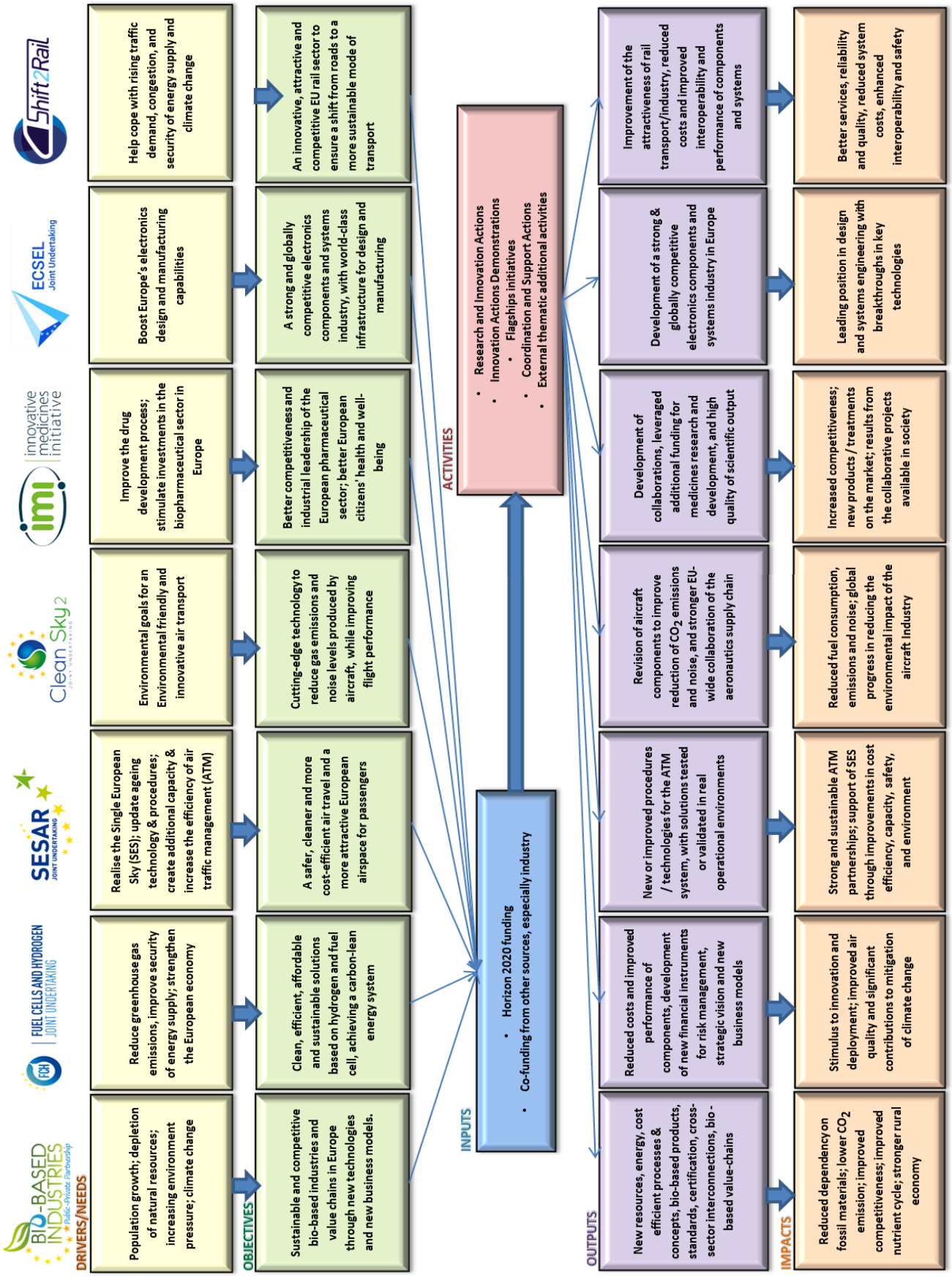


Figure 4: Intervention logic for the JUs under Horizon 2020

3. EVALUATION QUESTIONS

In line with the Better Regulation guidelines, each JU interim evaluation was required to address the criteria of relevance, efficiency, effectiveness, coherence and EU added value. On the basis of article 32(3) of the Horizon 2020 regulation[8], it was also necessary to perform an in-depth assessment of the JUs on the additional criteria of openness and transparency, as part of the interim evaluation of Horizon 2020. Therefore, the overall evaluation framework integrated the above mentioned seven criteria as summarised in the table below.

Relevance	Description of the objectives of Joint Undertakings and the problem they intended to address and assessment whether the original objectives still correspond to the needs within the EU
Effectiveness	The progress towards achieving the objectives set, including how all parties in the public-private partnerships live up to their financial and managerial responsibilities. ▪ Main achievements (KPIs) ▪ Effectiveness of implementation • To what extent is the JU achieving its objectives? • Assessment of the programme administration lifecycle and setting up a research agenda • Are all stakeholders relevant to the specific area of JU involved? Have the actions attracted and allowed a satisfactory level of participation of the best European players active in their specific areas?
Efficiency	The relationship between the resources used by an intervention and the changes generated by the intervention. ▪ Timely execution of the functions: time-to-grant, time-to-pay and average evaluation cost per proposal. ▪ Cost-efficiency of the management and control arrangements. ▪ Budget execution of commitment and payment appropriations Simplification and reduction of the administrative burden for the participants.
Coherence	To what extent is the JU coherent with other interventions (such as specific programme within Horizon 2020) that have similar objectives? What is the relation with other Union funding programmes (complementarity, synergies, potential overlaps)?
EU added value	Changes that can be reasonably attributed to JUs, rather than other factors. ▪ Leverage effect. ▪ Scale of resources involved. ▪ Ability to leverage additional investments in research and innovation.
Openness	The extent to which the JUs enable world-class research that helps Europe reach a leadership position globally, and how they engage with a wider constituency to open the research to the broader society.
Transparency	The extent to which the JUs keep an open non-discriminatory attitude towards a wide community of stakeholders and provide them with easy and effective access to information.

[8] Council Regulation 1291/2013 establishing Horizon 2020

4. METHODOLOGY

Seven independent expert groups were set up to carry out the interim evaluation of each of the Joint Undertakings (JUs) and produce evaluation reports. The experts were selected from a list that is continuously updated through an open call for applications. The independent experts were selected based on their level of professional experience and appropriate range of skills in the relevant fields covered by this evaluation. For the JUs in the transport domain, some of the experts were also tasked with ensuring a consistent approach between the three expert groups.

The expert groups used a wide range of methods and tools suitable for carrying out the requested tasks, since each task required a specific methodological approach. The expert groups collected relevant quantitative and qualitative information and evidence from different sources, as is shown in the table below.

Table 1: Overview of methodology for each JU evaluation

Source of evidence	BBI	CS2	ECSEL[9]	FCH2	IMI2	SESAR	S2R
Documentary review and desk research	X	X	X	X	X	X	X
Quantitative, statistical analysis CORDA data	X	X	X	X	X	X	X
Semi-structured or in-depth interviews with stakeholders	X	X	X	X	X	X	X
Interviews	X	X	X	X	X	X	X
Number of conducted interviews	19	20+	47	35	24	30	28
Focus groups						X	
A common open public consultation	X	X	X	X	X	X	X
JU Project Coordinators survey	X	X	X	X	X	X	X
Survey (other than the standard project coordinators survey)			X	X		X	X
Other (e.g. project visits)		X				X	
Participation in the events organised by the JUs	X	X	X	X			

Source: EC summary based on the individual JU interim evaluation reports

This Staff Working Document is based on a wide range of sources comprising the expert group evaluation reports, results from the common open public consultation and the seven surveys of JU project coordinators, as well as the views of the relevant Commission services.

At such an early stage, it is difficult to make an adequate quantitative assessment of the outcomes and impacts of these initiatives under Horizon 2020, due to the long time it takes for the research results to reach the market. This issue, together with the other limitations (timing,

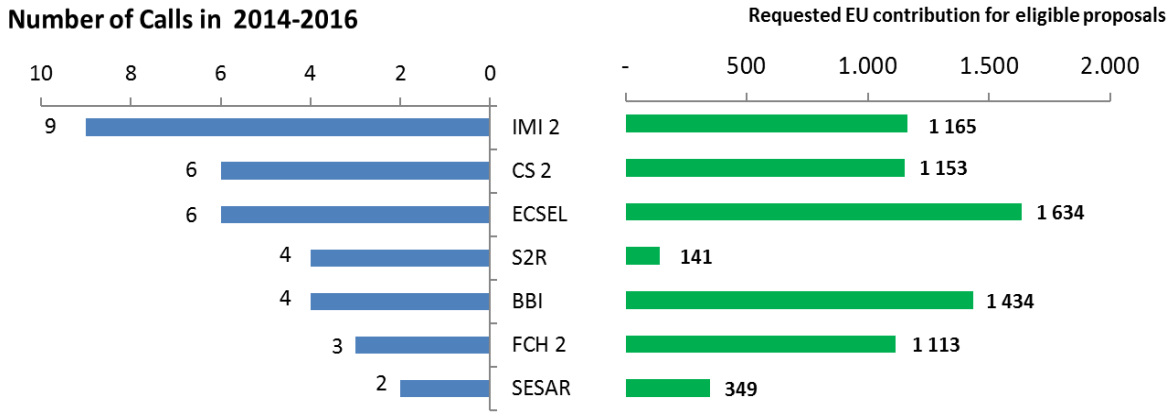
[9] For ECSEL, ENIAC and ARTEMIS, a fact-finding study was produced to support the evaluation process. This study includes interviews and dedicated surveys.

difficulty of benchmarking, early calculation of the leverage) encountered by the seven groups involved in this evaluation exercise are further discussed in Annex C.

5. IMPLEMENTATION STATE OF PLAY

The timing of adoption of the Council Regulations, with the first initiatives just starting in May 2014, had a significant impact on the Horizon 2020 calls calendar in 2014. Only a few calls were launched in 2014, and 2015 was basically the first year of actual implementation of calls for the JUs operating under Horizon 2020. The figure below presents the outcome of the calls launched and concluded by January 2017 by all seven JUs.

Figure 5: Number of calls launched and concluded by the JUs (left) and overall requested EU contribution in EUR million for the eligible proposals (right)



Source: CORDA, data extraction on 17 January 2017

In total, by the data extraction time of 17 January 2017 from Common Research Data Warehouse (CORDA) 34 calls had been launched and concluded. The calls attracted 1 751 eligible proposals with 13 815 participations in proposals. After the corresponding evaluations, 1 065 proposals were above the threshold and 482 of them were retained for funding.

The EU financial contribution to the 482 retained proposals amounted to EUR 2 296.8 million.

Regarding funded projects, by the CORDA extraction time in January 2017, 329 grants with 3 642 participations were already signed with a total of EUR 1 273.9 million in EU funding.

***1 751 eligible proposals** were received in the 34 calls launched in three years*

53% of the beneficiaries** in the signed grants **are newcomers

For the retained grants,** the total requested **EU funding is EUR 2.3 billion

During the first three years of Horizon 2020 implementation, JU funded projects attracted participants from 44 countries. The participation characteristics demonstrate an improvement over FP7 and are very much similar to those of Horizon 2020. Member States account for 93% in terms of participation and 94% in terms of EU funding. The participation rates of third countries account for 1% in terms of both participation and EU funding. They represent an increase from FP7 (respectively 0.52% and 0.02%) and are close to the respective rates of Horizon 2020 (1.9% in terms of participation and 0.6% in terms of EU funding).

The top five countries in terms of participations are Germany (546 participations), France (422), Spain (300), Italy (237) and the Netherlands (200). Participations from the top countries account for 47% of the overall participations in the signed grants. It should be noted that a large portion (53%) of the Horizon 2020 JUs' beneficiaries are new (they have not received funding from first generation JUs).

The average EU contribution to the signed grant is EUR 3.9 million. The average number of participants per signed grant is 11 organisations.

5.1. Participations in proposals and in projects per type of organisation

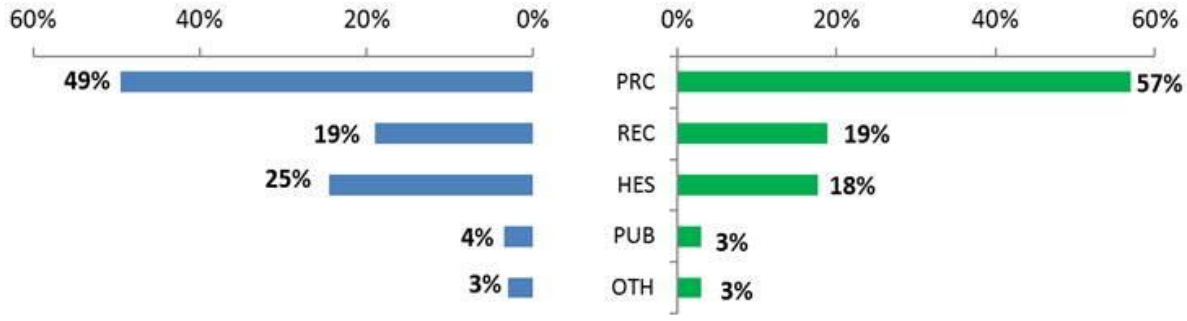
The following descriptions and convention codes are used for distinguishing between different types of organisations:

- Private for profit companies (PRC)
- Public bodies (excluding research and education) (PUB)
- Research organisations (excluding education) (REC)
- Secondary and higher education establishments (HES)

As of January 2017, the largest share of all 13 815 participations in the 1 751 eligible proposals corresponds to PRC (51%), followed by HES (24%), while REC ranks third with 20%.

Moreover, there are 3 642 participations (with 1 997 unique participants) in the 329 signed grants. The largest number of participants in the signed grants come from PRC (64%), followed by REC (18%) and HES (13%).

Figure 6: Participations in proposals and projects per type of organisation – eligible proposals (left) and signed projects (right)



Source: CORDA, data extraction on 17 January 2017

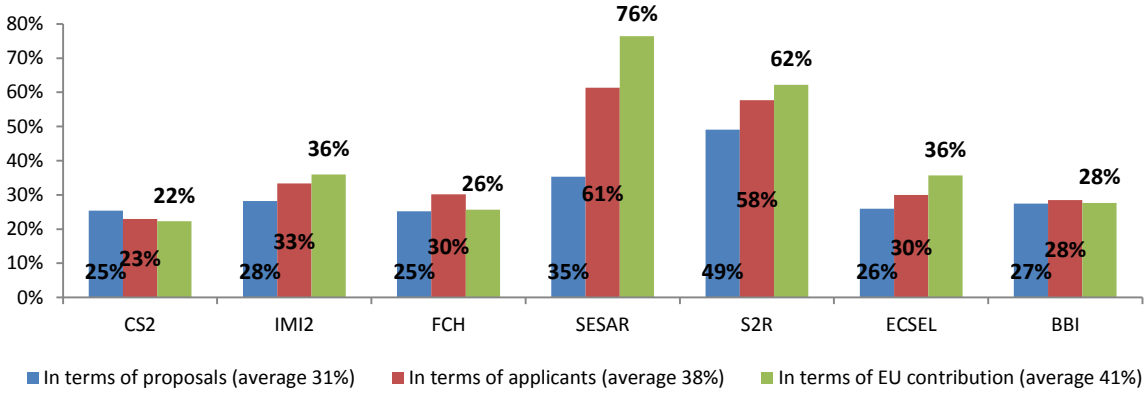
5.2. Success rates

Success rates are important in order to monitor the relationship between the proposals submitted to the JUs calls and the proposals finally retained for funding. In this section, three different ways of assessing this ratio are presented:

- **Proposals:** The success rate is equal to the number of retained proposals divided by the number of eligible proposals.
- **Participations in proposals:** The success rate is equal to the number of participations in the retained proposals divided by the number of total participations in the eligible proposals.

- **EU financial contribution:** The success rate is equal to the requested EU financial contribution going to the retained proposals divided by the EU financial contribution requested by the eligible proposals.

Figure 7: Success rates in terms of eligible proposals, applicants and requested EU contribution (2014-2016)



Source: CORDA, data extraction on 17 January 2017

The overall success rate for the JU-related calls is 31% in terms of the proposals. The success rate ranges from 25% in FCH 2 and CS2 calls to 49% in S2R calls. The overall success rate in terms of participations in proposals is 38%, ranging from 23% in CS2 to 61% in the SESAR calls. The overall success rate for the EU financial contribution is 41%, ranging from 22% in CS2 to 76% in SESAR.

The overall success rates for the JU–related Horizon 2020 calls are similar to the success rates of the JU-related FP7 calls. However, the success rates for JU calls are much higher than the overall Horizon 2020 success rates that account 12% in terms of proposals, 14.5% in terms of applicants and 13% in terms of EU contribution. The high success rates in JU-related calls can be explained by the focused industry related calls, highly relevant to the particular sector with fewer potential applicants. Good support from the JUs staff during proposal submission phase was also a positive factor.

Overall, 22.4% of all participations in proposals are by SMEs, with a 29.02% success rate on the basis of those participations. They represent 16.9% of the total requested EU contribution.

In signed grants, SMEs represent 22% of all JU beneficiaries and receive 17.6% of the EU funding. The SME participation rate in the JUs in terms of EU funding (17.6%) is higher than the overall Horizon 2020 rate, 15.9%. However, even though the SME rates represent an improvement in comparison to FP7 (20% and 16%), they are nevertheless lower than the corresponding combined rates in Pillars II (the LEIT part) and III ("Societal Challenges") of Horizon 2020, 27% and 24% respectively.

Figure 8: SME share in terms of participation and requested EU contribution (%)



Source: CORDA, data extraction on 17 January 2017

It is not easy to compare and benchmark the performance of JUs operating under Horizon 2020 with that of other similar entities as there are no comparable organisations (in terms of scale and scope). To overcome this challenge, whenever possible (e.g. in the case of the analysis of participation patterns), FP7 was used as a benchmark.

Table 2 lists the key implementation statistics on JUs under FP7 (2007-2013) and the first three years of Horizon 2020 (2014-2016).

Table 2: Overview of the implementation and participation patterns for JUs calls under FP7 (2007-2013) and Horizon 2020 (2014-2016)

	JUs calls under FP 7	JUs calls under Horizon 2020
PROPOSALS		
Average number of calls per year	9	11
Average number of proposals (eligible) per call	36	52
Average number of participations per proposal	6	8
Requested EU contribution per proposal (EUR million)	1.8	3.9
Requested EU contribution per participation (EUR million)	0.3	0.5
EVALUATION		
Average number of participations per retained proposal	8	9
Requested EU contribution per retained proposal (EUR million)	3.1	4.8
Requested EU contribution per participation in retained proposals (EUR million)	0.38	0.51
Success rate in terms of proposals	38.0%	35.5%
Success rate in terms of participations in proposals	41.4%	43.7%
Success rate in terms of EU contribution	44.1%	43.8%
PROJECTS		
Average number of participations per project	8	11
Average EU contribution per project (EUR million)	2.8	3.9
Average EU contribution per participation (EUR million)	0.3	0.3
Participation rates by type of organisations		
…in terms of participation		
Industry (PRC)	54.0%	63.7%
Research organisations (REC)	20.0%	18.1%
Higher educational organisations (HES)	23.2%	12.8%
Public (PUB)	1.3%	3.3%
Other (OTH)	1.5%	2.1%
…in terms of EU contribution		
Industry (PRC)	43.5%	66.2%
Research organisations (REC)	23.1%	21.8%
Higher educational organisations (HES)	30.6%	9.7%
Public (PUB)	1.9%	0.9%

	JUs calls under FP 7	JUs calls under Horizon 2020
Other (OTH)	0.9%	1.4%
SME participation		
SME share in terms of participations (%)	21.8%	21.9%
SME share in terms of granted EU contribution (%)	18.9%	17.6%

Source: CORDA, data extraction on 17 January 2017.
For IMI JU – the calls results from the 2nd stage were taken into account.

Table 3: Overview of the calls launched and concluded during 2014-2016

	Joint Undertakings						
	CS2	IMI2	FCH	SESAR	S2R	ECSEL	BBI
I. PROPOSALS							
Number of Calls	6	9	3	2	4	6	4
Number of proposals (eligible)	831	149	194	150	55	150	222
Number of applications	2215	1800	1516	1152	444	4245	2443
Requested EU contribution (EUR million)	1 153.21	1 164.68	1 113.02	349.31	141.41	1 633.60	1 433.62
Application rates (in %) per applicant type							
Industry (PRC)	48.0%	15.2%	57.5%	51.0%	56.8%	64.2%	53.7%
Research organisations (REC)	25.4%	22.2%	21.6%	19.1%	9.7%	16.1%	18.8%
Higher educational organisations (HES)	25.7%	51.7%	16.0%	16.1%	22.1%	18.1%	22.0%
Public (PUB)	0.2%	2.0%	2.0%	13.6%	4.7%	0.8%	1.2%
Other (OTH)	0.6%	8.9%	3.0%	0.2%	6.8%	0.7%	4.3%
SME participation							
Share in terms of applications (%)	25.0%	14.8%	22.3%	11.3%	24.3%	28.9%	30.2%
In terms of requested EU contribution (%)	14.7%	13.9%	18.3%	8.4%	16.2%	17.1%	29.6%
Top 5 countries (in terms of applications)							
1	ES: 414 (18.69%)	DE: 117 (12.42%)	DE: 303 (19.99%)	FR: 160 (13.89%)	DE: 76 (17.12%)	DE: 464 (20.69%)	IT: 288 (11.79%)
2	IT: 314 (14.18%)	UK: 111 (11.78%)	UK: 186 (12.27%)	ES: 123 (10.68%)	IT: 58 (13.06%)	FR: 253 (11.28%)	DE: 278 (11.38%)
3	FR: 273 (12.33%)	IT: 106 (11.25%)	IT: 170 (11.21%)	DE: 112 (9.72%)	ES: 57 (12.84%)	ES: 222 (9.90%)	ES: 266 (10.89%)
4	UK: 231 (10.43%)	FR: 98 (10.40%)	FR: 147 (9.70%)	IT: 109 (9.46%)	UK: 54 (12.16%)	NL: 210 (9.36%)	UK: 202 (8.27%)
5	DE: 228 (10.29%)	ES: 84 (8.92%)	ES: 106 (6.99%)	BE: 79 (6.86%)	BE: 34 (7.66%)	IT: 192 (8.56%)	NL: 192 (7.86%)
II. EVALUATION							
Number of retained proposals	211	42	49	53	27	39	61
Number of retained applications	509	600	458	707	256	1271	695
Requested EU contribution retained proposals (EUR million)	257.11	418.94	286.04	267.08	87.97	583.17	396.52
Success rate in terms of proposals	25.4%	28.2%	25.3%	35.3%	49.1%	26.0%	27.5%
Success rate in terms of applications	23.0%	33.3%	30.2%	61.4%	57.7%	29.9%	28.4%
Success rate in terms of EU contribution	22.3%	36%	25.7%	76.5%	62.2%	35.7%	27.7%

	Joint Undertakings						
	CS2	IMI2	FCH	SESAR	S2R	ECSEL	BBI
III. PROJECTS							
Number of signed grants	120	25	45	53	27	25	34
Number of participations	290	488	442	969	319	721	413
Number of unique participants	205	296	286	181	183	505	341
EU contribution (EUR million)	106.37	275.88	242.99	70.43	87.92	291.01	198.31
Average size projects in terms of EU contribution (EUR million)	0.89	11.04	5.40	1.33	3.26	11.64	5.83
Average number of project participants	2.42	19.52	9.82	18.28	11.81	28.84	12.15
Participation rates (in %) per activity type							
Industry (PRC)	45.5%	34.0%	60.9%	70.2%	59.6%	66.4%	62.7%
Research organisations (REC)	28.3%	19.7%	19.0%	16.3%	10.3%	18.2%	19.9%
Higher educational organisations (HES)	25.2%	35.7%	13.4%	6.6%	16.3%	14.4%	12.4%
Public (PUB)	0.7%	1.4%	2.5%	6.7%	6.9%	0.4%	1.0%
Other (OTH)	0.3%	9.2%	4.3%	0.2%	6.9%	0.6%	4.1%
SME participation							
In terms of EU funded participations (%)	25.2%	11.8%	26.5%	6.6%	19.1%	28.9%	35.4%
In terms of granted EU contribution (%)	23.8%	10.3%	30.7%	7.3%	10.8%	13.2%	27.4%
Top 5 countries (in terms of participations)							
1	FR: 55 (18.97%)	DE: 48 (16.22%)	DE: 90 (20.36%)	FR: 149 (18.4%)	DE: 65 (20.38%)	DE: 153 (21.2%)	DE: 61 (14.77%)
2	ES: 45 (15.52%)	UK: 47 (15.88%)	FR: 57 (12.90%)	ES:112 (11.56%)	ES: 47 (14.73%)	FR: 89 (12.34%)	NL: 59 (14.29%)
3	IT: 37 (12.76%)	FR: 31 (10.47%)	UK: 55 (12.44%)	IT: 93 (9.60%)	IT: 32 (10.03%)	NL: 81 (11.23%)	IT: 34 (8.23%)
4	UK: 37 (12.76%)	NL: 30 (10.14%)	IT: 41 (9.28%)	DE: 78 (8.05%)	FR: 29 (9.09%)	ES: 67 (9.29%)	BE: 31 (7.51%)
5	DE: 32 (11.03%)	FR: 43 (8.81%)	ES: 29 (6.56%)	BE: 51 (5.26%)	SE: 29 (9.09%)	AT: 61 (8.46%)	FI: 31 (7.51%)

Source: CORDA, data extraction on 17 January 2017

6. ANSWERS TO THE EVALUATION QUESTIONS

Each group of independent experts in charge of a JU evaluation addressed the set of evaluation questions in chapter 4, which are organised under the seven criteria, required in this exercise, namely relevance, coherence, efficiency, effectiveness, EU added value, openness and transparency. The following assessments, corresponding to each of those criteria, are based on the findings of the seven expert groups, the outcomes of the common open public consultation of stakeholders and the survey of project coordinators, as well as the views of the relevant Commission services summarised in the text boxes in each section.

6.1. Relevance

All individual evaluations confirm the continued relevance of the JUs in addressing strategic technologies that are already or rapidly emerging as cornerstones of a knowledge-based European economy and are linked to the objectives of the Europe 2020 strategy and Horizon 2020. They also underline that the socio-economic conditions that in 2013 justified the choice of the JU as the instrument to be used for the current JU based PPPs are still present and remain valid.

This view is shared by the Commission services and further supported by 78% of the surveyed stakeholders, who believe that the JU-specific strategic policy documents continue to be optimal in defining the scope of research and innovation which, naturally, varies among JUs depending on the specific characteristics of the relevant industrial sectors.

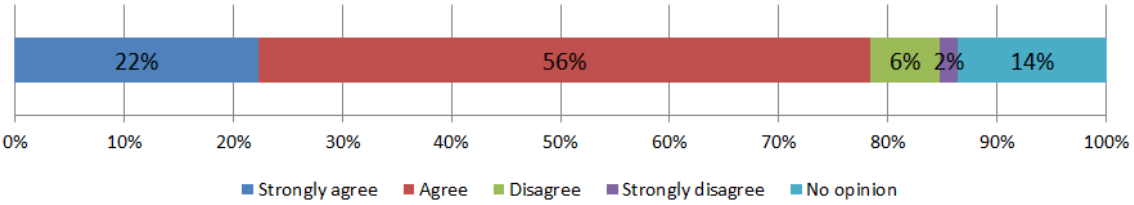
Unique initiatives, *in some cases with no counterparts elsewhere*

Objectives ***could not be addressed*** *with traditional EU instruments*

Need for capturing emerging trends *and adjusting research agendas accordingly*

For example, while it is relevant for the FCH2 JU to address the price and performance barriers that need to be overcome for the technology to be commercially viable, it is also relevant for the BBI JU to aim for a holistic value chain approach, lower the risk for industrial investment and focus more on demonstration and deployment.

Figure 9: Is the strategic policy document optimal for defining the scope of the research and innovation followed by the JU?



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

The IMI2 experts agree that the reasons to create a JU based public-private partnership to strengthen the European pharmaceutical industry were valid and the goals were justified, at the time of establishment of IMI2 JU, considering the need to increase the competitive

position of this industry. IMI2 JU was established in particular with the objective of reaching out to new stakeholders and broadening the network of collaboration in the healthcare family to non-pharmaceutical companies. The experts consider that increasing and facilitating collaborations with non-pharmaceutical companies remains essential.

The FCH2 JU experts perceive the activities of the JU as highly relevant to the grand challenges facing Europe by supporting the climate change objectives, helping improve energy security and contributing to raising the status of Europe as an international leader in FCH technologies. They add that in the specific cases where Europe is leading (e.g. hydrogen fuel cell buses, refuelling infrastructure), the contribution of the JU through R&D activities, demonstration projects and fostering European collaboration is clear and substantial.

