2020 ANNUAL ACTIVITY REPORT

ECSEL Joint Undertaking

Electronic Components and Systems for European Leadership

In accordance with Article 22 of the Statutes of the ECSEL JU annexed to Council Regulation (EU) No 516/2014 and with Article 23 of the Financial Rules of the ECSEL JU.

In pursuance of Financial Regulation 2018/10461, Framework Financial Regulation No 2019/7152

The annual activity report will be made publicly available after its approval by the Governing Board.

It is based upon the template communicated by the Common Support/Implementation Centre for Horizon 2020 Annual Activity Reports

1 REGULATION (EU, Euratom) 2018/1046 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012

2 REGULATION (EU) No 2019/715 of 18 December 2018 on the framework financial regulation for the bodies set up under the TFEU and Euratom Treaty and referred to in Article 70 of Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council

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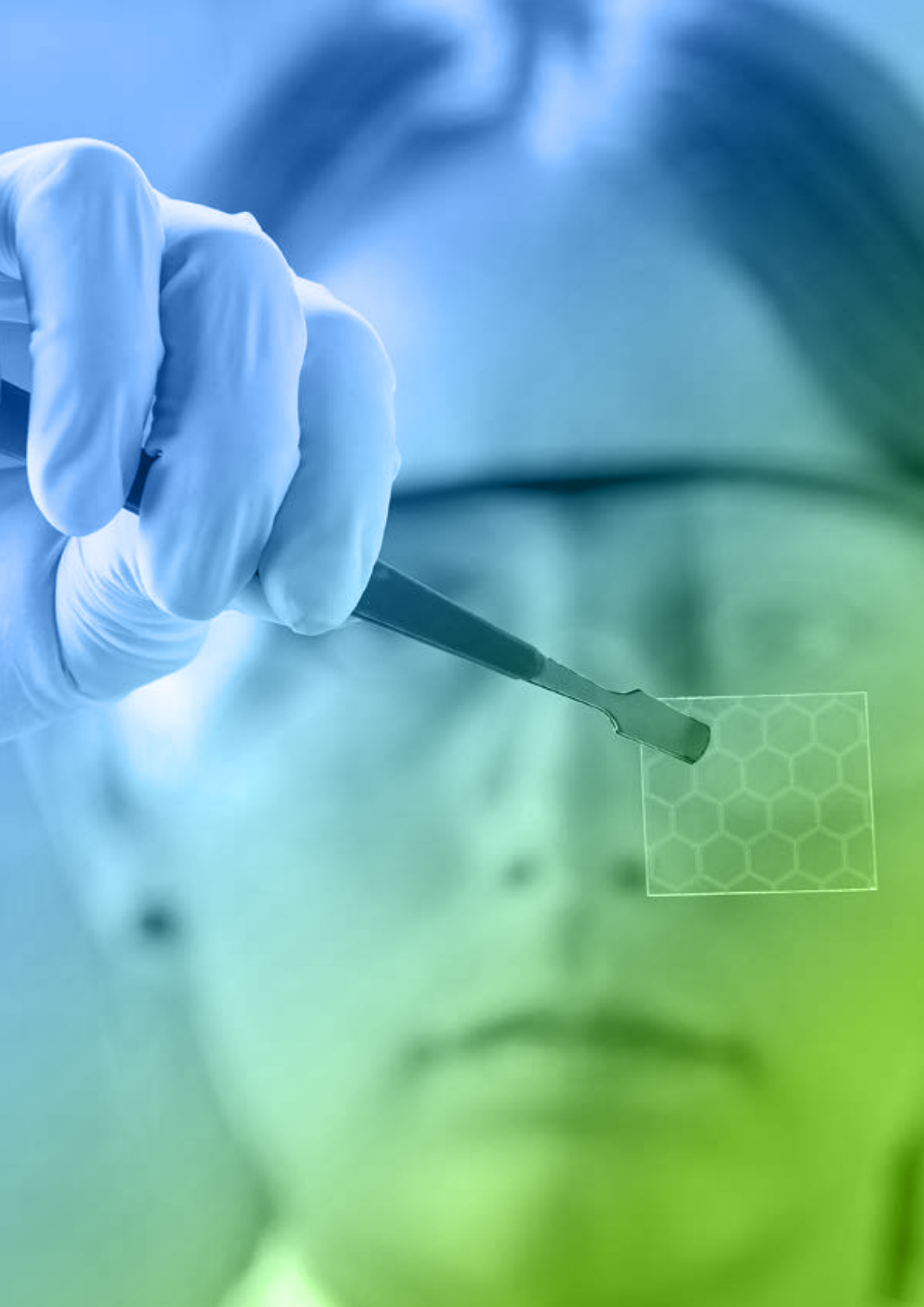
1 Introduction and Fact Sheet

Name	Electronic Component and Systems for European Leadership (ECSEL) Joint Undertaking (JU)
Objectives	The ECSEL JU shall have the following objectives: a) to contribute to the implementation of Regulation (EU) No 1291/2013, and in particular part II of Decision 2013/743/EU; b) to contribute to the development of a strong and globally competitive electronics components and systems industry in the Union; c) to ensure the availability of electronic components and systems for key markets and for addressing societal challenges, aiming at keeping Europe at the forefront of technology development, bridging the gap between research and exploitation, strengthening innovation capabilities, and creating economic and employment growth in the Union; d) to align strategies with Member States to attract private investment and contribute to the effectiveness of public support by avoiding an unnecessary duplication and fragmentation of efforts and by facilitating the participation of actors involved in research and innovation; e) to maintain and grow semiconductor and smart system manufacturing capability in Europe, including leadership in manufacturing equipment and materials processing; f) to secure and strengthen a commanding position in design and systems engineering including embedded technologies; g) to provide access of all stakeholders to a world-class infrastructure for the design and manufacture of electronic components and embedded/cyber-physical and smart systems; and h) to build a dynamic ecosystem involving Small and Medium-Sized Enterprises (SME's), thereby strengthening existing clusters and nurturing the creation of new clusters in promising new areas
Founding Legal Act	Council Regulation (EU) No 561/2014 of 6 May 2014 establishing the ECSEL Joint Undertaking[3] (referred to in the following as the REGULATION)
Executive Director	Bert De Colvenaer
Governing Board	Chair: Dr. Sabine Herlitschka Vice-chairs: Doris Vierbauch, Lucilla Sioli and Jean-Luc di Paola-Galloni Members: see Chapter 6.1.1
Public Authorities Board	Chair: Doris Vierbauch Vice-chair: Kari Leino Members: see Chapter 6.1.3
Private members Board	Chair: Rotating Chair: In 2020, the position was held by Jean-Luc di Paola-Galloni of ARTEMIS-IA. Members: see Chapter 6.1.4
Staff	30 (see Chapter9.3)
Work Plan	GB.2020.141 - Amendment Work Plan 2020 https://www.ecsel.eu/sites/default/files/2020-08/ED%202020.309%20-%2014th%20Amendment%20WP2020-v16%2004%20August%2020%20%20Clean%20SIGNED.pdf

2020 final adopted budget	**Commitment appropriations:** EUR 218 million final adopted budget - EUR 212 million for operational costs (only H2020): • Operational contribution from EU Budget 2020: EUR 204 million • Reactivation of unused appropriations from previous years: EUR 8 million - EUR 5.4 million or administrative costs: • Administrative contribution from EU Budget 2020: EUR 2.29 million • Private members administrative contribution: EUR 2.86 million • Reactivation of unused appropriations from previous years: EUR 0.25 million **Payment appropriations:** EUR 215 million final adopted budget - EUR 209 million for operational costs (H2020 and FP7) • EUR 189 million for H2020 operations › From EU Budget 2020: EUR 132 million › From previous years unused appropriations: EUR 57 million • EUR 20 million for FP7 operations (from previous years unused appropriations) - EUR 5.79 million for administrative costs: • Administrative contribution from EU Budget 2020: EUR 2.29 million • Private members administrative contribution: EUR 2.86 million • Reactivation of unused appropriations from previous years: EUR 0.64 million
Budget implementation on the total budget 2020 (*)	**COMMITMENT APPROPRIATIONS IMPLEMENTATION** EUR 218 million total available budget - 100 % for operational costs – H2020 (EUR 213 million) - 89 % for administrative costs (EUR 4.81 million) **PAYMENT APPROPRIATIONS IMPLEMENTATION** EUR 216 million total available budget - 91 % for H2020 operational costs (EUR 172 million) - 70 % for FP7 operational costs (EUR 14 million) - 83 % for administrative costs (EUR 4.84 million)
Grants	14 grants were signed in Q2 2020 selected from two calls 2019, for a total cost of EUR 629 million, a total EU funding of EUR 165 million and funding from the ECSEL Participating States of EUR 164.5 million
Strategic Research Agenda	The Multi-Annual Strategic Work Plan (MASP) can be found on the ECSEL JU website https://www.ecsel.eu/sites/default/files/2020-01/ECSEL%20GB%202019.134%20-%20MASP%202020%20and%20Annex.pdf
Call implementation	Number of calls launched in 2020: 4 (2 RIA, 1 IA and 1 CSA) Number of proposals submitted: 50 Number of eligible proposals: 44 Number of proposals funded: 8 RIA, 6 IA, 1 CSA Global project portfolio ECSEL JU projects: 96 of which 15 in call 2020
Participation, including SME's	ECSEL JU (2014 to 2020 at FPP stage) Total number of participations in submitted proposals: 9099, of which SME's: 29% and private (for profit) companies (including SME): 63% Total number of entities in submitted proposals: 3082, of which SME's: 44% and private (for profit) companies (including SME): 81%

* Total available budget includes, in addition to the budget voted by the Governing Board, appropriations carried over from the previous exercise, budget amendments as well as miscellaneous payment appropriations for the period (e.g., internal and external assigned revenue). The figures are those related to the provisional accounts and are not yet audited by the Court of Auditors (Source: ABAC DWH). More detailed information on budget implementation for 2020 will be presented in the context of the Annual Accounts 2020 and the Report of Budgetary and Financial Management as per ECSEL Financial Rules.

3 Council Regulation (EU) No 561/2014, OJ L169, 7.6.2014, p.152.



2 . Foreword by the Executive Director

Nobody in the early days of 2020 could foresee what a turmoil the year would become. True, there was something in China, but we have been there before with Ebola, SARS, H1N1, Flu, … Anyway, too far from us! But not for long …

In all aspects, 2020 became a very special year. The whole world and all of us were pushed out of our comfort zone. It was a real stress test for everything and everybody. But as every challenge is an opportunity and as every experience is a good experience (even a bad experience …), I sincerely hope that we keep the best lessons from this special year 2020 and quickly forget about all the rest …

The White Atrium, 5th floor is the office space we rent, but we have hardly been there. Our home became our office where we could work comfortably and less stressfully in more casual attire. Our 2020 ECSEL JU mission budget was largely overestimated, but we did not waste a single minute in a traffic jam and our CO2 business footprint reduced by some 50 tonnes. We have colleagues we hardly saw in person this last year, but we know they are only one mouse click away: teleconferencing holds no secrets for us anymore. We did not have a lunch break with our preferred office colleagues, we spent much more time with our partner and kids. We miss the familiar taste of the coffee machine and the dull sandwiches but learned to cook new dishes (and were surprised that it is rather that simple …!) We did not walk from office to office in Brussels but walked around our home neighbourhood and wondered why we did not start doing this earlier.

We cannot remember how we – pre corona – had time for our daily two-hour car commuting, but we now use that time for reading books we finally bought. We did not have meetings in person these last months, but all remote meetings started (and finished) punctually. We did not go on holidays, and that was not nice, but the air did get cleaner, and our travel appetite grew very (very) strong! When it all started in March, we did not trust online life and we did not really know where the Cloud was; all these ECS technologies are now commonplace for us, our parents and even our children …. The offices did not open from 08:00 till late, but we worked more intensively after kids and partner were cared for. We have more quality-time, and we manage it better, in balance. We work hard and we have more time to think, talk, call, and walk, podcast, read, cook, cycle, sleep, clean, observe, run, … We appreciate (again) the company of our partner, our cat, our fish, our neighbour, …

But it has been a hard year for many, too: for those with health concerns, for those with no family around or family in another country, for those in small, city-centre apartments, for everybody with exaggerated screen time statistics, … Very sadly, our old-time colleague, Helmut Ennen passed away. He has been the crucial hand in setting up the ECSEL JU not so very long ago. Rest in Peace, dear Helmut!

The ECSEL JU Office has been ready for a full digital life for some time. We needed it and we have used it to guarantee the ECSEL JU program business continuity. Despite a few overload cracks, we withstand at least that storm. All transactions, approvals, meetings & discussion happened "digital". We have notified more difficulties at the project level as many of them could not continue the practical, physical, and technical work in labs and workshops. We have helped them all out. As for the call 2020, we even have seen an increased interest with more proposals. We safely guided the program through 2021. We were ready, but none of us would have been ready in times gone by...

I would like to thank the whole ECSEL JU community for all its additional efforts, understanding and patience during these difficult, un-social and unhealthy times. More specifically, I give a big thanks to the ECSEL JU Office team for the resilience and endurance you showed to stand the home confinement for now close to one year. You all together, you did an amazing job: we kept our business continuity, we kept on serving and helping our stakeholders and we kept on meeting and making decisions: we kept the ECSEL JU running!

Whilst 2020 will be remembered as the year of the COVID, let 2021 be the start of the Roaring Digital Twenties.

26 February 2021

Bert De Colvenaer
ECSEL JU Executive Director

3. The Assessment from the Governing Board of the Annual Activity Report 2020 of the Executive Director of the ECSEL Joint Undertaking

The past year has been an outstanding one in many ways. With the Covid-19 pandemic, the challenges at organisational as well as individual level were highly demanding. At the same time, the vital relevance of ICT and the related ECS technologies and communities became more obvious than ever: from facilitating continuity - professionally and personally - to day-to-day communication all the way to its vital contribution in the medical field, this relevance has never been clearer.

The fact that the ECSEL JU has been able to continue its core activities at close to 100% efficiency while operating in an entirely remote mode is testament to the importance of these technologies, and therefore also to the importance of the RD&I work that the European Union and the Participating States fund through ECSEL JU, in securing a productive, healthy, and sustainable future for citizens of Europe and by extension, the world.

The Governing Board is pleased to observe the capacity of the ECS community in carrying forward their excellent work in support of the programmes' objectives. The Governing Board therefore wishes to encourage the community and all other stakeholders to keep on demonstrating this significant capability, particularly with a view to establishing a well-defined and optimally implemented follow-on programme under Horizon Europe, "Key Digital Technologies", the proposals for which are presently being debated in the EU Parliament and Council.

Of particular note is the fact that the ECSEL JU successfully executed the last of its programmed Calls for Proposals. These Calls resulted in the selection of 14 R&D&I projects and one Coordination and Support Action for a total investment (EU, National and participants own resources) of roughly 670 M€ (figures still to be finalised at the time of writing). This has now culminated in a collection of 92 projects for a total investment of some 4.8 bn€, that gives broad coverage to the technical work programmes' needs, and indeed has accumulated several successes that demonstrate the power of the coordination achieved by the JU's tri-partite model. We particularly welcome the documentation of this in the publication "Powering the Digital Transformation in Europe", compiled by external authorities within the ECS community at the initiative of the JU - a document that has proven to be invaluable in highlighting the impact potential of this model.

In addition to the handling of the calls and projects, the running of the Finance and Administration Units, monitoring and internal audit and the high-profile external Communications activities (even under conditions of lock-down) have also quietly contributed to a successful, if difficult, year (though we note that further impact of the pandemic on running projects may only appear later). Also, the three Lighthouse Initiatives - Mobility.E, Industry4.E and Health.E, set up to assure more critical mass and therefore concrete impact of the programme – have continued their regular efforts amongst project consortia, both inside and outside ECSEL and their related industry associations, and are setting an example for future activities of this type.

The Governing Board recognises once more that the important actions undertaken by the ECSEL JU in previous years addressing the remarks of the European Court of Auditors and the Budgetary Authority, have been diligently pursued to obtain reasonable assurance on the legality and regularity of the underlying transactions. The fruits of these actions are now clear: for the financial year ending on 31 December 2019, the European Court of Auditors issued an unqualified ("clean") audit opinion on the accounts of ECSEL JU and on the legality and regularity of the payments and revenue underlying the 2019 annual accounts.

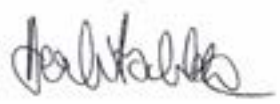
The Governing Board appreciates all efforts of the ECSEL JU Office to satisfy all stakeholders' requests in a positive, constructive, and friendly manner, and recognises the high workload handled by the team.

The Governing Board acknowledges that the internal control system has been assessed to be appropriate and appreciates being regularly informed on developments and updates. It also recognises that, according to the information provided in the Annual Activity Report, the Executive Director of the ECSEL JU has reasonable assurance that, overall, suitable controls are in place and are working as intended, risks are being properly monitored andmitigated, and necessary improvements detected by the auditors are being implemented. Therefore, the Executive Director, in his capacity as Authorising Officer, has signed the Declaration of Assurance without any reservation.

The Governing Board concludes that the Annual Activity Report for 2020 appropriately describes the activities and situation of the JU, and thanks the Executive Director and his entire team for contributing to the success of ECSEL JU.

For the Governing Board,

Dr. Sabine Herlitschka
Chairperson



4 Executive Summary

Without doubt, 2020 will be remembered in history as the year of the worldwide COVID-19 pandemic. Although the ECSEL JU did see its clear impact, the overall consequences on the program itself remained rather limited (ex. proposals preparation, all remote meetings, reviews and evaluations, delays in nearly all projects but none stopped, …) due to the facilitation by the ECSEL JU Office and efforts made by all project participants and stakeholders. The impact on the overall ECS ecosystem and its industry and research community may be much more important.

In 2020, ECSEL JU has launched its last calls and some overall key operational figures are important to keep in mind: with the €2248 m public funding (EC + EPS), ECSEL JU has supported 91 projects and 3205 beneficiaries from 34 countries. The average funding rate is 49 % and 41 % of the participating entities are SME's. All the projects together represent 407 730 person-months of work for a total financial budget of €4628 m. If ECSEL JU is compared with other H2020 instruments, it handles by far the biggest projects in terms of budget and number of participants, resulting in the highest average on patents and publications. Comparing further the implementation on table 34, the ECSEL JU team is handling the highest cost, budget, and number of beneficiaries per project. The evaluation result of the ongoing projects (section 5.5.1) is simply impressive and excellent!

The above is illustrated by the projects closed in 2020. Some of them (Aquas, Autodrive, Scott) cover safety related aspects over different applications and have led to the development of new hardware components, design tools and new standards and new market opportunities. In the project Dense, different types of sensors are combined to make a self-driving car "see" better than its driver in bad weather conditions, the ENSO project addressed the energy needs of small autonomous systems and the SILENCE project dealt with some unique applications of ultrasound. Mechatronics was the main application in the project I-MECH and validation of complex embedded systems elaborated in the project MegaMaRt2. Development of IC production technology/pilot line (Microprince, TAKEMI5) and production management systems (Productive 4.0) assures the coverage of the full ECS value chain. RF application-oriented projects with SoI technology (Reference) remains one of the success stories lines of the ECSEL JU. Overall, all projects make an important effort for wide dissemination of results and most are covered with an elaborated website referred to later in this report.

The Lighthouse Initiatives were introduced to signpost subjects of common European interest, and to accelerate the impact of R&D&I projects by promoting collaboration and fostering a continuous dialogue within the ECS community and between the ECS community and technology users, decision-making bodies, and society so that technologies and innovations have a real and speedier impact on business, the economy, and consumers. Important achievements in 2020 are the white papers by the Industry4.E Lighthouse Initiative (a cross-platform ECSEL – orientated Industry4.E strategic roadmap) and the one from Health.E identifying 13+ emerging medical domains that can be served now and in the future by the ECS industry. The Mobility.E LIASE (LIghthouse Advisory SErvice) was joined by industrial and research association side EARPA, ERTICO and CLEPA during 2020.

Quite some Communications resources were spent on internal and external activities related to COVID 19. The ECSEL JU Symposium 2020 was fully online with the highly appreciated participation of Commissioner Breton and Commissioner Gabriel. The first ECSEL JU (in a nutshell) infographics "megaposter" and the "Powering the Digital transformation in Europe" were published and in the early days of 2020 the second PAB – Permanent Representations to the EU meeting and the impact visit to the Grenoble area were organised.

All finance and administrative support activities, including amongst others the Joint JU IT services (utmost crucial for teleworking), legal support, the HR & procurement support, audit, and accounting liaison ran smoothly throughout the year.

All the ECSEL JU activities (operational, administrative, financial and communication) could seamlessly and without any disruption continue remotely/teleworking when the lockdown was announced on 18 March 2020.

5 Part I. Activities and Achievements of the year

This section describes the activities of the ECSEL JU with reference to the Annual Work Plan for 2020. It covers the core activities of the JU (i.e., the operational aspects of launching calls for proposals, the ensuing allocation of funding to projects and their monitoring), as well as the peripheral actions that are required for the programme. An overview of the whole ECSEL programme is also offered as 2020 was the last Call-year of the programme. In comparison to other programmes, ECSEL comes out as one of the more efficient and effective programmes.

2020 was also the year of the COVID-19 pandemic, and some of the impact on the activities will be discussed where relevant. The ECSEL operation team wishes to thank the consortia for their efforts in finalizing the proposals sometimes under very difficult circumstances, having to grief the loss of valuable members of the consortium. The operation team also would like to thank the experts that evaluated and reviewed the proposals or projects under difficult circumstances often having to adapt on short notice to changes.

5.1 Key objectives and associated risks

For 2020 the key objectives were at the start of the year:

- To run the 2020 calls within the set schedule without hiccups;
- Select projects on innovative topics that complement the project portfolio while making efficient use of both National and EU funding and improving the 1:1 ratio between National funding and JU funding;
- Proceed with the Lighthouse Initiatives;
- Efficiently manage the ECSEL JU projects selected in the preceding calls while providing best service to the consortia;
- Implement the IT developments in SYGMA-COMPASS, the H2020 IT tools;
- Promote ECSEL JU with the support of the Communications department;
- Provide adequate answers to the various audit services (IAS & ECA);
- Reporting to the EPS National Authorities, Industry Associations and Boards;
- Prepare the activities for 2021;
- Prepare contingency plans for BREXIT.

The identified risks for the operational unit can be summarized as follows:

- With the already gained experience on running calls, the preparation, launch and execution of a call has become routine but nevertheless requires dedicated attention. One of the risks concerns the availability of the National budget figures of the EPS in-time. Another risk concerns unforeseen IT issues that could delay or hamper the call execution;
- Selecting the projects by the PAB is each year a difficult exercise, in view of the high quality of the proposals and the requirements regarding portfolio, the synergy with national strategies, the available national budgets and rules. Some of the main risks concern the lack of sufficient funding from the EPS, the mismatch for the selected projects between national and EU funding, and the quality of the expert evaluation;
- The workings of Lighthouse Initiatives and the LIASE is still uncharted territory and requires extra attention to get to an efficient organization. The risk on those activities concerned loss of momentum and loss of credibility;
- An efficient management of the projects requires software tools that work without failure and are adapted to the special needs of ECSEL JU. In addition, enough time is required to execute the required administration. The main risks therefore pertain to the tools and to the time constraints;
- In 2020 projects of Call 2014, 2015 and 2016 had to be closed, technically and financially (different workflows, new procedures such as guarantee fund, etc.). As a risk this could lead to unforeseen issues, that especially in the final phase of a project could be challenging.

The COVID-19 pandemics started at the end of 2019 and became a threat in Europe in February 2020, pushing European governments and the European Commission as of March 2020 into various actions, from full lockdowns that included the closure of research and manufacturing sites to travel bans, teleworking, etc. Those measures affected international programmes such as ECSEL. Running the programme required the organisation of remote evaluation of calls, monitoring of projects, auditing of beneficiaries, etc. The projects themselves suffered because of inaccessibility of infrastructure, the difficulties of organising all kinds of meetings in a remote way, medical absence of personnel, closure of organizations due to bankruptcy, etc.

Nevertheless, it can be said that the operational objectives for 2020 were nearly all achieved although with an important caveat: due to COVID-19 there has been a delay in some activities and decisions in the projects and the programme as well as a scale down of some national promotion activities.

5 .2 Research & Innovation activities

The ECSEL JU bodies launched four calls for proposals: ECSEL Call 2020-1 inviting Innovation Actions (IA), ECSEL Call 2020-2 for Research and Innovation Actions (RIA), ECSEL Call 2020-3 for Research and Innovation Actions in cooperation with IMI JU and ECSEL Call 2020-4 inviting for a Coordination and Support Action (CSA).

The WP2020 describes the topics (based on the the Multi-Annual Strategic Plan), the schedule, the evaluation and selection procedure, the budgets (both EU and National), the National rules applicable for the National grants, and the H2020 appendices applicable to the different calls.

The call coordinator prepared an Applicants Guide (ED decision) that contains further relevant information, on those points that are different from the general H2020 procedure.

The ECSEL JU Governing Board (GB) also decided to appoint two independent observers to assess the evaluation procedure. In their report[4] to the GB they state:

> *"Due to the COVID-19 situation the three calls needed to be reviewed remotely. While this posed a challenge to the ECSEL JU staff to redesign the evaluation logistics and the online tools, the remote evaluation was very well organised and had few difficulties.*
>
> *The overall quality of the whole evaluation process was very good and professional. There was a strong commitment from ECSEL JU Staff with the evaluation, both in preparation and also in the execution phase together with the experts. There was also a high level of knowledge on the experts' side, producing insightful discussions and good quality evaluations. All meetings and communication took place in a very positive, task-oriented, and friendly atmosphere of mutual understanding and respect. The issue of gender balance that was raised for a number of years has been resolved with an almost equal representation of male and female experts.*
>
> *The observers have not identified any attitude or fact that can question the impartiality, fairness, and confidentiality of the evaluation. The matter of conflict of interest was treated with care and all the experts were reminded of its importance during the whole process."*

The office considered the recommendations of the GB-appointed observers of the preceding evaluations in as far as this was possible.

Thanks to the efforts of the call coordinator the submission, evaluation and selection ran smoothly.

The work plan also encourages the consortia to achieve a 1.2 to 1 ratio between National funding and EU funding at proposal level. This has helped in the last years to get close to the arget of 1:1 at grant signature, as required in ECSEL JU Council regulation.

The three Lighthouse Initiatives each supported through specific CSAs (Coordination and Support Actions) are evolving slowly but surely towards becoming bridges between communities and between programmes as originally envisioned. Nice results were achieved in this difficult year.

The Strategic Research Agenda (SRA) 2020 for the ECS community that is adapted each year by the 3 Industry Associations, served as basis for the MASRIA 2020 and was consolidated in the MASP2020 by the executive director. The Commission provided guidance by virtue of its statutory duty to "seek to ensure coordination between the activities of the ECSEL Joint Undertaking and the relevant activities of Horizon 2020 with a view to promoting synergies when identifying priorities covered by collaborative research" (Art. 7.2 of the Statutes attached to the REGULATION).

The MASP2020 (in line with the SRA) identifies five application areas and five essential capabilities that defines the topics for the Work Plan (WP) 2020 on which the Calls 2020 are based. The Governing Board adopted both MASP2020 (ECSEL GB 2019.134) and WP2020 (ECSEL GB 2019.132) subsequently amended, the last amendment of the WP2020 being ED 2020.309.

Some accents on the topics are highlighted in the WP2020 for the calls 2020-1 and 2020-2:

- For the Call 2020, proposals supporting specific aspects of 'edge computing' are encouraged and further described in the WP2020;
- Aspects of ECS value chain integration are important for the ECSEL programme and the whole European ECS sector, across applications and across capabilities. Consortia are encouraged to submit proposals that take this aspect into account.;
- Proposals that cut across disciplines, support platform building, interoperability, establishment of open standards are particularly encouraged; even outside the regular ECS sector.;
- Description of important challenges as proposed by the LIASEs of the ECSEL Lighthouse Initiatives in the topics of Mobility, Digital industry and Health, and the European Commission in the topic Energy (those are provided in annex 9 of the WP2020); these challenges are of special relevance and proposals for the Call 2020 supporting these topics are encouraged.

The call 2020-3 was prepared together with the office of IMI-JU. It addresses the topic of next generation digital technologies for clinical trials at home. The IMI supported project Trials@Home develops systems for remote decentralised clinical trials. The ECSEL project should complement and extent the technological activities. It is a RIA call with the same conditions as the call 2020-2.

The call 2020-4 is a CSA digital excellence support action. Results developed under the ECSEL project Productive 4.0 include a semantic web describing the typical semiconductor supply chains, including production data of several major semiconductor partners. This data and web need to be maintained, expanded, and made available to develop cutting edge solutions for the semiconductor supply chains. The CSA will make this possible and assure the sustainability of the results for future applications and projects. Conditions are similar to other CSA calls.

These two last calls will be discussed separately from the first two calls as they are not comparable to what was done in previous years.

4 The observers were only involved in the calls 1, 2 and 3. The Call 2020-4 ran earlier, before the observers were appointed.

5 .3 Calls for proposals, selection of projects and grant preparation

5.3.1 Calls 2020 organisation, conditions

The first two calls had two phases and ran in parallel, following the same schedule (Table 1):

Activity	2020-1 and -2	2020-3	2020-4
Calls launching	5 Feb. 2020	26 May 2020	5 Feb. 2020
Project Outline deadline	5 May 2020	n.a.	n.a.
Full Project Proposal deadline	16 Sep 2020	30 Sep 2020	5 May 2020
Evaluation and selection	14-23 Nov 2020	20 Nov 2020	27 May & 10 June 2020
Grant agreement signature	19 May 2021	n.a.	24 Sep 2020
PAB Decision	PAB 2020-54 & -55	PAB 2020-56	PAB 2020-53

Table 1: Call schedules

Although the calls 2020-1 and 2020-2 were planned as two phases, the GB decided that, in view of the COVID-19 situation, the PO stage should be non-blocking. To implement this decision, the thresholds at the PO phase were all put to zero (2nd GB amendment 2020-141 of 7 April 2020). Therefore, the only obligation was to submit an eligible proposal to the call in order to be allowed to submit a full project proposal in September 2020.

The different periods for the execution of the procedures are as follows (Table 2) (only for the main calls 1 and 2 per year):

	Launch to Decision	Launch to FPP submission deadline	FPP deadline to PAB decision	Time to inform from FPP deadline	Time to signature from FPP deadline
2014[5]	162	70	92	120	290
2015	246	175	71	79	242
2016	240	189	51	52	237
2017	266	211	55	56	240
2018	266	211	55	78	242
2019	292	224	68	71	245
2020	309	224	85	89	248[6]
Average	254	186	68	78	249

Table 2: Timing of the different submission steps

ECSEL has consistently provided a good service with 8.5 months from launch to decision of which 6 months for the preparation of the proposals by the consortia. The coordinators are informed shortly after the decision of the PAB (4 days in 2020). The signature of the projects selected end of 2019 took place in May 2020, 8 months after the call deadline (time to grant) only one project out of the 14 was signed with 8 days overdue, duly justified.

The well-respected strict timing of the call to grant-signature cycle demonstrates the efficiency of the ECSEL organisation. On this, one should keep in mind that, compared to other programmes in H2020, ECSEL has two added challenges. The projects of ECSEL are typically large with 30+ beneficiaries. Furthermore, simultaneous to the ECSEL cycle, the consortium members of selected projects need to sign grant agreements with their national authorities to benefit from the national funding. This requires a good coordination with the national authorities when executing the call to grant-signature cycle resulting in a PAB amendment to the PAB decision on the selected projects. And this needs to be done for the larger than normal number of beneficiaries in each project to allow the coordinator to sign the grant agreement in time. Over the 7- years of the programme, ECSEL has succeeded in keeping the timing every year with only few justified exceptions.

The EU funding rates, to be calculated based on the costs according to H2020 rules, remained the same for a fifth year on a row (Table 3).

	RIA			IA			CSA
	LE	SME	Other	LE	SME	Other	
2014	50%	50%	50%	25%	35%	50%	
2015	25%	30%	40%	15%	25%	40%	
2016	25%	30%	35%	20%	25%	35%	
2017	25%	30%	35%	20%	25%	35%	
2018	25%	30%	35%	20%	25%	35%	100%
2019	25%	30%	35%	20%	25%	35%	100%
2020	25%	30%	35%	20%	25%	35%	100%

Table 3: EU reimbursement rates

In ECSEL, the national funding rates and eligibility conditions need also to be considered. Those are described in the Work Plan. CSA call 2020-4 has EU funding rates of 100% and does not require matching national funding.

Although the EU funding rates did not change in the last five years, other changes in the workplans did limit the funding, the size, and the duration of the projects. Two such measures concern the capping of the funding per project and per partner:

5 The calls in 2014 were one phase while the other years were two phases.

6 Estimate

- For IA proposals to be eligible, the EU contribution per project is capped at EUR 25 million and the maximum contribution per partner in a project is limited to 50% of the total EU funding for the project. The number of partners is capped at 90 participants.
- For RIA proposals to be eligible, the EU contribution per project is capped at EUR 12 million and the maximum contribution per partner in a project is limited to 40% of the total EU funding for the project. The number of partners is capped at 50 participants.

As this is the last call year of the programme project duration was limited to 3 years. This should allow the programme to close in 2024 as planned.

Table 4 shows the split in the announced EU estimated expenditure between RIA and IA as well as the committed national funding prior to the submission deadline of the proposals:

	RIA	IA	Total EU estimated expenditure[7]	Total national estimated expenditure
2014	40.00	115.00	155.00	158.00
2015	50.00	95.00	145.00	137.69
2016	65.00	85.00	150.00	152.72
2017	67.50	92.50	160.00	164.00
2018	63.35	110.00	173.35	200.52
2019	80.80	92.50	173.30	174.26
2020[8]	66.00	93.00	159.00	209.46
TOTAL	432.65	683.00	1,115.65	1,196.64

Table 4: EU and national estimated expenditure in EUR million

The total national commitment follows the total EU budget available, but beware this total national commitment covers fluctuating national commitments. This table does not cover the ESI funding or some forms of regional funding that come on top of the national commitment.

The organisation of call 2020-3 required some extra coordination with IMI JU and the Trials@Home project consortium. A call for Expressions of Vision was launched prior to the call to better scope the call and 8 answers were received. This was shared with IMI-JU and used to supplement the call description. The call had only one phase and the evaluation and selection ran in parallel with the calls 2020-1 and 2020-2.

The organisation of call 2020-4 (CSA) was organised as the preceding CSA calls and had 1 phase. It was launched together with the calls 2020-1 and 2020-2 and the deadline for submission was the same as the PO deadline for the first two calls. Evaluation took place in the same week as the PO evaluation.

The COVID-19 pandemics has had a large impact on the organisation of the evaluations. For one it was unclear until quite late if one could travel or not in October and if the normally used facilities would be available for face-to-face meetings (they were not). In September it was then decided to organise everything remotely. Due to the tight schedule of the evaluation week and the requirement that consensus and panel meetings needed to go flawlessly (that is with all invited experts having access to their meetings with sufficient quality to follow the debates) it was decided to extend the evaluation week with 3 days and to leave sufficient time between the different consensus meetings and panel meetings to allow for glitches.

For the calls 2020-1, -2 and -3 the consensus and panel meetings were organised from 14 to 23 October 2020. This required to amend the contracts with the experts. Regarding video conferencing IT tools, several were compared, checked with the experts and Windows-Teams was selected as the most acceptable. For this evaluation week 98 Teams meetings had to be planned. Backups (by phone) were also put in place. Two test sessions were organized prior to this meeting to allow experts to become familiarized with Teams. Some glitches did occur mostly due to the connection issues at the expert side.

