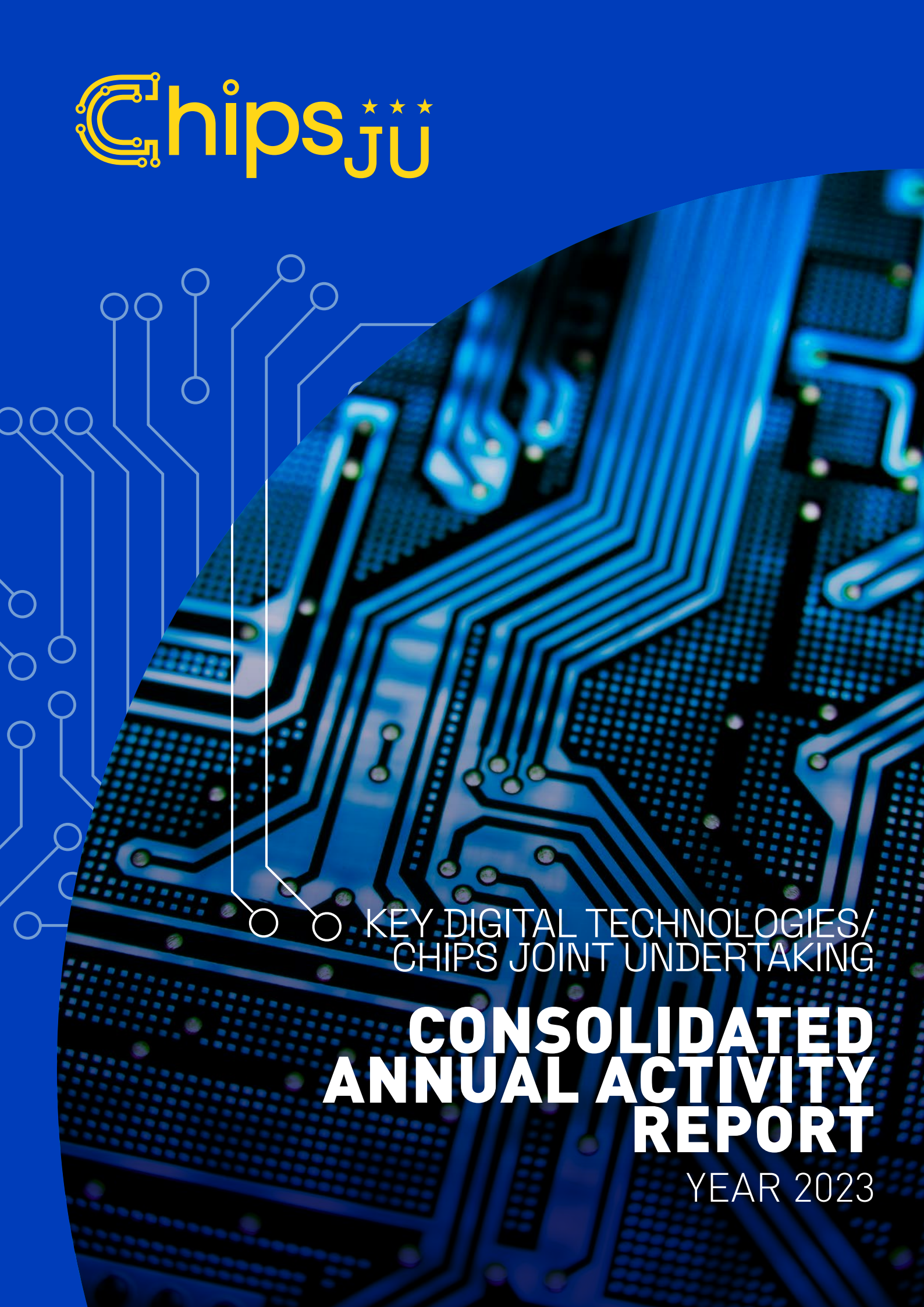

KEY DIGITAL TECHNOLOGIES/
CHIPS JOINT UNDERTAKING

CONSOLIDATED ANNUAL ACTIVITY REPORT

YEAR 2023

In accordance with Article 26 of Council Regulation (EU) 2021/2085 of 19 November 2021, as amended by Council Regulation (EU) 2023/1782 of 25 July 2023 and with Article 23 of the Financial Rules of the CHIPS JU.

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

KEY DIGITAL TECHNOLOGIES/
CHIPS JOINT UNDERTAKING

CONSOLIDATED ANNUAL ACTIVITY REPORT

YEAR 2023

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FACT SHEET

Name of the JU	**Key Digital Technologies Joint Undertaking (KDT), until September 20, 2023, and Chips Joint Undertaking (Chips JU), from September 21, 2023**
Objectives	In addition to the collective objectives to be delivered by all Joint Undertakings, the Chips Joint Undertaking shall have the following general objectives: (a) 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; (b) 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, which shall represent at least one third of the total number of participants in indirect actions and at least 20 % of public funding should go to them; (c) ensure that components and systems technologies address Europe's societal and environmental challenges. The target is to align with the Union policy on energy efficiency and contribute towards the reduction of energy consumption by 32,5 % in 2030. In addition to the objectives set out above, the Chips Joint Undertaking shall have the following specific objectives: (a) support research and development for establishing design and production capabilities in Europe for strategic application areas; (b) launch a balanced portfolio of large and small projects supporting the fast transfer of technologies from the research to the industrial environment; (c) foster a dynamic Union-wide ecosystem based on digital value-chains with simplified access to newcomers; (d) support research and development for enhancing component technologies that guarantee security, trust and energy- efficiency for critical infrastructures and sectors in Europe; (e) foster mobilisation of national resources and ensure coordination of Union and national research and innovation programmes in the field of electronic components and systems; (f) establish coherence between the Strategic Research and Innovation Agenda (SRIA) of the Key Digital Technologies Joint Undertaking and Union policies so that electronics components and systems technologies contribute efficiently.

Objectives (continued)	Further, as provided by Regulation (EU) 2023/1781[1], the Chips Joint Undertaking also has the objective to: (a) Assist the Union in achieving large-scale technological capacity building and support related research and innovation activities throughout the Union's semiconductor value chain to enable development and deployment of cutting-edge semiconductor technologies, next-generation semiconductor technologies and cutting-edge quantum technologies and the innovation of established technologies that will reinforce advanced design, systems integration and chip production capabilities in the Union, thereby increasing the competitiveness of the Union. It shall also contribute to the achievement of the green and digital transitions, in particular, by reducing the climate impact of electronic systems, improving the sustainability of next-generation chips and strengthening the circular economy processes, contribute to quality jobs within the semiconductor ecosystem and address security-by-design principles, which provide protection against cybersecurity threats. (b) building up advanced design capacities for integrated semiconductor technologies (c) building advanced technology and engineering capacities for accelerating the innovative development of cutting-edge quantum chips and associated semiconductor technologies (d) establishing a network of competence centres across the Union by enhancing existing or creating new facilities
Legal Basis	Article 187 of the Treaty on the Functioning of the European Union Council 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[2] as amended by Council Regulation (EU) 2023/1782 of 25 July 2023 amending Regulation (EU) 2021/2085 establishing the Joint Undertakings under Horizon Europe, as regards the Chips Joint Undertaking[3] ("**the Single Basic Act or SBA**") Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 establishing a framework of measures for strengthening Europe's semiconductor ecosystem and amending Regulation (EU) 2021/694 (Chips Act)[4]
Executive Director	01.01.2023 – 15.10.2023: **Dr.ir. Yves GIGASE** (Executive Director ad interim) As of 16.10.2023: **Prof. Dr. Jari KINARET**

1 Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 establishing a framework of measures for strengthening Europe's semiconductor ecosystem and amending Regulation (EU) 2021/694 (Chips Act)
2 OJ L 427, 30.11.2021, p. 17
3 OJ L 229, 18.09.2023, p. 55
4 OJ L 229, 18.9.2023, p. 1–53

Governing Board	Chair: **Ralf BORNEFELD** Vice-chairs: **Kari LEINO, Lucilla SIOLI** and **Jean-Luc di PAOLA-GALLONI** Members: see Annex 14
Public Authorities Board	Chair**: Kari LEINO** Vice-chair: **Francis DEPREZ** Members: see Annex 14
Private Members Board	Chair: **Jean-Luc di PAOLA-GALLONI** Members: see Annex 14
Staff number	Number of employees in the JU Programme office by 31 December 2023 (incl. ED): **33**
Total Budget 2023[5]	Commitment appropriations : EUR 834.130.301,00[6] Payment appropriations : EUR 516.870.185,66[7]
Budget implementation/ execution	**Commitment appropriations**: EUR 833.550.269,00 (100%) Title 1 – EUR 4.063.000,00 (93%) Title 2 – EUR 1.928.447,00 (85%) Title 3 – EUR 827.558.822,00 (100%) **Payment appropriations**: EUR 191.321.062,98 (37%) Title 1 – EUR 3.728.688,53 (82%) Title 2 – EUR 1.730.936,17 (76%) Title 3 – EUR 185.861.438,28 (36%)
Grants	**15 grants** of the calls 2022 were signed for a total cost of 634 MEUR, a total EU funding of 177 MEUR and funding from the KDT Participating States of 145 MEUR **3 Grants** of the calls 2023-3 (CSA-IA) were signed for a total cost of 8.7 MEUR and a maximum EU funding of 7.5 MEUR
Strategic Research & Innovation Agenda	KDT GB 2022.34 Adopting **KDT Strategic Research and Innovation Agenda for the year 2023** (7/12/2022) Chips GB 2023.50 Amending the Strategic Research and Innovation Agenda for the year 2023 (21/11/2023)

5 Total budget includes operational budget (used for funding selected projects) & administrative (used for funding Programme Office activities).

6 Initially voted commitment appropriations were EUR 323.878.061,01, subsequently amended to include the Chips JU Initiative part and unused appropriations from prior years.

7 Initially voted payment appropriations were EUR 259.100.150,00 and subsequently amended to include the Chips JU Initiative part.

Call implementation	**Number of calls launched in 2023**: Initiative calls: 4 (each call consists of 3 sub calls), Non-initiative calls: 3 **Number of proposals submitted**: Initiative calls: 4 (submitted in 2024; each proposal consists of 3 parts to be submitted to the 3 sub calls), Non-initiative calls: 34. **Number of eligible proposals**: Initiative calls 2023: 4 (selected in 2024) Non-initiative calls: 22 **Number of proposals selected**: Initiative calls 2023: 4 (selected in 2024) Non-initiative calls: 22
Participation, including SMEs	**Total number of beneficiaries in funded projects**: 741 of which: 31 % were SMEs, with 23% of EU funding received by those SMEs, 36 % were private for profit/large companies, with 41% of EU funding received by those companies; 4% of participants from third countries (openness) (CA, CH, TW, US, UK) as well as 1 partner from Egypt; 41% were newcomer entities .

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

By means of the Chips Act, the JU acquired new responsibilities. These new responsibilities cover the main part of the implementation of the Chips for Europe initiative (pillar one of the Chips Act) and were accompanied by a substantial increase of the budget of the JU, which now amounts to 4,175 million euros (MEUR).

Following the approval of the Chips Act, by Council Regulation (EU) 2023/1782, the Key Digital Technologies Joint undertaking was renamed as Chips Joint Undertaking (Chips JU). This Council Regulation entered into force on 21 September 2023. The Chips JU is a tripartite public-private partnership bringing together the European Union, Participating States and European industries, to strengthen Europe's strategic independence and technological sovereignty in micro- and nanoelectronics. We support broadly actors that form the industrial ecosystem based on electronic components and systems, and now have a strengthened mandate to focus on capacity building as defined in the Chips for Europe initiative. All our activities are outlined in a multiannual work programme that is based on a Strategic Research and Innovation Agenda, SRIA, which is yearly updated by the industrial associations AENEAS, EPoSS and INSIDE.