Example Box: Relevance of ECSEL JU – The experts 'view

- The intended role and objective of ECSEL is to keep Europe at the forefront of technology development in the area of Electronic Components and Systems, bringing together embedded systems (ARTEMIS), nanoelectronics (ENIAC) and Smart Systems Integration (EPOSS). It is clear that the combination of the three domains supported by private and public investment has allowed problems that could not be addressed by single funding sources alone to be tackled in order to create significant impacts.
- The relevance of ECSEL JU regarding its key aim to bring together the fragmented Electronic Components and Systems community with the purpose to achieve a greater impact is demonstrated unambiguously by its stakeholder participation of over 1000 organisations in 3 years.

Source : All Example Box texts quote the opinions from the expert group reports referred to in Annexes E and F, unless stated otherwise

All transport-related expert groups (S2R JU, CS2 JU and SESAR JU) agree that the JUs show significant matches with EU strategic goals and/or initiatives such as those detailed in the Transport White Paper.

The SESAR JU experts highlight the importance of the JU as a key enabler of the wider Single European Sky policy, already delivering solutions for the modernisation of the Air Traffic Management (ATM) in Europe and strengthening cooperation among ATM stakeholders, who have never before worked together, including national authorities.

Summary Box: Is the public-private partnership the most appropriate instrument to address the strategic objectives of the industrial sector?
The experts' views

FCH2 JU: The experts consider that this was the correct choice at that time. Neither the continuation under the Framework Programme, nor contractual PPP would have stimulated the creation of the FCH community that has developed around the JU, nor would it have engaged industry as fully or fostered the development of a strategic research agenda.

BBI JU: In the interviews, the change of situation before and after creating the BBI JU was characterised mainly through two main aspects: BBI JU has provided a structuring effect, bringing together the sectors and actors towards deployment of new value chains, and it has mobilised increasing investments on developing innovations for the bio-based industries.

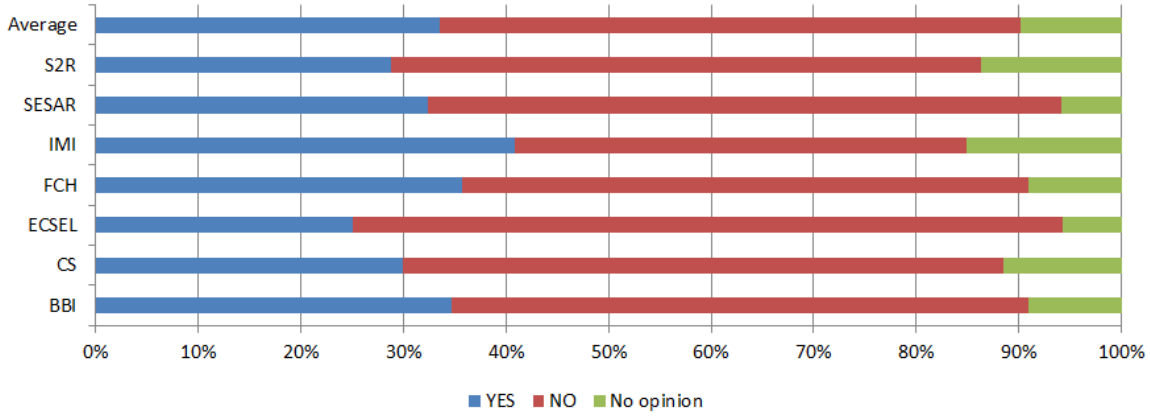
CS2 JU: The policy and rationale that underlay the Clean Sky programme in 2007 is still in line with the current challenges in the air transport sector and the portfolio of tasks entrusted to the Clean Sky 2 Joint Undertaking, and the effective execution of them in Clean Sky 1, continues to underwrite the PPP approach.

SESAR JU: "The on-time implementation of SESAR, compared with a scenario in which ATM is not modernised, would have a positive impact on GDP estimated at EUR 419 billion (SJU, 2011)." The experts agreed that this result continues to be relevant. Modernisation of the ATM is a key enabler of air transport and GDP growth.

The S2R JU experts agree that the JU and its objectives continue to be relevant. In this respect, they highlight the need for capturing emerging trends and incorporating them in the research agenda of a possible second generation S2R JU. They cite the emergence of new trends in the transportation market (driverless car, car-sharing platforms, etc.) that may significantly impact the innovation needs and existing market conditions and, as such, they should be added in the relevant research agendas.

This opinion of the experts regarding the relevance of the current activities is shared by the stakeholders. In general, only 33% of them consider that the JU should undertake new tasks in order to achieve the objectives set out in the current Regulation.

Figure 10: Should the JU undertake any other tasks in order to achieve the objectives set out in the Regulation?



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

6.2. Effectiveness

The question aims to provide an insight into the extent that JUs are on track to meet their objectives with regard to the intended outcome and expected impact. It is important to keep in mind that any reference to outcome and impact presented in this section is based on partial data and they can only present a partial snapshot of today's state-of-play.

Where possible, the achievements contributing to the objectives will be measured through some of the Key Performance Indicators (KPIs) structured into three types: the Horizon 2020 KPIs common to all JUs, Horizon 2020 KPIs on cross-cutting issues and the JU specific KPIs.

For a closer look at selected indicators, please refer to the individual evaluation reports, which present a detailed quantitative or qualitative assessment of the KPIs per JU.

6.2.1. Engagement of stakeholders

All expert groups agree that a main achievement is that the JUs managed to structure and mobilise an otherwise fragmented landscape of different sectors and industries and convince competing or different, seemingly unrelated stakeholders to work together in pursuit of commonly shared visions and goals.

Due to their importance in setting the research agenda, coupled with their ability to mobilise significant resources, both public and private, JUs are quickly becoming leaders in their areas of interest, potentially rising to a position of major influence when the core technology and changes are in question.

Therefore, there is a high interest of major players to be actively involved in the JUs. Judging from the composition of the individual JUs' membership and their top ranking beneficiaries, one can conclude that the JUs are able to attract prominent players in their respective fields of activity, not only in terms of size and position in the market but also in terms of R&D intensity and innovation potential.

*The Joint Undertakings **effectively** managed to **engage the major R&I actors** in the industrial sectors concerned*

***Need** to **reach a wider range** of stakeholders*

For example, in the case of the CS2 JU, the experts underscore that the JU is gathering together world-class aeronautical companies and industry leaders in the supply chain such as, for example, Airbus, Dassault Aviation, Augusta Westland, Rolls Royce, Saab, DLR, ONERA, Fraunhofer, Piagio Aerospace, Safran and Thales.

In the case of the ECSEL JU, the experts note that it is attracting the best European players in the semiconductor and systems domains like, for example, STMicroelectronics, Infineon, Philips, Thales, NXP, Bosch, Siemens, Daimler, Atos, etc.

However, despite this significant achievement, many expert groups call for a wider range of stakeholders to be included either in the governance structures or in project consortia.

For example, the FCH2 JU experts have counted among the participants many of the world class car manufacturers (Volkswagen, Daimler, Honda, BMW, Nissan, Renault) as well as top energy and utility companies (Bosch, Siemens, General Electric), and conclude that for both the transport and energy applications, top innovators are represented very well. They also consider that the way in which industry built the representative structure and engaged itself into the planning and execution of the programme is indicative of the appeal the JU exerts on the stakeholders and a testament to their commitment. At the same time, they call for stronger cooperation with additional regulators (e.g. health and safety, standards, etc.) than the ones currently in the Governing Board in order to foster further FCH technology deployment. Finally, they recommend strengthening the value chain approach by a greater participation of end users and customers.

Example box: Engagement of major R&I actors – The experts view of IMI2 JU

IMI2 JU: A unique collaboration model creating long-lasting collaborative networks

The main achievement of IMI2 JU, on which there was general consensus, was that since the Joint Undertaking started collaborations between different competing global companies, SMEs and academia became possible.

These collaborations created trust and new partnerships, including partners from a number of expertise areas, such as patient representative groups or regulatory bodies, which are essential stakeholders for medicines to enter the market with quality, safety and efficacy guarantees and in the shortest possible time.

However,
The experts note that there is an urgent and pressing need to meaningfully involve industries from other sectors

beyond the biopharmaceutical sector, such as technology providers.

Considering that the ECSEL JU emerged from the fusion of the ARTEMIS and ENIAC JUs existing under FP7, the experts appreciated the considerable efforts devoted by all actors to integrate the activities of three communities of stakeholders in the area of embedded systems, nanoelectronics and smart systems into one single domain, the ECSEL JU, and note that there is still a need for additional actions to this end.

The BBI JU experts confirm that the JU has attracted a satisfactory level of participation of the best European players in the areas of the selected value chains. At the same time they call for increased involvement of educational and research institutions in BBI JU programmes and projects in medium to long-term precompetitive industrial innovation topics that should be defined in common by all stakeholders.

The S2R JU experts mention that the JU helped already to create continuity and shared common vision for rail research within the railway community. In addition it has helped to build trust between players that would otherwise not have the opportunity to share ideas and common interests outside a commercial situation. They also note that, the presence of rail operators in the JU should be strengthened over time.

Finally, with regard to the SESAR JU, the experts note that, in comparison to the operation of the SESAR JU under FP7, a greater emphasis is already placed on achieving a wider involvement of the full range of stakeholders for the implementation of the European ATM Master Plan.

6.2.2. Governance

__Effective__ governance structures

Need for __stronger interaction__ between Governing Boards and advisory bodies

All experts agree that the governance structures of the JUs are effective in both their strategic and management tasks. Moreover, they acknowledge improvements over FP7 on the division of responsibilities between the Executive Directors and the Governing Boards allowing the latter to focus more on strategic matters.

In analysing the interactions between the different bodies in the governance of the JUs, a number of expert groups express concern on the role of the advisory groups and their limited impact on Governing Boards' strategic research decisions.

For example, the IMI2 JU experts suggest improvements that could lead to a more efficient and effective communication between the different bodies. In particular, they call for a stronger interaction with the States' Representatives Group (SRG) in order to ensure better alignment between national and regional developments and priorities. Also, they call for better feedback from the Governing Board on the relevance and impact of contributions from the Scientific Committee (SC), similar to the efficient communication established between the Governing Board and the seven Strategic Governing Groups, itself an improvement over FP7. They also comment on the communication with patient groups, which has also improved in comparison to FP7.

The FCH2 JU experts note that it is not clear how the advice and feedback of the advisory bodies is taken into account and reflected in the JU's strategic documents. This follows similar

conclusions regarding the FCH JU under FP7 where the experts concluded that the roles and responsibilities were not clear to all members of the advisory bodies and, therefore, they have not delivered to their full potential. While they acknowledge that the members of the SC are now carrying out their tasks meaningfully to provide a useful service to the JU, they also call for improved coordination within the Member States, starting with upgrading the SRG with members of sufficient seniority and power to reach agreements on improving consistency with national programmes.

The CS2 JU experts also consider that the SRG does not seem to have fulfilled its full potential in maintaining a close relationship with the Member States in order to influence the Clean Sky programme or to develop synergies with national research strategies. They do however praise the role of the SC in offering a good appreciation of the state of the art and analysing Clean Sky from the perspectives of environmental impact, technology and scientific trends and societal and economic considerations.

The S2R JU experts suggest enlarging the composition of the Scientific Committee with scientists other than railway engineers, such as economists, sociologists and geographers. In addition, synergies with other advisory bodies such as Transport Advisory should be created.

In the case of the SESAR JU, its strong link to the Single European Sky framework allows for the involvement of Member States, through i) the European Commission who consults the Single Sky Committee on strategic decisions of the Administrative Board such as the updates of the European ATM Master Plan, and ii) through cooperative agreements between the JU and the National Supervisory Authorities.

6.2.3. Impact: Key Performance Indicators

Key Performance Indicators (KPIs) are used to measure impact in order to improve the understanding of JU strategic challenges from the perspective of decision makers, management and societal stakeholders and, also, to justify support for the JU instrument.

***Re-visit** and **re-define** the JU-specific Key Performance Indicators*

*With **93% of projects** running the **first** or **second year** of implementation, no JU-specific KPIs can be properly measured*

Under FP7, while special care was taken to measure and report on input parameters (programme implementation statistics, budget execution, participation rates, etc.) and output (project results, patent applications, scientific publications), less effort has been devoted to measuring impact by defining objective, stable over time KPIs. The absence or selective use of such indicators hampers our ability to assess the lasting effects of the JUs under FP7.

The absence of established KPIs is no longer an issue under Horizon 2020. As provided for in the legal bases, three sets of KPIs were defined to measure impact, improve the understanding of strategic challenges from the perspective of decision makers, stakeholders and management and, also, justify support for the JU instrument. The first set contains KPIs common to all Horizon 2020 implementing entities including the JUs, the second set addresses Horizon 2020 cross-cutting issues that are also common to all JUs and the third set consists of KPIs that are specific to the objectives and impact of each JU.

All three sets of KPIs are monitored and reported by the JUs on an annual basis even though the majority of the JU-specific KPIs (third set of KPIs) cannot be properly measured yet since

they rely on project output data that, with 93% of the projects running the first or second year of implementation, are not yet available.

At present only two KPIs related to sustainable development and climate change can be safely reported since they are based on initial feedback from 420 ongoing JU funded projects. As indicated by the table below, the percentages of EU contribution to JU funded projects not only exceed the set targets but, also, they are significantly higher than the respective combined rates in Pillars II (the LEIT part) and III ("Societal Challenges") of Horizon 2020.

Table 4: KPIs measuring the impact on sustainable development and climate change actions

KPI	JUs funded projects	Horizon 2020 (Pillars II and III)
Climate action target: 35% of EU financial contribution is climate–related (RIO-Markers methodology)	79%	35%
Sustainable development target: 60% of EU financial contribution is sustainability related ((RIO-Markers methodology)	92%	75%

Source: CORDA data

Despite the abundance of available KPIs, several expert groups criticise the choices of the JU-specific KPIs, their respective targets and their presentation in the Annual Activity Reports by arguing that they do not serve the intended purpose and, therefore, need to be re-visited and re-defined.

In a discussion paper produced by the chair of the evaluation teams of the transport-related (CS2 JU, S2R JU and SESAR JU) expert groups, an in-depth analysis of the KPIs used currently by the JUs is presented, and it is concluded that while many KPIs are defined and reported, their current strategic value for decision makers, both within the JUs and outside, is limited. The experts suggest, among others, to reduce the number of reported KPIs to only those relevant to the main strategic challenges, focusing more on sector-specific global competitiveness. They also stress the importance of reporting evolution of KPIs over time.

The IMI2 JU group calls for a new performance measurement framework to replace the existing KPIs with SMART[10] indicators and report on them along with corresponding baseline metrics. The Commission Internal Audit Service had also recommended previously to IMI2 JU to design RACER (relevant-accepted-credible-easy-robust) KPIs.

The ECSEL JU group calls for the definition of appropriate metrics and compulsory follow up, once projects are finalised, to assess the impact of projects and thus justify EU funding.

While not questioning the choice of KPIs, the FCH2 JU group calls for revisiting the set targets since some were considered to be not sufficiently ambitious and others over-ambitious.

Finally, in the case of the BBI JU, while the available JU-specific KPIs were found to be on track, the experts call for further monitoring activity and analysis, making a clear distinction between the actually achieved KPIs at the end of each year and the projected KPIs.

[10] Specific, Measurable, Achievable, Relevant, Time-bound

Outputs

Owing to the late adoption of the Council Regulations establishing the JUs under Horizon 2020, only a few JU calls were launched late in 2014, with the majority following in 2015 and 2016. For this reason, the number of calls launched (34) and grants signed (329) during the reference period remain limited. Consequently, as of January 2017, 93% of the signed JU projects are running the first or second year of their duration and only a single JU project was completed. Clearly, this makes it too soon to make a comprehensive assessment of the outcome and impact of the projects funded by the JUs under Horizon 2020.

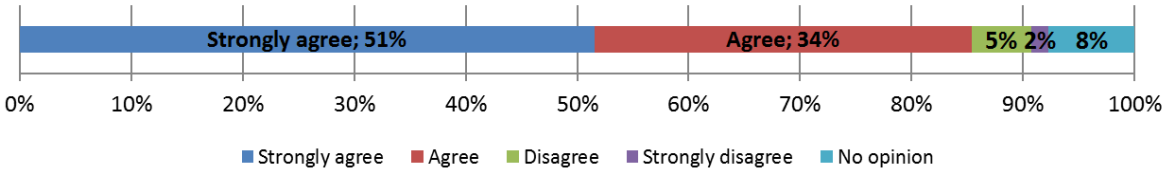
***Early** for JU funded output from Horizon 2020 to be assessed*

*FP7 JU projects **delivered** against **objectives***

***70% of stakeholders** expect JUs' **contribution to high-level objectives** in the medium or long term*

Judging, in particular, from their experience with the JUs under FP7, the large majority (85%) of the consulted stakeholders consider that the JUs contribute to economic growth and job creation in the EU

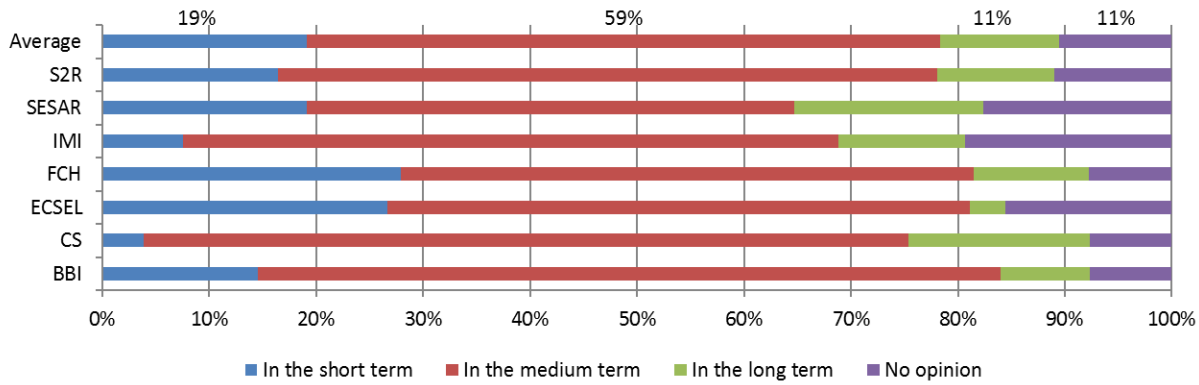
Figure 11: Does the JU contribute to economic growth and job creation in the EU?



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

Regarding the timing of the expected impact on the high-level objectives, 59% of the surveyed stakeholders consider that a JU can contribute towards improving the competitiveness and industrial leadership of Europe in the relevant industrial sector in the medium term (over the next 10 years), 11% believe that it can contribute only in the long term (over the next 20 years) while 19% consider that it can contribute in the short term (over the next 5 years).

Figure 12: Does the JU contribute to economic growth and job creation in the EU?



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

FP7 project outputs

In contrast to Horizon 2020, the final evaluations of the JUs under FP7 report on a large number of concrete project outputs that, according to the experts, give rise to reasonable expectations with regard to impact in the medium term.

For example, in the case of the SESAR JU, the experts report on impressive and concrete project outputs, as summarised in the box below.

Example box: SESAR JU – Major achievements

- Completion of over 400 projects, 350 validation exercises and 30,000 flight trials.
- 63 SESAR Solutions (new or improved operational procedures or technologies).
- 23 are already mandated for deployment by the SESAR Deployment Manager under the Pilot Common Project regulation.
- A strong and leading brand for ATM modernisation both within Europe and globally.

In the transport area, the FCH JU demonstrated 140 fuel cell cars and light duty vehicles and 45 buses in several Member States along with 17 hydrogen refuelling stations. The FCH experts consider that in the areas where Europe maintains a technology leading edge - hydrogen fuel cell buses, refuelling infrastructure - it is possible to detect a substantial contribution from the FCH JU through its demonstration projects, its capacity to facilitate European collaboration and its brokerage of cooperative solutions.

A good example of success for the ENIAC JU is the company AMS AG. With the help of the EU funding schemes, especially ENIAC and later ECSEL, but also to a number of acquisitions, it has managed to transform itself from a foundry with commodity products into a specialist for producing sensors and sensor systems for a variety of markets. Located originally in Austria, it now has research and development facilities in 20 design centres world-wide, employing around 3 300 people.

The IMI JU experts also report on a number of significant project outputs (see example box) even though they stress that impact is not yet demonstrated.

Example box: Examples of significant long term networks established by IMI JU under FP7

New Drugs 4 Bad Bugs: this programme represents an unprecedented partnership between industry, academia and biotech organisations to combat anti-microbial resistance in Europe by tackling the scientific, regulatory, and business challenges that are hampering the development of new antibiotics.

Under **COMBACTE-Net** project, a pan-European clinical trial hospital network - CLIN-Net - was set up, with

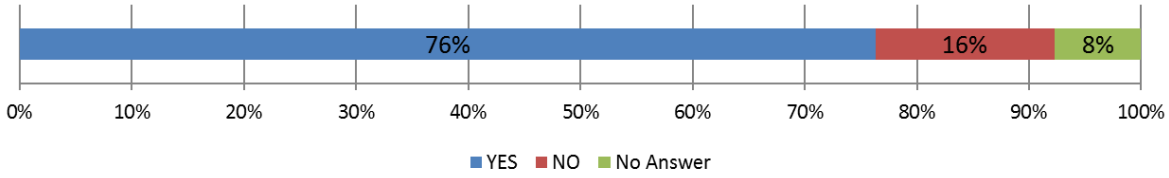
more than 800 clinical sites in 40 European countries to conduct high-quality clinical studies, to find new antimicrobials against resistant bacterial pathogens. This project has set up a clinical research network in autism which currently consists of 93 sites spread across 37 European countries. The database compiles clinical data of over 7 000 individuals with Autism Spectrum Disorder.

EU-AIMS: This project has set up a clinical research network in autism which currently consists of 93 sites spread across 37 European countries. The database compiles clinical data of over 7, 000 individuals with Autism Spectrum Disorder.

PROTECT: established an open access Adverse Drug Reaction database and Drug Consumption Databases.

Along the same lines, the majority of the stakeholders (76%) believe that the JU projects have resulted in specific scientific and/ or technological successes.

Figure 13: Do you consider that JU projects have resulted in specific scientific and/ or technological successes?



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

The importance of the sustainability of project results and outputs beyond the end of the projects is underscored by the experts, as they consider it to be an important success factor leading to the realisation of the greater, high-level and long-term objectives of the JUs. A sample of such projects is presented below.

Example box: Sustainability of JU funded project results

IMI JU: The eTOX project aimed to develop a drug safety database to better predict the toxicological profiles of small molecules in early stages of the drug development pipeline. The database includes a mature and professional software platform and a collection of useful models to support toxicity prediction. Several tools are now freely accessible for the scientific community benefit.

ARTEMIS JU: The AUTOSAR (AUTomotive Open System ARchitecture) was originally developed as a European standard for automotive systems integration (electronic control units) but has now been adopted world-wide by manufacturers, including in the US and Japan.

CS JU: The Tech 800 engine demonstrator provides a platform to test new engine designs with significant environmental and economic characteristics. The technologies were integrated in the product development of the new Turbomeca ARRANO engine, which has recently been selected by Airbus helicopters for the new Airbus H160 helicopter.

Patent applications

The industrial nature and orientation of the research agendas of the JUs is best reflected by the outstanding performance of CS JU and ENIAC JU in filing a large number of applications for patents (see table below). On average, the JUs under FP7 filed 2.73 applications per EUR 10 million of funding against 1.20 applications for the FP7-Cooperation Specific Programme.

Table 5: Patent applications filed by FP7 JUs funded projects

Joint Undertaking	FCH	CS	IMI	ENIAC	Artemis	Total JUs	FP7 Cooperation*

IPR reported as patent applications	36	151	32	303	49	606	1 593
No. of patent applications per EUR 10 million	0.82	7.44	0.33	6.46	3.49	2.73	1.20

Source: EC calculation based on the evaluation reports and CORDA data; FP7 data are reported based on the FP7 projects by July 2017

Publications

On average, the JU funded projects under FP7 published 34 publications per EUR 10 million against 41 respectively published by the projects funded by the Cooperation Specific Programme. Even though the output of the JUs in terms of publications is lower than that of the FP7 Cooperation Specific Programme, the FP7 JU output is still impressive considering the industrial relevance and closer-to-the-market positioning of the JU funded projects.

Table 6: Publications published by FP7 JUs funded projects

Joint Undertaking	FCH	CS	IMI	ENIAC	Artemis	Total JUs	FP7 Cooperation
Total publications	497	499	2 675	2 381	1 460	7 512	55 115
Average number of publications per EUR 10 million	11.34	24.59	27.70	50.77	103.86	33.89	41.36

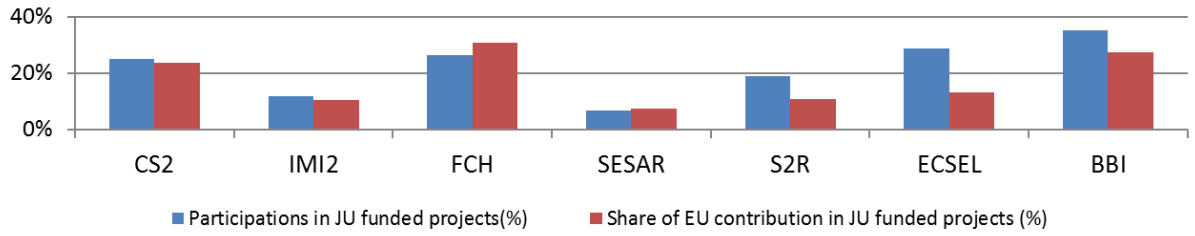
Source: EC calculation based on the evaluation reports and CORDA data; FP7 data are reported based on the FP7 projects by July 2017

6.2.4. SME participation

Overall, the SME rates in the signed JU grants under Horizon 2020 amount to 22% in terms of participations and 18% in terms of share of EU funding. Even though they represent a significant improvement in comparison to FP7 (20% and 16% respectively), on average, these rates are lower than the corresponding combined rates in Pillars II (the LEIT part) and III ("Societal Challenges") of Horizon 2020, which are 27% and 24% respectively.

It is observed that the SME rate vary sometimes substantially among the JUs. This is to be expected considering that some sectors are, by nature, less conducive than others to SME participation. For example, as shown in Figure 14, FCH2 JU, BBI JU and CS2 JU exhibit SME participation rates higher than 20%, thus exceeding the overall target of 20% of the Horizon 2020 budget earmarked for SMEs. On the other hand, SESAR JU and IMI2 JU present low participation rates, below or close to 10% in terms of share of EU funding. In the case of the IMI2 JU, the experts note that the SME rates decreased in comparison to IMI JU under FP7. In other cases, like for S2R JU and ECSEL JU, it is observed that the SME participation rates are almost double than their shares of EU funding, suggesting that participating SMEs have targeted responsibilities requiring relatively less resources.

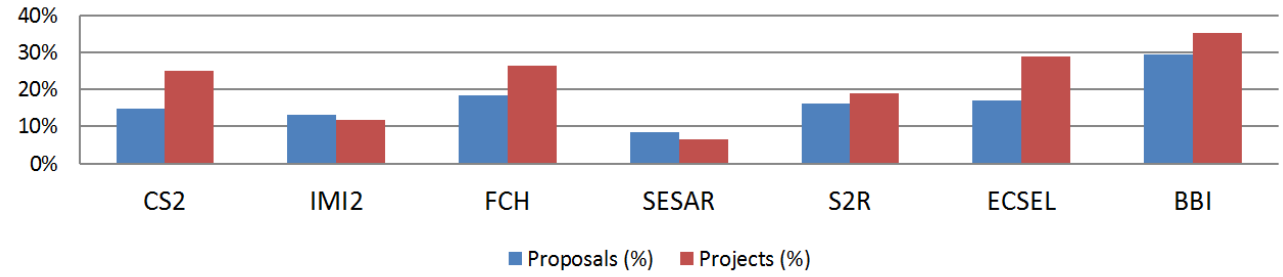
Figure 14: SME participation rates in funded projects for JUs under Horizon 2020



Source: EC calculations based on CORDA, data extraction on 17 January 2017

Figure 15 shows that with the exception of IMI2 JU and SESAR JU, the SME share of EU funding is higher in funded projects than in proposals, and in some cases (CS2 JU, ECSEL JU) substantially higher. This is indicative of the capacity of SMEs to be part of strong consortia that submit proposals of higher quality. It may also be due to the measures introduced by some JUs in order to increase the presence of SMEs in their activities like, for example, defining SME-friendly topics in calls for proposals, providing for specific SME representation in the Governing Board etc.