After a nerve-racking 10 days the evaluations could be closed, no major or even minor disruption of any sort is to be reported and all Evaluation Summary Reports were finalized in time. Particular attention was given to issues of conflict of interest. The same rigor as in the previous calls was applied. Detected conflicts were tackled and removed by reattribution to other experts for example. In the context of remote operations this requires more rigor and attention.

The whole evaluation process was closely followed by the two observers appointed by the Governing Board as well as two national observers. The GB-observers expressed their satisfaction with this organisation.

In general, the decisions took longer to come and both consensus meetings and panel meetings took longer than on-site. A questionnaire was shared and answered by nearly all experts. Generally, the experts expressed their satisfaction with the organisation and their conviction that the quality of the evaluation had not been hampered with this new organisation. Though, some experts rejoiced at the fact that this mode of evaluation required no travel, some also missed the networking aspects of on-site evaluation weeks.

7 These are the amounts declared in the Work Plan

8 The calls 2020 include the calls 1, 2 and 3 but not 4 (CSA). The budget for the Call 2020-3 was EUR 5 million (included in the EUR 66 million for RIA) and for the call 2020-4, EUR 2 million.

5.3.2 Call 2020: results and comparison to previous calls

This chapter discusses the results of the submission to selection process. The next chapter will discuss details of the organization (experts).

5.3.2.1 Submission of proposals

The results of the calls are:

- For the IA call 2020-1, 16 proposals were submitted at PO phase, out of which 6 were selected;
- For the RIA call 2020-2, 28 proposals were submitted (2 were declared non-eligible) at PO phase and 8 were selected;
- For the RIA call 2020-3, 4 proposals were submitted (2 were declared non-eligible) at FPP phase, both remaining proposals were below threshold. As a result no proposal was selected and the budget for this call was transferred to the call 2020-2;
- For the CSA call 2020-4, 2 proposals were submitted, 1 was selected.

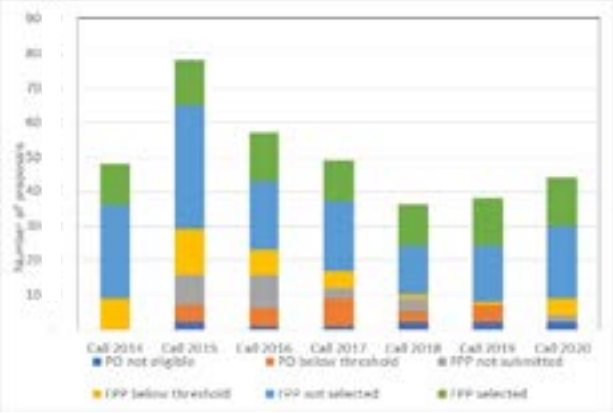


Figure 1: Project submission and selection statistics

Figure 1 compares the number of proposals with the other years. This figure does not include the 4 CSA calls, neither the call 2020-3 (one phase). The trend of increasing proposals is continuing after the decrease in the years 2015 to 2018.

For the 358 proposals submitted to an ECSEL call at the PO stage[9], we get following percentages (Table 5):

not eligible	3%
below threshold	19%
not submitted at FPP	8%
not selected	43%
selected	27%

Table 5: percentages over all the ECSEL calls

As a rule of thumb, one could conclude that: 30% of the submitted proposals are not good enough (below threshold, not eligible, or not submitted at FPP), 30% are selected while 40% are not because of lack of funding.

How does this look for RIA and IA separately? Figure 2 shows the evolution of the eligible proposals. The sharp decline from 2015 to 2018 for the RIA calls deserves our attention. It is also present in the IA call but much weaker. On the contrary the number of selected proposals (91 in total) is nearly constant over the years, fluctuating between 12 and 14, with 55% of the proposals from RIA calls and 45% from IA calls (and this is also fairly stable).

The decline in submitted RIA proposals cannot be explained by the EU funding rates that were stable as of 2016 or the amount of available funding that was increasing in 2016 and 2017. Factors outside the call mechanics such as the negative publicity surrounding ECSEL calls (sometimes propagated by non-participants) and its "complexity" probably explain more. Later we will answer the question if this also resulted in a decrease in the quality of the proposals, which it did not. Finally, one should point out that a similar drop in submitted proposals was observed during the FP7 programmes ENIAC and ARTEMIS.

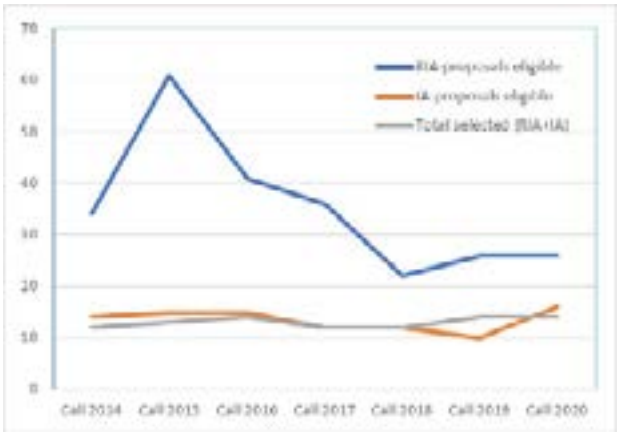


Figure 2: Evolution of eligible proposals

Evolution of cost and requested funding in proposals submitted FPP

The amounts involved at the FPP stage (i.e., at submission so prior to selection) are summarized in Table 6 as well as a comparison with previous year's FPP figures.

	Number of proposals	Total H2020 cost (EUR million)	Requested EU funding (EUR million)	Total National cost (EUR million)	Requested National funding (EUR million)	Number of participants
RIA 2014	34	791.1	394.1	907.9	245.4	941
IA 2014	14	1039.5	321.4	1287.2	231.6	429
Total 2014	**48**	**1830.5**	**715.5**	**2195.1**	**476.9**	**1370**
RIA 2015 FPP	51	962.9	294.4	1060.0	284.1	1155
IA 2015 FPP	11	833.6	175.3	869.3	196.2	409
Total 2015 FPP	**62**	**1796.5**	**469.7**	**1929.3**	**480.2**	**1564**
RIA 2016 FPP	28	605.1	176.6	653.0	175.9	748
IA 2016 FPP	13	1232.2	280.8	1340.2	269.7	548
Total 2016 FPP	**41**	**1837.3**	**457.3**	**1993.2**	**445.5**	**1296**
RIA 2017 FPP	26	567.1	165.6	624.2	178.5	779
IA 2017 FPP	11	660.2	157.6	721.4	158.3	313
Total 2017 FPP	**37**	**1227.3**	**323.2**	**1345.6**	**336.8**	**1092**
RIA 2018 FPP	18	500.6	147.1	550.0	150.7	615
IA 2018 FPP	9	866.8	208.5	963.1	208.5	474
Total 2018 FPP	**27**	**1367.3**	**355.6**	**1513.1**	**402.8**	**1089**
RIA 2019 FPP	21	500.3	145.8	541.9	153.3	654
IA 2019 FPP	10	708.1	172.2	797.4	196.3	484
Total 2019 FPP	**31**	**1208.4**	**318.0**	**1339.4**	**349.7**	**1138**
RIA 2020 FPP [10]	25	723.1	210.9	783.1	221.2	812
IA 2020 FPP	15	937.0	233.0	1029.6	261.8	679
Total 2020 FPP	**40**	**1660.0**	**443.9**	**1812.7**	**482.9**	**1491**
RIA TOTAL	203	4650.0	1534.5	5120.1	1409.0	5704
IA TOTAL	83	6277.4	1548.8	7008.2	1522.3	3336
ALL TOTAL	**286**	**10927.4**	**3083.3**	**12128.3**	**2931.3**	**9040**
RIA %	71%	43%	50%	42%	48%	63%
IA %	29%	57%	50%	58%	52%	37%

Table 6: Overview of proposals submitted at the FPP stage of ECSEL Calls.

The size of the proposals submitted for calls 2020-1 and -2 are like the figures for the preceding calls. This year again, the consortia did an effort to balance the requested national funding with the requested EU funding, the ratio national funding to EU funding for the two calls is 1.09. The total funding rate is 60% and 53% for respectively the RIA and IA call. Due to the larger number of projects in comparison to last years and a smaller EU budget the oversubscription (total requested/total available funding, 3.0 for the calls 2020) is 50% larger than in previous years.

Regarding the totals for ECSEL, the figures are impressive: 286 proposals were submitted at the FPP phase, involving 9,040 participations for a total cost of EUR 10 927.0 million. 30% of the proposals are submission to the IA calls, those proposals represent close to 60% of the cost and 40% of the participations. This demonstrates the effectiveness of ECSEL in attracting sufficient proposals of quality.

Evolution of number of participants and entities

Table 7 shows entities[11], participations, and some statistics. New entities are entities that did not participate under ENIAC or ARTEMIS in the years 2011 to 2013[12], and neither to ECSEL calls of previous years. The percentage of new entities (%New) has been nearly constant over the last years: around 40% of the entities participating in the submission of a proposal in one year did not participate to the previous ECSEL calls (or even to ENIAC and ARTEMIS). Overall, 82% of the entities that have participated to an ECSEL call had not participated to ENIAC and ARTEMIS calls. This demonstrates the effectiveness of the ECSEL programme in attracting new organizations to the programme.

The ECSEL/FP7 ratio is the proportion of entities that joined the ECSEL programme divided by the number of entities that were also active in the FP7 programmes ENIAC and ARTEMIS. One sees that this ratio has been climbing over the years. Demonstrating that the new entities became more and more active in the programme. The ratio participation over entity shows a nearly constant 1.6 average. On average each entity participates 1.6 times to the programme. This demonstrates that ECSEL is an open programme and not a closed club as is often claimed.

	2014	2015	2016	2017	2018	2019	2020	Over-all
New entities	461	470	326	292	295	292	403	2539
Total entities participating to calls in that year	849	971	841	700	732	753	890	3082
%New	54%	48%	39%	42%	40%	39%	45%	82%
ECSEL/FP7	0.6	0.8	0.8	1.0	1.3	1.3	1.7	
Participants	1393	1564	1332	1092	1089	1137	1492	9099
Participa-tion/Entity	1.6	1.6	1.6	1.6	1.5	1.5	1.7	

Table 7: Participations and entities

It is interesting to look at the histograms of the historical entities (those entities that were active in the ENIAC and ARTEMIS programmes) versus the new ECSEL entities. Figure 3 shows the number of entities that participated 1, 2, 3, to more than 8 times in an ECSEL call. So, around 1600 entities were new to ECSEL and participated only once to a submitted proposal under an ECSEL call.

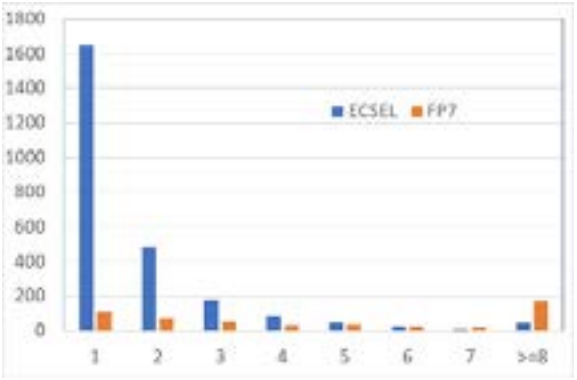


Figure 3: Histograms of participation frequency for organizations new to ECSEL and active under the FP7 programmes ENIAC and ARTEMIS

One can identify a core of 172 longstanding entities that participated 8 or more times (where we put the limit is quite arbitrary of course) in an ECSEL proposal. During the ECSEL programme 44 new entities joined this group, again demonstrating the openness of the programme.

How does this vary with the type of entity? Table 8 gives the number of ECSEL entities (new) participating 1 time, 2 to 4 times, 5 to 7 times and 8 or more times. A first figure is that clearly SMEs are in the majority when it comes to trying once but then less and less SMEs try more than once while LE and OTHERS do keep trying. But this is not the end of the story. Table 9 shows that some SMEs do persevere more than the LE, one SME having participated 27 times in a proposal submission. It also shows that 1124 SME entities participated to ECSEL calls, 44% of all entities.

	LE	OTHER	SME	SUM
1X	613	293	744	1650
2 TO 4X	254	165	337	756
5 to 7X	35	20	33	88
8X or more	15	10	10	35
TOTAL	917	488	1124	2529
PROPORTION	36%	19%	44%	100%

Table 8: ECSEL entities (new) participation per type

	LE	OTHER	SME
8	4	3	3
9	4	5	4
10	1		1
11	1		2
12	4		
13	1	2	
15		1	
16			2
17			1
18		1	
19			1
20			1
23			1
27			1

Table 9: Tail of the ECSEL entities (new) participating per type

How does this look for the 'historical' entities? Table 10 shows that the SMEs here will try several times but that it mainly is the LE and OTHER that will try 8 or more times. The 'core' of historic entities consists of 67 LE, 81 OTHER and 24 SMEs, and coming from 22 ECSEL participating states. Finally, one entity participated 127 times.

	LE	OTHER	SME
1X	60	26	30
2 TO 4X	72	47	45
5 to 7X	34	28	29
8X or more	67	81	24

Table 10: Historical entities participating per type

11 Entities are legal organizations. One entity can participate several times in one year in different projects.

12 This definition is different from the definition handled in previous Annual Activity Reports.

Evolution of the proportion of LE, SME and OTHER in the submitted proposals at PO stage

Another aspect concerns the way ECSEL addresses the whole community. By a system of differentiated funding rates ECSEL can steer the participation of SMEs, Large enterprises (indicated as 'LE') and public organisations such as RTOs, universities, etc collectively indicated as 'OTHER'. The two figures (Figure 4 and Figure 5) give the proportion of participants and cost per type of organization over the years at the PO phase (year 2014 is missing because there was no PO phase).

Figure 4: Proportion of participants per type of organization

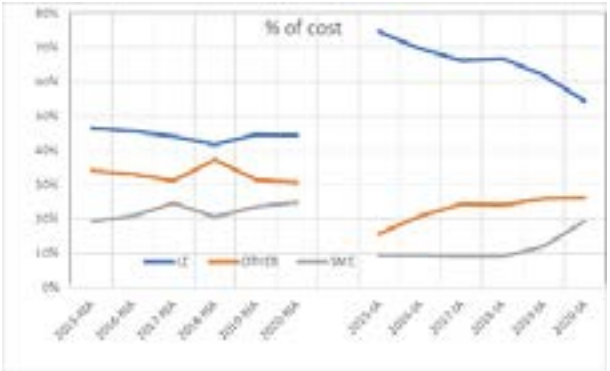


Figure 5: Proportion of cost per type of organization

The proportions for the RIA calls were fairly constant over the years: 40% of the participants are public organizations, 31% are SMEs and 29% LEs, but in cost 45% is caried by the LE, 33% by OTHER and 22% by SMEs. This still represents on average an investment of EUR 570 000 per SME participating of which 60% is funded so a net investment of around EUR 228 000 on average and over 3 years.

For the IA calls the situation is different. Although the proportions were fairly constant over the years 2016 to 2019 there was an initial steep decrease of the SME proportion from 2015 to 2016 and a final steep increase in 2020, both compensated by the LE. For the decrease in 2016 one can blame the increase in funding rates for the LEs (Table 3), thereby increasing the proportion of LE at the expense of SMEs. This cannot explain what happened in 2020. A closer look at the distributions of the three types of organizations over the projects of call 2020-1 (Figure 6), shows for the SMEs and LEs a bimodal distribution. Half of the projects have a low percentage of LE and a high percentage of SME, while for the other half more LEs and less SMEs. None of the other calls had such outspoken bimodal distribution and this pushes the average as seen in Figure 4.

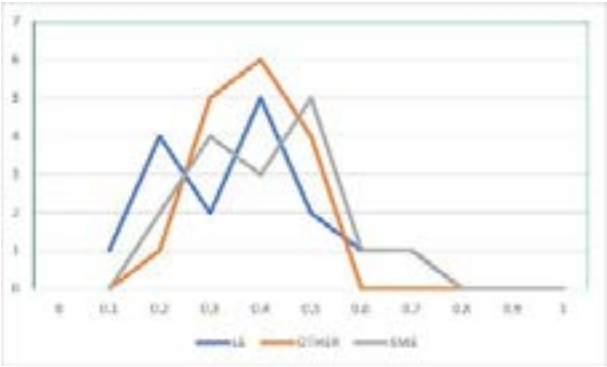


Figure 6: Histograms of proportion of type of organization for the 16 projects of the call 2020-1 IA.

One can conclude on the participation of SMEs that 1124 SMEs participated in one or more ECSEL calls. This demonstrates the effectiveness of ECSEL in attracting SMEs to the ECSEL programme.

Evolution of several performance indicators for selected projects

The calls 2020 had participants from 28 countries: all EU countries except Luxembourg, Cyprus, Malta, Bulgaria, UK, and Croatia, as well as participants from (in brackets number of participations): Israel (24), Norway (20), Switzerland (27), India (1), Turkey (65) and Iceland (1).

Over the 7 years that ECSEL is running, organisations of 38 countries have participated at least once: all EU countries except Malta and Croatia as well as well as Brazil, Canada, Iceland, India, Israel, Norway, Serbia, Switzerland, Russia, Taiwan, Tunisia, Turkey, and USA. The participation per country[13] and type of organization is shown in Figure 7.

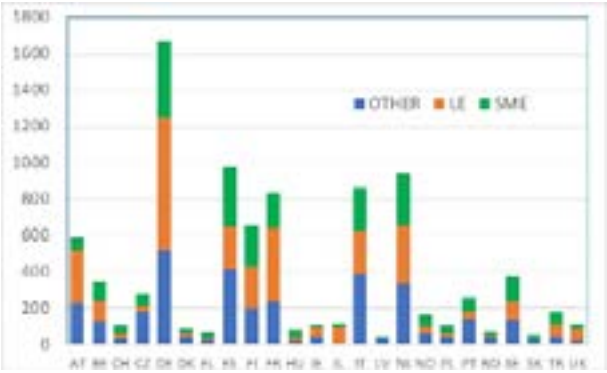


Figure 7: Participation per country and type

Most countries achieve a balance between the three types of organizations.

The participation rate to the ECSEL programme depends on political and economic considerations. Figure 8 is a chart for the participation per GDP (EUR million). A few countries stand out, like FI, AT, CZ, LV, NL, and PT. Of course, some countries joined more recently (like CH and TR) and their participation is more limited due to this.

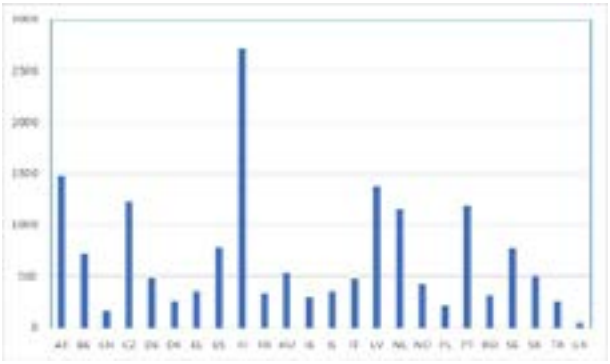


Figure 8: Participation per GDP

National policies to support the programme but maybe more importantly visibility of the programme through for example local organizations such as ECSEL-Austria or the organization of local brokerage events as organised by Tubitak (Turkey) are important factors to boost the national participation to the programme.

ECSEL thus demonstrates effectiveness in attracting participation from nearly all over Europe (even if some EU countries did not contribute to the national funding), from several associated countries (some becoming large contributors of national funding) and generated some interest from participants of third countries.

Coverage of topics by submitted proposals

All topics defined in the WP2020 were open for proposals. No special topics were included, but as already remarked above, some topics were encouraged in the workplan such as edge computing. The calls received proposals that covered the topics evenly. To calculate this spread we used the self-declaration of the proposals on the topics covered (chapters of the MASP) and weighted this with the total cost of the proposal. In this way we measure the relative effort/investment that contributes to a topic.

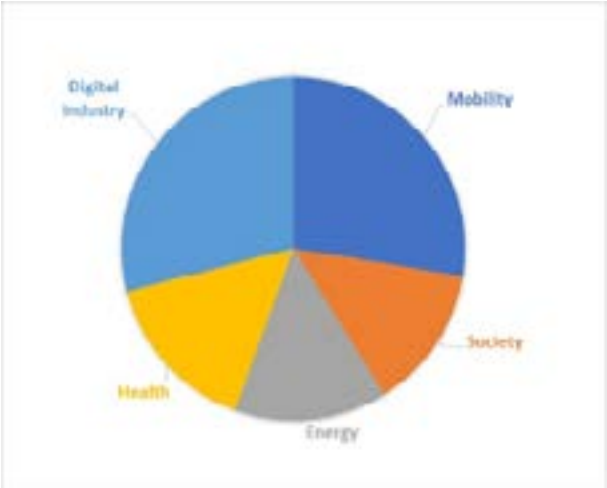


Figure 9: Coverage of the key application areas for the submitted proposals of all RIA-IA calls.

Regarding the development of particular technologies (Figure 10), 1/3 goes to the semiconductor technology. In this respect one should point out that the topics Cyber Physical Systems and Smart Systems Integration were included in the MASP from 2014 to 2017. As of 2018 those two topics were replaced by Safety and Security, then connectivity and interoperability, computing and storage and finally long term.

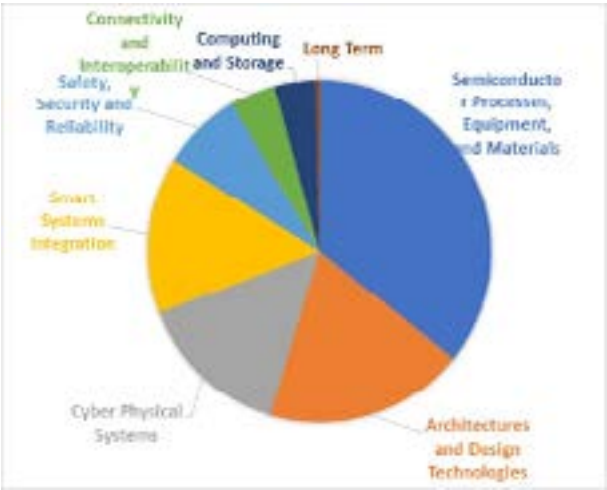


Figure 10: Coverage of the essential capabilities for the submitted proposals of all RIA-IA calls.

It is fair to say that ECSEL has attracted participation to the different domains of activities in a balanced way.

Comparison with the FP7 programmes

One can compare some of the participation figures between ECSEL and ENIAC-ARTEMIS (Table 11).

Submission stage	ECSEL	ENIAC-ARTEMIS
Years	2014-2020	2010-2013
Calls	14	11
Proposals	288	198
Entities	3,081	1,849
Participations	9,099	4,206
Participations per entity	3.0	2.3
Participations per proposal	31.6	21.2
Proposals per call	20.6	18.0
Entities per proposal	10.7	9.3

Table 11: Comparison submission participation to ECSEL (excluding CSA and 2020-3) and ENIAC ARTEMIS (excluding 2008 and 2009)

Participations went relatively up in the ECSEL programme but the number of entities relative to the number of projects or years remained constant. Both programmes (ECSEL and ENIAC-ARTEMIS) attracted nearly the same number of entities per project (10.7 and 9.3 respectively) but the entities participated more in the ECSEL programme (3.0 for ECSEL and 2.3 for ENIAC-ARTEMIS). Out of the 1849 entities participating in ENIAC-ARTEMIS, 543 (30%) then participated in the ECSEL programme (17%).

5.3.2.2 Calls 2020 scoring of proposals

The scoring of the proposals submitted at the FPP stage is done by independent experts, the selection is done by the Public Authority Board of ECSEL. Let us first look at the distribution of the scores (in Figure 11 scores at FPP evaluation normalized over the total number of eligible FPP submissions). Over the years the distribution peak moves towards higher scores (Figure 12 shows the evolution of the median).

Figure 11: Evolution of the histogram of the scores

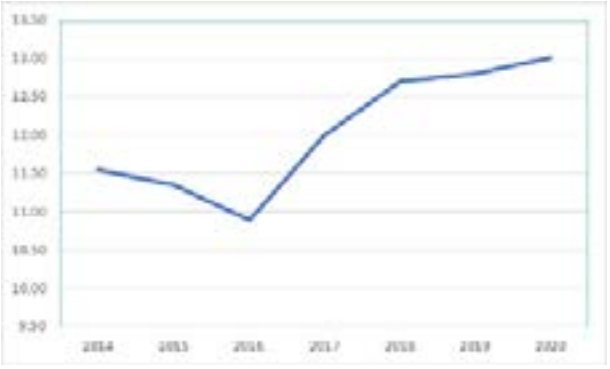


Figure 12: Median of the score distributions

One can conclude that the quality of the proposals has increased over the years making the competition between proposals tougher. Coming back to the drop in the submitted proposals (Figure 2), one could interpret this in part as a learning effect, whereby the selection of proposals to be submitted happens upstream of the submission process. This drop certainly did not influence the quality of the proposals. Only the potentially successful proposals are worked out and submitted. The cost for elaborating a proposal submitted to an ECSEL call is estimated at several hundred thousand euro (a few person-years of work) for the large proposals. At such a high cost one can better focus on proposals of high quality, even with the high success rates. But even this has become insufficient in recent years as the overall quality has improved thereby making the calls much more competitive.

A lingering question concerns the possible influence of the size of the project on the score. One can analyse this with a regression-analysis, the regression coefficient R2 for linear regressions[14] of the number of participants on the score and the total cost on the score was calculated and shown in Table 12.

	Score/Number of participants	Score/Total cost
IA	0.002	0.003
RIA	0.03	0.12

Table 12: R-square values for different regressions

In view of the very low values for R2 one can safely assume that the size of the proposal does not influence the scoring.

5.3.2.3 Calls 2020 Selection of proposals

The projects are selected by the PAB based on the ranking of the experts and the synergies with national strategies. Out of the 40 proposals 14 projects were selected that cover and complement the existing project portfolio (Table 13).

Call	Proposal	Title	Coordinator country
2020-1-IA	Energy ECS	Smart and secure energy solutions for future mobility	FI
2020-1-IA	GaN4AP	GaN for Advanced Power Applications	IT
2020-1-IA	ID2PPAC	Integration of processes and modules for the 2 nm node meeting Power Performance Area and Cost requirements	NL
2020-1-IA	StorAIge	Embedded storage elements on next MCU generation ready for AI on the edge	FR
2020-1-IA	TRANS-ACT	Transform safety-critical cyber-physical systems into distributed solutions for end-users and partners	NL
2020-1-IA	TRANS-FORM	Trusted European SiC Value Chain for a greener Economy	DE
2020-1-RIA	AI4CSM	Automotive Intelligence for/at Connected Shared Mobility	DE
2020-1-RIA	AIDOaRt	AI-augmented automation for efficient DevOps, a model-based framework for continuous development At RunTime in cyber-physical systems	SE
2020-1-RIA	AI-TWILIGHT	AI powered Digital twin for lighting infrastructure in the context of front-end Industry 4.0	NL
2020-1-RIA	DAIS	Distributed Artificial Intelligent Systems	SE
2020-1-RIA	HiEFFICIENT	Highly EFFICIENT and reliable electric drivetrains based on modular, intelligent, and highly integrated wide band gap power electronics modules	AT
2020-1-RIA	IMOCO4.E	Intelligent Motion Control under Industry 4.E	NL
2020-1-RIA	MATQu	Materials for Quantum Computing	DE
2020-1-RIA	YESvGaN	Vertical GaN on Silicon: Wide Band Gap Power at Silicon Cost	DE

Table 13: Selected projects from the calls 2020-1 and -2 (RIA and IA)

Call 2020-3

Call 2020-3 and 2020-4 cannot easily be compared with the other calls being very specific in their topic and that is why they have not been included in previous statistics. Regarding call 2020-3, the results were disappointing, only 2 proposals were eligible, and both did not live up to the original expectations of innovation as ECSEL is used to in other calls.

Selected project for call 2020-4

Regarding call 2020-4 two eligible proposals were submitted, both tackling the topic of the call. After evaluation by independent experts the highest scored proposal was selected by the PAB.

The ECSEL project SC3, Semantically Coordinated Semiconductor Supply Chains, was the selected action from the ECSEL Call 2020-4. This Coordination and Support Action started on 01/10/2020 for a duration of 3 years with at total estimated costs of nearly EUR 2 000 000. The consortium is composed by 5 beneficiaries from two countries (Germany and France) and coordinated by Infineon Technologies AG (Germany).

The semiconductor industry is characterised by complex supply chain structures. A common language and structure must be developed and enrolled to enable smooth collaboration among different supply chain participants in this B2B (business to business) environment. In that context, the SC3 project aims to enable collaboration of industrial and academic stakeholders to encourage interoperability between semiconductor companies and further industrial domains. To that end, it will develop a framework to ensure an agile development, validation, and refinement loop for top-level ontologies such as digital reference, which consists of a combination of different ontologies of semiconductor supply chains and supply chains containing semiconductors.

5.3.2.4. The ECSEL calls: 7-year programme results

Evolution of the success rate

The resulting success rate (= selected proposals divided by submitted eligible proposals) shown in Figure 13 climbs because of this decrease in submissions. Overall, the success rate for IA calls was 44% and 20% for RIA calls, 35% success rate all calls compounded. The success rate per type (in particular SMEs) will be discussed later.

Figure 13: Success rate

In this context it is interesting to look at the resubmission proportion for the calls as well at the below threshold proportion (Figure 14).

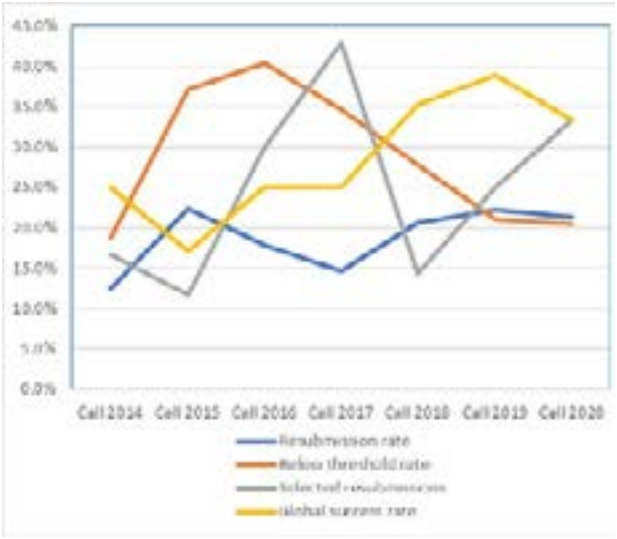


Figure 14: Resubmissions and threshold

The number of below threshold proposals (both at PO and FPP) as compared to the total number of proposals has been steadily decreasing as of 2016. And that even while the thresholds have increased.

Regarding the resubmission rate it has been constant over the years (on average 19%). The resubmitted proposals mostly come from other H2020 programmes but a few from ECSEL. The proportion of selected resubmitted proposals fluctuates (because of the small numbers) but as compared to the overall success rate, one can conclude that statistically there is not much difference in success rate between original proposals and resubmitted ones. In other words, while those proposals were not selected on first submission, they were on second submission. A second submission is often a reworked version of the first submission. Therefore, both the below threshold proportion and the resubmission success rate seem to indicate an improvement in the quality of the submitted proposals.

Evolution of cost and attributed funding for the selected proposals

The amounts for the ***selected*** projects of the RIA and IA calls (no CSA calls, no project selected in call 2020-3) after the PAB decision are given in the following table. The beneficiary contribution is calculated as: "Total H2020 cost minus the requested EU funding minus the requested National funding minus the ESIF funding".

	Selected projects	Partners	Total H2020 cost in EUR million	Requested EU funding in EUR million	Total national cost in EUR million	Requested national funding in EUR million	Requested ESIF in EUR million	Beneficiary Contribution
RIA 2014-1	6	162	140.7	47.5	140.7	38.0	0.0	55.2
IA 2014-2	6	175	463.5	101.8	499.5	90.0	0.0	271.8
Total 2014	**12**	**337**	**604.2**	**149.2**	**640.2**	**128.0**	**0.0**	**327.0**
RIA 2015-1	8	163	168.7	51.7	181.8	39.1	0.0	77.9
IA 2015-2	5	193	421.9	90.6	459.9	87.2	0.0	244.2
Total 2015	**13**	**356**	**590.6**	**142.2**	**641.7**	**126.3**	**0.0**	**322.2**
RIA 2016-1	8	243	216.3	60.5	196.7	47.8	9.0	99.0
IA 2016-2	6	268	502.0	103.0	454.1	85.9	1.6	312.6
Total 2016	**14**	**511**	**718.3**	**163.5**	**650.7**	**133.7**	**10.6**	**411.6**
RIA 2017-2	6	267	215.0	62.6	237.8	53.7	2.3	96.5
IA 2017-1	6	182	458.7	109.4	497.2	106.4	3.7	239.3
Total 2017	**12**	**449**	**673.7**	**171.9**	**735.0**	**160.1**	**5.9**	**335.7**
RIA 2018-2	6	206	211.6	62.2	234.5	53.6	2.1	93.7
IA 2018-1	7	302	586.2	138.8	634.4	141.1	3.3	303.0
Total 2018	**13**	**508**	**797.8**	**201.0**	**868.9**	**194.7**	**5.4**	**396.7**
RIA 2019-2	8	261	202.2	59.4	214.3	58.6	0.0	84.3
IA 2019-1	6	303	427.0	106.2	451.1	105.9	3.9	211.0
Total 2019	**14**	**564**	**629.2**	**165.5**	**665.5**	**164.5**	**3.9**	**295.3**
RIA 2020-2	8	273	243.2	70.5	258.2	66.8	0.0	105.9
IA 2020-1	6	207	425.5	102.8	466.6	107.2	0.0	215.5
Total 2020	**14**	**480**	**668.7**	**173.3**	**724.8**	**174.0**	**0.0**	**312.0**
Total RIA	50	1575	1398	414	1464	358	13	612.5
Total IA	42	1630	3285	752	3463	724	13	1797.4
Total	**92**	**3205**	**4682.6**	**1166.6**	**4926.9**	**1081.2**	**25.9**	**2400.5**

Table 14: Cost and Funding for selected projects (figures for 2020 not yet final)

The figures for 2020 are not final, nevertheless they form a first basis for comparison. A comparison with previous 3 years shows similarities in the amounts.

The total achieved leverage for the ECSEL JU programme calculated as the H2020 cost minus EU funding divided by the EU funding equals 3, meaning for each euro of H2020 funding, 3 euro are leveraged from other funding agencies (state aid) or private participants investment. One euro of H2020 funding also leverages 0.95 euro of State Aid (national funding and ESIF). The selection of projects is conditional on the available funding.

Figure 15 compares the evolution of the EU and national funding for the selected projects under the FP7 programmes ENIAC and ARTEMIS with the ECSEL programme. The pre-committed national funding for ECSEL is included (orange line). One essential difference between the programmes is the EU reimbursement rate that for the FP7 programmes was 16.7%

and for the ECSEL between 20% and 35%. Although the total funding for ECSEL went up by roughly 45% from the previous programmes ENIAC and ARTEMIS, in none of the years of ECSEL did the total funding go to a higher value than in the last year of the FP7 programmes.

Figure 15: EU and national funding for selected projects and pre-committed national funding (orange)

Averages per project and partner

Table 15 compares some average values for projects in the different calls.

