# 2021

# ANNUAL ACTIVITY REPORT

EUROPEAN PARTNERSHIP

KDT JU
KEY DIGITAL TECHNOLOGIES JOINT UNDERTAKING

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[1], Framework Financial Regulation No 2019/7152[2].

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.

With the Council Regulation 2021/2085[3] of 19 November 2021 ECSEL JU became KDT JU. This Annual Activity Report covers both the ECSEL JU actions until 19 November 2021, and KDT JU actions from the said date onwards.

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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

3 REGULATION (EU) 2021/2085 of 19 November 2021 establishing the Joint Undertakings under Horizon Europe and repealing Regulations (EC) No 219/2007, (EU) No 557/2014, (EU) No 558/2014, (EU) No 559/2014, (EU) No 560/2014, (EU) No 561/2014 and (EU) No 642/2014.

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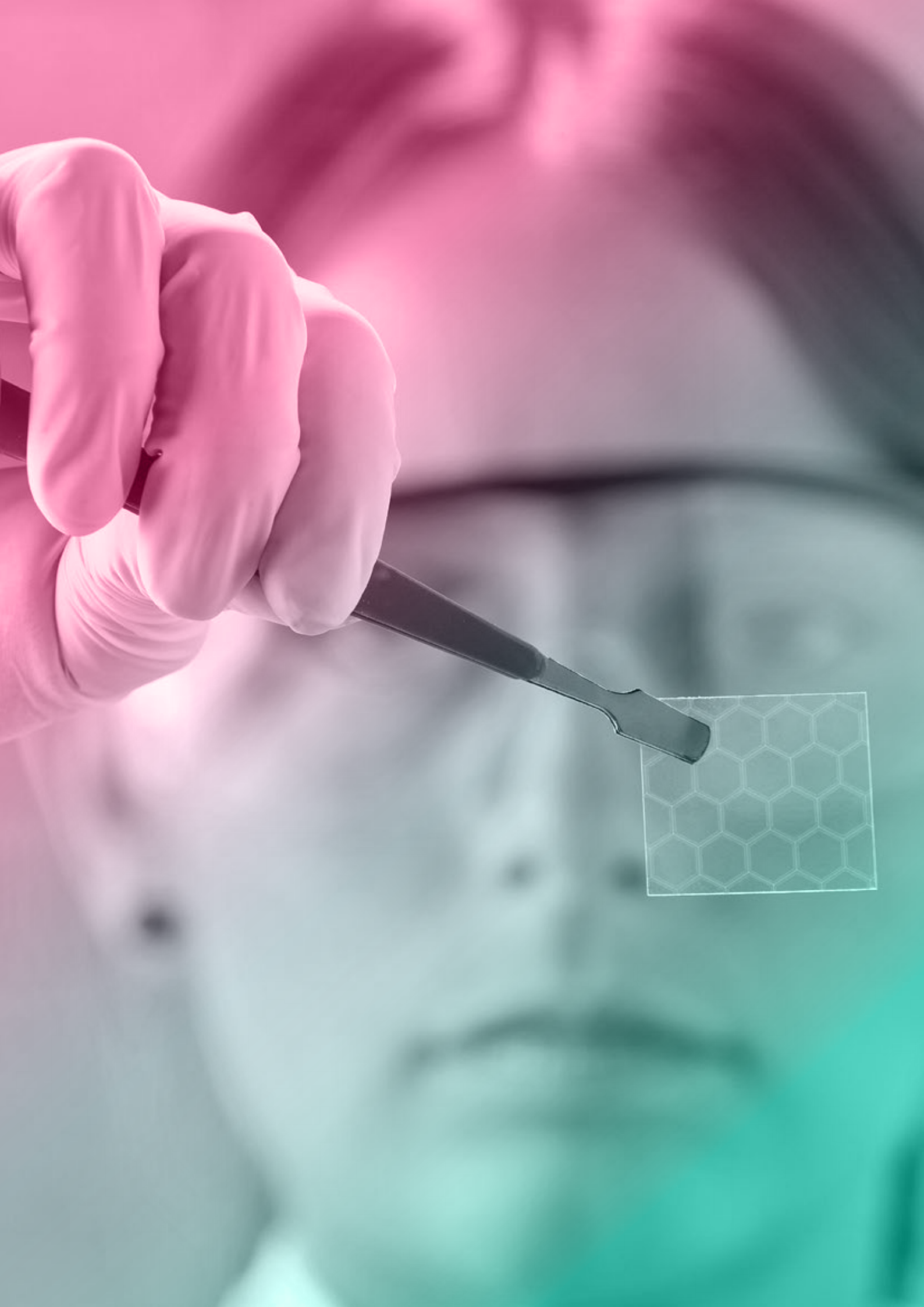
# 1. Introduction and Fact Sheet

| | |
|---|---|
| **Name** | Electronic Component and Systems for European Leadership (ECSEL) Joint Undertaking (JU) |
| **Objectives** | The ECSEL JU shall have the following objectives:<br>a) to contribute to the implementation of Regulation (EU) No 1291/2013, and in particular part II of Decision 2013/743/EU;<br>b) to contribute to the development of a strong and globally competitive electronics components and systems industry in the Union;<br>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;<br>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;<br>e) to maintain and grow semiconductor and smart system manufacturing capability in Europe, including leadership in manufacturing equipment and materials processing;<br>f) to secure and strengthen a commanding position in design and systems engineering including embedded technologies;<br>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<br>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[4] (referred to in the following as the REGULATION) |
| **Executive Director** | Bert De Colvenaer |
| **Governing Board** | Chair: Dr. Sabine Herlitschka / Dr. Ralf Bornefeld (from 14 Dec 2021)<br>Vice-chairs: Doris Vierbauch, Lucilla Sioli and Jean-Luc di Paola-Galloni<br>Members: see Chapter 7.1.1 |
| **Public Authorities Board** | Chair: Doris Vierbauch<br>Vice-chair: Kari Leino<br>Members: see Chapter 7.1.3 |
| **Private Members Board** | Chair: In 2021, the position was held by Jean-Luc di Paola-Galloni (INSIDE).<br>Members: see Chapter 7.1.4 |
| **Staff** | 30 positions filled (see Chapter 10.2) |
| **Work Plan** | GB 2020.151 - Work Plan 2021<br>https://www.kdt-ju.europa.eu/sites/default/files/2021-01/GB%202020.151%20-%20Annex%20WP2021%20v6.0%20clean.pdf |

| | |
|---|---|
| **2021 final adopted budget** | **Commitment appropriations:**<br>EUR 213 million final adopted budget<br>- EUR 208 million for operational costs (only KDT/Horizon Europe):<br>- EUR 4.94 million for administrative costs:<br>• Administrative contribution from EU Budget 2021: EUR 1.85 million<br>• Private members administrative contribution: EUR 2.54 million<br>• Reactivation of unused appropriations from previous years: EUR 0.55 million<br><br>**Payment appropriations:**<br>EUR 198.3 million final adopted budget<br>- EUR 193 million for operational costs (H2020 and FP7)<br>• EUR 190.5 million for H2020 operations<br>› From EU Budget 2021: EUR 94.2 million<br>› From previous years EU Budget years: EUR 57.3 million<br>› From previous years unused appropriations: EUR 39 million<br>• EUR 2.5 million for FP7 operations (from previous years unused appropriations)<br>- EUR 5.3 million for administrative costs:<br>• Administrative contribution from EU Budget 2021: EUR 1.85 million<br>• Private members administrative contribution: EUR 2.54 million<br>• Reactivation of unused appropriations from previous years: EUR 0.89 million |
| **Budget implementation on the total budget 2021 (*)** | **COMMITMENT APPROPRIATIONS IMPLEMENTATION**<br>EUR 214 million total available budget<br>- 100 % for operational costs – KDT/Horizon Europe (EUR 208 million)<br>- 93 % for administrative costs (EUR 4.62 million)<br>**PAYMENT APPROPRIATIONS IMPLEMENTATION**<br>EUR 199 million total available budget<br>- 85 % for H2020 operational costs (EUR 162 million)<br>- 23 % for FP7 operational costs (EUR 0.6 million)<br>- 84 % for administrative costs (EUR 4.84 million) |
| **Grants** | ECSEL JU: 14 grants were signed in Q2 2021 selected from two calls 2020, for a total cost of EUR 657.5 million, a total EU funding of EUR 170.5 million and funding from the ECSEL Participating States of EUR 169.7 million |
| **Strategic Research Agenda** | There was no ECSEL JU Call foreseen in 2021, so no Multi-Annual Strategic Work Plan (MASP) was produced. For the Calls of KDT-JU launched in December 2021, the Work Programme refers to the KDT SRIA adopted on December 10, 2021. https://ecscollaborationtool.eu/news-overview/news-ecs-sria-final.html |
| **Call implementation** | KDT: Number of KDT calls launched in 2021: 3 (1 RIA, 1 IA and 1 CSA). Submission, evaluation and selection in 2022 |
| **Participation, including SME's** | ECSEL JU (2014 to 2020 at FPP stage)<br>Total number of participations in submitted proposals: 9099,<br>of which SME's: 29% and private (for profit) companies (including SME): 63%<br>Total number of entities in submitted proposals: 3082,<br>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 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 2021 will be presented in the context of the Annual Accounts 2021 and the Report of Budgetary and Financial Management as per the JU Financial Rules.

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



# 2. Foreword by the Executive Director

Many of us would have hoped and liked to see 2021 as the year of the start of the Roaring Digital Twenties. I was one of them, referring to the foreword of the AAR 2020. But the time was not (yet) right.

In many aspects, 2021 has been the year of the patience : the pandemic did not come to an end, the next generation JUs were kept under preparation, the Alliance on Processors and Semiconductor Technologies and the European Chips Act, geopolitics kept slumbering, …

We all got used to the unusual. Over a period of less than 2 years, teleworking, video meetings, paperless workflows and e-administration became the new normal. Return to the old, pre-corona way of working will not be easy, if at all necessary. By now, we all have colleagues we did not meet in person for 2 years, but we met frequently on screen, in a virtual background/ environment. Few planes were taken. Most hairs became greyer. Few hands were shaken. How long is this tunnel?

The preparation of the Single Basic Act (SBA), the legal basis of the next (3rd) generation Joint Undertakings took much/ more time than expected. The respective particularities and the horizontal commonalities for the JUs did not allow for easy discussions and quick agreements. For a while, the ambition to simplify the tri-partite JU model by Central Management of Financial Contributions (CMFC) loaded the discussion. Our ambition to launch a tripartite co-funded call in 2021 relieved the pressure and KDT JU was the only JU able to launch its call in 2021, directly benefitting of having the participating states in the KDT JU governance. Tri-partites can go quicker!

Amongst many other effects of industry, society and health, the Chips shortage remained a loud booming noise in our ECS' sectors ears. A stress test with a sound and bold re-action? With the presentation of the Chips Act on 8 February 2022, the European Commission kept word: with a projected funding by 2030 of 43 B€, the Chips Act would prove an unprecedented acceleration to strengthen research and technology leadership, reinforce capacity in design, manufacturing and packaging of advanced chips, to increase European Chips production capacity, to promote and increase skills and understand deeply the ECS supply chains. KDT JU can be utmost proud as they are selected as the implementation instrument of choice by the European Commission to implement a large part (25 %) of this package. The foreseen amendment of the SBA will rename KDT into Chips JU and the implementation of some parts of the Chips for Europe Initiative will come on top of the running KDT JU scope.

The last 12 years, ENIAC, ARTEMIS, ECSEL and since 30 November 2021 also KDT, we have been building the partnerships on Electronic Components and Systems as a credible, reliable and affordable platform for the wider European community of Industries, RTOs, Universities, SMEs, the participating states and the European Commission/DG CNECT. Our achievements and success stories as referred to in the Annual Activity Reports, prove we are the unique vehicle to bring the community together and further. With the new elected KDT JU Chair, Ralf Bornefeld, we are fully ready to take up any new challenges and mandate.

I thank wholeheartedly the entire KDT JU Office team, running the administration as perfectly as clockwork. I thank all board delegates: Governing Board, Public Authorities Board and Private Members Board for their cooperative understanding, their patience and their smooth decision making. I thank Sabine Herlitschka, the outgoing ECSEL JU Chair, for her vision and leadership and bold actions. I thank and inform all our stakeholders and beneficiaries:

In 2022, we will go together, higher, faster, further.

28 February 2022

**Bert De Colvenaer**
*ECSEL / KDT JU Executive Director*

# 3. Assessment of the Annual Activity Report 2021 by the Governing Board

Looking back on 2021, the past year was still an incredibly hard period for many people due to the COVID-19 crisis and new models set by the pandemic. Challenges at societal, economic as well as individual level were highly demanding. And ICT and the related ECS technologies and communities could not escape from this perfect storm. Semiconductor manufacturing has become extremely complex.The effort it takes to get electronics delivered to the end customer at a reasonable price and timeframe are becoming increasingly challenging. For decades, many industry challenges have gone undetected in our daily lives. Yet,over the last two years, policy makers and broad public have become more aware of the semiconductor industry and the manufacturing disruption caused by the global chip shortage and massive supply chain delays. The current period has emphasised the importance of a joint effort (public-private) to face unprecedent disruption in the context of an ECS value chain which is constantly evolving with the need for resiliency in it.

The ECSEL/KDT JU has been able to efficiently continue its core activities while operating in an almost entirely remote mode. This testimony of the commitment of its members (public and private), shows the recognition of the key role played by the programme in supporting ECS technologies in securing a productive, healthy, and sustainable future for citizens of Europe.

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 under the new 'Key Digital Technologies Joint Undertaking'.

Of particular note is the fact that the ECSEL JU successfully engaged the EU budget allocated for year 2021 in its entirety. The new KDT JU was also the only JU able to launch a call still in 2021, despite its establishment was approved only in November 2021.

The 2021 calls opened on 16 December 2021, and comprised of three concurrent calls for proposals, addressing 5 topics with the special attention given to AI/Edge and Open-Source hardware such as RISC-V. The combined public funding exceeded €360 million from the EU (via the Horizon Europe programme) and from the national funding authorities of the Participating States. The first calls of KDT JU have recently closed with a count of 30 proposals, with the evaluation process currently ongoing.

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 COVID-19 restrictions) have also quietly contributed to a successful, if difficult, year.

The Governing Board recognises again, 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 followed 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 2020, 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 2020 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 the Executive Director of the ECSEL JU has reasonable assurance that suitable controls are in place and are working as intended, risks are being properly monitored and mitigated, 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 2021 appropriately describes the activities and situation of the JU, and thanks the Executive Director and his entire team for contributing to the success of KDT JU.

For the Governing Board,

Dipl.-Ing. Ralf Bornefeld

Chair

# 4. Executive Summary

In year 2 of the world-wide pandemic, we see a wider impact on our ECSEL projects: all projects in their end phase ask for minimum 6 months extension, all for valid COVID-19 reasons such as components shortages, no access to facilities, lack of resources and no F2F meetings due to lockdown or quarantine. Despite some hinderance, all projects report good or excellent progress (see section 5.5), thanks to the effort of all participants and stakeholders.

Over its lifetime, ECSEL JU has supported 91 projects and 3205 beneficiaries from 34 countries with 2,248 M€ public funding (EC + Participating States). The average funding rate is 48 % and 44 % of the participating entities are SME's. All the projects together represent 407,730 person-months of work for a total financial budget (funding and in-kind) of 4,682 M€.

The projects finished in 2021 show again excellent results. Digitalisation in the farming industry (by AFARCLOUD) is to make agriculture more efficient and cost competitive, using and applying the modern Industry 4.0 approach and showcased in different parts of Europe. The CONNECT project brought us a step closer to the microgrid as a way for better power management with the full integration of renewable energies. EuroPAT-MASIP promoted the ecosystem of ECS assembly and packaging in/towards Europe; something which is nowadays largely an Asian business. FITOPTIVIS integrated image and video processing for CPS with low power and high performance requirements. The many results may be soon exploited; many patents and publications. HiPERFORM addresses power electronics for smart mobility covering the whole supply chain. The GaN and SiC technologies researched show potential in weight, volume, cost and efficiency losses reduction. The project iDev4.0 applies the industry 4.0 approach to the ECS industry in Europe and could achieve in some cases up to 33 % time to market reduction. POSITION II pushes forward the concept of open technology platform; this is applicable in many ECS sectors and may be a step change in the ECS innovation cycle. Robust radar and lidar fusion is worked on in the project PRYSTINE and SECREDAS puts a step forward on cyber security. SILENCE covers high integrated RF applications (5G) & smart mobility and WakeMeUP progresses in the field of NVM. WinSiC4AP made nice progress with (obviously) SiC for Advanced Power applications. The above proves that the ECSEL JU projects have kept up with world class results building further on preceding projects results.

In 2021, the lighthouses and their respective CSA were running to a successful end: with the portals for project information sharing, white papers with strategic foresight & dedicated roadmaps, clear identification for synergy opportunities with and across instrument and associations. They all build a very coherent and engaged community around them. The impetus by ECSEL on the Lighthouses has well delivered and it would be unfortunate to see no further fuelling for these engaged communities under KDT.

In a year with COVID-19 and without a Call for proposals, the communication activities were tuned lower. The 10th birthday of the JU's in January was not forgotten. The virtual ECSEL JU symposium in June set off as a series of interviews with high level ECSEL stakeholders and caused very interesting interactions and reactions. The online EFECS demonstrated again a wide compilation of ECSEL projects and awarded TARANTO with "the best technology pioneer" with its BiCMOS technologies. At year end, all was put in place to launch the KDT JU with all its visuals.

In 2021 very few missions were organised and only 2 low-value procurements were required. Related to IT, the preparation for Office365 migration and ARES implementation was ongoing. All decisions were prepared for adoption by the new KDT JU's Governing Board in its first meeting of 10 December 2021 to ensure that the regulatory, legal and financial framework was in place, and thereby business continuity throughout the transition from ECSEL to KDT.