In the first half of 2023 the KDT JU launched several calls for Innovation Actions (IAs), Research and Innovation Actions (RIAs) and Coordination and Support Actions (CSA), which resulted in 22 projects being selected for funding with a maximum total funding of 237 MEUR of EU funding and 241 MEUR of national funding. As a result of the tripartite nature of the partnership, Union investments are matched by those of the participating states and project participants**,** so that the overall cost of the selected projects is 827 MEUR.

On December 1, the newly renamed Chips JU launched its first calls for four pilot lines, which are a major component of the capacity building envisioned in the Chips Act. These pilot lines, with the combined EU financing of 1,670 MEUR from the Horizon Europe and Digital Europe Programs, to be matched by a similar amount by the participating states, are a first in a series of actions to strengthen Europe's sovereignty and global standing in semiconductor technologies. The first pilot lines will cover the topics of sub-2-nanometre leading edge chip technologies, 7 nm transistor technologies based on fully depleted silicon on insulator, heterogeneous integration and advanced packaging, and wide band-gap semiconductor technologies. The proposals are due in the first quarter of 2024 and it is expected that contracts with the hosting consortia to be signed before the end of 2024.

The increased mandate and operational budget of the JU were accompanied by an increase in our staff allocation. In the course of 2023, 16 new staff recruitment procedures were carried out, of whom 9 started their employments before the end of the year. This large increase in staff puts strain on the on-boarding capacity for newcomers. A necessary refurbishment of our offices to accommodate this staff is scheduled for 2024. One of the new recruitments was that of a new Executive Director, Professor Dr Jari Kinaret, who entered office on October 16. On the same day, the interim Executive Director, Dr Yves Gigase, returned to his position as Head of programmes.

The launch of the Chips Joint Undertaking was marked by the Chips for Europe event that took place in Brussels on November 30 - December 1. The event was attended physically by some 700 participants representing European industries (including SMEs), brought by the three industry associations AENEAS, EPoSS and Inside, universities, research and technology institutes, EU member states and other participating countries, and the European Commission. The event coincided with the launch of the first calls linked to the Chips for Europe initiative, which were announced by Commissioner Thierry Breton in his opening remarks. The event was widely publicised and regarded as a great success by the participants and the members of the Chips JU.

The projects funded by the KDT/Chips JU cover a wide variety of topics and are described in sections 1.3, 1.4 and 5.11 below. The areas that the JU has supported include broad enabling technologies such as the development of new tools and technologies for the 2 nm node and novel computer architectures (*e.g.*, RISC-V, edge computing and neuromorphic computing). The application domain that the funded projects address ranges from the avi-

ation and automotive sectors to medical devices and electronic solutions to support the Green Deal transition. It can be noted that an increasing number of projects incorporate the development and use of artificial intelligence tools in their plans.

Other activities related to finance and administration included the Back Office Arrangements (BOAs) between joint undertakings to be set up on the basis of Article 13 of the SBA. Work was undertaken on four BOAs: Accountancy, Human Resources, Procurement, and Information and Communication Technology (ICT) systems. Accountancy BOA was implemented already during 2022 and BOA Human Resources and BOA Procurement were implemented in 2023. BOA ICT is expected being implemented in 2024. Internal events to Chips JU such as the approval of the Chips Act also had repercussions on the working of the office and delayed some of these BOAs.

ASSESSMENT

ASSESSMENT

Assessment from the Governing Board of the annual activity report 2023 of the Executive Director of the Chips Joint Undertaking

The year 2023 was very eventful and exceptional for the KDT/Chips Joint Undertaking. During the first nine months of the year the joint undertaking operated under the name of Key Digital Technologies, (KDT) JU, and for the last three months it was relabelled as Chips JU. This change was linked to the entering in force of the Chips Act, which assigned the Chips Joint Undertaking the responsibility to implement a major part of the first pillar of the act, the Chips for Europe initiative. This greatly broadened the mandate of the joint undertaking and more than doubled its budget to 4,175 million euros until the end of the current multi-annual financial framework.

After the Chips Act entered in force, the activities of the Chips JU can be divided into two parts: broad research and innovation activities on electronic components and systems (which was the mandate before the Chips Act), and capacity building actions that are explicitly mentioned in the Chips for Europe initiative. During the first part of the year the emphasis of the JU was firmly on the first part where a number of calls for projects were prepared, launched, evaluated and later selected for funding, covering a wide range of technologies and application areas.

After September, the focus shifted to implementing the Chips Act. After a frenetic effort by the Chips JU, Commissioner Breton was able to announce on November 30 that calls for pilot lines on sub-two-nanometre leading edge technologies, 7 nm fully depleted silicon on insulator technologies, heterogeneous integration and wide band-gap semiconductor materials would be opened the following day. These four calls have an indicative budget of nearly 3,400 million euros, half of which comes from the Chips JU and half from the participating states. They are a key component in the Chips Act and present a major milestone for European industries, strengthening our technological sovereignty in this key industrial sector. The Governing Board is pleased to note how swiftly the Joint Undertaking has been able to start implementing the Chips Act, in particular considering the size and complexity of the required actions.

The year 2023 was also one of change in many other respects. In October, the Chips JU got a new Executive Director, Professor Jari Kinaret, who has a background in physics and electrical engineering and a long experience from EU-funded research and innovation. Many other new staff members were recruited as well, in the operational, financial and administrative units of the JU. Despite these new recruitments, there is still a mismatch between the large volume of duties and tasks that must be executed and the number of staff. This poses risks to the operations of the JU that must continue to be monitored and addressed.

The year 2023 was marked by a very collaborative atmosphere among all the key stakeholders of the Chips JU – the European Commission, the Participating States and European industries represented by the associations Aeneas, EpoSS and INSIDE. This *esprit de corps* shows that we all realize the importance of the task we are facing and that we must continue working together to the benefit of European industries, not only in the core semiconductors and electronics domain but extending to almost all branches from automotive to telecommunications, from agriculture to energy, and from medical technologies to computing. The board is convinced that this sense of responsibility and commitment to the common European course will continue to be the key values of the Chips JU and its Governing Board in the years to come.

For the Governing Board,

Dipl. -Ing. Ralf Bornefeld

IMPLEMENTATION OF THE WORK PROGRAMME 2023

1. IMPLEMENTATION OF THE WORK PROGRAMME 2023

The Chips Act entered into force on 21 September 2023, simultaneously with the Council Regulation (EU) 2023/1782 that amended the Regulation (EU) 2021/2085 establishing the Joint Undertakings under Horizon Europe (the Single Basic Act, SBA), renaming the Key Digital Technologies Joint Undertaking as the Chips Joint Undertaking.

Recital (7) of the Council Regulation (EU) 2023/1782 reads as follows:

"The activities funded by the Chips Joint Undertaking should be covered in one single work programme, which should be adopted by the Governing Board of the Chips Joint Undertaking set up in accordance with Article 14(1) of Regulation (EU) 2021/2085 (the 'Governing Board'). The work programme should include two specific parts. The first specific part should include a subsection on capacity-building activities for operational objectives 1 to 4 and a subsection on research and innovation activities related to operational objectives 1 to 4. The second specific part should be dedicated to research and innovation activities not covered under the Initiative."

The work programme 2023 was amended to match this Regulation. A part describing the implementation of the actions under the Chips for Europe Initiative (the "Initiative") was introduced containing the call descriptions of the first four pilot lines to be launched by the Chips JU. Furthermore, the GB decided to introduce a multi-annual work programme covering the period 2023 to 2027. This will contain for each year a part on the actions related to the Initiative and a part on the research and innovation actions not covered under the Initiative.

This split in the work programme will be reflected in the Annual Activity Report (AAR).

The scope of the AAR is to inform in a transparent manner about the Joint Undertaking's past activities in accordance with the legal provisions, in particular:

- The **SBA**, Regulation (EU) 2021/2085 establishing the Joint Undertakings under Horizon Europe;
- 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[8];
- Regulation 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing **Horizon Europe (HE)** – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination[9];
- Regulation (EU) 2021/694 of the European Parliament and of the Council of 29 April 2021 establishing the **Digital Europe Programme** (DEP)[10];
- Commission Delegated Regulation (EU) 2019/887 of 13 March 2019 on the model financial regulation for public-private partnership bodies referred to in Article 71 of Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council;
- **Financial rules of the Chips Joint Undertaking**, decision KDT GB 2021.02, Annex 12;
- The **Strategic Research and Innovation Agenda** (SRIA) 2023 issued by the Private Members Board (decision KDT GB 2023.34).

8 OJ L 193, 30.7.2018, p. 1–222
9 OJ L 170, 12.5.2021, p. 1–68
10 OJ L 166, 11.5.2021, p. 1–34

1.1. OBJECTIVES OF THE CHIPS JU

The Chips JU gets its objectives from the SBA and the Chips Act. The SBA lists as objectives specific to the Chips JU (Article 126):

1. 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;
2. 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, which, for all research and innovation activities, including those related to the Chips for Europe Initiative established by Regulation (EU) 2023/1781, shall represent at least one third of the total number of participants in indirect actions and at least 20 % of public funding should go to them
3. ensure that components and systems technologies address Europe's societal and environmental challenges. The target is to align with the Union policy on energy efficiency and contribute towards the reduction of energy consumption by 32.5 % in 2030.
4. achieve large-scale technological capacity building and support related research and innovation activities throughout the Union's semiconductor value chain to enable development and deployment of cutting- edge semiconductor technologies, next-generation semiconductor technologies and cutting-edge quantum technologies and the innovation of established technologies that will reinforce advanced design, systems integration and chip production capabilities in the Union, thereby increasing the competitiveness of the Union; and contribute to the achievement of the green and digital transitions, in particular by reducing the climate impact of electronic systems, improving the sustainability of next-generation Chips and strengthening the circular economy processes, contribute to quality jobs within the semiconductor ecosystem and address security-by-design principles, which provide protection against cybersecurity threats.

Next to those general objectives, the Chips JU also has the following specific objectives:

1. support research and development for establishing design and production capabilities in Europe for strategic application areas;
2. launch a balanced portfolio of large and small projects supporting the fast transfer of technologies from the research to the industrial environment;
3. foster a dynamic Union-wide ecosystem based on digital value-chains with simplified access to newcomers;
4. support research and development for enhancing component technologies that guarantee security, trust and energy-efficiency for critical infrastructures and sectors in Europe;
5. foster mobilisation of national resources and ensure coordination of Union and national research and innovation programmes in the field of electronic components and systems;
6. establish coherence between the Strategic Research and Innovation Agenda of the Chips Joint Undertaking and Union policies so that electronics components and systems technologies contribute efficiently.
7. build up advanced design capacities for integrated semiconductor technologies;
8. enhance existing and develop new advanced pilot lines across the Union to enable development and deployment of cutting-edge semiconductor technologies and next-generation semiconductor technologies;
9. build advanced technology and engineering capacities for accelerating the innovative development of cutting- edge quantum Chips and associated semiconductor technologies;
10. establish a network of competence centres across the Union by enhancing existing or creating new facilities.