Figure 15: SME share of EU funding in proposals and projects for JUs under Horizon 2020



Source: EC calculations based on CORDA, data extraction on 17 January 2017

In fact, the issue of SME participation should be considered separately for each JU by taking into account the respective industrial characteristics. In this respect, it is important to study the differences between JUs and the typical industry profile participating in JUs' activities. For some JUs, SME participation objectives are easier to reach simply due to the nature of their private sector, e.g. in the case of ECSEL, where over 1000 organisations took part in the JU activities in the period 2014 – 2016 and, correspondingly, the SME participation was also above average, hovering around 27%. On the other hand, JUs like SESAR, which support research in air traffic management in Europe, attract partners with a different profile, since air traffic management is not an area of interest to typical SMEs. Other barriers that can prevent SMEs to participate are[11]:

- Competition with other programmes at national level and EU level, which are sometimes more attractive to SMEs, such as the SME instrument and Eurostars;
- The rather short deadlines in the calls, in combination with a rather long time-to-grant from an SME perspective;

[11] SWD Interim evaluation Horizon 2020

- SMEs have relatively weak links with the rest of the innovation ecosystem (academia, pharmaceutical industries), thus facing problems to join the right consortia;
- Topics that are too narrowly defined for SMEs, which would need more flexibility

The results of the public consultation show that 67% of the respondents agree that the JUs sufficiently encourage participation of SMEs in their research funded projects. However 20% of the respondents disagree, proving that there is a need for a continuous effort from JUs to involve SMEs and to tackle the potential barriers.

6.2.5. Member States participation and Widening

Member States' participation rates in JU funded projects are quite similar to those in Horizon 2020 projects as shown in the table below. More specifically, table 7 presents the Top 10 ranking of the Member States by share of JU funding and the same ranking by share of the Horizon 2020 funding. It is observed that 9 out the 10 top Member States are the same under both rankings. The exceptions are Denmark and Finland which swap between the 10th and 11th positions in the two rankings. It is also observed that the cumulative shares of funding and participations are close to each other, with the JU rates being consistently higher by around 5%. This relatively small difference in the rates can be attributed to the more focused, product or market oriented research promoted by the JUs, a declared JU objective, which typically attracts participants from the top industrial Member States.

Table 7: Top 10 Member States by share of JU funding (left) and Top 10 Member States by share of Horizon 2020 funding (right)

Ranking by share of JU funding	Member State	JU	
		Share of participa-tions	Share of JU funding
1	Germany	16.1%	19.9%
2	France	13.3%	14.7%
3	UK	8.7%	14.5%
4	Netherlands	8.4%	11.0%
5	Italy	9.3%	7.9%
6	Spain	10.5%	7.8%
7	Belgium	5.7%	6.2%
8	Austria	5.4%	4.3%
9	Sweden	4.6%	3.4%
10	Finland	3.0%	2.5%
Total Top 10		**85.3%**	**92.2%**

Ranking by share of H2020 funding	Member State	Horizon 2020	
		Share of participa-tions	Share of H2020 funding
1	Germany	13.7%	18.4%
2	UK	13.5%	16.2%
3	France	10.8%	11.0%
4	Spain	11.3%	9.5%
5	Italy	10.6%	8.7%
6	Netherlands	6.9%	8.3%
7	Belgium	4.9%	5.3%
8	Sweden	3.4%	3.7%
9	Austria	3.1%	3.0%
10	Denmark	2.5%	2.6%
Total Top 10		**80.6%**	**86.7%**

Regarding Widening, the participation rates of the EU-13 Member States in JU funded projects amount to 7.3% in terms of number of participations and 3.6% in terms of share of EU funding. While these rates are higher than those of FP7 (4.3% and 2.3% respectively) and suggest improved performance over time, they are nevertheless lower than the corresponding combined rates of 8.2% and 4.7% in Pillars II (the LEIT part) and III (Societal Challenges) of Horizon 2020. Here again, one important reason for the poor performance of EU-13 in JU funded research is considered to be the more focused, product or market oriented research promoted by the JUs that corresponds well to the interests and capacities of applicants from advanced industrial countries.

While it can be argued that the extent of EU-13 participation is generally commensurate with the number of researchers or the scale of R&D investment, it is acknowledged that EU-13 rates are still rather low, despite their improvement over FP7.

6.3. Efficiency

All expert groups concluded that the JUs carry out their **operations** in an **efficient** manner. The Commission shares the positive views of all expert groups on the operational efficiency of the JUs, even though it is unfortunate that the current lack of Horizon 2020 project outputs limits the possibility for an in-depth comparative assessment of inputs invested against outputs/impact acquired.

Most experts consider the JUs to be lean and efficient organisations operating with low administrative costs (5 out of 7 JUs function below 5% of their operational budget) given the complexity, spectrum and volume of operations that they are called to carry out by respecting and following EU rules and procedures.

Basic performance indicators such as time-to-grant, time-to-inform and time-to-pay are all shown to be within the set targets and have shown improvement in comparison to the first generation JUs under FP7.

*JUs carry out their operations in an **efficient manner***

***Programme management** indicators have improved*

***High levels of satisfaction** with JUs' services among stakeholders*

Summary Box: Experts conclusions on the JUs operational efficiency

CS 2 JU: - The Clean Sky Programme Office performs remarkably well and efficiently.

FCH2 JU: The overall operational efficiency of the FCH 2 JU has improved as the institution has matured. Settlements of prepayments and costs claims (TTP) were never late, which is a very important fact in particular for SMEs and beneficiaries of large demonstration projects.

IMI 2 JU: The operational efficiency including the efficiency of management and budget execution is satisfactory for IMI2 JU as well as IMI JU.

S2R JU: S2R is still setting into its management processes. The management functions of the JU appear to be timely and well executed. There is no benchmark for time-to-grant, as there are few calls to base this on. There are some areas which may improve matters in the future.

SESAR JU: There is currently limited evidence available to gauge the efficiency of the SESAR JU under Horizon 2020 rules, as only a limited part of the programme has been just launched. The SESAR JU has engaged extra staff with the requisite knowledge to deal with the additional burden. Current metrics indicate transition issues from SESAR 1, but this was due to an initial lack of knowledge by the JU and its members of the Horizon 2020 rules, procedures, and tools as well as lack of maturity in those rules, procedures and tools, which caused some delays. The SESAR JU has already taken corrective action and performance levels have returned to the excellent levels of SESAR 1.

6.3.1. Analysis of the Joint Undertakings' performance

6.3.1.1. Timely execution of the functions

The summary table below shows that the JUs were efficient in producing the planned outputs (issuing calls, evaluating proposals and administering grants) and achieving good results in terms of KPIs. All calls for proposals were published and closed according to the respective work plans. The results regarding 'time-to-grant' and 'time-to-pay' are considered as very good, as all JUs remained well below the defined targets. The KPIs corresponding to 2016 demonstrated an improvement compared to the values corresponding to 2015 (e.g. the average time-to-grant in 2016 is 222 days compared to 261 days in 2015).

Table 8: Management performance indicators (2016)

Management performance indicators 2016	CS2	IMI 2	FCH 2	BBI	S2R	SESAR	ECSEL
Time-to-inform (target 153)	74.5	76	126	99	92	113	71
Time-to-grant (target 245 days)	218	232	222	233	184	240	224
Time-to-pay (final - 90 days)	69	62	71	n/a	n/a	55	79

Source – EC calculation based on Annual Activity Reports 2016; time-to-pay figures are mostly for FP7 projects, as there are only a limited number of interim-payments for Horizon 2020 projects

Similarly, the time-to-pay indicator was well within the target. There were no notable issues in pre-financing, interim payments or in final payments. The BBI JU and S2R JU, having been established recently, have not registered any interim or final payments yet, while for the rest of the JUs the time-to-pay is within the 90-day target.

The systematic monitoring of the JUs' operational performance started in 2011. In 2014, the basic performance indicators were redefined under Horizon 2020 rules and procedures and, in addition, ambitious respective targets were also set. The absence of set targets under FP7 limits the possibility for a comparative assessment of the performance of the individual JUs under FP7 and under Horizon 2020.



JUs project coordinators assessed the overall timelines of the key processes positively

The JU project coordinators were asked in the survey to assess the overall timeliness of the processes involved in the proposal application stage. The majority of the respondents (77%) expressed their positive opinion about the duration of the time-to-inform. The time for grant preparation was assessed positively by 68% respondents. The opinions of coordinators were slightly less positive on the overall time-to-grant (58%).

6.3.1.2. Cost-efficiency of the programme management

The cost-efficiency indicator used in the evaluations of the individual JUs is defined by the ratio between the administrative costs (e.g. infrastructure, staff salaries, external IT services and others) and the operational budget managed by the JU.

Overall, the programme management cost ratio (administrative/ operational budget) remains below or close to 5% and this points to rather lean and efficient organisational structures.

Table 9: Administrative efficiency

Administrative efficiency 2016	CS2	IMI 2	FCH 2	BBI	S2R	SESAR	ECSEL
Programme management cost ratio (administrative/ operational budget)	3.10%	4.34%	5.37%	4.95%	4.67%	6.97%	2.05%

Source: Annual Activity Reports 2016, calculation by the Commission based on payment appropriations

Average evaluation costs per proposal vary substantially among JUs. The reported 2016 figures range from EUR 902 to more than EUR 6 000. These significant variations from one JU to another are due to differences in particular in the respective proposal evaluation procedures, the most important being the two-stage proposal evaluations and the organisation of hearings.

6.3.1.3. Budget execution

The JUs implement approximately 10% of the overall Horizon 2020 budget through EU contributions ranging from EUR 450 million for the S2R JU to EUR 1 755 million for the CS2 JU.

Table 10: Horizon 2020 contributions to each JU budget

	CS2	IMI 2	FCH 2	BBI	S2R	SESAR	ECSEL
Maximum EU contribution (EUR million)	1755	1638	665	975	450	585	1185
% from Horizon 2020 budget	2.26%	2.21%	0.86%	1.26%	0.58%	0.76%	1.54%

Source – EC calculation based on the Council Regulations establishing JUs

Regarding operational budget execution, on average the JUs executed their respective budget by 96% (commitments) and 80% (payments) over the 2014-2016 period. While this is not considered an optimal performance, it can be explained, at least in part, by the phasing in and adapting to the new Horizon 2020 rules and procedures, as well as the result to use newly developed corporate IT tools.

Table 11: JU Operational budget execution 2014-2016

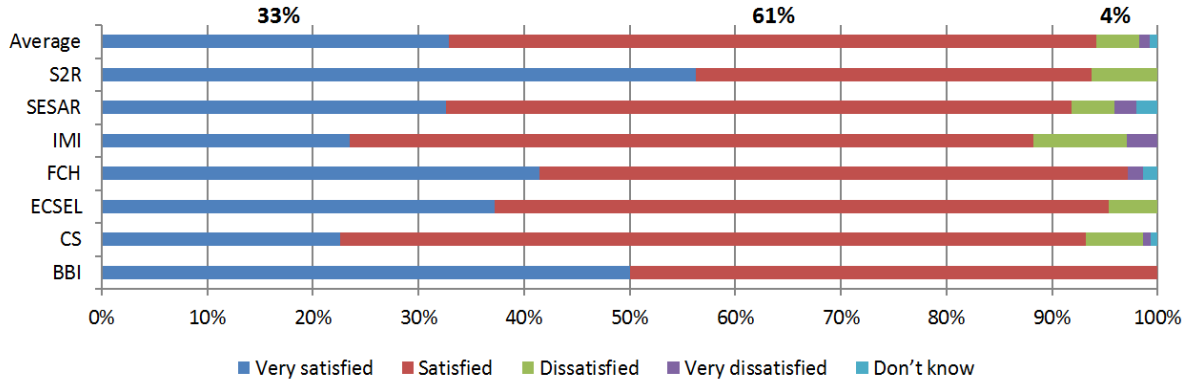
Budget execution in 2014 - 2016	CS2	IMI 2	FCH 2	BBI	S2R	SESAR	ECSEL
% to Commitments	97%	93%	89%	93%	100%	98%	99%
% to Payments	84%	72%	83%	99%	87%	66%	72%

Source – EC calculation based on Annual Activity Reports 2016

6.3.2. Beneficiary satisfaction with the JU services

Overall, 94% of the project coordinators are very satisfied (33%) or satisfied (61%) with the services provided by the JUs. It is interesting to note that the two most recently established JUs, S2R and BBI, record the highest rate of project coordinators' satisfaction for services provided, which is 56% and 50% respectively.

Figure 16: Overall satisfaction with the services provided by JUs



Source: Results of the seven Joint Undertakings project coordinators surveys

The project coordinators acknowledge that the JUs strive to provide excellent programme management and high quality services and praise JU staff for knowledge and competence (90%), commitment to providing quality service (89%), as well as courtesy and availability (92%).

6.3.3. Simplification

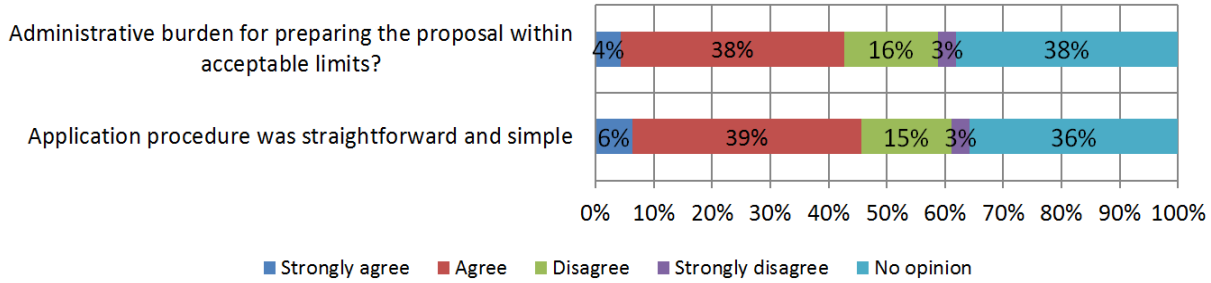
A key feature of Horizon 2020 is that it has been constructed from the outset around a radical simplification of previous rules and procedures to attract more top researchers and a broader range of innovative enterprises. The simplification measures focus mainly on simplified business processes and simpler rules for applicants and participants. JUs under Horizon 2020 benefit from a number of implementation features that will make them better fit for purpose. Cutting red tape for businesses in Horizon 2020 includes:

- Simplified administration through alignment with Horizon 2020 (uniform application of Horizon 2020 Rules for Participation[12] and funding rates).
- Establishment of the Common Support Centre (CSC). The CSC assists the Commission departments implementing Horizon 2020, as well as the JUs.
- Lighter financial rules – based on Article 209 of Financial Regulation[13].
- Fewer controls and audits, but without compromising the sound financial management of EU funds.
- Introduction of additional activities – commitment of industry in order to leverage more investment in the form of in-kind contributions.

Figure 17: When you applied for funding from the JU, did you think that:

[12] 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)" and repealing Regulation (EC) No 1906/2006 (OJ L 347, 20.12.2013, p. 81).

[13] SESAR JU has financial rules based on Article 208 of the Financial Regulation.



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

To a certain extent the improved operational efficiency can be attributed to the uniform application of the Horizon 2020 Rules for Participation and the accompanying simplification measures and to the corporate IT support tools that have grown to maturity since FP7. While this is true for many of the JUs, the SESAR JU experts consider that enforcing the application of the Horizon 2020 rules that were developed specifically for carrying out traditional R&I activities, may not be the most appropriate approach for PPPs such as the SESAR JU, which carries out activities beyond R&I[14]. They also express concern on the cumbersome reporting imposed to each JU member by the above-mentioned rules, which may lead in some cases to double reporting requirements.

Others, like the experts of the CS2 JU and S2R JU mentioned the obligation imposed by the Horizon 2020 Rules for Participation to use the common IT applications that, in their view are not adapted to the specific JU reporting needs. On this issue, it should be emphasised that despite a number of teething issues experienced immediately following the launch of Horizon 2020, the corporate IT applications have evolved significantly since then and are now delivering state-of-the-art support and responding to the specific requirements of a large community of users on a constant basis.

Opinions from the stakeholders in the open public consultation varied when assessing the administrative burden for preparing the proposal and application procedure. Overall, 45% of the respondents consider that the application procedure is straightforward and simple. 42% of the respondents expressed their agreement that the administrative burden for preparing the proposal was within acceptable limits.



JUs project coordinators confirmed that JUs under Horizon 2020 present improvement compared to JUs under FP7

A majority of respondents to the JU project coordinators survey (58%) agrees that the second generation JUs present an improvement compared to their predecessor under FP7. The responses refer to IMI2, CS2, FCH2 and ECSEL JUs.

6.4. Coherence

[14] It should however be noted that SESAR JU has followed, under Horizon 2020, a different approach in its basic act (amendment of the SESAR JU regulation instead of re-establishment of the JU) and is not using the financial rules based on Art. 209 of the Financial Regulation, specifically introduced in order to facilitate budget implementation through PPPs, but those for Regulatory Agencies under Art. 208 of the Financial Regulation.

***Good synergy** with relevant parts of Horizon 2020*

Closer cooperation and alignment of** research and innovation at **national and regional level

***Risk of decreased national funding** due to*

This section examines how well the JUs' activities align with other instruments of similar objectives and their relation to other Union funding programmes. Based on the specific evaluation findings, Figure 19 at the end of this section presents an overview of the coherence of JUs' activities with those of Horizon 2020 and with the EU, national and regional policies.

Being part of and supported by Horizon 2020, it is important that the JU specific objectives,

both long- and short-term, are synchronised and complementary to those of the framework programme. Most expert groups acknowledge the efforts made by the Commission services and the JUs to ensure coherence in the research priorities and avoid duplication in the funded projects. They conclude that the JUs' activities are overall coherent and well-coordinated with their respective parts of the framework programme.

For example, in the case of the ECSEL JU, the experts commend the efforts made by the Commission services to promote the JU activities and ensure that Horizon 2020 calls specifically require synergies with ECSEL activities.

The SESAR JU experts consider that coherence with Horizon 2020 is ensured through synergies with the CS2 JU and also by working together with ACARE[15] in defining synchronised and complementary research priorities.

The IMI2 JU experts identified similar objectives with a number of Joint Programming Initiatives, citing also views of stakeholders advocating for a better coordination with Horizon 2020 funded projects and for building on synergies.

Example Box: Coherence of the Joint Undertakings with Horizon 2020 – The experts' view on the BBI JU

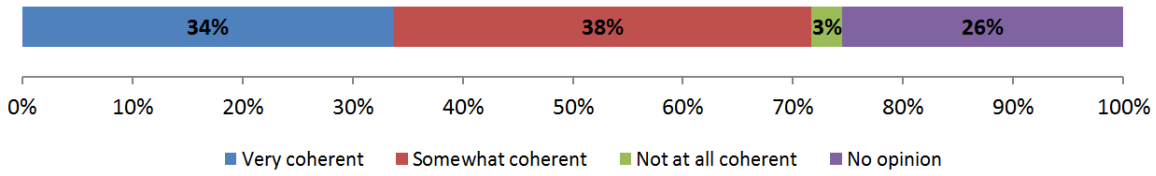
The experts consider that the objectives of the JU are in line and complementary with other parts of Horizon 2020. They specifically cite:

- The JU mainly finances projects with much higher Technology Readiness Level and market potential compared to Horizon 2020 projects.
- A working group between BBI JU and SPIRE (Sustainable Process Industry through Resource and Energy Efficiency; a contractual Public-Private Partnership) under Horizon 2020 was established in June 2016 aiming at searching for synergies and collaborations between the two partnerships and at avoiding redundancies in the work programmes and projects.

Around 72% of the consulted stakeholders consider the activities of the JUs to be very or somewhat coherent with Horizon 2020 activities; only 3% think otherwise.

Figure 18: To what extent are the activities of the JU coherent with other activities of the Horizon 2020 programme?

[15] ACARE: Advisory Council for Aviation Research and innovation in Europe



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

Regarding coherence with EU policies, while all experts agree that the JUs are effectively supporting the goals of EU policies in the fields of energy, transport, environment, competiveness and citizens' health and wellbeing, they consider that there is still room for additional synergies and efforts to this end.

A notable exception is raised by the FCH2 JU experts, who underline the difficulties faced by this JU to position itself and contribute meaningfully to the EU energy and transport policies, due to the lack of clearly defined boundaries in the scopes of the two policies (in FCH relevant contexts). They concede, however, that the issue is beyond the will or power of the JU to rectify.

Focusing on the synergies with large scale initiatives across Europe, like the ITEA and EURIPIDES programmes under EUREKA, the ECSEL JU experts identified complementarities, synergies and links, noting, however, the need for closer collaboration in order to avoid potential overlaps.

Unlike their positive views on JUs' coherence with parts of Horizon 2020, the experts consider that the alignment of the JUs' activities with the relevant policies at national and regional level varies from one JU to another, reflecting the different Smart Specialisation priorities and research and industrial capacities of the EU countries and regions.

Specifically, while the SESAR JU experts consider that there exist strong policy links at all levels (global, EU, national and regional), the ECSEL JU experts call for synchronisation with national activities. Similarly, the IMI2 JU experts detect "a lack of buy in" by Member States leading to a limited alignment with national policies and strategies. In the case of the CS2 JU, the experts conclude that the coordination of national programmes has not yet yielded visible and explicit results and call for more action to this end.

Regarding SESAR, the experts point to an interesting observation: the emergence of SESAR and its increasingly important role as an EU-wide authority and leader in Air Traffic Management (ATM) technology has led to a gradual retreat by national programmes from pure ATM research. Therefore, the success of the EU-level initiative has caused an important scaling back of other funding sources in the EU.

Example Box: Coherence of the Joint Undertakings with national activities – The experts' view on FCH2 JU

There is no obvious evidence that there are overall synergies or cooperation between FCH 2 JU and similar international, national and intergovernmental programmes.

National programmes and interventions are in some countries formed through workshops and discussions with relevant national stakeholders. By evaluating the specific needs at a national level, strategies and work plans are not influenced by the priorities in FCH 2 JU.

Consequently, the coherence between national programs and FCH 2 JU can be weak. Thereby, projects are funded through other channels such as national programmes and structural funds.

At regional level the experts report on the efforts of the FCH2 JU that signed 70 memoranda of understanding with EU regions and municipalities and those of the CS2 JU that signed memoranda of understanding with 13 EU regions with 8 pilot projects currently being under preparation.

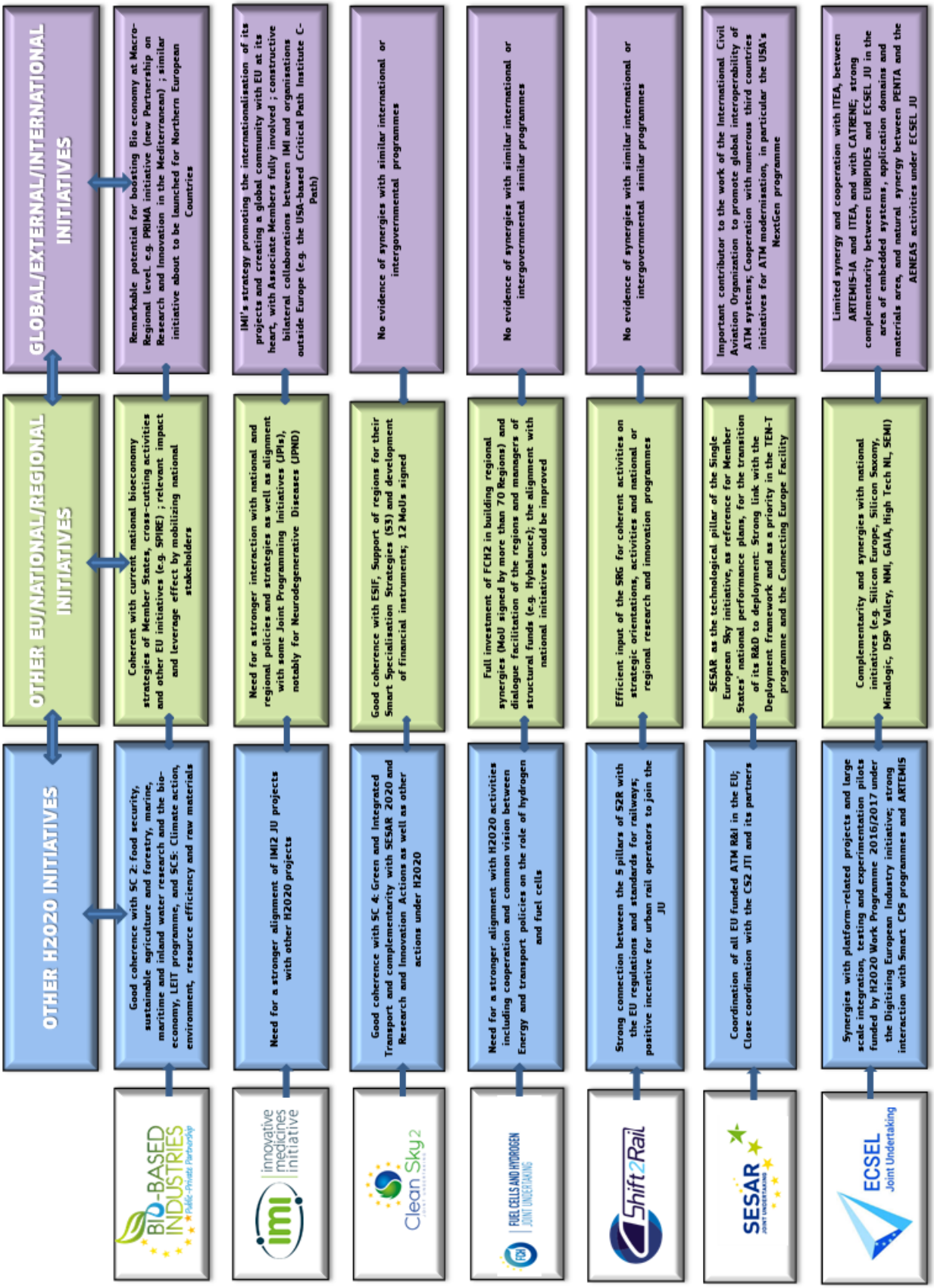


Figure 19: Co-operation and synergies with other programmes and partners

6.5. EU added value

EU added value is an important consideration in order to demonstrate that an action at the Union level is indeed necessary and the targeted effects cannot be achieved by the industry alone, or by its partnership with the Member States without an intervention at the EU scale.

The evaluation reports show that the JUs are working well towards the overarching objectives and provide European added value.

Some of the most important effects highlighted by the expert groups in the evaluation reports and supported by the opinion of the external stakeholders can be summarised as follows:

1. Integration of European research
2. More cross-border and cross-sector/interdisciplinary collaboration
3. Creation of a powerful framework for academic and industrial research
4. De-risking effect and encouragement of entrepreneurship
5. Better use of the available funding; better availability of research results
6. Quicker adoption of standards
7. Building of a genuinely EU-level supply chain capability
8. Resolving structural issues within sectors

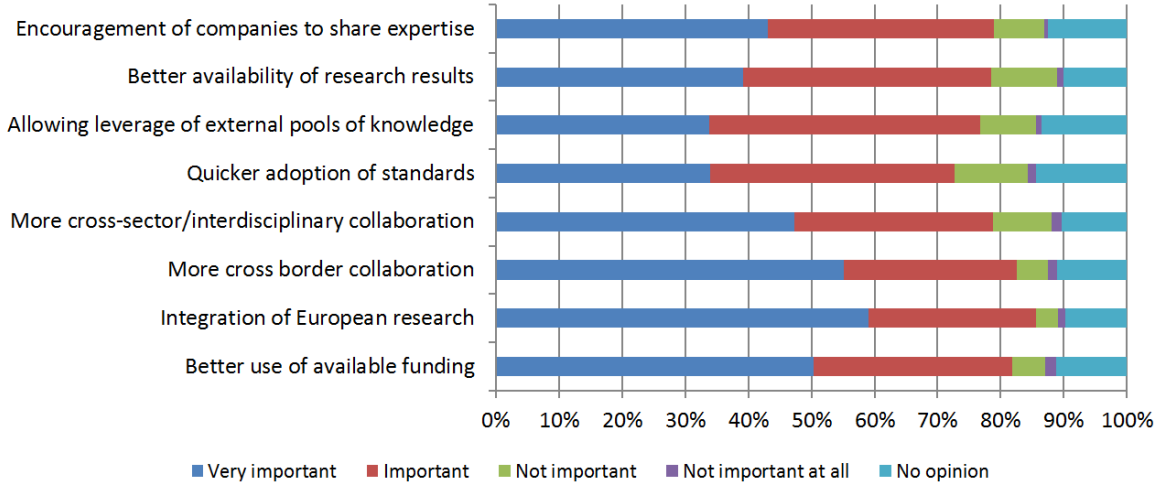
Integration, lowering risk, solving structural issues, building EU-level supply chains *are among the key improvements brought by JUs*

Leverage effect *seems to be well on track*

Long time needed for research results to reach impact *– mostly indirect effects of EU added value can now be observed*

Of the above list of effects, the integration of European research, better availability of research funds and more cross border collaboration were the top three responses by the stakeholders in the public consultation.