For both the administrative commitment and payment appropriations, the execution was not complete, largely due to COVID-19 impact. On the operational side, the commitment was 100 % but the payment was only 85% due to COVID-19 project delays.

All audit related matters and findings (IAS, ICAM, ECoA) were closely followed up and implemented in a timely manner. The discharge process was followed closely and properly . The internal control system was updated in 2020 and a self-assessment followed in 2021.

The controls on the operational expenditure identified a residual error rate of 1,19, well below the threshold of 2 %. This thanks to the well-functioning prevention and control system.

As main risks for the JU, we have the disruption of the accounting function for which a solution still needs to be found and adopted by the board and the delay of the implementation of the next generation JU, in casu KDT. This may cause operational disruption and more complex planning.

All finance and administrative functions ran smoothly throughout the year; all in remote. Respecting the COVID-19 rules, some team meetings & gatherings were held through the year. However, the team spirit and corporate identity feeling is not what it was pre-COVID-19. Let's see to the end of this tunnel.

# 5. Part I. Activities and Achievements of the year

This section describes the activities of the KDT JU and ECSEL JU with reference to the Annual Work Plan for 2021. It covers the core activities of the JUs (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.

The KDT JU started very close to the end of the year and 3 calls were launched before the end of the year.

The COVID-19 pandemics continued in 2021, and its impact was felt on the activities mainly by delaying some of the activities.

The KDT JU operational team wishes to thank the consortia for their efforts in finalising the proposals sometimes under very difficult circumstances. Also, we would like to thank the experts who evaluated and reviewed the proposals or projects under difficult circumstances.

## 5.1 Key objectives and associated risks

For 2021 the key objectives were at the start of the year:

- To support the preparations and take-off of KDT JU
- To run the first KDT calls in 2021
- Proceed with the Lighthouse Initiatives.
- Efficiently manage the ECSEL JU projects selected in the preceding calls while providing best service to the consortia.
- Provide adequate answers to the various audit services (IAS & ECA)
- Reporting to the EPS National Authorities, Industry Associations and Boards.

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

- The switch from ECSEL to KDT was planned for begin of 2021. End 2020 it became clear that it would take more time. The risk was that the launch of the calls would run into difficulties.
- The new Horizon Europe regulation and the Single Basic Act include changes like the provision for CMFC that needs implementation in the Administrative Agreement, Model Grant Agreement & IT tools. Experience under ECSEL learns that this can go wrong or be delayed hampering the programme.
- The usual risks in the call procedures, proposal selection, … are of course still actual.
- The role of the Lighthouse Initiatives and the LIASE under KDT was under discussion end of 2020. Lighthouses are an ECSEL approach to promote cooperation with other funding programmes. If discontinued under KDT, other means will need to be developed to further this cooperation.
- Covid-19 related delays or other issues in the projects of ECSEL pose a risk regarding the discontinuation of projects.

KDT JU started only very late in the year, and this has affected the programme in delaying activities such as call launches. The different stakeholders of KDT JU, though, wholeheartedly support KDT JU.

## 5 .2 Research & Innovation activities

The KDT JU launched three calls for proposals: KDT Call 2021-1 inviting Innovation Actions (IA), KDT Call 2021-2 for Research and Innovation Actions (RIA) and KDT Call 2021-3 inviting for a Common Support Action (CSA). Both the RIA and the IA call included a focus topic. The inclusion of focus topics reflects the new approach under KDT for a more balanced top-down and bottom-up approach. The WP2021 describes the topics (based on the SRIA 2021), the schedule, the evaluation and selection procedure, the budgets (both EU and National), the National rules applicable for the National grants, and the HE 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 HE procedure. The Strategic Research and Innovation Agenda (ECS SRIA) 2021 for the ECS community that is adapted each year by the 3 Industry Associations, served as basis for the KDT Calls 2021 after adoption as KDT SRIA 2021 by the first KDT GB.

The description of the RIA and IA calls put some accents:

- Aspects of ECS value chain integration are important for the KDT programme as they were 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.

The focus topics for the two calls are:

- Focus topic for the IA call with as title “Development of open-source RISC-V building blocks”. This call relates to the first general objective of the KDT JU: reinforce the Union’s strategic autonomy in electronic components and systems to support future needs of vertical industries and the economy at large. The overall target is to contribute towards doubling the value of the design and production of electronic components and systems in Europe by 2030, in line with the weight of the Union in products and services.
- Focus topic for the RIA call with as title “Processing solutions for AI at the edge addressing the design stack and middleware”. This call relates to the first two general objectives of the KDT JU: reinforce the Union’s strategic autonomy in electronic components and systems to support future needs of vertical applications and promote the active involvement of SMEs.

The call 2021-3 is a CSA with as title "A Pan-European chip infrastructure for design innovation". This call relates to the second general objective of the KDT JU: establish Union scientific excellence and innovation leadership in emerging components and systems technologies, including in activities related to lower TRLs; and promote the active involvement of SMEs.

The submission, evaluation, and selection will all take place in 2022. Grant signature will take place before end 2022.

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

Although the calls were launched end of 2021, the bulk of the activities such as submission, evaluation and selection will all take place in 2022. Therefore, a description of the calls 2021 and their outcome will be reported in the AAR of 2022.

## 5.4 Call for tenders

No tenders related to operational activities were launched in 2021.

## 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 51 reviews were organised (each with 2 external experts), out of which 4 were interim reviews organised to redress situations discovered during an official review or to cover a project extension leaving 47 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 1. Each expert can participate in one or several reviews. In 2021, 102 appointment letters for review experts were signed.

| | Reviews 2014 | Reviews 2015 | Reviews 2016 | Reviews 2017 | Reviews 2018 | Reviews 2019 | Reviews 2020 | Reviews 2021 |
|---|---|---|---|---|---|---|---|---|
| Reviews organised | 64 | 59 | 55 | 49 | 48 | 43 | 44 | 51 |
| Experts | 74 | 54 | 60 | 58 | 56 | 52 | 52 | 62 |

*Table 1: Reviews and experts*

Table 2 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 which will later be appointed for coming reviews.

| Gender of experts | Reviews 2014 | Reviews 2015 | Reviews 2016 | Reviews 2017 | Reviews 2018 | Reviews 2019 | Reviews 2020 | Reviews 2021 |
|---|---|---|---|---|---|---|---|---|
| Male | 62 | 47 | 55 | 55 | 51 | 47 | 44 | 50 |
| Female | 12 | 7 | 5 | 3 | 5 | 5 | 8 | 12 |
| Total | 74 | 54 | 60 | 58 | 56 | 52 | 52 | 62 |
| % Female | 16% | 13% | 8.3% | 5.2% | 8.93% | 9.6% | 15.4% | 19.4% |

*Table 2: Gender of experts for reviews*

Table 3 provides the country-of-origin based breakdown:

| | Reviews 2014 | Reviews 2015 | Reviews 2016 | Reviews 2017 | Reviews 2018 | Reviews 2019 | Reviews 2020 | Reviews 2021 |
|---|---|---|---|---|---|---|---|---|
| AT | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 |
| BE | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| BG | 0 | 0 | 1 | 2 | 1 | 2 | 1 | 2 |
| CH | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| DE | 14 | 8 | 14 | 12 | 17 | 13 | 16 | 14 |
| DK | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 |
| EL | 4 | 5 | 4 | 3 | 1 | 1 | 1 | 2 |
| ES | 4 | 3 | 4 | 3 | 4 | 5 | 3 | 7 |
| FI | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| FR | 12 | 10 | 8 | 12 | 8 | 8 | 5 | 6 |
| HU | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| IE | 4 | 2 | 2 | 2 | 2 | 1 | 1 | 2 |
| IT | 6 | 4 | 6 | 5 | 4 | 3 | 5 | 7 |
| LU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| NL | 5 | 4 | 4 | 5 | 3 | 1 | 2 | 2 |
| NO | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| PL | 1 | 0 | 1 | 0 | 2 | 2 | 3 | 2 |
| PT | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| RO | 2 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| SE | 5 | 4 | 0 | 1 | 2 | 2 | 2 | 2 |
| TR | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| UK | 7 | 3 | 4 | 5 | 4 | 4 | 2 | 2 |
| USA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

*Table 3: Country of origin of experts for reviews*

Finally, Table 4 provides the breakdown according to the affiliation of the expert:

| | Reviews 2014 | Reviews 2015 | Reviews 2016 | Reviews 2017 | Review 2018 | Review 2019 | Reviews 2020 | Reviews 2021 |
|---|---|---|---|---|---|---|---|---|
| Private | 35 | 30 | 32 | 31 | 31 | 29 | 28 | 34 |
| Public | 31 | 20 | 23 | 18 | 16 | 8 | 17 | 21 |
| Independent | 8 | 4 | 5 | 9 | 9 | 15 | 7 | 7 |

*Table 4: Affiliation of experts for reviews*

COVID-19 impact

We already remarked in the AAR2020 that due to COVID-19 all review meetings were organised remotely and that this had some drawbacks, such as the exhibition of results and demonstrators. At the end of 2020 the effect of the pandemic was mitigated, and the impact was less visible though some projects indicated that they had experienced delays.

In this second pandemic year the impact is now felt much more and in practically all projects. It is not uncommon that projects in their last year ask for an extension but in 2021, all projects in their final years (3rd or 4th year) were extended, most with 6 months but 2 with 12 months and all for valid COVID reasons. From the projects in their first year some already indicated delays due to COVID. The valid COVID related reasons had to do with:

- The global shortage of components due to the COVID-19 pandemic situation which has disturbed global manufacturing and logistics. This results in multiple impacts: designs must be made so that component availability is verified first, and even then, some components needed for the demonstrators might not be available in the end, equipment delivery is delayed, etc.
- As the pandemic situation and the accompanying measures (country dependent) are unpredictable, some additional risks have been identified. For instance, demonstrators or testing cannot proceed due to lockdown, activities (e.g., equipment set-up) are delayed due to quarantine rules or limited access to labs, etc.
- Staff related issues: some partners had to reduce their contribution due to lack of personnel
- Cancellation/postponement of F2F meetings, conferences and workshops that were foreseen for data collection and result discussions with peer experts. F2F meetings continue to be vitally important in certain aspects of the project cycle, but also in the elaboration of proposals.

All projects that asked for extension indicated that they would finish the project with minimal impact on results. If major revisions were announced, this had nothing to do with the pandemic but rather with issues in global trade and the US-China commercial conflict.

Results of the monitoring

Table 5 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

The postponement of some of the reviews for projects is mostly a consequence of COVID-19.

| 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 | SECREDRAS | 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 | | | | |
| 2019 | ADACORSA | GP- | | | | https://adacorsa.eu/ |
| 2019 | ArchitectECA2030 | GP | | | | https://autoc3rt.automotive.oth-aw.de https://www.mobilitye.eu/projects/architecteca2030 |
| 2019 | BEYOND5 | GP- | | | | https://www.beyond5project.org/ |
| 2019 | CHARM | GP | | | | https://charm-ecsel.eu/ |
| 2019 | InSecTT | GP | | | | https://www.insectt.eu/ |
| 2019 | iRel40 | GP | | | | https://www.irel40.eu/ |
| 2019 | IT2 | GP | | | | |
| 2019 | Moore4Medical | GP | | | | https://moore4medical.eu/ |
| 2019 | NextPerception | GP | | | | https://www.nextperception.eu/ |
| 2019 | PROGRESSUS | EP | | | | https://progressus-ecsel.eu/ |
| 2019 | VALU3S | EP | | | | https://valu3s.eu/ |
| 2020 | SC3 | GP | | | | https://sc3-project.eu/ |

*Table 5: Results of the ECSEL project reviews*

### 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 6. Obviously, only the projects from calls in 2014 to 2019 had anything to report on those indices[5].

| 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 |
| 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 |

5 Some figures of closed projects are updated due to the obligation of projects to continue reporting on those numbers after the end of project.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 2018-3 | CSA-Industry4.E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2018-4 | COSMOS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2019-1 | BEYOND5 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2019-1 | CHARM | 0 | 0 | 7 | 0 | 1 | 0 | 11 | 1 |
| 2019-1 | InSecTT | 1 | 17 | 16 | 0 | 5 | 3 | 3 | 0 |
| 2019-1 | iRel40 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2019-1 | IT2 | 0 | 7 | 29 | 0 | 11 | 3 | 16 | 3 |
| 2019-1 | Moore4Medical | 0 | 4 | 27 | 3 | 11 | 5 | 20 | 14 |
| 2019-2 | ADACORSA | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2019-2 | ANDANTE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2019-2 | ArchitectECA2030 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2019-2 | BRAINE | 0 | 3 | 3 | 0 | 19 | 12 | 10 | 7 |
| 2019-2 | FRACTAL | 0 | 6 | 3 | 0 | 11 | 5 | 5 | 2 |
| 2019-2 | NextPerception | 0 | 5 | 21 | 0 | 23 | 18 | 23 | 18 |
| 2019-2 | PROGRESSUS | 0 | 12 | 15 | 0 | 3 | 1 | 3 | 1 |
| 2019-2 | VALU3S | 0 | 16 | 8 | 0 | 0 | 0 | 16 | 10 |
| 2019-3 | HELoS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | | 258 | 2474 | 1790 | 21 | 548 | 190 | 547 | 165 |

*Table 6: Progress indicators of dissemination and exploitation*

### 5.5.3 Success stories of projects completed

The following success stories are related to projects that finished in 2021.

**Project AfarCloud (Aggregate Farming in the Cloud)**

The main objective is the development of a distributed, open-source platform for autonomous farming that will allow the integration and cooperation of agriculture Cyber Physical Systems in real-time in order to increase efficiency, productivity, animal health, food quality and reduce farm labour costs. This platform will be integrated with farm management software and will support monitoring and decision-making solutions based on big data and real time data mining techniques. A second objective is to make farming robots accessible to more users by enabling farming vehicles to work in a cooperative mesh, thus opening up new applications and ensuring re-usability, as heterogeneous standard vehicles can combine their capabilities in order to lift farmer revenue and reduce labour costs. The project will be demonstrated in 3 holistic demonstrators (in Finland, Spain and Italy), including cropping and livestock management scenarios and 8 local demonstrators (in Latvia, Sweden, Spain and Czech Republic) in order to test specific functionalities and validate project results in relevant environments located in different European regions.

AFarCloud outcomes will strengthen partners' market position boosting their innovation capacity and addressing industrial needs both at EU and international levels. The consortium represents the whole ICT-based farming solutions' value chain, including all key actors needed for the development, demonstration and future market uptake of the precision farming framework targeted in the project.

The project achieved the above-described objectives and produced several interesting exploitable missions/autonomous functionalities from the platform that deserve to be emphasised, including:

- fertilizer and irrigation optimisation based on real time image processing onsite the tractor,
- tractor communication hub,
- missions including drones and soil sensors,
- low-cost sensing collars with GPS and sensors for livestock well-being optimisation,
- silage scanner,
- air-purifier for green houses that could be used in other civil application areas, and many others.

Time to market for prospective products originating from this project is expected to be up to 3 years. In addition, there were demonstrations of promising experiments with AI on the edge developments leading to an exploitable microcontroller unit and a set of neural network embedded tools.

On the exploitation side: the creation of market potential is analysed, gains related to project output are described and supported by a competitive analysis, and appropriate business models are proposed. All this contributes to the potential impact of the project in the value chain and implements the concept of Farming-as-a-Service.

A youtube channel contains further information on the demonstrators: https://www.youtube.com/channel/UC7pmxhwq01Bj9sENSy6TP2Q/featured

**Project CONNECT (Innovative smart components, modules and appliances for a truly connected, efficient and secure smart grid Communication)**

The project provides concepts, technologies and components that support enhanced integration of renewables and storage combined with intelligent control of the power flow. The demand for primary energy and the carbon dioxide emissions can be reduced and a de-centralized energy infrastructure can be facilitated by the solutions developed in this project. New concepts and technologies for power conversion were

investigated that are specifically developed for bidirectional power exchange with the grid and for controllable power flow to support the extended integration of renewables like PV and local storage. Power quality optimisation was explored to avoid unnecessary energy flows in the grid. The enhanced capabilities of the power conversion should fit seamlessly to the smart energy management systems of single/multiple buildings and quarters as researched in this project. Monitoring approaches and advanced control algorithms will be developed which consider renewable energy sources, local storage and electric vehicles for peak demand reduction and optimisation of local generation, consumption, and storage. To fully exploit the advantages of the technologies it is also necessary to enhance the data transmission capacity of the smart grid communication infrastructure. For this purpose, the project developed solutions for high interoperable, high data rate local and wide area communication in the grid with enhanced security to protect this critical infrastructure against attacks. Effort is spent to minimise the power consumption of the developed solutions. Selected results were demonstrated not only in lab environment but also in close to real life scenarios.


The project achieved its objectives and has been advancing a number of components with good exploitation potential, such as (but not limited to):

- low loss AC/DC converter, with controllable power factor compensation;
- high efficiency DC-DC converter, with a wide range flat efficiency curve;
- a DC microgrid proof-of-concept, with the potential of saving 15-30% energy demand compared to traditional solutions;
- low power current sensors, with a 1MHz bandwidth;
- wireless components, operating on energy captured from RF or light;
- ultra low-power sensing with zero standby consumption.

The components were developed to the originally envisioned maturity level and demonstrated in close-to-real environments, confirming the initially set performance goals.


The overall and long-term strategy for the exploitation of results may lead to microgrids as "products" to tap the full potential, that microgrids offer in terms of energy demand peak shaving, energy efficiency and reduction of CO2 footprint, thereby contributing to environment friendliness and support of the European Green Deal.