Besides those objectives, the Chips JU also contributes to a larger effort envisioned in the following documents:

- Joint Declaration on Processor and Semiconductor Technologies[11] (7 Dec 2020);
- Digital Compass communication[12] (COM(2021) 118 9 March 2021); and
- The Chips Act[13].

1.2. KEY OBJECTIVES 2023, ASSOCIATED RISKS AND CORRECTIVE MEASURES

The key operational activities for 2023 were:

- Launching calls 2023 under the initiative part that included capacity building and research and innovation actions,
- Launching calls 2023 under the non-initiative part for research and innovation actions and selecting proposals,
- Launching the projects selected under calls 2021 and 2022 including focus topics,
- Monitoring the running projects selected under the ECSEL JU,
- Preparing the amendment to the work programme 2023 and the work programme 2024.

The top 3 identified operational risks are the following:

1. Business continuity

Until October 15, 2023, the Head of programmes (HoP) served as ED *ad interim* and one programme officer served as the HoP. After the arrival of the new ED, the interim ED returned to his earlier position as HoP. A number of absences of key personnel posed risks to business continuity.

2. Launching the calls for the initiative part of the work programme

The very short timeline (entry into force of the regulation on 21.09.2023, launch of the calls on 01.12.2023) and the complexity of the actions involved posed a serious risk of not delivering results.

3. Staff recruitment

The Chips JU recruited 16 new staff members in 2023. The risk there is that essential staff needed for the challenges involved in the implementation of the initiative would not be available and fully trained in time.

Regarding risk 1: a temporary re-organisation was put in place until the arrival of the new Executive Director:

- a programme Officer temporarily stepped in as head of programmes;
- the finance department required extra support due to the long-term absence of the head of unit and the resignation of three colleagues: the budget officer in 2022, the accounting correspondent in 2022 and the internal audit officer in 2023;
- a programme officer took up the management of the finance team and instigated the recruitment of all the necessary personnel.
- 3 out of 8 staff members in the operation unit had an increased workload requiring a redistribution of the tasks amongst the whole unit.

As a result, business continuity was guaranteed. This risk was alleviated by a clear planning and by extra efforts by all staff involved. After the arrival of the new director and the recruitment of a head of the finance sector, the office's ability to cope with the new broader mandate started to improve. Towards the end of the year, also a head of the administration

11 https://digital-strategy.ec.europa.eu/en/library/joint-declaration-processors-and-semiconductor-technologies
12 https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021DC0118
13 Regulation (EU) 2023/1781 European Parliament and of the Council of 13 September 2023 establishing a framework of measures for strengthening Europe's semiconductor ecosystem and amending Regulation (EU) 2021/694 (Chips Act); Council Regulation (EU) 2023/1782 of 25 July 2023 amending Regulation (EU) 2021/2085 establishing the Joint Undertakings under Horizon Europe, as regards the Chips Joint Undertaking.

sector was recruited with arrival date planned in the first quarter of 2024.

Regarding risk 2: the very short time schedule was a result of the late adoption of the Chips Act. The complexity of the calls was a result of the complexity of the endeavour, whereby simultaneously procurements and grants had to be combined to cover the world first implementation of four advanced pilot lines at the forefront of technology. The risks were mitigated by a close cooperation with the PAB delegates and the GB delegates as well as various services of the Commission.

Regarding risk 3: recruiting new staff is a long process which requires the involvement of several staff members, from human resources to legal, financial, members of the selection committee to perform the evaluation of the candidates and the director for the decision. Having to select and eventually to hire 12 on top of the 4 recruitments due to the resignation of some key staff members was considered a risk. This risk was addressed by a consequential planning of the recruitment exercises, the use of interim staff and extra efforts from the whole staff. Nevertheless, this rapid expansion represented a very high workload for the personnel.

During the year, some new risks were identified that could affect the projects and the programme:

- Inflation was high due to the war in Ukraine, affecting severely some companies in projects from Call 2021 and 2022. The projects of Call 2023 will have included this risk in their planning.
- The worldwide disruption of electronic components and systems supply chains impacted the timely availability of prototypes resulting from project research or standard (so called 'off the shelf') components needed to build demonstrators.

There is no easy mitigation strategy for these risks (already mentioned in the AAR 2022). A close follow-up of projects identifying issues early on and working with the coordinators to find solutions is the best that can be proposed. Also, all projects are reviewed annually which allows for an early detection of potential issues. Until now, no immediate impact has been identified.

1.3. RESEARCH & INNOVATION ACTIVITIES/ ACHIEVEMENTS

This section provides an overview of some of the results of actions that closed in 2023 and their impact, as well as some details on the selected projects from the calls 2023. Some of the success measures (number of patents, publications, etc.) are discussed in the dissemination section.

A full description is available in Annex 5.11. It should be noted that fewer projects finished in 2022 because of the extension of the duration due to COVID-19 related issues. Nevertheless, the projects that are presented below achieved exceptional results with important commercial perspectives.

ADACORSA – Airborne data collection on resilient system architectures

This project had as objective to develop technology for drones as a safe and efficient component of the mobility mix, with differentiated, safe and reliable capabilities in extended beyond visual line of sight (BVLOS) operations.

The project delivered some impressive results:

- new radar and 3D imaging sensors with better performance,
- path planning algorithms for fail-safe drone operations based on redundant information from different sensors,
- Federated Machine Learning for better route planning,
- detect-and-avoid technologies for reliable communication, and high-accuracy positioning and secure communication technologies.

ADACORSA has made a step forward towards its vision of autonomous, intelligent and safe drones for everyday complex tasks. The developments will have impact on the technological capabilities and therefore contributes on potential changes in regulations.

While most results will require further investments to mature the technology, the potential for innovative products and services is undoubtedly demonstrated from a technology standpoint.

An additional important aspect of this project is that it also has addressed the social dimensions of drones, more specifically, public acceptance of drones as a key enabler to fulfil the potential of drones integrated into daily routines.

COMP4DRONES – Framework of key enabling technologies for safe and autonomous drones' applications

The COMP4DRONES project complements SESAR JU efforts with a particular focus on safe software and hardware drone architectures. COMP4DRONES aims at supporting (1) efficient customization and incremental assurance of drone embedded platforms, (2) safe autonomous decision-making concerning individual or cooperative missions, (3) trustworthy drone-to-drone and drone-to-ground communications even in presence of malicious attackers and under the intrinsic platform constraints, and (4) agile and cost-effective compositional design and assurance of drone modules and systems. COMP4DRONES will also build an open sustainable ecosystem around public, royalty-free and goal-driven software platform standards that will ease the development of new drone functionalities for multiple application domains. Lead applications driving ecosystem development and benchmarking are in the fields of transport, inspection, logistic, precision agriculture, parcel delivery.

COMP4DRONES has managed to gather a wide set of requirements from various important use cases in the areas of railway monitoring, digitalisation of civil infrastructure, autonomous inspections and logistic support, smart agriculture, etc. All those use cases were successfully implemented with innovative solutions. The project achieved results on

- the safe use of drones in business applications: the Project showcased a wide range of applications spanning from Transport and Smart Mobility to Digital Industry,
- technologies for safer drones: the Project developed or improved the performances of drone components aiming at safer operations (e.g. improved navigation capabilities, secure communications),
- a framework and reference architecture has been devised although further work is needed for its effective use.

Part of the use case owners will exploit the results in future products. The project also contributed to develop a unified community that is now much better equipped to implement the SESAR strategy on unmanned traffic management services. Furthermore, COMP4DRONES has a great potential to contribute to European Standardization to enable future safe and secure autonomous UAV operations.

APPLAUSE – Advanced packaging for photonics, optics and electronics for low-cost manufacturing in Europe

The APPLAUSE project developed advanced packaging tools, methods and processes for high volume mass manufacturing of electrical and photonic components. The beneficiaries in this project have complementary expertise in conception, design, packaging, testing and manufacturing of electronic components, as well as a wide range of expertise from several different end use areas. This unique European ecosystem established in this project represents the competitive, leading edge of the packaging technologies available. The collaborative approach ensured breakthrough developments in this very competitive field.

The development of new technological concepts and the integration and improvement of existing technologies produced a valuable scientific output in the field of advanced packaging and advanced manufacturing. Many of those results are exploitable and will lead to advanced packaging products, such as:

- a double side prober with light stimulus,
- a new pick and place machine with improved precision,
- new transfer moulding capabilities
- Vacuum Alignment module for MEMS bonding, Laser debonding and low-temperature bonding,
- unique advanced infrared inspection and void inspection system,
- automated grey scale optical inspection of Via and trench structures
- new wafer test of ultrathin wafers and mounting ultrathin wafers
- Low-temperature soldering; Laser sealing at wafer level
- infrared imaging preprocessing algorithm with microbolometer technology,
- improved simulation tools,
- Si capping and integration of anti-reflection coating, moulding based 3D preform for optics, flip-chip embedded flex.

In short, APPLAUSE is expected to reach a high impact through the development of manufacturing equipment for packaging microsystems and photonics devices.

FRACTAL – A Cognitive Fractal and Secure EDGE based on a unique Open-Safe-Reliable-Low Power Hardware Platform Node

The objective of this project is to develop a reliable computing node that will create a Cognitive Edge under industry standards. This computing node will be the building block of scalable Internet of Things (from Low Computing to High Computing Edge Nodes).

The consortium has completed the "FRACTAL System", which is poised as a modular open reference architecture that includes a set of components developed to aid the adoption of the system by the consortium members as well as by other external users. An impressive list of exploitable foreground Ips has been developed, that form a strong prerequisite for enhancing the competitiveness and growth of the relevant companies.

A solid contribution to the EU RISC-V efforts has been made by implementing new hardware extensions and delivering new or enhanced toolsets and training materials. Some of these developments are anticipated to form the foundation for developments in upcoming Chips JU projects in the RISC-V area.

The SMEs who participated in the project are expected to benefit in several directions:

- know-how and capacity enhancement on the developed technologies,
- integration of developed technologies to expand their product offerings,
- setting up more aggressive timelines for the product technology roadmaps due to the validation of key technologies in project.

IT2 – IC Technology for the 2 nm Node

The overall objective of the IT2 project is to explore, develop and demonstrate technology options to realize 2 nm CMOS logic technology. This covers developments on advanced lithography equipment and processes and metrology tools with a 2nm 3D capability.

The resulting innovations will result in improved tools and equipment for this advanced technology to be introduced to the market in the near future.

MADEin4 – Metrology Advances for Digitized ECS industry 4.0

The project developed an Industry 4.0 equipment and manufacturing framework for the next generation metrology tools, using machine learning methods, to support high volume manufacturing in both the semiconductors and automotive industries.

Several solutions were developed in this project such as advanced machine learning for predicting yields and maintenance in front end chip manufacturing as well as welding inspection tools using digital twin technologies for simulations. Such technologies will have a significant impact beyond the automotive industry.

Moore4Medical – Accelerating Innovation in Microfabricated Medical Devices

The project developed systems for emerging medical applications that offer significant new opportunities for the ECS industry including active implantable devices (bioelectronic medicines), organ-on-chip, drug adherence monitoring, smart ultrasound, radiation free interventions and continuous monitoring. These new technologies will help fighting the increasing cost of healthcare by reducing the need for hospitalization, helping the development of personalized therapies, and realizing intelligent point-of-care diagnostic tools.

The project developed an array of tools that will find their way in future medical technology products:

- A platform that uses focused ultrasound based on MEMS technology to energize implants located near organs deep inside the body.
- A smart well plate comprising microfluidics, micropumps and electronics to bridge the gap between organ-on-chip devices from a variety of manufactures and the pharmaceutical workflow.
- Micropumps and a variety of sensors for a generic platform to administer and monitor how, when, and where expensive drugs are delivered, ensuring proper drug adherence.