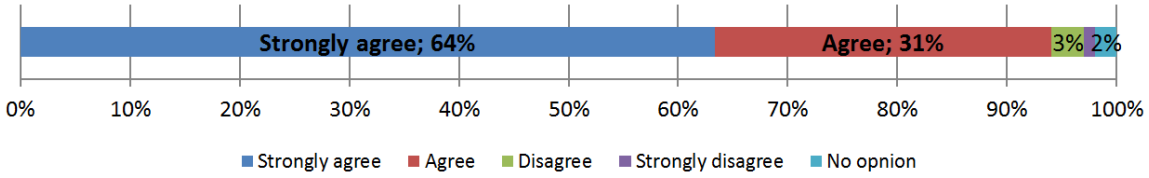
Figure 20: What is the added value of the public-private partnership?



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

The absolute majority (96%) of the respondents either strongly agreed (64%) or agreed (31%) that the EU cooperating with industry in the context of a public-private partnership brings better results to the society and the different markets in Europe.

Figure 21: EU cooperation with industry in the context of a public-private partnership brings better results to the society and the markets in Europe



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

When asked to express their opinion on whether "industry along with other possible actors at national level but without the involvement of the EU" would be able to overcome the barriers which hinder innovation and drive up costs in the particular industry sector, 74.5% of the respondents either strongly disagreed (30.3%) or disagreed (44.2%) with the statement.

Of special note are the JUs with a particular mission to integrate existing national systems, such as the SESAR JU and S2R JU (see example box).

Example box: EU- added value – S2R JU: The experts' view

- S2R JU has helped to create continuity and shared common vision for rail research within the railway community. It is clear that this alone will help to deliver a more coordinated and seamless rail system.
- It has helped to build trust between players that would otherwise not have the opportunity to share ideas and common interests outside a commercial situation.
- The rail supply industry is still highly fragmented as local suppliers have served many national rail operators for many years. S2R JU plays an important role in bringing these players together at European level, and thus aligning developments for achieving the Single European Rail Area. Its outputs should also reduce their costs and (by eliminating standards conflicts) speed up deployment (increasing interoperability).
- Compared to the previous situation, a far better continuity will be obtained in projects planning and, as a consequence, in the coordinated participation of all stakeholders.
- JU will lead to better services to the stakeholders and addressees as compared to the alternative options.
- The creation of the JU appears as an excellent way of promoting the EU policies for rail and also to promote the sector's leadership position.

In SESAR's case, the experts consider that by its very nature the consolidation of the European air traffic management cannot be achieved at the level of individual Member States.

In the case of ECSEL, the EU added value stems from the tripartite nature of the JU. Participating States renewed their contribution to ECSEL after the merge of the ENIAC and ARTEMIS JUs. The Participating States clearly see added value compared to the intergovernmental Eureka programmes in having a strategic instrument where they team up with the Commission to enable strategic actions that they cannot support in the other existing programmes, at national or intergovernmental levels.

A relevant recognition of IMI's worldwide reputation is offered by the IMI2 JU experts, reporting that in a US House of Representatives issued white paper on the "21st Century Cures initiative" (February 2015), it is acknowledged that what is missing in the USA is a public-private partnership that would bring together the various stakeholders and would need to be "modelled after the Innovative Medicines Initiative".

As already mentioned above, it should be clear at this stage that mostly indirect effects may be observed (e.g. establishing framework, building capacities, developing community, lowering risk, etc.). Although some Horizon 2020 JUs report jobs created through their actions, these are usually projections based on trends started by a few early Horizon 2020 projects. Similarly, project results for JUs' Horizon 2020 activities are limited, with most supported projects still in early stages. Concrete numerical evidence is not yet available. SESAR is an exception, as it is more advanced in connecting R&D with industrialisation and deployment. Since 2014, there are EU rules making the deployment of essential SESAR solutions mandatory for the Member States. The SESAR JU is at the heart of SESAR's ATM modernisation lifecycle.

6.5.1. Leverage effect

A key objective and measure of the success of the JUs is their capacity to leverage private funding, the minimum amount of which is explicitly mentioned in the respective JU establishing Council regulations.

While it was generally agreed that the JUs under FP7 managed to leverage private funding that matched or exceeded the EU funding, it became clear from the evaluation findings and comments of experts that the private members reported in-kind contributions without clear references to the methodologies used for such calculations.

Given the importance of the leverage effect in the justification of support for the JUs, existing and future, the description of a methodology for the calculation of in-kind contributions, commonly agreed by the private members of all JUs, has been drafted by the Commission services and is now used by the JUs operating under Horizon 2020.

The calculation of the leverage effect takes into account on one side the operational component (private in-kind and financial contributions to projects for each euro committed by the European Commission) and on the other side the additional leverage (private contributions to additional activities not directly linked to the portfolio of projects but contributing to the overall JUs' objectives).

For the CS JU, IMI JU and FCH JU operating under FP7 the target for the leverage effect was to achieve parity, i.e. that the contributions from the private side matched those from the EU. All experts agreed that the FP7 JUs have met, even exceeded their respective targets.

The experts report that even in the cases of the ENIAC JU and ARTEMIS JU where no specific targets were set, the two JUs clearly succeeded in increasing both private and public investment in the respective sectors, reporting that EUR 630 million of EU funding under FP7 leveraged EUR 912 million of national contributions and EUR 2.46 billion of private funding. Finally, the SESAR JU experts estimate a leverage of 1.8 counting in the contribution of EUROCONTROL.

While the definite amount of leveraged funding will only be known at the end of the JUs' operations, current Commission estimates point to private sector committed funding that already equals or exceeds the set targets in four out of seven Joint Undertakings whereas for the remaining three, the leverage funding is closing in (table 12). In reading table 12, it should be noted that the presented leverage effects should not lead to a comparison between JUs but, rather, to assess progress against the targets set by the respective Council regulations. Evidently, the target leverage effects reflect the individual JU characteristics.

Table 12: Interim values of leverage effect compared to the overall Horizon 2020 targets

Joint Undertaking	FCH2	CS2	IMI2	BBI	ECSEL*	S2R*	SESAR*
The overall Horizon 2020 targets (EUR million) set in the Council Regulations over the whole period 2014-2020							
Total minimum contribution from members other than the EU	380	2 193	1 638	2 730	1 657	470	825
EU contribution	570	1 755	1 638	975	1 184	450	585
Interim values for the calls concluded by December 2016 (EUR million)							
Operational component (in kind and in financial contributions by members to projects)	279	131.58	263.5	115.37	1 089.02	79.3	241.4
Certified additional activities	186.4	199.16	n.a.	291.48	n.a.	0	n.a.
Committed EU contribution to projects	286	214	275.88	228.69	459.98	88	235.8
Interim values of leverage effect for the calls concluded by December 2016							
Target leverage effect over the whole 2014-2020 period**	**0.67**	**1.25**	**1.00**	**2.80**	**1.39** (on EU funding only)	**1.04**	**1.41**
Interim values of leverage effect (December 2016)***	**1.63**	**1.55**	**0.96**	1.78	**2.17**	0.90	1.02

Source: EC calculation based on committed amounts presented in JU Annual Activity Reports 2016 and complemented by CORDA data (with the exception of BBI JU which is solely based CORDA data). Costs in additional activities in 2016 which are not yet certified have not been taken into account.

**Please note that ECSEL JU and SESAR JU receive additional contributions from the Participating States and Eurocontrol respectively. Additional details can be consulted in the evaluation report.*
For S2R only 70% of the EUR 450 milion of EU contribution is planned to contribute to the leverage effect (i.e. (up to) 40% is reserved for the Founding Members and (up to) 30% going to the Associated Members). The remaining 30% is equivalent to the main H2020 open call programme, although it is managed by the JU rather than the Commission; see also Article 17, Annex I to the Council Regulation (EU) 642/2014 of 16 June 2014 establishing the S2R JU.
*** The ratio is calculated as a total minimum contribution from members other than the EU set in the respective Council Regulations over EU contribution*
**** The ratio is calculated as the sum of operational component and certified additional activities over the committed EU contribution to projects*

Stakeholders opinion: the current minimum leverage targets are realistic

When asked to assess if the current minimum leverage targets foreseen in the Council Regulations establishing Joint Undertakings, 58.4% respondents to the open public consultation stated that the level is realistic, 10% think that it is too low, while 12% believes that it is too high.

The opinions expressed in the open questions confirm that the current minimum leverage targets are feasible and come across as fair and balanced. The leverage also depends on the specific area of research –for the projects closer to commercialisation the value should be higher, while for basic research more public contribution is needed.

However, some of the industry respondents emphasised on the importance of the flexible framework for the valuation of the in-kind contributions. For example, a narrow interpretation of Horizon 2020 rules led companies either to declare contribution much lower than their actual costs or renounce to participate in projects where their costs would not be considered eligible. The respondents consider that the real leverage effects are actually higher than the reported figures.

The BBI JU and IMI2 JU are the only currently operating JUs for which there is a specific provision in the Council Regulation for financial contributions to the operational costs of the JU by the private members. Owing to difficulties by the private members to contribute financially to the operations of the BBI JU, the Commission deferred part of its contribution towards the end of the programme. An amendment to the Council Regulation is under way to facilitate private members' financial contributions to the BBI JU field of activities.

6.6. Openness

For the purpose of this evaluation, openness is understood as the extent to which the JUs enable world-class research that helps Europe advance to a leadership position globally, and how they engage with a wider constituency to open the research to the broader society.

***Positive steps** towards openness*

*JUs have an **open access policy** towards **membership***

***Uneven SME** participation*

The expert groups confirmed that overall the JUs have an open access policy towards membership. As a general rule, any legal entity that directly or indirectly supports research and innovation in a Member State or in an Associated Country can become a member. However, depending on the level of the membership, some eligibility conditions and entry or annual fees apply.

It is also important to analyse the openness of JUs towards new members and to new participants. While except maybe for ECSEL JU the public side, represented by the Commission, is fixed, the private side usually takes form of a consortium of industry leaders, with its own membership requirements.

Membership policy

Most JUs apply a system where a request for membership can be submitted at any given time and is evaluated on a case by case basis. Others organise competitive calls for membership on a periodic basis. Members are asked to contribute financially and /or provide in-kind contributions to the JUs in exchange of important benefits such as direct involvement in JU governance, voice on the definition of the research agenda and call topics, etc.

In order to overcome some of the entry barriers and to demonstrate openness towards newcomers and players like SMEs, universities and research organisations, some of the JUs (CS2 JU, S2R JU) introduced different levels of membership (e.g. full members vs. associated partners) corresponding to different levels of financial contributions.

In the case of S2R JU, smaller stakeholders have the possibility of participating in different ways, as members (in this case a long-term commitment and financial contribution is expected) or as beneficiaries participating in open calls.

Openness towards newcomers

According to call participation policy, JUs:

- publish calls that are open to all, members and non-members (BBI JU, IMI2 JU, FCH2 JU, and ECSEL JU),
- prescribe restricted research activities reserved to members only and, also, publish calls on other research activities open to non-members (SESAR JU, S2R JU and CS2 JU). In addition, the SR2 JU organises calls that are reserved to non-members only,
- reserve a minimum percentage of the EU contribution to open calls (CS2 JU and S2R JU). The S2R JU experts consider that there is an argument for the open-calls for non-members to form a larger proportion of the budget.

Example Box: JUs approach to newcomers – experts views

ECSEL JU: A key requirement for the JUs funded under Horizon 2020 is that they are open to all. In this respect, ECSEL has made very good efforts to be open with all the calls made being open to all. Anyone can participate in ECSEL projects and they do not need to be a member of ARTEMIS-IA, AENEAS or EPOSS Industrial Associations.

BBI JU: The nature of BBI calls is fully open to the participation of any stakeholder. BBI JU has made great efforts in communicating the BBI JU and its calls to the stakeholders in the EU through its events, meetings and website.

IMI2 JU is open to newcomers through several modes. They can become Associated Partners with IMI2 JU, they can join EFPIA (the private partner of IMI) as members or as partners in research, or they can participate as beneficiaries in IMI2 JU funded projects. Participation of Associated Partners is still low considering the objectives established in the IMI2 JU Regulation and will need to be scaled up in the remaining years of IMI2 JU.

S2R JU: There is, however, a certain danger for the JU to be considered as a "closed shop", partly due to historical reasons that remain in people's minds. It is necessary to address this and for progress and trust to be built, especially via the open processes for the selection of future innovation topics and new partners in view of a possible S2R-2. Elsewhere in the report, referring to stakeholders' views on the "close shop", the experts mention in a footnote that "It is difficult to estimate if this is a historical reaction or the present day reality as the experts are aware of significant efforts made by the JU management to address this."

It should be noted that the efforts to foster openness and attractiveness of the JUs are already showing results; 53% of the current beneficiaries in second generation JU funded projects are newcomers i.e., they have not received funding from first generation JUs. The percentage of newcomers in JU funded projects is slightly above the overall percentage of newcomers in Horizon 2020 funded projects (52%).

Additionally, during the first three years of Horizon 2020 implementation JU funded projects attracted participants from 44 countries - an increase from FP7 where 40 countries received funding from JUs during the 2007-2013 period.

Example box: Openness – BBI JU: The experts' view

A total of 517 out of the 729 (71%) project beneficiaries are not members of the Bio-Based Industries Consortium (BIC), the private member of BBI JU. This as a signal of the openness and attractiveness of the JU.

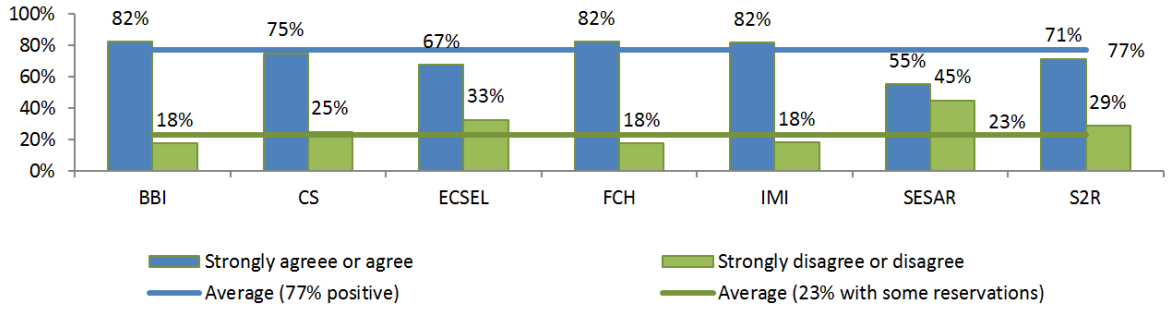
When analysing the type of participation of BIC members in funded projects, the percentage of associated BIC members has increased significantly from 2014 to 2016. Specifically, it was observed that while the percentage of full BIC members taking part in funded projects was slightly higher than that of the associated BIC members in 2014 and 2015 calls, in 2016 calls the percentage of the associated BIC members rose to 64% of the total number of BIC members. This is indicative of a significant and growing mobilisation of non-industrial BIC members.

Openness to SMEs

The evaluation reports show that the SME participation rates vary among JUs and while there are JUs with SME participation rates already exceeding the current global rates of Horizon 2020, others need to intensify their efforts to attract more SMEs to their activities. A more detailed analysis on SME participation, on participation patterns of the other type of organisations is presented in chapter 5 on Implementation and in section 6.2 on Effectiveness.

On average, the majority of the stakeholders (77%) in the public consultation considered that the JUs encourage the participation of SMEs. However, the positive (or negative) responses vary significantly among JUs. It is observed, for example, that the efforts of the BBI JU, FCH 2 and IMI2 JU to encourage the participation of SMEs are acknowledged by most (82%) of the stakeholders, whereas those of the SESAR JU and the ECSEL JU are acknowledged respectively by 55% and 67% of the stakeholders.

Figure 22: Do you consider that the JU encourages the participation of SMEs?



Source:Results of the common open public stakeholder consultation on the Joint Undertakings

6.7. Transparency

In this evaluation, transparency analyses the extent to which the JUs keep a transparent attitude towards the wide community of stakeholders and provide them with easy and effective access to information.

*Improved **communication** and interaction with stakeholders activities*

*Easy access and **clear information** provided in the JU websites*

***Need to improve dissemination** of project results*

The expert groups observe an improvement over FP7 in the way in which JUs communicate and interact with the community of stakeholders, although some areas still need attention. Under FP7, when the JUs were still struggling to establish their organisation structures, define business processes and launch operations, they had to invest additional effort into setting up their communication toolset and developing best practices.

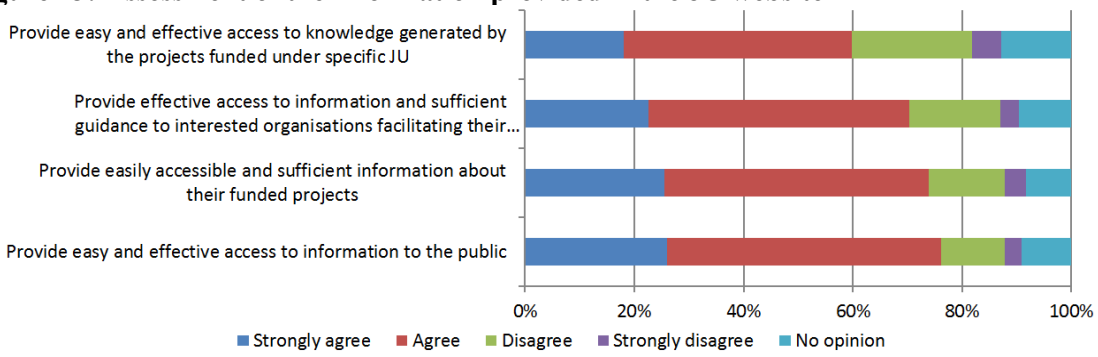
Communication

While the Horizon 2020 communication strategy is defined centrally by the Commission, the implementation of the strategy, as well as any additional support communication activities are carried out by the JUs themselves.

The procedures established by the JUs on the provision of information to external stakeholders are a crucial aspect of the transparency of the JUs. In this respect, the evaluation reports confirmed that the JUs have implemented a range of mechanisms in order to ensure an open and non-discriminatory attitude towards the wider stakeholder community, including the general public. This included various communication tools like an up-to-date, informative website, the use of social media, organisation of and/or participation in events, seminars and conferences and publications in the specialized and general press.

Overall, the respondents were satisfied with the information provided in the JU websites. The websites provide easy and effective access to information by the public (76% of the respondents strongly agreed or agreed with this statement). However, the respondents were slightly less positive (70%) when assessing JU websites in terms of providing effective access to information and sufficient guidance to interested organisations to facilitate their participation in proposals (70%).

Figure 23: Assessment of the information provided in the JU website



Source: Results of the common open public stakeholder consultation on the Joint Undertakings

Despite the overall positive views on JUs' communication efforts, however, the chair of the transport-related expert groups (CS2 JU, S2R JU and SESAR JU) considers that social media are not used consistently across JUs, while the IMI2 JU experts highlight the need for more efforts towards improving the monitoring and impact of communication activities. Finally, the FCH2 JU group of experts calls for more efforts in order to raise public awareness on FCH technologies.

Dissemination

In order to communicate on and disseminate project results to a community as large as possible, the JUs use a variety of tools, very similar to the above mentioned communication tools:

- A dedicated section on the JU's website for dissemination of project results and publishable project summaries (SESAR, BBI, CS2, ECSEL JUs). FCH2 JU, for example, has a fully searchable project database, accessible to all.
- Scientific publications and articles related to project results.
- Publication of a book summarising important project results (ECSEL, CS2, FCH2 JUs annual programme review report, SESAR JU releases, solutions catalogue and solution packages).
- Social Media such as Twitter, Facebook or YouTube to communicate and demonstrate project results.
- Organisation of and participation in events aiming at the distribution of project results (conferences, project demonstrations).

Despite the above-mentioned dissemination tools, many experts report that while project results originating from JU-funded projects are communicated effectively to stakeholders that are directly involved in the JUs, this is not the case for the external stakeholders and the general public. In this respect, the chair of the transport-related expert groups in a discussion paper reports the absence of clear dissemination strategies implemented by the JUs. A notable exception to this relatively poor performance of these JUs is the SESAR JU. In its initial days, the JU was only communicating to professionals within the relevant industries. Under Horizon 2020, this approach has changed: SESAR offers factsheets and makes available through its website the SESAR Solutions catalogue and the data packs for almost all solutions. The experts opinions are supported by the stakeholders' views on the access to knowledge generated by JU funded projects (around 60% positive assessment).

7. CONCLUSIONS

During the period from October 2016 to June 2017, a total of 39 independent experts working in seven groups evaluated the progress realised until the end of 2016 by the seven Joint Undertakings (JUs) operating under Horizon 2020.

Their findings and conclusions, specific to each JU, are presented as part of the respective evaluation reports. The present chapter presents the Commission services' view on the performance of the seven JUs operating under Horizon 2020 based on their own experience, the findings of the seven expert groups, the outcomes of the public consultation of stakeholders and the survey of project coordinators.

The **overarching conclusion** is that the JU-based public-private partnerships (PPPs), while still early for most of them to demonstrate tangible project outputs leading towards stated objectives and expected achievements, have demonstrated efficiency improvements in comparison to FP7. They have effectively managed to engage the major actors in research and innovation in the respective industrial sectors and have shown their potential as important drivers for strengthening Europe's competitiveness and helping to respond to major socio-economic challenges.

The Commission services' view is that the JUs are on track to deliver against their set objectives, despite a number of identified shortcomings that need to be addressed by the JUs, industries and the Commission services in order to improve their functioning, ensure delivery of solid output and objectively assess impact.

The industrial sectors addressed by the JUs are not only of high economic relevance for Europe but, also, areas where well-identified market risks require a long-term concerted research and innovation effort. Depending on the needs of the specific sector, JUs are fostering synergies by linking activities across the innovation cycle, from research outcomes to closer to market activities and facilitating the creation of an internal market for innovative technologies, products and services.

This view is shared by more than 95% of the consulted stakeholders who consider that EU cooperation with industry in the context of a JU-based public-private partnership brings better results to the society and markets in Europe. Moreover, 85% of the stakeholders consider that the JUs contribute to economic growth and job creation in Europe.

It is also the position[16] of the European industry associations and the European Association of Research and Technology organisations (EARTO) stating that the public-private partnerships are '*… unique platforms, which foster cooperation between public and private actors by pooling their diverse capabilities and creating the critical mass for innovative breakthrough. They also leverage the necessary funds for large-scale European projects. Understanding the channels to market as well as the challenges to upscaling, industry bridge gaps and accelerate the generation of impact and results from R&I programmes.*"

[16] "An Ambitious FP9 Strengthening Europe's Industrial Leadership – Joint Declaration by Industry and RTOs", 7 June 2017

Strengths

*The continued **relevance** of the seven Joint Undertakings in contributing directly to competiveness and EU policy goals is **confirmed** by all expert groups and the consultation of stakeholders.*

All JUs are addressing strategic technologies in sectors that are already or rapidly emerging as cornerstones of a knowledge-based European economy and are linked to the objectives of the Europe 2020 strategy and Horizon 2020.

Overall, it is confirmed that the socio-economic conditions that justified the establishment of such public-private partnerships in 2013 are still present and valid.

This is also the opinion of 78% of the respondents to the stakeholders' consultation who consider that the JU-specific strategic policy documents continue to be optimal in defining the scope of research and innovation.

Naturally, the scope varies among JUs depending on the specific characteristics of the relevant industrial sectors. For example, while it is relevant for the FCH2 JU to address the price and performance barriers that need to be overcome for the technology to be commercially viable, it is also relevant for the BBI JU to aim for a holistic and sustainable value chain approach, lower the risk for industrial investment and focus more on demonstration and deployment.

For the transport-related JUs (S2R, CS2 and SESAR), it is clear that they all show significant links with, and contribute towards achieving EU strategic goals and/or initiatives such as those detailed in the Transport White Paper.

Similarly, the IMI2 JU experts agree on the relevance of the Strategic Research Agenda and the launched calls for proposals.

Finally, ECSEL is one of the important pillars of the strategy on electronics and the main implementation of research and innovation in the area of electronic components and systems. It allows for a long-term stable environment for the fostering of advanced technologies in this area in support of the digitisation of the European economy.

*The Joint Undertakings **effectively** managed to engage the major actors in research and innovation in the industrial sectors concerned.*

One of the main achievements since the establishment of the JUs, on which there is general consensus among the expert groups, is that the JUs managed to structure and mobilise an otherwise fragmented landscape of different sectors and industries and convince competing or different, seemingly unrelated stakeholders to work together within a single project.

For the IMI2 JU, the expert group acknowledges that the JU led to a new type of consortia where competing pharmaceutical industries work together to achieve a common goal and, equally important, these consortia induced a change in the respective perceptions of scientists from academia and industry. The experts conclude that the IMI2 JU is a unique collaboration model, creating long-lasting collaborative networks.

The CS2 JU, building on the success of the first generation JU under FP7, fosters further coordinated cooperation among world-class aeronautical companies and major industry leaders in the supply chain to pursue common objectives.

The ECSEL JU and SESAR JU bring together not only academia and industry but, also, the Member States. In the case of the SESAR JU, the Member States are participating through the EUROCONTROL. In the case of the ECSEL JU - a public-private partnership with a unique tri-partite model that brings together on equal footing the participating states, three industrial associations and the EU - the experts acknowledge that it succeeded in mobilising a high level of investments, which would not have been available otherwise. They cite as a particular challenge the considerable efforts required by all actors to integrate the activities of the three communities of stakeholders in the areas of embedded systems, nanoelectronics and smartsystems into one single domain, the ECSEL JU, and note that there is still a need for additional actions to this end.

Leveraged private funding, *measured in a harmonised manner across all Joint Undertakings, is well on track against set targets*

A key objective, which is also a measure of the success of a JU, is the capacity to leverage private funding, the minimum amount of which is explicitly mentioned in the respective JU Council regulation.

A long standing criticism carried over from the evaluation of the first generation of JUs was directed at private members reporting in-kind contributions without clear references to the methodologies used for such calculations. In response to this criticism and in the light of the revised, more ambitious targets set for the in-kind contributions by the private members in the second generation JUs, the Commission together with the JUs defined, a year ago, commonly agreed and transparent principles for the calculation of such contributions.

While the definite amount of leveraged funding will only be known at the end of the JU operations, current Commission estimations point to private sector funding that already equals or exceeds the set targets in four out of the seven JUs, whereas for the remaining three it is closing in to the target.

In this context, it should be noted that the BBI JU and IMI2 JU are the only JUs for which there is a specific provision in the Council Regulation for financial contribution to the operational costs of the JU by the private members. An amendment to the Council Regulation is currently under way to facilitate private members' financial contributions to the BBI JU field of activities.

Positive steps towards openness

It is generally accepted that, in comparison to the first generation, the second generation JUs have developed more open and straightforward policies regarding membership of private entities which are described clearly, along with eligibility criteria, in the respective Council regulations. Members are required to contribute financially and/or in kind to the JUs in exchange of important benefits such as direct involvement in JU governance and a voice in the definition of research agenda and call topics, etc.

For the FCH JU calls under FP7, each consortium was required to include at least one member of either the industry group or the research group in order to ensure alignment with

the JU strategic objectives. Under Horizon 2020, this rule has been abandoned, and currently is used only exceptionally, for duly justified reasons. This approach has significantly increased the participation of non-members; under FP7, 48% of the funding was attributed to non-member entities, whereas (for the three first calls under Horizon 2020) this percentage had grown to 54%; in these three calls the members represented only 37% of the beneficiaries and 24% of the participants in signed grants were newcomers.

The BBI JU experts also commend the openness and attractiveness of the JU by reporting that 71% of the beneficiaries in JU funded projects are not members of the Bio-Based Industries Consortium (BIC), the private member of the BBI JU. Also interesting to note is that the percentage of associated BIC members in JU funded projects has increased significantly over time from 2014 to 2016. In 2016 calls, the percentage of associated BIC-members in JU funded projects rose to 64% of the total BIC members. This is indicative of a significant and growing mobilisation of non-industrial BIC members.

Conscious of the financial burden that SMEs, universities and research organisations may face in becoming members and keen to demonstrate openness, some JUs have introduced a number of special facilitating provisions such as offering different levels of membership (CS2 JU, S2R JU). They also organise calls which are reserved to non-members only (S2R JU). Others CS2 JU and S2R JU reserve a minimum percentage of the EU contribution for open calls. These efforts are already showing results; 53% of the current beneficiaries are newcomers i.e., they have not received funding from first generation JUs.