	Average number of beneficiaries	Average cost per project EUR million	Average EU Funding per project EUR million	Average National Funding per project EUR million	Average cost per beneficiary EUR million
RIA 2014-1	27	23.4	7.9	6.3	0.87
IA 2014-2	29	77.3	17.0	15.0	2.65
Total 2014	**28**	**50.4**	**12.4**	**10.7**	**1.79**
RIA 2015-1	20	21.1	6.5	4.9	1.03
IA 2015-2	39	84.4	18.1	17.4	2.19
Total 2015	**27**	**45.4**	**10.9**	**9.7**	**1.66**
RIA 2016-1	30	27.0	7.6	6.0	0.89
IA 2016-2	45	83.7	17.2	14.3	1.87
Total 2016	**37**	**51.3**	**11.7**	**9.6**	**1.41**
RIA 2017-2	45	35.8	10.4	9.0	0.81
IA 2017-1	30	76.4	18.2	17.7	2.52
Total 2017	**37**	**56.1**	**14.3**	**13.3**	**1.50**
RIA 2018-2	34	35.3	10.4	8.9	1.03
IA 2018-1	43	83.7	19.8	20.2	1.94
Total 2018	**39**	**61.4**	**15.5**	**16.0**	**1.57**
RIA 2019-2	33	25.3	7.4	7.3	0.77
IA 2019-1	51	71.2	17.7	17.6	1.41
Total 2019	**40**	**44.9**	**11.8**	**11.7**	**1.12**
RIA 2020-2	34	30.4	8.8	8.3	0.89
IA 2020-1	35	70.9	17.1	17.9	2.06
Total 2020	**34**	**47.8**	**12.4**	**12.4**	**1.39**
All RIA	32	28.0	8.3	7.2	0.89
All IA	39	78.2	17.9	17.2	2.02
All calls	**35**	**50.9**	**12.7**	**11.8**	**1.46**

Table 15: Average beneficiaries, cost, and funding per (selected) project

The interesting figures are the averages for all RIA and all IA calls. The cost per beneficiary is much higher in the IA than in the RIA calls. The ratio cost per beneficiary IA/RIA equals 2.26 (=2.02/0.89). Can this be explained? The next section gives it a try.

Evolution of person-months

The effort in person-months could be a better measure of the amount of activity than cost for example, Table 16 shows some statistics on this.

	Total Cost (EUR million)	Number of beneficiaries	Person months (PM)	Number of projects	PM per project	PM per beneficiary	Cost (EUR) per PM
2014-1-RIA	141	162	13,982	6	2330	86	10,060
2015-1-RIA	169	163	14,599	8	1825	90	11,555
2016-1-RIA	216	243	24,778	8	3097	102	8,728
2017-2-RIA	215	267	23,337	6	3889	87	9,213
2018-2-RIA	212	206	18,721	6	3120	91	11,302
2019-2-RIA	202	261	21,163	8	2645	81	9,556
2020-2-RIA	243	273	24,474	8	3059	90	9,937
2014-2-IA	464	175	34,743	6	5791	199	13,342
2015-2-IA	422	193	36,188	5	7238	188	11,660
2016-2-IA	503	268	38,057	6	6343	142	13,221
2017-1-IA	459	182	35,295	6	5882	194	12,996
2018-1-IA	586	302	50,545	7	7221	167	11,598
2019-1-IA	427	303	38,098	6	6350	126	11,209
2020-1-IA	426	207	33,750	6	5625	163	12,609
All RIA	**1,398**	**1,575**	**141,055**	**50**	**2821**	**90**	**9,908**
All IA	**3,286**	**1,630**	**266,675**	**42**	**6349**	**164**	**12,322**
All calls	**4,684**	**3,205**	**407,730**	**92**	**4432**	**127**	**11,487**

Table 16: Person-months statistics

The 92 selected projects represent nearly 34,000 person-years! This is an impressive amount.

First let us compare the RIA and IA projects. IA projects require on average 2X more person-months than RIA projects and slightly less in terms of person months per beneficiary. Clearly IAs require appreciably more efforts from the beneficiaries.

The cost per beneficiary that we previously calculated (2.26) can be decomposed in the cost per person-month multiplied by the person-months per beneficiary. The ratio cost per person-month IA/RIA equals 1.24 and the person-months per beneficiary IA/RIA equals 1.82. The product of those two factors indeed gives 2.26. Therefore, the higher IA costs (+126%) can be explained as coming from a higher unit costs (+24% higher) and a higher level of activity (+82%). The higher unit costs most probably come from more non-personnel related costs.

Regarding the cost per person-months it is on average is EUR 11 500 per person-month (or 7.1 person-years per million euro in cost). Figure 16 plots the person-months with the total cost for all the projects and the trendline. Some projects are well above this trendline and therefore have high cost compared to lower person months. Those are in general capital-intensive projects with a proportion of personnel cost of around 50% of the total H2020 cost, while projects on the trendline have a proportion of 65%. Some go even higher like Produktive 4.0. Those are typically larger platform development projects.

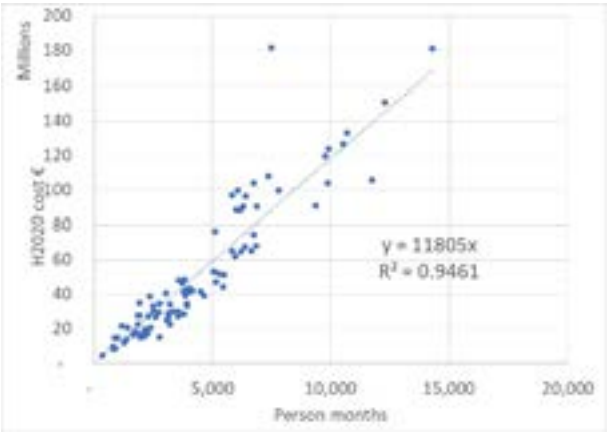


Figure 17: Cost versus effort for the selected projects

The number of person-months per beneficiary is markedly different from IA to RIA. There is much more variation amongst the IA projects as can be seen in Figure 1è. The IA projects above the trendline are typically projects developing equipment, or other hardware.

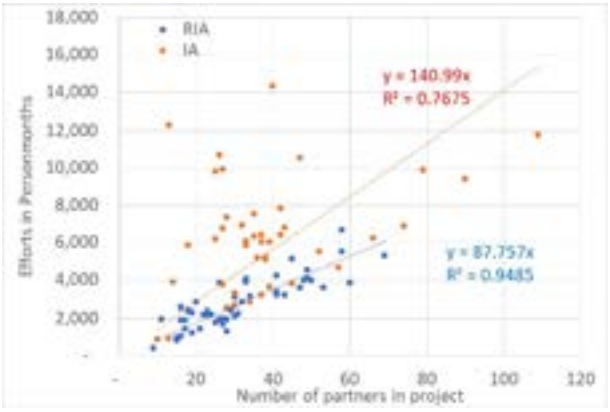


Figure 17: Efforts versus beneficiaries in a project

Gender balance in projects

The total female staff involved in the ECSEL projects of RIA and IA calls 2014 to 2018 amounts to 19% the beneficiaries' staff involved, of which 66% are involved in research activities and 34% in non-research activities. For the remaining 81% males, 80% are involved in research while 20% are involved in non-research activities.

	Female Staff	Male Staff	Female Researcher	Male Researcher
Number	6844	29980	4511	23945
Proportion	19%	81%	16%	84%

Table 17: Gender statistics

Beneficiary staff statistics

Comparing the declared number of staff working on the projects with the declared person-months one can calculate some statistics (Table 18, for calls 2014 to 2018). On average staff works 6 months on a project. Overall, the ECSEL projects involved more than 28,000 researchers and a total of close to 37,000 persons. Though there is a good correlation between the staff-number and the person-months, correlation is less between cost and staff.

	All staff	Researchers	Average Staff per project	Average PM per staff	Average Cost per staff (EUR thousands)
RIA	12,498	9,447	12.3	6.3	188
IA	24,326	19,009	26.2	6.2	454

Table 18: Staff statistics

Support per category of partner, in particular SMEs

The participation to the ECSEL programme was already discussed at the submission stage. ECSEL is one of the few programmes where SMEs need to do a self-assessment and not just a self-declaration to get the funding. In some cases, this is also checked by the national authorities for the national funding.

Over the seven years 3,182 participants were selected (35% of those that submitted, equals the overall success rate) representing 1,493 entities (equals 48% of the entities that submitted).

For the SMEs, those figures are: 896 SME participations that were selected (34% of SME participations that submitted and 28% of the selected participations) representing 617 SME entities (49% of SME entities that submitted and 41% of the selected entities).

The success rate of the SMEs equals the overall success rate, both at the level of participations and at the level of entities. A few remarks: nearly half the entities that participate in ECSEL JU calls are selected at least once; the same for SMEs.

SME entities make up 41% of all the entities selected over all calls but SMEs make only 28% of the selected participations (the same percentage as in the participations of SMEs in submitted proposals: 29%). In terms of cost: SMEs bring in only 13% of the cost of the selected projects and receive 14% of the EU funding, close to the percentages at submission.

Therefore, if a lot of the newcomers are SMEs, and a sizable few sticking around, the average investment per SME participation is relatively low. This is maybe a reflection of the carefulness that companies and certainly SMEs must handle when investing, even more when the funding is not 100%. The attractiveness of the ECSEL programme for SMEs lies in the more application-oriented R&D&I (higher TRLs) and in the opportunity to work with other companies with similar interests thanks to the larger participation of private organizations (LE and SMEs) in ECSEL.

It is often heard that the ECSEL programme does not achieve a sufficient funding support to SMEs. In order to judge this one can compare the ECSEL programme with the EASME programme, specifically tuned to SMEs. It is expected that the EASME programme will reach 7500 SME organizations providing a total funding of 2.9 billion euro, That is on average 358,000 euro per SME organization. The 617 SME organizations that participated in selected ECSEL projects (sometimes in several projects) were awarded in total 315 million euro in funding (both EU and national), that is on average 510,000 euro per SME organization or on average 32% more than EASME. In that sense ECSEL is effective in funding SMEs.

Finally, there are differences between RIA and IA projects as shown for participations in Table 19. Participation to IA projects is smaller for SMEs, maybe due to the higher entrance ticket (larger investment required).

CALLS 1 and 2 ALL YEARS	LE	OTHER	SME	TOTAL	LE%	OTHER%	SME%
IA	679	538	412	1629	42%	33%	25%
RIA	470	599	484	1553	30%	39%	31%
TOTAL	1149	1137	896	3182	36%	36%	28%

Table 19: Participation to selected IA and RIA projects by type of entity

Some country related statistics

In the next tables we summarize some statistics per country of origin of the beneficiaries of selected projects. The success rate for beneficiaries is the ratio of the number of beneficiaries in selected projects to the number of participants in submitted projects (at FPP) . The national to EU funding ratio is the ratio of national funding to EU funding for the beneficiaries of a particular country. The total contribution is the total country funding over the total national funding from all countries 1,081 million euro, excluding ESIF.

Member State	Number of beneficiaries	Success rate of beneficiaries	National to EU funding ratio for selected projects	Average national funding per beneficiary (EUR)	Total contribution to the programme
AT	257	44%	0.86	246,436	5.9%
BE	138	40%	0.90	707,857	9.0%
BG	1	9%	0.00	-	0.0%
CY	2	100%	0.00	-	0.0%
CZ	95	34%	1.26	181,383	1.6%
DE	654	39%	0.91	388,287	23.5%
DK	22	27%	0.78	95,643	0.2%
EL	19	30%	0.00	-	0.0%
ES	286	29%	0.93	158,548	4.2%
FI	177	27%	1.22	233,340	3.8%
FR	348	42%	0.81	513,240	16.5%
HU	37	48%	1.21	238,373	0.8%
IE	45	42%	1.33	207,379	0.9%
IT	281	33%	0.83	267,502	7.0%
LT	12	63%	0.00	-	0.0%
LV	19	45%	1.76	163,441	0.3%
LX	3	75%	1.30	447,672	0.1%
NL	312	33%	1.01	503,051	14.5%
PL	27	25%	1.66	351,214	0.9%
PT	68	27%	0.85	80,256	0.5%
RO	20	29%	1.32	58,820	0.1%
SE	117	32%	1.17	287,742	3.1%
SK	27	57%	1.59	156,992	0.4%
SI	10	63%	0.00	-	0.0%
UK	19	17%	0.86	126,315	0.2%

Table 20: Some statistics for the MS

In Figure 18 we plotted the total contribution versus the GDP (nominal, 2019 in EUR million). One can distinguish two trends: the lower with ES, IT, FR, DE and the higher with FI, AT, BE, NL probably related to differences in policies. Finally, although the UK was participating to ECSEL, it did so in a limited way. Two countries did not participate at all to ECSEL: Croatia and Malta while one Estonia, had few participants but none that were selected.

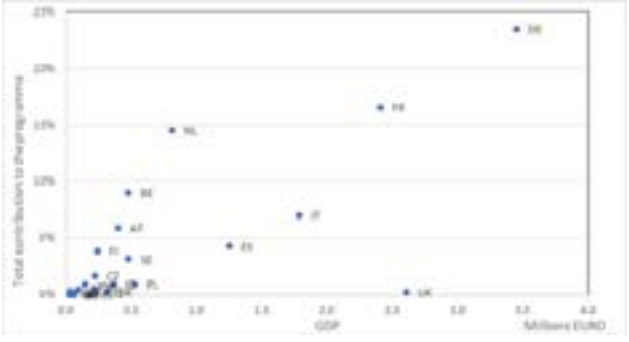


Figure 18: Total contribution to ECSEL against GDP

There was also an appreciable participation from some EFTA and associated countries (H2020-associated) as is shown in the next two tables. The last table are the third countries. One beneficiary of a third country will receive some EU funding on decision of the PAB.

	Beneficiaries	Total contribution to the programme
Switzerland	42	0.6%
Iceland	2	0.0%
Norway	57	1.3%

Table 21: EFTA countries

	Beneficiaries	Total contribution to the programme
Israel	53	3.6%
Taiwan	2	0.0%
Turkey	47	1.0%

Table 22: Associated countries

	Beneficiaries
BR	1
IN	1
TW	2
US	1

Table 23: Third countries

Coordinators

The next two tables provide the type and origin of the coordinators at submission and selected. Proposals coordinated by SMEs seems to have a harder time getting selected (Table 20), less so for proposals coordinated by a LE. As was noted the success rate for SMEs is similar to the total success rate, therefore the difference pointed here has more to do with the quality of the proposal.

	At submission (FPP)			At selection		
Coordinators	LE	OTHER	SME	LE	OTHER	SME
2014-1	16	13	7	3	3	
2014-2	13	1		6		
2015-1	29	18	4	6	2	
2015-2	9	2		5		
2016-1	18	7	3	7	1	
2016-2	12	1		5	1	
2017-1	9	1	1	6		
2017-2	15	7	4	5	1	
2018-1	8	1		6	1	
2018-2	11	5	2	5	1	
2019-1	9	1		5	1	
2019-2	10	10	1	3	4	1
2020-1	12	2	1	5	1	
2020-2	13	10	2	5	3	
All calls	184	79	25	72	19	1
Proportions	64%	27%	9%	78%	21%	1%

Table 24: Coordinators at submission and selected per type

	All Submitted	All selected
AT	19	10
BE	11	5
CH	1	
DE	54	20
DK	1	
EL	2	
ES	23	7
FI	19	3
FR	45	15
IE	2	
IL	4	1
IT	19	6
LV	1	
NL	52	19
NO	3	
PL	3	
PT	5	1
SE	15	5
TR	3	
UK	6	

Table 25: Coordinators at submission and selected per country

Conclusions about the selected projects

At the end of the ECSEL programme:

- EUR 1,167 million of EU funding and EUR 1,081 million of national funding went to 3205 beneficiaries spread over 92 RIA and IA projects and coming from 34 countries;
- Selected projects have on average 35 beneficiaries and a cost of EUR 51 million. The average funding rate equals 49%;
- The total contribution of the beneficiaries (sso, total eligible H2020 costs minus EU funding minus national funding) equals to EUR 2,400 million or 2.1 times the EU funding;
- The national to EU funding ratio (NER) is calculated as the ratio of national funding and ESIF over EU funding, at the end of the programme, this ratio reaches 0.96;
- 617 SME entities (representing 41% of the entities) participated 896 times in selected projects and were funded up to EUR 167 million through the ECSEL grants (EU funding) and EUR 148 million through national grants;
- The activities developed represent 407,730 person-months, nearly 34,000 person years.

Those figures demonstrate the effectiveness of ECSEL in allocating funding to the best proposals, whereby the quality of the proposals has steadily increased over the years. It also shows the effectiveness of ECSEL at attracting SMEs.

Finally, looking at the larger picture, the ENIAC-ARTEMIS-ECSEL programmes that ran from 2008 to 2020 totalled (13 years):

- EUR 1.8 billion in EU funding;
- EUR 2.0 billion in national funding;
- EUR 8.9 billion in declared cost according to national rules;
- 215 selected projects from close to 500 submitted proposals;
- 25 calls;
- 5950 beneficiaries from close to 13,300 participations.

Summary by category of participants

The following tables summarise the distribution of EU funding and average cost per beneficiary, for all ECSEL JU RD&I Calls, per category of the beneficiary.

	LE	OTHER	SME
2014-1	17.4	15.3	14.8
2014-2	44.6	46.4	10.7
2015-1	22.0	22.4	7.3
2015-2		38.2	8.6
2016-1	27.6	22.3	10.5
2016-2	65.8	25.7	11.5
2017-1	60.8	40.4	8.2
2017-2	26.3	23.1	13.2
2018-1	78.1	46.9	13.8
2018-2	25.0	29.6	7.7
2019-1	49.4	44.5	12.3
2019-2	18.1	23.7	17.6
2020-1	54.8	35.5	12.5
2020-2	27.0	25.6	18.6

EU Funding per category of beneficiary (M€)

	LE	OTHER	SME
2014-1	1.69	0.72	0.63
2014-2	3.74	2.68	0.97
2015-1	1.47	0.97	0.54
2015-2	3.79	1.35	0.77
2016-1	1.44	0.61	0.65
2016-2	3.50	0.84	0.66
2017-1	3.78	1.78	0.94
2017-2	1.13	0.72	0.54
2018-1	3.03	1.44	0.72
2018-2	1.42	1.05	0.48
2019-1	2.09	1.17	0.67
2019-2	1.13	0.65	0.66
2020-1	3.30	1.58	0.85
2020-2	1.35	0.76	0.67
AVERAGE COST	2.45	1.08	0.68
AVERAGE FUNDING RATE	38%	70%	51%
AVERAGE COST NOT FUNDED	1.52	0.32	0.33

Average cost per beneficiary (M€)

Portfolio analysis

This section describes the progress in the portfolio analysis of the whole programme. In previous years we attempted an analysis based on a clustering of the beneficiaries (AAR-2017). This analysis had its merits but required some educated guess about the expected result through the choice of the parameters for the statistical analysis. Also, as it was based on an analysis of the network of beneficiaries one had to identify the topics per cluster in an ad-hoc way. The projects in ECSEL are by requirement (value chain approach) multi-topics and this brings a specific difficulty in mapping this portfolio as there is no straightforward approach available to extract topics and communities of participants simultaneously. In the last two years new approaches were developed that could circumvent some pitfalls and propose an analysis with as little *a priori* information as possible.

For topic extraction, the most direct unsupervised machine learning technique is the Latent Dirichlet Allocation[1] (LDA) that solves the problem of mapping documents. The documents used are the Excellence sections of the project description at FPP stage. A first step consists in identifying "relevant" words for each document (can be several thousand per document). The pruning of the relevant words (many words are not relevant such as articles, pronouns, etc.) per project was done semiautomatically and is rather laborious, one of the disadvantages at this stage. This pruning has been implemented through a dataflow that cannot yet consider multi-word phrases[2] . Despite this important limitation, those lists of words per document/project where then fed to the LDA algorithm. Based on this data, the LDA algorithm extracted topics and assigned to the projects a certain fitness per topic. Following a wide screening in terms of sensitivity parameters and number of topics, it was possible to extract a stable set of topics onto which the ECSEL projects can be mapped.

For the 92 projects of the RIA and IA calls, one finds that 21 topics is a good choice. Till now the analysis has required no *a priori* information. Nearly 2/3 of the projects are regrouped in topics that can be identified. But the LDA algorithm struggles with some distinctions. For example, the FDSOI projects are regrouped in the topic that covers power electronics because FDSOI projects are also about low power electronical components. It also makes no distinction between Si power electronics and SiC power electronics. Finally, 1/6 of the projects are regrouped in a topic 0 that indicates that the algorithm is not capable of deciding for a main topic (highest fitness), but interestingly enough the second highest fitness percentage indicates in nearly all the cases the most appropriate topic. In this way more than 80% of the projects are correctly regrouped in recognizable topics. The remaining projects are then appropriately distributed over the relevant topics. Also, few topics where regrouped or split in two when that made sense. This resulted in 17 identifiable categories of projects whereby some categories were further split in subcategories.

1 https://en.wikipedia.org/wiki/Latent_Dirichlet_allocation
2 e.g. Internet of Things, complex systems, extreme ultraviolet, silicon carbide and so on

Those categories are listed, with a short description (and some explanation if needed on the attribution of certain projects), the list of projects for that topic, the total cost, funding, and person-months in the tables below. It should be reminded that a fair number of projects could be fitted in several of the categories, and that the proposed allocation is based on an algorithm that decides according to the likeliness in the use of groups of relevant words in project specific documents. So, one cannot use the fitness percentage to for example distribute the efforts of a project over several categories of activities, because there is presumably no correlation between the use of groups of words and the efforts put in some activities. This is most probably true for the documents used now, maybe when using project execution documents such as deliverables a vague correlation might appear.

From this list one can conclude several things:

There is for some categories a resemblance with what was proposed in the AAR2017 (based on cluster of organizations), but the present regrouping of projects is much more satisfactory and has a stronger statistical backing.

Several categories with more than 3 projects (spread in time over the duration of the programme) hints at the continuous evolution of the different categories and at how the community picks this up by proposing new project ideas.

Also new fields of R&D&I emerge either as new category (e.g. edge computing or neuromorphic computing, quantum computing) or as new subject within an existing category (emergence of RF-SOI in the More Moore – SOI category).

Comparing with the different versions of the MASRIA it is evident that some chapters barely were addressed: digital life, smart society, though one should point out that projects eventually did address specifics in those chapters.

It is fair to say that the ECSEL programme pretty much covered the whole set of MASP topics. But there is no straightforward mapping of the chapters on the categories, again a result of the previously discussed value chain approach of the programme.

There seems to be an imbalance between the "Components" and "Systems" categories, roughly 55 to 45 in cost less in person-months. But one should be careful with such simplistic interpretation. Many "Components" projects do include system related developments (e.g. 3DAM, StorAIge, mobility related projects, etc.) and vice versa. In other words, the picture is not that black and white and points again to the value-chain approach.

As a general conclusion one could remark that this analysis improves on the previous analysis, delivers a set of categories that could be used to analyse other sets of projects (e.g. not-selected project proposals, projects in other related programmes, etc.), but also demonstrates indirectly (projects covering several topics) that the value-chain approach pervades the portfolio and enriches this portfolio with all kinds of interactions along those value chains.

On the project – participant network, a typical algorithm for community detection has been used (unsupervised machine learning). More specifically, the Louvain algorithm[3] for modularity maximisation was implemented in its version adapted to bipartite networks. On top of it, a consensus clustering algorithm was used to circumvent the modularity maximum degeneracy[4]. This approach finds communities by maximising the strength of interrelations between participants in a community as opposed to their relations with the other communities. The network is built from the total costs of participants in projects. One of the important limitations of most community detection algorithm is that they do not take into consideration overlapping communities and result in strict attachment of projects and participants to given communities. For participants engaged in many projects, this approach does not show the diversity of their contribution. Nevertheless, the communities extracted demonstrate a solid coherence. Because of this limitation, several communities only correspond to one project. The number of communities identified is 40. This result is statistically convincing. An interpretation though as to the deeper reasons for those communities is not evident yet. Some of the communities can be clearly identified with a topic or a group of projects, other are more geographical. A convincing allocation of the communities to the topics for example is however not do-able at this stage.

A general limitation for all those (big data) techniques is the limited amount of data for the topic extraction or for the community detection. One could think of extending this analysis to include deliverables, etc. But the amount of work in the extraction of the list of relevant words is daunting. It probably would be interesting to include in this analysis the projects of other related programmes under H2020 or EUREKA and obtain in this way a better overview of the activities in Europe on the different categories. Future work includes the integration of multi-word phrases in the topic extraction, the use of alternate algorithms to extract the communities from the project – participant network, and the exploration of the temporal evolution of both topics and communities.

3 https://en.wikipedia.org/wiki/Louvain_method
4 Fast consensus clustering in complex networks, arXiv:1902.04014v2 (2019)

Portfolio analysis of ECSEL programme

Category	Overall Topic	Topic Description	Partners	COST	EU FUNDING	NATIONAL FUNDING	PERSON MONTHS	Topic Projects
	COMPONENTS	**includes More Moore & More Than Moore**	**1,120**	**2,700,785,701**	**634,846,284**	**573,855,164**	**204,392**	
	More Moore		**376**	**1,417,091,421**	**325,128,374**	**292,233,330**	**104,451**	
1	More Moore - CMOS	This category covers More Moore pilot lines and focusses on the technology development of equipment, processes and devices for the nodes from 7nm to 3nm (CMOS/FINFET) and new device architectures for 2nm using design-technology and system-technology co-optimisation. The equipment and processes cover nearly the whole front-end: lithography (EUV) including mask manufacturing, etching, ion-beam as well as metrology (3D, defect characterisation).	208	927,589,524	196,134,688	174,493,491	73,218	SeNaTe (2014-2) 3DAM (2015-1) TAKE5 (2015-2) TAKEMI5 (2016-2) TAPES3 (2017-1) PIN3S (2018-1) IT2 (2019-1) ID2P-PAC (2020-1)
2	More Moore - SOI	This category covers the rapid development of the SOI (Silicon on insulator) transistor technologies through pilot line developments in both digital FD-SOI (Field Depleted) and analog RF-SOI (Radiofrequency) that led in the last years to the first commercialized SOI based products. Important technical aspects are the possibility of ultra-low power operation and improved high frequency performances. On the digital side this topic also covers the development of embedded non-volatile memory technologies and integration into circuitry for MCU (Microcontroller Unit) to be used in Cyber Physical Systems, Mobile applications, Edge computing. On the analog side it allowed for circuitry that will be used in communication equipment for 5G and future generations. This topic supports the European climate goals. Two projects in this group (PRIME and WAKEMEUP) are put under category 9 by the algorithm. This is probably due to the focus on memories. But the technology for those two projects definitely relates to SOI. Other projects: WAYTOGO FAST; REFERENCE; OCEAN12 are classified under 4 by the algorithm probably due to the power element, but obviously these projects look at the low power aspects of the SOI technology while topic 4 covers power-electronics.	149	467,794,887	122,400,537	112,550,269	30,028	WAYTOGO FAST (2014-2) REFERENCE (2015-1) PRIME (2015-1) OCEAN12 (2017-1) WAKeMeUP (2017-1) BEYOND5 (2019-1)
0a	More Moore - quantum computing	This project MATQu support developments for quantum computing. The algorithm puts it under the Medtech topic but that does not seem sensible.	19	21,707,010	6,593,149	5,189,570	1,205	MATQu (2020-2)
	More Than Moore	**Includes: MtM-Power & MtM-Other**	**744**	**1,283,694,280**	**309,717,910**	**281,621,834**	**99,941**	
	More Than Moore - Power		**425**	**796,009,386**	**183,805,563**	**160,660,166**	**60,252**	

Category	Overall Topic	Topic Description	Partners	COST	EU FUNDING	NATIONAL FUNDING	PERSON MONTHS	Topic Projects
3	MtM - Power GaN	This category covers the development of GaN technology for power transistors and RF power, including: development of adequate SiC substrates, RF amplifiers for 5G base stations, LIDARs, HEMT power components and circuitry, integration with BCD for smart power systems, special packaging requirements for this technology, etc. but also new device architectures such as Vertical Membrane transistors. This topic supports the European climate goals. Project PowerBase is put under category 4 by the algorithm because of the focus on power but the material basis for this project is GaN.	156	256,221,682	65,367,902	61,154,572	20,409	OSIRIS (2014-1) PowerBase (2014-2) 5G_ GaN2 (2017-2) UltimateGaN (2018-2) GaN4AP (2020-1) YESvGaN (2020-2)
4a	MtM - Power Si	This category covers pilot lines and developments of Silicon based grid power components both for power application and RF (to THz) power using BCD (Bipolar CMOS-DMOS) or HBT (Heterojunction Bipolar Technology) architectures. The components are integrated with other Si-circuitry for smart power applications (embedded PCM (Phase Change Memory), mixed signal ICs, etc). The RF components are for 5G systems. This topic supports the European climate goals. The algorithm does not make a distinction between 4a and 4b but one can make a difference based on the material basis, Si or SiC.	121	304,904,246	59,154,416	45,973,619	18,990	R2POWER300 (2014-2) TARANTO (2016-1) R3-PowerUP (2016-2) Power2Power (2018-1)
4b	MtM - Power SiC	This category covers pilot lines for SiC (Silicon Carbide) technology for smart grid power. One project supports the building of the first 8" SiC pilot line, another develops new Trench VMOS architectures. This topic supports the European climate goals.	82	151,768,768	35,528,482	32,332,529	12,883	WInSiC4AP (2016-1) REACTION (2017-1) TRANSFORM (2020-1)
4c	MtM - Power SiC applied to automotive systems	This category covers developments in power systems for mobility (automotive, railway, avionics) using SiC (Silicon Carbide) technology. It includes projects that develops the ecosystem through multiple applications. This topic supports the European climate goals, including decarbonisation. The algorithm does distinguish those two projects from the other in category 4.	66	83,114,690	23,754,763	21,199,446	7,970	HiPERFORM (2017-2) HiEFFICIENT (2020-2)
	More Than Moore - Other		**319**	**487,684,895**	**125,912,347**	**120,961,668**	**39,689**	
5a	MtM - Packaging	This category covers a number of pilot line and development projects on advanced packaging and heterogenous integration, including micro-transfer printing, low cost options, optic and photonic components, MEMS, medtech, harsh environment sensors, etc. The algorithm does not make a difference between 5a and 5b but the distinction made here makes sense as the projects under 5a specifically focus on packaging aspects.	112	106,948,371	26,437,807	25,471,792	9,378	EuroPAT-MASIP (2016-2) MICROPRINCE (2016-2) APPLAUSE (2018-1) CHARM (2019-1)

Category	Overall Topic	Topic Description	Partners	COST	EU FUNDING	NATIONAL FUNDING	PERSON MONTHS	Topic Projects
5b	MtM - Sensors and MEMS	This category covers development for More Than Moore technologies (MEMS, organic electronics, sensors) including novel aspects on reliability, robustness validation.	47	104,252,825	25,776,567	24,922,081	9,738	ADMONT (2014-2) Io-Sense (2015-2)
6	MtM - Imaging	This category covers photonic and imaging technologies using laser and/or sensors for hyper and multi-spectral imaging, thermal vision, short and long range 3D imaging etc.A project of category 11, Astonish, is classified under category 6 because it focusses on imaging, but the application is clearly medical technology and therefore it makes sense to put it there.	52	142,929,060	38,070,911	38,676,649	10,038	EXIST (2014-1) VIZTA (2018-1) HELIAUS (2018-2)
7	MtM - LED	This category covers projects in lighting and LED technologies.	40	27,783,831	8,169,899	7,258,695	2,610	DELPHI4LED (2015-1) AI-TWILIGHT (2020-2)
0b	MtM - micro batteries, acoustics	This category covers developments in acoustic technologies and micro batteries. The ENSO project is classified under the category 12 due to the focus on power, but it makes more sense to put it as a More Than Moore topic.	68	105,770,807	27,457,163	24,632,451	7,926	EnSO (2015-2) SILENSE (2016-1)
	SYSTEMS	**includes Computing, Mobility, Medtech, Power Smart Grid, Industry4.0, CPS**	**2,113**	**1,993,395,730**	**535,536,819**	**510,887,706**	**204,647**	
	Computing		**231**	**267,059,433**	**73,628,957**	**75,226,250**	**23,025**	
8	Computing - Edge	This category covers edge computing: AI empowered software, reliable computing node to create a Cognitive Edge under industry standards, to allow for distributed safety-critical CPS solutions with a heterogeneous architecture along a device-edge-cloud continuum, running existing AI algorithms on vastly distributed edge devices, low use of energy in the core of the Edge Computing components, integral approach for smart integration of image- and video-processing pipelines.	133	91,890,235	26,345,375	27,876,520	10,206	BRAINE (2019-2-ST2) FRACTAL (2019-2-ST2) TRANSACT (2020-1) DAIS (2020-2)
9	Computing - Neuromorphic	This category covers neuromorphic technologies: hardware and software platforms. Some projects like TEMPO could certainly fit under category 8 Edge computing.	98	175,169,198	47,283,582	47,349,729	12,819	TEMPO (2018-2) ANDANTE (2019-2) StorAIge (2020-1)
	Mobility		**346**	**319,660,276**	**93,015,314**	**82,482,525**	**32,103**	
10a	Mobility - hardware	This category develops advanced electronic components and systems (ECS) and architectures for future electrical, autonomous, connected, and shared vehicles; that enabled by embedded intelligence and functional integration for future mobility, becomes the pivotal factor for the automotive sector to address the Green Deal principles. The algorithm does not make the distinction between 10a and 10b but one can based on certain aspects: 10a on the more general aspects of autonomous driving, 10b more on the sensor aspects.	214	216,761,653	62,270,181	53,191,162	21,450	3Ccar (2014-1) AutoDrive (2016-1) NewControl (2018-2) ArchitectECA2030 (2019-2-ST1) AI4CSM (2020-2)

Category	Overall Topic	Topic Description	Partners	COST	EU FUNDING	NATIONAL FUNDING	PERSON MONTHS	Topic Projects
10b	Mobility - software	This category covers embedded systems for autonomous driving: coping with real world requirements under all environmental conditions, sensor fusion, accurate detection of human behaviour and physiological parameters, etc. The project NextPerception is brings in elements of edge, cloud and AI.	132	102,898,624	30,745,134	29,291,363	10,653	RobustSENSE (2014-1) DENSE (2015-1) PRYSTINE (2017-2) NextPerception (2019-2)
11	**Medtech**	This category covers medical technology through a number of pilot lines and includes: polymer processing, medical devices, minimal invasive smart catheters, deep brains stimulation, electrophysiology devices, spectral CT, near infrared optical imaging, Image guides surgery, open and enabling technology platforms, biomedical signal processing, active implantable devices (bioelectronic medicines), organ-on-chip, drug adherence monitoring, smart ultrasound, radiation free interventions and continuous monitoring.	**174**	**172,455,653**	**44,610,664**	**44,768,977**	**15,833**	InForMed (2014-2) ASTONISH (2015-1) POSITION-II (2017-1) Moore4Medical (2019-1)
12	**Power Smart Grid**	This category covers the smart grid, components and systems: power conversion, energy management, local storage, dc micro-grid, energy efficiency, energy system, security, smart meter, distributed energy resources, low power, providing technologies and components that support enhanced integration of renewables and storage combined with intelligent control of the power flow. Project EnergyECS focusses on the interface of energy and mobility as well as related ICT and electronic and overlaps with mobility category looking into smart charging infrastructure, using blockchain. This category supports the European climate targets and decarbonization.	**71**	**70,921,218**	**19,520,659**	**18,811,903**	**7,694**	CONNECT (2016-1) PROGRESSUS (2019-2) Energy ECS (2020-1)
13	**Industry4.0**	This category covers Industry4.0 and develops technologies to this effect such as: digitization of development processes, industrial internet, systems of systems approach, application of artificial intelligence	**242**	**368,890,544**	**86,183,079**	**84,546,647**	**34,949**	SemI40 (2015-2) iDev40 (2017-1) MADEin4 (2018-1) AI4DI (2018-2-ST) iRel40 (2019-1)
	CPS		**1,049**	**794,408,606**	**218,578,145**	**205,051,404**	**91,042**	
14a	CPS - Industry4.0	This category covers Cyber Physical System technologies for Industry4.0 such as: proactive and collaborative maintenance, robotics, smart supply management, engineering methodologies, suitable integrated tool chains, IoT interoperability, design efficiency and productivity, enabling secure certification, provide vertically distributed edge-to-cloud intelligence for machines, robots and other human-in-the-loop cyber-physical systems, develop a semantic web for semiconductor manufacturing. The algorithm makes the distinction between 14a and 14b.	312	290,563,587	75,150,238	74,814,286	31,114	MANTIS (2014-1) Productive4.0 (2016-2) Arrowhead Tools (2018-1) CPS4EU (2018-1) SC3 (2020-4)
14b	CPS - Industry4.0	This category covers Cyber Physical System technologies for Industry4.0 related to mechatronics	81	51,505,193	14,547,689	14,174,466	6,211	I-MECH (2016-1) IMOCO4.E (2020-2)

Category	Overall Topic	Topic Description	Partners	COST	EU FUNDING	NATIONAL FUNDING	PERSON MONTHS	Topic Projects
15	CPS - autonomous	This category develops technologies for autonomous systems: submarine drones for offshore missions, airborne drones and autonomous farming. The FITOPTIVIS project is a special case as it integrates distributed video streams. One could make a case to put it under another category such as imaging or edge-computing for example.	222	136,600,156	41,799,325	38,047,352	17,260	SWARMs (2014-1) FITOPTIVIS (2017-2)AFar-Cloud (2017-2) COMP4DRONES (2018-2) ADACORSA (2019-2)
16	CPS - connected	This category covers aspects of safety, security, privacy, trustability in connected CPS systems as well as trust in AI-based intelligent systems, moving AI to the edge and making AI and ML based systems trustable, explainable.	178	134,722,814	36,395,316	33,493,354	15,449	SCOTT (2016-2) SECREDAS (2017-2) In-SecTT (2019-1)
17	CPS-general	This category covers CPS: European-wide assurance and certification open tool platform, test and validation framework that proves the functionality, safety and security,validation environment for rapid re-qualification; improving productivity, while reducing costs and ensuring quality in development; framework incorporating methods and tools for continuous development and runtime validation to significantly improve productivity, quality and predictability of large and complex industrial systems; reduce the time and cost needed to verify and validate automated systems with respect to safety, cybersecurity and privacy (SCP) requirements; development of a model-based framework to support teams during the automated continuous development of CPSs by means of integrated AI-augmented solutions. The project AIDOaRt is classified under 2. It is not clear how that comes but it makes more sense to put it under 17.	256	181,016,856	50,685,578	44,521,946	21,007	SafeCOP (2015-1) AMASS (2015-1) ENABLE-S3 (2015-2) AQ-UAS (2016-1) MegaMaRt2 (2016-1) VALU3S (2019-2) AIDOaRt (2020-2)

5.3.3 Evaluation: procedures and global evaluation outcome, redress, statistics

Evaluation rules, selection of experts

The rules for evaluation and selection are based on the H2020 general rules, and the specific provisions required by the ECSEL setup have been established and then reviewed by the decision PAB-2018.31 valid for the calls 2020. The experts to be assigned must be registered in the H2020 expert database. Table 26 shows the number of experts as a function of the submitted proposals. Extra efforts are put into selecting experts with the right expertise. The assignment procedure considered the area of expertise, gender, country, and the absence of conflicts of interests.