- A flexible 3D ultrasound platform consisting of MEMS transducers, a programmable front-end and AI data interpretation brings non-radiative imaging from the clinic to the world.
- Optical tracking and optical shape sensing, in open platforms to be used to locate and track a variety of instruments.
- An array of sensors in and around the beds of patients to be used to gain valuable patient information, for example to detect atrial fibrillation during sleep.

PROGRESSUS – Highly efficient and trustworthy electronics components and systems for the next generation energy supply infrastructure

This project developed a next generation smart grid that integrates seamlessly into the already existing smart-grid architectures keeping additional investments minimal. It was demonstrated in a smart charging infrastructure having high-power requirements for ultra-fast charging stations. This leads to special challenges for designing and establishing an intelligent charge-infrastructure.

The project developed amongst others:

- the required AC/DC and DC/DC converters for this type of application,
- innovative inductive charging systems up to 50 kW will provide more convenience to consumers,
- new solutions for current measurement with exceptionally high dynamic control for power electronics, such high dynamic current sensors on highly efficient power electronic chips offer important benefits in comparison to competitors,
- energy harvesting for sensors,
- data management/security algorithm of data transmission and processing and new control architectures for self-organized grid. Aspects for secure communication and data transfer are realised at sensor level.

REACTION – First and euRopEAn siC ine Inches ine ine

REACTION innovates with the first worldwide 200 mm Silicon Carbide (SiC) Pilot Line Facility for Power technology. This will enable the European industry to set the world reference of innovative and competitive solutions for critical societal challenges, like Energy saving and CO2 Reduction as well as Sustainable Environment through electric mobility and industrial power efficiency.

The development of the 8" SiC manufacturing technology is of strategic importance for the European competitiveness of its semiconductor industry and, in particular, to produce power SiC devices. The project has prepared the ground for future Europe-based manufacturing of those important power electronic components. The increased capacity of SiC devices will contribute to meet the higher demand of EV and HEV industry, essential for the decarbonisation of the European transport sector.

The project results in terms of available 8" wafers, epitaxial structures as well as devices (diodes, MOSFETs) are innovative and indicate that the developed technology will result in commercial products in the next 1-2 years.

SC3 – Semantically Coordinated Semiconductor Supply Chains (CSA – 2018)

SC3 relies on enabling a collaboration of industrial as well as academic stakeholders to ensure interoperability among semiconductor companies, and further industrial domains. SC3 implements an industrial reference platform as a de facto standard. The project will lead to more efficient supply chains in the semiconductor industry and strengthen the competitiveness of European companies, especially those that are project partners. The ontologies of the SC3 portal are freely and openly accessible. The ontologies can be downloaded and installed by third parties. This will contribute to enhancing the innovation capacity.

TEMPO – Technology and hardware for neuromorphic computing

TEMPO project targeted advancements in neuromorphic circuits introducing emerging non-volatile memory devices (NVM) and other technology options as scaled micro-bumps for heterogeneous 3D integration, and Back End of the Line TFT switches for dynamically configurable global buses. Some specific project highlights are:

The project demonstrated significant progress on NVM based technologies, and different technology options had been identified for the more promising approaches for neuromorphic computing. Exploitation opportunities of the

results are strong on the technology side and will be explored further by different industrial enterprises. The exploitation of the neuromorphic processors is also considered with the successful demonstration of the improved performances.

1.4. CALLS FOR PROPOSALS, GRANT INFORMATION AND OTHER FUNDED ACTIONS

1.4.1. INITIATIVE CALLS

On 1st December 2023, the Chips JU launched the calls for the first four pilot lines as part of the Chips for Europe Initiative (PAB decision 2023.25 launching the calls for the four pilot lines).

Those activities stem from Article 126(2)(h) SBA, which tasks the JU to *"enhance existing and develop new advanced pilot lines across the Union to enable development and deployment of cutting-edge semiconductor technologies and next-generation semiconductor technologies"*. Access for European universities and industry is a key element of each pilot line. Pilot lines serve as a bridge from the lab to the fab, by providing industry a facility to test, experiment and validate semiconductor technologies and system design concepts. Such testing and experimentation will allow industry actors to test technologies for the development of new or improved products and processes. While the pilot lines are not expected to offer fully matured fabrication services, their evolution is crucial in aiding industry to refine and advance its processing techniques and prototype next generation devices.

Implementing an advanced pilot line is a complex endeavour requiring a coordinated effort of multiple procurements of equipment, as well as set-up and integration activities related to the equipment to achieve a specific technologically advanced infrastructure that then can be accessed by industry, both large enterprises, SMEs and startups, as well as academia for research and innovation.

For each pilot line, three calls were launched simultaneously:

- one call to select the hosting entities,
- one Horizon Europe (HE) call to provide the funding for the setup and integration costs,
- one Digital Europe (DEP) call to provide funding for the operational costs.

The same application is to be submitted to the three calls that close simultaneously. The evaluation will consist of the simultaneous evaluation of the three interrelated calls. A pilot line proposal will be funded only if the proposal passes the necessary thresholds for all three calls and is selected by the Public Authority Board.

The four pilot line calls are:

CPL1: Pilot line on advanced sub 2nm leading-edge system on chip technology

- Chips 2023-CPL-1
- HORIZON-Chips-2024-IA-CPL-1
- DIGITAL-Chips-2024-SG-CPL-1

CPL2: Pilot line on advanced Fully Depleted Silicon on Insulator technologies targeting 7nm

- Chips 2023-CPL-2
- HORIZON-Chips-2024-IA-CPL-2
- DIGITAL-Chips-2024-SG-CPL-2

CPL3: Pilot line on advanced Packaging and Heterogenous Integration

- Chips 2023-CPL-3
- HORIZON-Chips-2024-IA-CPL-3
- DIGITAL-Chips-2024-SG-CPL-3

CPL4: Pilot line on advanced semiconductor devices based on Wide Bandgap materials

- Chips 2023-CPL-4
- HORIZON-Chips-2024-IA-CPL-4
- DIGITAL-Chips-2024-SG-CPL-4

The submission, evaluation, selection of those calls as well as the signatures of the hosting agreement, joint procurement agreement, Horizon Europe grant and Digital Europe grant will take place in 2024. The submission deadline is 29 February 2024 and it is planned to launch the different pilot lines mid-2024.

1.4.2. NON-INITIATIVE CALLS

Calls 2023 conditions

On 7 February 2023, the Chips JU (then called KDT JU[14]) launched three calls for proposals:

- Call 2023-1 for "Innovation Actions" (higher TRLs) that consisted of a global topic and 3 focus topics,
- Call 2023-2 for "Research and Innovation Actions" (lower TRLs) and consisted of a global topic and one focus topic,
- Call 2023-3 for one "Research and Innovation Actions" and two "coordination and support actions".

The work programme 2023 describes the different topics (based on the Strategic Research and Innovation Agenda, SRIA 2023), the schedule, the evaluation and selection procedure, the funding rates, the budgets (both EU and national), the national rules applicable for the national grants, and the Horizon Europe (HE) appendices applicable to the different calls. A Guide for Applicants is available that contains further relevant information on those points that are different from the general Horizon Europe calls. The SRIA 2023 for the ECS community that is updated each year by the 3Ias, served as basis for the Calls 2023 after adoption by the Governing Board.

The two global topics in the calls 2023-1 and 2023-2 cover all the topics described in the SRIA and aim at the reinforcement of the industrial competitiveness, stimulating industrial innovation and transfer of innovation from research environments (RTOs and Universities) to SMEs and Large Enterprises. Research and Innovation Actions (RIA) and Innovation Actions (IA) essentially differ by the Technology Readiness Level (TRL) and therefore by the reimbursement rates. Projects selected should demonstrate high impact, Europe wide collaboration with a mixed participation of large enterprises, SMEs and academia.

Next to those two global topics, the following focus topics are included in the IA call 2023-1:

- **Call 2023-1 Topic 2 IA**: Focus topic on 6G Integrated Radio Front-End for TeraHertz Communications. This call represented a collaboration between the Chips community and the SNS JU community.
- **Call 2023-1 Topic 3 IA**: Focus topic on Integration of trustworthy Edge AI technologies in complex heterogeneous components and systems,
- **Call 2023-1 Topic 4 IA**: Focus topic on Electronic Control Systems (ECS) for management & control of decentralized energy supply & storage.

And the following focus topic is included in the RIA call 2023-2:

- **Call 2023-2 Topic 2 RIA**: Hardware abstraction layer for a European Vehicle Operating System

The third call Call 2023-3 covered three topics:

- **Call 2023-3 Topic 1 IA**: Improving the global demand supply forecast of the semiconductor supply chain.
- **Call 2023-3 Topic 2 CSA**: Pan-European network for Advanced Packaging made in Europe.
- **Call 2023-3 Topic 3 CSA**: Coordination of the European software-defined vehicle platform.

The submission, evaluation, and selection took place in 2023. Grant signature will take place in 2024, except for Call 2023-3 that closed earlier and for which grants were signed in 2023.

The calls 2023-1 and 2023-2 were organised as two phase-calls (with Project Outline phase) while the call 2023-3 is a one phase call (no Project Outline phase) with the following schedules (Table 1):

14 The calls 2021, 2022 and 2023 were launched under KDT but are now running under Chips, they should all be considered as Chips JU non initiative calls because they are funded through the same budget for the non-initiative part of the programme. We therefore will drop the reference to KDT in the document.

Activity	2023-1 and 2023-2	2023-3
Calls launching PAB 2023.17	7 Feb. 2023	7 Feb. 2023
Full Project Proposal deadline	19 Sep. 2023	3 May 2023
Evaluation and selection	23-27 Oct. 2023	5-9 June 2023
Grant agreement signatures by JU	May 2024	August to September 2023
PAB selection decision	PAB 2023.23	PAB 2023.21

Table 1 Call schedules

Specific information sessions (webinars) on the evaluation were organised for the evaluation experts before the evaluation of each call.

The different periods for the execution of the procedures are as follows (Table 2):

Calls	Launch to Decision (in days)	Launch to FPP submission deadline (in days)	FPP deadline to PAB decision (in days)	Time to signature from FPP deadline (in days)
2023-3	142	85	57	111 to 201
2023-1 and -2	287	224	63	na
2022	217	141	76	235
2021	209	132	77	226
Average ECSEL JU	254	186	68	249

Table 2 Timing of the different submission steps in number of days

Coordinators are informed within one week of the PAB decision on selection.

The EU funding rates for the calls 2023-1 and 2023-2 were kept the same as in preceding calls (Table 3). SMEs get a higher funding rate to encourage their participation in the programme. Focus topics (whether RIA or IA) get the same conditions as the RIA calls, to encourage submission and participation to proposals submitted to those topics.

	RIA			IA			CSA
Calls	LE	SME	Other	LE	SME	Other	All
ECSEL 2020	25%	30%	35%	20%	25%	35%	100%
Calls 2021, 2022, 2023 (-1 and -2)	25%	35%	35%	20%	30%	35%	100%
Calls 2021, 2022, 2023 FT (1 and 2)	25%	35%	35%	25%	35%	35%	100%
Calls 2023-3 (IA)				70%	70%	100%	
Calls 2023-3 (CSA)							100%

Table 3: EU reimbursement rates

Under the Chips JU, the national funding rates and eligibility conditions also need to be considered. Those are described in the work programme. For calls with 100% EU funding, there is no need for matching national funding. The call 2023-3 topic 1 IA follows the rules of HE and there is no need for national funding.