*Joint Undertakings carry out their operations in an **efficient** manner*

The Commission shares the positive views of all expert groups that the operational efficiency of the second generation JUs has improved in comparison to the first generation. This improvement can be partly attributed to the uniform application of the Horizon 2020 Rules for Participation and to the gradual development of simplified business processes despite a number of concerns expressed mainly by the SESAR JU experts who question the one-size-fits-all approach considering the inherent specificities of the JUs. Regarding the IT support applications, the need to address the specific needs of JUs is still present despite their ever evolving development and delivery of excellent support to a large community of users.

Overall, it is concluded that public funds have been managed through transparent processes and competitive calls, even though complaints are voiced with regard to the process of defining call topics in some JUs and the share of the budget reserved for open calls in others. An added complication that impacts efficiency is reported by the ECSEL JU experts on the need for projects to report both to the JUs and the funding national authorities.

Basic performance indicators – such as time-to-grant, time-to-inform and time-to-pay – are all observed to be within the set targets. As an example of operational efficiency and flexibility, the experts commended the IMI2 JU for its rapid and efficient reaction to the threat resulting from the Ebola outbreak in Africa at the end of 2014.

The majority of the surveyed project coordinators (58%) consider that the efficiency of the second generation JUs has improved in comparison to the first generation. All JUs score above 90% in terms of stakeholder satisfaction on their services. More than 94% of the coordinators acknowledge that the JUs strive to provide excellent programme management and high quality services and praise JU staff for its knowledge and competence (90%), commitment to providing quality service (89%) as well as courtesy and availability (92%).

*The objectives and activities of the Joint Undertakings are **coherent** with the corresponding Horizon 2020 activities*

Being part of and supported by Horizon 2020, it is important to find that the JU specific objectives, both long- and short-term, are synchronised and complementary to those of the framework programme.

Almost 72% of the surveyed stakeholders consider the activities of the JUs to be coherent with Horizon 2020 activities; only 3% think otherwise.

Most expert groups acknowledge the conscious efforts made by the Commission services and the JUs in ensuring coherence in research priorities and funded projects.

For example, in the case of the ECSEL JU, the experts commend the Commission services for being a strong promoter of the JU activities and ensuring that Horizon 2020 calls specifically require synergies with the JU activities.

In the case of the BBI JU, the experts find that the objectives of the JU are in line, but also complementary with other parts of Horizon 2020. They specifically note that the JU mainly finances projects with much higher technology readiness level and market potential compared to Horizon 2020 projects. They also make reference to a joint working group established by the BBI JU and SPIRE[17], aiming to search for synergies and collaborations between the two partnerships and to avoid redundancies in the work plans and funded projects.

The SESAR JU experts report that coherence with Horizon 2020 is ensured through synergies with the CS2 JU and also, by working together with ACARE (Advisory Council for Aviation Research and innovation in Europe) in defining synchronised and complementary research priorities. The technical solutions developed by SESAR JU play a key role in the development of global standards for air traffic management prepared by the International Civil Aviation Organisation (ICAO).

The IMI2 JU experts cite views of stakeholders advocating better coordination with Horizon 2020 funded projects and building on synergies and identify potential overlaps with some Joint Programming Initiatives.

Challenges

Despite the general acceptance that the JUs operating under Horizon 2020 are on track to achieve their objectives, the seven groups of experts identified a number of issues that need to be addressed in order to reap the maximum of their potential and impact. Owing to the specific nature of the JUs, very few of these issues are common to all; some apply to a group of JUs whereas many just point to a problem within one or two JUs.

The following is a list of challenges that, according to the Commission services, are considered to be important to the objectives and expected socio-economic impacts of the JUs and therefore need to be carefully considered. It is emphasised that this list is by no means

[17] SPIRE: Sustainable Process Industry through Resource and Energy Efficiency; a contractual Public-Private Partnership under Horizon 2020

exhaustive; it merely presents issues that touch upon the underlying principles, objectives and functioning of the JU-based public-private partnerships and, as such, deserve attention.

A comprehensive view of challenges and issues specific to each JU is presented in the respective evaluation report.

*Need to reach a wider range of **stakeholders.***

It is generally acknowledged, and this is cited as one of the strengths of the JUs, that most of the key players in the respective industrial sectors are already engaged actively. Still, many expert groups call for the inclusion of a wider range of stakeholders either in the governance structures or in submitted proposals.

This is the case of the IMI2 JU for which the experts, while acknowledging progress, recommend more action towards its stated objective "to reach out to new stakeholders towards broadening the network of collaboration in the healthcare family" by involving more rapidly the industries beyond the biopharmaceutical sector such as technology providers. They warn that failure of IMI2 JU to quickly find a way to meaningfully include other sectors in IMI2 JU funded projects would represent a significant long-term threat for the position of the European pharmaceutical and healthcare system and industry.

Similarly, the FCH2 JU experts, while commending the JU's strategy to sign memoranda of understanding with municipalities and regions, call for stronger cooperation with additional regulators (e.g. health and safety, standards, etc.) beyond the ones currently in the Governing Board, in order to foster FCH technology deployment.

In a similar context, the ECSEL JU experts report on the need for small private members (e.g. SMEs) to have a voice in the drafting of the Multi-Annual Strategic Plans or Annual Work Plans.

*Revisit and re-define the **key performance indicators**.*

Key performance indicators (KPIs) are employed in order to improve the understanding of JUs' strategic challenges from the perspective of management, decision makers and societal stakeholders and to justify support for the JU instrument on the basis of its impact.

As provided for in the legal bases, progress against achieving set objectives is measured by three sets of KPIs; one that contains KPIs common to all Horizon 2020 implementing entities, one that addresses Horizon 2020 cross-cutting issues that are common to all JUs and one that consists of KPIs that are specific to the objectives and impact of each JU.

All sets of KPIs are monitored and reported by the JUs on an annual basis, even though the majority of JU-specific KPIs cannot be properly measured yet, since they rely on project output data that are not yet available. The choices of the JU-specific KPIs, their respective targets and their presentation have been the subject of criticism by several expert groups.

The transport-related expert groups consider the absence of indicators related to the global competitiveness of the transport industry value chains to be a particular risk which might undermine the JUs' legitimacy. The IMI2 JU group also calls for a new performance

measurement framework to replace the existing KPIs with SMART[18] ones together with the corresponding baseline metrics. The ECSEL JU group calls for the definition of appropriate metrics and compulsory follow up, once projects are finalised, to assess the impact of projects and thus justify EU funding.

While not questioning the choice of KPIs, the FCH2 JU expert group calls for revisiting the set targets, since some were considered to be not sufficiently ambitious and others over-ambitious.

Finally, in the case of the BBI JU, while the available JU-specific KPIs were found to be on track, the experts call for further monitoring activity and analysis making a clear distinction between the actually achieved KPIs at the end of each year and the projected KPIs.

*Need for stronger **interaction** between **Governing Boards** and **advisory bodies** (States' Representatives Groups and Scientific Committees).*

Despite the well thought out governance structure of the JUs designed to ensure transparency and inclusiveness of the widest possible community of stakeholders, a number of expert groups express concern on the role of the advisory groups and their impact on Governing Boards' strategic research decisions.

For example, the S2R JU group notes that the Scientific Committee and the States' Representatives Group have little involvement, apart from a formal consultation process, in the preparation of the multi-annual action plan. They suggest enlarging the composition of the Scientific Committee with scientists other than railway engineers, such as economists, sociologists and geographers.

The FCH2 JU expert group points out that it is not clear how the advice and feedback of the advisory bodies is taken into account and reflected in the JU's strategic documents. The group calls for improved coordination between Member States starting with upgrading the States' Representatives Group with members of sufficient seniority and power to reach agreements on improving consistency with national programmes.

Finally, the IMI2 JU experts suggest improvements that could lead to a more efficient and effective communication between the different bodies. In particular, they call for a stronger interaction with the States' Representatives Group in order to ensure better alignment between national and regional developments and priorities. Also, they call for better feedback from the Governing Board on the relevance and impact of contributions from the Scientific Committee, similar to the efficient communication established between the Governing Board and the seven Strategic Governing Groups.

[18] Specific, Measurable, Achievable, Relevant, Time-bound

*Need for closer **cooperation and alignment** of research and innovation priorities **at national and regional level**, in particular with Smart Specialisation priorities*

Regarding EU policies, while all experts agree that the JUs are supporting EU policies in the fields of energy, transport, environment, competiveness and citizens' health and wellbeing, they also consider that there is still room for additional synergies.

For example, the FCH2 JU experts point to the difficulties faced by this JU to position itself and contribute meaningfully to the EU energy and transport policies, due to not clearly defined boundaries in the scopes of the two policies (in FCH relevant contexts). They concede, however, that the issue is beyond the will or power of the JU to rectify.

Focusing on the synergies with large scale initiatives across Europe, like the ITEA and EURIPIDES programmes under EUREKA, the ECSEL JU experts identify complementarities, synergies and links, while highlighting at the same time the need for even closer collaboration in order to avoid potential overlaps.

Unlike their positive views on JUs' coherence with parts of Horizon 2020, the experts consider that the alignment of the JUs' activities with the relevant policies at national and regional level varies from one JU to another, reflecting the different Smart Specialisation priorities and research and industrial capacities of the EU countries and regions.

Specifically, while the SESAR JU experts consider that there exist strong policy links at all levels (global, EU, national and regional), the ECSEL JU experts call for synchronisation with national activities. Similarly, the IMI2 JU experts detect "a lack of buy in" by Member States leading to a limited alignment with national policies and strategies. In the case of CS2 JU, the experts conclude that the coordination of national programmes has not yet yielded visible and explicit results and call for more action to this end.

Notable exceptions, at regional level, are the efforts of the FCH2 JU that signed 70 memoranda of understanding with EU regions and municipalities and those of the CS2 JU that signed memoranda of understanding with 13 EU regions with 8 pilot projects currently being underway.

Regarding SESAR, the experts point to an interesting observation; the emergence of SESAR and its increasingly important role as an EU-wide authority and leader in Air Traffic Management (ATM) technology has led to a gradual retreat by national programmes from pure ATM research. Thus the success of the EU-level initiative has caused an important scaling back of other funding sources in the EU.

***Uneven SME** participation rates; overall lower than those in Pillars II (LEIT[19]) and III (Societal Challenges)*

Overall, the SME rates in signed JU grants amount to 22% in terms of participations and 18% in terms of share of EU funding. Even though they represent a significant improvement in comparison to FP7 (20% and 16% respectively), these overall rates are lower than the corresponding rates in Pillars II (the LEIT part) and III (Societal Challenges) of Horizon 2020; 27% and 24% respectively.

[19] Leadership in Industrial Technologies

What is more, these rates are fluctuating widely among JUs. For example, the IMI2 JU and ECSEL JU experts express their concern about the decreasing SME participation from IMI1 to IMI2 JU (from 16% down to 12% in terms of participations and 10% share of EU funding) and the downward trend in SME participation from 30 % in 2014 to 24 % in 2016 in the ECSEL JU. On the other hand, the FCH2 JU and BBI JU experts are quite satisfied with SME rates exceeding those of Pillars II and III. In other cases, like S2R JU and SESAR JU, it is observed that the SME participation rates are almost double than their shares of EU funding, suggesting that SMEs are more successful in proposals with a small budget allocated to them. While all experts accept that the JUs are taking measures to increase the presence of SMEs through communication campaigns targeted to SMEs, they also consider that the issue of SME participation should be considered carefully by each JU by taking into account the respective industrial sector characteristics.

Improved but still low EU-13 *participation rates*

Overall, the participation rates of the EU-13 Member States in JU funded projects amount to 7.3% in terms of number of participations and 3.6% in terms of share of EU funding. While these rates are higher than those of FP7 (4.3% and 2.3% respectively) and suggest improved performance over time, they are nevertheless lower than the corresponding combined rates of 8.2% and 4.7% in Pillars II (the LEIT part) and III (Societal Challenges).

While it can be argued that the extent of EU-13 participation is generally commensurate with the number of researchers or the scale of R&D investment, it is acknowledged that EU-13 rates are still rather low, despite their clear improvement over FP7. This issue is observed across Horizon 2020 and it is therefore not specific to JUs.

Need to improve ***communication*** *and, in particular,* ***dissemination*** *of project results.*

In their effort to ensure an open and inclusive attitude towards the wider stakeholder community, the JUs employ a wide range of mechanisms and tools such as dedicated up-to-date websites, social media, webinars (to inform on calls for proposals), events, publications and articles in the specialised and general press.

More than 70% of the stakeholders in the consultation consider that the websites provide easy and effective access to the information about the JUs, the funded projects and call related information.

A report published by the European Parliament[20]calls the JUs to better communicate the number and type of their members and stakeholders, SMEs and new members along with annual trends. It also proposes to present progress on objectives to date in a user-friendly manner in order to improve transparency and demonstrate openness.

The IMI2 JU experts consider that while the communication strategy, tools and channels are logical, well thought out and extensive, the monitoring of their effectiveness and impact could be further improved. They also report insufficient use of important assets generated by projects.

[20] "Scrutiny on Horizon 2020 focusing on the European Parliament's priorities", European Parliament, February 2016

Along the same lines, the FCH2 JU group welcomes the possibility to download from the webpage most of the public deliverables of the projects (also the case with the SESAR JU), but calls for more communication activities to be focused on the general public to increase FCH technologies awareness.

Concerning dissemination, the satisfaction of stakeholders drops to 60% with regard to access to knowledge generated by funded projects. The experts also point to poor or insufficient dissemination of project results to stakeholders other than those involved directly in the JUs.

In this context, it is recalled that the Commission has recently developed a *"Strategy for the Dissemination and Exploitation of Horizon 2020 Research Results"* that aims at creating the necessary conditions and establishing the means to put research results into economic and societal use and make available scientific evidence in support of policy making. The actions set out by this strategy apply to all actors involved in Horizon 2020 activities, including the JUs.

As most of the JU research projects started within the past two years and, therefore, it is still early for project outputs to be delivered, the Commission services are currently working together with the JUs in order to set up a transparent dissemination system taking into account the provisions of the above-mentioned strategy, the specific characteristics of the JUs and the sensitivities of the involved industrial actors.

Annex A. Procedural information

Lead DG: Directorate General Research and Innovation (RTD)
Agenda Planning number: 2015/RTD/009 final and interim evaluation of Joint Undertakings.

The requirement for the Interim evaluation of the Joint Undertakings under Horizon 2020 derives from Article 11 of the Council Regulation establishing each Joint Undertaking[21]. This stipulates that *"by 30 June 2017 the Commission shall carry out, with the assistance of independent experts, an interim evaluation of the Joint Undertaking. The Commission shall prepare a report on that evaluation which includes conclusions of the evaluation and observations by the Commission. The Commission shall send that report to the European Parliament and to the Council by 31 December 2017."* Where applicable, each expert group was also required to carry out the final evaluation of the corresponding JU established under the seventh framework programme. Finally, the results of the interim evaluation of the Joint Undertakings would be taken into account in the in-depth assessment as part of the interim evaluation referred to in Article 32 of Regulation (EU) No 1291/2013 establishing Horizon 2020. The evaluation roadmap of this overall Horizon 2020 interim evaluation, published in May 2016[22], presents the required information on the final and interim evaluation of JUs.

The evaluations were carried out by seven independent expert groups, with the "New management modes" Unit in DG RTD coordinating this process. To guarantee coherence between the seven evaluations and ensure that all legal requirements as well as the recommendations from previous evaluations were properly addressed, common terms of reference have been drafted by the "New management modes" Unit in DG RTD in close consultation with the responsible thematic directorates and horizontal Commission services (e.g. Secretariat-General).

As already mentioned, for each JU interim evaluation, the Commission is required to prepare a report presenting the conclusions along with its observations, which has to be communicated to the European Parliament and the Council by 31 December 2017. For reasons of efficiency and clarity, it was agreed by the relevant Directors-General that only one comprehensive report in a form of a Staff Working Document would be prepared, presenting the conclusions of the evaluation of each of the seven JUs.

The Staff Working Document is based on a wide range of sources comprising the expert group evaluation reports, results from the common open public consultation and the seven surveys of JU project coordinators as well as the internal assessment and observations of the European Commission.

An inter-service group (ISG)[23] to overlook and follow the final and interim evaluation of all the Joint Undertakings was set up early in 2016 and held four meetings until the Staff

[21] In the case of SESAR, the requirement for the interim evaluation derives from Article 7, Council Regulation (EU) No 721/2014 amending Regulation (EC) No 219/2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system (SESAR) as regards the extension of the Joint Undertaking until 2024.
[22] See: http://ec.europa.eu/smart-regulation/roadmaps/docs/2015_rtd_005_evaluation_ie_horizon_2020_en.pdf
[23] The ISG for the JU interim evaluation consisted of representatives from the following Directorates-General: BUDG, HR, CNECT, MOVE, RTD, and SG.

Working Document was finished in July 2017 (on 24 February 2016, 31 May 2016, 27 April 2017 and 27 June 2017). In addition, to facilitate the evaluation process a large number of working level meetings took place between the thematic units in charge of each JU and the relevant horizontal services of the European Commission. Finally, a meeting of the rapporteurs of the seven independent expert groups was organised by the Commission services on 2 March 2017.

External expert groups

The expert groups produced 12 evaluation reports (seven interim evaluation reports for Horizon 2020 and five final evaluation reports for FP7). The full list of the evaluation reports can be found in Annexes E and F.

Expert Group	Experts
Expert group on the final evaluation of the **Innovative Medicines Initiative** Joint Undertaking operating under the Seventh Framework Programme and the Interim Evaluation of the Innovative Medicines Initiative 2 Joint Undertaking operating under Horizon 2020	André Syrota (FR), Chair Kathleen D'Hondt (BE), Rapporteur Katherine Payne (UK) Belen Crespo (ES) Marcin Szumowski (PL)
Expert group on the interim evaluation of **BBI** Joint Undertaking (2014-2016) operating under Horizon 2020	Roland Wohlgemuth (CH), Chair Lucia Gardossi (IT), Rapporteur Alistair Reid (UK) Tiina Pursula (FI) Erick Vandamme (BE) (until January 2017) Danuta Cichocka (PL)
Expert group on the final evaluation of the **Clean Sky** Joint Undertaking operating under the Seventh Framework Programme and the Interim Evaluation of the Clean Sky 2 Joint Undertaking operating under Horizon 2020	Michael Dooms (BE), Chair Heather Allen (UK) Helge Pfeiffer (DE) Cheryl Atkinson (NL), Rapporteur Piotr Doerffer (PL)
Expert group on the final evaluation of the **Fuel Cells and Hydrogen** Joint Undertaking operating under the seventh framework programme and the interim evaluation of the Fuel Cells and Hydrogen 2 Joint Undertaking operating under Horizon 2020	Ana Sofia Caires Branco (PT), Chair Annelie Carlson (SE) John Loughhead (UK) Renate Lemke (DE) Piotr Bujlo (PL)
Expert group on the final evaluation of the ENIAC and ARTEMIS Joint Undertakings (2008-2016) operating under the Seventh Framework Programme and the interim evaluation of the **ECSEL** Joint Undertaking (2014-2016) operating under Horizon 2020	Emilio Lora-Tamayo (ES), Chair Haydn Thompson (UK), Rapporteur Jean-Luc Dormoy (FR) Margriet Jansz (NL) Leonard Hobbs (IE) Wolfgang Pribyl (AT) Werner Damm (DE) Tomasz Kosmider (PL)
Expert group on the interim evaluation of the **Shift2Rail** Joint Undertaking (2014-2016) operating under Horizon 2020	Michael Dooms (BE), Chair Roderick Smith (UK), Rapporteur Heather Allen (UK) Eric Fontanel (FR)
Expert group on the final evaluation of the **SESAR** Joint Undertaking (2007-2016) operating under the seventh framework programme and the interim evaluation of the SESAR Joint Undertaking (2014-2016) operating under Horizon 2020	Michael Dooms (BE), Chair Tatjana Bolic, Rapporteur Helge Pfeiffer (DE) Heather Allen (UK) Paul Ravenhill (UK)

Annex B. Stakeholder consultation results

Background

A mandatory open public stakeholder consultation on the Joint Undertakings as part of the JU interim evaluation was launched on 13 December 2016 and closed on 10 March 2017. The questionnaire was structured along the seven evaluation criteria, namely the five criteria required by the Better Regulation Guidelines (relevance, effectiveness, efficiency, coherence and EU added value) and the two additional criteria of openness and transparency mentioned in article 32(3) of the Council Regulation establishing Horizon 2020. It covered important aspects of the implementation of the Joint Undertakings under Horizon 2020. The questionnaire consisted of two sections: the first section included questions that are common to all JUs, whereas the second one covered questions that are specific to each JU. Starting with a single entry point, after responding to a few questions common to all JUs, the respondents were directed to the respective set of questions corresponding to the JU(s) of their choice.

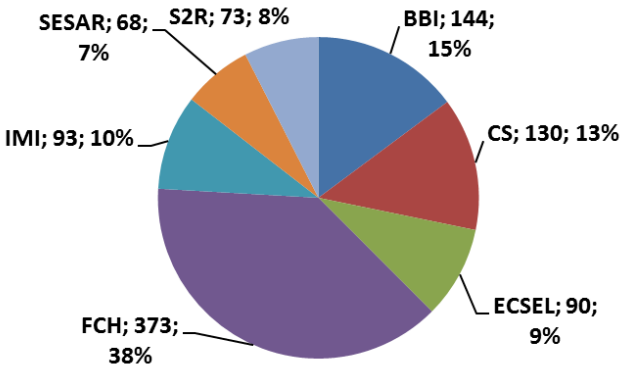
This annex provides a summary of the responses received, structured according to the seven evaluation criteria. A distinction between the responses received from the different stakeholders groups, namely private-for-profit organisations versus the remaining type of stakeholders, was initially made. However, this distinction gave only a limited number of questions where the stakeholders representing private-for–profit organisations expressed relatively different opinions compared to the remaining group of the stakeholders. Where the opinions were relatively different, two positions are presented in the summary of the public consultations results. The main area where the opinions expressed by the private sector were different from the remaining stakeholders was on the way how JUs are organising the calls for proposals (defining the topics, proposal evaluation system and feedback provided).

More details about the consultation can be found online through the link:
http://ec.europa.eu/research/consultations/interim_joint-undertakings_h2020/consultation_en.htm

Section A: Overview of the respondents

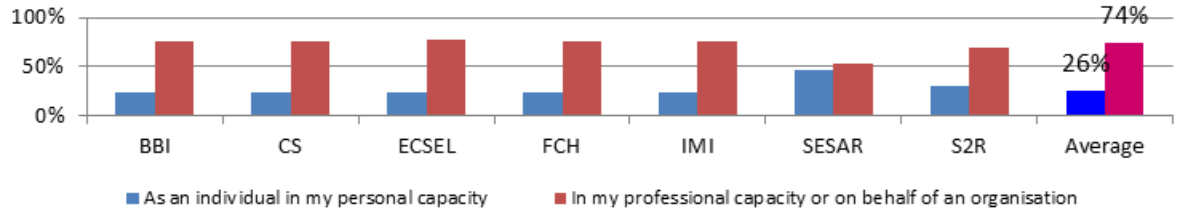
In total, 909 responses were received in the stakeholder consultation for all seven JUs.

Figure 24: Distribution of replies among the Joint Undertakings



Source: EC, results of the common open public stakeholder consultation on the Joint Undertakings otherwise stated)

Figure 25: In which capacity are you responding to this consultation?

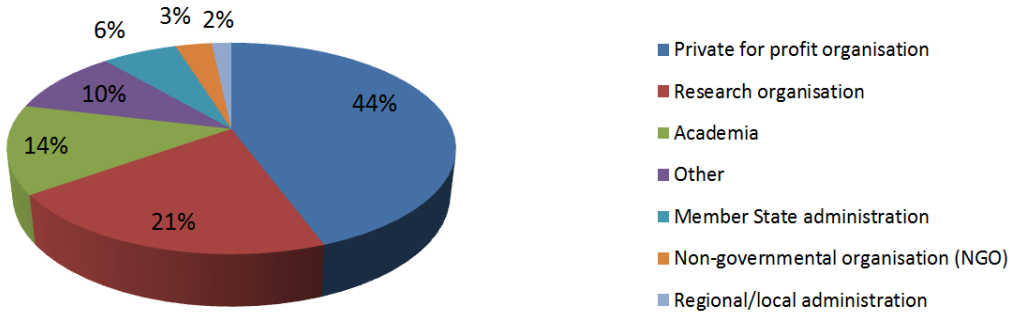


In total, 26% of the responses were received from individuals and 74% from organisations. A similar structure for the responses could be observed across all JUs, except for SESAR where the individual contributions are almost equal in number to the ones from organisations. In addition, two organisations submitted their position papers, European Association of Research and Technology Organisations (EARTO) and the Netherlands' position paper on the interim evaluation of Horizon 2020 from the Ministry of Economic Affairs.

Overall, 37% of the respondents agreed that their contribution could be published with their personal information, while the remaining 63% agreed to publish their contributions only if they remained anonymous.

The replies from private-for-profit organisations accounted for 44%, followed by research organisations (21%) and academia (13.6%). Additionally, 8.2% of the responses were received from national and regional authorities.

Figure 26: What type of organisation do you represent?



In total 719 respondents to the stakeholder survey did it on behalf of their organisations. Overall, 151 respondents were SMEs.

Figure 27: Are you a small or medium-sized enterprise (SME)?

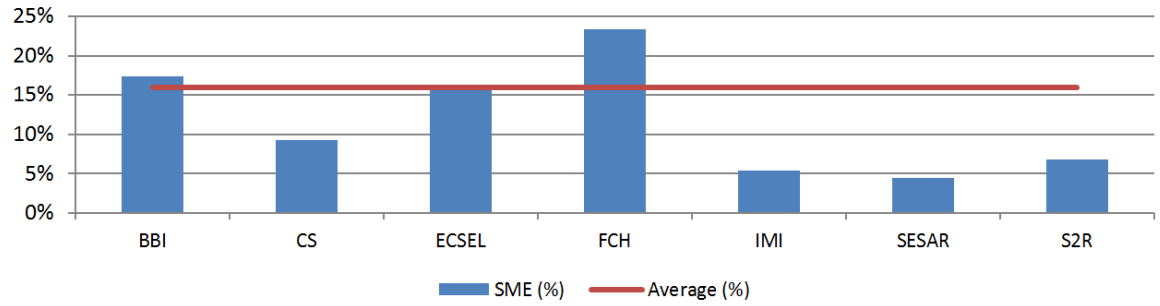
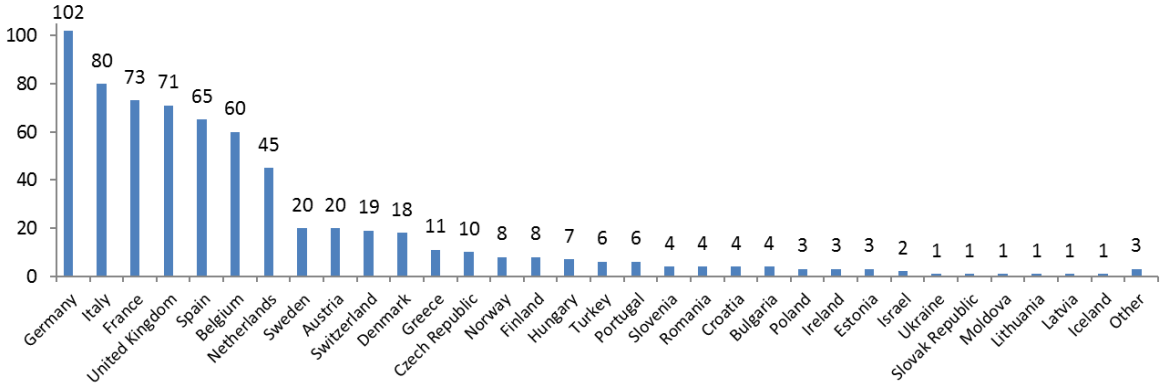
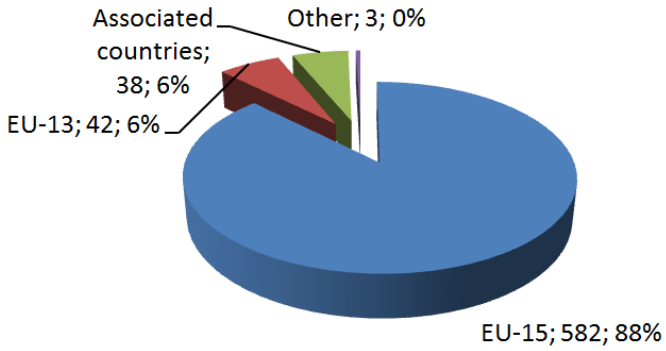


Figure 28: Country of the respondents

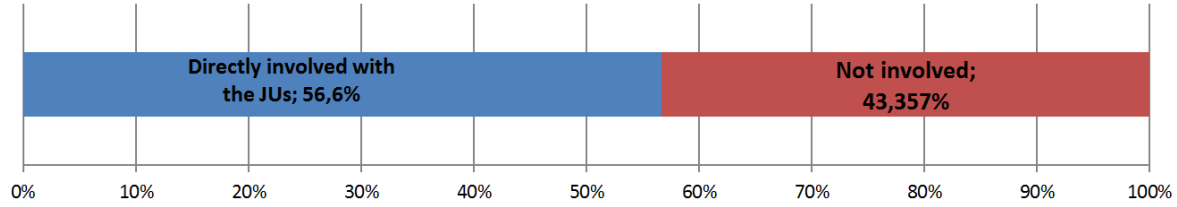




The answers came from 33 countries, with Germany and Italy being the most active. The replies from organisations located in Germany, Italy, France, United Kingdom and Spain accounted jointly for 43% of the total replies.