	PO 2017	FPP 2017	PO 2018	FPP 2018	PO 2019	FPP 2019	CSA	CSA 2019	PO 2020	FPP 2020	CSA 2020	IMI 2020
Proposals to be evaluated	49	37	34	27	37	31	2	1	43	40	2	2
Experts appointed	57	39	46	32	46	36	6	4	56	50	5	4

Table 26: Evaluations and experts

Table 23 provides a gender-based overview. The relative proportion of female experts has appreciably increased, and gender parity was achieved this year.

Gender of experts	PO 2016	FPP 2016	PO 2017	FPP 2017	PO 2018	FPP 2018	PO 2019	FPP 2019	PO 2020	FPP 2020	CSA 2020	IMI 2020
Male	53	38	42	30	32	23	26	21	26	23	4	3
Female	9	6	15	9	14	9	20	15	30	27	1	1
Total	62	44	57	39	46	32	46	36	56	50	5	4
% Female	15%	14%	25%	24%	30%	28%	43%	42%	54%	54%	20%	25%

Table 27: Gender of experts for evaluation of calls

A breakdown based on country-of-origin is provided in Table 28. Here, "IMI2020" refers to the Call 2020-3.

Country of residence	PO 2017	FPP 2017	PO 2018	FPP 2018	PO 2019	FPP 2019	CSA 2018	CSA 2019	PO 2020	FPP 2020	CSA 2020	IMI 2020
AT	3	2	1	1	1	1	0	0	2	1	0	0
BE	2	1	2	1	2	2	0	0	2	2	1	0
BG	3	2	3	2	2	2	0	0	3	3	0	0
CY	1	0	1	0	0	0	0	0	0	0	0	0
CZ	4	2	0	0	0	0	0	0	1	1	0	0
DE	12	7	7	4	9	7	2	0	7	6	3	1
DK	0	0	2	2	1	1	1	1	1	1	0	0
EL	1	2	2	1	1	1	1	0	3	3	0	0
ES	6	3	5	4	6	4	1	1	8	6	0	0
FI	0	0	0	0	1	1	0	0	0	0	0	0
FR	4	4	4	3	5	4	0	0	5	5	0	1
HU	2	4	0	0	0	0	0	0	1	1	0	0
IE	0	0	2	2	3	2	0	0	1	1	0	0
IL	1	0	2	2	1	1	0	0	2	2	0	1
IT	4	4	4	3	4	3	0	0	7	7	1	0
LV	0	0	0	0	0	0	0	0	1	1	0	0
NL	2	1	2	0	2	2	0	0	3	1	0	0
NO	0	0	0	0	1	0	0	0	0	0	0	0
PL	2	2	3	2	3	3	0	0	2	2	0	0
PT	2	1	1	1	1	0	0	0	2	2	0	0
RO	2	1	1	1	1	0	0	0	0	0	0	0
SE	3	1	2	1	2	2	0	1	2	2	0	0
TR	0	0	1	1	0	0	0	0	1	1	0	0
UK	3	2	1	1	0	0	1	1	1	1	0	1
USA	0	0	0	0	0	0	0	0	1	1	0	0

Table 28: Nationality of experts

Finally, Table 25 provides the breakdown according to the affiliation of the expert:

Affiliation	PO 2016	FPP 2016	PO 2017	FPP 2017	PO 2018	FPP 2018	PO 2019	FPP 2019	CSA 2018	CSA 2019	PO 2020	FPP 2020	CSA 2020	IMI 2020
Private	32	24	31	19	26	17	25	21	4	4	25	26	2	1
Public	23	14	22	14	17	13	19	13	1	0	29	22	2	3
Independent	7	6	6	5	3	2	2	2	1	0	2	2	1	0

Table 29: Affiliation of experts

ECSEL is a LEIT programme (Leadership in Enabling and Industrial Technologies, part of Horizon 2020) and the proposals are oriented towards industrial topics, which explain the relatively high participation of experts from industry. Of course, the rules against conflict of interest are applied and during the evaluation procedure several checks are performed at each stage of the procedure.

As each year an effort was made to attract new experts. A new method of calculation for the new experts was implemented. New experts are experts that never participated in an ECSEL evaluation. Therefore in 2014, all experts are counted as new, even if 50 had participated under FP7 to the evaluation of ENIAC and ARTEMIS calls. The count of the total number of new experts (over the 7 years) equals 158 experts, of which around 50 were also active under the ARTEMIS and ENIAC programmes.

	2014	2015	2016	2017	2018	2019	2020
Appointed	54	56	61	59	46	46	56
New	54	32	20	17	11	14	10
% new	100.00%	57.14%	32.79%	28.81%	23.91%	30.43%	17.86%

Table 30: New experts

COVID-19 impact on submission and selection

The impact of COVID-19 on the evaluation process was already discussed. It remains to be answered if COVID-19 had an impact on the submission and selected proposals. At PO stage around 10% of the proposals indeed indicated that they had had difficulty gathering information from some of the partners. Also, more proposals were submitted than in preceding years. In fact, it is known that proposals are prepared long time in advance (up to 1 year) and therefore at the PO submission deadline in May (3 months after the begin of the lockdown) only the final details needed to be added.

The measure to lower the threshold to zero seems fully justified, while maintaining the PO evaluation was also fully justified. Indeed, even those proposals that indicated missing information from some partners were largely complete as to the required information to be provided at PO phase. One should remind here that not all information is required at the PO stage, only part of the information on excellence and impact and few details on the consortium under implementation. This PO stage evaluation was of course helpful to the ECSEL Participating States.

At FPP stage no project claimed missing information due to COVID-19. This demonstrates the tremendous work done by the consortia under difficult circumstances to finalize the proposals. Evaluation went forward as already discussed. The selected proposals were adopted by the PAB after lengthy online discussion (remote PAB) but with the full support of the PAB.

Ethic evaluation

In 2020, 1 ethics evaluation (More4Medical in Call 2019-1-IA) took place, and 2 experts were appointed for this.

Redress

In 2020 no redress was required.

Observer recommendations

In 2020 the Governing board appointed two observers.

The observers made 4 recommendations:

1. Prepare a short Guide to Rapporteurs and organise a dedicated briefing for those experts that take on this role;
2. Panels:
   a) If the COVID-19 situation allows us to have physical meetings in the coming year then the sub-panels and final ranking panels are preferably done face-to-face.
   b) If the COVID-19 situation forces us to have all meetings remotely, then consider limiting the number of experts that take part in the sub-panels and final ranking panel to ensure a more engaged discussion;
   c) In both cases, it is recommended to reduce the time and energy spent on debating proposals that have no chance to be funded and to start the subpanels and the final ranking panel with the top ranked or alternatively the cluster of proposals around the funding cut-off point;
3. Ensure that moderators follow a common protocol that is also adapted to situations of remote evaluations, with more emphasis on the process of the meeting;
4. Improve the explanation on and limit the use of the labels "weakness", "shortcoming" and "minor shortcomings" in the CR text, to ensure they are not used as a calculation tool to determine or rank the scores.

To conclude: some comments on the evaluation process

> *"You did a tremendous job to organise and moderate all these meetings. All considering, it went pretty smoothly." Observer*

> *"I would like to thank you and your colleagues once again for the perfect organization of the evaluations and all your hard efforts during all this time!!!" Expert*

> *"I am amazed how smooth these online sessions are running. Congrats for the hard work, I know how hard must be to organize this remotely." Expert*

> *"In any case today's exercise has been very important and constructive for newcomers like* me. Double thanks!" Expert

Overall, ECSEL has demonstrated that it handles the call to grant signature in a most efficient way.

5.4 Call for tenders

No tenders were launched in 2020.

5 .5 Dissemination and information about projects' results

5.5.1 Monitoring: organisation and results per project

Organisation of the monitoring, appointment of experts

In total 44 reviews were organised (each with 2 external experts), out of which 3 were interim reviews organised to redress situations discovered during an official review or to cover a project extension, leaving 41 official reviews. The size of the pool of experts used in the reviews as a function of the number of organised reviews is shown in Table 31. Each expert can participate in one or several reviews, in 2020, 88 appointment letters for review experts were signed.

	Reviews 2014	Reviews 2015	Reviews 2016	Reviews 2017	Reviews 2018	Reviews 2019	Reviews 2020
Reviews organised[21]	64	59	55	49	48	43	44
Experts	74	54	60	58	56	52	52

Table 31: Reviews and experts

Table 32 provides a gender-based overview. The number of female experts for reviews will increase in the coming years through the higher proportion of female experts in the evaluation who can later be appointed for coming reviews.

Gender of experts	Reviews 2014	Reviews 2015	Reviews 2016	Reviews 2017	Reviews 2018	Reviews 2019	Reviews 2020
Male	62	47	55	55	51	47	44
Female	12	7	5	3	5	5	8
Total	74	54	60	58	56	52	52
% Female	16%	13%	8.3%	5.2%	8.93%	9.6%	15.4%

Table 32: Gender of experts for reviews

Table 33 provides the country-of-origin based breakdown:

	Review 2014	Review 2015	Review 2016	Review 2017	Review 2018	Review 2019	Review 2020
AT	3	3	3	3	3	3	3
BE	1	1	1	1	2	2	2
BG	0	0	1	2	1	2	1
CH	1	2	0	1	0	0	0
DE	14	8	14	12	17	13	16
DK	3	2	1	2	2	3	3
EL	4	5	4	3	1	1	1
ES	4	3	4	3	4	5	3
FI	1	1	1	0	0	0	0
FR	12	10	8	12	8	8	5
HU	0	0	0	0	0	1	1
IE	4	2	2	2	2	1	1
IT	6	4	6	5	4	3	5
LU	0	0	1	0	0	0	0
NL	5	4	4	5	3	1	2
NO	1	1	1	0	0	0	0
PL	1	0	1	0	2	2	3
PT	0	0	3	0	0	0	0
RO	2	1	1	0	1	1	1
SE	5	4	0	1	2	2	2
TR	0	0	0	0	0	0	1
UK	7	3	4	5	4	4	2

Table 33: Country of origin of experts for reviews

Finally, Table 34 provides the breakdown according to the affiliation of the expert:

	Reviews 2014	Reviews 2015	Reviews 2016	Reviews 2017	Review 2018	Review 2019	Reviews 2020
Private	35	30	32	31	31	29	28
Public	31	20	23	18	16	8	17
Independent	8	4	5	9	9	15	7

Table 34: Affiliation of experts for reviews

COVID-19 impact

Due to COVID-19 all review meetings were organised remotely. This required several re-plannings. For one, most remote reviews were spread over several days, allowing for ample break times necessary when conducting remote presentations to avoid attention deficit and allowing for in-between consultations between experts or project members.

Second the exhibition of the results of the projects also suffered. For projects in their initial phase where results are often paper studies, specifications, etc. remote reviews did not pose an issue. But for the projects in a later phase or for the final review where demonstrators are exhibited this did pose a problem. It required for example the access to the facilities where the demonstrators were installed. In certain countries those facilities were inaccessible due to COVID-19 measures. The demonstrators needed to be filmed while exhibiting their features for video presentation. This was not always possible and the interaction with the experts having questions is difficult. Live streaming of the demonstrator was also tried but connection issues due to interferences of the environment where an issue. Also, demonstrators in special facilities such as clean rooms also potentially posed an issue for filming.

Finally, some projects had difficulties in finalising their demonstrators due to COVID-19 and asked for an extension of the project. Intermediate reviews took place focussing on the accessible deliverables, while postponing the non-accessible deliverables to a later, hopefully on-site, review.

As conclusion, reviews, an essential part in the monitoring of projects, suffered more than the evaluations from the constraints imposed by COVID-19 restrictions and projects in their final stage more than beginning projects. But the reviews covered as much as possible all the facets of a project and the conclusions of the reviews reflect with good accuracy the status of the projects. All this was made possible thanks to extra efforts by the consortia and the experts.

Results of the monitoring

Table 35 shows the results of the reviews for ECSEL projects as well as the websites. The appreciations under ECSEL are different than under FP7.

- EP = Excellent Progress: project has achieved beyond expectations;
- GP = Good Progress: project has fully achieved its objectives and milestones for the period or has achieved most of its objectives and milestones for the period with relatively minor deviations;
- GP- = Good Progress minus: project has achieved some of its objectives and milestones; however, corrective actions were or are required;
- UP = Insufficient Progress: corrective actions and intermediate review are required.

Call	Projects	1st Year	2nd Year	3rd Year	4th year	Website
2014	3Ccar	GP	GP	GP (final)		https://assrv1.oth-aw.de/3Ccar/
2014	ADMONT	GP	GP	GP	EP (final)	https://admont-project.eu
2014	EXIST	GP	GP-	GP (final)		http://www.exist-project.eu/
2014	INFORMED	GP	GP	GP (final)		http://informed-project.eu
2014	MANTIS	GP	GP	GP (final)		http://www.mantis-project.eu
2014	OSIRIS	GP-	GP-	GP (final)		http://osiris-ecselju.eu
2014	POWERBASE	GP	GP	GP (final)		http://www.powerbase-project.eu
2014	R2POWER300	GP-	GP-	GP (final)		https://r2power300.eu/
2014	ROBUSTSENSE	GP-	GP-	GP (final)		http://www.robustsense.eu
2014	SENATE	GP	GP-	GP (final)		No website
2014	SWARMs	GP	GP	GP (final)		http://www.swarms.eu
2014	WAYTOGOFAST	UP	EP (final)			http://www.way2gofast-ecsel.eu/
2015	3DAM	GP	GP	GP (final)		No website
2015	AMASS	GP	GP	GP (final)		http://www.amass-ecsel.eu
2015	ASTONISH	GP	GP	EP (final)		http://www.astonish-project.eu
2015	DELPHI4LED	GP	GP	GP (final)		https://delphi4led.org
2015	DENSE	GP-	GP-	GP	GP (final)	http://www.dense247.eu
2015	ENABLE-S3	GP	GP	EP (final)		http://www.enable-s3.eu
2015	ENSO	GP	GP	GP	GP (final)	http://enso-ecsel.eu
2015	IoSENSE	GP	GP	EP (final)		http://www.iosense.eu
2015	PRIME	GP	GP	GP (final)		http://www.prime-h2020.eu/index.php
2015	REFERENCE	GP	GP-	GP	GP (final)	http://reference.ecsel.soitec.eu/
2015	SAFECOP	GP-	GP-	GP- (final)		http://www.safecop.eu
2015	SEMI40	GP	GP	EP (final)		http://www.semi40.eu
2015	TAKE5	GP	GP	EP (final)		No website
2016	AQUAS	GP	GP	GP (final)		http://aquas-project.eu/
2016	AUTODRIVE	GP	GP	GP (final)		www.autodrive-project.eu/
2016	CONNECT	GP-	GP-	Final review in 2021		http://www.connectproject.eu/
2016	EUROPATMASIP	GP	GP	GP+	Final review in 2021	http://www.europat-masip.eu/
2016	I-MECH	GP	GP	GP (final)		https://www.i-mech.eu/
2016	MegaMaRt2	GP	GP	GP (final)		https://megamart2-ecsel.eu/
2016	MICROPRINCE	GP	GP-	GP (final)		https://microprince.eu/
2016	Productive4.0	GP	GP	GP (final)		http://productive40.eu/
2016	R3POWERUP	EP	GP-	Final review in 2021		https://r3powerup.eu/
2016	SCOTT	GP	GP	EP (final)		https://scottproject.eu/

2016	SILENSE	GP-	GP-	GP (final)		https://silense.eu/
2016	TAKEMI5	GP	EP (final)			no website
2016	TARANTO	GP	GP-	GP (final)		http://tima.univ-grenoble-alpes.fr/taranto/
2016	WINSIC4AP	GP	GP	Final review in 2021		https://www.winsic4ap-project.org/
2017	5G_GaN	GP-	GP			https://www.5ggan2.eu/
2017	AfarCloud	GP	GP			http://www.afarcloud.eu/
2017	FITOPTIVIS	GP	GP			https://fitoptivis.eu/
2017	HiPERFORM	GP	GP			https://hiperform.eu/
2017	iDev40	GP	GP			http://www.idev40.eu/
2017	OCEAN12	GP-	GP			https://ocean12.ecsel.soitec.eu/
2017	POSITION-II	GP	GP			http://position-2.eu/
2017	PRYSTINE	UP	GP			https://prystine.eu/
2017	REACTION	GP	Review in 2021			http://www.reaction-project.eu/news.php
2017	SECREDAS	GP	GP			https://secredas.eu/
2017	WakeMeUP	GP-	GP			http://www.wakemeup-ecsel.eu/
2017	TAPES3	GP	Review in 2021			No website
2018	CSA-Industry4.E	GP-	Final review in 2021			https://industry4e.eu/
2018	AI4DI	GP-				https://ai4di.automotive.oth-aw.de/
2018	APPLAUSE	GP				https://applause-ecsel.eu/
2018	Arrowhead Tools	GP				https://arrowhead.eu/arrowheadtools/
2018	COMP4DRONES	GP+				https://www.comp4drones.eu/
2018	COSMOS (CSA)	GP	Final review in 2021			https://mobilitye.eu/
2018	CPS4EU	GP				https://cps4eu.eu/
2018	HELIAUS	GP				https://www.heliaus.eu/
2018	MADEin4	GP				https://madein4.eu/
2018	NewControl	GP-				https://www.newcontrol-project.eu/
2018	PIN3S	Review in 2021				No website
2018	Power2Power	GP				https://www.infineon.com/cms/en/product/promopages/power2power/#page
2018	TEMPO	GP				https://tempo-ecsel.eu/
2018	UltimateGaN	EP				http://www.ultimategan.eu/
2018	VIZTA	GP				https://www.vizta-ecsel.eu/
2019	Helos (CSA)	GP				

Table 35: Results of the ECSEL project reviews

The postponement of some of the final reviews for projects of the calls 2016 is mostly a consequence of COVID-19.5.5.2 Dissemination and exploitation

Under H2020, the projects must provide several indicators at each reporting period regarding their progress. These are provided in Table 36. Obviously only the projects from call 2014, 2015, 2016, 2017 and 2018 had anything to report on those indices[15].

Calls	Project Acronym	TOTAL patents	Number of publications	Number of prototypes	Number of clinical trials	Companies introducing innovation(s) new to the market	How many of these are SMEs	Companies introducing innovation(s) new to the company	How many of these are SMEs
2014-1	3Ccar	5	70	0	0	0	0	0	0
2014-1	EXIST	7	40	20	1	11	5	11	5
2014-1	MANTIS	2	55	61	0	29	3	32	13
2014-1	OSIRIS	0	9	1	0	3	1	1	1
2014-1	RobustSENSE	0	9	1	0	3	2	10	2
2014-1	SWARMs	1	7	3	0	0	0	0	0
2014-2	ADMONT	1	11	240	5	2	1	3	2
2014-2	InForMed	4	6	10	6	16	14	9	8
2014-2	PowerBase	7	78	0	0	0	0	0	0
2014-2	R2POWER300	0	0	1	0	0	0	0	0
2014-2	SeNaTe	34	56	83	0	31	4	31	4
2014-2	WAYTOGO FAST	7	97	2	0	13	5	13	5
2015-1	3DAM	9	17	22	0	10	2	9	2
2015-1	AMASS	0	89	1	0	11	4	13	2
2015-1	ASTONISH	1	10	6	5	8	5	8	5
2015-1	DELPHI4LED	0	54	0	0	0	0	0	0
2015-1	DENSE	36	36	2	0	9	3	16	5
2015-1	PRIME	10	27	8	0	11	6	11	6
2015-1	REFERENCE	15	19	0	0	0	0	0	0
2015-1	SafeCOP	0	68	0	0	0	0	0	0
2015-2	ENABLE-S3	9	89	15	0	27	11	15	2
2015-2	EnSO	22	28	2	0	15	6	11	4
2015-2	IoSense	11	117	9	0	12	4	12	4
2015-2	SemI40	0	159	32	0	9	4	17	4
2015-2	TAKE5	15	20	26	0	11	1	10	1
2016-1	AQUAS	4	44	12	0	10	4	9	4
2016-1	AutoDrive	10	76	45	0	17	3	30	6
2016-1	CONNECT	2	42	22	0	7	4	7	4
2016-1	I-MECH	0	25	0	0	11	4	5	1
2016-1	MegaMaRt2	0	123	0	0	14	3	0	0
2016-1	SILENSE	4	32	17	0	12	7	16	6
2016-1	TARANTO	2	129	0	0	0	0	0	0
2016-1	WInSiC4AP	0	13	8	0	11	5	0	0
2016-2	EuroPAT-MASIP	8	10	6	0	14	7	14	7

15 The figures are not always very accurate, certainly for the projects in 2014 and 2015. Some of the figures are taken from the deliverables. There appears to be an issue to declare national patents in the system. Those can only be introduced as confidential patents as they are not recognised by the system, only European patents are. Participants were not aware of this at the beginning of the programme.

Calls	Project Acronym	TOTAL patents	Number of publications	Number of prototypes	Number of clinical trials	Companies introducing innovation(s) new to the market	How many of these are SMEs	Companies introducing innovation(s) new to the company	How many of these are SMEs
2016-2	MICROPRINCE	0	15	17	0	2	0	3	0
2016-2	Productive4.0	1	150	90	3	35	5	55	8
2016-2	R3-PowerUP	0	11	8	0	25	7	25	4
2016-2	SCOTT	1	130	753	0	14	6	5	3
2016-2	TAKEMI5	8	29	49	0	20	4	21	4
2017-1	iDev40	1	108	16	0	12	6	13	1
2017-1	OCEAN12	4	4	0	0	0	0	0	0
2017-1	POSITION-II	0	13	0	0	0	0	0	0
2017-1	REACTION	0	6	7	0	17	6	17	6
2017-1	TAPES3	0	19	42	0	21	3	24	3
2017-1	WAKeMeUP	0	30	3	0	11	1	11	1
2017-2	5G_GaN2	0	vv8	0	0	0	0	0	0
2017-2	AFarCloud	0	16	33	1	12	11	7	6
2017-2	FITOPTIVIS	10	67	0	0	0	0	0	0
2017-2	HiPERFORM	0	20	10	0	7	3	15	8
2017-2	PRYSTINE	4	41	0	0	0	0	0	0
2017-2	SECREDAS	2	30	0	0	0	0	0	0
2018-1	APPLAUSE	0	6	5	0	0	0	0	0
2018-1	Arrowhead Tools	0	42	32	0	0	0	0	0
2018-1	CPS4EU	0	25	24	0	24	14	24	14
2018-1	MADEin4	1	3	0	0	0	0	0	0
2018-1	PIN3S	0	1	38	0	8	2	14	4
2018-1	Power2Power	0	6	0	0	0	0	0	0
2018-1	VIZTA	0	3	0	0	0	0	0	0
2018-2	AI4DI	0	4	0	0	0	0	0	0
2018-2	COMP4DRONES	0	12	0	0	0	0	0	0
2018-2	HELIAUS	0	2	0	0	0	0	0	0
2018-2	NewControl	0	2	0	0	0	0	0	0
2018-2	TEMPO	0	0	0	0	0	0	0	0
2018-2	UltimateGaN	0	6	8	0	13	4	0	0
TOTAL		258	2474	1790	21	548	190	547	165

Table 36: Progress indicators of dissemination and exploitation

For the closed projects, that is projects from calls 2014 to 2016 one calculates 5 patents per EUR 10 million of EU funding.

Comparison with other programmes[16]

One can compare the previous numbers with the results obtained in other programmes. Table 37 compares various programmes. The first three columns give some general indications on the projects selected in the calls. ECSEL has on average the largest projects in cost and beneficiaries with the lowest EU funding per project. The other columns show that ECSEL does particularly well in terms of (always per EUR 10 million funding) patents, prototypes, innovations, innovations by SMEs and is good in terms of publications.

For calls 2014 to 2016	Cost / Project	Funding / Cost	Beneficiaries / Project	Patents /10M€ Fund	Publications /10M€ Fund	Prototypes /10M€ Fund	Clinical Trials /10M€ Fund
ECSEL	48.8	28%	34.3	4.04[17]	37.04	29.51	0.38
JU1	9.7	77%	13.6	1.13	10.32	4.48	0.23
JU2	1.1	85%	2.7	0.95	22.43	35.94	0.05
JU3	11.3	77%	11.5	0.33	7.47	2.45	0.00
JU4	24.7	54%	23.8	0.15	11.58	0.78	0.84
JU5	7.3	53%	15.1	0.16	6.52	8.84	0.00
JU6	3.3	97%	12.5	0.12	22.24	6.91	0.12
H2020 EC RIA & IA	5.7	91%	14.0	1.06	45.44	10.43	1.25
ERC	1.6	100%	1.3	1.33	82.85	0.00	0.00
ERA-NET-Cofund	22.1	32%	25.8	0.00	2.35	0.27	0.06
Global average	**4.1**	**82%**	**7.2**	**1.12**	**50.42**	**7.71**	**0.79**

For calls 2014 to 2016	Innovation new to Market	Innovation new to Market introduced by SME	Innovation new used by company	Innovation used by SME
ECSEL	7.9	2.6	7.9	2.3
JU1	3.6	2.1	3.1	1.6
JU2	6.2	2.8	6.0	2.8
JU3	2.1	1.0	1.5	0.6
JU4	0.7	0.3	0.5	0.2
JU5	3.1	1.0	2.2	0.7
JU6	9.1	1.6	7.4	1.3
EC H2020 RIA & IA	5.0	3.0	4.4	2.5
ERC	0.0	0.0	0.0	0.0
ERA-NET-Cofund	0.0	0.0	0.0	0.0
Global average	3.5	2.0	3.1	1.7

Table 37: Comparison of patents and publications with other programmes

Results used in other projects

In Figure 19 the re-use of results per call (RIA+IA) is shown. To calculate this one uses the information provided in the proposal description of the selected projects, where for each project are given the results and the origin (=project) of those results. So,

16 The information on other programmes comes from CORDA.

17 This figure is calculated using the collected data in the Commission systems. For the projects of calls 2014 and 2015 this collection of information did not work well and - based on information from the projects - one calculates the number of patents per EUR 10 million in EU funding to be equal to 5.1.

for example in the projects submitted to the calls 2014, 20% of the results used in the selected projects come from previous ENIAC and ARTEMIS projects, while 55% come from other programmes. One should be careful with those numbers as some proposals mention the origin of the projects very clearly while others are less accurate. One can retrace H2020 projects as the list of projects is available. That is not so for older framework programmes FP6/FP7, for national programmes, for private developments, for EUREKA programmes and for other international programmes (ESA, EDA, IPCEI). The graph is calculated for the selected projects.

From Figure 19 one can draw some conclusions:

1 By looking at the use of results from the ENIAC-ARTEMIS and FP6-FP7 one sees that some results are still used several years after the end of the projects though this diminishes in time. For example, for the proposals of the calls 2015, proposals were prepared in 2014, that is at the end of the FP7 programmes, and the use of result is maximal. It then gradually goes down and becomes nearly zero for the calls 2020. With this information one can estimate a halftime for results to be around 3 years.
2 There is also a lag of 3-4 years between the call year and the real use of the results. Look at the re-use of the results generated by ECSEL and H2020. From practically zero in 2014 they grow to nearly 50% in 2018 then tend to saturate in 2019-2020. This confirms the previous estimate for an information half-time of 3 years but does not explain the saturation.

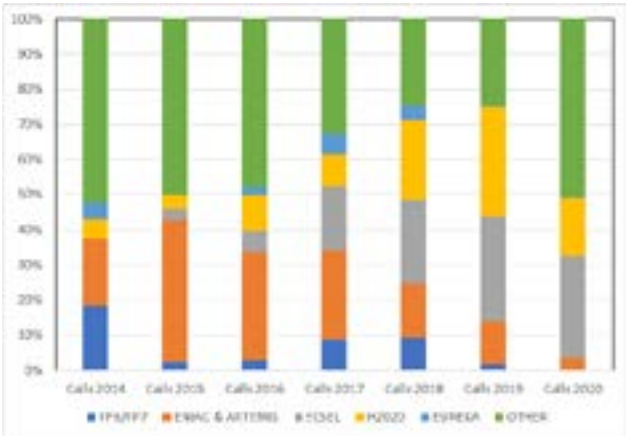


Figure 19: Re-use of results in ECSEL projects

In the last year (call 2020) practically all the results come from projects of the past 7 years (at least for those that could be traced to a programme). This represents 50% of the re-used results. The other results come from programmes such as EUREKA, national, private developments. In Figure 20, the sources of the re-used results are shown: 50% come from H2020 and ECSEL while more than 40% come from sources outside H2020.

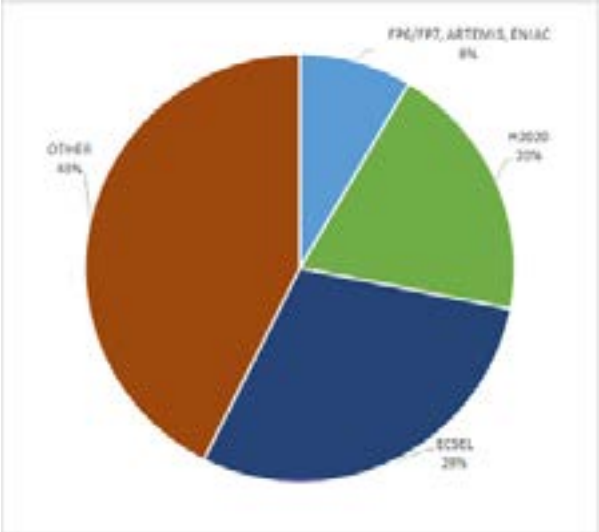


Figure 20: Source of the re-used results for calls 2019 and 2020

Some sources of re-used results deserving to be mentioned are projects from other JUs (28 identified from SESAR, S2R, FCH2, IMI2, CS2), EUREKA clusters (CELTIC, PENTA, CATRENE, ITEA). Within the H2020 programme most come from ICT projects (CNECT) while some come from: RTD, REA, MOVE, INEA, EASME.

5.5.3 Success stories of projects completed

The following success stories are related to projects that finished in 2020.

Project AQUAS (Aggregated Quality Assurance in Systems)

The project developed a methodology for safety, security, and performance (SSP) co-engineering (CE) and a related product life cycle (PLC) that involves qualitative and especially quantitative techniques for the analysis and assessment of safety, security, and performance properties, both in separate and integrated ways[18].

This project focussed on the following:

- Safety/Security/Performance to be considered together, during the overall life cycle of products.
- Flexibility across domains.
- Consolidate the industrial market by reducing costs and increasing system quality and maintaining compliance with more and more exacting standards.
- Improved tool features and capabilities

As planned, the project has defined a development process supported by tools for safety-critical systems to enable the early detection and solution of problems, which result of safety, security, performance, and function interdependencies. This early detection and avoidance of related failures will reduce the lifecycle cost of systems dramatically, by 20% or more, even if the development cost can be reduced only marginally. For this cost reduction, more important is the fact that late detected failures are difficult and expensive to repair.

In detail, the project delivered a methodology, a process definition, and tools for development of safety-critical Cyber Physical Systems (CPS). The significant exploitable project results include:

1. definition of a co-engineering (CE) process for analysis, assessment and design decision-making for CPS Safety, Security, and Performance (SSP) aspects, aiming at SSP risk reduction and related cost reduction;
2. design automation tools and combinations of communicating and collaborating tools that support the defined CE process;
3. technical results and lessons learned of five use cases out of the following five domains: air traffic management, medical devices, rail carriage mechanism, industrial drive, and space multicore architectures, that were used to analyse and evaluate the proposed CE process, as well as various techniques and design tools supporting this process;
4. contribution to standards;
5. report on the future challenges to be overcome for dependability co-engineering;
6. technical reports and scientific publications.