Table 4 shows the split in the announced EU estimated funding between RIA and IA, as well as the committed national funding prior to the submission deadline of the proposals. The total national commitment follows the total EU budget available, though clearly the national commitments have difficulties in keeping up with the larger EU budget as compared with the ECSEL JU commitments for previous calls.

Calls	EU budget for RIA	EU budget for IA	EU funding budget for CSA	Total EU estimated expenditure[15]	Total national estimated funding
2021	70.0	128	10	208.0	162.40
2022	94.5	160		254.5	187.70
2023	96.7	218	3	317.7	192.85
TOTAL	261.2	506	13	780.2	542.95

Table 4 EU and national estimated funding in million EUR

Calls 2023 submissions

The results for the calls are summarized in Table 5.

Call and topic	Submitted proposals	Ineligible	Bellow threshold	Selected proposals	Success rate
2021-1-IA	12	1		6	50%
2021-1-IA-FT1	2		1	1	50%
2021-2-RIA	11		1	4	36%
2021-2-RIA-FT1	4			3	75%
2021-3-CSA	1			1	100%
Total Call 2021	**30**			**15**	**50%**
2022-1-IA-Topic-1	7		1	4	57%
2022-1-IA-FT-2	1			1	100%
2022-1-IA-FT-3	1			1	100%
2022-2-RIA-Topic-1	14	1	2	7	50%
2022-2-RIA-FT-2	4	2		2	50%
Total Call 2022	**27**			**15**	**56%**
2023-1-IA-T1	11		2	5	45%
2023-1-IA-FT2	0			0	
2023-1-IA-FT3	2			2	100%
2023-1-IA-FT4	1			1	100%
2023-2-RIA-T1	16		1	10	63%
2023-2-RIA-FT2	1			1	100%
2023-3-IA-FT1	1			1	100%
2023-3-CSA-FT2	1			1	100%
2023-3-CSA-FT3	1			1	100%
Total Call 2023 NI	**34**			**22**	**65%**
Total IA	38	1	4	22	58%
Total RIA	50	3	4	27	54%
Total CSA	3			3	100%
Total	**91**	**4**	**8**	**52**	**57%**

Table 5 Results for the calls 2021, 2022 and 2023 (non-initiative)

15 These are the amounts declared in the work programme.

A few comments on the calls 2023:

- There were no ineligible proposals.
- No proposal was submitted to one call (IA-FT2 on 6G), there is no conclusive evidence why this was the case but some participating states had declined funding this topic.

Regarding the success rate for proposals submitted under the calls 2023: the IA proposals saw their success rate drop as compared to the preceding years while for the RIA proposals it has increased. Overall, the success rate reached an all-time high. This is partly due to the higher budget allowing the funding of more proposals, a higher number of calls for which only one proposal was submitted and the improved quality of the proposals.

The number of proposals per call increased marginally. The low submission rate to the focus topics continues to question. Sufficient visibility as to the focus topics was given upfront and there was more time to prepare.

Comparison with previous calls is done in Table 6 (non-eligible proposals excluded). Calls 2023 are larger than previous years and come close to the ECSEL average[16].

	Number of proposals	Total HE cost (EUR million)[17]	Requested EU funding (EUR million)	Total National cost (EUR million)	Requested National funding (EUR million)	Number of participants
2021-RIA	15	419.9	147.0	464.9	143.5	525
2021-IA	13	691.4	218.9	777.9	202.3	568
2022-RIA	15	413.0	125.6	474.7	145.2	564
2022-IA	9	491.4	128.6	572.6	143.5	393
2023-RIA	17	530.9	164.5	554.6	171.8	607
2023-IA	14	879.1	228.4	973.9	248.0	621
Total Chips (RIA+IA)	**83**	**3425.7**	**1013.1**	**3818.6**	**1054.3**	**3278**
Average per year ECSEL RIA	21	574.7	167.9	625.0	175.1	694
Average per year ECSEL IA	11	837.3	204.6	930.0	222.2	546

Table 6 Global call results for Chips (launched as KDT) and comparison with average ECSEL calls

16 The average for ECSEL calls is calculated over the last 3 years (2018, 2019, 2020).

17 HE cost stands for the cost calculated according to the rules of Horizon Europe. Obviously, the cost for ECSEL

As the number of proposals is lower in Chips JU compared to ECSEL, it is more interesting to compare the average amounts per project in Table 7.

Average per proposal	Ave. HE cost (EUR million)	Ave. Requested EU funding (EUR million)	Ave. National cost (EUR million)	Ave. Requested National funding (EUR million)	Ave. Number of participants
2021-RIA	28.0	9.8	31.0	9.6	35
2021-IA	53.2	16.8	59.8	15.6	44
2022-RIA	27.5	8.4	31.6	9.7	38
2022-IA	54.6	14.3	63.6	15.9	44
2023-RIA	31.2	9.7	32.6	10.1	36
2023-IA	62.8	16.3	69.6	17.7	44
Average per year ECSEL RIA	26.9	7.9	29.3	8.2	33
Average per year ECSEL IA	73.9	18.1	82.1	19.6	48

Table 7 Averages per submitted proposal.

The proposals under the calls 2023 tend to be larger than in the previous years in terms of cost. For the las this means that the difference with the ECSEL averages tends to reduce. In terms of number of participants though there seems to be no large difference with preceding years.

Table 8 splits the proportion of type of organization over the calls. It is very much constant except for a drop in SMEs in the IA calls 2023, due to a larger participation of LE in the las. The SME figure depends on self-declaration (if filled in) and is not very reliable. A check on the SME status is only done when the proposal is selected for funding.

	LE	SME	OTHER
IA	33%	32%	35%
2021	30%	35%	35%
2022	30%	34%	37%
2023	39%	28%	33%
RIA	27%	36%	37%
2021	28%	33%	39%
2022	24%	39%	37%
2023	30%	35%	35%
ALL	**31%**	**33%**	**36%**

Table 8 Proportion of different types of organization in the calls

Regarding the country of establishment of the participants, Table 9 summarizes those numbers.

	2021	2022	2023	Total per country
DE	219	194	265	678
NL	125	107	163	395
IT	116	94	116	326
FR	95	71	129	295
AT	83	97	98	278
ES	65	52	88	205
FI	57	48	78	183
SE	40	57	56	153
TR	51	26	41	118
CH	47	33	33	113
BE	29	19	50	98
CZ	22	23	27	72
PT	22	21	24	67
EL	19	24	17	60
IL	23	6	23	52
RO	8	20	14	42
DK	8	15	13	36
HU	11	11	11	33
LV	10	11	12	33
IE	12	7	13	32
PL	9	14	9	32
NO	13	14	3	30
LT	6	3	6	15
SK	4	4	5	13
CY			8	8
SI		3	3	6
UK	2	1	1	4
EE			3	3
TW	2		1	3
BG		1	1	2
CA			2	2
US			2	2
EG			1	1
Total per year	**1098**	**976**	**1316**	**3390**

Table 9 Participation per country

In 2023, some facts on the origin of the participants:

- 21 EU Member States have participants in the calls 2021, 2022 and 2023, but there are no participants from the Member States HR, LU and MT.
- Three associated countries to Horizon Europe are participating in KDT: Norway, Türkiye and Israel. They have participants in the calls. The UK will join in 2024.
- One beneficiary from Egypt: while Egypt is not associated to HE, its beneficiaries can receive EU funding.
- CA, CH, TW, UK, US are third countries with participants in the calls[18].

Resubmissions are compared with the ECSEL averages (last 5 call years) in Table 10.

Calls	RIA	IA	TOTAL
2021	20%	29%	25%
2022	22%	22%	22%
2023	24%	0%	13%
Ave. ECSEL	27%	10%	21%

Table 10 Resubmissions

In 2023, none of the IA proposals were resubmissions. It appears that in the previous calls a number of existing proposals were resubmitted probably due to the compact schedule of those calls that left little time to prepare new proposals, while in 2023 time was found to prepare sufficient new proposals.

Calls 2023 Selection of proposals

The projects are selected by the PAB based on the ranking of the experts, considering the overall consistency of the portfolio approach as well as national strategic priorities in accordance with Article 12.1 of the SBA. Focus topics were selected first, then the projects submitted from the bottom-up parts of the calls.

In 2023, out of the 34 proposals (including Call 2023-3), 22 projects were selected that cover and complement the existing portfolio. The grant agreements for these projects are expected to be signed in the spring of 2024. The projects are presented in Annex 5.14. Only a brief overview is given here of their place in the portfolio of Chips.

18 Third countries are allowed to participate but normally without funding from the EU. They can receive national funding though.

Selected projects

The first set of projects covers the bottom-up part of the programme with IA and RIA actions from Calls 2023.

The IA calls 2023 include:

A. Two projects that prepare the pilot lines to be launched under the Chips JU:
- **10Ace** on the 10 Angstrom node exploring solutions for this node in terms of devices and processes including design. This fits with the future pilot line on advanced devices below 2 nanometers (= 20 Angstrom).
- **SOIL** will strengthen and expand the European FDSOI ecosystem from materials to systems. It supports therefore the efforts developed in the future pilot line on FDSOI.

B. One project that pursue developments on device and circuit technologies in line with the technological ambitions of the Union
- **FastLane** targets a competitive and sustainable value chain for SiC based power electronics.

C. Two projects that pursue developments on systems using technologies developed by the ECS community in line with the societal goals of the Union on healthcare.
- **H2TRAIN** will develop more sensitive, efficient, and miniaturized biosensing capabilities compatible with CMOS technology using 1 and 2 dimensional materials for IoT and healthcare.
- **UNLOOC** will develop, optimize, and validate a multitude of ECS-based tools to build Organ On Chip (OOC)-models to replace animal and in-human testing.

The RIA calls 2023 include:

A. Six projects that investigate new types of technologies and systems aiming at societal improvements (mobility, healthcare, circular economy, manufacturing) and European leadership:
- **ATHENA** aims at strengthening European economy in high-tech imaging technologies for visible, LWIR and VLWIR wavelengths, offering advanced functionalities and cost effectiveness.
- **Cynergy4MIE** will develop technologies for cyber-physical systems that consider the convergence of the eco systems mobility, infrastructure and energy in the circular economy for the Society 5.0
- **DistriMuSe** intends to improve sensing of human presence, behaviour, and health in a collaborative or common environment by means of multi-sensor systems.
- **MATISSE** aims to develop a multidomain and automated digital twin toolchain for the verification and validation of complex industrial systems based on digital twins.
- **PhotonMed** aims at accelerated uptake of the latest photonics technologies in medical device applications.
- **ShapeFuture** will drive innovation in fundamental Electronic Components and Systems (ECS) that are essential for robust, powerful, fail-operational, and integrated perception, cognition, AI-enabled decision making, resilient automation and computing, as well as communications, for highly automated vehicles.

B. Four projects that investigate new types of technologies for future innovative devices and systems:
- **ARCTIC** will develop scalable cryogenic ICT microsystems and control technology for quantum processors.
- **Move2THz** will innovate the manufacturing process of InP-on-silicon (InP-o-Si), thereby facilitating the upscale of wafer size & volume compatible with CMOS manufacturing capacities, while minimizing the use of rare InP resources and ecological footprint. Such material can be used in circuits for wireless applications that operate at sub-THz frequencies and beyond.
- **RIBL** sets out to strengthen Europe's market for integrated components by creating and benchmarking integrated open-source toolchains for RISC-V, multi signal processing and low-energy chips that will run on both desktop's and in the cloud. Furthermore, new developments such as iterative design flows and readiness for integration of AI in the design process will be evaluated and tested.
- **VIVA** will develop the technologies to enable a new class of eye-tracking systems, which will be light-weight, small, power efficient, fast, reliable, and highly accurate under nearly all ambient coCynergy4Mnditions.