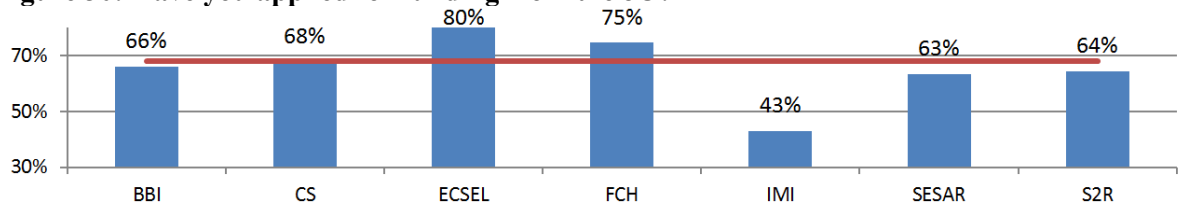
In their replies, 90% of the respondents indicated that they are either very familiar with the objectives and activities of the JUs (59.4% of the respondents) or expressed their moderate knowledge about the JUs (30.6%). Also, 8.9% of the respondents indicated that they are slightly familiar with the JUs and 1.1% indicated that they are not at all familiar with the objectives and activities of the JUs.

Figure 29: Are you directly involved with the JU?



To this question, 56.6% of the respondents said that they are directly involved with the JUs, 40.2% of them as beneficiaries of the JUs, 39% of them as core partners or members, 5.2% as Advisory Board members and the remaining 3% as evaluators.

Figure 30: Have you applied for funding from the JU?



In total, 68% of the respondents mentioned that they had applied for funding from the Joint Undertakings.

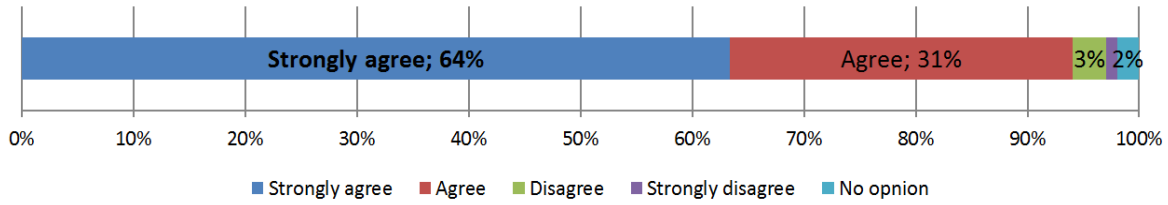
Section B: European added value

When asked to express their opinion on whether "industry along with other possible actors at national level but without the involvement of the EU" would be able to overcome the barriers which hinder innovation and drive up costs in the particular industry sector, 74.5% of the respondents either strongly disagreed (30.3%) or disagreed (44.2%) with the statement.

The expressed opinions varied between the different JUs. For example, for the FCH JU 81% of the respondents agreed with the statement that without EU involvement it would be difficult to overcome the barriers which hinder the market introduction and deployment of fuel cells and hydrogen technologies, while for the SESAR JU 63% of the respondents agreed that without EU support for the ATM industry it would be difficult to develop innovative and interoperable solutions in order to modernise and harmonise the European ATM system.

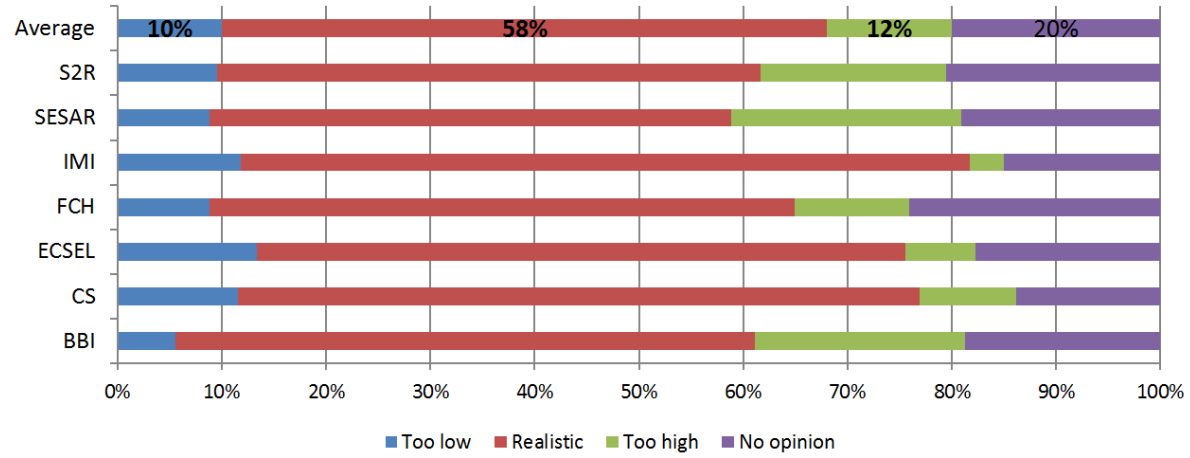
The absolute majority (96%) of the respondents either strongly agreed (64%) or agreed (31%) that the EU cooperating with industry in the context of a public-private partnership brings better results to the society and the different markets in Europe.

Figure 31: EU cooperation with industry in the context of a public-private partnership brings better results to the society and the markets in Europe



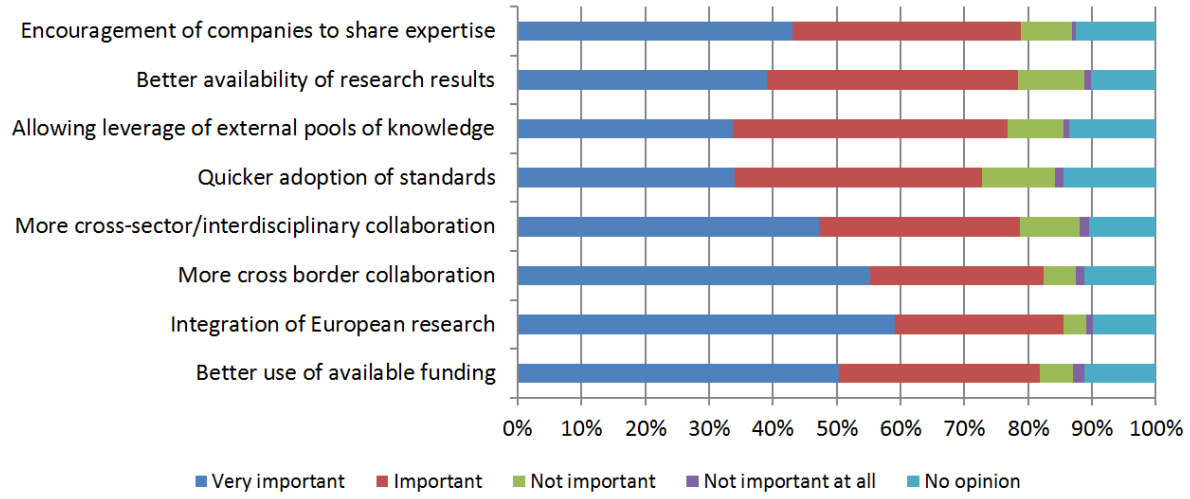
With regard to its financial participation in the public-private partnerships, industry has committed to fulfil the obligations set out in the Council Regulations establishing the corresponding Joint Undertaking. The leverage effect is defined as the ratio between the total contributions provided by "the members of the JU other than the EU" and the EU contribution.

Figure 32: The current minimum "leverage effect" foreseen is:



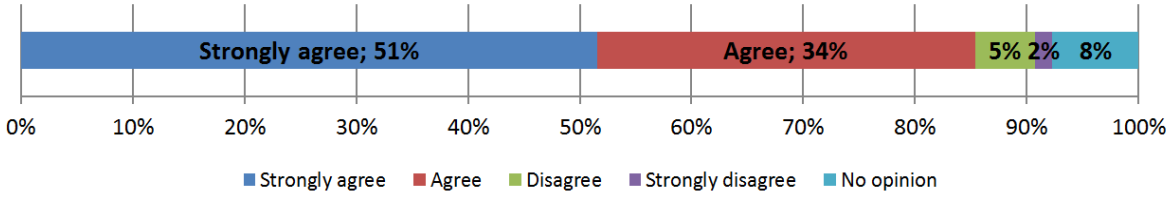
When asked to assess the current minimum leverage effect foreseen in the Council Regulations establishing Joint Undertakings, 58.4% respondents stated that the level is realistic, 10% thought that it is too low while 12% believed that it is too high.

Figure 33: What is the added value of the public-private partnership?



Overall, the respondents considered that the most important value added of the public-private partnership is the integration of European research (86% of respondents considered this as very important or important element), better availability of research funds and more cross border collaboration (scored equally 82% as very important or important element).

Figure 34: Does the JU contribute to economic growth and job creation in the EU?



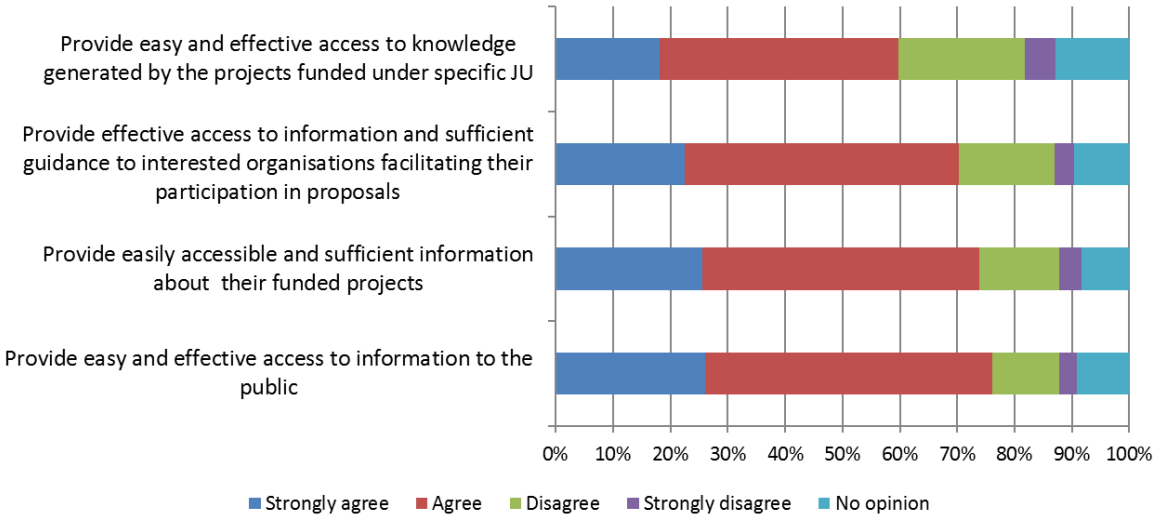
Overall, 85.3% of the respondents strongly agreed (51%) or agreed (34%) that the JUs contribute to economic growth and job creation in the EU.

Section C: Openness -Transparency

The respondents were asked to assess the information provided in the JU websites and express their opinion on whether the JU websites provide to the general public and potential participants an easy access to information.

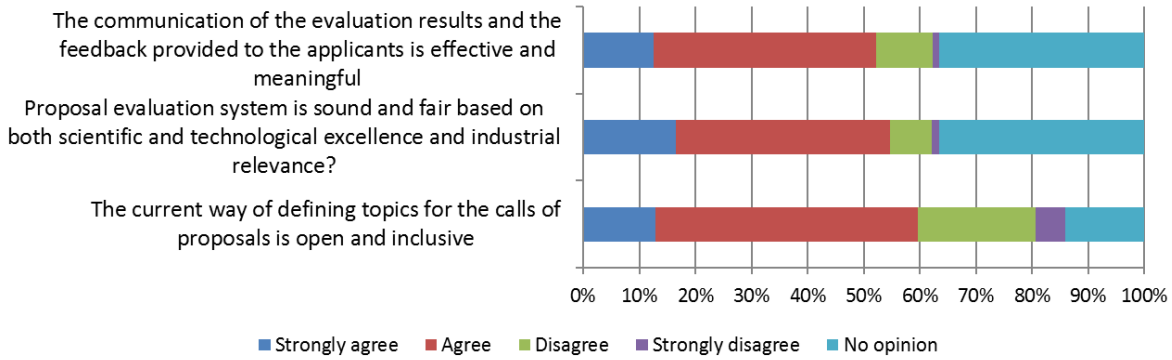
Overall, the respondents were satisfied with the information provided in the JU websites. The websites provide easy and effective access to information by the public (76% of the respondents strongly agreed or agreed with this statement). The respondents also agreed that the JU websites provide easily accessible and sufficient information about their funded projects (74%). The respondents were slightly less positive in their assessment that the JU websites provide effective access to information and sufficient guidance to interested organisations to facilitate their participation in proposals (70%). Opinions varied more when assessing the JU websites regarding whether they provide an easy and effective access to the knowledge generated by the projects funded under a specific JU (60%).

Figure 35: Assessment of the information provided in the JU website



The respondents were satisfied with the current way of defining topics for the JU calls for proposals. Some 60% of the respondents strongly agreed (13%) or agreed (47%) that the current way of defining topics for the calls for proposals is open and inclusive. On average, the respondents were slightly less positive when assessing the proposal evaluation system. Specifically, 55% of the respondents found it was organised in a sound and fair way, based on both scientific and technological excellence and industrial relevance. The opinions varied more when assessing the communication of the evaluation results and the feedback provided to the applicants. Just over half of the respondents (52%) found that the feedback provided is effective and meaningful.

Figure 36: Assessment of the cycle of JU calls for proposals



The assessment expressed by the private-for–profit organisations was slightly more positive when compared to the remaining stakeholders. Specifically, 61% of the respondents from private sector found that the proposal evaluation system was organised in a sound and fair way, compared to 51% of the remaining stakeholders who assessed the system positively.

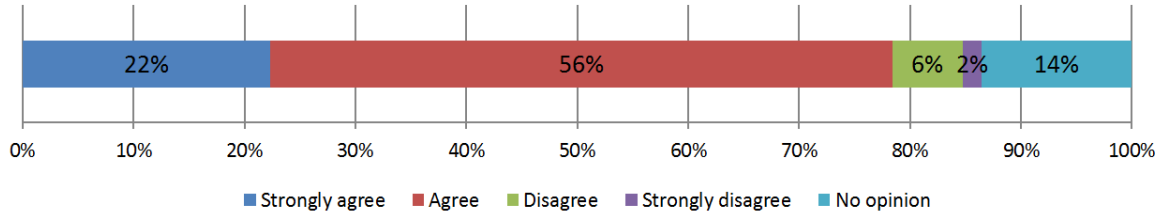
The opinions varied also when assessing the communication of the evaluation results and the feedback provided to the applicants. The private-for–profit organisations were more positive on this statement (61% of positive assessment) compared to the remaining stakeholders (47%).

Section D: Relevance – Coherence – Effectiveness

Relevance

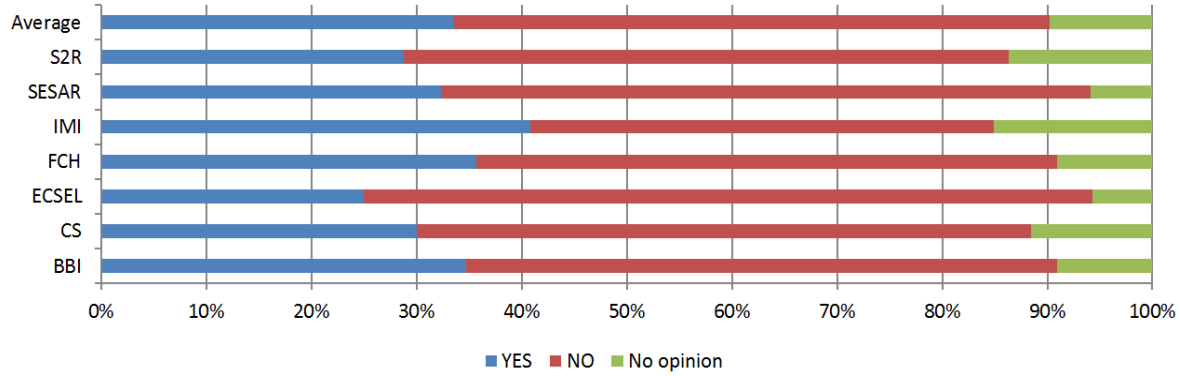
The scientific priorities addressed by the specific JUs are set in strategic policy documents. The stakeholders were asked to express their opinion on whether the strategic policy document is optimal for defining the scope of the research and innovation followed by the JU. In total, 78% of the respondents either strongly agreed (22%) or agreed (56%) that the strategic policy documents are optimal for defining the scope of research and innovation.

Figure 37: Assessment of whether the policy documents are optimal for defining the scope of research and innovation followed by the JU?



The opinions were slightly divided on whether the JUs should be required to undertake any other tasks in order to achieve the objectives set out in the Council Regulations establishing the specific JU. Only 33% of the respondents considered that the JU should undertake other tasks, while 56% of the respondents considered that the JU should not undertake any other tasks.

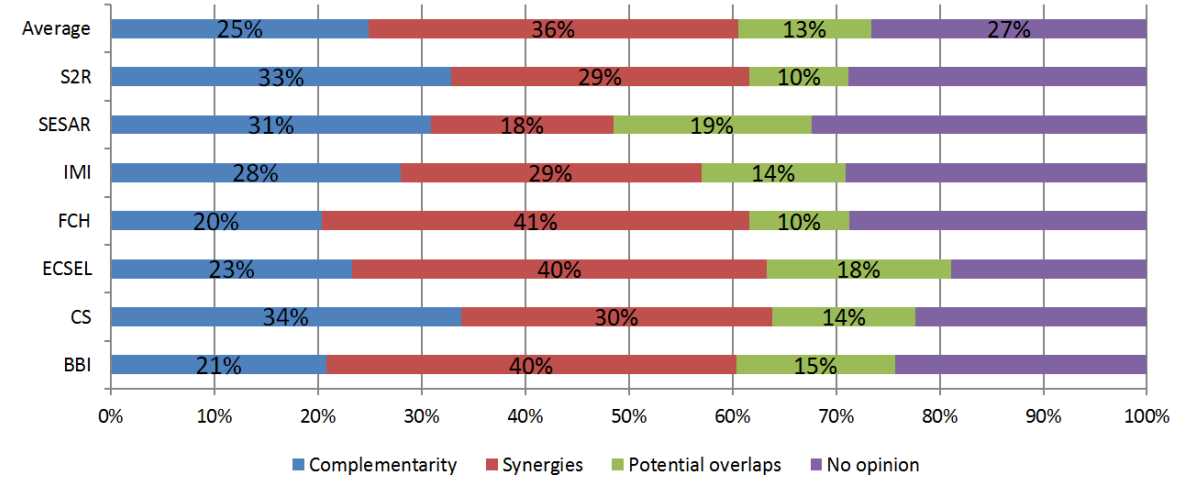
Figure 38: Should the JU undertake any other tasks in order to achieve the objectives set out in the Regulation?



Coherence

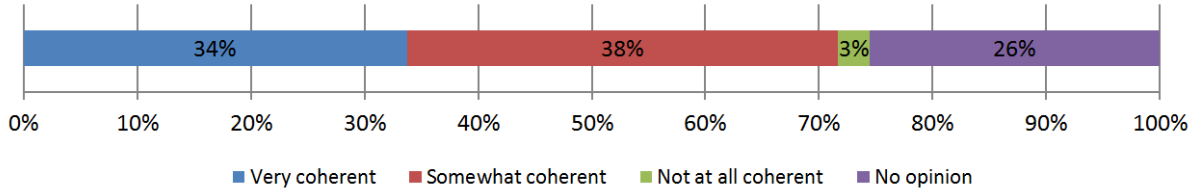
Around 61% of the respondents assessed positively the scope of the research funded by JU in relation with other Union funding programmes and/ or with similar international, national or intergovernmental programmes. A quarter of the respondents considered that the research funded by the JU provides complementarity, 36% considered that it gives synergies with other Union funding programmes and/ or with similar international, national or intergovernmental programmes. However, 13% of the respondents considered that in some areas there is a potential overlap.

Figure 39: What is the relation of the JU with other Union funding programmes and/ or with similar international, national or intergovernmental programmes?



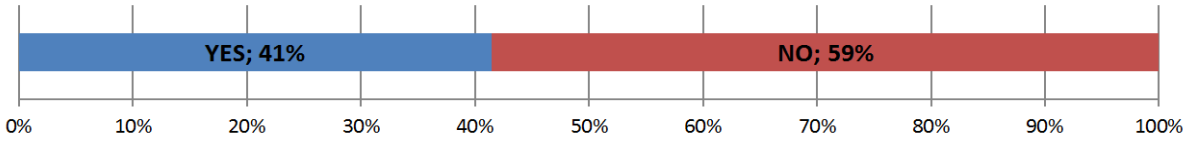
The majority of the respondents (72%) considered that in general the activities of the JU were very coherent (34%) or coherent (38%) with other activities of the Horizon 2020 programme. Just 3% of the respondents expressed a negative opinion about the coherence between the respective activities and almost a quarter of the respondents did not have an opinion on this question.

Figure 40: To what extent are the activities of the JU coherent with other activities of the Horizon 2020 programme?



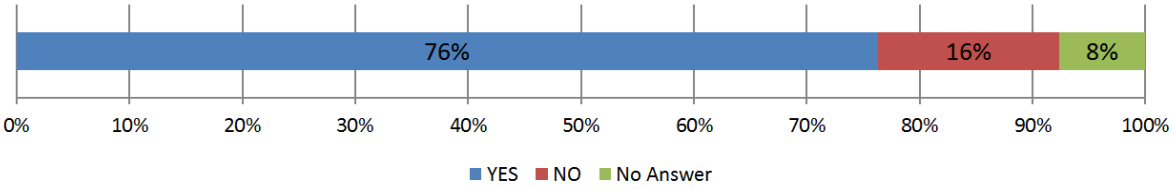
The opinions expressed by private and public sectors were relatively different on this topic. The respondents from the public sector considered that the activities of the JU were very coherent or coherent with other activities of the Horizon 2020 programme in a higher percentage when compared to the assessment of the respondents from the private sector (75% and 66% respectively).

Figure 41: Do you have any experience in combining different sources of EU funds and/ or with national funds for research and over the innovation value chain?



Effectiveness

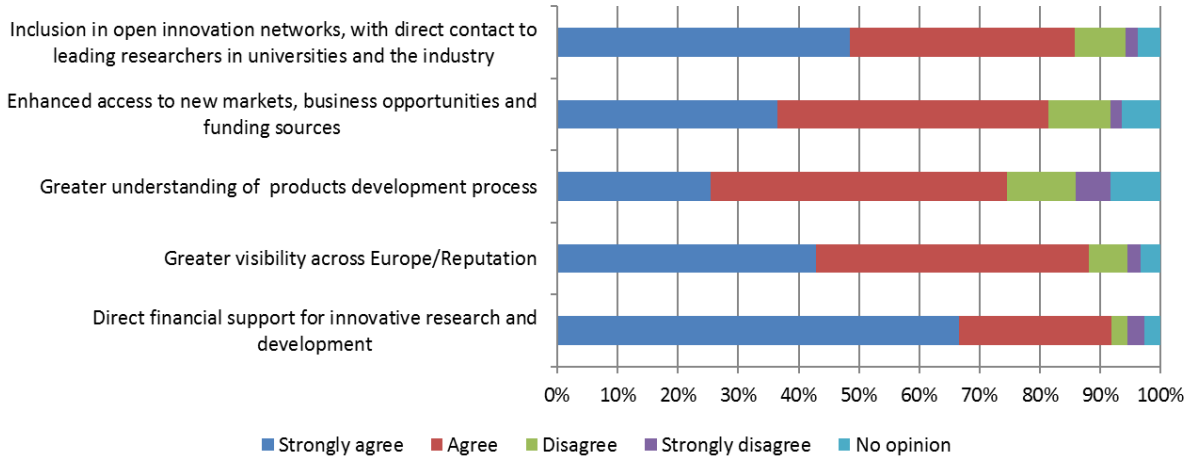
Figure 42: Do you consider that JU projects have resulted in specific scientific and/ or technological successes?



The majority of the respondents (76%) confirmed that the JU projects have resulted in specific scientific and/ or technological successes.

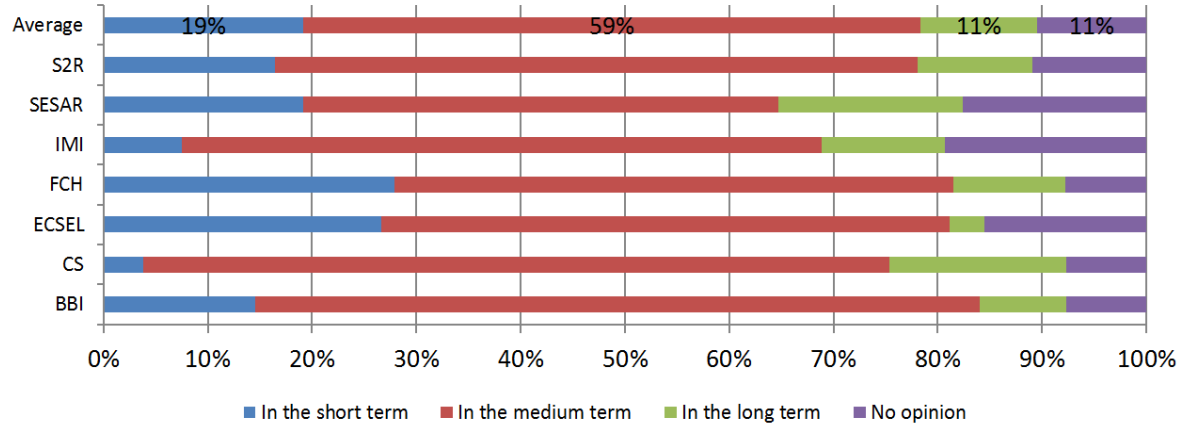
Overall, the respondents either strongly agreed or agreed that one of the three major benefits of participating in a JU project is a direct financial support for innovative research and development (92%), followed by greater visibility across Europe and reputation (88%) and then by inclusion in open innovation networks, with direct contact to leading researchers in universities and the industry (82%).

Figure 43: Which would you consider as major benefits of participating in a JU project?



Overall, the respondents either strongly agreed or agreed that one of the three major benefits of participating in a JU project is a direct financial support for innovative research and development (92%), followed by greater visibility across Europe and reputation (88%) and then by inclusion in open innovation networks, with direct contact to leading researchers in universities and the industry (82%).

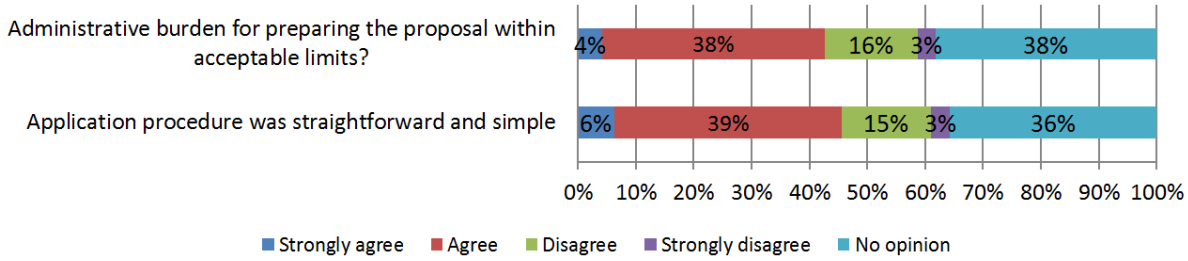
Figure 44: Do you think that the JU can contribute towards improving the competitiveness and industrial leadership of Europe in the particular industries sector?



Most of the respondents (59%) considered that the JUs can contribute towards improving the competitiveness and industrial leadership of Europe in the particular industries sector in the medium term (over the next ten years), 19% of the respondents considered that it can contribute in the short term (over the next five years) and 11% believed that it can contribute only in the long term (over the next twenty years).