The SSP co-engineering methodology and supporting tools are general, but specific implementation of the methodology and tools selected can be different for different application areas due to the specific needs, as well as, standards, and design processes, methods and tools currently used in each area.

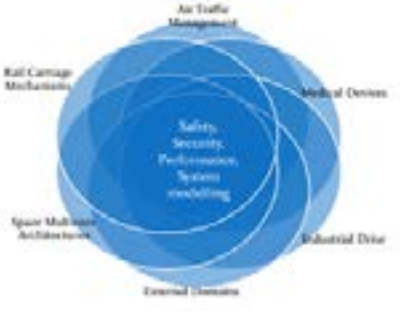
The proposed five different application domains: Unmanned Aerial Vehicles, Medical Devices, Railways, Industrial drives, Space Multicore applications (on satellites) were thoroughly analysed, and implementation of demonstrators was finalized and evaluated. All five demonstrators were delivered as planned. Furthermore, various techniques, design tools and tool combinations were further analysed, and their applicability was evaluated in the context of five use cases from these five domains. Moreover, the SSP co-engineering methodology was detailed and refined, the concept of Interaction Points was further clarified, and application of the concept and overall SSP co-engineering methodology was analysed in the context of the demonstrator's development.

Major work was also performed on tool support for the SSP co-engineering with Interaction Points. The work was focused on finalization of tool implementation and integration, and their analysis and evaluation. Several design automation-tools and tool combinations for supporting the SSP co-engineering methodology were developed, and their applicability was separately tested and evaluated in the context of each of the product development environments of the five use-cases from five different domains.

A cost model, developed in the project, demonstrates that AQUAS methodology leads to cost savings, if compared with the alternative forms of co-engineering (i.e., dealing with safety-security-performance concerns in isolation). For example, a very intriguing result for the medical use case demonstrates that the AQUAS methodology can reduce the cost of development in absolute terms: AQUAS made the development of RGB Medical Device cheaper than if it had been developed without the AQUAS methodology. Another aspect of cost reduction, which is application-specific, is reduced probability of flaws remaining in deployed products causing accidents, unavailability due to stops and recalls, environmental damage etc.

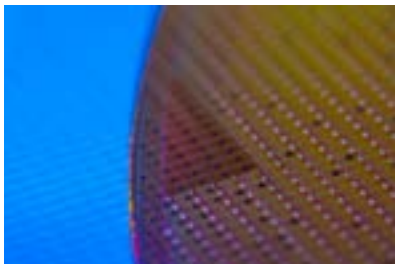
Tangible results from the project include transfer of the developed tools to partners' or external businesses, widened client base with significant returns, and new design features enabled. For example, Security Analysis conducted on a virtual prototype in the project, identified potential security risks that could be closed early by changing the configuration of the Operating System. Another example, in the Space use case, the combination of different AQUAS tools and methodologies led to an "enhanced-architecture" with barriers that increase the reliability of the system.

Different tools and tool combinations are differently advanced, but on average their maturity is at TRL5.



18 Link to the project web site: https://aq-uas-project.eu/
Detailed overview of AQUAS Results: http://aquas-project.eu/wp-content/uploads/2020/12/Detailed-overview-of-AQ-UAS-Results.pdf

Project AUTODRIVE (Advancing fail-aware, fail-safe, and fail-operational electronic components, systems, and architectures for fully automated driving to make future mobility safer, affordable, and end-user acceptable)



The main objective of the AutoDrive project was to advance fail-aware, fail-safe and fail-operational electronic components, systems and architectures that enable highly automated driving in city shuttles, buses, and cars, and therewith to contribute to safer and more efficient mobility.

As purely redundancy-based solutions are not viable in high-volume automotive market, mainly for cost reasons, AutoDrive looked for new smart concepts to achieve fail-operational behaviour of the systems without just duplicating the hardware. This approach looks very promising.

The project has generated many excellent results with high impact potential. This includes new semiconductor-based components, new concepts of fail-aware and fail-operational design as well as new sub-systems in vehicles.

Examples of convincingly demonstrated fail-operational systems are:

- powertrains and battery systems for automotive
- inverters and battery monitoring system for unmanned aerial vehicle
- urban electric bus demonstrator driving on a fixed route including sensor integration, V2I communication and control

Examples of successfully demonstrated components and systems are:

- CMOS radar chips using 28nm CMOS;
- full/true solid-state Lidar using CMOS and VCSEL technology;
- MEMS inertial sensor for vehicle positioning with 6 Degrees of Freedom (DoF);
- architectures and systems for the external (V2X) communication as well as for the internal in-vehicle communication and computing.

The consortium has been very active in dissemination (83 publications, 63 events; 3 press releases; 3 digital articles, 7 newsletters; 33 videos of demonstrators; 3 project videos).

Dissemination highlights are the ECA conferences as well as the European industrial workshop on fault-tolerant design of power electronics (Stuttgart, July 2019).

The standardization activities have been strong and convincing, the partners play an active role in international standardization bodies.

Project DENSE (aDverse wEather eNvironmental Sensing systEm)

The project focus was on automated driving and its key enabling technology, environment perception. The main objective is to develop and validate an all-weather sensor suit for traffic services, driver assistance and automated driving[19].

The new sensor suit is based on a smart integration of three different technologies: (i) Radio radar, 77 GHz-81 GHz, (MIMO Radar); (ii) Gated short wave infrared camera with pulsed laser illumination (SWIR camera) and (iii) Shortwave infrared LIDAR (SWIR Lidar). Such a full fusion approach has never been investigated before, so that the outcome will advance the state-of-the-art significantly and demonstrate the potential of all-weather environment perception.

Significant achievements were reported especially regarding data fusion of existing LiDAR/Radar/Cameras using Convolutional Neural Networks (CNN). The project has successfully demonstrated that the cars equipped with the DENSE system could detect the road even when it was completely covered by snow. It uses a CNN algorithm to analyse the environment conditions to take roadside information, vegetation, and other markers in the view of the system into account. This is an important step towards autonomous driving under bad (snowy) weather conditions.

19 Article on project final results: https://cordis.europa.eu/article/id/421705-first-full-fusion-sensor-solution-enables-all-weather-assisted-driving

Multispectral sensor, radar and road friction sensors were successfully demonstrated. Some of the sensors were not finalised at the last review: the first one is the IBEO LiDAR that was built but results of the tests could not be presented in time for the final review and the second one was the Gated camera that was not fully built (optics not assembled with the camera) and only partially tested. But partners will continue after end of the project with assembly and further developments due to the important exploitation opportunities that have arisen from the project.

The project objectives continue to be scientifically and technologically relevant for the automotive sector when considering all driving weather conditions. The approach taken by the DENSE project to test the final results, based on standardised weather conditions, should be given the deserved attention and become the standard approach to follow at international level when moving towards autonomous driving. The results of the DENSE project are a mandatory milestone in the development of Highly Autonomous Driving (HAD).

Exploitation results are dense and numerous, including 36 patents, the highest of any ECSEL project and most probably of any H2020 projects.

Project ENSO (Energy for Smart Objects)

The goal of EnSO is to develop and consolidate a unique European ecosystem in the field of autonomous micro energy sources (AMES) supporting Electronic European industry to develop innovative products, in particular for IoT markets.

The EnSO multi-KET objectives are:

- Objective 1: demonstrate the competitiveness of EnSO energy solutions of the targeted Smart Society, Smart Health, and Smart Energy key applications;
- Objective 2: disseminate EnSO energy solutions to foster the take-up of emerging markets;
- Objective 3: develop high reliability assembly technologies of shapeable micro batteries, energy harvester and power management building blocks;
- Objective 4: Develop and demonstrate high density, low profile, shapeable, long lifetime, rechargeable micro battery product family;
- Objective 5: develop customizable smart recharge and energy harvesting enabling technologies for Autonomous Micro Energy Source "AMES";
- Objective 6: demonstrate EnSO Pilot Line capability and investigate and assess the upscale of AMES manufacturing for competitive very high-volume production.

The AMES is a key enabling technology of Smart Energy key applications. In this project lots of technological and scientific progress were made in the field of thin-film battery, power management and energy harvesting. It is a very innovative concept that has been brought to the level that its business potential can be exploited. But it is important to develop a suitable business model / market approach and to identify partnerships, who can assist to place the AMES platform on the market.

Most use cases developed in this project, deployed their prototypes in a relevant environment, obtained crucial feedback from potential customers and/or other stakeholders, and showcased clear innovative results. Quite some of the use cases / application demonstrators have shown exceptional results, which can be exploited on short term. It is worth mentioning the use cases of Enerbee and Naturgy, who have both set an example. CAIRDAC made great progress at R&D level fuelling their ambitious product development for a miniaturized autonomous-powered pacemaker. Many of the use case owners are SMEs. Most of them have participated in EnSO thanks to the AMES platform and the solid-state battery technology promises. However, the technology promise of providing a competitive advantage could not be materialized for most SMEs. Nonetheless, quite a few of the participating SMEs managed to achieve excellent progress with their product prototypes.

The exploitation exploration has been driven by Blumorpho and this has resulted in a clear improvement of the exploitation plans. They have been updated for each of the demonstrators and corresponding partners. In total 22 patents were released since October 2017. The EnSO pilot line will continue to operate and will keep on improving its technology platform offering to remain relevant to the European industry in the IoT domain.

The EnSO project faced many challenges and setbacks over the course of the project, not the least being the withdrawal of an important partner from the project, but thanks to excellent project management of the CEA the project was able to get back on track and deliver exceptional results.

Project I-MECH (Intelligent Motion Control Platform for Smart Mechatronic Systems)

The I-MECH target is to provide augmented intelligence for wide range of cyber-physical systems having actively controlled moving elements, hence support development of smarter mechatronic systems.

The project has tackled the new demands on bottom layers of employed motion control system, which cannot be routinely handled by available commercial products. With novel intelligence into Instrumentation and Control Layers mainly bridging the gap between latest research results and industrial practice in related model-based engineering fields. New interfaces and diagnostic data quality for System Behaviour Layer are also needed. Cutting-edge reference motion control platform for nonstandard applications where the control speed, precision, optimal performance, easy re-configurability, and traceability are crucial are important.

Five pilots, 5 use cases and 2 demonstrators were developed:
Pilot 1: Generic substrate carrier
Pilot 2: 12" wafer stage
Pilot 3: inline filling and stoppering and Tea bag machine
Pilot 4: Smart machining tools and milling machines
Pilot 5: Medical manipulator
Use Case 1.1: Drive for industrial application
Use case 1.2: Compact control and HMI unit for CNC machines
Use case 1.3: PAC based modular hardware
Use case 2.1: Validation of GNC systems
Use case 2.2: Open modular robotic arm
Demonstrator 1: Contact lens automated transport layer
Demonstrator 2: Injection mould industry

The project successfully delivered the I-MECH architecture containing three layers: Instrumentation layer, control layer and system behaviour layer[20].

The instrumentation layer focuses on the design of intelligent sensors, drives, actuators, and multi-many core ECUs suited to work in smart mechatronic applications. It considers different operating principles (piezo, mems, induction, ...) volume factors and power constraints to find a viable solution for a sensor integration layer suitable for a unified platform.

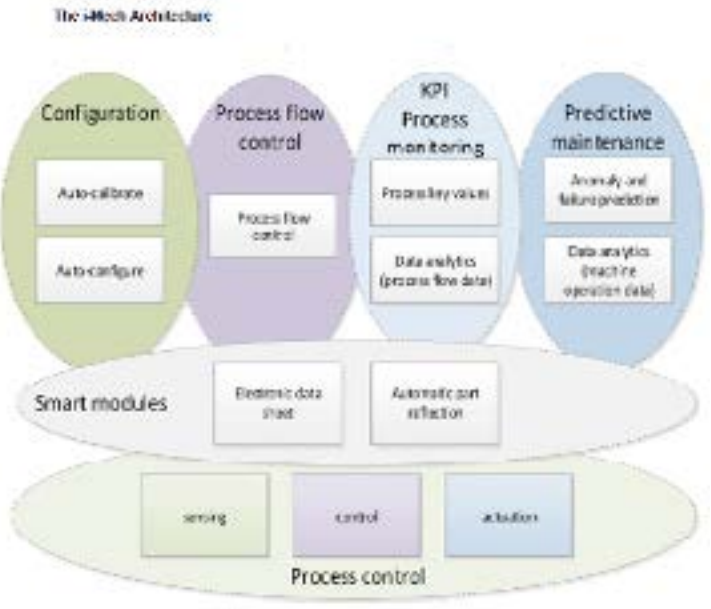
The control layer tackles motion control and model-based design of motion control, modelling and identification of complex multivariable systems, vibration control, iterative and repetitive control methods, and predictable implementations of control mechanisms for multi-many core platforms. The project also focussed was on assisting, verification and validation of the different pilots, demonstrators and use cases.

The system behaviour layer encompasses the integration and the use of up-to-date interfaces, the utilization of self-tuning strategies and the application of condition monitoring and predictive maintenance into a wider range of industrial drives.

This modular I-MECH platform has been successfully tested in the different demonstrators / pilots / use cases following an iterative approach. The pilots, use cases and demonstrators provided good evidence that the objective of reducing the barriers between the most advanced research results in advanced control theory can be delivered to the industry via an integrated platform solution that has the potential to dramatically improve the potential penetration, the adoption performance and the overall collaboration between academia and industry.

It was verified in high-speed/big CNC machining, additive manufacturing, semiconductor, high-speed packaging, and healthcare robotics.

Dissemination and communication activities within the I-MECH project have laid a solid foundation for further building awareness of the I-MECH platform and the I-MECH Centre. A first version of the I-MECH Centre, which shall ensure sustainable cooperation between consortium partners after the project termination, has been realized. It is in the hands of the consortium partners now whether the results achieved within the project timeline and very well demonstrated in pilots, use cases and demonstrators can survive the project completion and achieve the market traction that they certainly deserve.



20 Article on project final results: https://cordis.europa.eu/article/id/422568-embedded-algorithms-design-faster-and-more-accurate-industrial-and-health-care-equipment

Project MegaMaRt2 (MegaModelling at Runtime - scalable model-based framework for continuous development and runtime validation of complex systems)

MegaMaRt2 created a framework incorporating methods and tools for continuous development and runtime validation of complex systems. The developed tools that were validated in 8 highly relevant European industry case studies[21].

- Flight management system
- Railway system
- Smart warehouse digital platform
- Short range communication
- Telecommunication system
- Train control and management system
- Construction Equipment
- Vision-based intelligent system for traffic surveillance

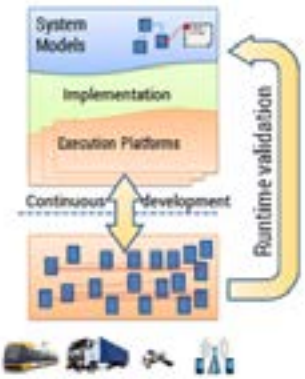
The end users from the maritime, railway, telecom and other industrial domains provided real-world requirements and case studies and validated/endorsed the project results. The development and evaluation of the case studies reveals excellent results. Competitive demonstrators have been set up to showcase the benefits of using the individual tools and how they work in conjunction. To evaluate the use cases, comprehensive KPI measurements have been performed, which quantify the achievable benefits and will serve as an enabler for securing more wide-spread impact of the project results. All in all, the case studies have been incredibly useful to direct tool developers towards novel uses and combinations of tools that solve end user problems.

The technological achievement of the project is the final version of the model-based framework architecture and tool set that integrates system and runtime model tool sets via mega-modelling and tracing. Next to the model-driven tool architecture and tool sets, technical highlights of the projects particularly include: the common traceability approach, also including the common traceability metamodel, and the project's contributions to the upcoming MARTE standards (Modelling and Analysis of Real-Time and Embedded systems) to shape the modelling language profile according to industrial needs and the state of the art in research.

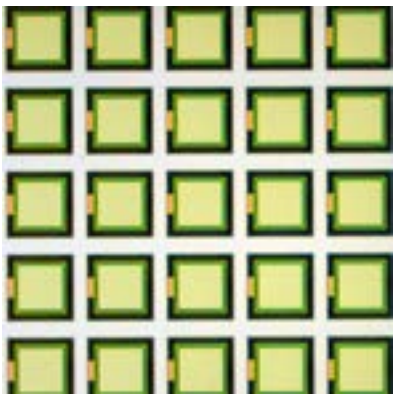
The achieved result, a competitive tool integration framework together with the tool catalogue, provides excellent ground for the project to achieve further impact and for the partners to gain competitive advantage on the market. The project setup has enabled a clear path for the tool providers from research over development to bring the innovations to the market via their tools and enabled them to evidence the achievable benefits via the KPI measurements performed in the strong case studies of the project.

In terms of dissemination the project has achieved a large and competitive number of scientific publications which ensure the impact of the project results. As a particular highlight, the partners have organized an open Hackathon in the last review period collocated with the HiPEAC conference in Bologna, involving external researchers and professionals to jointly work on MegaMaRt2-relevant topics.

The joint exploitation agreement that MegaMaRt2 partners are currently setting up has high potential to further strengthen the interoperability of tools within the MegaMaRt2 tool set and establish MegaMaRt2 as a brand far beyond the project's duration.



Project Microprince (Pilot line for micro-transfer-printing of functional components on wafer level)



The primary objective of the MICROPRINCE project was to create the first worldwide open access foundry pilot line for micro-transfer-printing (µTP) and to demonstrate its capability for heterogeneous integration of different functional components in an industrial environment.

Five different target applications were initially selected to represent the possibilities of the technology for smart system integration (SSI) ranging from:

1. III/V Hall plates for current sensors,
2. optical filter elements for Human Eye Response (HER) sensors,
3. µLEDs for automotive interior lightning as well as
4. GaAs- & InP-based emitters, modulators, and sensors for photonic integrated circuits (PICs) in life science.

For the implementation of the pilot line and the process development for the selected target applications the following work was conducted:

1. With respect to the pilot line installation the required tools for the adhesive deposition (coater/ developer), the micro-transfer-printing and the adhesive curing were specified, selected, and installed in the XFAB MEMS cleanroom.
2. Moreover, a Silane supply for an existing CVD chamber was established to allow the deposition of SiN on 8-inch source wafers.

21 Article on project final results: https://cordis.europa.eu/article/id/422064-model-based-technologies-modernise-european-manufacturing

3. Based on these new equipment and already existing tools general process capabilities were investigated/ developed for a 3D-integration via µTP.
4. A first generation of design aid tool was created.

Results for the target applications are:

1. The characterized samples indicated that GaAs transfer-printed Hall elements provide increased signal to noise ratio (SNR) of a factor of five, compared to chips with Silicon Hall plates.
2. Concerning the printing of filters on optical sensors: source wafers carrying HER filter were fabricated and after additional processing further processing were finally heterogeneously integrated. Optical measurements of the integrated sensors (Responsivity and dark current) indicated a full functionality of the HER sensors.
3. A new LED driver IC for transfer printed RGB µLEDs was developed. The driver IC was completely characterized and qualified according to automotive standards. The functionality of the "integrated LED" driver package was shown, and general characterization procedures were started. The characterization will be finalized after the end of the project. Additionally, special GaN based blue and green LEDs for µTP were designed and fabricated. These LEDs were afterwards directly printed on the driver IC. After metallization and packaging, the integrated µLEDs were tested indicating a promising performance.
4. Concerning the integration of active components in silicon photonic circuits: InP and GaAs photodiodes (PDs) have been fabricated and revealed promising performance with respect to bandwidth (3dB of ~50 nm), dark current (as low as 200nA) and responsivity (0.85 A/W). Moreover, these PDs have been packaged on Si photonic circuits and functional integrated spectrometers were build.

Consequently, the main goal of the MICROPRINCE project of building a pilot line for heterogeneous integration and showing its applicability for different material classes and target applications by the generation of demonstrator devices has been achieved.

MICROPRINCE has strengthened the connection of the involved partners and will have a positive influence on the future industrial competitiveness since a new technology has been transferred into an industrial environment.

Furthermore, the involved partners identified new market opportunities and started related projects based on their knowledge gained in the project. Thereby MICROPRINCE will contribute to a stable and sustainable growth of the related business in Europe.

For the project partner XMF the pilot line for µTP is an elementary step towards its vision to become a leading centre for monolithic CMOS-MEMS integration as well as heterogeneous semiconductor integration. Furthermore, the project has proven an innovative and unique solution for the integration of silicon photonics. Hence, cheaper and more miniaturized photonic integrated sensors systems could be fabricated based on the µTP process which will enable new medical diagnostic systems.

Project Productive4.0 (Electronics and ICT as enabler for digital industry and optimized supply chain management covering the entire product lifecycle)

Productive4.0 furnished the companies with fundamental tools necessary to transform the potentials of the upcoming digital revolution, known as Digital Industry, into business success.

The main objective was to take a step forward towards a hands-on approach and practical implementations focusing on the three main pillars: Digital Production (DP), Supply Chain Networks (SCN) and Product Lifecycle Management (PLM). These fields interact and influence each other.

The results such as IoT components modelling and simulation methods as well as toolchains for cross-lifecycle and cross domain digitisation are suitable means for linking all stages of a product lifecycle. They relate to several different reference implementations.

Productive4.0, the biggest project in digital transformation proved that the ECSEL concept of big projects with critical mass for a big impact can be successful. With the right management such big projects can run smoothly and produce outstanding results.

Productive4.0, was also a cornerstone project for the Industry4.E lighthouse (the ECSEL lighthouse in the field of digital industry) It managed to establish and move forward the collaboration among different projects within the lighthouse initiative. One clear example is the collaboration between the Productive4.0 and Arrowhead Tools projects that has allowed for the continuous development of the Arrowhead Framework and, more importantly, for the Arrowhead Framework becoming a self-sustainable project result as it is now an open-source incubator project within the Eclipse foundation.

Another outstanding result of the Productive4.0 project is the publicly available generic data model for the semiconductor manufacturing industry including datasets provided by beneficiaries Bosch, Infineon, and ST microelectronics. This is the first time that competitors collaborate so deep in such kind of activities. This generic semiconductor data-model, together with the digital reference (a semantic web also developed/enhanced in the project), allows the entire supply chain (containing the different partners of the supply chain) to modelled, and this includes the product life-cycle management. A digital twin of the entire supply chain is a very powerful and effective decision-making tool for planning and logistics activities but also allows to substantially reduce the time needed for the development of new products as well as the integration of these new products into mature supply chains. The development of this generic semiconductor data model and the digital reference platform will continue in a new ECSEL project SC3 (a coordination and support action – semantically coordinated semiconductor supply chains) that started in October 2020 (Call 2020-4). This is another good example on how ECSEL as programme can help promote the uptake and sustainability of important project results.

Regarding dissemination activities, Productive4.0 has developed a comprehensive and remarkable dissemination strategy resulting in, on one side, a high number of scientific publications and, on the other side, an appealing project website for the general public and professional community alike, including articles and videos.

Project REFERENCE (Rf Engineered substrates to FostER fEm performaNCE)

The REFERENCE project aimed to leverage a European leading edge Radio Frequency (RF) ecosystem based on RF Silicon On Insulator (SOI) disruptive technology, perceived as the most promising to address performance, cost and integration needs for RF Front End Modules (FEM).

The project targeted the development of innovative solutions from material, engineered substrates, process, design, metrology to system integration capable to address the unresolved 4G+ requirements for RF FEMs (data rate >1Gb/s) and pave the way to 5G.

Three applications were investigated:

- Cellular / IoT: 4G+ RFSOI FEM demonstrator at SiP device level
- Automotive: 4G+ RF-SOI demonstrator at SiP device level
- Aviation: RF-SOI high data rate wireless communication module at system level; targeting a new frequency band for aeronautic.

The R&D and demonstration actions that were planned and achieved (some showed significant achievements that will be continued in the follow-up project BEYOND5):

- Development of innovative RFSOI substrates for 4G+ / 5G: Thanks to the benchmarks between different substrates for RF SOI technologies, improved RF performances for switches, PA and passive devices is achieved. It is based on a 130nm RF-SOI process on 200mm wafers (with an anticipated move to 300 mm) and a 22nm FD-SOI process on 300mm wafers. The technology bricks needed for 5G performances have been developed for 200mm. The performances of the 4G+ capable RF-SOI development and 5G are demonstrated.
- Move to 300 mm diameter: The transition towards 300 mm diameter of RFSOI respectively FD-SOI has been realized. For the 300 mm 4G+ RFSOI final demonstration three different RFSOI 300mm substrates for 4G+/5G applications have been fabricated. More development work is identified to reach the targeted characteristics.
- Development of 4G+ / 5G RF-SOI devices with 2 major European foundries: analogue circuits in 200 mm 130nm technology, RF digital by combining RFSOI and FDSOI in 300 mm at 22nm: The first 200mm wafer batch was processed on wafers with 19kOhm.cm, which could achieve the desired -100 dB linearity successfully.
- Innovative design for 4G+ /5G (analogue and RF digital): PA and Front-End Module designs by LETI and ST using the 130nm RFSOI achieve significant improvement over the state-of-the art.
- Integration of several 4G+ FEM components on the same chip and demonstration System in Package Technology (SiP): First wafer level packaging was developed and demonstrated successfully for high frequency applications building blocks. Demonstrator circuits are designed, and circuits are available. The development of packaging technology and system to integrate developed components in a 4G+ functional environment (Avionic and cellular) has made significant progress. A demonstration of the technology capability for 4G+ applications in Cellular and IoT has been done, based on fan-out-wafer-level-packaging (FOWLP, which means that the wafer is diced first, assembled on a carrier, then completely assembled and separated into the final modules). But the demonstration of the advantages of RFSOI technology, packaging approach, integration of PA has only been partially achieved due to late availability of the silicon chips and the overall close-down by COVID19. This will be pursued in the follow-up project BEYOND5.

The project has delivered exceptional results with significant impact (short and long term), has achieved most of its objectives and milestones for the period with relatively minor deviations.

Project SCOTT (Secure COnnected Trustable Things)

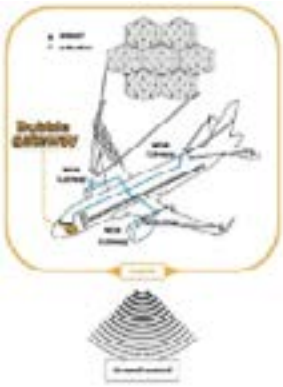
Creating trust in wireless solutions and increasing social acceptance are major challenges. SCOTT set out to provide efficient solutions for wireless, end-to-end secure, trustworthy connectivity and interoperability to bridge the last mile to the market (TRL 6-7). This is vital to achieve the full potential of the Internet of Things.

The project focussed on wireless sensor & actuator networks and communication in mobility, smart infrastructure, and health.

The project developed 15 industrial use cases with a focus on cross-domain applications and heterogeneous environments, emphasizing 5G and cloud computing aspects. It uses a standardized multi-domain reference architecture, fully compliant with ISO 29182, which fosters reusability, scalability, and interoperability. Those 15 use cases were demonstrated in 20 demonstrators that were presented all over Europe to a broader public. Some examples of use cases are shown here:

- Air Quality Monitoring for Healthy Indoor Environments (demonstrator shown);
- Autonomous Wireless Network for Rail Logistics and Maintenance;
- Secure Wireless Avionics Intra Communications for Sensing and Actuation.

The use cases have been evaluated and determined to fulfil more than 90% of the original objectives. 47 reusable technical building blocks (SCOTT Technology Building Blocks, TBB) were developed and successfully demonstrated within those use cases, proving cross-domain sharing of trustable wireless technologies and services.



The achievements can be summarised as:

- Boosting Security, Privacy, Safety and Trust for IoT;
- Ensuring Industry-compliant Connectivity via Cloud Integration;
- Developing Innovative Energy-constrained and Autonomous IoT Components;
- Providing a Reference Architecture for Secure Connected Trustable Things demonstrated across 5 Domains;
- Design a scientifically sound yet practical Methodology for developing Trusted Systems.

SCOTT opened up new market opportunities for the European industry, significantly reduced time to market and decreased costs for trustable wireless solutions on the market, in particular by using new designs and technical building blocks

The number of exploitable foregrounds identified by the SCOTT partners includes 37 identified items. In addition, exploitation was substantially supported by the successful activities in terms of standardisation. SCOTT is being represented by its beneficiaries in many standardisation boards and open innovation activities (workshops, idea contests, hackathons etc.). The industrial exploitation plans, and commitments show that the partners individually and collectively will try to keep the momentum and bring the building blocks to higher exploitable TRLs e.g., for Rail, Health.

Project SILENSE ((Ultra)Sound Interfaces and Low Energy iNtegrated Sensors)

The SILENSE project will focus on using smart acoustic technologies and ultrasound for Human Machine- and Machine to Machine Interfaces and extend the application beyond the mobile domain to Smart Home & Buildings and Automotive domains. Acoustic technologies have the main advantage of a much simpler, smaller, cheaper, and easier to integrate transducer.

The project achieved exceptional scientific and technical results on:

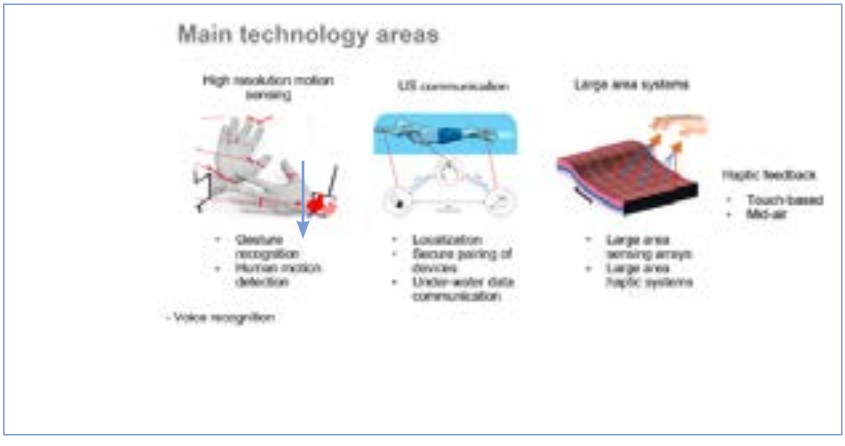
- Adapt and improve cost, performance, directivity, and power consumption of (MEMS) acoustic transducers (incl. testing and qualification);
- Heterogeneously integrate arrays of acoustic transducers with other electronics, using advanced (3D) packaging concepts;
- Develop smart algorithms for acoustical sensing, localisation, and communication;
- Combine voice and gesture control by means of the same transducer(s).

At application level the SILENSE project has applied acoustical sensing for touchless activation/control of mobile devices, wearables and, more in general, IoT nodes. A total of 9 prototypes have been built that reached TRL5/6 and exceptionally even TRL9. The project shows potential to achieve substantial technical and commercial impact. The scale of impact varies considerably across the targeted domains.

Project TAKEMI5 (Technology Advances and Key Enablers for Module Integration for 5nm)

In line with industry needs, Moore's law, scaling in ITRS 2013/2015, and ECSEL JU MASP 2016, the main objective of the TAKEMI5 project was to discover, develop and demonstrate lithographic, metrology, process and integration technologies enabling module integration for the 5 nm node. This was planned with available EUV/NA0.33 scanners that are optimized for mix and match with existing DUV/NA1.35 scanners, and with system design and development of a new hyper NA EUV lithography tool to enable more single exposure patterning at 5 nm to create complex integrated circuits. The following results were achieved, thereby fulfilling the objectives of this project:

1. The scanner improvements and new alignment modules have been developed by ASML to improve matching between the DUV and EUV scanners.
   a. A cross-platform matched machine overlay of 1.9nm was demonstrated. This matches the requirements for the 5nm-node.
   b. For further IC scaling and cost reduction of the lithographic process the design of a new "Hyper NA" EUV has been completed and prepared for integrations.
   c. For the realization of the Hyper NA EUV mirrors Zeiss developed numerous innovative techniques for mirror manufacture and evaluation. The first large mirror has been grinded and polished (below a picture of unloading the vacuum chamber for the mirrors production at Zeiss)
2. IMS in cooperation with Zeiss has defined the specification parameters and measurement techniques for the X-ray large Diffractive Optical Elements (DOE). A first evaluation was carried out and a manufacturing process has been developed and implemented resulting in homogeneous feature profiles that are independent of the position on the DOE substrate and its layout.
3. Production ready metrology tools have been created for application in the 5nm node. The key challenges have been to improve resolution and enable multi-dimensional metrology capability for characterization and defect detection in "Under Layers", that is beneath the surface of the chip. The key results which will be exploited are 'through layer mapping' and 'multi-dimensional metrology' capabilities for key critical parameters, such as Critical Dimensions, Overlay and defects characterization, for the 5nm technology node.
4. Successful reduction of metal contamination on the Plasma Immersion Ion Implant tool was achieved - meeting 5nm node specifications.
5. Recif developed a new Equipment Front End Module (EFEM) compliant to 5nm node specifications.
6. The patterning and advanced metallization options assessment, consolidated in the demonstration of a three metal-level damascene BEOL integration, including electrical qualification, implementing a TiN liner / Ru bulk metal metallization scheme for 5nm technology node.
7. Module development for tall FinFET, the target device for 5nm node, has been completed including the integration of Buried Power Rail and Self-Aligned Gate Contact scaling boosters. High-Block Co-Polymers (BCP) have been successfully as-



sessed for resolving sub 20nm DSA lines/spaces, including reduction of the dislocation density with 7 orders of magnitude. The project full achieved its overall objectives.

With the predominantly European based EUV Lithography equipment ecosystem, Europe reinforces its lead in this part of the semiconductor equipment market.

TARANTO (Towards advanced Bicmos nanotechnology platforms for RF and the applications)

Taranto aims at the establishment of the next BiCMOS technology platforms with improved SiGe Heterojunction Bipolar Transistor (HBT) performances and higher integration level needed to develop next generation of high speed & high data rate communication systems, and smart mobility system involved in the future fully automated transportation systems. This new generation of HBT transistors will be a key factor to meet the needs of high-speed communications systems and high data rate required for the integration of heterogeneous intelligent systems as well as for intelligent mobility systems that will be used in future fully automated transport systems.

The major achievements of this project are the following:

- Epitaxial base link (EBL) was used in joint fabrication runs
- EBL SiGe transistor is processed on manufacturing lines of one of the partners
- A cut of frequency up to 700GHz was reached (world-premiere)
- First time noise results were obtained
- A first set of integrated circuits was produced in B11HFC technology, and in BiCMOS55 technology.
- A reduced temperature budget was demonstrated using the 55nm CMOS technology of one of the partners
- New proprietary transistor architecture was investigated
- A second design cycle was achieved by two of the major European semiconductor companies

5.5.4 Conclusions

This chapter discussed how ECSEL projects achieve their objectives and results by:

- obtaining world class results;
- having the highest patent per EU funding ratio;
- achieving high publication rates in open access;
- re-using obtained results in future projects and by including results from other programmes;
- building project pipelines consisting of projects that build on one another;
- Establishing a well-balanced project portfolio across the value chain.

One can conclude that ECSEL is amongst the most effective programmes of H2020.

Table 34 compares ECSEL to its predecessor programmes ENIAC and ARTEMIS:

	ECSEL	ENIAC-ARTEMIS
Calls (8 RIA, 7 IA, 4 CSA)	19	11
Projects	95	119
Beneficiaries	3,182	2,743
Entities	1,493	
Person-years	34,000	
Total cost (national rules)/ EUR million	4,682	4,008
National funding (incl. ESIF) / EUR million	1,107	907
EU Funding / EUR million	1,116	632
Average % of funding	49%	38%
National to EU funding (incl. ESIF)	0.95	1.44

Table 38: comparison between ECSEL and ENIAC/ARTEMIS for selected projects

5 .6 Lighthouse Initiatives

The Lighthouse Initiatives were introduced to signpost subjects of common European interest, and to accelerate the impact of R&D&I projects by promoting collaboration and fostering a continuous dialogue within the ECS community and between the ECS community and technology users, decision-making bodies, and society so that technologies and innovations have a real and faster impact on business, the economy, and consumers.