The projects ATHENA, Cynergy4MIE, PhotonMed and RIBL were originally on the reserve list and were selected in 2024. To keep the overview of the calls, we nevertheless include them here in the AAR 2023.

The second set covers the focus topics, the top-down part of the KDT/Chips programme.

A. For Call 2023-1 Topic 3 IA: "Focus topic on Integration of trustworthy Edge AI technologies in complex heterogeneous components and systems", two projects were selected:
   - **EdgeAI-Trust** aims to develop a domain-independent architecture for decentralized edge AI along with HW/SW edge AI solutions and tools, which enable fully collaborative AI and learning at the edge.
   - **SMARTY** invokes a cloud-edge continuum, made from heterogeneous systems, that protects data-in-transit and data-in-process to offer a trustful fabric to run AI processes. The securitization occurs by employing novel accelerators for quantum resilient communications, confidential computing, software defined perimeters and swarm formation, offering multiple layers of security.

B. For Call 2023-1 Topic 4 IA: "Focus topic on Electronic Control Systems (ECS) for management & control of decentralized energy supply & storage", one project was selected:
   - **ECS4DRES** targets flexible, coordinated, and resilient distributed renewable energy systems developing several innovations.

C. For Call 2023-2 Topic 2 RIA: "Hardware abstraction layer for a European Vehicle Operating System", one project was selected:
   - **HAL4SDV** aims to pioneer methods, technologies, and processes for series vehicle development beyond 2030, driven by anticipated advancements in microelectronics, communication technology, software engineering, and AI.

The third set covers the projects selected under the Call 2023-3 covering special topics:

A. For Call 2023-3 Topic 1 IA: "Improving the global demand supply forecast of the semiconductor supply chain", one project was selected:
   - **SC4EU** aims at strengthening European digital sovereignty by mitigation of the chip shortage through reduction of bullwhip effect in the semiconductor industry and supply chains containing semiconductors.

B. For Call 2023-3 Topic 2 CSA: "Pan-European network for Advanced Packaging made in Europe", one project was selected:
   - **Pack4EU** objectives are (1) the creation of the "Pan European network on advanced semiconductor packaging", and (2) give guidance and deliver the awaited urgent results through policy recommendations, the "Advanced Semiconductor Packaging Master Plan for Europe", addressing investments, pilot lines, competence centres and further coordination actions dedicated to semiconductor packaging and the EU green deal.

C. For Call 2023-3 Topic 3 CSA: "Coordination of the European software-defined vehicle platform", one project was selected:
   - **FEDERATE** aims to bring together all relevant stakeholders to accelerate the development of an SDV Ecosystem, to foster a vibrant European community and orchestrate the SDV R&D&I activities.

Evolution of cost and attributed funding for the selected proposals

The amounts[19] for the ***selected*** projects after the PAB decision are given in Table 11.

The beneficiary contribution is calculated as: "*Total HE cost minus the requested EU funding minus the requested National funding*".

The totals for ECSEL concern the 4 last years of the programme[20], as those had call conditions similar as those of Chips.

19 The amounts for the calls 2023 will be finalized in May 2024, the numbers mentioned here are the numbers at the begin of the grant agreement preparation.

20 The national funding for the ECSEL programme includes the ESIF amounts. Under HE such amounts are declared (if used) as national funding, the same holds true for other EU funds such as funds from the *Recovery and Resilience Facility* (*RRF*).

Call	Selected projects	Partners	Total HE cost EUR million	Requested EU funding EUR million	Total national cost EUR million		Beneficiary contribution EUR million
2021-1-IA	6	273	411	104	425	90	216
2021-1-IA-FT1	1	46	54	16	57	13	26
2021-2-RIA	4	125	105	33	104	26	46
2021-2-RIA-FT1	3	91	57	17	59	16	24
2021-3-CSA	1	5	7	7	-	-	0
2022-1-IA	4	176	266	66	293	65	136
2022-1-IA-FT2	1	17	42	13	46	15	14
2022-1-IA-FT3	1	39	39	12	41	11	16
2022-2-RIA	7	255	176	55	180	60	62
2022-2-RIA-FT2	2	101	65	19	73	22	24
2023-1-IA	5	188	376	95	406	104	177
2023-1-IA-FT3	2	87	71	21	73	21	29
2023-1-IA-FT4	1	33	29	9	34	8	12
2023-2-RIA	10	326	307	96	326	99	112
2023-2-RIA-FT2	1	52	65	18	62	18	29
2023-3-CSA-2	1	47	1	1	-	-	-
2023-3-CSA-3	1	29	2	2	-	-	-
2023-3-IA-1	1	12	6	4	-	-	1
Total IA Chips	21	859	1,288	336	1,375	327	626
Total RIA Chips	27	950	775	238	803	240	297
Total CSA Chips	4	93	16	15	-	-	1
Total Chips	52	1,902	2,079	588	2,179	567	924
Total IA ECSEL	25	994	1,897	457	2,049	461	980
Total RIA ECSEL	28	1,007	872	255	945	233	385
Total ECSEL	53	2,001	2,769	712	2,994	693	1,364

Table 11 Overview of selected projects

Comparing figures of Chips with ECSEL, the figures are similar taking into account that ECSEL covers 4 years and has a higher EU budget. The beneficiary contribution is an indication[21] for the in-kind contribution for operational projects (IKOP).

Table 12 compares some ratios in more details (for the ECSEL programme again for projects selected in calls 2017, 2018, 2019 and 2020 excluding the CSAs).

21 The difference being that IKOP only is to be calculated for the members of the 3IAs.

	Average EU Funding rate	Average National funding rate compared to HE cost	Average total funding rate	Leverage of public and private monies for 1 Euro of EU funding	Leverage of national funding for 1 Euro of EU funding	Leveraging of beneficiary contribution for 1 Euro of EU funding
IA Chips	26%	25%	51%	2.8	0.97	1.87
RIA Chips	31%	31%	62%	2.3	1.01	1.25
Total Chips (RIA+IA)	28%	27%	55%	2.6	0.99	1.61
IA ECSEL	24%	24%	48%	3.2	1.01	2.14
RIA ECSEL	29%	27%	56%	2.4	0.91	1.51
Total ECSEL (RIA +IA)	26%	25%	51%	2.9	0.97	1.92

Table 12 Averages for selected projects

One notes that (*N.B.*: the figures for 2023 are not final):

- All funding rates (EU, National, Total) are slightly higher under Chips.
- The achieved leverage calculated as the HE cost minus EU funding divided by the EU funding equals 2.6 for Chips, meaning that for each euro of HE funding, 2.6 Euros are leveraged from other funding agencies (national funding) and project participants investment. For ECSEL under H2020 that ratio was higher (2.9), though there are appreciable differences between the type of calls.
- Leveraging of beneficiary contribution is lower under Chips, due to higher funding rates under Chips JU.

The percentage of newcomers[22] in the selected proposals has decreased as compared to the previous calls but is still very much appreciable (Table 13). What is encouraging is the high number of new SMEs.

Call	LE	OTHER	SME	Total		LE	OTHER	SME
2023-1-IA	47	25	57	129		42%	23%	63%
2023-2-RIA	43	24	74	141		38%	18%	56%
2023-3	17	7	11	35		35%	30%	69%
2023 All	**107**	**56**	**142**	**305**		**39%**	**21%**	**60%**
2021 & 2022	200	102	221	523		50%	25%	69%

Table 13 Newcomers and category of organizations for selected projects

Finally, Table 14 compares some average values for projects in the different calls with the average for ECSEL over the 4 last years.

Cost per project under KDT is markedly smaller than under ECSEL, while this does not reflect in the average number of beneficiaries. This confirms what was said before: under KDT, projects are smaller in cost and therefore in activity but not in size of consortia.

Overall, funding per project is lower but, due to the higher funding rates, not as much lower as the cost per project. And finally, the average cost per beneficiary is very similar for the two KDT calls but lower than under ECSEL.

22 As defined in Article 2 SBA, 'newcomer' means an entity that is, for the first time, a beneficiary of a grant awarded by an individual joint undertaking or its preceding initiative and that is not a founding member of that joint undertaking or its preceding initiative.

	Average number of beneficiar-ies per pro-ject	Average cost per project EUR million	Average EU Funding per project EUR million	Average National Funding per project EUR million	Average cost per beneficiary EUR million
KDT IA 2021	45.6	66.4	17.1	14.8	1.5
KDT RIA 2021	30.9	23.1	7.2	6.0	0.7
KDT 2021	38.2	44.8	12.1	10.4	1.2
KDT IA 2022	38.7	58.0	15.2	15.1	1.5
KDT RIA 2022	39.6	26.8	8.3	9.0	0.7
KDT 2022	39.2	39.3	11.0	11.5	1.0
ECSEL Average IA	39.8	75.6	18.2	18.4	2.0
ECSEL Average RIA	36.5	31.7	9.3	8.4	0.9
ECSEL Average total	37.5	52.6	13.5	13.4	1.4

Table 14 Averages per project and beneficiary

Support per category of partner, in particular SMEs

Calls	LE	OTHER	SME	TOTAL		LE	OTHER	SME
2021-1-IA	101	86	86	273		37%	32%	32%
2021-1-IA-FT1	19	12	15	46		41%	26%	33%
2022-1-IA	65	75	36	176		37%	43%	20%
2022-1-IA-FT2	8	2	7	17		47%	12%	41%
2022-1-IA-FT3	16	15	8	39		41%	38%	21%
2023-1-IA	69	63	56	188		37%	34%	30%
2023-1-IA-FT3	34	27	26	87		39%	31%	30%
2023-1-IA-FT4	8	17	8	33		24%	52%	24%
IA TOTAL	**320**	**297**	**242**	**859**		**37%**	**35%**	**28%**
2021-2-RIA	34	49	42	125		27%	39%	34%
2021-2-RIA-FT1	31	37	23	91		34%	41%	25%
2022-2-RIA	85	96	74	255		33%	38%	29%
2022-2-RIA-FT2	39	33	29	101		39%	33%	29%
2023-2-RIA	84	116	126	326		26%	36%	39%
2023-2-RIA-FT2	29	17	6	52		56%	33%	12%
RIA TOTAL	**302**	**348**	**300**	**950**		**32%**	**37%**	**32%**
2021-3-CSA		5		5		0%	100%	0%
2023-3-CSA-2	23	13	11	47		49%	28%	23%
2023-3-CSA-3	21	5	3	29		72%	17%	10%
2023-3-IA-1	5	5	2	12		42%	42%	17%
OTHER TOTAL	**49**	**28**	**16**	**93**		**53%**	**30%**	**17%**
All Chips projects	**671**	**673**	**558**	**1902**		**35%**	**35%**	**29%**

Table 15 Statistics per category of organization

According to SBA, 1/3 of participants should be SMEs; with 28% Chips is not far from this goal.