The developed solutions enable a significant reduction of peak power demand to the grid. Reduction of losses and increased efficiency at the device and at the component level boost system level efficiency. According to the research results, more energy efficient, reliable power electronics alone have the potential to reduce the world's electric energy consumption by some 20-30% by 2025. The project provided key technologies to make this happen.

The developed prototype components and subsystems can be easily integrated into existing installations and represent key enabling technologies, thus important building blocks, which face excellent exploitation opportunities.

The project was based on a strong, experienced consortium, with partners covering the entire required application chain from the sensing node, via secure communication and power conversion to the energy management. The project results will benefit education and increase employment potential in Europe. European companies' and organizations' market position is strengthened in the key technology fields of semiconductor, power electronics, de-centralised power grids and electromobility. CONNECT techniques help to reduce the primary energy demand, thus will decrease the dependency of the European society to non-European energy suppliers and at the same time provide the next step to achieve the 2020 Energy Efficiency Plan and to support the EU targets for 2030.

It is to be emphasized that microgrids are no "standard product". Their implementation requires additional stakeholders outside the partners in the consortium, e.g., city planners, neighbourhood planning, treasurers, facility management and public utilities (energy providers). Requirements and derived specifications of microgrids depend on the local demands, country specific legal restrictions, regulations, size of the microgrids, etc. In that respect, the knowledge achieved in this project supports the design, installation and economically viable operation of microgrids.

The Consortium recognised that all levels of exploitation (microgrid, synergetic elements, individual components/subsystems) should be supported by targeted dissemination. Therefore, the project focused on wide dissemination to address all potential stakeholders required to prepare exploitation of microgrids, namely from politicians, decision makers, global business community to the interested general public.

**Project EuroPAT-MASIP (European Packaging, Assembly and Test Pilot for Manufacturing of Advanced System-in-Package)**

The project is an important collaboration to drive assembly and packaging in Europe. The main goal of the project is to build a European ecosystem for advanced packaging and manufacturing. With ongoing miniaturization on chip level and increasing system integration, packaging is becoming of more and more importance. Although Asia is presently leading in standard packaging, Europe must set-up the proper skills of package technologies to keep competitive with More than Moore devices which are major enablers for EC microelectronics, in particular for heterogeneous system integration that is fast becoming of increasing importance. The project will reinforce the European semiconductor manufacturing position through focused actions in the semiconductor and MEMS packaging ecosystem with following strategic objectives:

- Consolidating and extending the leadership in semiconductor processing know-how
- Accelerating the manufacturing uptake of the new technologies and shortening time-to-market
- Increasing the competitiveness and global market share of the European semiconductor industry

EuroPAT-MASIP developed to this end:

- Modelling, design and simulation of packaging related key features and challenges;
- Key packaging technologies, equipment and materials
- Heterogeneous (3D) integration of the smart system building blocks (More than More, MtM) and System in Package (SIP)
- Test strategy including metrology, methods and equipment, reliability and failure analysis.

Most developments in this project are advanced and even beyond state-of-the-art. The developed technology is excellent and some exceptional results with significant immediate or potential impact were achieved. The innovation appears solid, wide ranging and cross-cutting, moreover the project clearly contributed to path finding in Fan-out wafer-level packaging applications. The impact is not only on new package technologies, but also on production and test equipment, as well as innovative applications for those technologies. Six application pilots were defined for which the process and test equipment as well as methods have significant innovative potential in their market segments.

The results of this project demonstrated that Europe is lagging in assembly and packaging manufacturing. It needs to be evaluated very soon if Europe can afford to lack assembly and packaging competence. Although assembly and packaging cost for many products already exceed chip costs, Europe only has little assembly and packaging capabilities. The project clearly demonstrated that prototyping capabilities need to be strongly strengthened in Europe and the tools developed to achieve this.

**Project FITOPTIVIS (From the cloud to the edge - smart IntegraTion and OPtimization)**

The objective of the project is to develop an integral approach for smart integration of image- and video-processing pipelines for CPS covering a reference architecture, supported by low-power, high-performance, smart devices, and by methods and tools for combined design-time and run-time multi-objective optimisation within system and environment constraints. Low latency Image processing is often crucial for autonomy and performing the right interaction of the CPS with its environment. The most important CPS in the project have sensors and processing at distributed places. For many reasons (parts of) CPS must operate on low energy, whereas the complete system needs results with low latency. The focus of the project is on multi-objective optimisation for performance and energy use. However, other qualities, like reliability, security etc. also play a role in the optimisation.

The five main objectives have been successfully achieved. Evaluations and validations have been performed using clearly defined performance indicators for the use cases.

The first objective concerns a reference architecture and the development of a virtual platform. The final definition of the reference architecture and supported components abstraction models is available. Virtualisation methods support the modelling of virtual resources and their abstract budgets to achieve predictable and composable application behaviour and resource reconfiguration options. A particular highlight is the development of the modelling language QRML which has been used in 9 of the 10 use cases.

The second objective concerns model driven development for design-time support. The project collected, developed, and documented the design time resources as baseline to work on this objective. Tools for modelling, analysis, verification, and synthetization support have been developed and demonstrated/applied on different HW/SW aspects as well as on different platforms.

The third objective is on-line multi-objective optimisation for run-time support. The project realised the basis for the system-wide software stack that can support diverse heterogeneous platforms and facilitate testing of techniques related to monitoring, portability, reconfiguration, and redistribution of tasks across the local and remote computation devices. A particular highlight is the FIVIS tool which was used in several use cases for monitoring and visualisation.

The fourth objective concerns the development of energy-efficient, high-performance, smart devices and components. The project created a core set of 26 hardware, software and communication technologies/components. An interesting highlight is the founding of a start-up company for the commercialisation of one specific component.

The fifth objective concerns the effective impact. The project conducted various exploitation and communication activities. The consortium identified 38 results for potential exploitation, submitted/prepared 11 patent applications and produced about 123 publications. All ten use-cases have been further developed utilizing the technologies developed in this project and show innovative results. Eight use cases reached their targeted TRL. One use case (UC7 – Sustainable safe MRI) achieved TRL 7/8 and exceeded the planned TRL.

The innovation capacity is mainly driven by the adoption/integration of tools and components and the exploitation of new operational workflows. The developed reference architecture, tools and methods will strengthen competitiveness of the project partners. The open-source strategy of some tools will foster an eco-system for further development and exploitation. Furthermore, many of the use cases have increased the TRLs in an industrial context and consequently address important industrial needs.

Impact for SMEs is foreseen via the use-cases (where relevant), the reference architecture as well as the planned open-source tools. It is worth mentioning that one start-up company has already been founded as a result of this project.

**Project HiPERFORM (High performant Wide Band Gap Power Electronics for Reliable, energy eFficient drivetrains and Optimization thRough Multi-physics simulation)**

The project investigates the industrial applicability of high-performance semiconductors with wide-band gap materials in the field of Smart Mobility. For this purpose, a holistic approach was selected that includes the entire supply chain - from the semiconductor and power modules manufacturer through suppliers of development methods and tools for the system manufacturer to vehicle manufacturers. Concurrently, specific requirements for power electronics were addressed in specific application areas, that include both power inverters in the vehicle, electrical charging modules inside and outside the vehicle, as well as the associated development and test systems. A video of the project can be found here: https://www.youtube.com/watch?v=Nzf1q4klvSQ

The objectives are:

- Long-term cost reduction and reliability improvement for GaN switches;
- Powertrain applications based on WBG switches with high switching frequencies, having 30% less energy losses and energy efficiency of up to 98%;
- Power electronics subsystems with 50% less spatial volume;
- Electromagnetic compatibility compliant system using Wide Band Gap semiconductor technology with same reliability and safety as a similar system but in Silicon technology.

The project achieved its objectives with the following major results:

A) For the Gallium Nitride (GaN) semiconductor devices following solutions were developed:

- First European 100V and 200V GaN switches.
- State-of-the-art 650V GaN E-mode technology that can be used to develop cost-efficient products and modules for a wide range of applications in the automotive market.
- Feasibility study for 200V GaN based DC/DC converter, potentially used in battery module tester application.

B) For the Silicon Carbide (SiC) semiconductor devices following solutions were developed:

- 1200V double-sided cooled (DSC) power module.
- 1700V SiC based power converter for the use in high voltage battery pack testers and 1200V SiC based flexible smart power stack for different testing solutions
- Double sided cooled SiC power module
- Automotive Silicon Carbide based traction dual inverter
- High efficient SiC based EV charger architecture

C) Telematic unit that reads vehicle sensor data from the Controller Area Network (CAN) bus and uploads them to the cloud by means of LTE or WiFi interfaces

D) Improvement in automotive applications with power conversion efficiencies superior to 98% were demonstrated, showing the advantages of the GaN and SiC based solutions.

The project results confirm the potential impact of wide-bandgap power electronics in automotive applications to reduce losses, weight, volume and costs in various converter systems related to vehicle electrification and e-mobility.

The project innovations will create new market opportunities for wide-bandgap power electronics technologies in automotive applications. The breakthroughs e.g. the high blocking voltage GaN HEMTS or the SiC DSC modules, together with further results in reliability and robustness improvement of devices have an important impact on the sustainable and highly efficient electrification of cars and e-mobility in general. 55 exploitable results were produced in the HiPERFORM project, such as:

1. Automotive and industry:
   - The on-board charging system based on GaN, to enter market
   - Charging station with SiC switches, full functional power conversion system to enter market
2. Semiconductors:
   - Wafer test bench for GaN switches with new materials. The result to be shared with industrial partners to introduce poly-AlN substrate material of GaN power devices.
   - Wide BandGap Power module inverters, know-how already put in use

Currently 14 patents were applied or already granted during the project.

The high-performance spectrum of wide-band gap semiconductors and the resulting potential for improvement and savings within the concrete applications of the electrified power train also contribute to substantial savings of CO2 in transport and thus support the achievement of the set climate targets in Europe. Thus, the project directly contributed to several European policy objectives and strategies:

- reducing climate change by zero-emission vehicles and improved energy efficiency (European Green Deal)
- strengthening semiconductor manufacturing in Europe (European Chips Act)
- supporting the global transition from fossil fuel vehicles to EVs with key innovations strengthening industrial competitiveness and employment in Europe.

**Project iDev40 (Integrated Development 4.0)**


The main objective of the project was to achieve a disruptive step toward speedup in time to market by digitalising the European industry, closely interlinking development processes, logistics and manufacturing. Ultimately, the project aimed at suitable digital technology advancements to strengthen the electronic components and systems industry in Europe. It addresses various industrial domains with one and the same approach of digitalisation towards competitive and innovative solutions.

The new concept of introducing seamlessly integrated development together with automation and network solutions as well as enhancing the transparency of data, their consistence, flexibility and overall efficiency will lead to a significant speedup in the time to market (T2M) race. The project's unique approach addresses:

- AI learning, Data Life Cycle Management and IP Protection
- Embedding Digital Development in Digital Production (the digital twin)
- Close the Knowledge loop in product life cycle management along the supply chain
- Collaboration 4.0 and Development of highly skilled R&D and Manufacturing Teams
- Prove the innovated technologies on selected use cases in real productive environment

Progress in mastering these challenges will significantly impact the productivity of future design processes embedded in an Industrial Internet environment. The global state-of-art technologies already offer tremendous diagnostics algorithms, machine controls, simulators, optimizers, etc., but only an extensive framework like in this project can combine them into an effective integration into the development process enabling such powerful simulations like "digital twins" that ever more govern the hardware, manufacturing service and business functions.

The project successfully demonstrated in the context of multiple industrial use cases the fulfilment of the overall project goals: accelerate time to market (in use cases the reductions could go up to 33%) and provide sustainably competitive products by developing and implementing a digitalisation strategy on ECS manufacturing domains.

The project successfully developed methods, tools and approaches enabling Artificial Intelligence and Machine Learning in the ECS domain supporting the digital transformation of the project partners organizations and set them up for the implementation in their respective working environments. Additionally, digital solutions were developed and prepared for market introduction.

More than 90 exploitable results were generated within the project, such as:

- Cumulative efforts to automate the production of the 200 mm and 300 mm. The purpose is bidimensional, on one hand the actions are working towards the increase of production efficiency, while at the same time the workplaces conditions are improving.
- The generation of a SSoT (Single Source of Truth) Database to

be used during the entire product lifecycle. This exploitable result targets to ease the digitalisation of physical assets in production.
- The concept of One Virtual Fab. A concept developed in-house for the Infineon business, which has been well demonstrated.
- DC-DC Converter Digital Twin. The generation of a Digital Twin for a widely used component like the DC-DC converter provides a competitive benefit in terms of time and cost savings.

In addition, the project included as novelty a whole work package on Skills & Workplaces 4.0 and Smart Collaboration in ECS Value Chains in order to define and improve the required skills, competences and knowledge of workers in digitized systems.

The project produced several high-level scientific research achievements (published in high-impact journals) and a set of technological achievements advancing the current industrial practices (validated by the implementation at the end-user sides). The technological results will strengthen the competitiveness and growth of companies with respect to their own product strategy/offerings as well as future strategic directions. As such, new market opportunities can now be explored, while some of the results are already in usage internally, which shows the maturity level of technology readiness.

By the end of the project, digital solutions were developed and prepared for market introduction by the different partners like for instance new productive lifecycle management systems, digital twins for predictive maintenance and development, new simulation models, etc. All iDev40 project partners are well aware of the digital transformation and through the use cases implemented in the project, they supported this transformation for their respective organizations in the context of Single Source Of Truth, Digital Twins and Digital Culture. In addition, the project thoroughly addressed the collaboration between human and machine and successfully designed the framework conditions for human-machine cooperation in highly specialised teams making use of Virtual Reality solutions and smart knowledge management tools.

By improving the digitalisation efforts of organizations and by innovative and timely ECS solutions, the market growth is positively affected and the European position on the world market fortified. The project contributed with its evolution of digital processes and open mind-set to strengthen the competitiveness of the participating European companies in the ECS sector. A video summarizes the project ideas: https://www.youtube.com/watch?v=BGIq8Zlh0fI

**Project POSITION-II (A pilot line for the next generation of smart catheters and implants)**

The objective of this project is to bring innovation in the development and production of smart catheters by the introduction of open technology platforms for miniaturization, AD conversion at the tip, ultra-sound MEMS devices and encapsulation. The project fits in the vision of open technology platforms as generators of sufficient production volume to enable sustainable innovation. The availability of open technology platforms will result in new instruments that have a better performance, new sensing, and imaging capabilities, while the scale of volume will result in lower manufacturing costs. The open platform will reduce the cost of smart catheters by rationalising their production process and is supposed to move the industry towards compatibility among manufacturers. The project helps to consolidate Europe's premier position as manufacturer using the cath-lab infrastructure. The cath-lab was developed in the ECSEL JU InForMed project that assembled the critical mass of expertise needed, developing this pilot manufacturing facility in the Netherlands. These new smart catheters will be seamlessly integrated in the cath-lab hardware and software platforms. By combining the different sensing and imaging data a more intuitive cath-lab experience will be achieved.

The project reached its objectives as shown by the very valuable results that were achieved, such as for example innovative designs of Capacitive/Piezo Micro-machined Ultra-sound Transducers (CMUT / PMUT), such as a CMUT pressure sensor with excellent sensitivity, new optical technologies used for sensors (data communication and power supply), in catheter tip Analog-to-Digital-Converter (ADC), CMUT / PMUT benchmark, Intravascular Ultra-Sound (IVUS) applications, soft encapsulation of implants and a number of promising demonstrators and innovative approaches and proof-of-concepts. The main scientific and technological results are:

- Advancing the Flex-to-Rigid (F2R) technology and bringing the F2R integration platform in production at TRL 8, force sensors for catheter placement, actively linking with key European manufacturers of advanced substrates, ASIC processing, passives integration, MEMS processing and assembly.
- Development of generic IP blocks for imaging and sensing catheter with in-tip ADC with demonstrated use for Fractional Flow Reserve (FFR), IVUS and electrophysiology (EP).
- Definition of common benchmark for ultra-sound transducer devices (CMUT / PMUT) and mapping the different device configurations to the application space in a common roadmap.
- Development of a universal application platform for the cath-lab by integrating different data streams. Demonstration of a wireless communication suited for the IVUS application, and a user interface optimized for IVUS that helps the cardiologist interpret the data.
- Development of a test protocol for the testing of polymer encapsulations with different encapsulation schemes and designs, as well as the fabrication of a wireless implantable test platform to monitor the reliability and hermeticity of soft-encapsulated implants in-vitro and in-vivo.

The technology platforms developed in the project are demonstrated by five challenging product demonstrators using the results described above as well as cell therapy and a bioelectronics implant to treat cluster headache.

The pilot lines in this project are complementary to European suppliers for: ASICs, advanced substrates, integrated passives, MEMS devices and assembly. In the future more focus on open interfaces and standards is needed to fulfil the goals of an open technology platform and a matching ecosystem.

The consortium managed to initiate and build multiple part-

nerships resulting from the very good cooperation and community building. Communication activities used the ECSEL Health.E lighthouse initiative as a steppingstone and have been adequately intensified during the last year.

The project contributed to the expected impacts: fight heart diseases at lower cost, create and maintain European leadership in smart catheter development and production, expand Europe's top position in catheter lab infrastructure, accelerate innovation and open new markets, and deliver innovative next generation demonstrator products, each with a significant positive impact on outcome for the patient and cost of care. The real benefit to enhance the European industrial/SME competitiveness within smart catheters is the promoted idea of an open platform, which should invite vendors from both inside and outside the consortium to use the platform for manufacturing of further catheter products. The strategy to unfold such important market perspectives is likely to unfold during the coming years.