A Lighthouse Initiative consists of a LIASE (LIghthouse Advisory SErvice) and a group of projects (ECSEL but also of other programmes). The LIASE is a board that steers the Lighthouse Initiative. The three Lighthouse Initiatives got the support from a CSA. The CSA supports the Lighthouse Initiative in the organisation of events, publication of documents, communication with stakeholders, etc. The three Lighthouse Activities are structured differently and focus on different action paths, which reflects the differences between the communities and their needs.

5.6.1 Industry4.E Lighthouse

The Industry4.E LIASE was enhanced with 3 new members, Prof. Jerker Delsing (Lulea University of Technology), Prof. Oscar Lazaro (Innovalia Association) and Mr. Sandro D'Elia (European Commission) bringing in additional points of view and links to new communities. Discussions within this extended Industry4.E LIASE, always well supported by the associated Coordination and Support Action, have significantly contributed to the Digital Industry chapter of the new 2021 ECS-SRIA (Electronics, Components and Systems - Strategic Research & Innovation Agenda), jointly produced by the three Industrial Associations (AENEAS, ARTEMISIA and EPOSS) participating in ECSEL JU.

The list of projects within Industry4.E was increased with the inclusion of four new ECSEL projects, AI4DI, CHARM, CPS4EU and iRel4.0. During 2020 and under the Industry4.E umbrella, different activities were performed to bring these projects together and to provide them with additional support in this difficult Covid-19 period. In particular, the different workshops on how to perform communication, dissemination and transfer on knowledge using only remote tools should be highlighted.

Several important results were achieved. The first one to mention is the production of the Industry4.E white paper, a cross-platform ECSEL – orientated Industry4.E strategic roadmap. This key document, which went into community consultation at the EU Industry days on 23-26 February 2021, further details the vision and the mission for Industry4.E as well as the recommendations and ambition for the future of this important ECSEL initiative.

Second main result for the period is the consolidation of the ECSEL portal whose aim is to provide results for sharing information about R&D projects along with their associated project results and demonstrators. The portal is a dynamic repository of key information which facilitates an intuitive connectivity and shareability between different project sets to significantly enhance the overall project impact.

And finally, the Industry4.E Coordination and Support Action has managed to give high visibility to the Industry4.E lighthouse by setting up a digital network with more than 1.300 followers covering platforms like LinkedIn, Instagram, and Twitter. In addition, several Industry4.E sessions were organised at key relevant events, like for instance during EFECS 2020.

All in all, a very successful year for Industry4.E in inspiring followers, boosting participation, promoting the future of the Industrial Digitalisation roadmap, and exploiting project results and collaboration.

The CSA- Industry4.E project supports Industry4.E. The project has made good progress this second running year, especially with respect to supporting the LIASE activities and reaching out to a broader community.

The arrival of a new coordinator helped to further structure and strengthen the cohesion of the Industry4.E LIASE and to better support the projects within the lighthouse. As the project has been extended 6 months, until the end of March 2021, no review took place during 2020, but the project has been closely monitored by weekly telcos with the coordinator.

Several digital workshops with more than 1000 participants were organised by the CSA, from road mapping to communication, dissemination, and knowledge transfer aspects. On the latter, the CSA published an excellent communication, dissemination, and exploitation guideline publicly available to all EU projects.

During this second year, improvements were also made to the project website that now includes a direct link to the ECSEL portal and 107 published resources. The work of the CSA Consortium has been instrumental for bringing high visibility to the Industyr4.E lighthouse by means of different media, like LinkedIn or Twitter and by the organization of several workshops at key relevant events. The website for the Industry4.E lighouse initiative is at: https://industry4e.eu/

5.6.2 Mobility.E Lighthouse Initiative

During 2020, despite the pandemic situation, Mobility.E activities have been preserved and even gained momentum. This acceleration is visible in all important components/activities of the Lighthouse.

Representation of the mobility value chain and the R&D&I ecosystem in the LIASE

The LIASE has gradually extended its members to include important players in the mobility field.

NXP has been added to the LIASE as Si solutions provider for mobility. Because connectivity is a crucial component of future mobility, ERICSSON has joined to fill this important gap on communication solution providers. SINTEF has been added to reinforce the presence of academic players in the LIASE. From industrial and research association side EARPA, ERTICO and CLEPA have actively joined the LIASE during 2020.

The LIASE has been strengthened not only by the completeness and balance of the represented industry, academy, industrial associations, and PPPs, but also by the high skills, competence, and quality of the appointed representatives.

With 13 very active members, the Mobility LIASE has become a centre of gravity for discussions on R&D&I priorities in the ECS mobility field as well as a natural platform for alignment and synergy definition between various R&D&I mechanisms present in Europe.

R&D&I priorities and finding mechanisms synergies.

One of the main activities of the LIASE, and the lighthouse in general, has been to correctly map the R&D&I needs and to identify gaps and eventual accelerators which can respectively hinder or enhance the competitiveness of the EU ECS players. In the course of 2020, the LIASE itself has worked on this action, but most importantly during 3 workshops organized by the CSA action COSMOS, a broader audience across the ECS value chain had been involved in the brainstorming activity. In these workshops the R&D&I priority topics were reviewed for relevance and further defined.

In addition, on proactive proposition of the CCAM (Cooperative Connected Automated Mobility) community, the LIASE and COSMOS have worked with them and issued a document outlining possible future synergies between CCAM and the future KDT. The LIASE has evaluated the full landscape of PPPs in the future Horizon Europe program and identified potential synergetic PPPs to be approached proactively.

Participation of R&D projects in the Lighthouse

During 2020, not only the number of participating projects has doubled, but even more important, amongst the newly joining projects there are projects from other funding mechanisms than ECSEL JU.

Gradual expansion of the focus to include broader sense of Mobility.

3 years ago, the LIASE decided to gradually address mobility. This was justified at that time by capacity availability. The LIASE was much smaller and CSA action was not there. The consensus was that in the first place the focus would be on road mobility as it had been the most relevant for the ECS ecosystem at that time. However, since the beginning, there was the understanding that mobility is not limited to automotive. During 2020 clearly R&D elements on mobility related to see transport and airspace have come on board as natural evolution to cover better the ECS involvement in the Mobility spectrum.

Website: www.emobility.eu

5.6.3 Health.E Lighthouse Initiative

The Health.E Lighthouse Initiative will accelerate the innovation in medical devices and systems by stimulating the development of open technology platforms and standards, thereby moving away from the inflexible and costly point solutions that presently dominate electronic medical device manufacturing. These open technology platforms, supported by roadmaps, will generate the production volumes needed for sustained technology development, resulting in new and better solutions in the healthcare domain.

The Health.E Lighthouse, supported by the HELoS CSA, as an initiative to bring together a community of industries, universities, research institutes, healthcare organizations and policy makers, is unique in its kind in Europe and the world. In this way, a European ecosystem has been created that has the capability to identify and build open technology platforms that will enable and accelerate ECS-driven innovation in emerging medical domains. This will constitute the technological backbone for the digitization of healthcare in the digital age.

A dissemination strategy has been defined and is being executed. An informative website including an appealing animation explaining the mission and the vision of the lighthouse has been realized and a social media platform in the form of a LinkedIn channel has been installed.

At present twelve EU projects (ECSEL JU, PENTA and H2020) have been connected to the lighthouse initiative. A successful workshop was organised (on-line, due to the COVID-19) where the first version of a white paper produced by the Health.E Lighthouse was discussed and elaborated.

In this white paper, thirteen emerging medical domains that offer opportunities to the ECS community and vice versa are identified and described. The draft version of the white paper was ready in time for it to give extensive input for the 2021 edition of the European ECS research and innovation agenda (ECS-SRIA). With this, one of the most important goals of the Health.E Lighthouse, "giving input to the health chapter of the ECS SRA," has been realized. The white paper was officially launched at EFECS 2020.

Website: https://www.health-lighthouse.eu/

LinkedIn channel: https://www.linkedin.com/company/health-lighthouse/

The HELoS CSA-project supports the Health.E. Four main components are identified in the project that need to be connected to address the complex issue of innovation in the medical industry:

- Connecting existing networks: ECSEL projects, (inter)national and regional projects and initiatives;
- Addressing and connecting scientific/technical issues and non-technical aspects e.g., legal, regulatory, standardization, ethical, economic (cross-cutting issues);
- Extending the network of stakeholders and markets across Europe (spreading excellence, facilitating international collaboration, new applications);
- The dissemination of the results of this initiative to the stakeholders and the public.

The main objective of the first period was to set up a community of stakeholders of the Health.E domain. This was done by means of the following activities:

- The coordinators of 14 European cooperative projects (Horizon 2020, ECSEL, PENTA) in the healthcare & ECS field were invited to join the Health.E Lighthouse initiative. They provided information on their projects and shared their views and input on technology requirements for emerging medical domains.
- A White Paper has been prepared on the identification of 13+ emerging medical domains that can be served now and in the future by the ECS industry.
- An online workshop was organized in August 2020 with the objective to develop a vision for the Health.E community. It was attended by 49 participants, representing the HELoS consortium, industry, RTOs, universities, the EC and ECSEL. The following questions were addressed:
    - Which Open Technology Platforms in ECS for medical devices are under development? What is the technology offering resulting from projects?
    - Do they fit the future needs of the emerging medical domains identified?
    - What is missing?

The results of the workshop have been incorporated and elaborated in the White Paper.

Two additional workshops and white papers are planned for 2021.

5.6.4 Conclusions

This chapter discussed how projects achieve their goal of co-operation and synergy between actions. Through this, ECSEL JU is the first programme to actively encourage such inter-programme synergies. By pushing for such synergies, ECSEL JU effectively increases the effectiveness of its programme. This has been well understood, and such cooperation is now a core aspect of the Horizon Europe programme.

5.7 Progress against KPIs, other statistics and miscellaneous topics

This chapter presents various topics not discussed previously, amongst other the narrative for some KPIs presented in the Annexes (chapter 10).

5.7.1 Grant Agreement Preparation to signature for projects selected in call 2019

The ECSEL decisions PAB 2020-51 and PAB 2020-52 on the amendment of the selection of projects from the Call 2019 were signed on 18 May 2020. The Grant Agreement of 14 projects were signed from submission (FPP deadline 18 September 2020) to signature on average in 244 days within the 8-month deadline, with a slight (duly justified) delay for BEYOND5 that was signed after 253 days.

5.7.2 Prefinancing of the projects selected in call 2019

The prefinancing of the EU-funding occurred in time (9-10 June 2020) for all the projects of the calls 2019-1, -2 and -3. The total amount was EUR 88.6 million. The total prefinancing over the 7 years period is EUR 490.7 million. The prefinancing of calls 2020-1 and -2 will occur in in the second quarter of 2021.

5.7.3 Amendments

The activities supporting a project also involve amendments.

In 2020, 63 amendments were handled. Over the 7 years: 309 amendments were launched. If one considers only the finished projects (calls 2014 to 2016) the number of amendments boils down to 8 amendments per project (including notification based, amendments by the consortium and by ECSELJU).

There is a weak correlation with the number of beneficiaries and the average number of amendments per 10 beneficiaries equals 2 amendments. The weak correlation is most probably due to the habit of coordinators to bundle several changes in the project into one amendment. Some coordinators will do this less and for those projects the number of amendments climbs to 6 amendments per 10 beneficiaries.

The average time between an amendment request and the amendment taking effect is 21 days.

There are also information procedures (for minor changes, those occur automatically such as address changes). For those there is a better correlation with the number of beneficiaries and so for the finished calls one calculates an average of 15 information procedures per 10 beneficiaries.

5.7.4 Payments

Payments are part of the reporting and payment workflow that includes the monitoring (reviews). The payment part of this workflow involves both programme and financial officers. In 2020, 49 Reporting and Payment (RePa) workflows were executed and 15 were pre-financings. A RePa workflow includes: the technical review of the project (including a review session, the checks on deliverables, reports, and demonstrators, checks on performance indicators, other checks such as the open access of the publications), the assessment of the financial documents (eligibility of the submitted costs for each partner, audits, third parties, recoveries, etc.) and that result in a payment to the coordinator. Over the 7 years, ECSEL executed 179 RePa workflows and 81 pre-financings. Those workflows implemented in the Commission tools COMPASS-SYGMA require the close cooperation of a Programme Officer and a Financial Officer. On average the reporting period lasts 76 days and the payment period 62 days. That the reporting period last slightly longer than the envisioned 60 days is due to the size of the projects that results in a much larger quantity of documents (on average 21 deliverables and reports but it can go as high as 75) as well as the mandatory inclusion of a review (physical or remote) with external experts in that period. On the other hand, the average payment period of 62 days is much lower than the envisioned 90 days and none of the payment periods go above this value.

5.7.5 Role of regional funding

Several European regions are actively participating in the funding of projects.

- In Germany, Saxony has been a staunch supporter from the beginning of ECSEL and in 2018 Thuringia joined.
- In France, the AURA region is systematically co-funding some French partners in ECSEL projects.

Partners from Romania, Latvia and Italy participate in ECSEL projects with ESIF funding but of course then without H2020 funding.

5.7.6 Efficiency of the operations

Table 39 provides comparative statistics between different DGs and JUs as to the number of projects, number of project participants, total cost of projects and total funding of projects per project officer.

The ECSEL operations team (with 7 POs, 1 manager and 3 assistants) handles per PO the largest amount of funding (close to 3X the global average), the largest numbers of beneficiaries (more than 3X the global average), the largest number of calls (3X the global average).

DG/JU	Number of PO	Average number of projects handled per PO	Average of total cost of projects handled per PO (EUR)	Average of EU funding handled per PO (EUR)	Average of Beneficiaries handled per PO	Calls per PO
ECSEL	7	13.7	570,803,365	141,042,847	426.0	2.3
JU 1	8	15.6	141,823,715	95,175,803	206.1	0.9
JU 2	17	33.2	129,004,304	95,527,628	136.6	0.8
JU 3	2	11.5	96,188,218	49,320,240	169.5	1.5
JU 4	10	13.3	135,770,514	68,707,088	147.8	0.7
JU 5	13	8.3	204,061,477	100,793,627	200.0	1.5
JU 6	7	21.3	177,040,023	82,330,906	326.6	1.1
CNECT	200	8.6	49,602,852	45,009,585	114.0	0.7
EAC	7	1.4	960,837	885,266	8.1	1.3
EASME	166	42.5	43,889,982	35,343,886	125.0	0.7
ENER	12	1.3	11,025,306	4,218,364	12.5	1.1
GSA	16	4.9	11,334,018	8,922,880	41.8	0.3
HOME	9	4.1	20,798,146	19,546,616	64.7	1.3
INEA	49	17.3	142,581,431	119,645,955	285.7	1.3
MOVE	4	2.5	12,360,463	12,354,213	54.3	0.8
REA	298	40.6	46,140,570	42,493,677	178.1	0.6
RTD	320	6.7	45,028,259	36,682,158	89.3	0.9
Global	1145	22.0	57,357,360	45,068,123	135.0	0.8

Table 39: Statistics regarding operations

This last table demonstrates the efficiency of the ECSEL operations in running the programme. No other programme in H2020 achieves as much with so few resources.

From this statistic and the performances of the operational activities one can conclude that ECSEL is amongst the most efficient programmes under H2020.

5.8 Operational budget execution

The EU budget allocated for year 2020 has been engaged in its entirety and covered for the minor part Calls 2019 and for the major part Calls 2020. Detailed reporting on the budget consumption shall be provided within the Report on Budgetary and Financial Management as per article 53 of ECSEL Financial Rules.

6 Support to Operations

6.1 Communications and Events

6.1.1 Internal Communication

The practice of engaging all staff in regular and frequent information exchange meetings was continued in 2020, with increasing participation by absent colleagues via videoconferencing. From March onwards, these meetings were all carried out in remote mode due to obligatory teleworking imposed at government level (COVID-19 measures). The meetings offer a medium for keeping all staff abreast of developments in our often quickly changing environment, while offering an open platform for asking questions or giving feedback.

In addition to the monthly staff meetings, a short, weekly conference-call with all staff was organised, to offer support and suggestions for colleagues working in an enforced teleworking regime, and to assure the general well-being of all colleagues.

6.1.2 External Communication

The ECSEL JU also initiated intensive external communication activities. Among the highlights of these are:

6.1.2.1 Publications produced:

The collaboration with OIB, as a main resource for production of publications we continued. While most publications are designed for on-line (paperless) publication, a small number of printed copies are made, to serve as marketing and publicity aids.

- Annual Activity Report 2019
- ECSEL JU Infographic poster "MEGAPOSTER"
- Powering the Digital Transformation in Europe – a book covering an impact analysis study
- Innovation in Action – a brochure made in collaboration with 7 other JUs

6.1.2.2 Press activities:

Press releases and articles

In 2020, and influenced by the specific circumstances, ECSEL JU issued only one Press-Release : "ECSEL JU opens its Calls for Proposals for 2020" – 5th February 2020. However, this was complemented by 37 news releases, disseminated via the JU's website, covering a wide range of topics and projects' activities.

Published Articles

Several ECSEL JU funded projects have been selected by DG RTD as success stories to show the added value of the European RD&I activities. For the projects Powerbase, Robustsense and Senate, these articles will be published online in the course of 2021.

It should be noted that most projects also maintain detailed websites where a lot of interesting articles, videos, etc… are published: for links, see Table 31: Results of the ECSEL project reviews.

Media Coverage

Media tracking of third-party publications about ECSEL JU is done ad-hoc and entirely with internal resources – no recourse has been made to external services as yet.

6.1.2.3 Events

Events establish links between the various stakeholders, bring together ECSEL JU community, provide a space for networking and raise awareness about the latest ECSEL JU activities, strategies, and work plan.

Highlights

In 2020, the ECSEL JU Office, together with the Commission and Private Members Stakeholders, organised or attended several events during the course of the year. The Symposium 2020 was held online (due to travel/meeting restrictions caused by the Covid-19 pandemic), and ECSEL JU played a major part in the EFECS event organised together with all stakeholders, which too was an online experience.

6.1.2.3.1 Brokerage / Call Forum (January 14 and 15 2020)

Organised by the Industry Associations, this annual event brings together a broad section of the RD&I community around project proposal ideas, with a view to building consortia. ECSEL JU participated, with information about the planned Calls in 2020 (which included a specific call defined together with the IMI JU, as a result of ongoing collaborations between the two JUs).

6.1.2.3.2 2nd Permanent Representations meeting, Jan 23rd

Held on the evening between its PAB and GB meetings, ECSEL JU invited relevant staff of the Permanent Representations to meet with PAB delegates. As an informal meeting, it is meant to assure proper "Bridge" between ECSEL JU Governance and Member State decision influencers in Council. Presentations by the PAB Chair, the Chair of the Private Members Board, the European Commission, and the Executive Director served to seed relevant discussions amongst the guests, during the informal networking dinner.

6.1.2.3.3 Symposium 2020 – online event

Following the previous editions, ECSEL Joint Undertaking's Symposium for 2020 was held as an online event. In face of the limitations on travel and meetings imposed by the measures countering the COVID-19 pandemic, organising this event presented new and specific challenges. The event was organised with the help of a contractor offering specific experience and services for running such events, selected based on price quotation due to the very low procurement value. The Communications team was able on the one hand to attract very relevant high-level speakers, including Thierry Breton (European Commissioner for Internal Market), Maria da Graça Carvalho (Member of the European Parliament) and Victor Negrescu (Member of the European Parliament), as well as Lucilla Sioli (Director for Artificial Intelligence and Digital Industry, DG CONNECT, European Commission), Ina Schieferdecker (Director General for Research for Technological Sovereignty and Innovation, Federal Ministry of Education and Research, Germany) and Julie Galland (Deputy Director for Electronics and Software, DG of Enterprises, Ministry of Economy and Finance, France) for the Public sector. For Industry, the participation was greatly appreciated of leading figures included Sabine Herlitschka (CEO of Infineon Technologies Austria AG), Björn Ekelund (Corporate Research Director, Ericsson), Jens Fabrowsky (Executive Vice-President, Automotive Electronics, Robert Bosch GmbH), Milan Petkovic (Department Head, Philips CTO Organization – Research Digital Europe), Stefano Firpo (Head of Business Solutions, Sales and Marketing Department, Intesa Sanpaolo) and Stephan Neugebauer (Chairman of ERTRAC, Director Global Research Cooperation, BMW Group).

The programme of the event was designed to go beyond a discussion about technical aspects of the ECSEL JU programme. The panel sessions not only demonstrated the political and societal importance of the ECSEL JU programme, but they also presented the added value of the ECSEL JU as an effective European collaborative RD&I instrument. The organisation of the usual Exhibition of project results was not feasible in the online format.

The event was moderated by Bert De Colvenaer, ECSEL JU's Executive Director, who led the discussions from a professional studio in Brussels, with all participants located at their "home" location. Audience interaction was encouraged through some polling actions, as well as a "tickertape" feed showing some remarkable quotes from the speakers, while Twitter was used to keep messages flowing into the outside community.

The event was followed by a Satisfaction Survey available to all participants. The Survey was built of 16 questions related to different parts of the event, from logistics, organization to detailed agenda. The results of the survey were overwhelmingly positive, with a big number of Survey attendees describing various aspects of the event as exceeding or fulfilling their expectations.

6.1.2.4 Impact Visits

As in 2019, the ECSEL JU Office organised, together with local beneficiaries of the ECSEL JU programme, some visits with representatives of the ECSEL Public Authorities, such that they can witness first-hand the fruits of the projects that they have collectively helped to finance. On January 23rd and 24th, a delegation of PAB members and representatives from the JU Office visited the companies STMicroelectronics and Soitec, as well as the renowned research centre of CEA, in the Grenoble / Crolles area. The meetings, where some spectacularly positive impacts of ECSEL JU programme were in evidence, were very constructive and generally well received.

6.1.2.5 EFECS - November 25 and 26: online event.

ECSEL JU signed an SLA with ARTEMIS-IA, the Association taking the leading role in the organisation of the EFECS event on behalf of the three Associations, ECSEL JU and the European Commission and supporting partner Eureka, to assure a high visibility of the ECSEL JU and its projects. Despite some initial technical glitches, not related to the organisers of the event at all, the event went well and ECSEL JU was able to enjoy a high-profile display of projects in the exhibition, had many keynote speakers refer to their successes, and in particular the Lighthouse Initiatives contributed to stressing the importance of a programme like that of ECSEL JU.

6.1.2.6 Project awards

For the EFECS online event, ECSEL JU decided to rename its annual project prize as "Best Technology Pioneer", to recognise the specific contribution to European semiconductor technology excellence of the winning project, TARANTO. The project's impressive achievements have drawn great international attention and have been globally recognized as breakthrough, propelling Europe into pole position with these crucial BICMOS technologies.

In addition to giving its own prize to a project, ECSEL JU is very proud to announce that the project REFERENCE was awarded the French "Étoile de l'Europe" ("Star of Europe") prize for innovation, in recognition of its major advances in the domain of Silicon-on-Insulator semiconductors for radio-frequency applications. The award was presented by Frédérique Vidal, France's Minister of Higher Education, Research, and Innovation.

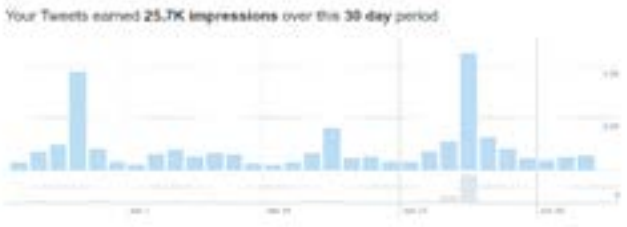
6.1.2.7 Website & Networks

The website that went online in 2017 continued to be regularly updated, serving particularly as a useful vehicle for dissemination about ECSEL JU projects and events. Though no traffic analysis is yet integrated, user feedback is generally positive. The transfer of the site hosting and support to DG-DIGIT continued to function well, though a few technical issues have required addressing. All content is still provided and maintained by "Content editors" within the ECSEL JU Office – for the most part staff of the Communications unit. The Communications unit has agreed with their counterparts in DIGIT for an extension to the support package presently used, to cover the additional effort that will be required during 2021 to migrate the existing site to support the new JU that should launch in that year.

Social Media:

- Twitter

As one of the main means of external communication during COVID-19 pandemic, ECSEL JU had continued actively using and updating Twitter account throughout the whole of 2020. The number of our followers went from 1154 (as of December 2019) to 1351 (as of December 2020).



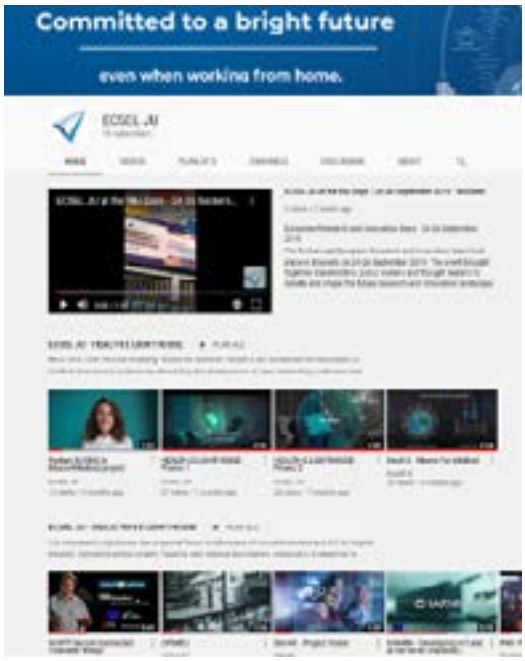
The peak of interest in ECSEL JU Twitter account was related to the online ECSEL JU Symposium 2020, during which, and prior to, the staff created the most engaging organic content.

- LinkedIn

ECSEL JU had expanded the engagement with LinkedIn community throughout 2020. The Communication Unit had carried out several LinkedIn campaigns, promoting the ECSEL JU activities and the leading events. ECSEL JU LinkedIn profile reached a peak of 832 followers in December 2020.

- YouTube

New in 2020, a YouTube channel was set up as a vehicle for public promotion of the programme though video clips. While "Vimeo" is used as a platform for videos destined for viewing via the JU's own website (it has a more professional interface for such applications), YouTube offers the advantage of a much broader public following and is generally better known both within the community and beyond. The channel is fed on a regular basis with links to videos from partners (the three Associations, from projects etc…). At the time of writing the channel has 49 videos in its playlist.



6.1.2.8 Institutional Communications

To raise the profile of the ECSEL JU Programme within the EU institutions in the run-up to decisions about the future Framework Programme "Horizon Europe", and with the aim to increase awareness about the impact on the daily life of European citizens and key role in terms of technology independence played by electronic components and systems technologies, a set of institutional communication initiatives have been planned and implemented. See the table below.

15 January 2020	"Bridge building" initiative: walking dinner with Public Authority Board and Permanent Representation to the EU members
16 January 2020	Meeting with the Permanent Representation member of Italy to the EU
20 February 2020	Meeting with Mrs Maria da Graça Carvalho, MEP (PT)
3 March 2020	Meeting with Jean-Eric Paquet, dedicated presentation of the ECSEL JU impact study's results
24 June 2020	Meeting with Commissioner M. Gabriel (Symposium)
24 June 2020	Meeting with Commissioner T. Breton (Symposium)
24 June 2020	Meeting with Victor Negrescu, MEP (RO) (Symposium)
24 July 2020	Meeting with Carlos Morais Pires, Cabinet member of Commissioner M. Gabriel

Table 40: List of meetings with EU Institutions' representatives

Over the whole year, several meetings, and contacts with EU Institution representatives (i.e., MEPs and MEPs' assistants, EC, and Council delegates) took place on-line due to the COVID-19 restrictions.

6.1.2.9 Other outreach activities

On 23 July 2020, the ECSEL JU was invited as a lecturer to the webinar organised by the Italian University ''La Sapienza'', about the European Joint Undertakings' model, with a specific focus on the ECSEL JU activities.

The key role of JUs was emphasised, as public-private partnerships able to scale up investments in strategic sectors to support the transition towards a green economy, meeting the goals of the European Green Deal and Digital Europe.

In particular, the ECSEL JU, with its tripartite model (EU, Participating States, and Industry), contributes reaching the critical investment needed to maintain EU competitiveness in the global strategic dimension of the electronic components and systems, and to the overall security and technology autonomy of the EU.

6.2 Legal and financial framework

Main decisions had been adopted at the time of the setup of ECSEL JU in 2014 by the Governing Board, the Public Authorities Board, and the Executive Director.

In 2020, the Governing Board continued adopting decisions relating to the smooth running of the organisation as well as annual decisions: MASP, Work Plan, annual accounts, budget, assessment on the ED Annual Activity Report. Moreover, in 2020, ECSEL Governing Board has adopted a new set of Financial Rules, as well as a decision on a Revised Internal Control Framework.

6.3 Procurement and contracts

Procurement and contracts are managed in accordance with the provisions of ECSEL Financial Rules and coordinated within the ECSEL Administration & Finance team.

To reach its objectives and adequately support its operations and infrastructures, ECSEL JU allocated funds to procure the necessary services and supplies. In the context of sound financial management and efficiency, ECSEL JU made to the most possible extent use of the various Service Level Agreements (SLAs) already concluded with relevant Commission Services, as well as its private members and made use of inter-institutional framework contracts (e.g., IT services and equipment, interim staff services, external audit services, staff trainings).

Due to the COVID-19 crisis and the restrictions imposed as of mid-March 2020, substantially all meetings and events with physical presence were either cancelled or turned into digital (e.g., ECSEL Symposium 2020), essentially limiting thus ECSEL procurement needs to preserving business continuity.

As a result, in 2020, ECSEL JU run very few procurement procedures mainly for low value contracts, as well as one re-opening of competition.

6.3.1 Major procurement procedures

- A re-opening of competition under a framework contract of DG BUDG for the supply of technical, assistance services in the field of audits and controls of the annual accounts of ECSEL Joint Undertaking for the years ending at 31/12/2020 and 31/12/2021 was launched in June 2020. The evaluation took place later in the year and the contract was awarded to Ernst & Young in October 2020.

- In May 2020, a negotiated procedure for low value was launched for the award of a contract for the organisation of the digital version of "ECSEL JU Symposium 2020".

6.4 IT and logistics

JUs co-located with ECSEL in the White Atrium building share the same IT infrastructure. The governance includes an ECSEL JU representative in the joint IT steering committee. At present the shared ICT infrastructure is hosted by Cancom datacentres.

ECSEL is currently implementing elements of mitigation required by the Office 365 DPIA (Data Protection Impact Assessment): Teams, SharePoint, Exchange, OneDrive are scheduled to be completed by June 2021, and the remaining components by December 2021. As the core components' risk would have been mitigated by Q2, the initial migration is planned to begin in Q3.

For the financial management and monitoring of projects as well as the calls management under Horizon 2020, ECSEL JU implements the common ICT tools designed, updated, and maintained by the European Commission.

ECSEL JU also uses ABAC (accounting system of the European Commission) for its financial management related to procurement and FP7 transactions.

During 2020, ECSEL has developed an extranet that provides National Funding Authorities with a platform in which they can include their information regarding the projects, their beneficiaries and view the situation project by project. It is aimed at serving as a repository where information available can easily be tracked back. From ECSEL JU's perspective, this should be an appropriate tool in support of compliance with the reporting obligations set in Article 4 of ECSEL Council Regulation and with the obligation to report the in-kind contribution to operational activities (IKOP).

The business continuity plan and disaster recovery plan were established in 2015, providing guidance and establishing procedures in case of interruption of activities or unforeseen situations. In January 2019, a complete test of the BCP/DRP was successfully performed, and throughout the lockdown, the various systems performed adequately.

In early March 2020 at the outbreak of the COVID-19 pandemic, ECSEL JU performed a stress test to check the functioning of its teleworking ICT capacity, under the assumption that all ECSEL staff would be on teleworking mode simultaneously for a certain period. The test demonstrated that ECSEL was able to ensure business continuity and support a long-term teleworking regime for all its staff, as this has been confirmed throughout the COVID-19 period.

7 Part II. Management Report

7.1 GOVERNANCE

7.1.1 Governing Board

In 2020 the Governing Board was chaired by Sabine Herlitschka.

The vice-chairs of the Governing Board were:

Doris Vierbauch, Chair of the Public Authorities Board,
Lucilla Sioli, Lead delegate of the Commission delegation in the Governing Board, and
Jean-Luc di Paola-Galloni, Chair of the Private Members' Board.

In 2020 the Governing Board held four meetings, organised 11 written procedures and adopted 16 decisions. Meeting summaries and decisions adopted are available on the ECSEL JU website.