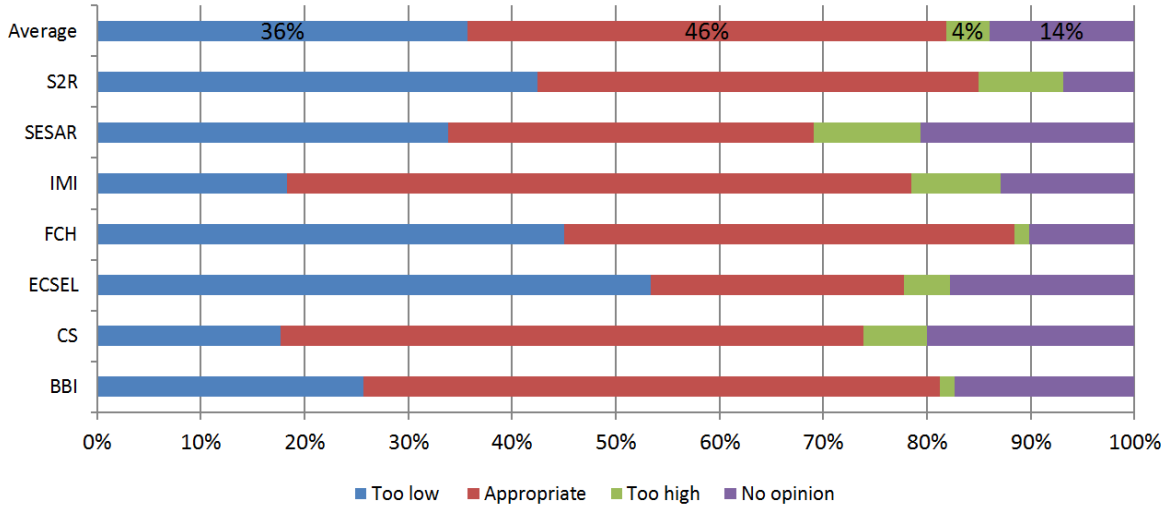
Section E. Efficiency

Figure 45: When you applied for funding from the JU, did you think that:



The opinions varied more when assessing the administrative burden for preparing the proposal and the application procedure. A total of 45% of the respondents considered that the application procedure is straightforward and simple and 42% of the respondents expressed their agreement that the administrative burden for preparing the proposal was within acceptable limits.

Figure 46: Do you consider that the JU overall budget (public and private) in relation to its objectives and expected outcomes is too low, appropriate or too high?



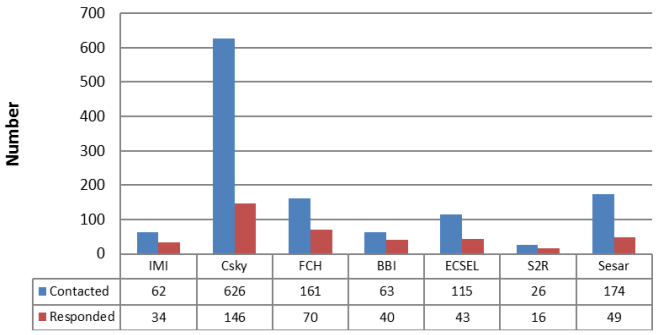
A total of 46.1% of the respondents considered that the JUs overall budget (public and private) in relation to their objectives and expected outcomes is appropriate, 35.7% considered that the overall budget is too low and should be increased and 4.1% of the respondents considered that the budget is too high and it should be partly used for other types of research and innovation actions in this area.

Consultation of Joint Undertaking project coordinators – Summary of the survey results

Seven identical surveys for the project coordinators who signed the grant agreements with one of the seven JUs have been launched as part of JU interim evaluation. The web-based survey of the project coordinators aimed to obtain their feedback and experience in dealing with the JU administration throughout all stages of the project life-cycle, i.e. from provision of call related information to proposal submission, communication of evaluation outcome and selection decision, up to the signature of the grant agreement and follow up of the project.

In total, **1 277** project coordinators, managing JU projects under FP7 or Horizon 2020, have been contacted from January to March 2017. The opinion of **398** project coordinators was collected, corresponding to an average response rate of **33.4%,** ranging from 23.3% in Clean Sky2 JU to 63.5% in BBI JU.

Figure 47: Response rate per JU

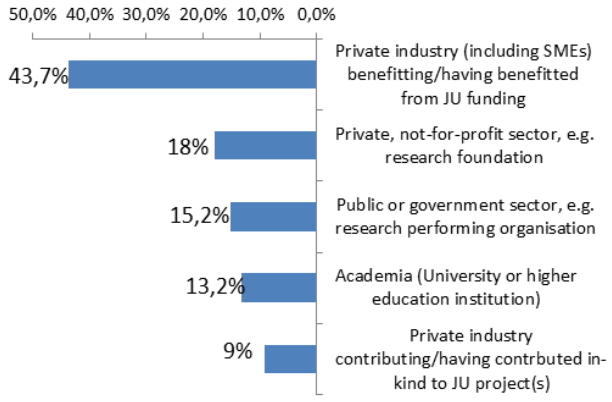


	IMI	Csky	FCH	BBI	ECSEL	S2R	Sesar
Contacted	62	626	161	63	115	26	174
Responded	34	146	70	40	43	16	49

Source: Seven JU project coordinators surveys, EC calculations (for all figures unless stated otherwise)

A. Information on the respondents

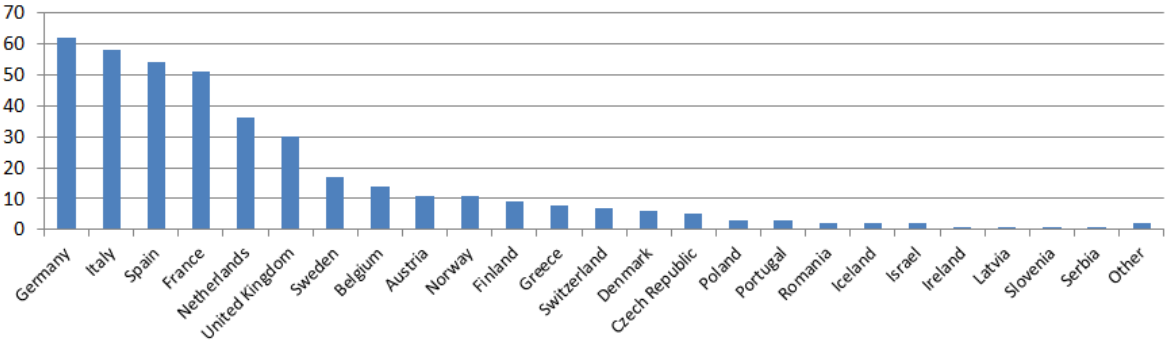
Figure 48: The research team belongs to:



Almost half (44%) of the respondents corresponds to research teams from private industry (including SMEs) benefitting/ having benefitted from JU funding. The respondents from private, but not-for-profit sector, e.g. research foundation, accounted 18% replies followed by public or government sector organisations (15%), academia (13%) and private industry contributing to JU projects (9%).

The answers indicate that the top five countries where the research teams are based are Germany (15.6%) followed by Italy (14.6%), Spain (13.6%), France (12.8%) and the Netherlands (9.1%). Overall, 87% of the research teams of the respondents are located in 10 countries.

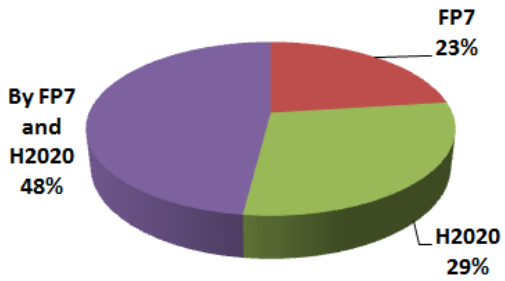
Figure 49: The research team is based in which country (in number of answers)



The respondents have different experience with the different programming periods and different generations of the JUs. Almost a quarter, 23%, of the project coordinators who responded to the survey only have experience dealing with the Joint Undertakings established under FP7, 29% only with the JUs operating under Horizon 2020 and 48% of the respondents indicated that they have experience with both generations of the Joint Undertakings. As regards the project portfolio managed by the project coordinators, the group of project coordinators managing more than 3 projects under FP7 was slightly more dominant (42%) than the other two groups – managing one project (27%) and managing two to three projects (31%). The number of Horizon 2020 projects in the portfolio managed by the project coordinators is more balanced than under FP7.

On average, 48% of the respondents unsuccessfully applied for JU grants before a successful application resulting in a grant agreement and 52% were successful in the first attempt.

Figure 50: Experience on managing projects funded under different framework programmes (right) and number of projects (completed and ongoing) (left)



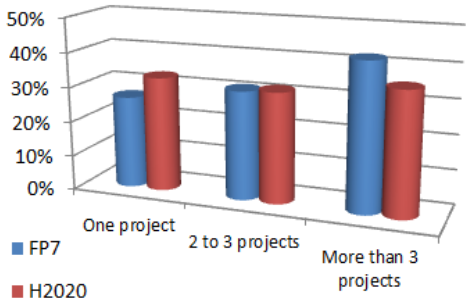
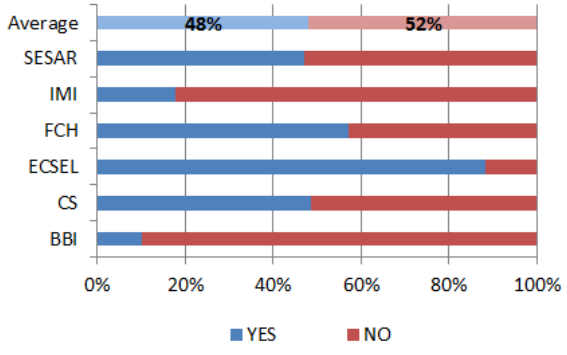
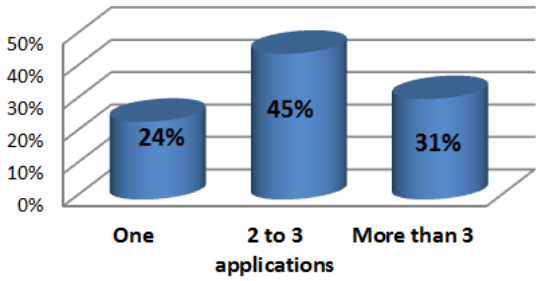


Figure 51: Percentage of successful and unsuccessful applications (right) and number of unsuccessful applications (left)

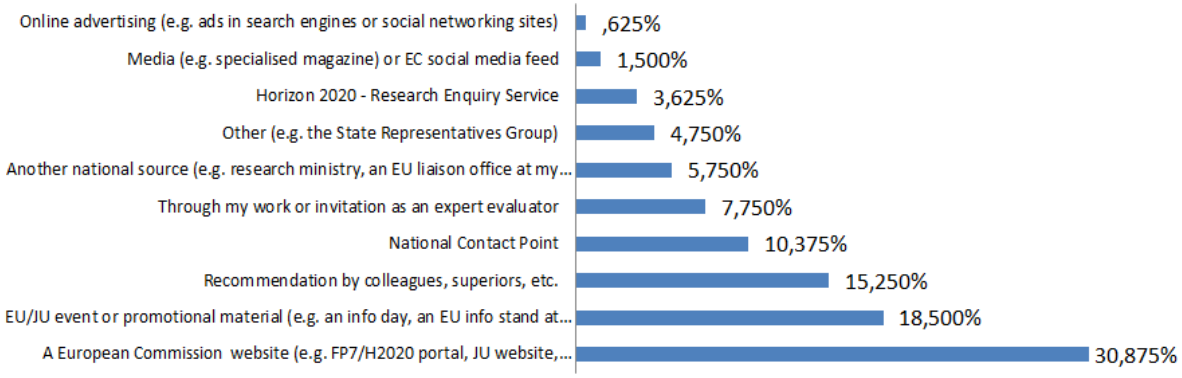




B. Application process

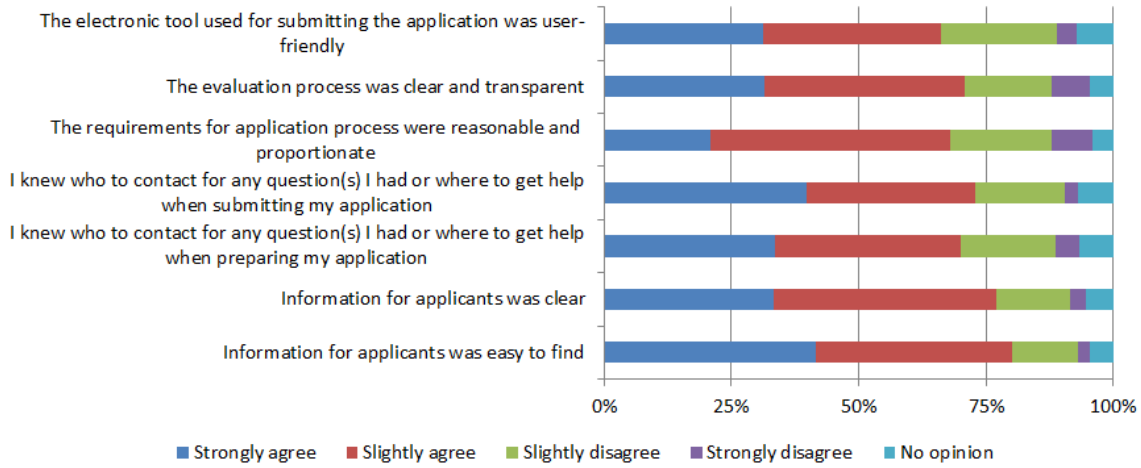
The most important information channels for information on the funding opportunities from JUs were reported to be: the European Commission websites such as FP7/Horizon 2020 portal, the JU website, CORDIS (indicated by 31% of the respondents), followed by EU/JU events or promotional material (such as an info day or an EU information stand at a conference) with 19% of the respondents, and recommendation by colleagues or managers (15%).

Figure 52: Main information channels on JU opportunities



Overall, the project coordinators are satisfied with the application process. The information for applicants is easy to find and clear (almost 80% strongly agreed or agreed with these statements). It was also clear whom the applicants had to contact in case of questions related to application preparation and submission procedures. The respondents were slightly less positive on clarity and transparency of the evaluation process (71%). Opinions varied more on the appropriateness and the logic of some of application requirements (68% respondents expressed their agreement) and on the user-friendliness of the electronic tools for submitting applications (66% of positive assessment).

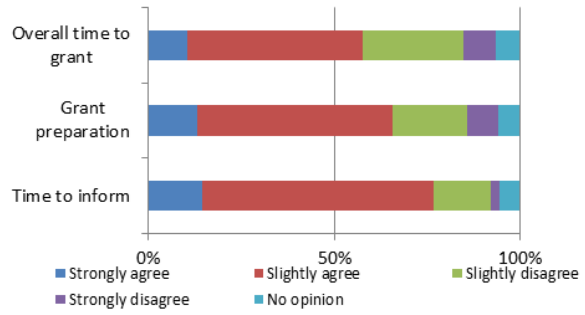
Figure 53: Assessment of the following aspects during the application process



The project coordinators were asked how they assess the overall timeliness of the three key processes during the application stage:

- The time period from the call deadline to the time when the outcome of the proposal evaluation was announced to the responded (i.e. **time-to-inform**);
- The time period from the announcement of your proposal's outcome to the time when you signed the grant agreement (i.e. **grant preparation**);
- The overall time period from submission of the proposal to signature of the grant agreement (i.e. **overall time-to-grant**).

Figure 54: Assessment of the timeliness of the three key processes

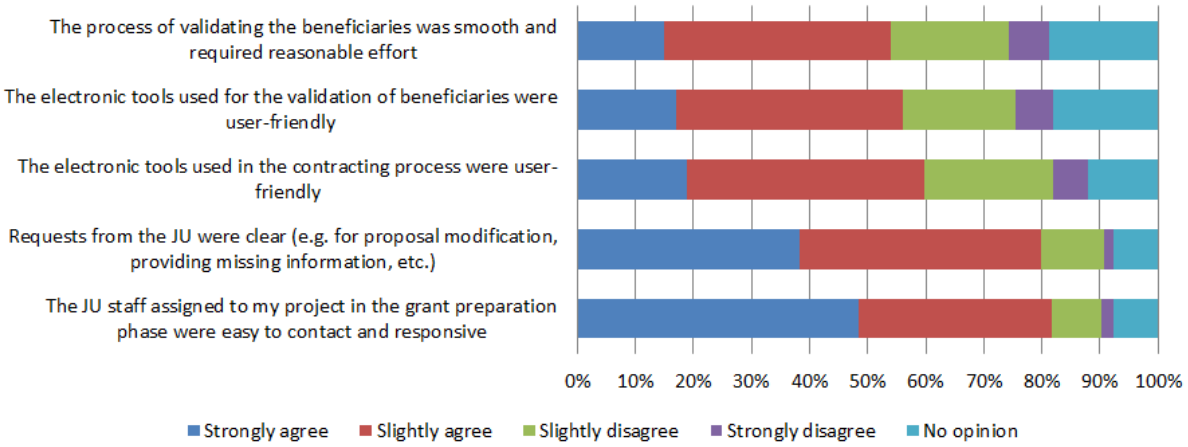


The majority of the respondents (77%) expressed their positive opinion about the duration of the time-to-inform. The duration of the grant preparation was assessed positively by 68% respondents. Opinions were slightly less positive regarding the duration of the overall time-to-grant (58%).

C. Grant finalisation phase

The satisfaction of the project coordinators with the JU staff during the grant agreement finalisation phase is high in terms of their accessibility and responsiveness (82%) as well as the clarity of the JU requests (79%). The project coordinators were less positive when assessing the electronic tools used during the contracting phase (60%) and the electronic tools (56%) and processes (54%) for validation of beneficiaries.

Figure 55: Assessment of grant finalisation process

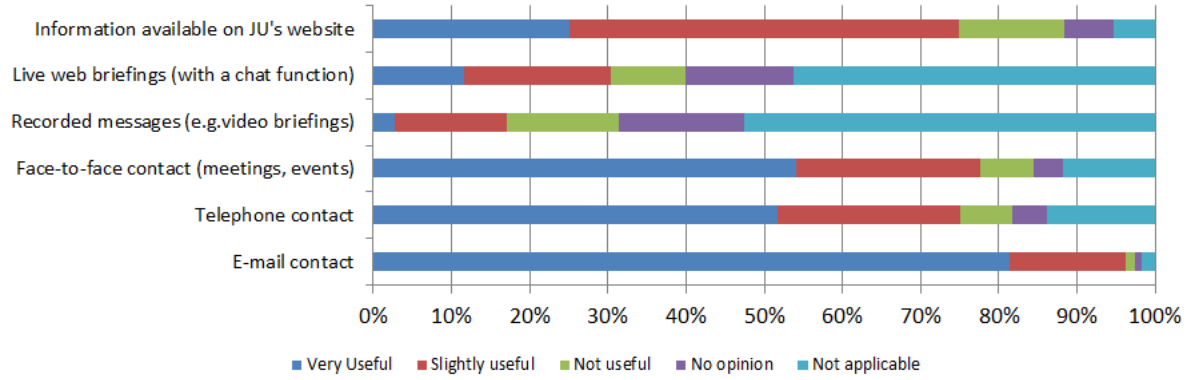


D. Communication and interaction

The respondents are very satisfied with the communication and interaction with the JU. The majority of the respondents found very useful or useful the communication through email (96%), face-to-face contacts during various meetings or events (77%), the telephone contacts (75%) as well as the information available at the website (75%). Opinions were not so

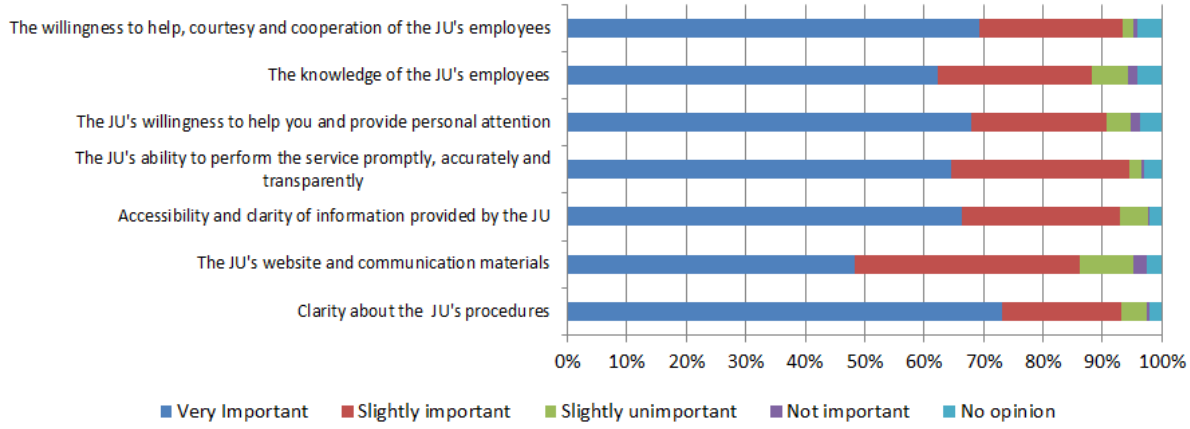
positive on life web briefings (30% respondents consider them useful) and recorded messages (17%).

Figure 56: Assessment of the methods of communication used by the JU



The respondents consider important the following aspects when dealing with the JU: ability to perform the service promptly, accurately and transparently (94.5%), cooperation of the JU's employees (93.5%), clarity about the JU's procedures (93.2%), accessibility and clarity of the information provided by the JU (93%), the JU's willingness to help you and provide personal attention (90%), the knowledge of the JU's employees (88%) and communication materials in the JU's website (86%).

Figure 57: Assessment of factors dealing with the JU



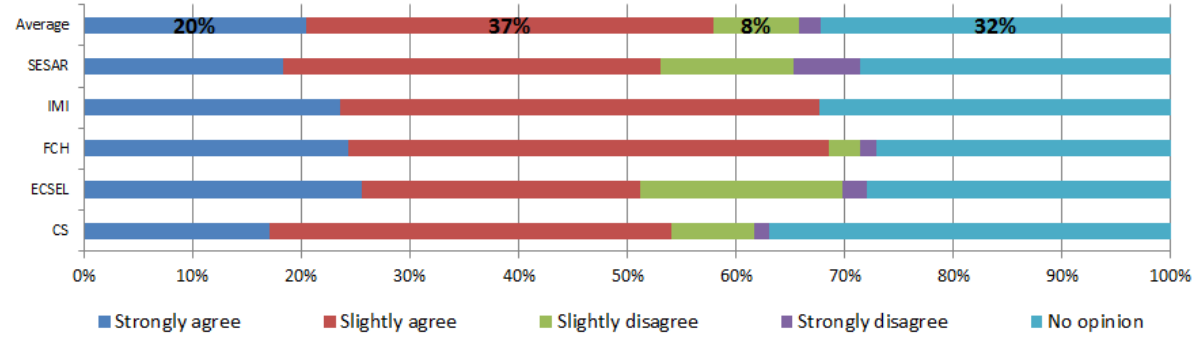
The highest number of the respondents who would definitely apply again for JU funding came from the S2R JU project coordinators (87.5%) followed by SESAR and FCH project coordinators (86%). Clean Sky and IMI project coordinators were slightly less sure about their future plans (71% of the respondents would definitely apply).

A total of 4% of the respondents would probably not (3%) and definitely not (1%) apply again for the JU funding in the future. Regarding the main reasons for not applying for JU research funding again, the respondents indicated that the administrative requirements for managing grants are too heavy (34%), the application procedure is too complex (7%) and the success rate of applications is too low (7%).

E. Overall performance of JU

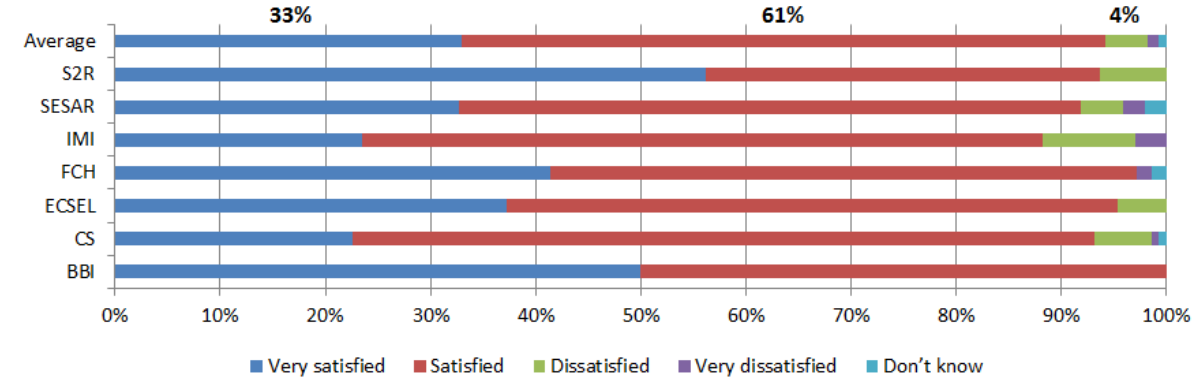
A majority of the respondents (58%) agreed that the second generation of the JU presents an improvement compared to its predecessor under FP7. This question is applicable for assessing IMI 2, Clean Sky2, FCH 2, SESAR and ECSEL JUs.

Figure 58: Assessment of whether the 2nd generation JUs present an improvement compared to their predecessors



On average, 94% of the project coordinators were very satisfied (33%) or satisfied (61%) with the services provided by the JU. The Shift2Rail and BBI JUs recorded the highest rate of the project coordinators who are very satisfied with the services provided (56% and 50% respectively).

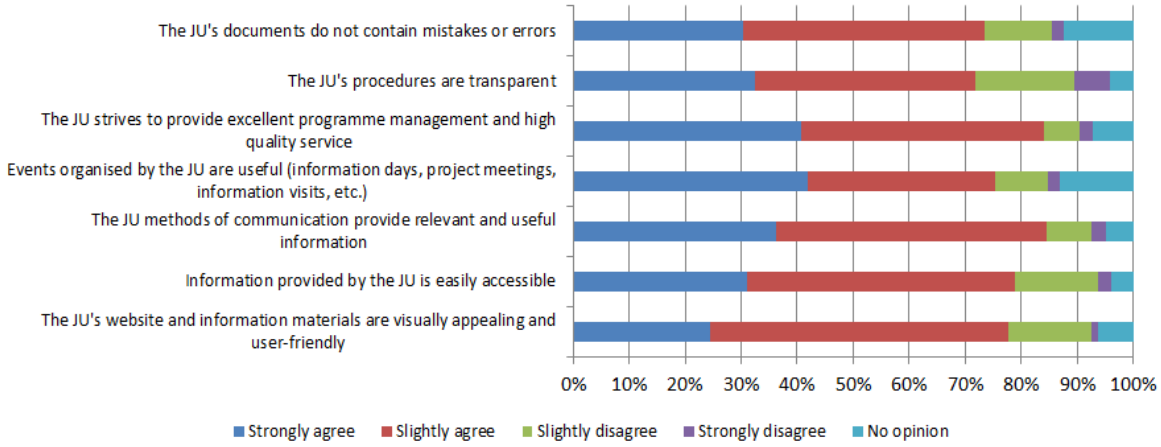
Figure 59: Overall satisfaction of the services provided by JUs



The project coordinators were positive (strongly or slightly agreed) on the following statements when evaluating the actual services provided by JUs: the methods of communication provide relevant and useful information (positively assessed by 84.4% of the respondents), the JU strives to provide excellent programme management and high quality service (84.2%), the information provided by the JU is easily accessible (78.9%) and the JU's website and information materials are visually appealing and user-friendly (77.6%).

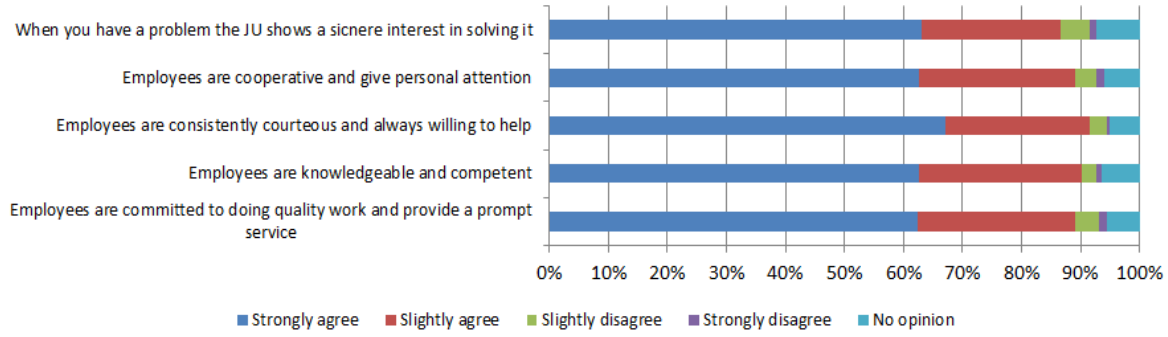
The usefulness of the events organised by the JU (information days, project meetings, information visits, etc.) scored slightly less positive (75.4%), as well as the appreciation on JU's documents without mistakes or errors (73.4% positive assessment) and the transparency of the JU's procedures (71.9%).