The RIA proposal have slightly more SMEs. In terms of EU funding the figures are (Table 16):

Calls	LE	OTHER	SME	TOTAL		LE	OTHER	SME
2021-1-IA	45.9	35.8	22.5	104.2		44%	34%	22%
2021-1-IA-FT1	8.6	3.2	3.9	15.6		55%	20%	25%
2022-1-IA	31.9	26.3	8.0	66.3		48%	40%	12%
2022-1-IA-FT2	3.5	3.2	6.5	13.3		27%	24%	49%
2022-1-IA-FT3	5.9	3.4	2.3	11.6		51%	29%	20%
2023-1-IA	43.9	34.7	16.2	94.8		46%	37%	17%
2023-1-IA-FT3	9.7	5.9	5.6	21.2		46%	28%	27%
2023-1-IA-FT4	3.2	3.6	1.9	8.7		36%	41%	22%
IA TOTAL	**152.5**	**116.0**	**67.0**	**335.6**		**45%**	**35%**	**20%**
2021-2-RIA	10.5	11.4	10.9	32.7		32%	35%	33%
2021-2-RIA-FT1	6.8	6.9	3.7	17.4		39%	39%	21%
2022-2-RIA	18.7	20.1	16.2	54.9		34%	37%	29%
2022-2-RIA-FT2	9.4	5.8	4.2	19.4		48%	30%	22%
2023-2-RIA	28.2	38.4	29.3	95.9		29%	40%	31%
2023-2-RIA-FT2	12.5	4.3	1.0	17.8		70%	24%	6%
RIA TOTAL	**86.1**	**86.8**	**65.3**	**238.2**		**36%**	**36%**	**27%**
2021-3-CSA	0.0	7.2	0.0	7.2		0%	100%	0%
2023-3-CSA-2	0.2	0.5	0.3	1.0		18%	47%	35%
2023-3-CSA-3	1.3	0.3	0.4	2.0		65%	17%	18%
2023-3-IA-1	2.2	1.7	0.6	4.5		49%	39%	12%
OTHER TOTAL	**3.7**	**9.7**	**1.3**	**14.7**		**25%**	**66%**	**9%**
ALL	**242.2**	**212.6**	**133.6**	**588.4**		**41%**	**36%**	**23%**

Table 16 Statistics of funding per category of organization

In Chips, 23% of the funding is going to SMEs as compared to ECSEL where that percentage was 13%. According to SBA, at least 20% of funding should go to SMEs and with 23% Chips surpasses this objective.

Country related statistics

The next table (Table 17) summarizes some statistics per country of origin of the beneficiaries for the selected projects.

Country	Beneficiaries (% of total)	EU Funding %	National funding/EU funding	National funding rate as % of National cost
AT	6%	5%	0.78	22%
BE	5%	8%	1.08	36%
CA	0%	0%		
CH	3%	0%		
CY	1%	0%	0.82	30%
CZ	1%	1%	1.55	48%
DE	22%	24%	0.93	23%
DK	1%	1%	0.66	21%
EE	0%	0%	1.14	40%
EG	0%	0%		
EL	1%	1%	0.61	25%
ES	8%	5%	1.08	35%
FI	6%	5%	1.14	32%
FR	13%	24%	0.91	27%
HU	1%	0%	1.42	47%
IE	1%	1%	1.15	35%
IL	1%	2%	0.84	17%
IT	8%	5%	0.96	31%
LT	1%	0%	-	0%
LV	1%	0%	1.13	42%
NL	11%	12%	1.10	27%
PL	1%	0%	1.41	45%
PT	1%	1%	1.37	43%
RO	1%	1%	1.66	66%
SE	2%	2%	1.25	38%
SI	0%	0%	-	
SK	1%	0%	1.19	42%
TR	2%	1%	0.94	41%
TW	0%	0%		
UK	0%	0%		
US	0%	0%		

Table 17 Country statistics for selected projects

1.5. EVALUATION PROCEDURES AND OUTCOMES

1.5.1. NON-INITIATIVE CALLS

Evaluation rules, selection of experts

The rules for evaluation and selection are based on the HE general rules, and the specific provisions required by the Chips JU setup have been established and then reviewed by decision GB 2022.28 valid for the Chips JU calls.

The experts to be assigned must be registered in the expert database of the Commission.

Table 18 shows the number of experts as a function of the submitted proposals. Extra efforts are put into selecting experts with the right expertise. The assignment procedure considers the area of expertise, gender, country, and the absence of conflicts of interests. With the introduction of focus topics, experts with competences in those topics were contracted. New experts (that had not participated in the previous programme) were attracted as in the previous years. For the evaluation of the call 2023-3 more experts than usual where needed due to the very different subjects of each of the topics.

	PO 2023	FPP 2023	2023-3
Proposals to be evaluated	34	31	3
Experts appointed	45	39	11

Table 18 Evaluations and experts

Table 19 provides a gender-based overview. The overall % of female experts is around 28%. This is a drop of the ECSEL % in the last years that was close to 50%. The pools were established with gender balance but at the selection of experts and attribution of projects, quite some female experts declined to participate to the evaluation, which pulled down the gender balance.

Gender of experts	PO 2023	FPP 2023	2023-3
Male	31	30	7
Female	14	9	4
Total	45	39	11
% Female	31%	23%	36%

Table 19 Gender of experts for evaluation of calls

Table 20 provides a country-of-origin based breakdown for the experts.

Country of residence	PO 2023	FPP 2023	2023-3	% of total
AT	1	1	0	2.1%
BE	0	1	0	1.1%
BG	3	4	0	7.4%
DE	6	5	4	15.8%
DK	2	2	0	4.2%
EL	4	3	2	9.5%
ES	4	2	1	7.4%
FI	1	0	0	1.1%
FR	4	6	0	10.5%
IE	2	1	0	3.2%
IL	1	1	1	3.2%
IT	7	5	2	14.7%
NL	1	2	0	3.2%
PL	3	2	0	5.3%
PT	1	0	0	1.1%
RO	1	1	0	2.1%
SE	2	2	1	5.3%
UK	2	1	0	3.2%

Table 20 Nationality of experts

Table 21 provides the breakdown according to the affiliation of the expert:

Affiliation	PO 2023	FPP 2023	2023-3	% of total
Private	20	17	5	44%
Public	22	20	4	48%
Independent	3	2	2	7%

Table 21 Affiliation of experts

Finally, 54% of the experts are new.

Redress

No redress procedures were required.

Observer recommendations

In 2023, the Governing board appointed two observers for Calls 2023. The observers made the following recommendations:

a) To consider designing an introductory briefing for the new experts, before the more informative and detailed Experts Briefing.
b) To ask experts to verify the suitability, settings and core functionalities of their devices for online meetings.
c) To create the room and opportunity for sharing good practices in drafting Consensus Reports (CRs), under supervision of the Chips-JU coordinator and staff. Possible advantages in terms of:
    a. training of experts who are new in the role,
    b. quality of the draft CRs and CRs, and
    c. more efficient utilisation of the discussion time.
d) To plan for systematically dedicating few minutes before starting Consensus Meetings of proposals related to Focus Topics, to recap the specificities of the focus topics of the calls and, possibly, their rationale.
e) As it is not possible to differentiate evaluation templates (RIAs or IAs), consider putting beside such templates a compact guiding document or structured instructions,
    a. for example, in the form of an assessment grid or an annotated IER;
    b. it could eventually serve as support tool and reminder about the most evident differentiating aspects of the different types of actions.

The recommendations will be implemented in future evaluations. To conclude: some conclusions on the evaluation process as made by the observers:

- *The whole process was very well prepared, organised, planned, and managed by the Chips JU staff.*
- *The selection of experts targeted the involvement of high-quality experts covering with their expertise and competencies the different fields and technological areas addressed by the Call 2023.*
- *Conflicts of interest were carefully checked prior to and during the evaluation process.*
- *The evaluation process was excellent in terms of quality, organization, and implementation, (an expert commented: "*excellent, close to perfection*").*
- *The outcome of the sub-panels significantly improved the quality of the consensus reports and further ensured transparency in the process. The value of these steps in the evaluation process was confirmed high also by the experts.*
- *The Observers received a very positive impression of the contribution offered by the cross-reading exercise.*
- *The final ranking was the result of an effective joint effort of all participating experts, with a very fair and constructive contributions of evaluators. The final ranking lists were considered an optimal result of the entire process.*
- *The Observers did not observe any situation or identified any issue, which could cast doubts on impartiality, fairness or confidentiality of the process.*

1.5.2. INITIATIVE CALLS

No initiative calls were evaluated in 2023.

1.6. FOLLOW-UP ACTIVITIES LINKED TO PAST CALLS

1.6.1. NON-INITIATIVE CALLS

Organisation of the monitoring, appointment of experts

In total, 44 reviews were organised (each with 2 external experts), out of which 1 was an interim review organised to redress situations discovered during an official review, leaving 43 official reviews.

The next tables compare reviews in year 2023 with preceding years. There is a drop in 2023 because no projects were started in 2021. The size of the pool of experts used in the reviews as a function of the number of organised reviews is shown in Table 22. Each expert can participate in one or several reviews. The ratio of experts to reviews has slightly decreased and this tends to show a more efficient attribution of experts to reviews.

	Reviews in year 2021	Reviews in year 2022	Reviews in year 2023
Reviews organised	51	52	44
Experts	62	62	53

Table 22 Reviews and experts

Table 23 provides a gender-based overview. Gender balance has slightly improved.

Gender of experts	Reviews in year 2021	Reviews in year 2022	Reviews in year 2023
Male	50	43	36
Female	12	19	17
Total	62	62	53
% Female	19.3%	30.6%	32.1%

Table 23 Gender of experts for reviews

Table 24 provides the country-of-origin based breakdown:

	Review 2021	Review 2022	Review 2023
AT	4	4	3
BE	3	2	2
BG	2	2	2
CH	0	0	0
DE	14	11	10
DK	3	1	1
EL	2	2	2
ES	7	8	4
FI	0	0	0
FR	6	7	7
HU	1	0	0
IE	2	2	1
IL	0	0	1
IT	7	9	8
LU	0	0	0
LV	0	1	0
NL	2	2	2
NO	0	0	1
PL	2	3	2
PT	0	1	1
RO	1	0	0
SE	2	2	2
TR	1	1	1
UK	2	3	2
USA	1	1	1

Table 24 Country of origin of experts for reviews

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

	Reviews in year 2021	Reviews in year 2022	Reviews in year 2023
Private	34	30	29
Public	21	26	18
Independent	7	6	6

Table 25 Affiliation of experts for reviews

COVID-19 impact

As noted in 2022, several projects asked for extensions because of the consequences of COVID-19. Those extensions were allowed after a careful assessment of the requests. All projects that asked for extension indicated that they would finish the project with minimal impact on results.

	Number of projects	Number of projects requesting an extension	Projects requesting extension over all projects	Average duration of the requested extension
Projects finishing before 1/1/2020	24	14	58%	161
Projects finishing after 1/1/2020	72	56	78%	210

Table 26 Impact of Covid-19

As can be seen from Table 26, the number of projects ending during or after the Covid-19 pandemic is significantly higher and the consortia of those projects required a significantly longer extension. This can be seen as an indication of the impact of Covid-19, though of course, other influences (like rise in inflation as of 2023) cannot be excluded but would require a more in depth analysis.

1.6.2. INITIATIVE CALLS

No initiative activities to be monitored.

1.7. OPENNESS, COOPERATION, SYNERGIES AND CROSS-CUTTING THEMES AND ACTIVITIES

Focus topics offer an opportunity to reach out to other partnerships and foster collaboration between the communities of those partnerships with the Chips community.