A documentary on the project can be watched under https://vimeo.com/604674309/bd8b94050c

**Project PRYSTINE (Programmable Systems for Intelligence in Automobiles)**

The ambition of this project is to strengthen and to extend traditional core competencies of the European industry, research and universities in smart mobility and in particular the electronic component and systems and cyber-physical systems domains. The target is to realise Fail-operational Urban Surround perceptION (FUSION) which is based on robust Radar and LiDAR sensor fusion and control functions in order to enable safe automated driving in urban and rural environments. Therefore, the overall objectives are:

- Enhanced reliability and performance, reduced cost and power of FUSION components
- Dependable embedded control by co-integration of signal processing and AI approaches for FUSION
- Optimized E/E architecture enabling FUSION-based automated vehicles
- Fail-operational systems for urban and rural environments based on FUSION

The project delivered: a fail-operational sensor-fusion framework on component level, a dependable embedded E/E architecture, and the safety compliant integration of Artificial Intelligence (AI) approaches for object recognition, scene understanding, and decision making within automotive applications. In this context fail operational is the next step of fail-safe in which the electronic components and the related systems need to continue to be partially operational in case of failure even though with reduced performance to allow the vehicle to reach safe location. The resulting reference FUSION hardware/software architecture and reliable components for autonomous systems was validated in 22 industrial demonstrators, such as:

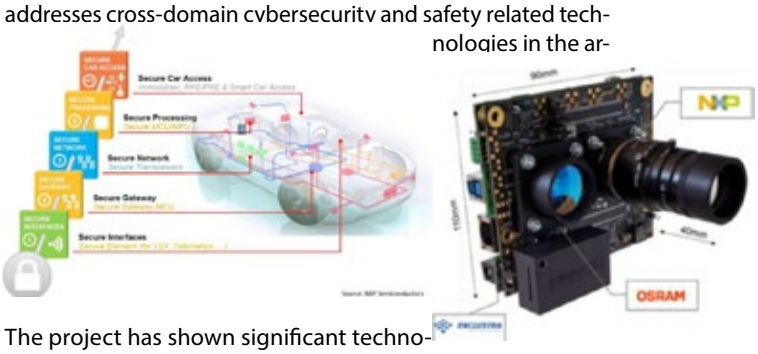
- Fail-operational autonomous driving platform
- An electrical and highly automated commercial truck equipped with new FUSION components (such as LiDAR, Radar, camera systems, safety controllers) for advanced perception
- Highly connected passenger car anticipating traffic situations
- Sensor fusion in human-machine interfaces for fail-operational control transition in highly automated vehicles

The project delivered exceptional results with significant immediate or potential impact thereby contributing to the achievement of the objectives. Some notable results include the Radar and LIDAR technologies developed and manufactured in the project, the development of the next generation AURIX family of safety controllers that will have direct impact as it will provide the base for an upcoming product line. Other results with good opportunities for impact include the Driver Monitoring Systems (DMS), the broader concepts developed for the embedded FUSION components (HW/SW) and the incorporation of fail-operational sensors, components, embedded controllers, and processing systems into fail-operational E/E architecture. The project consortium has put in place an exercise for each partner to indicate the exploitable results they have produced in the lifetime of the project. In this way more the 100 directly exploitable results were identified. At the final review all partners presented their exploitation plans, and some joint exploitations were also presented. The consortium successfully finalised and demonstrated in the last 2 reviews 30 demonstrators.

**Project SECREDRAS (Cyber Security for Cross Domain Reliable Dependable Automated Systems)**

The objective of the project is to develop and validate multi-domain architecting methodologies, reference architectures, components and suitable integration and verification approaches for automated systems in different domains, combining high security and privacy protection while preserving functional-safety and operational performance. This project made a first important step into the development of "trust"-building components and (sub)systems for, in particular, the European transportation and medical industry of tomorrow.

This will assist in making connected and automated vehicles a reality, to ensure that European OEMs remain competitive and that they remain world leaders. In addition, the project also addresses cross-domain cybersecurity and safety related technologies in the ar-




The project has shown significant technological results, in particular:

- Sensor fusion: Development of advanced fusion algorithms in order to improve the safety and security of the perception system by taking benefit of the multiple different types of sensors;

- Drone testbed: Setup of a drone-based demonstration platform for functionalities related to autonomous driving, in particular collision avoidance and traffic prediction;
- Security test cases: Elaboration of proper tests to prove the security of the environment and right functioning of the elements, e.g., sensors and image processing with predicted reactions to arisen situations. The involvement of a professional 3rd party doing a kind of ethical hacking was noteworthy;
- Interference-resilient LiDAR: World's first implementation of a single photon avalanche diode (SPAD) array-based Flash LiDAR.
- Sensor and network attack anomaly detections: Concepts and implementations for distinguishing between normal events and attack signs;
- Secure communications platforms for cloud or IoT connections: Components to ensure data transfer confidentiality and integrity with right performance on communication speed;
- Implementations of several novel HW elements which in some cases were done from scratch and reached TRL 7, such as physical demonstrations of self-made computer PCB, complex boxes or even drone components for better processing than "out-of-the-box" elements.

Summary of exploitable results with high impact potentials: The results of the project were convincingly demonstrated in 5 integrated demonstrators at 6 locations in the EU (NL, IT, CZ, SP, PT, FIN). The demonstrations used 13 well defined scenarios which were all validated.

On standardisation the project has followed a highly comprehensive and well elaborated strategy with following main achievements and contributions:

- Safety, security and privacy co-engineering for critical systems, particularly in the basic functional safety standards (IEC 61508-3, IEC 63069, ISO PDTR 27550 - Privacy Engineering)
- Threat catalogue used by UNECE (United Nations Economic Commission for Europe)
- Automotive Cybersecurity standardization: ISO 21434, ISO PAS 5112, ISO NP 24089 (SW Update-OTA)
- Health: IEC TC62, IEC 80601/60601
- Railways: CENELEC TS 50701
- Monitor ISO/IEC JTC1 SC41 (IoT), SC42 (AI – Trustworthiness) and SC38 (Cloud computing), IETF and ETSI IoT (AIOTI) on relevant issues for SECREDAS
- ITS Standards: ETSI TC ITS, CEN TC 278, ISO TC 204, co-operative ITS Standards, e.g., ISO 21217:2014 under review (ITS station units – Station and Communication Architecture).

Moreover, the Consortium partners have been active and successful in discussions at national and EU level on changes to existing security/safety and privacy standards related to automated/autonomous driving and even managed to initiate the development of new standards.

The project provided significant contributions towards an adequate methodology, including requirement specification, testing and development modelling considering different layers of the development lifecycle and giving a sample reference architecture for further developments. The addressed domains include health, railway and automotive, for which the project has developed hardware prototypes, SW implementations including working algorithms, as well as tests and validations.

During the final year, the integrated solutions were tested and validated in live on-road demonstrations against the threats that had been defined. The outcomes were very positive and resulted in technology advances across all three domains that went even beyond the expected TRL end-levels foreseen for the project. All demonstrations were recorded and are available from the website of the project.

Several project videos demonstrate the ideas developed:

https://vimeo.com/600819721

https://www.youtube.com/watch?v=2dYjc-faZiU

https://www.youtube.com/watch?v=SRwYMT-kprA

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

The project has as objective the establishment of the next BiCMOS technology platforms with improved SiGe Heterojunction Bipolar Transistor (HBT) performances with a higher integration level. This new generation of transistors HBT 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 project also aims at further strengthening the leading position of the European semiconductor industry in SiGe BiCMOS technology and at providing a solid industrial base for the development of new products in areas such as telecommunications, home electronics, and car electronics which are of key importance for Europe's high-tech industries.

The major results are as follows:

- Optimized HBT process
- Improved EXBIC architecture
- HBT TCAD Model is delivered
- Characterization of the devices is achieved.
- Optical telecommunication Digital to Analog chip is realised with with a data rate of 1.52 TB/s over 82 km of optical fibre achieved
- 8 demonstrators were fabricated, validating the developed technology, such as: demonstration of E-band and D-band transceivers incorporating beam-forming and smart sensors equipped with the radar systems with frequencies range from 79 to 240 GHz.

The project was awarded 'Best Technology Pioneer' by the ECSEL JU in 2020 and was selected for the worldclass technology performances:

- breakthrough fmax of 700GHz,
- record 1.52Tbps reported for optical communication

This project is a highly important project for Europe in order to preserve and reinforce its leadership in electronics for high

integrated RF applications like 5G data rate communication and smart mobility and the related system industries.

With its success the project contributes to the improvement of the competitive advantage of EU companies in the global IC semiconductor, telecommunication, and radar sensing markets. It fosters the industrial ambition of value creation in Europe by establishing, de-facto, three main value chains leaded by the four large enterprise partners involved in the project:

- Backhauling in 5G network infrastructure
- Radar for automotive safety systems
- Fixed Wireless Access (FWA) and optical links in 5G network infrastructure

**Project WakeMeUP (Wafers for Automotive and other Key applications using Memories, embedded in Ulsi Processors)**

The project objective is to set-up a pilot line for advanced microcontrollers with embedded non-volatile memory, design and manufacturing for the prototyping of innovative applications for the smart mobility and smart society domains. The already defined microcontrollers with 40nm embedded flash technology were consolidated into a solid manufacturing platform. Additional developments for the integration of memory, power management, connectivity, hard security on the same chip were also part of the project. The project targeted the industrialisation of the embedded Phase Change Memory (PCM) technology built on top of the FDSOI 28nm logic process pilot line. The development of this innovative memory technology will be driven by the final application requirements as well as decreasing the power consumption. Alternative memory solutions were also studied as they have different - and complementary - traits such as read/write speed, power and energy consumption, retention and endurance, and device density. They were benchmarked with the PCM technology and with conventional Flash memory technology.

The project achieved its objectives through the following main important results:

- Qualification of the pilot line 40nm eNVM now ready for production.
- 28nm PCM control units with features close to product requirements.
- Qualification of the ePCM 28FDSOI silicon line ready for prototyping.
- Final selection of Libraries/ IPs (availability & maturity assessment) for the non-volatile Low Power master control unit platform including fully performed simulation job.
- Secure and General-purpose master control unit applications of the 40nm eNVM technology in line with requirements and demonstration ready.

The work done in these achievements have been explained in two demonstrators: one on Secure 40nm RF MCU tape out and the other on 28nm ePCM technology for the automotive market used for the qualification of the 28nm FDSOI ePCM pilot-line development.

The impact is in line with the expectations in the Description of Action: the pilot lines for 40 nm eNVM and 28 nm FDSOI ePCM are ready and pave the way for next-generation technologies: 34nm eNVM and 18nm ePCM. The MCU product portfolio (products, components, SW building blocks…) has been extended to support general purpose, secure and automotive applications. In general, all the participants have reinforced their expertise on advanced NVM technologies and applications.

**Project WInSiC4AP (Wide band gap Innovative SiC for Advanced Power)**

The core objective is to evolve and demonstrate the capability of SiC MOSFETs for a number of applications in mobility. In those harsh environments, the importance of packaging of the power electronic modules is an essential element to achieve proper integration. Improvement is only possible based on an excellent understanding of the physics, the materials defects, the manufacturing processes, as well as the identification of failures to enable packaging and modules to reach high reliability.

The project framework has been built so that companies working in different domains (automotive, avionics, power grid) and in the vertical value chain (semiconductor supplier, discrete manufacturer, packaging) collaborate to codesign solutions, solve problems and exchange know-how. This ecosystem is supported by Universities and SME specialised in characterisation and modelling grounding all developments with solid physical understanding and measurements.

New topologies and architecture were developed for targeted application emulating operational environment, at laboratory level. Those include:

- For automotive, a 22kW onboard charger, a DC-DC converter for the new automotive battery 800V specifications, and a bidirectional converter for smart grid integration of electric vehicles,
- For avionics, an inverter for aircraft electrification, and two modules for fuel-cell powered droneS
- And transversally, a new packaging approach to power modules and a test bench addressing the specific test requirements for SiC-based modules.

The outstanding performances of the results are detailed as follows:

- The 22kW onboard charger achieved 95% efficiency. Such module is required for fully electric vehicle. At the end of the project, it has excellent performances even though there is room for improvement. Development is continuing beyond the project lifetime.
- The developed 1200V SiC power device demonstrates a big improvement on dynamic performances and a higher reliability (achieved by reducing the electric field at SiC oxide interface). The 15 years' estimated lifetime will allow industrialisation of the targeted automotive modules. The correlation of the measurements with the physics had been successfully addressed.
- The high-efficiency bidirectional SiC-based power convertor has produced very good test results for V2G / V2H in nano/microgrid scenario. The targeted efficiency of 95% was achieved.
- The aeronautical power module is donut shaped to be placed around the motor. It demonstrated the capacity to function

at high current, low temperatures, whilst having very low losses for a high efficiency.
- Finally, the setup of test bench demonstrator is fully compliant with the market needs. This characterisation equipment is new to the market and will support the development and testing of SiC-based power modules.
- The project has a very high potential in term of impact and market penetration. The exploitation plan was detailed for each partner, and is convincing for the major industrial players, as well as for the research institutes. The further improvement and cost reduction of the SiC components are ongoing in the project REACTION. For the application to drones, the limiting factor remains the regulation of fuel-cell powered drones that will enable the full exploitation of the weight reduction enabled by the SiC power electronics developed in the project.

### 5.5.4 Conclusions

In the AAR2020 we noted that ECSEL projects achieve their objectives and results by:

- obtaining world class results;
- having high 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.

We can only conclude in view of the projects presented above that this holds true this year as well.

## 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 Initiative 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.

All lighthouses contributed to the ECS SRIA2021 as part of their mandate. They organised workshops and symposiums, information sessions, etc.

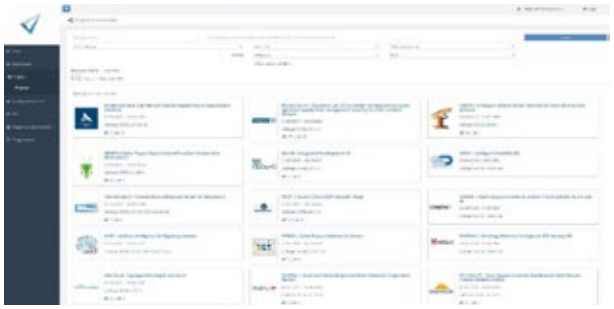
### 5.6.1 Industry4.E Lighthouse

The Industry4.E lighthouse continued its activities during 2021. The associated CSA project, CSA_Industry4.E, supported the lighthouse activities until March 2021 when the project finalised its two years plus 6 additional months cost neutral extension.

One of the main achievements of the lighthouse has been the ECSEL portal (https://www.ecsel-portal.eu/projects ), that became public in 2021 a tool for sharing information about R&D projects along with their associated project results and demonstrators. It 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. Mechanisms to keep the contents automatically up to date by fetching data from relevant databases were implemented. Relevant social media posts are also being displayed. The portal was promoted in user workshops and media campaigns of the CSA.

Another highlight was the official publication of the Lighthouse Industry4.E white paper: https://www.kdt-ju.europa.eu/sites/default/files/2021-06/Lighthouse4.E_Whitepaper_2021%20v2.pdf). This key document is a cross-platform ECSEL – orientated Industry4.0 strategic roadmap that also details the vision and the mission for Industry4.E as well as the recommendations and ambition for the future of this important ECSEL initiative.


Regarding the project CSA_Industry4.E there was a continued effort to engage citizens, resulting in a wealth of material and online actions for this purpose. The connection with the SMEs has been refocused and oriented to a research activity to understand their barriers when trying to access ECSEL opportunities and funding. A fair summary of obstacles/difficulties and suggestions on how to overcome them can be found at https://industry4e.eu/wp-content/uploads/2020/08/Industry4.E-D2.5.pdf. The project also exceeded its original target regarding organisation of workshops. 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: https://industry4e.eu/wp-content/uploads/2020/11/Industry4E-ebook.pdf . Finally, they set up a digital network with more than 1.300 followers covering platforms like LinkedIn, Instagram, and Twitter. The dissemination and communication activities contribute to the spreading of excellence of digitalisation of industry across Europe and help increase awareness of European activities in the field. The website for the Industry4.E lighthouse initiative is at: https://industry4e.eu/



### 5.6.2 Mobility.E Lighthouse Initiative

The Mobility.E lighthouse had a productive and successful 2021. The associated Coordination and Support Action, COSMOS, successfully supported the lighthouse activities until the end of Jun 2021 when the project was finalised. The project has been extended with 6 additional months bringing the project to 30 months duration. Despite the uncertainty of the KDT start date and the doubt for the continuation of the activities of the Light Houses the Mobility.E LIASE and the CSA action COSMOS have been actively working. Listed below are some of the achievements of the year.

Mobility.E worked on the identification and definition of possible synergies between national funding programmes, PPPs and JUs active in mobility. For example, information sessions were organised on the Austrian and German national programmes; on the activities of the CleanSky JU that resulted in a follow up workshop on possible collaboration and the analysis of common beneficiaries. Further work on the alignment of priorities and eventual synergies with the PPPs CCAM and 2Zero was done.

The CSA project, COSMOS, finalised and published the Mobility.E white paper: Mobility.E Implementation Plan, that contains key recommendations for the acceleration of ECA mobility deployment were identified and documented. The Implementation Plan is the final result of the COSMOS project, and it completes the Strategy Development Process. The link to the implementation plan on the mobility web page is: https://www.mobilitye.eu/documents

The results presented in this report were obtained primarily by expert consultations throughout the year 2020 and in the first half of 2021. The definition of actions was accompanied by an assessment of European competitiveness on a global scale. The results of these preparatory steps are documented in :

- International comparison of the state of the art for ECA mobility with respect to the 7 Urgent Priorities and non-technical aspects (Chapter 2).
- Update on Research Priorities (Chapter 3).
- Action plan (Chapter 4).