Figure 60: Assessment of the services provided by JU



The respondents provided very positive assessment of the JU staff. The project coordinators expressed themselves positively (strongly agreed or slightly agreed) on the following statements when assessing the JU employees: JU employees are consistently courteous and always willing to help (91.5%), knowledgeable and competent (90.2%), committed to doing quality work and provide a prompt service (89.2%), cooperative and give personal attention (89.2%), showing a sincere interest in solving a problem (86.7%).

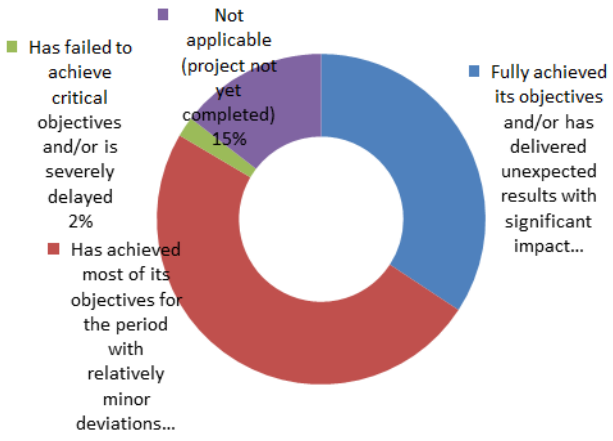
Figure 61: Assessment of the JU employees



F. Overview of the project(s) objectives and impacts

The project coordinators reported that 34% of the projects have fully achieved their objectives and/ or have delivered unexpected results with significant immediate or potential impact (even if not all objectives mentioned in the technical annex were achieved). Almost half, 49% of the projects have achieved most of their objectives with relatively minor deviations and only 2% failed to achieve critical objectives and/ or were severely delayed. The remaining 15% of the

Figure 62: Overview of the project(s) objectives and impacts

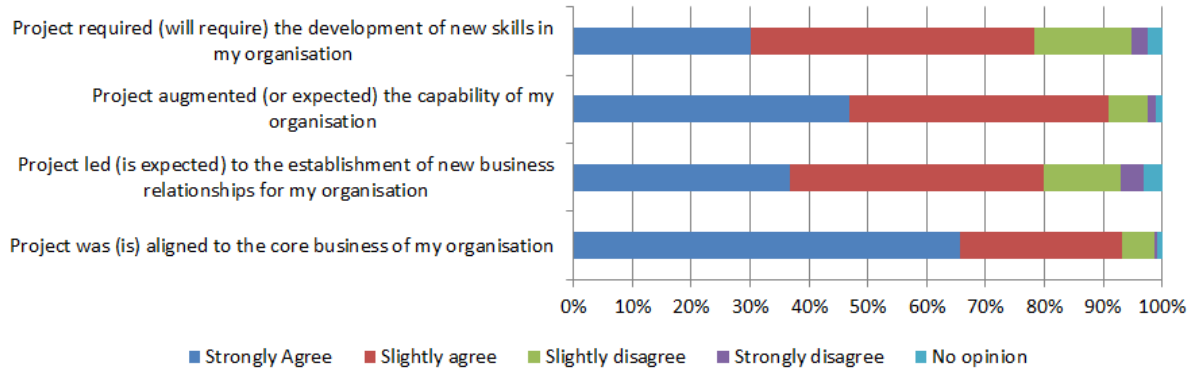


projects are still ongoing.

In addition, the majority (83%) of project coordinators indicated that the project(s) directly contributed (or are expected to contribute) to new products and services for their organisation.

Furthermore, the project coordinators indicated that the projects funded by JU research grants also had impacts beneficial to their organisation: the project augmented (or were expected to augment) the capability of their organisation (91%), the project led (or is expected to lead) to the establishment of new business relationships for their organisation (80%) and the project required (or will require) the development of new skills in their organisation (78%).

Figure 63: Project(s) impact to the beneficiary organisation

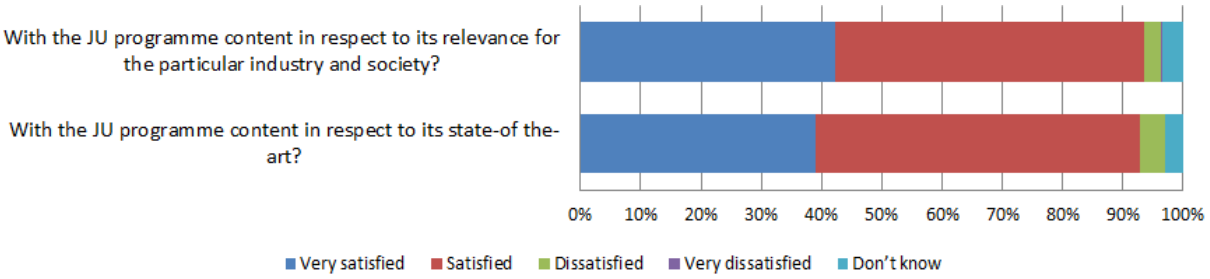


G. Level of satisfaction with the content of the programme

Regarding the question *How satisfied are you with the JU programme content in respect to its state-of the-art?*, 93% of the respondents indicated that they are either very satisfied (39%) or satisfied (54%).

A very high number of project coordinators (93.5%) expressed their satisfaction with the JU programme content with respect to its relevance for the particular industry and the society.

Figure 64: Level of satisfaction with the content of the JU research programme



Annex C. Evidence and Methodology

The JU Interim evaluation focuses on the implementation of the Joints Undertakings (JUs) under Horizon 2020 from 6 May 2014 (adoption of the Council Regulations establishing the JUs) to 31 December 2016, a date that was adopted as the cut-off point for the analysis.

Seven independent expert groups were set up to carry out the interim evaluation of each of the JUs and produce evaluation reports. In total, 39 experts were selected from a list, prepared through an open call for applications. The independent experts were selected based on their level of professional experience and appropriate range of skills in the relevant fields covered by this evaluation.

The expert groups used a wide range of methods and tools suitable for carrying out the requested tasks. Each task required a specific methodological approach. The expert groups undertook a detailed review of pertinent literature, gathered evidence from interviews with a wide range of stakeholders, including both participants and non–participants in funded grants.

The expert groups were given a standard set of data on the calls launched by the JUs and their funded research projects under Horizon 2020 and under FP7, where applicable, from the Common Research Data Warehouse (CORDA) database. Additionally, the results from the various surveys (e.g. common open public consultation, seven surveys of JU project coordinators) were analysed and cross-referenced to assess their validity. More details on individual methodologies can be found in the respective expert group reports annexed to this Staff Working Document (SWD).

The European Commission prepared the SWD based on a wide range of sources comprising the expert group evaluation reports, results from the common open public consultation and the seven surveys of JU project coordinators, as well as the views of the relevant Commission services. Reports and opinions produced by the other EU institutions were also taken into account: namely, the Council Conclusions on the FP7 ex-post evaluation, opinions and reports from the European Parliament, the European Economic and Social Committee and the Committee of Regions and relevant Court of Auditors reports.

The main limitation of this interim evaluation concerns its **timing**: it is taking place only three years at most after establishing the JUs operating under Horizon 2020. The different JUs only launched their first calls late in 2014 or even later. Many projects are still in the very early stages of implementation. There is, in fact, only one completed project presently, out of 329 grant agreements signed.

Concretely this means that it **is too early to carry out a full 'effectiveness' assessment**, i.e. an analysis of progress towards achieving the objectives. The emphasis on the 'effectiveness' assessment will therefore be on the preliminary expectations based on individual JU design features, first reported project outputs and preliminary results (publications, patents, etc.). On the other hand, a much deeper analysis was possible regarding relevance, coherence, European added value, and efficiency (but mostly on the inputs parts, since so far the effects can only be estimated).

This limitation and the related reservation were shared by all the expert groups. However, the expert groups noted that significant progress has been made in launching the calls, signing the grant agreements and the follow-up of the running projects in 2017, but this has not been covered by the current evaluation exercise.

In addition to the effect of some of the key performance indicators specific to each JU, the above mentioned limitation also applies to the leverage effect, which is a key aspect of a PPP: in fact, the Horizon 2020 **targets are set for the whole period 2014 – 2024**. Currently, there are only partial results that can be consulted in the evaluation question of EU added value and in chapter six of the SWD, but the final figures will not be available before the framework programme has finished.

It deserves to be emphasised that the JU interim evaluation **cannot and does not present results and impacts achieved by the JUs operating under Horizon 2020**. It is difficult to make already an adequate quantitative assessment of the results and impacts of these initiatives under Horizon 2020, due to the long time it takes for the research results to reach the market. This is the well-known 'time-lag' issue, i.e. the fact that research projects take time to produce societal impacts: it takes years before the new knowledge generated within the scope of a single project or a portfolio of projects is valorised in the form of new products. This makes it hard for the experts to make an informed assessment on the eventual outcomes or the subsequent impacts.

Limitations also include **shortcomings on data availability and measurability of outcomes.** For example, most indicators focus on input/results but not on impact. The majority of the indicators to track progress relate to classical outputs from R&I projects - publications, patents, prototypes, but not to their impacts on e.g. decreasing CO_2 emissions, improving health of the citizen. As the indicators are collected for individual JUs only and the monitoring data come from various data sources, it is really difficult to aggregate them. Additionally, there is a reliability issue of certain monitoring data as, for example, data on patents and publications are based on self-reporting by project coordinators; data on the cross-cutting issues are based on flagging by project officers.

Another limitation is **the lack of benchmarks to compare performance**. It is not easy to compare and benchmark the performance of JUs operating under Horizon 2020 with the performance of other similar entities, as no comparable (in terms of scale and scope) organisations exist. To overcome this challenge, whenever possible (e.g. in the case of the analysis of participation patterns), FP7 results and figures were used for benchmarking.

As regards the **stakeholder consultation**, it was considered only as a complementary information source to validate or cross-check various evidence coming from the other sources. A distinction between the responses received from the different stakeholders groups, namely private-for-profit organisations versus the remaining type of stakeholders, was initially made. However, this distinction gave only a limited number of questions where the stakeholders representing private-for–profit organisations expressed relatively different opinions compared to the remaining group of the stakeholders. Where the opinions were relatively different, two positions were presented in the summary of the public consultations results (Annex B). The main area where the opinions expressed by the private sector were different from the remaining stakeholders was on the way how JUs are organising the calls for proposals (defining the topics, proposal evaluation system and feedback provided).

To overcome/mitigate these limitations, the SWD is always indicating its data sources. All underlying data sources are also made publicly available. All evaluation results have been systematically cross-referenced and checked against several inputs, namely quantitative data

available, opinions and judgements expressed by the experts groups and opinions expressed by various stakeholders. Conclusions are drawn based on the systematic triangulation of evidence from various data sources.

Annex D. Outcome of the Final evaluations of the JUs established under FP7

Conclusions on the final evaluations of Joint Undertakings operating under FP7

During the period from October 2016 to July 2017, a total of 32 independent experts working in five groups evaluated the outcomes provided by the six Joint Undertakings (JUs) that operated under FP7, namely, ARTEMIS, CS, ENIAC, FCH, IMI and SESAR.

Their conclusions, specific to each JU, are presented as part of the respective evaluation reports. This annex presents the Commission services' position on the performance of the six JUs that operated under FP7, based on the findings of the five expert groups (the ARTEMIS and ENIAC JUs were evaluated by one, enlarged group of experts) and its own experience.

The main conclusion, shared by all individual JU evaluation findings, is that the first generation of JU-based public-private partnerships (PPPs) demonstrated their capacity to effectively and efficiently pursue and contribute to objectives that, while highly relevant to the major socio-economic challenges that Europe is facing, were often judged to be very ambitious, in one case even unrealistic considering the resources available, the capacity of competitors at global level and the relatively limited timeframes.

They managed to overcome significant teething problems under particularly challenging circumstances, such as bridging public and private mentalities and interests while operating under firm Community rules and procedures. The industrial sectors addressed by the JUs continue to be of high economic relevance for Europe and define the areas where well-identified market failures or risks require a long-term concerted research and innovation effort.

Subject to the specificities of the respective industrial sectors, the JUs promoted synergies in linking activities across the innovation cycle, from research outcomes to closer to market activities. As regards impact, while the experts identified project outputs that collectively contribute to set, high-level objectives of the respective JUs, they also stress that it is still early for these outputs to materialise into products or processes ready for market deployment and therefore to assess properly the impact.

Strengths

*The **relevance** of the six Joint Undertakings in contributing to EU competitiveness and policy goals is **confirmed**.*

All JUs addressed strategic technologies in sectors that were, and still are, emerging as cornerstones of a knowledge-based European economy and were linked to the FP7 objectives.

For example, the IMI JU experts consider that the underlying socio-economic conditions at that time justified the establishment of a JU-based public-private partnership aiming at improving the efficiency and effectiveness of the drug development process to produce more effective and safer innovative medicines.

Along this line, the CS JU experts confirm that the policy and rationale that motivated the Clean Sky programme in 2007 is still in line with the current challenges in the air transport

sector and that the portfolio of tasks entrusted to the CS JU continues to underwrite the public-private partnership approach.

The FCH JU experts perceive the activities of the JU as highly relevant to the grand challenges facing Europe by supporting the climate change objectives, helping improve energy security and contributing to raising the status of Europe as an international leader in FCH technologies. They add that in the specific cases where Europe is leading (e.g. hydrogen fuel cell busses, renewable hydrogen production via electrolysis, etc.), the contribution of FCH through R&D activities, demonstration projects and fostering European collaboration, is clear and substantial.

Similarly, in the area of information and communication technologies (ICT), the ARTEMIS and ENIAC JUs have strongly supported the embedded systems and semiconductor domains thereby contributing to the strengthening of the European industry in key strategic areas which generate billions of euros in turnover for Europe and are supporting tens of millions of jobs across Europe.

Finally, the SESAR JU experts highlight the importance of the JU as a key enabler of the wider Single European Sky policy, already delivering solutions for the modernisation of the Air Traffic Management (ATM) in Europe and strengthening cooperation among ATM stakeholders, who have never before worked together, including national authorities.

*The Joint Undertakings **effectively** engaged the major actors in research and innovation in the industrial sectors concerned.*

One of the main achievements on which there is general consensus among the expert groups is that the JUs managed to structure and mobilise an otherwise fragmented landscape of different sectors and industries and to convince competing or different, unrelated stakeholders to work together within a single project.

In the case of the IMI JU, the expert group concludes that the JU led to a new model of collaboration where competing pharmaceutical industries work together to achieve a common goal and, equally important, these collaborations were based on trust, mutual understanding and appreciation among previously distant researchers from academia and industry.

The FCH JU experts agree that one of the JU's main achievements is that it managed to bring together a wide range of stakeholders combining diverse skills and functions. The way in which industry built the representative structure (originally NEW-IG, renamed to Hydrogen Europe in 2014) and engaged into the planning and execution of the programme is indicative of the appeal that this public-private partnership exerts on the stakeholders and a distinct proof of commitment on their part.

The experts evaluating the ARTEMIS and ENIAC JUs acknowledge the presence of all key players necessary to have a strong impact on the respective markets while noting the increased complexity of the JUs' tri-partite organisation (Members States, Industry and the EU) and the associated administrative and coordination difficulties faced by the two JUs.

Similarly, the SESAR JU experts see clear benefits in air navigation service providers, airspace users and airports working together and leading to partnerships beyond the JU's scope and in manufacturers having their R&D potential improved by gaining access to operational stakeholders.

*Projects funded by the Joint Undertakings **effectively** delivered against objectives.*

While it is generally acknowledged that it is still early to assess the final impact of the JUs against high level goals (e.g. competiveness, jobs creation, commercialisation, energy savings, etc.), the evaluations do report on a large number of JU funded project outputs that give rise to reasonable expectations with regard to impact a few years later.

Depending on the orientation of the research agendas and priorities, these very promising outcomes linked to project results range from the leveraging of private funding and filing patent applications to dissemination via publications and direct employment in funded projects.

For example, ENIAC JU funded projects led to the filing of 209 patent applications, while those of the CS JU filed for 151 patent applications. Projects funded under the ENIAC and ARTEMIS JUs engaged more than 3 000 full time researchers while IMI JU projects led to over 2 700 direct jobs.

IMI JU projects produced close to 2 700 publications with an average citation impact (2.03) almost double than that of the EU (1.14), while ENIAC JU projects produced close to 2 400 publications. IMI JU projects also produced 32 patents by end 2016. Twelve of the 21 finished IMI JU projects had already created a total of 16 spin-offs by end 2016. Also 2768 full-time jobs had been created by end 2016.

In the case of SESAR JU, more than 300 completed projects resulted in 350 validation exercises and 30 000 flight trials leading to 61 SESAR solutions (new or improved operational procedures or technologies) of which 27 are in the pipeline for deployment. According to the experts, this uptake of solutions is indicative of the excellent quality of the research performed by the SESAR JU projects.

Finally, the FCH experts commented on the JU's excellent performance in matching the allocation of funds to the research priority areas funded by the calls. In the transport area the JU demonstrated 140 fuel cell cars and light duty vehicles and 45 buses in several Member States along with 17 hydrogen refuelling stations.

Despite the fact that not all projects managed to achieve the planned objectives due to inherent R&I risks and over-ambitious targets, the experts report that project results were comparable to those of the main global competitors. In the area of stationary power generation, the FCH JU portfolio of projects helped Europe to maintain its leading edge internationally, even though deployment activities in Europe are lagging significantly compared to Japan and the USA, probably due to less favourable regulatory regimes in Europe.

*Joint Undertakings carried out their operations in an **efficient** manner.*

There is an overall satisfaction with the operational efficiency of the JUs. As expected from newly established entities faced with the complexities of integrating public and industrial interests in a research context and constrained by Community rules and procedures, operations were slow in the initial period.

This was best reflected by the long time to grant reported by most JUs in the early years of their operations. However, operational efficiency picked up as the JUs matured, even though in some cases the increasing number and/or size of projects affected performance.

Time to grant indicators improved significantly over time while the time-to-pay indicator was always found to be within the set targets.

Most experts consider the JUs to be lean and efficient organisations operating with reasonably low administrative costs (below or close to 5% of the operational costs), given the complexity, spectrum and volume of operations carried out by following cumbersome FP7 processes and sub-optimal IT support tools.

Leveraged *private funding matched or exceeded EU funding.*

An important argument in justifying support for funding FP7 JU-based public-private partnerships has been the requirement for the JUs to leverage private funding that, in the cases of CS JU, IMI JU and FCH JU, would at least match the corresponding EU funding.

The private funding is considered to be in the form of in-kind contributions by the private members (IMI JU, FCH JU) or the legal entities participating in JU activities (CS JU). All experts agreed that the JUs have met, even exceeded their targets of matching the respective EU contributions.

In the cases of the ENIAC JU and ARTEMIS JU, there was a general objective to increase and leverage private and public investment in the sectors of nanoelectronics and embedded systems in Europe without specifying any targets.

The experts report that the two JUs clearly succeeded in increasing both private and public investment in the respective sectors, citing that EUR 630 million of EU funding leveraged EUR 912 million of national contributions and EUR 2.46 billion of private funding.

Finally, the SESAR JU experts estimate a leverage factor of 1.8 counting in the contribution of EUROCONTROL.

Challenges

Despite the general acceptance of the fact that the JUs under FP7 performed efficiently and delivered outputs that were considered remarkable by many accounts, the evaluations identify a number of shortcomings that have persistently limited the potential of the JUs to contribute even more effectively to their objectives. Most of them, relating to management efficiency and effectiveness, have already been addressed by the Horizon 2020 JUs and are now considered to be less of a problem.

However, there still exist a few important ones that continue to affect the currently operating second generation of JUs. Very few, if any, of these shortcomings are common to all JUs; some apply to a few, whereas most refer to one or two only.

The following is a list of the challenges associated to the identified shortcomings that the Commission considers important in relation to the objectives and expected outputs of the JUs. It is by no means exhaustive; for a comprehensive list of challenges specific to each JU the reader is referred to the respective evaluation report.

Need for a stable set of objective ***key performance indicators.***

Key Performance Indicators (KPIs) are used to measure impact in order to improve the understanding of JU strategic challenges from the perspective of management, decision makers and societal stakeholders and, also, to justify support for the JU instrument.

While special care was taken on measuring and reporting on input parameters (implementation statistics, participation rates, etc.), less effort has been devoted to measuring outputs. The absence or selective use of such indicators hampers our ability to assess the lasting effects of the JUs. The issue is a long-standing one and still figures among the main challenges faced by the Horizon 2020 JUs, even though serious efforts were devoted to composing and defining long lists of KPIs and associated targets that, according to experts of some JUs, still do not serve well the intended purpose and need to be revisited.

For instance, the IMI JU experts argue strongly for the development of SMART[24] KPIs along with baseline metrics to allow benchmarking exercises over time.

Similarly, the ARTEMIS JU and ENIAC JU experts consider the absence of objective, stable over time KPIs to be of critical importance to the legitimacy and justification of the support to the JUs.

Need for clear, harmonised methodology for the ***calculation of in-kind contributions*** *by the private members.*

While it was generally agreed that the JUs managed to leverage private funding that matched or exceeded the EU funding, it became clear from the evaluation findings and comments of experts that the private members reported in-kind contributions without clear references to the methodologies used for such calculations.

Given the importance of the leverage effect in the justification of the support for the JUs, existing and future, the definition of a methodology for the calculation of in-kind contributions, commonly agreed by the private members of all JUs, was treated as a Commission priority and a harmonised methodology is now implemented by the JUs operating under Horizon 2020.

Openness to new members

Many expert groups make specific references to the difficulties experienced by certain organisations such as SMEs, universities or research centres in becoming members of the JUs. In exchange of important benefits such as direct involvement in JU governance, voice on the definition of research agendas and call topics, candidate members were required to contribute financially amounts disproportionate to their size or financial capacity (e.g. CS JU and SESAR JU).

In the IMI JU, mid-cap companies could not benefit from EU funding, and companies active in non-pharma sectors could not easily contribute to IMI JU activities (these limitation were later lifted in IMI2 JU respectively with the eligibility for EU funding of mid-size companies, and with the new status of "Associated Partners").

[24] Specific, measurable, achievable, relevant, time-bound

Prior to the autonomy of the CS JU, the Commission together with the private members launched an "Associates" programme in order to establish a critical mass of stakeholders in an open and transparent manner. Despite the efforts, the selection process left many rejected candidates complaining about the absence of reasoned decisions.

Closely linked to the openness of JUs to new members is the concern expressed by the experts about the top-down approach employed when compiling the Strategic Research Agendas (SRA) or, equally important, defining call topics. A number of experts pointed to the fact that such processes were influenced heavily by the large industries even though they conceded that the issues addressed in the SRA were relevant to realise the set objectives.

Participation in projects was also not straightforward in JUs characterised by the presence of large industries where, in addition to financial burdens, SMEs and academic stakeholders were often discouraged by complex and time-consuming decision-making procedures, negotiations on IP rights, etc.

*Need for stronger **interaction** between **Governing Boards** and **advisory bodies** (States' Representatives Groups and Scientific Committees).*

When establishing the governance structure of the JUs, great emphasis was placed on defining the role of advisory bodies such as the States' Representatives Group (SRG) and the Scientific Committees (SC), and their interaction with the Governing Boards (GBs) of the JUs. The efficient collaboration between these bodies is considered by all experts to be of critical importance to the purposeful functioning and successful outcome of the JUs.

On this important issue, a number of expert groups express concern, among others, on the low impact of the advisory bodies on the Governing Boards' strategic decisions. For example, the CS JU experts consider that the NSRG (National States' Representatives Group) did not seem to have fulfilled its full potential in ensuring a close relationship with the Member States in order to influence the Clean Sky programme or to develop synergies with national research strategies.

The IMI JU experts call for improved communication between these bodies echoing the opinion of SRG and SC that the GB should be more open to their feedback and input.

Finally, in the case of FCH JU, the experts report that even though the definitions of roles and responsibilities were clearly defined in the regulation, some of these roles and responsibilities were not clear to all members of the advisory bodies and, therefore, they have not delivered according to their full potential. They especially noted and questioned the appropriateness or effectiveness of SRG membership.

***Uneven SME** participation rates; close to those of the FP7 Cooperation Specific Programme.*

Overall, the SME rates in signed JU grants were around 20% in terms of participations and 16% in terms of share of EU funding. These rates are close to the corresponding rates in the FP7 COOPERATION Specific Programme; 19% and 17% respectively.

All experts, as well as the Commission, expected higher SME rates from JUs that have industrial needs at the heart of the matter. Another issue is that these rates are fluctuating widely among JUs.

For example, the CS JU rates for SMEs are among the highest in FP7 programmes (34% both in terms of participation and share of EU funding), the IMI JU rate of 13% in share of EU funding is lower than that of the FP7 Health Priority Area which is 18% (but equivalent in terms of share of participations, with respectively 16% and 15.9%).

Also worth noting is that although 16% of the participants in ENIAC JU projects are SMEs, their share of funding is only 6%, raising questions about the meaningfulness and motivation of such participations. Clearly, the issue of SME participation should be considered separately for each JU, by taking into account the respective industrial specificities and characteristics.

Further efforts are required to increase coherence of the objectives and activities of the Joint Undertakings with the corresponding parts of FP7 and other EU funding programmes as well as the policies at EU, national and regional level.

Being part of and supported by FP7, the JUs should ensure that their scope and objectives were synchronised and considered to be complementary to the respective priority areas of FP7.

The CS JU and SESAR JU experts identified clear synergies between the JU and FP7 activities and commented on the fruitful coordination between CS JU, SESAR JU and ACARE (Advisory Council for Aviation Research and innovation in Europe. Regarding national policies, while the SESAR JU maintains strong links with national authorities and agencies, the CS JU experts did not detect any visible and explicit results stemming from the JU's coordination with national research programmes.

The Strategic Research Agendas developed by the ARTEMIS JU and ENIAC JU were used to ensure the relevance of these themes and therefore influence FP7 priority research areas. However, the experts found overlaps and weak, if any, links with other EC and national programmes.

The IMI JU experts considered that complementarity with other FP7 projects, as well as with Joint Programming Initiatives, remained only limited.

The FCH JU experts concluded that while the existence of the JU contributed to a reduced fragmentation in FP7 and other EU support programmes, the boundaries between the JU and FP7 were not clearly defined. Regarding coherence with national programmes, the experts believed that this was the task of the States' Representatives Group; to provide guidance to the JU activity and provide a forum through which the content of the Member States' own programmes might be influenced. This goal has been realised to a limited extent, so in this area the FCH JU has not brought about significant changes.

***Low EU-13** participation rates.*

Overall, the participation rates of EU-13 Member States in JU funded projects amount to 4.3% in terms of number of participations and 2.3% in terms of share of EU funding. These rates are lower than the corresponding rates of 7.0% and 3.8% in the FP7 Cooperation Specific Programme. While it can be argued that the extent of EU-13 participation is generally commensurate with the number of researchers or the scale of R&D investment, it is acknowledged that EU-13 rates are rather low.

*Need to improve **communication** and **dissemination** of project results*

In their effort to ensure an open and inclusive attitude towards the wider stakeholder community, the JUs employed a range of mechanisms and tools such as websites, social media, webinars (to inform on calls for proposals), events, publications and articles in the specialised and general press. These means of communication have improved considerably over the course of the JUs lifetime.

It was generally accepted that the websites provide easy and effective access to information about the JUs, the funded projects and call related information. The experts evaluating the transport JUs note that social media are not used consistently across JUs and also the absence of clear dissemination strategies. The IMI JU experts consider that while the communication strategy, tools and channels are logical, well thought out and extensive, the monitoring of their effectiveness and impact could be further improved. Along the same lines, the FCH JU group calls for more focused communication activities to increase FCH technologies awareness.

The dissemination of project results, however, was considered to be insufficient. Access to knowledge generated by funded projects was mostly confined to directly involved stakeholders.

Both the Commission and the experts see the need for more active and targeted dissemination, especially to the wider European industry and potential end-users. The dissemination of results continues to be a challenge for the second generation of JUs, under Horizon 2020.

Annex E. Interim Evaluation Reports for the JUs under Horizon 2020

Expert Group, *Interim Evaluation of the Innovative Medicines Initiative 2 Joint Undertaking (2014-2016) operating under Horizon 2020*, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-69299-4

Expert Group, *The Interim Evaluation of Bio-based Industries Joint Undertaking (2014-2016) operating under Horizon 2020*, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-67438-9

Expert Group, *Interim Evaluation of the Clean Sky2 Joint Undertaking (2014-2016) operating under Horizon 2020*, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-69188-1

Expert Group, *The Interim Evaluation of the Fuel Cells and Hydrogen 2 Joint Undertaking (2014-2016) operating under Horizon 2020*, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-68891-1

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