Decisions adopted:

Number	Title	Date	Adoption
GB 2020 137	1st Amendment Work Plan 2020	21.01.2020	meeting 26
GB 2020 138	Financial Rules	02.03.2020	written procedure 49
GB 2020 139	Budget 2020 Amendment 1	07.04.2020	written procedure 50
GB 2020 140	Implementing rules to staff regulations	15.05.2020	written procedure 52
GB 2020 141	2nd Amendment Work Plan 2020	20.04.2020	written procedure 51
GB 2020 142	Endorsing the certified IKOP for 2019	15.05.2020	written procedure 53
GB 2020 143	Internal rules for JU's ART 25 restrictions	18.09.2020	written procedure 56
GB 2020 144	Final Annual Accounts 2019	25.05.2020	meeting 27
GB 2020 145	AAR 2019 & assessment by the GB	25.05.2020	meeting 27
GB 2020 146	Budget 2020 Amendment 2	29.09.2020	written procedure 57
GB 2020 147	Revised Internal Control Framework	17.08.2020	written procedure 55
GB 2020 148	ToR observers Call 2020	17.08.2020	written procedure 54
GB 2020 149	Nomination reporting officers ED appraisal	22.10.2020	written procedure 58
GB 2020 150	Budget 2021	11.12.2020	meeting 29
GB 2020 151	Work Plan 2021	11.12.2020	meeting 29
GB 2020 152	Budget 2020 Amendment 3	05.12.2020	written procedure 59

Members of the Governing Board

Private Members:

	Bedran	Caroline
AENEAS	Bériot	José
	Bressler	Patrick
	Crippa	Danilo
	Muller	Sophie
	Doell	Gerhard
	Dupont-Nivet	Eric
	Geraets	Maurice
	Graignic	Fabrice
	Hellenthal	Berthold
	Herlitschka	Sabine
	Jarre	Alain
	Krijgsman	Arco
	Leroy	Pascal
	Mokrani	Hervé
	Roncales Poza	Miguel
	Roux	Laurent
	Sangiorgi	Enrico
	Sebastian	Ina
	van den Biesen	Jan
	Van den Bosch	Anne
	van Staa	Peter
	Wyon	Christophe
	Zandbergen	Peter
ARTEMIS-IA	Azzoni	Paolo
	Bonecki	Mateusz
	Bonilla Díaz	Francisco Javier
	Burtscher	Jean-Baptiste
	Candry	Patrick
	Coda	Alessandro
	Delsing	Jerker
	di Paola Galloni	Jean-Luc
	Eckel	Andreas
	Garcia Sanchez	Jesus Angel
	Guido	Stephan
	Harris	Philip J.
	Herlitschka	Sabine
	Hufeld	Knut

EPOSS	Kulas	Lukasz
	Leibbrandt	Wouter
	Lohstroh	**Jan**
	Niehaus	Juergen
	Paulweber	Michael
	Pistauer	Markus
	Pype	Patrick
	Rogo	Francesco
	Roning	Juha
	Ruiz	Pedro
	Saarinen	Jukka
	ten Berg	Ad
	Van Baelen	Stefan
	van den Biesen	Jan
	Watzenig	Daniel
	Zafalon	Roberto
	Carpanzano	Emanuele
	DalMolin	Renzo
	Donat	Albrecht
	Finkbeiner	Stefan
	Gessner	**Wolfgang**
	Groppo	Riccardo
	Herlitschka	Sabine
	Hoffmann	Karsten
	Korhonen	Anssi
	Lequepeys	Jean-René
	Merveille	Chris
	Moore	Eric
	Offenberg	Michael
	Otto	Thomas
	Rzepka	Sven
	Rödig	Herbert
	Storer	David
	van den Biesen	Jan
	Vigna	Benedetto

*Lead delegates in **bold***

ECSEL Participating States:

Delegation	Name	First Name
AT	Hegny	Ingo
	Almansa	Ana
	Mosnik	Lisbeth
	Vierbauch	Doris
	Wiesmüller	**Michael**
BE	Deprez	Francis
	Maas	Stijn
	Sileghem	Maarten
	Van de Loock	**Leo**
BG	**Komatichev**	**Emil**
	Tomov	Kalin
CH	Buehler	Roland
	Gut	**Andreas**
CZ	**Vávra**	**Michal**
	Núñez Tayupanta	Lucie
DE	Jester	Sebastian
	Mengel	**Stefan**
	Rittner	Johannes
DK	Hansen	Michael
	Lindberg	Børge
	Vittrup	**Jens Peter**
EE	**Vahtrus**	**Mikk**
EL	Farmaki	Danae
	Zekentes	**Konstantinos**
ES	Serrano Agejas	Joaquin Angel
	Fernandez Garcia	Estrella
	Gómez Miguel	Beatriz
	Ginard Pariente	**David**
	Suarez Martín	Antonio Fernando
	Pelayo	Enrique
	Lucena Chacón	Rafael
FI	Ahola	Kimmo
	Heikki	**Uusi-Honko**
	Leino	Kari
FR	Capy	Loic
	Madigout	Geoffrey
	Piault	Clément
	Weill	**Mathieu**
HU	**Csuzdi**	**Szonja**
	Divinyi	Agnes

IE	**O'Reilly**	**Stephen**
IL	**Seker**	**Dan**
	Shalev	Nili
IT	**Covello**	**Aldo**
	Noto	Maria Chiara
	Macii	Enrico
LV	**Alberts**	**Maris**
LU	**Grotz**	**Mario**
	Crean	Gabriel
MT	Cutajar	Omar John
	Foden	**James**
NL	Ruck	Ben
	Schaap	Wilbert
	van Roosmalen	Fred
NO	**Davis**	**Kim**
	Aune	Agnes
PL	Drewniak	Dariusz
	Wojciechowska-Grochola	**Barbara**
PT	Amaral	Mario
	Azevedo	Sofia
	Coelho	Filipa
	Isidro	Anabela
	Leandro	Cristiana
	Viseu Melo	**Luis Humberto**
RO	**Anania**	**Cristina**
	Dinu	Elena
	Hilgen	Sanda
	Gheorghian	Daniela
	State	Ruxandra
SE	Aurelius	Andreas
	Gustafsson	**Lars**
	Saavredra Granholm	Adela
SK	**Donoval**	**Daniel**
	Telek	Peter
TR	Bener	Ezgi
	Cetin	Utku
	Hasekioglu	**Orkun**

*Lead delegates in **bold***

European Commission:

	Delia	Sandro
	Ibañez	Francisco
	Maloney	Colette
	Mendez Blanck Conrady	Enrique
	Rouhana	Khalil
	Sioli	**Lucilla**
	Zwegers	Arian

Lead delegate in bold

7.1.2 Executive Director

Bert De Colvenaer was appointed Executive Director as from 1 January 2016 and was renewed in December 2018 for three years (as of 1 January 2019).

The Executive Director has adopted the following decisions:

Number	Title	Date
ED 2020 281	Calls documents (update Part B templates)	23.01.2020
ED 2020 282	Update of the evaluation forms	23.01.2020
ED 2020 283	Additional requirements document for the CSA call	27.01.2020
ED 2020 284	Amendment to work plan 2020 through ED Decision (V3)	31.01.2020
ED 2020 285	Amendment to work plan 2020 through ED Decision (V4) repealing ED 2020 284	04.02.2020
ED 2020 286	Amendment to work plan 2020 through ED Decision (V5) repealing ED 2020 285	07.02.2020
ED 2020 287	Amendment to work plan 2020 through ED Decision (V6) repealing ED 2020 286	12.02.2020
ED 2020 288	Amendment to work plan 2020 through ED Decision (V7) repealing ED 2020 287	14.02.2020
ED 2020 289	Amendment to work plan 2020 through ED Decision (V8) repealing ED 2020 288	23.03.2020
ED 2020 290	Expression of Vision for Call 3 - IMI-ECSEL Joint Activity	30.03.2020
ED 2020 291	Amendment to work plan 2020 through ED Decision (V9) repealing ED 2020 289	01.04.2020
ED 2020 292	Amendment to work plan 2020 through ED decision (v11) repealing GB 2020.291	20.04.2020
ED 2020 293	Allocation of the proposals to the experts for the evaluation PO phase of the ECSEL Calls 2020-1-IA & 2020-2-RIA	13.05.2020
ED 2020 293.v1	Allocation of the proposals to the experts for the evaluation PO phase of the ECSEL Calls 2020-1-IA & 2020-2-RIA	28.05.2020
ED 2020 294	Allocation of the proposals to the experts for the evaluation PO phase of the ECSEL Calls 2020-4-CSA	13.05.2020
ED 2020 295	Explanatory note to GB 2016.66	07.05.2020
ED 2020 296	Additional information document for the IMI-ECSEL call	15.05.2020
ED 2020 297	Amendment to work plan 2020 through ED decision (v12) repealing ED 2020.292	25.05.2020
ED 2020 298	Nomination DMO and DMO Deputy for ARES	05.06.2020
ED 2020 299	Administrative agreement Portugal 17.2	04.12.2020
ED 2020 300	Amendment to workplan 2020 through ED decision (V13) repealing ED 2020.297	19.06.2020
ED 2020 301	Transfer 2020-01 relating to budget transfers	30.06.2020
ED 2020 302	AOD delegation YGI from 13/07/2020 to 17/07/2020	30.06.2020
ED 2020 303	AOD delegation OLA from 03/08/2020 to 21/08/2020	30.06.2020
ED 2020 304	Reclassification Committee 2020	03.07.2020
ED 2020 305	Amendment to workplan 2020 through ED decision (V14) repealing ED 2020.300	08.07.2020
ED 2020 306	Designation of user access rights, roles, and teams in H2020 IT tools and H2020 workflows in IT tools	07.08.2020
ED 2020 307	Amendment to workplan 2020 through ED decision (V15) repealing ED 2020.305	30.07.2020
ED 2020 308	Selection committee CA III FIN	04.08.2020
ED 2020 309	Amendment to workplan 2020 through ED decision (V16) repealing ED 2020.307	04.08.2020
ED 2020 310	Decision relating to Reclassification of Staff for the year 2020	22.09.2020
ED 2020 311	AOD delegation OLA from 24/08/2020 to 28/08/2020	20.08.2020
ED 2020 312	Allocation of the proposals to the experts for the evaluation FPP phase of the ECSEL Calls 2020-1-IA & 2020-2-RIA	18.09.2020
ED 2020 312v1	Allocation of the proposals to the experts for the evaluation FPP phase of the ECSEL Calls 2020-1-IA & 2020-2-RIA after COI	14.10.2020
ED 2020 313	Nomination DMO-Deputy DMO	POSTPONED
ED 2020 314	Allocation of the proposals to the experts for the evaluations of the Call 2020-3-RIA-IMI-ECSEL	01.10.2020
ED 2020 314v1	Allocation of the proposals to the experts for the evaluations of the Call 2020-3-RIA-IMI-ECSEL - corrigendum	02.10.2020
ED 2020 315	Budgetary transfer 2020-02	12.10.2010
ED 2020 316	Amendment of ECSEL Privacy Policies (repealing ED 2019.276)	05.12.2020
ED 2020 317	Budgetary transfer 2020-03	02.12.2020

7.1.3 Public Authorities Board

In 2020 the Public Authorities Board was chaired by Doris Vierbauch. The vice-chair was Kari Leino: his mandate has been prolonged.

The mandate of the new Public Authorities Board Chair, Doris Vierbauch, started at the end of the meeting on 25th November 2019.

In 2020 the Public Authorities Board held 5 meetings, organised 3 written procedures and adopted 9 decisions. Meeting summaries and decisions adopted are available on ECSEL JU website.

Decisions adopted:

Number	Title	Date
PAB 2020 48	Amendment to PAB Rules of Procedure (conflict of interest)	written procedure 17 25.06.2020
PAB 2020 49	Launch Call 2020	meeting 16.01.2020
PAB 2020 50	Amendment to launch decision call 2020	written procedure 15 21.04.2020
PAB 2020 51	Amendment Funding decision ECSEL Call 2019-1	written procedure 16 18.05.2020
PAB 2020 52	Amendment Funding decision ECSEL Call 2019-2	written procedure 16 18.05.2020
PAB 2020 53	Funding decision ECSEL Call 2020-4	meeting 10.06.2020
PAB 2020 54	Funding decision ECSEL Call 2020-1	meeting 10.12.2020
PAB 2020 55	Funding decision ECSEL Call 2020-2	meeting 10.12.2020
PAB 2020 56	Funding decision ECSEL Call 2020-3	meeting 10.12.2020

Delegates to the Public Authorities Board:

AT	**Almansa**	**Ana**
	Niklfeld	Georg
	Vierbauch	Doris
	Wiesmüller	Michael
BE	Deprez	Francis
	Maas	Stijn
	Sileghem	Maarten
	Van de Loock	**Leo**
BG	**Komatichev**	**Emil**
	Tomov	Kalin
European Commission	Delia	Sandro
	Ibañez	Francisco
	Maloney	Colette
	Mendez Blanck Conrady	Enrique
	Rouhana	Khalil
	Sioli	**Lucilla**
	Zwegers	Arian
CH	**Buehler**	**Roland**
	Gut	Andreas
CZ	**Vávra**	**Michal**
	Núñez Tayupanta	Lucie
DE	Kaltschew	Julia
	Jester	Sebastian
	Mengel	**Stefan**
	Pötschke	Konstantin
	Rittner	Johannes
DK	Lindberg	Børge
	Vittrup	**Jens Peter**
	Hansen	Michael
EE	**Vahtrus**	**Mikk**
EL	Farmaki	Danae
	Pappa	**Aliki**
ES	Serrano Agejas	Joaquin Angel
	Fernandez Garcia	Estrella
	Gómez Miguel	Beatriz
	Ginard Pariente	**David**
	Suarez Martín	Antonio Fernando
	Pelayo	Enrique
	Lucena Chacón	Rafael
FI	**Ahola**	**Kimmo**
	Heikki	Uusi-Honko
	Leino	Kari
FR	Capy	Loic
	Madigout	Geoffrey

	Piault	**Clément**
HU	Csuzdi	Szonja
	Divinyi	**Agnes**
IE	**O'Reilly**	**Stephen**
IL	**Seker**	**Dan**
	Shalev	Nili
IT	**Covello**	**Aldo**
	Noto	Maria Chiara
	Macii	Enrico
LV	Alberts	Maris
	Asmuss	Julija
	Levandelis	Egons
	Pliksa	**Ineta**
LU	**Grotz**	**Mario**
	Crean	Gabriel
MT	Cutajar	Omar John
	Foden	**James**
NL	Ruck	Ben
	Schaap	**Wilbert**
	van der Bijl	Robert-Jaap
	van Roosmalen	Fred
NO	**Davis**	**Kim**
	Aune	Agnes
PL	Maciejko	Krystyna
	Ratajczak	**Agnieszka**
PT	Amaral	Mario
	Azevedo	Sofia
	Coelho	Filipa
	Isidro	Anabela
	Leandro	**Cristiana**
	Viseu Melo	**Luis Humberto**
RO	Anania	Cristina
	Dinu	Elena
	Hilgen	Sanda
	Gheorghian	Daniela
	State	Ruxandra
SE	Aurelius	Andrea
	Engström	Julia
	Gustafsson	Lars
	Saavedra Granholm	**Adela**
SK	**Donoval**	**Daniel**
	Telek	Peter
TR	**Bener**	**Ezgi**
	Cetin	Utku
	Hasekioglu	Okrun

*Lead delegates in **bold***

7.1.4 Private Members Board

In 2020 members of the Private Members Board of the ECSEL JU were:

From AENEAS:
Caroline Bedran
Ina Sebastian
Peter Zandbergen

From ARTEMIS-IA:
Jan Lohstroh
Jean-Luc di Paola-Galloni
Michael Paulweber

From EPoSS:
Wolfgang Gessner
Michael Offenberg
Renzo DalMolin

7.2 Major Developments

In 2020, according to the relevant Rules of Procedure, Dr. Sabine Herlitschka was re-elected as Chair of the Governing Board. Ms. Doris Vierbauch (AT) was elected as Chair of the PAB until 26.11.2021.

7.3 Budgetary and financial management

ECSEL JU Governing Board approved the initial annual budget for year 2020 on 14 December 2019 by ECSEL GB Decision 2019.133.

On 7 April 2020, ECSEL JU's Governing Board adopted GB Decision 2020.139 amending for the first time the initially adopted budget to increase the appropriations for commitments and payments under Titles 1, 2 and 3 by reactivating unused appropriations deriving from previous budget exercises as foreseen in article 6.5 of ECSEL Financial Rules. Moreover, the first amendment served for the adjustment of needs in payment appropriations regarding the execution of payments related to FP7 projects under Title 3, reducing the total amount of payment appropriations.

A second budget amendment was adopted by ECSEL JU's Governing Board (GB Decision 2020.146) on 29 September 2020. The second amending budget introduced the reactivation of unused operational (H2020) commitment and payment appropriations from the previous budget exercises under Title 3 as foreseen in article 6.5 of ECSEL Financial Rules.

On 5 December 2020, ECSEL JU's Governing Board adopted a third budget amendment (GB Decision 2020.152) introducing the reactivation of unused operational (H2020) commitment appropriations from the previous budget exercises under Title 3 to be used in Calls 2020 as foreseen in article 6.5 of ECSEL Financial Rules.

Overall, in 2020, total available appropriations were EUR 218 million for commitments and EUR 216 million for payments. The budget implementation reached roughly 100% in terms of commitment appropriations and 89% in terms of payment[22].

Administrative expenditure (Title 1 – Staff and Title 2 – Running Costs)

Under Title 1 the ECSEL budget execution reached 91% in terms of commitment appropriations and 89% in terms of payment appropriations. This title was mainly used for salaries of the JU staff, as well as staff trainings and medical costs.

Under Title 2 the execution reached 84% in terms of commitment appropriations and 73% in terms of payment appropriations.

22 Total available budget includes, in addition to the budget voted by the Governing Board, appropriations carried over from the previous exercise, budget amendments as well as miscellaneous payment appropriations for the period (e.g., internal and external assigned revenue). The figures are those related to the provisional accounts and are not yet audited by the Court of Auditors (Source: ABAC DWH). More detailed information on budget implementation for 2020 will be presented in the context of the Annual Accounts 2020 and the Report of Budgetary and Financial Management as per ECSEL Financial Rules.

In addition to the budget amendments, the Executive Director, in accordance with Article 10 of the ECSEL Financial Rules, transferred appropriations between chapters within the same Title over the year. These transfers had the objective to better allocate the resources needed for the running costs. Overall, budget transfers had no impact on the approved budget.

The part of the administrative budget that was not used because of the COVID 19 crisis, mainly relating to missions, IT and technical support costs, staff costs and reviews experts' costs, meetings, and communications, was carried over to 2021 budget by ECSEL JU's Governing Board decision.

Operational expenditure (Title 3 – Selected projects after annual calls)

Under Title 3, the ECSEL JU budget covers the operational expenditure related to the implementation of projects under the 7th Framework Programme (FP7 completion), as well as under the Horizon 2020 Programme (H2020).

Under H2020, the budget implementation in terms of commitment appropriations reached 100%, whereas the implementation in terms of payment appropriations reached 91%. A major part of the payment appropriations was used for the pre-financing of the grants resulting from the 2019 calls for proposals, while the minor part was used for interim and final payments for grants resulting from previous ECSEL calls for proposals.

Under FP7, the budget implementation in payment appropriations reached 70% compared to 45% in 2019 and 41% in 2018, reflecting the important efforts made by ECSEL JU towards the closure of FP7 projects.

7.4 Human Resources

In September 2020, ECSEL JU launched a new recruitment procedure for the post of financial/ administrative assistant. The recruitment is expected to be finalised in Q1 of 2021.

In May 2020, ECSEL Governing Board has adopted a new set of implementing rules to staff regulations:

	Implementing Rules	implementing Commission Decision(s)
1.	Guidelines on 'whistleblowing'	C(2018) 1362
2.	'Middle management staff'	C(2018) 2542
3.	'Function of adviser'	C(2018) 2209
4.	'Opt-out 7 years rule'	C(2019) 6929
5.	'Learning and development'	C(2017) 6772
6.	'Types of post and post titles'	C(2018) 8800
7.	'Staff committee'	C(2016) 3323
8.	'Leave on personal grounds'	C(2015) 5320
9.	'Outside activities'	C(2018) 4048
10.	'Contractual agents'	C(2019) 3016
11.	'Leave'	C(2020) 1559
12.	'Commission drivers'	C(2004) 1318 and C(2019) 7822
13.	'Conduct of administrative inquiries and disciplinary proceedings'	C(2019) 4231

7.5 Follow –up on Audits and Evaluations

The following paragraphs contain an overview of audit and evaluation actions and their follow-up during 2020.

7.5.1 Internal Audit Service (IAS)

The Internal Audit Service performed in January 2021 a follow-up of audit recommendations in ECSEL JU. The objective of the engagement was to assess the progress made in implementing the open recommendations that resulted from past IAS audits. Based on the results of the follow-up audit, the IAS concluded that all recommendations raised during the audit on Horizon 2020 grant agreement implementation and closing in the ECSEL JU, have been effectively implemented. For the audit: Performance management of ECSEL JU activities, the important recommendation on the performance framework was downgraded from "very important" to "important" in a previous follow-up note. ECSEL' s efforts on indicators, aligned with the Common Implementation Centre, should now be directed towards Horizon Europe and ECSEL will no longer follow up on the remaining action points in relation to those indicators. Therefore, the IAS took note that management accepted the residual risk and closed this recommendation in its tracking system and no further follow-up will be done.

7.5.2 Internal Audit Capability (IAC)

Based on Council Regulation (EU) No 561/2014 of 6 May 2014 establishing the ECSEL Joint Undertaking, having regard to Article 30 of the financial rules of ECSEL JU and as adopted by the Governing Board decision (ECSEL GB. 2020.138) the JU established an Internal Audit Capability (IAC) which provides independent, objective assurance and consulting services designed to add value and improve the operations of the JU.

Within ECSEL JU, the internal audit capability is performed by the Internal Control and Audit Manager (ICAM).

As every year, the objective established for the Internal Audit Capability is to provide the Executive Director with assurance as to the effectiveness and efficiency of risk management, control, and governance process in the ECSEL JU.

During 2020, the main activities of the ICAM focused on coordinating the implementation and follow-up of the audits carried out by the internal auditor of the ECSEL JU (IAS), the European Court of Auditors, the external auditors and the ECSEL JU ex-post audits as per H2020 Common Audit Strategy. In addition, in 2020, the ICAM coordinated the implementation of the revised Internal Control Framework (ICF).

7.5.3 European Court of Auditors (ECA)

In 2020, the ECSEL JU continued to assist the Court of Auditors during their missions carried out during the year. The ECSEL JU followed up on the findings raised by the Court by implementing actions that improve the procedures and internal controls of the JU.

The audit on the accounts of the ECSEL JU and on the legality and regularity of the payments and revenue underlying the 2020 annual accounts is ongoing. A first mission of the Court of Auditors took place in December 2020 and will be followed up by a second mission. The annual accounts are audited by an external audit firm (contracted through a DG Budget framework contract).

For the financial year ended 31 December 2019, the European Court of Auditors issued an unqualified ("clean") audit opinion on the accounts of ECSEL JU and on the legality and regularity of the payments and revenue underlying the 2019 annual accounts.

7.5.4 Follow up on discharge

The discharge in respect of the implementation of the budget of ECSEL JU for the financial year 2019 is ongoing. The timeline of the annual discharge procedure foresees that, by end March n+2, the European Parliament (EP) discusses the reports in a Plenary session, which then decides whether to grant or postpone discharge.

7.5.5 Evaluations

As required by the Council Regulation setting up the ECSEL Joint Undertaking, in 2017 the Commission performed the final evaluation of the JU´s performance under FP7 and mid-term evaluation of its performance under Horizon 2020. In response to the recommendations of the interim evaluation of the ECSEL Joint Undertaking (2014-2016) and in particular the Final Report prepared for the European Commission in June 2017, ECSEL´s Governing Board prepared an action plan that presented responses to each of the recommendations. The majority of the actions have been implemented as reported during the Governing Board meeting of 24 June 2020, whilst some were considered beyond the scope of the ECSEL JU.

7.6 Environment management

A "Go-green group" has been created in 2019 for all JU's. The aim is to compile environmental initiatives and ideas that we can implement in the different JU's. Due to the pandemic situation, there was no opportunity to take further initiatives on this during 2020.

8 Part III. Internal Control

In the course of 2020, the ECSEL JU moved to a principle-based system to align its Internal Control Framework (ICF) to the revised control framework adopted by the European Commission[23]. The revised internal control framework of ECSEL JU was adopted by the Governing Board (GB) in August 2020 (Decision ECSEL GB 2020.147).

The revised framework replaced the former internal control standards and requirements by a principle-based approach and a shift of focus towards an assessment of the effectiveness and efficiency of the control system rather than compliance. The revised Internal Control Framework consists of five internal control components and 17 principles based on the COSO 2013 Internal Control-Integrated Framework.

The revised internal control framework considers the structure and size of the JU, the nature of its tasks, and the financial and operational risks involved. The Executive Director and other members of JU's management, together with the Internal Control and Audit Manager and the JU staff at all levels ensure the implementation of the internal control framework.

The priority objective remains to implement and maintain an effective internal control system so that reasonable assurance can be given that resources assigned to the activities are used according to the principles of sound financial management and control procedures in place give the necessary guarantees concerning the legality and regularity of transactions.

The implementation of the internal control system is performed by the internal auditor, by the internal audit capability and by the management of the ECSEL JU. At this point in time, most controls are present and are assessed as functioning effectively.

8.1 Compliance and effectiveness of Internal Control

According to Article 14 of the ECSEL JU Financial Rules and Article 36 of the EU Financial Regulation the internal control framework is designed to provide reasonable assurance regarding the achievement of the following five objectives: (1) effectiveness, efficiency and economy of operations; (2) reliability of reporting; (3) safeguarding of assets and information; (4) prevention, detection, correction and follow-up of fraud and irregularities, and (5) adequate management of the risks relating to the legality and regularity of transactions, taking into account the multiannual character of programmes as well as the nature of the payments concerned.

As an entrusted body implementing the EU Budget, ECSEL JU needs to ensure a proper management and control mechanism in accordance with Article 36 of the EU Financial Regulation[24] and provide a level of assurance from its systems at least equivalent to the one of the European Commission.

In this respect, in 2020 the ECSEL JU implemented the new Internal Control Framework proposed by the EC. The Governing Board adopted the revised internal control framework in August 2020 (Decision ECSEL GB 2020.147). As part of the transition into the revised ICF, an action plan was set up with steps and a timeline to implement the revised internal control framework.

As from 2020, the ECSEL JU has assessed the effectiveness of its internal control systems based on the revised framework. The overall objective of the self-assessment exercise was to understand if all principles were present and functioning. The exercise was based mainly on analysis of reports by the internal audit service, the Court of Auditors and external auditors and supported with other evidence (such as the register of exceptions, the risk assessment exercise, follow-up of actions, recommendations, findings) and discussions with management on the activities and objectives of the JU.

The ECSEL JU keeps a register of exceptions and non-compliance events to manage and monitor deviations from established processes and procedures. All deviations reported are recorded in the register and analysed to identify any control failures. The assessment of potential risks from the deviations reported in 2020 did not reveal any control weaknesses.

Risks identified through the annual risk assessment exercise (described in section 8.1.6) were also assessed and managed through appropriate controlling and mitigating actions.

The ECSEL JU has assessed the internal control system during the reporting year and has concluded that it is effective and that the components and principles are present and functioning as intended.

23 Communication on the revision of the Internal Control Framework (ICF) – C(2017)237

24 OJ-L 193/30.07.2018

8.2 INTERNAL CONTROL FRAMEWORK (elements supporting assurance)

8.2.1 Financial Procedures

The ECSEL JU Financial Rules have been adopted by the Governing Board on 2nd March 2020 (Decision ECSEL GB 2020.138). The Financial Circuits were updated in 2018.

8.2.2 Ex-ante Controls on Operational Expenditure

Again in 2020, the ECSEL JU has been operating under two different regimes:

- For the completion of projects initiated under FP7 with implementing the regulations and rules defined under the ARTEMIS and ENIAC Joint Undertakings, and along the terms of the administrative agreements signed with the Member states: control on operational expenditures of ARTEMIS/ENIAC projects continue being entrusted to the national Funding Authorities that certify the eligible costs and the amounts paid as national contributions, so that the JU can calculate its contribution following the national pace of payment.
- For the implementation of projects selected under H2020, in accordance with the H2020 common rules, and as defined in the new administrative agreements signed with Participating States: ex-ante control of operational expenditure is implemented using the tools and methods developed by the European Commission.

8.2.3 Ex-post Control of Operational Expenditure and Error Rates Identified

The operational expenditure of the ECSEL JU in 2020 can be split in 2 main parts: FP7 completion payments (EUR 14,287,434.81) and Horizon 2020 operational payments (EUR 172,171,678.57, which includes prepayments and actual intermediate and final payments for projects and final payment of an impact study: EUR 180 900).

Regarding the FP7 completion of actions selected for funding by ARTEMIS JU and ENIAC JU, a continuous series of activities took place, in accordance with the rules defined under the legal framework of the ARTEMIS and ENIAC Joint Undertakings.

As every year, at the end of 2020, ECSEL JU has invited the National Funding Authorities (NFAs) to issue a declaration of assurance for the audits in FP7 performed under their responsibilities regarding the 2019 activities.

The declarations received provide the JU with a rate of assurance reaching 100 % of the total of transactions concerned.

Table 41: Summary of ex-post audit declarations received

Total NFAs	15
Total declarations received	15
Response % by NFA	100%
Response % by payments	100%

The same procedure will be followed for the 2021 expenditure and a similar financial coverage is expected.

Under the coordination of the Common Implementation Centre of the European Commission, and of its Common Audit Service, ECSEL JU has been cooperating with the other stakeholders of the H2020 research family on the update of the H2020 Common Audit Strategy for interim and final payments of operational expenditure and in the definition of implementing rules.

The main objective of the ex-post audit strategy is to provide the individual Authorising Officers with the necessary elements of assurance in a timely manner, thus allowing them to report on the budget expenditure for which they are responsible. Ex-post controls on operational expenditure contribute in particular to:

- assessing the legality and regularity of expenditure on a multi-annual basis;
- providing an indication of the effectiveness of the related ex-ante controls;
- providing the basis for corrective and recovery mechanisms, if necessary.

The Representative Error Rate for ECSEL JU for H2020 is 2.68% and the Residual Error Rate is 1.25%, staying below the targeted threshold of 2%. This calculation is based on EU contribution paid to beneficiaries in H2020.

8.2.4 Audit of the European Court of Auditors

For the financial year ended 31 December 2019, the European Court of Auditors issued an unqualified ("clean") audit opinion on the accounts of ECSEL JU and on the legality and regularity of the payments and revenue underlying the 2019 annual accounts.

The full report including the reply of the ECSEL JU can be found here: https://www.eca.europa.eu/Lists/ECADocuments/JUS_2019/JUS_2019_EN.pdf

8.2.5 Internal Audit

The Internal Audit Service of the European Commission performs the role of Internal Auditor of the ECSEL JU. Following the implementation of the IAS Strategic Internal Audit Plan 2019-2021 for ECSEL JU, the audit on Horizon 2020 grant agreement implementation and closing in the ECSEL JU was finalised. The final report was published in June 2020.

The objective of the audit on Horizon 2020 grant agreement implementation and closing in the ECSEL JU was to assess the adequacy of the design and the efficiency and effectiveness of the internal controls in place in the ECSEL JU for the implementation and closing of grant agreements under the H2020 programme. The first stage of the H2020 grant management lifecycle was audited in 2016.

As part of the findings, the auditors recognised the ongoing efforts made by the ECSEL JU in the grant implementation process. In particular, the auditors identified a strong control

environment, including systematic reviews of the periodic reports by independent experts and the JU project officers, a solid and necessary basis to monitor the effective implementation of ex ante controls on H2020 grant payments.

The IAS concluded that, overall, ECSEL JU has set up an efficient and effective internal control system for the implementation and closing of grant agreements under the H2020 programme. While the audit did not result in the identification of any critical or very important issues, the IAS issued two important recommendations in the following areas:

- Monitoring compliance with dissemination, exploitation, and communication requirements;
- Processes and procedures.

The ECSEL JU set up a detailed action plan to address the risks underlying these recommendations. By Q4 of 2020, the ECSEL JU was able to confirm that the action plan related to the two recommendations was implemented. These recommendations were revised by the Internal Audit Service. Based on the results of the IAS follow-up audit, the IAS concluded in January 2021 that the recommendations have been adequately and effectively implemented and will therefore be closed.

8.2.6 Risk management

Risk Management is one of the key elements in an effective internal control framework. ECSEL JU systematically analyses the risks in relation to its main activities at least once a year, develops action plans to address them and assigns staff responsible for implementing those plans.

A risk is defined as "any event or issue that could occur and adversely impact the achievement of the ECSEL JU´s strategic and operational objectives. Lost opportunities are also considered as risks". Hence, risks relate to the non-achievement of objectives.

The ECSEL JU management performed an annual risk assessment complementary to the work performed by the internal auditor. The risk assessment exercise took place in the last quarter of the year and as a result the risk register was updated. In addition, in 2020, a specific covid-19 risk assessment was performed.

At JU level, the risk register documents the most significant risks and provides a record of risks and measures taken to manage them. Risks listed in the risk register are assessed in terms of impact and likelihood, mitigation actions are proposed to reduce the probability of the risk materialising or the severity of the exposure should the risk occur, and owners are identified.

The risks included in the risk register are detailed in the following table which also contains the main mitigation actions:

Risk title	Risk Description	Action Plan Summary - Brief description
Inadequate number or framework of resources in the JU	Risk of inadequate resources due to issues with retention, motivation workload, long time absences	Possible actions: • Development of rotation plans • Back-up based on projects not per staff member.
Dependence on Common Implementation Centre for workflows	The underlying legal basis for H2020 programme establishes a centralised and uniformed programme management approach – activity entrusted to the CIC. In such a context, the IT tools adaptability to ECSEL specificities is sometimes limited. The potential risks are linked with: - Tools not working properly => causing delay in the operational processes => interest on late payments - Delay in the setting of the workflows and further need of fine-tuning - Grant agreement changes retroactively - Loss of visibility/credibility vis-à-vis the stakeholders due to delayed decisions and/or payments, lack of clarity on procedures to be followed etc.	Organise consultations/meetings with CIC to raise issues
Data and system security breach & dependency on IT systems	Risk of data and system security breach and leak of sensitive information either due to hacking or internal risk. In addition, the lack of awareness of the JUs Code of conduct and more specially of rules regarding ethical behaviour by the staff could lead to breach of ethical behaviour (e.g., sensitive information being disclosed to third parties). Claims against the organisation due to disclosure of business sensitive/ confidential information.	Training of staff on ethics and integrity and external communication to raise the awareness on the matter.
Full dependency on IT infrastructure increased due to covid-19 circumstances	Full dependency upon the good working of various aspects of IT infrastructure, internal and external Lack of backup solutions for certain key personnel	Heavy reliance for IT on ECSEL IT manager/Realdolmen. Action: identify back up for remote meetings. (NB work-around for Outlook using webmail tool is an effective backup but does not replace access to either SharePoint or Shared Drives)

Access to confidential project data by third parties	ECSEL JU projects involve some confidential information that require protection to guarantee the market value of the final product	Include confidentiality in the JU´ s suggestions for the new Council Regulation as a point to be addressed more thoroughly on the regulatory front (done) In particular, confidentiality was consistently raised as an issue upon requests by EC to access or be transferred project data - liability being also of the essence (done) A specific form of confidentiality undertaking was developed for third parties (incl. JU members) accessing sensitive data - and is in use (done) Action to be established on steps to take if a beneficiary shares confidential data (need to take action if cases arise)
Not achieving the target values of IKOP	Not achieving target values of IKOP. Certification of IKOP as defined in Council Regulation , which indicates an approximate ratio of 1:1.4:1	Prepare actual updates on a yearly basis with latest information on project data (as part of IKOP validation for accounts)
insufficient communication of project publishable results/ success stories	1.Insufficient communication of success stories 2. Inappropriate target audience for the information produced by projects for public information, making communication ineffective (or counter-productive) external communication: right info to right audience. Impact not communicated adequately to the right audience	Continue Communication actions as in previous years

Data protection

European Regulation (EU) N°2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons regarding the processing of personal data by the Union institutions, bodies, offices, and agencies on the free movement of such data ("EUI-GDPR") has been implemented by ECSEL JU with the support of an external contractor.

This has resulted in a complete review of the protection of personal data by the Joint Undertaking's staff and an update of the general privacy policy. Specific privacy policies have been drafted to cover the specific following fields: applicants privacy policy in the context of selection and recruitment, access to documents, events, external experts, grant management and procurement procedures. An online register of processing activities has been developed and is available on ECSEL website: https://www.ecsel.eu/register-processing-activities.

Conflict of interest

In 2020, the ECSEL JU continued to apply the Governing Board Decision on the rules on the prevention and management of conflicts of interest (ECSEL GB 2015.41). It addresses all actors involved in the Joint Undertaking activities, including staff, PAB and GB members, experts involved in projects reviews and evaluations, participants in procurement and recruitment committees.

The PAB has updated its rules of procedure to clarify conflict of interest provisions to guarantee confidentiality and absence of conflict of interest of delegates, in particular during the approval process of project proposals (ECSEL PAB 2020.48).

9 Declarations of Assurance

9.1 Reservations

There are no elements that indicate any reservation is necessary.

9.2 Declarations of assurance

9.2.1 Declaration of Assurance of the Executive Director

I, the undersigned,

Executive Director of the ECSEL JU

In my capacity as the authorising officer

Declare that to the best of my knowledge the information contained in this report gives a true and fair view.

State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.

This reasonable assurance is based on my own judgement and on the information at my disposal, such as the results of the self-assessment, ex-post controls, the work of the Internal Audit Service and the lessons learnt from the reports of the Court of Auditors for years prior to the year of this declaration.

Confirm that I am not aware of anything not reported here which could harm the interests of the institution ECSEL JU.