In a second phase, actions were derived in an interactive workshop at the EFECS conference in November 2020 and during workshops of the COSMOS consortium and associated partners (COSMOS ad-hoc working groups) in February and May 2021. The actions that have been defined either follow the previously defined research topics directly, e.g. where a need for funding is identified for a topic where Europe lags with the international competition, or from the observation of the current state of R&D, such as the need for (broad) stakeholder exchange. The COSMOS project was concluded with a virtual symposium that presented: project results of the Mobility.E, trends and synergies within the mobility sector. An important take away from this symposium is the observation that collaborative approaches are gaining in importance because the ecosystem for ECA mobility becomes increasingly diverse and those diverse stakeholders are key to tackling the most urgent R&D challenges, including those depending heavily on non-technical factors. The strategies and the results in this document should be continuously updated to perpetuate the progress of the EU actors in the mobility field.

The Mobility.E Lighthouse connects different projects, the mobility ecosystem, and partnerships and is the perfect instrument to derive the priorities in the field. It is a living platform for cross-sector collaboration and networking and it was highly recommended to continue this activity under Horizon Europe in support of the very broad and diverse mobility community.

### 5.6.3 Health.E Lighthouse Initiative

The main objective of the ECSEL Health.E lighthouse is to accelerate the innovation in medical devices and systems by stimulating the development of open technology platforms and standards as endorsed by its vision for the healthcare domain: "Moore for Medical". In 2021, the activities of the associated Coordination and Support Action (CSA) HELoS focused on exploring and disseminating the possibilities, advantages and issues associated with open technology platforms for emerging medical devices, by means of fruitful discussions with stakeholders and a second comprehensive white paper. HELoS extended the lighthouse activities for four months until the end of April 2022. This is mainly due to the COVID-19 outbreak and the consequent shift of the first and second workshops (2020 and 2021, respectively). The third public workshop, focused on "Implementation" challenges, started to be organized in 2021 and will be held in March 2022.

The main results and progress towards the achievement of the Health.E vision in 2021 are:

• The second Health.E workshop was held as a virtual event on May the 12th, 2021. It brought together experts from the ECS and Medtech fields to prioritize the issues associated with setting up technology platforms for emerging medical domain and discuss mitigation plans. The workshop was prepared and organized by IMEC in Leuven and was professionally moderated by Caren Coleman. Five emerging medical domains were selected and "champions" from these domains were invited to chair panel sessions with experts to discuss the Health.E issues for their specific domains. The recommendations from these experts have been summarized in the conclusions of the second Health.E white paper (see next bullet). For this second workshop, 165 people attended, with a broad mix from industry, SME, RTOs and academia.

•Another important highlight of Health.E during 2021 was the

official publication of the second Lighthouse Health.E white paper: (https://www.kdt-ju.europa.eu/sites/default/files/2022-01/Whitepaper%20II%20OTP4EMD%20final.pdf), entitled Open Technology Platforms for Emerging Medical Domains. Open technology platforms, instead of point solutions, are the way to go forward in accelerating innovation for medical devices. This second whitepaper of the Health.E lighthouse tackles the particular challenges related to technology platforms for medical devices and gives recommendations for the ECS industry, the healthcare community and policymakers.

• Despite the cancelation of many events due to COVID, the Health.E lighthouse participated in a couple of relevant dissemination actions:

- Frank v.d. Scheur from Philips Engineering Solutions held a Keynote presentation at the IVAM online Hightech Symposium 25-26 August 2021 "Micro and Nanotechnologies as Enablers for future Healthcare".
- Ronald Dekker, "Accelerating innovation inm smart medical devices, enabling Moore for Medical," keynote speech at the Semicon Europe Executive Forum, session "Enabling Next Generation Applications" Nov 15-18, 2021, Messe München, Germany https://www.semiconeuropa.org/program/executive-forum. This conference was attended by approximately 700 people.

• During the last few months of 2021, the Health.E lighthouse also started the organization of the final public workshop/symposium which will be held on March 8-9, 2022 at the High Tech Campus in Eindhoven the Netherlands. The program was prepared to cover:

- The view of large companies, SMEs, RTOs and the Commission on the implementation of innovation for medical devices;
- How projects that are connected to the Health.E lighthouse implement open technology platforms for emerging medical domains;
- Open technology platforms for medical devices that are available right now!

#### 5.6.4 Conclusions

Lighthouse initiatives were created to stimulate cooperation and synergy between actions inside the ECSEL programme but also outside. One of the expected results was contributions to the SRIA and the priority setting of the ECSEL JU. All three lighthouses delivered on this. With its emphasis of across programmes cooperation, the ECSEL JU is now being emulated by Horizon Europe where this type of inter-programme synergies is highly encouraged. The role of the lighthouses or similar organization under KDT will have to be further discussed.

## 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 Annex.

#### 5.7.1 Grant Agreement Preparation to signature for projects selected in call 2020

The ECSEL decisions PAB 2021-57 and PAB 2021-58 on the amendment of the selection of projects from the Call 2020 were signed on 12 May 2021. The Grant Agreement of 14 projects were signed from submission (FPP deadline 16 September 2020) to signature on average in 239 days within the 8-month deadline.

#### 5.7.2 Prefinancing of the projects selected in call 2020

The prefinancing of the EU-funding occurred in time for all the projects of the calls 2020. The total amount was EUR 90.9 million (5% of which went into the guarantee fund). The total prefinancing over the 7 years period is EUR 581.6 million.

#### 5.7.3 Amendments

The activities supporting a project also involve amendments. In 2021, 70 amendments were handled. Please refer to the AAR2020 for some statistics on the amendments.

#### 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, 37 Reporting and Payment (RePa) workflows were started in 2021. 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. Please refer to the AAR2020 for some statistics on this workflow.

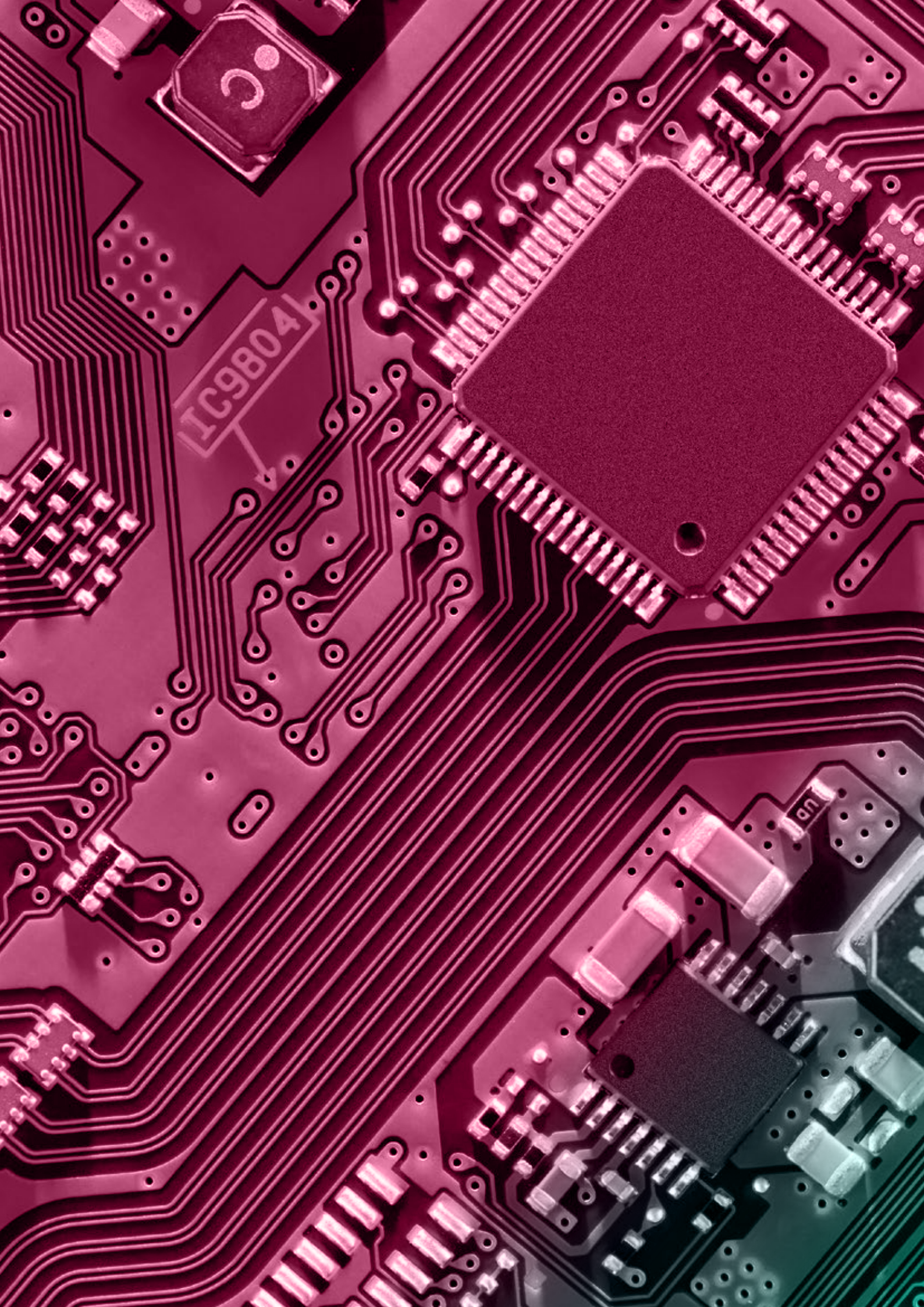
Several European regions are actively participating in the funding of projects.

- 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 as well.

## 5.8 Operational budget execution

The EU budget (in terms of commitment appropriations) allocated for year 2021 has been engaged in its entirety covering KDT JU Calls 2021. In terms of payment appropriations, the EU budget has been used to cover for the pre-financing and actual intermediate and final payments for ECSEL projects. Further information is provided under point "7.3 Budgetary and financial management". 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.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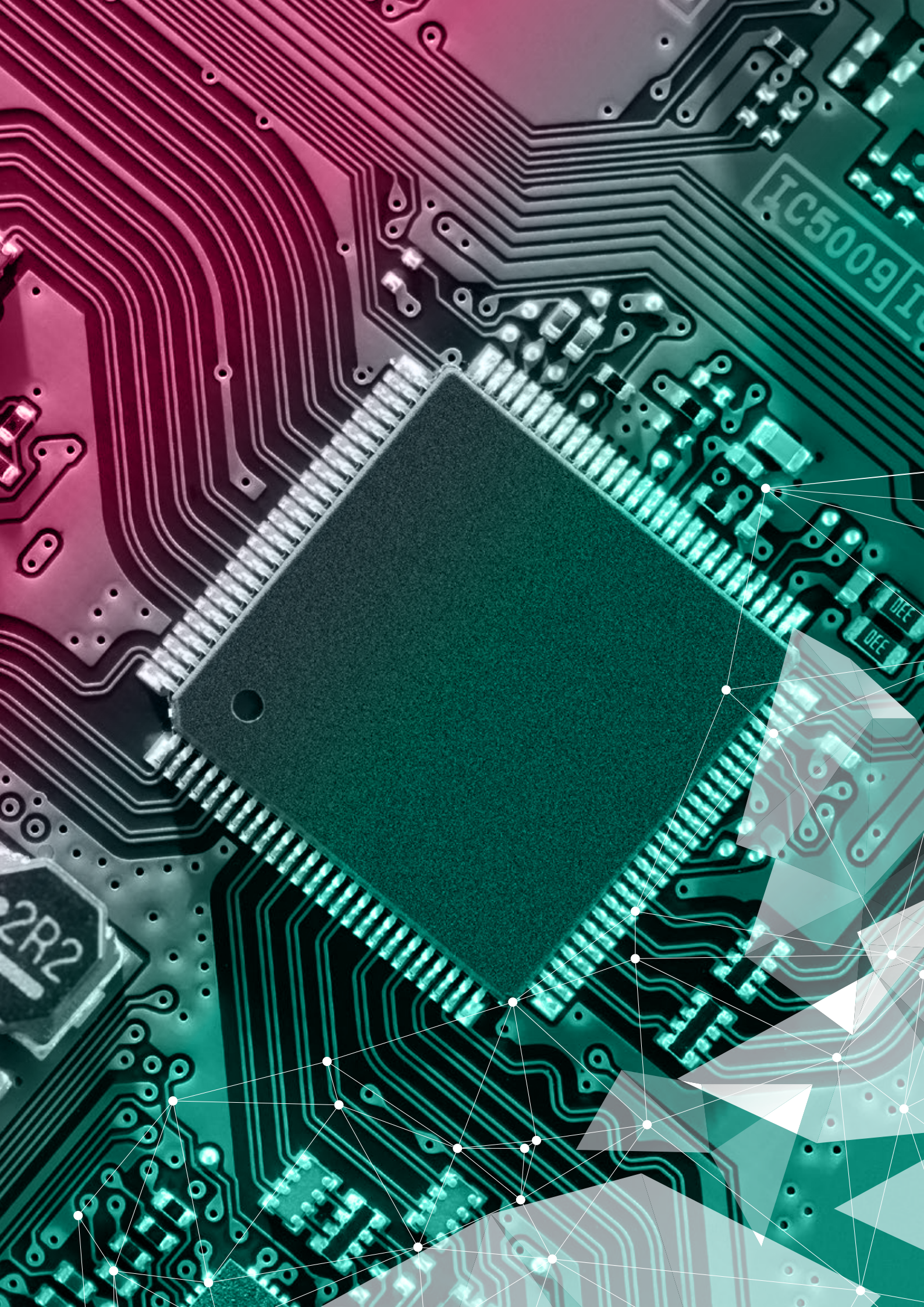
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# 6. Support to Operations

## 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 2021, entirely via videoconferencing due to the limitations imposed by the still ongoing Covid-19 pandemic. 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 external communication activities, with following highlights:

*6.1.2.1 Publications produced:*

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.

Due to the prevailing pandemic situation and the extended rolling-down phase of ECSEL JU, publications were limited to the Annual Activity Report for 2020.

*6.1.2.2 Press activities:*

**Press releases and articles**

In 2021 and influenced by the specific circumstances (including the absence of a Call for Proposals in that year), ECSEL JU only issued Press-Releases in 2021 related to the start-up of its successor JU, KDT JU. However, this was complemented by 19 news releases specific for ECSEL JU, disseminated via the JU's website, covering a wide range of topics and projects' activities.

PR and news items about launch of KDT are covered in the section under chapter 6.1.7.

**Published Articles**

No articles were published in 2021

**Media Coverage**

Media tracking of third-party publications about ECSEL JU is limited due to limited 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 the ECSEL JU community, provide a space for networking and raise awareness about the latest ECSEL JU activities, strategies, and work plan. Such physical meetings were not allowed during the year, due to restrictions imposed on travel and attendance, so all such activities were held online.

**Highlights**

The Symposium 2021 comprised a series of video interviews with key stakeholders. One significant outreach action resulting from this was the initiation of a specific workshop on gender balance in the digital economy – an event to take place in 2022.

With 41 of the 61 projects present, ECSEL JU played a major part in the EFECS event organised by AENEAS, EPoSS and Inside, in association with the European Commission, the ECSEL JU and Eureka, which too was an online experience. Several speaking slots about ECSEL JU were also secured at this important community event.

*6.1.2.3.1 Innovation in Action*

At the end of 2020, in anticipation of the EU's next funding programme, Horizon Europe, ECSEL JU & the 7 other Joint Undertakings (BBI, Clean Sky, FCH, F4E, IMI, S2R and SESAR) collaborated to create a joint publication to present the institutionalised European public-private partnerships (PPPs) and the results of their programmes to date. The publication was announced at the end of 2020, together with a coordinated social media campaign Innovation in Action that run well into January 2021, demonstrating excellent results and celebrating their 10-year run.



*6.1.2.4 Brokerage event (January 12 and 13 2021)*

Organised by the Industry Associations, the event brings together a broad section of the RD&I community around project proposal ideas, with a view to building consortia. ECSEL JU participated, though at a lower level than usual due to there being no ECSEL JU Calls planned for 2021.

*6.1.2.5 Symposium 2021 – online event*

Due to the limitations on travel and meetings imposed by the measures countering the COVID-19 pandemic, the 5th ECSEL JU Symposium took the format of an online event. In particular, it

comprised a set of virtual face-to-face exchanges (15 in total) between an invitee and Mr Bert de Colvenaer, the Executive Director of ECSEL JU, acting as moderator. Members of the European Parliament, European Commission (DGs CNECT, ENER and GROW), Industry and Public Authorities have been interviewed and asked to reply to key questions, as well as their insights for the future and how the new Key Digital Technologies JU (KDT JU) could support the Green Deal, the Digital transformation and all related EU policies in a post-COVID-19 scenario.

Synergies and cooperation at EU and National level are crucial to secure a sustainable transition. In this respect, the programme of the event was designed to go beyond a discussion about technical aspects of the ECSEL JU programme and has seen the contribution of RTOs and other Joint Undertakings (EuroHPC) also.


Interviews 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. Individual interviews and a compilation of the best moments have been posted online. A social media campaign, via Twitter and LinkedIn, has been developed to raise interest and involve ECS stakeholders well in advance and before each interview session.

*6.1.2.6 EFECS - November 25 and 26: online event.*

ECSEL JU signed an SLA with ARTEMIS-IA, the Industry Association taking the leading role in the organisation of the EFECS event on behalf of AENEAS, EPoSS and Inside, in association with ECSEL JU, the European Commission and Eureka, to assure a high visibility of the ECSEL JU and its projects. The event registered a significant number of participants and confirmed once again the high-profile of the ECSEL JU programme. Most of the projects displayed in the exhibition were ECSEL JU funded projects. Participants indicated a high interest in projects results and the crucial role the next generation of JU (Key Digital Technologies) is going to play in the ECS field. It is to be noted that amongst other tasks, the Private Members Board shall organise an advisory Stakeholder Forum. In this respect EFECS is 1. open to all public and private stakeholders having an interest in the field of key digital technologies, and 2. aims to inform stakeholders about and collect feedback on the draft Strategic Research and Innovation Agenda for a given year.

### 6.1.3 Project Award

For the EFECS online event, organised by AENEAS, EPoSS and Inside, in association with ECSEL JU, the European Commission and Eureka, 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.

### 6.1.4 Website & Networks

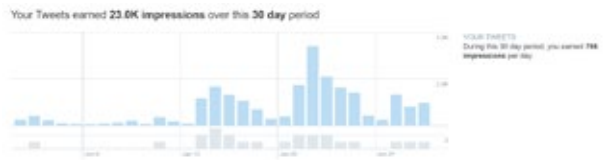
The website that went online in 2017 continued to be regularly updated, serving particularly as a useful vehicle for dissemination about ECSEL JU projects and events. Though no traffic analysis is yet integrated, user feedback is generally positive. The transfer of the site hosting and support to DG-DIGIT 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 had agreed with their counterparts in DG-DIGIT for an extension to the support package presently used, to cover the additional effort that will be required during 2021 to update the existing site to support the new JU that should launch in that year. This was a major effort and was successfully completed as part of the rebranding exercise (see also section 6.1.7): the site was launched with its new KDT-JU livery on November 27th 2021 with url "kdt-ju.europa.eu". Importantly, for continuity of information, all relevant data for ECSEL JU remains available via the new url domain as well as the original "ecsel.eu" domain.


*6.1.4.1 Social Media*

**Twitter**

As one of the main means of external communication during COVID-19 pandemic, ECSEL JU (and KDT JU as of the end of November 2021) had continued actively using and updating its Twitter account throughout the whole of 2021. The number of our followers went from 1351 (as of December 2020) to 1514 (as of December 2021) – a growth of roughly 12%.




The peak of interest in ECSEL JU Twitter account was related to the online ECSEL JU Symposium 2021, during which, and prior to, the staff created the most engaging organic content.

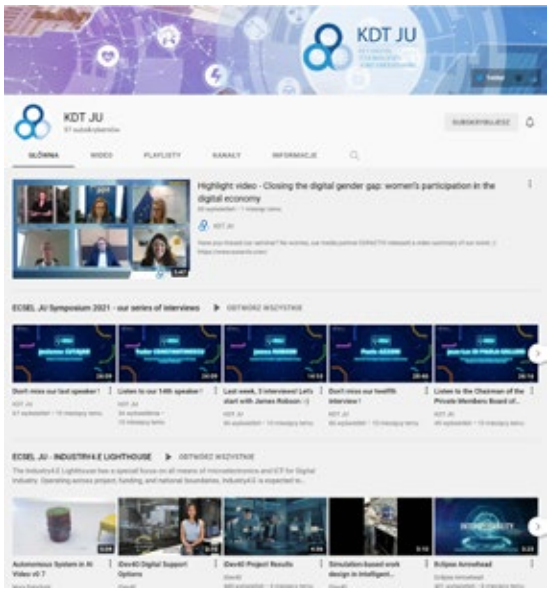
**LinkedIn**

ECSEL JU had expanded the engagement with LinkedIn community in the entire 2021. The Communication Unit had carried out a several LinkedIn campaigns, promoting the ECSEL JU activities and the leading events. ECSEL JU/KDT JU LinkedIn profile reached a peak of 1180 followers in December 2021.

**YouTube**

New in 2020, a YouTube channel was set up as a vehicle for public promotion of the programme though video clips. In 2021, the Communication Unit had extensively used the channel to promote the JU's activities, especially related to the online event ECSEL JU Symposium 2021, which took a form of 15 video interviews released daily for two weeks. 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…).

In particular, the YouTube channel was used to host the video-interview series of the Symposium 2021 (see above).




### 6.1.5 Institutional Communications

The continuing COVID-19 pandemic situation has affected the regular working method throughout 2021. Institutional communication is about building relationships and trust with all those communities interested in and working for ECSEL JU and its future. In this new and sensitive environment, we have multiplied video calls and virtual meetings as the only effective opportunity of exchanges for decision makers to hear from us and our stakeholders (e.g. the ECSEL JU was often present at the ITRE and CONT Committees parliamentary works and other key events organised by the EC).

Some examples:

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.

| | |
|---|---|
| 22 March 2021 | On-line meeting with Ms M. da Graça Carvalho, MEP (PT) |
| 22 March 2021 | On-line meeting with Mr C. Ehler, MEP (DE) |
| 22 April 2021 | On-line meeting with ECSEL Austria |
| 19 May 2021 | On-line meeting with ECSEL Italy |
| 22 June 2021 | On-line meeting with Ms J. Cutajar, MEP (MT) (Symposium) |

*Table 7: 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

### 6.1.6 Other outreach activities

Unlike previous years, no such outreach activities were possible due to the pandemic situation.

### 6.1.7 Launch of KDT JU: rebranding and announcement

In support of the transformation from ECSEL JU to KDT JU, the communications unit developed – entirely with internal resources – a new visual identity as part of the necessary re-branding exercise.

The new logo is the most obvious element in the branding of KDT JU. The logo design was conceived follow guidelines that, in order to set the new JU apart, it should be visually very different from the previous JUs logos, yet still contain element reminiscent of its history. Several designs were put forward, and the Governing Board expressed preference for the design shown below.

The KDT JU logo, shown here, is made available in different formats; each to be used as best fits the layout requirements.

The logo emphasises inclusivity, collaboration, and diversity, as well as projecting a sense of renewal. It comprises the initials "KDT JU" with its definition, conjoined with a pictogram based on three circles. The circle represents community, unity, collaboration, and strength while the different shades of blue, the colour of technology and creativity, flow into each other to imply unity, representing the tri-partite concept of the Joint Undertaking (the four stars simply indicating the link with the EU), the diversity of all involved partners and the contributions they bring to the whole. Derivatives offering different aspect ratios but retaining all essential elements are available for various layout uses (presentations, letterheads, website, …).

In support of the launch of KDT and based on this new logo, various elements were designed and produced in-house, including:

- a complete set of stationery templates, such as official letterhead, documents, PowerPoint slides. In all these documents, new requirements regarding the use of the EU emblem are implemented, which requires the addition of the item "European Partnership".
- a mini video clip, used on the home page of the website, further drawing attention to the change (https://vimeo.com/651485802)
- press releases and a statement from the Executive Director on the launch of KDT JU (see below).

Sadly, due to the changeover being so late in the year, a planned online presentation of KDT JU by the main stakeholders could not be executed due to limited availability of many of the key stakeholder representatives. This is postponed to 2022, where it can be integrated alongside other planned events.

To assure consistency in communications materials for KDT JU, a new Visual Identity Guide was developed. Alongside graphic standards and recommendations, the document also expands on the style of communication to be maintained (reference the EC's language guide for English), extending also to the use of gender-inclusive language (also referring to documents of the EP for guidelines).

Four press-releases in total were made concerning KDT JU:

- Tuesday, 30 November 2021 - ECSEL / KDT JU Executive Director on the launch of KDT
- Friday, 10 December 2021 - The first KDT JU calls in 2021 will be launched on 16 December 2021.
- Tuesday, 14 December 2021 - Ralf Bornefeld elected as the new Chair of KDT Joint Undertaking
- Thursday, 16 December 2021 - KDT JU Launches Calls for Proposals 2021

## 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 2021, the Governing Board continued adopting decisions relating to the smooth running of the organisation as well as annual decisions: MASP, work programme, annual accounts, budget, assessment on the ED Annual Activity Report.

Decisions were prepared for adoption by the new KDT JU's Governing Board in its first meeting of 10 December 2021 to ensure that the regulatory, legal and financial framework was in place, and thereby business continuity throughout the transition from ECSEL to KDT.

The JU prepared and submitted its legal defence in a court case brought by a beneficiary disputing a recovery.

## 6.3 Procurement and contracts

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

To reach its objectives and adequately support its operations and infrastructure, the JU allocated funds to procure the necessary services and supplies. In the context of sound financial management and efficiency, the JU made to the largest 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).

Given the sanitary context due to the COVID-19 pandemic and the restrictions imposed, substantially all meetings and events were held remotely and only a very few missions took place in the last quarter of 2021.

As a result, in 2021, the JU ran very few procurement procedures, essentially for low value contracts.

### 6.3.1 Major procurement procedures

- In May 2021, two negotiated procedures for very low value were launched for the award of two contracts for the logistical support and the creation of videos in the context of the organisation of the digital version of "ECSEL JU Symposium 2021".

- In September 2021, the JU launched a negotiated procedure for a low value contract related to the organisation of a high-level seminar.

## 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 organisation in the joint IT steering committee.

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.

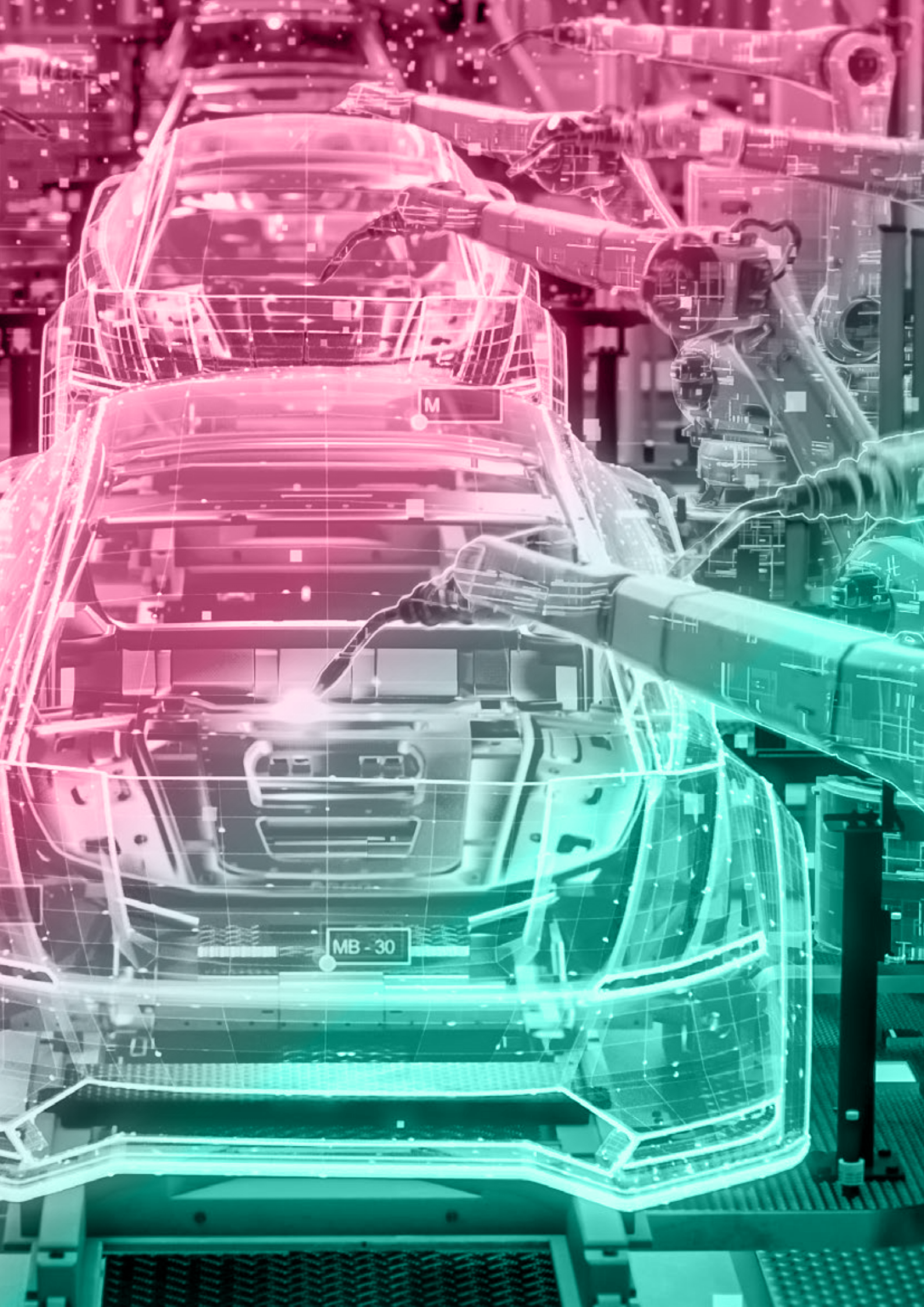
With the name change to KDT, the JU Office had to ensure that all Commission systems and internal systems were updated to reflect the change. With thorough planning between relevant departments and external services, the JU ensured a smooth transition. The Commission services helped resolve some issues, but all services were kept running or restored in a very timely manner.

The exercise to mitigate risks identified by the DPIA was performed and the JU is working with the service provider to ensure mitigations are implemented in Office 365. Completion is scheduled for June 2022.

During 2021, ECSEL has developed a new modern application using the new functionalities offered by Microsoft 365, allowing national authorities, industry associations and ECSEL staff to remotely provide the necessary information.

The application provides a modern and user-friendly platform in which to input information regarding the projects, their beneficiaries and visualise the situation project by project. It aims to serve as a repository where available information can easily be found. From the perspective of the JU, this should be an appropriate tool to support compliance with the reporting obligations set out in Article 4 of the ECSEL Council Regulation and the reporting of in-kind contributions to operational activities (IKOP).

In view of the pandemic situation, efforts were put to support staff with IT equipment and applications to facilitate work and ensure business continuity. Landline telephony systems were transferred to Teams telephony for more flexibility and financial efficiency. A ''Building access'' tool was also put in place to ease the coordination of office presence.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# 7. Part II. Management Report

## 7.1 Governance

### 7.1.1 Governing Board

Up to 14 December 2021, the Governing Board was chaired by **Sabine Herlitschka**. Following the adoption (November 2021) of the Council Regulation establishing KDT JU, the Governing Board was chaired by **Ralf Bornefeld.**

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 2021 the Governing Board held three meetings, organised four written procedures and adopted six decisions. Meeting summaries and decisions adopted are available on the JU website.

Decisions adopted:

| Number | Title | Date | Adoption |
|---|---|---|---|
| GB 2021 153 | IKOP contribution in operational activities in 2020 | 11.02.2021 | written procedure 60 |
| GB 2021 154 | Budget 2021 Amendment 1 | 19.04.2021 | written procedure 61 |
| GB 2021 155 | Vacancy ECSEL ED | 21.05.2021 | written procedure 62 |
| GB 2021 156 | Final Annual Accounts 2020 | 22.06.2021 | meeting 30 |
| GB 2021 157 | AAR 2020 & assessment by the GB | 22.06.2021 | meeting 30 |
| GB 2021 158 | Observer and representative for ECSEL ED recruitment | 05.08.2021 | written procedure 63 |
| KDT GB 2021 01 | KDT GB Rules of Procedure | 10.12.2021 | |
| KDT GB 2021.02 | ECSEL decisions that continue to apply to KDT JU:<br>• Conflict of interests' policy<br>• Public access to documents<br>• Internal audit capability<br>• Ex-post audit strategy<br>• Prevention of Fraud, corruption and any illegal activity<br>• Anti-fraud strategy<br>• Methodology for calculating IKOP | 10.12.2021 | |
| KDT GB 2021.07 | SRIA 2022 | 10.12.2021 | |
| KDT GB 2021.08 | Work programme 2022 | 10.12.2021 | |
| KDT GB 2021.09 | Budget 2022 | 17.12.2021 | |
| KDT GB 2021.10* | Appointment of interim Executive Director | 24.12.2022 | |

* The list of KDT GB decisions in 2021 is just indicative. For a full list, please consult KDT JU website.

Members of the Governing Board

Private Members:

| | | |
|---|---|---|
| AENEAS | **Bedran** | **Caroline** |
| | 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 |
| | Mokrani | Hervé |
| | Roux | Laurent |
| | Sangiorgi | Enrico |
| | Sebastian | Ina |
| | van den Biesen | Jan |
| | Van den Bosch | Anne |
| | van Staa | Peter |
| | Wyon | Christophe |
| | Zandbergen | Peter |
| INSIDE | 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 |

| | | |
|---|---|---|
| EPOSS | Harris | Philip J. |
| | Herlitschka | Sabine |
| | Hufeld | Knut |
| | 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 |
| | Burger | Thorsten |
| | Carpanzano | Emanuele |
| | DalMolin | Renzo |
| | Dettmann | Wolfgang |
| | Donat | Albrecht |
| | Finkbeiner | Stefan |
| | Gessner | Wolfgang |
| | Groppo | Riccardo |
| | Herlitschka | Sabine |
| | Hoffmann | Karsten |
| | Lequepeys | Jean-René |
| | Offenberg | Michael |
| | O'Murchu | Cian |
| | Otto | Thomas |
| | Ruano | Jesus |
| | **Steimetz** | **Elisabeth** |
| | Tafuri | Alberto |
| | Torkkeli | Altti |
| | 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 |
| | Monté | Ann |
| | 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 |
| | Kaltschew | Julia |
| | **Mengel** | **Stefan** |
| | Rittner | Johannes |
| | Schröder | Sabine |
| | Schmidt | Uwe-Michael |
| **DK** | **Cagdas** | **Citirikkaya** |
| | Lindberg | Børge |
| | Vittrup | Jens Peter |
| **EE** | **Vahtrus** | **Mikk** |
| **EL** | Farmaki | Danae |
| | Koniaris | Marios |
| | Gongolidis | Vasileios |
| | **Zekentes** | **Konstantinos** |
| **ES** | de Francisco Marcos | David |
| | Fernandez Garcia | Estrella |
| | Gómez Miguel | Beatriz |
| | **Ginard Pariente** | **David** |
| | Ibáñez de Aldecoa Quinta | Juan Miguel |
| | Pelayo | Enrique |
| | Lucena Chacón | Rafael |
| | Serrano Agejas | Joaquin Angel |
| **FI** | Ahola | Kimmo |
| | **Heikki** | **Uusi-Honko** |
| | Leino | Kari |
| **FR** | Alcayna | Simon |

| | | |
|---|---|---|
| | Madigout | Geoffrey |
| | **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** | **Tesi** | **Fiona** |
| | Sammut | Isaac |
| **NL** | Ruck | Ben |
| | Schaap | Wilbert |
| | van Roosmalen | Fred |
| **NO** | Ahmed | Waqar |
| | Aune | Agnes |
| | **Herrera** | **Ivonne** |
| **PL** | Katcki | Jerzy |
| | **Michalowski** | **Marcin** |
| | Sobanski | Przemyslaw |
| **PT** | Azevedo | Sofia |
| | **Coelho** | **Filipa** |
| | Isidro | Anabela |
| | Joao | Ribau |
| | 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** | **Telek** | **Peter** |
| **TR** | **Bener** | **Ezgi** |

*Lead delegates in **bold***

European Commission:

| | | |
|---|---|---|
| | Ibañez Gallardo | Francisco |
| | Magan | John |
| | Maloney | Colette |
| | Mendez Blanck Conrady | Enrique |
| | **Sioli** | **Lucilla** |
| | Zwegers | Arian |

*Lead delegate in **bold***

### 7.1.2 Executive Director

Bert De Colvenaer was appointed Executive Director as of 1 January 2016 and was renewed in December 2018 for three years (as of 1 January 2019). He was also appointed as an Interim Executive Director of KDT JU until 31 October 2022.