Brussels,

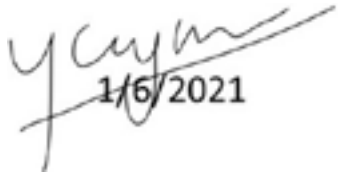
9.2.2 Joint statement of the Heads of Unit contributing to the annual activity report

We the undersigned hereby declare that the information provided in our respective contributions to the present Annual Activity Report and in its annexes are, to the best of our knowledge, accurate and complete in all material respects.

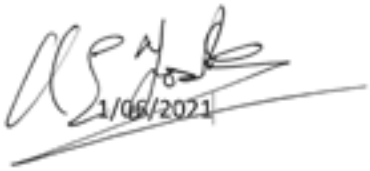
Brussels, 19th February 2021

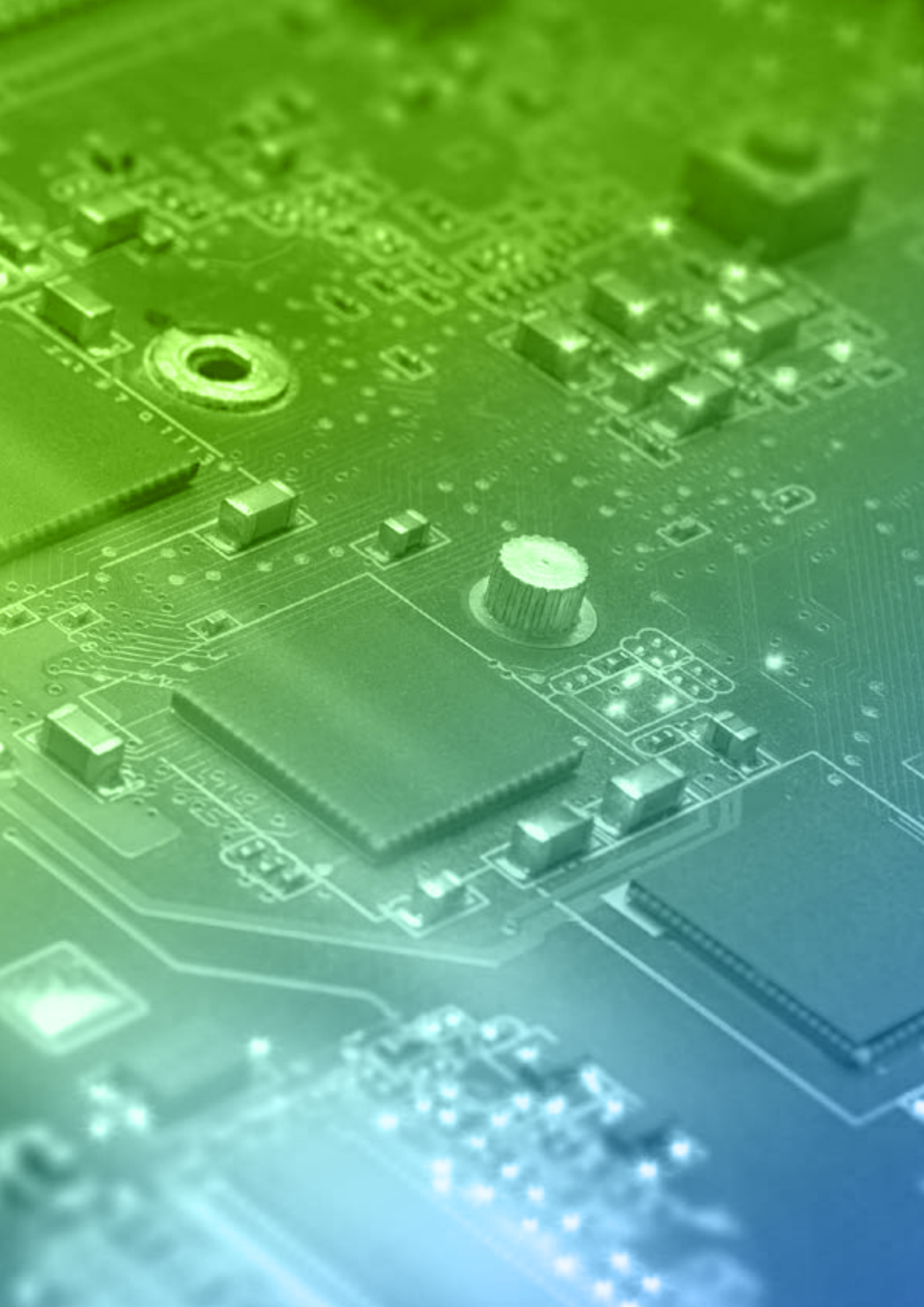
Olivier LAMBINET, Head of Finance and Administration

Yves GIGASE, Head of Programmes



Alun FOSTER, Head of Communications





10 Annexes

10.1 Annex I. Core business statistics

10.1.1 Scoreboard of H2020 common KPIs

TABLE I

Horizon 2020 Key Performance Indicators[25] common to all JTI JUs

	Correspondence to general Annex	Key Performance Indicator	Definition/ Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Result	Further information
INDUSTRIAL LEADERSHIP	12	SME - Share of participating SMEs introducing innovations new to the company or the market (covering the period of the project plus three years);	Based on Community Innovation Survey (?). Number and % of participating SMEs that have introduced innovations to the company or to the market;	Number of SMEs that have introduced innovations;	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]		351 SMEs introduced innovations from the 339 SME-beneficiaries from the projects of calls 2014 to 2016. Later years are not included as the values are only meaningful at the end of the project. The higher degree of innovation comes about because an SME can declare both a market innovation and a manufacturing related innovation. The share equals: 103%	
	13	SME - Growth and job creation in participating SMEs	Turnover of company, number of employees	Turnover of company, number of employees;	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]			Available information is not reliably stored in the system.

25 (based on Annex II to Council Decision 2013/743/EU)

	Correspondence to general Annex	Key Performance Indicator	Definition/ Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Result	Further information
SOCIETAL CHALLENGES	14	Publications in peer-reviewed high impact journals		Publications from relevant funded projects (DOI: Digital Object Identifiers); Journal impact benchmark (ranking) data to be collected by commercially available bibliometric databases.	H2020 beneficiaries through project reporting; Responsible Directorate/Service (via access to appropriate bibliometric databases)	n.a. [new approach under H2020]	[On average, 20 publications per €10 million funding (for all societal challenges)]		Not available
	15	Patent applications and patents awarded in the area of the JTI	Number of patent applications by theme; Number of awarded patents by theme	Patent application number	H2020 beneficiaries through project reporting; Responsible Directorate/Service (via worldwide search engines such as ESPACENET, WOPI)	n.a. [new approach under H2020]	On average, 2 per €10 million funding (2014 - 2020) RTD A6	4.04 patents per €10 million for finished projects (calls 2014 to 2016)	(Table 37) It should be noted that more patents were produced but could not be introduced in the system. Taking those in account the number is 5.1.
	16	Number of prototypes testing activities and clinical trials[26]	Number of prototypes, testing (feasibility/ demo) activities, clinical trials	Reports on prototypes, and testing activities, clinical trials	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]	[To be developed on the basis of first Horizon 2020 results]	29.9 prototypes and clinical trials per €10 million for finished projects (calls 2014 to 2016)	(Table 37)
	17	Number of joint public-private publications in projects	Number and share of joint public-private publications out of all relevant publications.	Properly flagged publications data (DOI) from relevant funded projects	H2020 beneficiaries through project reporting; Responsible Directorate/ Service (via DOI and manual data input-flags)	n.a. [new approach under H2020]	[To be developed on the basis of first Horizon 2020 results]	37.04 publications per €10 million EU funding for finished projects (calls 2014 to 2016)	(Table 37) All those publications are open access
	18*	New products, processes, and methods launched into the market	Number of projects with new innovative products, processes, and methods,	Project count and drop-down list allowing to choose the type processes, products, methods,	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]	[To be developed on the basis of first Horizon 2020 results]	15.8 innovations per €10 million for finished projects (calls 2014 to 2016)	(Table 37)
EVALUATION	NA	Time to inform (TTI) all applicants of the outcome of the evaluation of their application from the final date for submission of completed proposals	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number and % of information letters sent to applicants within target Average TTI (calendar days) Maximum TTI (calendar days)	Joint Undertaking	71	52 calendar days	44 letters 100% 89 calendar days 89 calendar days	This concerns the RIA and IA calls 2020. The longer delay in announcing the results is due to the planning of the PAB that decides the selection.

Clinical trials are IMI specific

	Correspondence to general Annex	Key Performance Indicator	Definition/ Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Result	Further information
EVALUATION	NA	Redress after evaluations	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number of redresses requested	Joint Undertaking	FP7 latest know results?		No request for redress	
GRANTS	NA	Time to grant (TTG) measured (average) from call deadline to signature of grants	To minimise the duration of the granting process aiming at ensuring a prompt implementation of the Grant Agreements through a simple and transparent grant preparation process	Number and % of grants signed within target	Joint Undertaking	n.a. [new approach under H2020]	TTG < 270 days (as %of GAs signed)	For projects of Call 2019 signed in 2020: 14 projects 100% grants signed within target In calendar days. Average TTG: 245 Max TTG: 254	
	NA	Time to sign (TTS) grant agreements from the date of informing successful applicants (information letters)	To minimise the duration of the granting process aiming at ensuring a prompt implementation of the Grant Agreements through a simple and transparent grant preparation process	Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	Joint Undertaking	n.a. [new approach under H2020]	TTS 92 calendar days	Not applicable any more in H2020, the only KPI is the 8 months	
PAYMENTS	NA	Time to pay (TTP) (% made on time) -pre-financing - interim payment -final payment	To optimize the payments circuits, both operational and administrative, including payments to experts	Average number of days for Grants pre-financing, interim payments, and final payments; Average number of days for administrative payments; Number of experts appointed	Joint Undertaking		-pre-financing (30 days) - interim payment (90 days) -final payment (90days)	For ECSEL JU (H2020) payments: Pre-financing: 100 % were on time Interim payment: 100% were on time Final payment: 100% were on time Experts: see else where	

	Correspondence to general Annex	Key Performance Indicator	Definition/ Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Result	Further information
HR	NA	Vacancy rate (%)		% of post filled in, composition of the JU staff [27]	Joint Undertaking	n.a. [new approach under H2020]		9.68% 1 SNE (non-successful recruitment) and 2 CA (retirement)]. A recruitment procedure for the filling of CA posts was launched in 2020 and is to be finalised in Q1 2021	
JU EFFICIENCY	NA	Budget implementation/ execution: 1. % CA to total budget 2. % PA to total budget	realistic yearly budget proposal, possibility to monitor and report on its execution, both in commitment (CA) and payments (PA), in line with sound financial management principle	% of CA and PA	Joint Undertaking			100% of CA 89% of PA	
	NA	Administrative Budget: Number and % of total of late payments	realistic yearly budget proposal, possibility to monitor and report on its execution in line with sound financial management principle	Number of delayed payments % of delayed payments (of the total)	Joint Undertaking			32 payments were delayed (6.08% of total administrative payments)	

NOTES:

18* This indicator is not a legally compulsory one, but it covers several additional specific indicators requested for more societal challenges by the services in charge.

27 Additional indicators can be proposed/discussed with R.1 and/or DG HR

10.1.2 Indicators for monitoring cross-cutting issues

TABLE II

Indicators for monitoring H2020 Cross-Cutting Issues[28] common to all JTI JUs

Correspondence in the general Annex 2	Cross-cutting issue	Definition/ Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	Result End 2016	Further information
2	Widening the participation	2.1 Total number of participations by EU-28 Member State	Nationality of H2020 applicants & beneficiaries (number of)	H2020 applicants & beneficiaries at the submission and grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Participants at submission in calls 2020 from: AT, BE, BG, CZ, DE, DK, EL, ES, FI, FR, HU, IE, IT, LT, LV, NL, PL, PT, RO, SE, SK, UK Representing 1464 participants At selection: same MS except BG and UK and 442 beneficiaries	For calls 2020
		2.2 Total amount of EU financial contribution by EU-28 Member State (EUR millions)	Nationality of H2020 beneficiaries and corresponding EU financial contribution	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report	YES	The amount for signed grant agreements: 153M€ out of a total of 165M€	For calls 2019
NA		Total number of participations by Associated Countries	Nationality of H2020 applicants & beneficiaries (number of)	H2020 applicants & beneficiaries at the submission and grant agreement signature stage	JU AAR RTD Monitoring Report	YES	At submission: CH, NO, IS, IL, TR for 136 participants At selection: 36 beneficiaries	For calls 2020
		Total amount of EU financial contribution by Associated Country (EUR millions)	Nationality of H2020 beneficiaries and corresponding EU financial contribution	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report	YES	The amount for grant agreements 13M€	For calls 2020
3	SMEs participation	3.1 Share of EU financial contribution going to SMEs (Enabling & industrial tech and Part III of Horizon 2020)	Number of H2020 beneficiaries flagged as SME; % of EU contribution going to beneficiaries flagged as SME	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report	JU AAR	The amount for grant agreements signed in 2020 165 beneficiaries 18% of total EU funding	For calls 2019

28 (based on Annex III to Council Decision 2013/743/EU)

6	Gender	6.1 Percentage of women participants in H2020 projects	Gender of participants in H2020 projects	H2020 Beneficiaries through project reporting	JU AAR	YES	19% women participating in all ECSEL projects	All projects but missing information for recent projects
		6.2 Percentage of women project coordinators in H2020	Gender of MSC fellows, ERC principal investigators and scientific coordinators in other H2020 activities	H2020 beneficiaries at the grant agreement signature stage	JU AAR	YES	The amount women project coordinators for grant agreements signed in 2020: 0	For calls 2019
		6.3 Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of memberships in advisory groups, panels, etc.	Compiled by Responsible Directorate/ Service/ Joint Undertaking based on existing administrative data made available by the CSC	JU AAR	YES	Unavailable, no data received from CIC	
7	International cooperation	7.1 Share of third-country participants in Horizon 2020	Nationality of H2020 beneficiaries	H2020 beneficiaries at the grant agreement signature stage	JU AAR RTD Monitoring Report	YES	IN The number of beneficiaries in calls 2020 1	For calls 2020
		7.2 Percentage of EU financial contribution attributed to third country participants	Nationality of H2020 beneficiaries and corresponding EU financial contribution	H2020 beneficiaries at the grant agreement signature stage	U AAR RTD Monitoring Report	YES	0%	For calls 2020
9	Bridging from discovery to market[29]	9.1 Share of projects and EU financial contribution allocated to Innovation Actions (IAs)	Number of IA proposals and projects properly flagged in the WP; follow up at grant level.	Project Office – at GA signature stage he/she will be required to flag on SYGMA. Responsible Directorate/Service (WP coordinator)/ Joint Undertaking - via tool CCM2	JU AAR RTD Monitoring Report		The number of IA projects selected in 2020 6	For calls 2020
		9.2 Within the innovation actions, share of EU financial contribution focussed on demonstration and first-of-a-kind activities	Topics properly flagged in the WP; follow-up at grant level	Responsible Directorate/Service (WP coordinator)/ Joint Undertaking - via tool CCM2	JU AAR RTD Monitoring Report		Information not available from CCM2	
NA		Scale of impact of projects (High Technology Readiness Level)	Number of projects addressing TRL[30] between… (4-6, 5-7)?	Joint Undertaking	JU AAR RTD Monitoring Report		For the JU this is the difference between RIA and IA actions. For the grant agreements signed in 2020: 8 projects address the TRL levels with a focus 3-4 and 6 projects address the TRL levels with a focus 5-8	For calls 2020

29 This indicator (9.2) is initially intended to monitor the Digital Agenda (its applicability could be only partial)
30 TRL: Technology Readiness Level

11	Private sector participation	11.1 Percentage of H2020 beneficiaries from the private for-profit sector	Number of and % of the total H2020 beneficiaries classified by type of activity and legal status	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report		The % private beneficiaries of the total H2020 beneficiaries at grant agreement signature stage from calls 2020 67%	For calls 2020
		11.2 Share of EU financial contribution going to private for-profit entities (Enabling & industrial tech and Part III of Horizon 2020)	H2020 beneficiaries classified by type of activity; corresponding EU contribution	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report		The % for at grant agreement signature stage 65%	For calls 2020
12	Funding for PPPs	12.1 EU Financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187)	Responsible Directorate/Service/	JU AAR		The EU contribution to ECSEL for the year 2020 amounts to: € 191 million	
		12.2 PPPs leverage: total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution	Total funding made by private actors involved in PPPs - in-kind contribution already committed by private members in project selected for funding - additional activities (i.e., research expenditures/ investment of industry in the sector, compared to previous year)	Joint Undertaking Services	JU AAR RTD Monitoring Report JU annual accounts (part of)		The ratio of the cost committed by the private members (all beneficiaries in the projects) in the projects selected in 2018 divided by the EU funding for those partners equals 4.	According to the ECSEL Council Regulation, only beneficiaries should be counted that are constituent entities of the private members (i.e. industry associations0 or their affiliates
13	Communication and dissemination	13.3 Dissemination and outreach activities other than peer-reviewed publications - [Conferences, workshops, press releases, publications, flyers, exhibitions, trainings, social media, websites, communication campaigns (e.g., radio, TV)]	A drop-down list allows the type of dissemination activity to be chosen. Number of events, funding amount and number of persons reached thanks to the dissemination activities	H2020 Beneficiaries through project reporting	JU AAR RTD Monitoring Report	YES	Information not available. The number of open access publications is available but not the ones that are peer reviewed.	

14	Participation patterns of independent experts	14.2 Proposal evaluators by country	Nationality of proposal evaluators	Responsible Directorate/Service/ Joint Undertaking in charge with the management of proposal evaluation	JU AAR		Information available in chapter 5	See chapter 5
		14.3 Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Responsible Directorate/Service/ Joint Undertaking in charge with the management of proposal evaluation	JU AAR	YES	Information available in chapter 5	See chapter 5
NA	Participation of RTOs and Universities	Participation of RTO[31]s and Universities in PPPs (Art 187 initiatives)	Number of participations of RTOs to funded projects and % of the total Number of participations of Universities to funded projects and % of the total % of budget allocated to RTOs and to Universities	H2020 beneficiaries at the grant agreement signature stage	JU AAR RTD Monitoring Report	YES	The amounts at grant agreement signature for universities and RTOs and other not for profit organizations are: Participations: 165 % Participations: 35% % EU funding: 38%	For calls 2020
NA	Ethics	The objective is ensuring that research projects funded are compliant with provisions on ethics efficiently	% of proposals not granted because non-compliance with ethical rules/ proposals invited to grant (target 0%); time to ethics clearance (target 45 days) [32]	Responsible Directorate/Service/ Joint Undertaking	JU AAR RTD Monitoring Report		0%	NA
NA	Audit	Error rate	% of common representative error; % residual error	CAS	JU AAR RTD Monitoring Report		Representative error rate: 2.68% Residual Error rate ECSEL JU: 1.25%	
		Implementation of ex-post audit results	Number of cases implemented; in total €million; ´of cases implemented/total cases	CAS	JU AAR RTD Monitoring Report			

Notes:

* H2020 applicants - all those who submitted H2020 proposals
*H2020 beneficiaries - all those who have signed a H2020 Grant Agreement
*Responsible Directorate - DG RTD Directorates and R&I DGs family in charge with management of H2020 activities
*Services -Executive Agencies and other external bodies in charge with H2020 activities
*Project officer - is in charge of managing H2020 projects in Responsible Directorate/Service including Executive Agencies

31 RTO: Research and Technology Organisation
32 Data relates to pre-granting ethics review. This time span runs in parallel to granting process.

10.1.3 Scoreboard of KPIs specific to ECSEL JU

The adopted KPIs are mentioned in 2nd amendment to the Workplan 2020 (decision GB 2020.141). The KPI-guidelines are also included below.

10.1.3.1 Operational performance

KPI	Definition	Baseline	Objective for year 2020	Achieved in 2020	Reference, comment
OP-1	% New participating entities	33%	>40%	45%	Table 7: Participations and entities
OP-2	Success rate %	17%	>25%	35%	5.3.2.2.2 Selection of proposals
OP-3	Budget % of selected projects along value chain				This criterium was dropped by the GB
OP-4	Time to grant % below maximum time	100%	100%	93%	5.8.3. Calls 2020: organisation, conditions
OP-5	Time to payments % Late	2%	<2%	6.33%	Source: ABAC DWH
OP-6	% Projects achieving insufficiently (Monitoring)	5%	<5%	0%	Table 31: Results of the ECSEL project reviews
OP-7	Lighthouse activity	5	>5	5 each	
OP-8	Ethics: projects not complying	2%	<2%	0%	
OP-9	Redress requested	0	0	0	
OP-10	Gender (%women in projects)				This criterium was dropped by the GB
OP-11	Participants from non-EU state	5%	7%	9.4%	Most non-EU participants from Turkey, Switzerland, Israel, and Norway
OP-12	Error rate: % common representative errors	2%-5%	<2%	1.25%	
OP-13	Events/Communication	10	>10	15	(co)organiser of 3 major public events, 3 "Impact Visits", 1 outreach event (university students), 1 meeting PermRep+PAB, 7 presentations/meetings with key institutional partners

KPI	Definition	Description
OP-1	% New participating entities	Percentage of entities (identified by using PIC number) to total that are participating in one of the submitted proposals at the FPP stage and that have not participated in any of the proposals at FPP stage in the 3 preceding years.
OP-2	Success rate %	Percentage of selected and funded proposals to all eligible submitted proposals at FPP stage
OP-3	Budget % of selected projects along value chain[33]	To allow a proper measure for this we need a reliable portfolio analysis. The portfolio analysis is in progress.
OP-4	Time to grant % below maximum time	Percentage of grants that are signed in time (that is within the 8 months from the FPP deadline)
OP-5	Time to payments % Late	Percentage of payments (operational and administrative) that are past deadline
OP-6	% Projects achieving insufficiently (Monitoring)	Percentage of the project under monitoring that are assessed as insufficient at yearly review
OP-7	Lighthouse activity	Number of events attended or organised
OP-8	Ethics: projects not complying	Percentage of projects that at review show insufficient on the ethics part.
OP-9	Redress requested	Redress requested in any of the workflows
OP-10	Gender (%women in projects)	The SYGMA system previously did not allow to automatically extract the gender proportion per project. This recently changed and the data are explained in Chapter 5.3.2.4 The ECSEL calls: 7-year programme results.
OP-11	Participants from non-EU state (associated or third country)	Percentage of participants in selected projects from non-EU countries
OP-12	Error rate: % common representative errors	% common representative errors
OP-13	Events/Communication	Number of: presentations given by ECSEL staff at non ECSEL events, publications, organised events by ECSEL.

33 Dropped by GB

10.1.3.2 Programme performance KPI

KPI	Definition	Baseline	Objective for year 2020	Achieved in 2020	Reference, comment
PP-1	Number of projects	10	>12	14	5.3.2.2.2 Selection of proposal
PP-2	National Funding / EU Funding per year	0.92	0.95	1.0	Table 14: Cost and Funding for selected projects (figures for 2020 not yet final)
PP-3	Private partners / Public partners	1.5	2.0	1.7	The overall value for the ECSEL programme is 1.8 (Table 19).
PP-4	Average Size of project RIA	EUR 27 million H2020 Cost 30 Beneficiaries	EUR 27 million H2020 Cost 30 Beneficiaries	EUR 30 million 34	Table 15: Average beneficiaries, cost, and funding per (selected) project
PP-5	Average Size of project IA	EUR 80 million H2020 Cost 40 Beneficiaries	EUR 80 million H2020 Cost 40 Beneficiaries	EUR 71 million 35	Table 15: Average beneficiaries, cost, and funding per (selected) project
PP-6	EU-countries without national funding Countries participating in the call	5 20	<5 >20	5 29	(BG, EL, LT, SL, UK)
PP-7	Oversubscription	2.0	2.0	3.0	5.3.2.1 Submission of proposals.
PP-8	Number of patents per EUR 10 million of EU funding	3	>3	5.1	All projects call 2014-2016
PP-9	Participation of SMEs to the programme	25%	>25%	31%	All projects call 2014-2016
PP-10	Publications	Under study	Under study	1984	Number of publications by finished projects

KPI	Definition	Description
PP-1	Number of projects	Number of selected projects
PP-2	National Funding / EU Funding per year	Ratio for the selected projects of the total national funding to the total EU funding
PP-3	Private partners / Public partners	Ratio for the selected projects of the total participation of private entities (Large enterprises and SMEs) to the public entities
PP-4	Average Size of project RIA	Average H2020 cost for selected project and
PP-5	Average number of beneficiaries for selected project	Average H2020 cost for selected project and Average number of beneficiaries for selected project
PP-6	EU-countries without national funding Countries participating in the call	Number of EU countries without national funding in the call but with beneficiaries in the selected calls All countries participating in the selected projects of the call
PP-7	Oversubscription	Average of EU and national oversubscription. Oversubscription is calculated as the requested funding for the eligible proposals submitted at the FPP divided by the total amount that is committed by the funding authority
PP-8	Number of patents per EUR 10 million of EU funding	Number of patents for all finished ECSEL projects divided by the total EU funding for those projects (per EUR 10 million)
PP-9	Participation of SME to the programme	Proportion of SMEs participating in the selected projects of the calls of that year.
PP-10	Publications	Number of publications in one year as published by the projects under review[34]

10.1.3.3 Impact KPI

Will be defined according to the lines of the Key Impact Pathways (KIP) defined for the Horizon Europe programme.

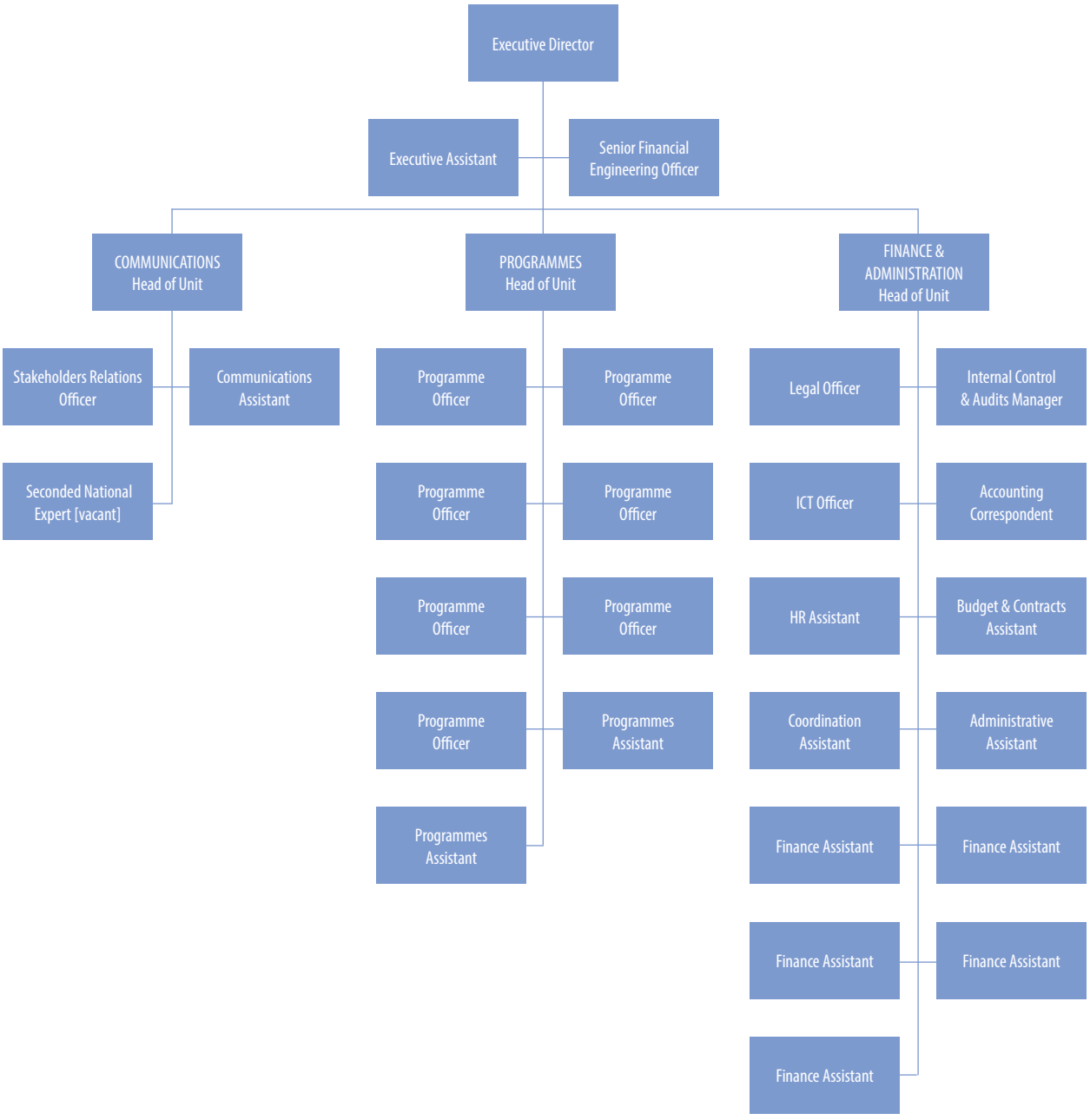
10.2 Annex III. Establishment plan at 31.12.2020

Positions	ED	Unit A	Unit B	Unit C	Total
TAD	2	2	8	2	14
TAST					
CA	1	1	2	12	16
SNE		1			1
Total	3	4	10	14	31

ED: Executive Directors: Office
TAD: Temporary Agent - Administrator
TAST: Temporary Agent - Assistant
CA: Contract Agent
SNE: Seconded National Expert (position authorised but not yet filled)

34 This should be rephrased as total number of publications since begin of programme.

10.3 Annex IV. Organisational chart



10.4 Materiality criteria

The 'materiality' concept provides the Executive Director with a basis for assessing the importance of the weaknesses/risks identified and thus whether those weaknesses should be subject to a formal reservation to his declaration. The materiality criteria are applicable to the H2020 programme.

When deciding whether something is material, both qualitative and quantitative terms must be considered.

In qualitative terms, when assessing the significance of any weakness, the following factors are considered:

- The nature and scope of the weakness;
- The duration of the weakness;
- The existence of compensatory measures (mitigating controls which reduce the impact of the weakness);
- The existence of effective corrective actions to correct the weaknesses (action plans and financial corrections) which have had a measurable impact.

In quantitative terms, to make a judgement on the significance of a weakness, the potential maximum (financial) impact is quantified.

Whereas the ECSEL JU control strategy is of a multi-annual nature (i.e., the effectiveness of the JU's control strategy can only be assessed at the end of the programme, when the strategy has been fully implemented and errors detected have been corrected), the Executive Director is required to sign a declaration of assurance for each financial year. To determine whether to qualify his declaration of assurance with a reservation, the effectiveness of the JU's control system must be assessed, not only for the year of reference, but more importantly, with a multi-annual outlook.

The control objective for ECSEL JU is to ensure that the 'residual error rate', i.e., the level of errors which remain undetected and uncorrected, does not exceed 2 % by the end of the JU's programme. Progress towards this objective is to be (re)assessed annually, in view of the results of the implementation of the ex-post audit strategy. As long as the residual error rate is not (yet) below 2 % at the end of a reporting year within the programme's life cycle, a reservation would (still) be made. Nevertheless, apart from the residual error rate, the Executive Director may also consider other management information at his disposal to identify the overall impact of a weakness and determine whether it leads to a reservation.

If an adequate calculation of the residual error rate is not possible, for reasons not involving control deficiencies, the consequences are to be assessed quantitatively by estimating the likely exposure for the reporting year. The relative impact on the declaration of assurance would then be considered by analysing the available information on qualitative grounds and considering evidence from other sources and areas (e.g., information available on error rates in more experienced organisations with similar risk profiles).

The starting point for determining the effectiveness of the controls in place is the 'representative error rate' (RepER) expressed as a percentage of errors in favour of the ECSEL JU detected by ex-post audits measured with respect to the amounts accepted after ex-ante controls.

The representative error rate will be based on the weighted average error rate (WAER) for a population, from which a random sample has been drawn according to the following formula:

Where: $$WAER\% = \frac{\Sigma\,(er)}{A} = RepER\%$$

Σ (er) =sum of all individual error rates of the sample (in value).
Only the errors in favour of the JU will be taken into consideration;
A = total amount of the audited sample expressed in EUR.
Second step: calculation of residual error rate.

To take the impact of the ex-post controls into account, this error level is to be adjusted by subtracting:

- errors detected and corrected as a result of the implementation of audit conclusions;
- errors corrected as a result of the extrapolation of audit results to non-audited contracts with the same beneficiary.

This results in a residual error rate, which is calculated by using the following formula:

$$ResER\% = \frac{[RepER\% * (P-A) - RepERsys\% * E]}{P}$$

Where:

ResER% = residual error rate, expressed as a percentage;
RepER% = representative error rate, or error rate detected in the representative sample, in the form of the WAER, expressed as a percentage and calculated as described above (WAER%).
RepERsys% = systematic portion of the RepER% (the RepER% is composed of complementary portions reflecting the proportion of 'systematic' and 'non-systematic' errors detected) expressed as a percentage.
P = total amount of the auditable population of cost claims, expressed in EUR.
A = total amount of all audited amounts, expressed in EUR.
E = total non-audited amounts of all audited beneficiaries, expressed in EUR. This will comprise the total amount of all non-audited but validated and paid costs for all audited beneficiaries, excluding those beneficiaries for which an extrapolation is ongoing.

This calculation will be performed on a point-in-time basis, i.e., all the figures will be provided as of a certain date.

10.5 List of acronyms

CCAM	Cooperative Connected Automated Mobility
COSO	Committee of Sponsoring Organizations of the Treadway Commission, sponsored and funded by the Institute of Internal Auditors (IIA), the Institute of Management Accountants (IMA), Financial Executives International (FEI) and the US Accounting Organisations (AAA & AICPA)
DMO	Document Management Officer
DPO	Data Protection Officer
DRAM	Dynamic Random-Access Memory
EC	European Commission
ECA	European Court of Auditors
ECSEL	"Electronic Components and Systems for European Leadership"
EDPS	European Data Protection Supervisor
EPS	ECSEL Participating State
ESIF	European Structural and Investment Funds
EUR	Euro
FPP	Full Project Proposal
GB	Governing Board
HLG	High-Level Experts Group
IA	Innovation Action
IAS	Commission's Internal Audit Services
ICF	Internal Control Framework
ICS	Internal Control Standard
IDM	Integrated Devices Manufacturer
IMI	Innovative Medicines Initiative, a JU
IPCEI	Important Project of Common European Interest
IT	Information Technology
JTI	Joint Technology Initiative
JU	Joint Undertaking
JUGA	Joint Undertaking Grant Agreement
KDT	Key Digital Technologies (future JU)
KET	Key Enabling Technology
KPI	Key Performance Indicator
LEIT	Leadership in Enabling and Industrial Technologies
LISO	Local IT Security Officer
MARTE	Standards for Modelling and Analysis of Real-Time and Embedded systems
MASP	Multi Annual Strategic Plan
MASRIA	Multi Annual Strategic Research and Innovation Agenda
MEMS	Micro Electro-Mechanical System
NFA	National Funding Authority
NGA	National Grant Agreement
NPA	National Public Authority
PA	Public Authority
PAB	Public Authorities Board
PO	Preliminary Offer - Programme Officer - Project Outline - Programme Office
R&D	Research and Development
R&D&I	Research, Development, and Innovation
RIA	Research and Innovation Action
RIAP	Research and Innovation Activities Plan
TRL	Technology Readiness Level
WP	Work Plan

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