The Executive Director has adopted the following decisions:

| Number | Title | Date |
|---|---|---|
| ED 2021 318 | Nomination DMO-Deputy DMO | 12.01.2021 |
| ED 2021 319 | IKOP explanatory note | 02.02.2021 |
| ED 2021 320 | Acceptable Use Policy for Mobile Devices and ICT Services | 30.06.2022 |
| ED 2021 321 | ABAC and eGrants IT tools contact points | 07.05.2021 |
| ED 2021 322 | ECSEL Data Protection internal rules | 30.06.2022 |
| ED 2021 323 | Amendment to ED 2020 316 (Privacy Policies) | 30.06.2022 |
| ED 2021 324 | *Classification sensitive data* | cancelled |
| ED 2021 325 | Budgetary transfer 2021-01 | 30.06.2022 |
| ED 2021 326 | AOD delegation | 25.06.2021 |
| ED 2021 327 | Reclassification Committee | 05.10.2021 |
| ED 2021 328 | Budgetary transfer 2021-02 | 11.10.2021 |
| ED 2021 329 | Decision relating to the Reclassification of staff for the year 2021 | 11.11.2021 |

### 7.1.3 Public Authorities Board

In 2021 the Public Authorities Board was chaired by Doris Vierbauch. The vice-chair was Kari Leino: his mandate was prolonged.

The mandate of the new Public Authorities Board Chair, Doris Vierbauch, started at the end of the meeting on 25th November 2019 and was prolonged until the end of ECSEL JU. She was also appointed the KDT JU PAB Chair as of November 2021.

In 2021 the Public Authorities Board held four meetings, organised one written procedure and adopted two decisions. Meeting summaries and decisions adopted are available on the JU website.

Decisions adopted:

| Number | Title | Date | Adoption |
|---|---|---|---|
| PAB 2021 57 | Amendement funding decision ECSEL Call 2020-1 | 12.05.2021 | WP 18-2021 |
| PAB 2021 58 | Amendement funding decision ECSEL Call 2020-2 | 12.05.2021 | |

Delegates to the Public Authorities Board:

| | | |
|---|---|---|
| AT | **Almansa** | **Ana** |
| | Niklfeld | Georg |
| | Vierbauch | Doris |
| | Wiesmüller | Michael |
| BE | Deprez | Francis |
| | Maas | Stijn |
| | Monté | Ann |
| | Sileghem | Maarten |
| | **Van de Loock** | **Leo** |
| BG | **Komatichev** | **Emil** |
| | Tomov | Kalin |
| European Commission | Ibañez | Francisco |
| | Magan | John |
| | Maloney | Colette |
| | Mendez Blanck Conrady | Enrique |
| | **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 |
| | Schröder | Sabine |
| | Schmidt | Uwe-Michael |
| DK | **Cagdas** | **Citirikkaya** |
| | Lindberg | Børge |
| | Vittrup | Jens Peter |
| EE | **Vahtrus** | **Mikk** |
| EL | Farmaki | Danae |
| | Koniaris | Marios |
| | **Gongolidis** | **Vasileios** |
| ES | de Francisco Marcos | David |
| | Fernandez Garcia | Estrella |
| | Gómez Miguel | Beatriz |
| | **Ginard Pariente** | **David** |
| | Ibáñez de Aldecoa Quinta | Juan Miguel |
| | Pelayo | Enrique |
| | Lucena Chacón | Rafael |
| | Serrano Agejas | Joaquin Angel |
| FI | **Ahola** | **Kimmo** |
| | Heikki | Uusi-Honko |
| | Leino | Kari |
| FR | Alcayna | Simon |
| | Madigout | Geoffrey |
| 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 | **Tesi** | **Fiona** |
| | Sammut | Isaac |
| NL | Ruck | Ben |
| | **Schaap** | **Wilbert** |
| | van der Bijl | Robert-Jaap |
| | van Roosmalen | Fred |
| NO | Ahmed | Waqar |
| | Aune | Agnes |
| | **Herrera** | **Ivonne** |
| PL | Maciejko | Krystyna |
| | **Ratajczak** | **Agnieszka** |
| | Wajs | Andrzej |
| PT | Azevedo | Sofia |
| | **Coelho** | **Filipa** |
| | Isidro | Anabela |
| | Joao | Ribau |
| | 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 |
| | **Gezici Koc** | **Ozlem** |
| | Hasekioglu | Orkun |

*Lead delegates in **bold***

### 7.1.4 Private Members Board

In 2021 members of the Private Members Board of the ECSEL JU were:

**From AENEAS:**
Caroline Bedran
Ina Sebastian
Peter Zandbergen

**From ARTEMIS-IA (INSIDE as of October 2021):**
Jan Lohstroh
Jean-Luc di Paola-Galloni
Michael Paulweber

**From EPoSS:**
Elizabeth Steimetz
Michael Offenberg
Thorsten Burgen

## 7.2 Major Developments

In 2021, 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 Public Authorities Board until the end of ECSEL JU.

Following the adoption of the Council Regulation establishing KDT JU, Ralf Bonerfeld was elected the Chair of the KDT JU Governing Board, and Doris Vierbauch was elected as Chair of the Public Authorities Board.

The Council Regulation establishing the new generation of JUs under Horizon Europe, including Key Digital Technologies (KDT) Joint Undertaking (as ECSEL JU's successor) was published in the Official Journal for KDT JU's creation to become effective on 30.11.2021.

## 7.3 Budgetary and financial management

ECSEL JU's Governing Board had approved the initial annual budget for year 2021 on 11 December 2020 by ECSEL GB Decision 2021.150.

On 19 April 2021 ECSEL JU's Governing Board adopted GB Decision 2021.154 amending for the first time the initially adopted budget. Applying article 6.5 of the JU Financial Rules that foresees the reactivation of unused appropriations from previous budget exercises which should be used in priority, this first amendment served for:

- the increase of administrative payment appropriations under Titles 1 and 2 in order to honour payments due under administrative commitments entered in previous years,
- the adjustment of operational payment appropriations under Title 3 by lowering the appropriations from budget 2021 and reverting them into reactivated unused appropriations in order to be consumed in priority.

Following the launching of the new JU, the KDT JU's Governing Board approved on 10 December 2021 the first KDT budget for year 2021 by KDT GB Decision 2021.06. This first KDT budget introduced a new budget structure and authorised the commitment appropriations for the KDT Calls 2021 under Horizon Europe without bringing any further modification with regard to the last approved ECSEL budget.

Overall, in 2021, total available appropriations were EUR 214 million for commitments and EUR 199 million for payments (including 1 million assigned revenue in both commitment and payment appropriations). The budget implementation reached roughly 100% in terms of commitment appropriations and 84% in terms of payment appropriations[6].

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

Under Title 1 the JU budget execution reached 93% 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 94% in terms of commitment appropriations and 73% in terms of payment appropriations covering the JU's running costs.

In addition to the budget amendments, the Executive Director, in accordance with article 10 of the JU Financial Rules, transferred appropriations between chapters within the same Title in the course of 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 as a result of the COVID 19 crisis, mainly relating to staff costs, missions, reviews experts' costs, meetings and audits, was carried over to 2022 budget by KDT JU's Governing Board decision.

6 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 2021 will be presented in the context of the Annual Accounts 2021 and the Report of Budgetary and Financial Management as per the JU Financial Rules.

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

Under Title 3, the JU budget covers the operational expenditure related to the implementation of projects under the 7th Framework Programme (FP7 legacy), the Horizon 2020 Programme (H2020), the Horizon Europe Programme and as of the launching of the new JU, the expert costs for evaluations and reviews.

Under Horizon Europe, the budget implementation in commitment appropriations reached 100% corresponding to the first KDT calls launched in December 2021.

Under H2020 and given the completion of the actions, there were no commitment appropriations in 2021. The budget implementation in terms of payment appropriations reached 85%. The major part of the payment appropriations was used for the pre-financing of the grants resulting from the 2020 calls for proposals, while the minor part was used for interim and final payments for grants resulting from previous ECSEL calls for proposals. At the end of the year following the completion of several H2020 projects and the signature of grant agreements for calls 2020, the JU has made de-commitments for a total amount of kEUR 6 508.

Under FP7, the budget implementation in payment appropriations reached 23% covering the very few remaining final payments related to FP7 legacy projects. At the end of 2021 according to the principle of sound financial management and following the receipt of the few remaining end of projects certificates from the related National Funding Authorities, the JU has proceeded to de-commitments for a total of kEUR 1 932, closing all remaining FP7 commitments for calls 2012 and 2013. At the end of 2021, only one FP7 project was carried forward to 2022 as it was pending finalisation due to an open audit.

## 7.4 Human Resources

In 2021, ECSEL JU recruited two contractual agents for posts of financial/administrative assistant (left vacant after former staff departure). The recruitment was finalised in Q4 of 2021. Two temporary agents went on retirement, one has already been successfully replaced.

In May 2021, the Governing Board of the ECSEL JU adopted the vacancy notice for the position of the Executive Director of the Joint Undertaking.

## 7.5 Follow –up on Audits and Evaluations

The following paragraphs contain an overview of audit and evaluation actions and their follow up during 2021.

### 7.5.1 Internal Audit Service (IAS)

ECSEL JU closed all recommendations from previous audits and no IAS audit was conducted in 2021.

### 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 2021, the main activities of the ICAM in the area of audit management focused on coordinating the implementation and follow-up of the audits carried out by IAS (internal auditor of the ECSEL JU), the European Court of Auditors, the external auditors and the ECSEL JU ex-post audits as per H2020 Common Audit Strategy. Further, the main activities in internal control focused on coordination of the Risk Management Exercise and consolidation of the internal control framework in the JU including the self-assessment of the effectiveness of the Internal Control Framework.

### 7.5.3 European Court of Auditors (ECA)

In 2021 ECSEL JU continued to assist the Court of Auditors during their missions. 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 2021 annual accounts is ongoing. A first mission of the Court of Auditors took place in October 2021 and will be followed up by a second mission in 2022. The annual accounts are audited by an external audit firm (contracted through a DG Budget framework contract).

### 7.5.4 Follow up on discharge

The discharge in respect of the implementation of the budget of ECSEL JU for the financial year 2020 is ongoing. The timeline of the annual discharge procedure foresees that by end of March n+2 adoption of the European Parliament (EP) reports in plenary session, the EP decides whether to grant or postpone the discharge.

### 7.5.5 Evaluations

There were no evaluations on ECSEL JU in 2021. The action plan resulting from the final evaluation of the JU´s performance under FP7 and mid-term evaluation of its performance under Horizon 2020 was completed.

## 7.6 Environment management

A “Go-green group” has been created in 2019 for all JUs. The aim is to compile environmental initiatives and ideas that can be implemented in the different JUs.

Due to the pandemic situation and the lack of office presence, the activities of this group were largely suspended.


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# 8. Part III. Internal Control

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 Internal Control Framework is based on the framework adopted by the European Commission that 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 principle 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 and provide a level of assurance from its systems at least equivalent to the one of the European Commission.

Since 2020, ECSEL JU has 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).

In 2021, 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 the self-assessment of monitoring indicators and 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 2021 did not reveal any control weaknesses.

Risks identified through the annual risk assessment exercise (described in section 8.2.7) 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.

## 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 2021, 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 2021 can be split in two main parts: FP7 completion payments (EUR 0.6 million) and Horizon 2020 operational payments (EUR 162 million, which include prepayments and actual intermediate and final payments for projects).

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 2021, 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 2020 activities.

*Table 24: Summary of ex-post audit declarations received*

| | |
|---|---|
| Total NFAs | 10 |
| Total declarations received | 7 |
| Response % by NFA | 70% |
| Response % by payments | 66% |

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 2.24% and the Residual Error Rate is 1.19%, staying below the targeted threshold of 2%. This calculation is based on EU contribution paid to beneficiaries in H2020.

### 8.2.4 Control efficiency and cost-effectiveness

The principle of efficiency concerns the best relationship between resources employed and results achieved. The principle of effectiveness concerns the attainment of the specific objectives set and the achievement of the intended results.

The purpose of this section is, therefore, to report on the overall assessment of the costs and benefits of controls and the information is summarised in the tables presented below:

| | |
|---|---|
| Operational Expenditure (Payments in EUR) | 162,702,348 |
| % in total budget | 97.3% |
| Estimated cost of controls ex-ante | 1,086,192 |
| Cost of ex-ante controls as % of expenditure | 0.67% |
| Estimated Benefits of controls (EUR) | 1,809,028.85 |
| Total estimated FTEs (ex-ante & ex-post) | 10.9 |
| Total costs controls | 1,284,342.43 |

Detailed table of the FTEs performing the control activities:

| Sector | Estimated FTEs allocated to controls | FTEs costs* | Other costs related to controls | Total |
|---|---|---|---|---|
| Call management, selection & evaluation phase/Grant Award/ Grant management | 9.8 | 845,600 | 231,592.43 | 1,086,192 |
| Total cost of ex-ante controls | 9.8 | 845,600 | 231,592.43 | 1,086,192 |
| | | | | |
| Total Ex-post control | 1.1 | 198,150 | 0 | 198,150 |
| Total | 10.9 | 1,519,450 | 231,592.43 | 1,284,342.43 |

| | |
|---|---|
| Cost of controls/Operational Expenditure | 0.79% |

*For this calculation we have used average cost for estimates for Legislative Financial Sheets. As per DG BUDG note, 30/11/2021.

### 8.2.5 Internal Audit

For the financial year ended 31 December 2020, 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 2020 annual accounts.

The report concluded the following:

- The ECSEL JU accounts for the year ended 31 December 2020 present fairly, in all material respects, the financial position of the ECSEL JU, the results of its operations, its cash flows and the changes in net assets for 2020, in accordance with its Financial Regulation and with accounting rules adopted by the Commission's accounting officer.

- The revenue underlying the accounts for 2020 is legal and regular in all material respects.

- The payments underlying the accounts for 2020 are legal and regular in all material respects.

Without calling into question the European Court of Auditors´ unqualified opinion, the ECA also made observations related to the implementation of the FP7 and H2020 budget and internal controls. The report also included a follow-up of previous years' observations.

In particular, the ECA mentioned:

- Implementation of FP7 budget: the auditors indicated that ECSEL is still finalising FP7 projects but remaining FP7 budget at end 2020 is low. FP7 projects of ARTEMIS/ENIAC: ECSEL 2020 annual accounts did not disclose the estimates of financial contributions of Participating States and in-kind contributions of private partners. ECSEL informed the Court of Auditors that at the time of ARTEMIS and ENIAC JUs, after discussions with DG BUDG (inter alia), it was decided not to include this information in the annual accounts.

- Implementation of H2020 budget: the auditors noted the use of reactivated payment appropriations of previous years before using the new payment appropriations of the year. ECSEL confirms that at the end of 2021, any remaining operational payment appropriations were reactivated and consumed.

- Internal controls: the auditors confirmed that the new Internal Control Framework is implemented;

- 2020 audits of randomly selected ECSEL payments to Horizon 2020 beneficiaries revealed in one case, errors related to calculation of declared personnel costs, and in another case, lack of evidence on declared direct costs for the purchase of services from another beneficiary that is only acceptable if duly justified. ECSEL JU addressed the identified findings with the respective beneficiaries.

The full report including the reply of the ECSEL JU can be found here:

Annual report on EU Joint Undertakings for the financial year 2020 https://www.eca.europa.eu/Lists/ECADocuments/JUS_2020/JUS_2020_EN.pdf

### 8.2.7 Internal Audit

The Internal Audit Service of the European Commission performs the role of Internal Auditor of the ECSEL JU, as specified in Article 28 of the Financial Rules.

In October 2021, the ECSEL JU Executive Director informed the internal auditors on the latest important developments at the JU and the results of the latest risk assessment exercise.

### 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 October 2021 and as a result the risk register was updated.

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 |
|---|---|---|
| Disruption of the accounting function | Disruption of the accounting function as DG BUDG will terminate the SLA and function of accountant of the JU.<br>Termination of DG BUDG SLA on accounting means that the JU may not be able to ensure proper business continuity within the expected imposed timeframe and could result in not getting a clean audit opinion nor a favourable GB opinion, and of facing subsequent issues during the discharge process. | Evaluate and discuss with DG BUDG and with the other JUs potential solutions on the accounting function. |
| Lack of adequate and sufficient resources in KDT | The increase in KDT budget with the same staff plan as for ECSEL JU affects the adequacy and sufficient resources to implement the objectives and functionalities set in KDT. | Increase of recruitment of external experts to support the workload in operations.<br>Overall, the JU would need to find adequate external resources to implement all activities. |
| Lack of clarity and delays for KDT launch | Lack of clarity in the transition to KDT and delays affecting how the future programme will be governed and administered. | Monitor and discuss with Commission and engage stakeholders to share information and engage on discussions with GB to find solutions. |
| Low quality and few proposals in launch of KDT | In 2022 there will be two evaluations with higher budget (450m). Also, for call 2021, difficulties are identified with selection of priority topics.<br>The identified risk would bring dissatisfaction/disappointment on KDT. KDT could be perceived as too ambitious and not reaching objectives.<br>Impact will be long term - for the duration of KDT. | Discuss and agree with GB the best approach for the first calls of KDT and engage stakeholders through communication actions to the KDT community. |
| 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.<br><br>In addition, the lack of awareness of the JU's 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 in order to raise awareness on the matter. |
| Not achieving the target values of IKOP | Not achieving target values of IKOP. Certification of IKOP as defined in Council Regulation. | Prepare actual updates on a yearly basis with latest information on project data (as part of IKOP validation for annual accounts) |

**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 ("EU-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 KDT website: Register of Processing Activities of the Joint Undertaking https://www.ecsel.eu/register-processing-activities

**Conflict of interest**

In 2021, 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.

# 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, Bert De Colvenaer, Executive Director of the KDT 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[7] 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 KDT JU.

Brussels,

7 "True and fair" in this context means a reliable, complete and correct view on the state of affairs in the Joint Undertaking

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

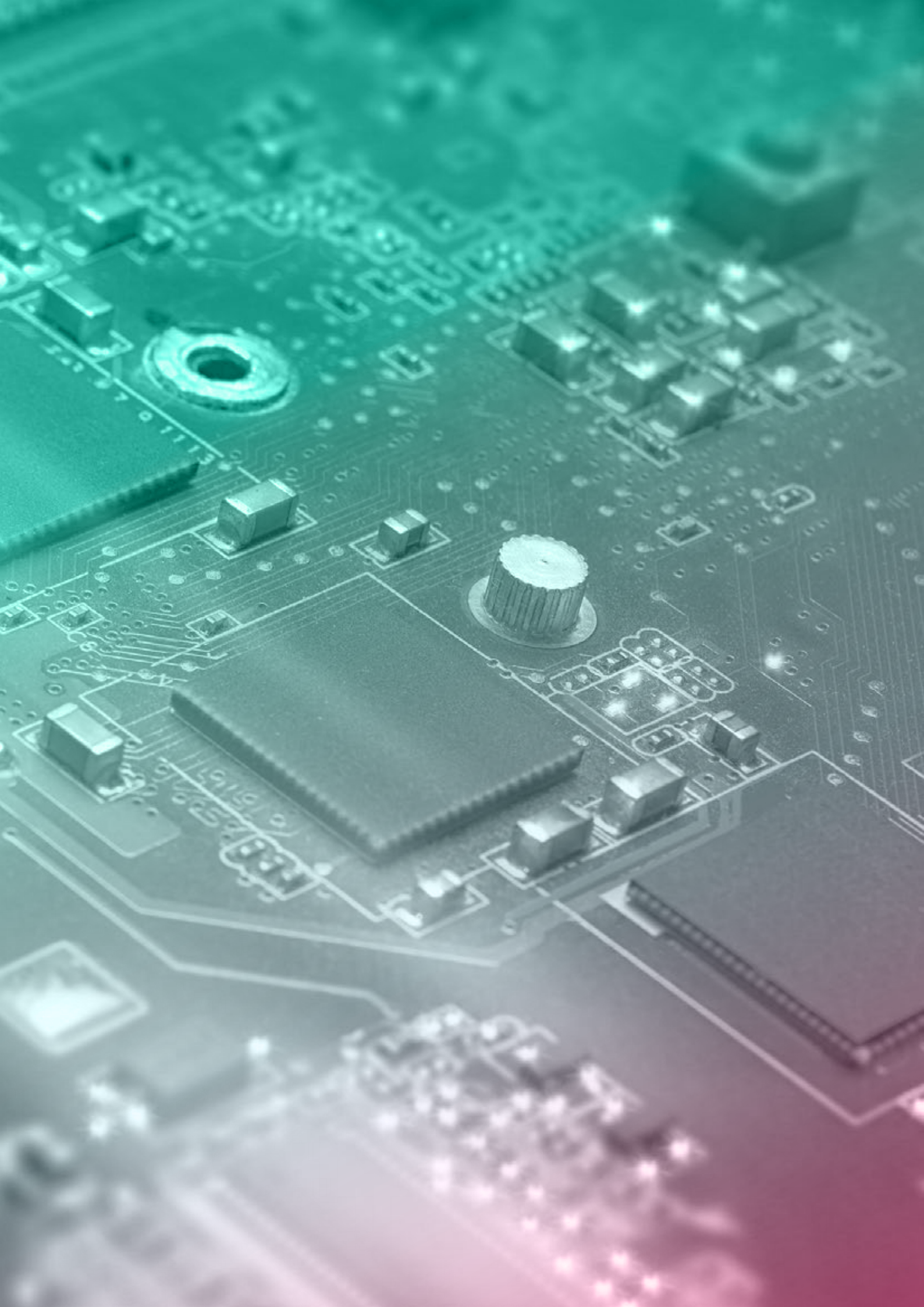
We the undersigned hereby declare that the information provided in our respective contributions to the present Annual Activity Report and in its annexes are, to the best of our knowledge, accurate and complete in all material respects.

Brussels, 09th June 2022

Bert DE COLVENAER, Executive Director

Yves GIGASE, Head of Programmes


Luciano GAUDIO, Acting 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[8] common to all 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] | | 374 SMEs introduced innovations from the projects of calls 2014 to 2017. Later years are not included as the values are only meaningful at the end of the project. An SME can declare both a market innovation and a manufacturing related innovation. | |
| | 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. |
| 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 |

8 (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 | 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 | 5.06 patents per 10M€ EU Funding for finished projects (calls 2014 to 2017)) | (Table 8) 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. |
| | 16 | Number of prototypes testing activities and clinical trials[9] | 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] | 32 prototypes and clinical trials per 10M€ EU funding for finished projects (calls 2014 to 2017) | (Table 9) |
| | 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] | 47 publications per 10M€ EU funding for finished projects (calls 2014 to 2017) | (Table 10) 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] | 20 companies introducing innovations new to market or company per 10M€ EU funding for finished projects (calls 2014 to 2017) 41 finished projects (82%) introduced innovations | (Table 11) |
| 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 | Not applicable | No evaluations were launched in 2021. |

9 Clinical trials are IMI specific

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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? | | Not applicable | |
| 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 2020 signed in 2021:<br>14 projects<br>100% grants signed within target<br>In calendar days.<br>Average TTG: 239<br>Max TTG: 243 | |
| | 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<br>Average TTG in calendar days<br>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)<br>-pre-financing<br>- interim payment<br>-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;<br>Average number of days for administrative payments;<br>Number of experts appointed | Joint Undertaking | | -pre-financing (30 days)<br>- interim payment (90 days)<br>-final payment (90days) | For ECSEL JU (H2020) payments:<br>Pre-financing: 100 % were on time<br>Interim payment: 100% were on time<br>Final payment: 100% were on time<br>Experts: see else where | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| HR | NA | Vacancy rate (%) | | % of post filled in, composition of the JU staff [10] | Joint Undertaking | n.a. [new approach under H2020] | | Recruitment of 2 CA in 2021<br>SNE post still open as of 31/12/2021<br>A recruitment procedure for the filling of the ED post was launched in 2021 and will be finalised the Q4 of 2022<br>2 TAs retired, 1 was replaced, 2nd replacement in preparation | |
| JU EFFICIENCY | NA | Budget implementation/ execution:<br>1. % CA to total budget<br>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<br>84% 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<br>% of delayed payments (of the total) | Joint Undertaking | | | 8 payments were delayed (0.4% of total administrative payments) - delays did not exceed 15 days | |

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.

10 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[11] common to all 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 | Not applicable | No calls in 2021 |
| | | 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 EU funding amount for signed grant agreements: 157M€ out of a total of 170M€ | For calls 2020 |
| 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 | Not applicable | For calls 2021 |
| | | 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 | Not applicable | For calls 2021 |
| 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 142 SME beneficiaries 17% of total EU funding | For calls 2020 |

11 (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 2020 |
| | | 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<br>RTD Monitoring Report | YES | Not available | No calls 2021 |
| | | 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<br>RTD Monitoring Report | YES | Not available | No calls 2021 |
| 9 | Bridging from discovery to market [12] | 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<br>RTD Monitoring Report | | Not available | No calls 2021 |
| | | 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<br>RTD Monitoring Report | | Information not available from CCM2 | |
| NA | | Scale of impact of projects (High Technology Readiness Level) | Number of projects addressing TRL[13] between… (4-6, 5-7)? | Joint Undertaking | JU AAR<br>RTD Monitoring Report | | Not available | No calls 2021 |

12 This indicator (9.2) is initially intended to monitor the Digital Agenda (its applicability could be only partial)
13 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<br>RTD Monitoring Report | | Not available | No calls 2021 |
| | | 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<br>RTD Monitoring Report | | Not available | No calls 2021 |
| 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/KDT for the year 2021 amounts to: € 153 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<br>- in-kind contribution already committed by private members in project selected for funding<br>- additional activities (i.e., research expenditures/ investment of industry in the sector, compared to previous year) | Joint Undertaking Services | JU AAR<br>RTD Monitoring Report<br>JU annual accounts (part of) | | N/A for ECSEL | |
| 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<br>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 | | Not available | No calls 2021 |
| | | 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 | Not available | No calls 2021 |
| NA | Participation of RTOs and Universities | Participation of RTOs[14] 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 | Not available | No calls 2021 |
| 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) [15] | 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: 2.24% Residual Error rate ECSEL JU: 1.19% | |
| | | 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

14 RTO: Research and Technology Organisation
15 Data relates to pre-granting ethics review. This time span runs in parallel to granting process5

### 10.1.3 Scoreboard of KPIs specific to ECSEL JU

The adopted KPIs are mentioned in the Annual Workplan 2021 (decision GB 2020.151). The KPI-guidelines are also included below.

*10.1.3.1 Operational performance*

| KPI | Definition | Baseline | Objective for year 2021 | Achieved in 2021 | Reference, comment |
|---|---|---|---|---|---|
| OP-1 | % New participating entities | 33% | >40% | na | No call submissions in 2021 |
| OP-2 | Success rate % | 17% | >25% | na | No call submissions in 2021 |
| OP-4 | Time to grant % below maximum time | 100% | 100% | 100% | |
| OP-5 | Time to payments % Late | 2% | <2% | 8 payments were delayed (0.4% of total administrative payments in value) - delays did not exceed 15 days | Source: ABAC DWH |
| OP-6 | % Projects achieving insufficiently (Monitoring) | 5% | <5% | 0% | |
| OP-7 | Lighthouse activity | 5 | >5 | na | In 2021 2 lighthouses were discontinued |
| OP-8 | Ethics: projects not complying | 2% | <2% | 0% | |
| OP-9 | Redress requested | 0 | 0 | 0 | |
| OP-11 | Participants from non-EU state | 5% | 7% | na | No call submissions in 2021 |
| OP-12 | Error rate: % common representative errors | 2%-5% | <2% | 1.19% | |
| OP-13 | Events/Communication | 10 | >10 | 11 | (co)organiser of 3 major public events, 5 presentations/meetings with key institutional partners, 3 presentations at community events |

| 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[16] | To allow a proper measure for this we need a reliable portfolio analysis. The portfolio analysis is in progress. Dropped by GB. |
| 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 does not allow to automatically extract the gender proportion per project. Dropped by GB. |
| 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. |

16 Dropped by GB

*10.1.3.2 Programme performance KPI*

| KPI | Definition | Baseline | Objective for year 2020 | Achieved in 2021 | Reference, comment |
|---|---|---|---|---|---|
| PP-1 | Number of projects | 10 | >12 | na | No call submissions in 2021 |
| PP-2 | National Funding / EU Funding per year | 0.92 | 0.95 | na | No call submissions in 2021 |
| PP-3 | Private partners / Public partners | 1.5 | 2.0 | na | No call submissions in 2021 |
| PP-4 | Average Size of project RIA | EUR 27 million H2020 Cost 30 Beneficiaries | EUR 27 million H2020 Cost 30 Beneficiaries | na | No call submissions in 2021 |
| PP-5 | Average Size of project IA | EUR 80 million H2020 Cost 40 Beneficiaries | EUR 80 million H2020 Cost 40 Beneficiaries | na | No call submissions in 2021 |
| PP-6 | EU-countries without national funding<br>Countries participating in the call | 5<br>20 | <5<br>>20 | na | No call submissions in 2021 |
| PP-7 | Oversubscription | 2.0 | 2.0 | na | No call submissions in 2021 |
| PP-8 | Number of patents per EUR 10 million of EU funding | 3 | >3 | 5.1 | All projects call 2014-2017 |
| PP-9 | Participation of SMEs to the programme | 25% | >25% | na | No call submissions in 2021 |
| PP-10 | Publications | Under study | Under study | 2627 | 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<br>Average number of beneficiaries for selected project |
| PP-6 | EU-countries without national funding<br><br>Countries participating in the call | Number of EU countries without national funding in the call but with beneficiaries in the selected calls<br>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*

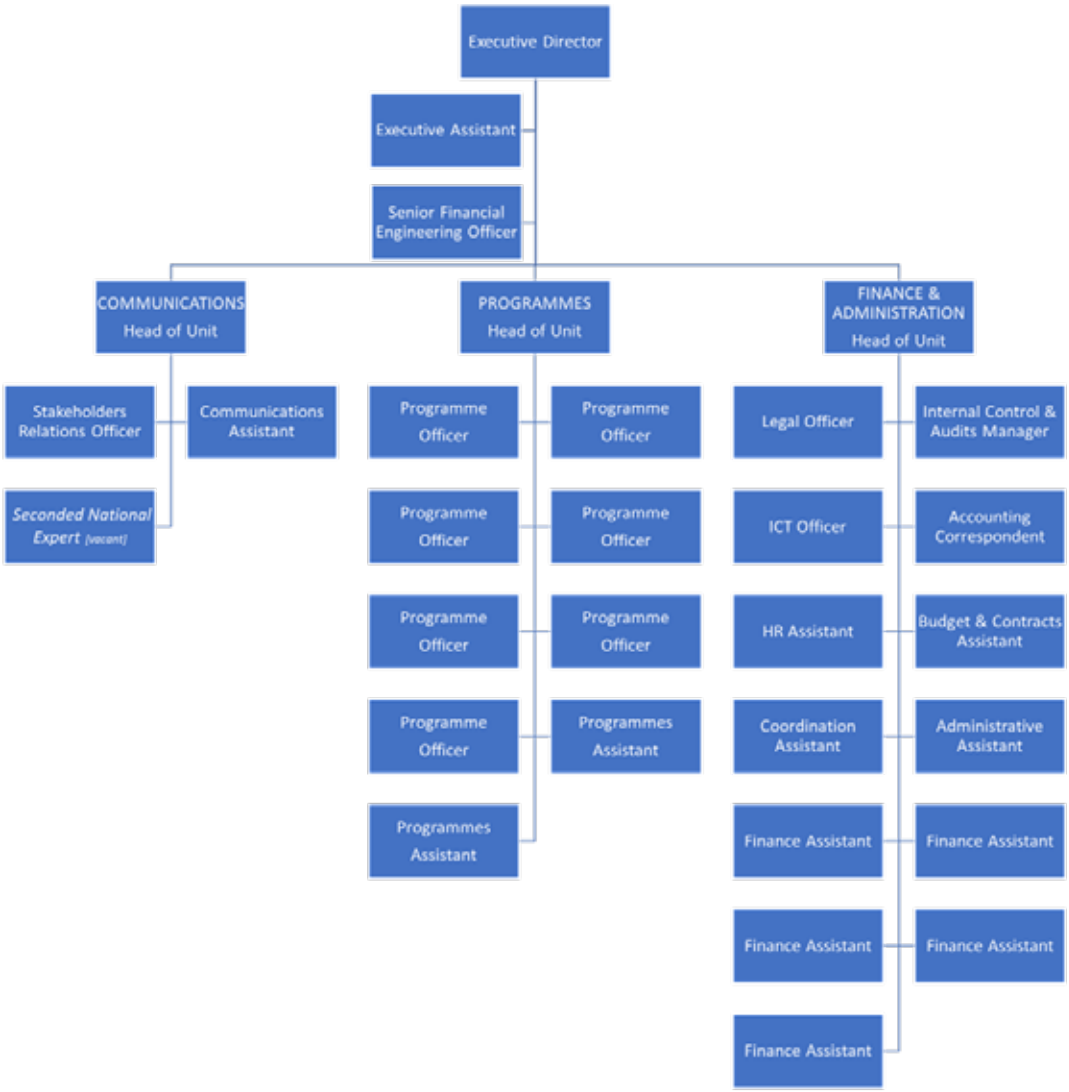
Will be defined according to the lines of the Key Impact Pathways (KIP) defined for the Horizon Europe programme.

## 10.2 Annex II. Establishment plan at 31.12.2021

| 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)

## 10.3 Annex III. 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:

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

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 Organisations 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 |
| 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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