- *Call 2023-1 Topic 2 IA on "6G Integrated Radio Front-End for TeraHertz Communications"* is an opportunity to reach out to the SNS JU community, specifically to plan coordinated actions with the consortium to be selected for an SNS call and to foresee linked actions.
- *Call 2023-1 Topic 3 IA on "Integration of trustworthy Edge AI technologies in complex heterogeneous components and systems"* reaches out to the co-programmed partnership on AI, data and robotics in view of contributing to the European AI lighthouse. The call text requires to allocate tasks to road mapping, co-creation and cohesion activities with related projects (including ECSEL JU/Chips JU, H2020/Horizon Europe or EUREKA-cluster projects) and initiatives (including partnerships and Horizon Europe clusters, e.g., the European Processor Initiative, GAIA-X, among others) towards a European edge AI ecosystem. Proposals are encouraged to liaise with the project which was selected under Call DIGITAL-2021-CLOUD-AI-01-TEF-EDGE - Testing and experimentation facility for edge AI.
- *Call 2023-1 Topic 4 IA on "Electronic Control Systems (ECS) for management & control of decentralized energy supply & storage"* encourages to establish synergies with the projects and activities related to the topic supported by the Clean Hydrogen Joint Undertaking for those proposals addressing hydrogen related solutions. Some of the recommendations defined in several High-Level Use Cases (HLUCs), and Priority Project Concepts (PPCs), as defined in the ETIP SNET R&I Implementation Plan, are in most cases translated in Clusters 4 and 5 HE Calls and could offer for synergies that the proposal could explore.

- *Call 2023-3 Topic 3 CSA on "Coordination of the European software-defined vehicle platform"* will support the coordination between existing or future projects on the European software-defined vehicle platform, under any initiative on European processors and open-source hardware for the automotive sector, and under relevant European partnerships like CCAM or 2ZERO. The CSA will ensure the coherence under a joint roadmap, longer-term strategy and reference architecture, and helping maximise their impact. The call 2023-2 Topic 2 RIA on "Hardware abstraction layer for a European Vehicle Operating System" will build on previous projects on RISC V applying the developments to this topic.

With the Initiative part of the programme, other cooperation and cross cutting activities will become possible but this will have to wait for the implementation of the different capacity building activities pilot lines and design platform.

1.8. PROGRESS AGAINST KPIS

1.8.1. GENERAL HORIZON EUROPE KEY IMPACT PATHWAYS

The data for the General Horizon Europe Key Impact Pathways (KIPs) is collected by Commission service and provided to the JU as in Figure 1 for the first time. They only cover the short-term KIPs as data is not yet available for the mid- and long-term KIPs.

The co-investment is calculated as follows:

Co-investment =
Total HE Cost – EU Contribution

It covers the calls 2021, 2022 and the call 2023-3[23]. For the publications only peer-reviewed are counted[24]. Further details on the methodology can be found in the document[25].

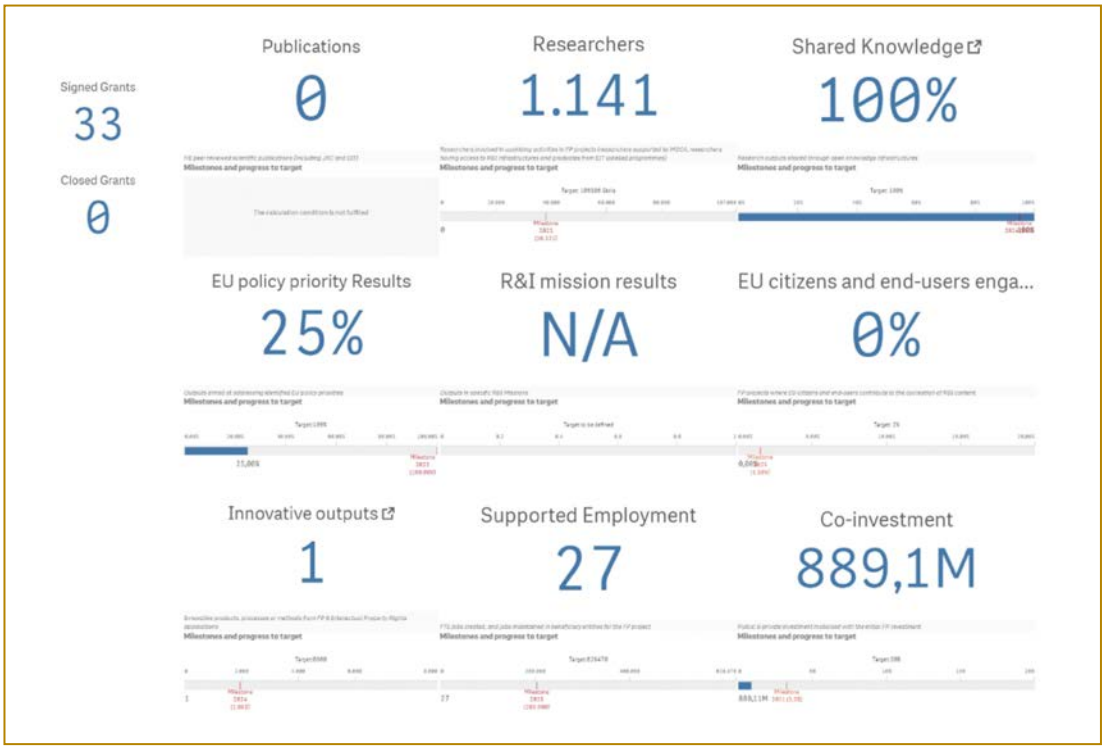


Figure 1 Key Impact Pathways for the Chips JU, March 2024

23 At the time of writing the AAR the JU was informed that this calculation was not correctly implemented yet.

24 Regarding publications, the number is calculated as the Count of Peer reviewed Foreground publications by DOI which is matching with Scopus as indicated by the methodology. If the publication is not peer-reviewed foreground or does not match with Scopus, it is not counted.

25 https://op.europa.eu/en/publication-detail/-/publication/2236c81c-c9bd-11ec-b6f4- 01aa75ed71a1/language-en/format-PDF/source-256388146

1.8.2. BIENNIAL MONITORING REPORT INCLUDING THE PROGRESS AGAINST HORIZON EUROPE COMMON INDICATORS FOR JUS

The Biennial Monitoring Report (BMR)[26] on European Partnerships aims to provide a strong evidence base to guide the implementation of partnerships and to inform strategic discussions on the effectiveness of the new policy approach to European Partnerships and the progress of European Partnerships towards their objectives and targeted impacts.

The Office participates in this exercise by providing requested information.

The exercise 2023-2024 is under way. Available information of this exercise was provided and will be included in the BMR under preparation. The reader is referred to that report when it becomes available.

1.8.3. CHIPS JU SPECIFIC KEY PERFORMANCE INDICATORS

The Key Performance Indicators (KPIs) for Chips (operational and programme performance) have been revised to include the initiative part of the programme.

The available data is included in Annex 5.6.

1.8.4. SPECIFIC KEY PERFORMANCE INDICATORS RELATED TO THE CHIPS FOR EUROPE INITIATIVE PART OF THE CHIPS JU PROGRAMME

Annex II of the Chips Act gives a list of measurable indicators to monitor the implementation and to report on the progress of the initiative towards the achievement of its objectives.

The KPIs relevant to the Chips JU are the first seven:

1. The number of legal entities involved (subdivided by size, type and country of establishment) in the actions supported by the Initiative.
2. In relation to the Initiative's operational objective 1 (building up advanced design capacities for integrated semiconductor technologies): The number of design tools developed or integrated under the Initiative.
3. In relation to the Initiative's operational objective 2 (enhancing existing and developing new advanced pilot lines): The total amount co-invested by the private sector in design capacities and pilot lines under the Initiative.
4. In relation to the Initiative's operational objective 3 (innovative development of cutting-edge quantum chips): The number of users of semiconductors or user communities seeking, and the number of users of semiconductors or user communities obtaining, access to design capacities and pilot lines under the Initiative.
5. In relation to the Initiative's operational objective 4 (network of competence centres): The number of businesses which have used the services of national competence centres supported by the Initiative.
6. The number of persons who have successfully concluded training programmes supported by the Initiative to acquire advanced skills and training on semiconductor technologies and quantum technologies.
7. The number of active competence centers in the Union in the context of the Initiative.

It seems that the 4th objective should be interpreted in the frame of the first 3 operational objectives and not only operational objective 3.

Collection of this information will start in 2024 when the first projects linked to the Chips for Europe initiative are expected to have started.

26 Those are discussed on p. 56 of https://op.europa.eu/en/publication-detail/-/publication/8c-558fae-ec57-11ec-a534-01aa75ed71a1

1.9. DISSEMINATION AND INFORMATION ABOUT PROJECT RESULTS

1.9.1. NON-INITIATIVE CALLS

Under Horizon 2020 and Horizon Europe, the projects must provide several indicators at each reporting period regarding their progress.

These are provided in Annex 5.3. Those are of course not the final figures, as several projects are still on-going.

1.9.2. INITIATIVE CALLS

This information is not available for 2023 as no actions had started then.

SUPPORT TO OPERATIONS

2. SUPPORT TO OPERATIONS

2.1. COMMUNICATION ACTIVITIES

2.1.1. INTERNAL COMMUNICATION

As per the adopted work programme, internal communication is to be regarded as part of the general management of the JU Office.

The practice of engaging all staff in monthly hybrid meetings was continued in 2023 to keep the staff informed of developments in a quickly changing environment and to review objectives, progress made and future actions.

In addition, the director has weekly management meetings (administration, communication, finance and operations) where issues that are specific for a particular team are discussed and information are shared.

2.1.2. EXTERNAL COMMUNICATION

The JU Communications Policy and Strategy adopted by the GB in April 2022 is the main direction for the external communications in 2023 (decision GB 2022.15).

The Communication Unit planned and undertook a series of activities in line with the goals and objectives set by in this decision, executing actions towards the adoption of the Chips Act.

Monitoring and key performance indicators show that the 2023 year's objectives have been fully achieved.

In particular, the JU initiated external communication activities, with following highlights:

(Co-)organised events

ECS Brokerage event 2023 (7-8 February 2023)
The JU's involvement in the 2023 ECS Brokerage Event was pivotal in enhancing collaboration across the Electronic Components and Systems sector. This two-day event, organized by AENEAS, EPoSS and INSIDE Industry Associations, merged the efforts of the industry associations into a single networking platform. It featured key sessions such as the KDT Calls 2023 overview, insights from European country representatives, and discussions on upcoming initiatives, like the Chips for Europe Initiative. The agenda also included SME pitches, project presentations, and networking opportunities, aimed at fostering partnerships and innovation within the ECS community.

Smart Systems Integration (SSI) Conference (28-30 March 2023)
The SSI Conference 2023 took place from March 28-30 in Bruges, Belgium, with EPoSS as a co-organiser. The event set the stage for a unique blend of networking, knowledge exchange, and innovation in process control, manufacturing, and smart systems integration. The event fostered synergies across these critical technological domains, aiming to more tightly knit the European tech community through shared exhibition spaces and networking. The KDT JU was present with a stand, highlighting the collaborative spirit and forward-looking prospects on the coming Chips Joint Undertaking.

Chips for Europe Event (30 November – 1 December 2023)
The 2023 edition of the Chips for Europe event, the launch event for the Chips Joint Undertaking, marked a significant milestone for the Electronic Components and Systems (ECS) community. Featuring the "Walk of Fame" exhibition, it attracted key industry figures brought by the three industry associations AENEAS, EPoSS and INSIDE Industry Associations, sparking discussions and showcasing projects that underline Europe's ambitions in the semiconductor sector. The event included keynotes by the new Executive Director of the Chips JU, Jari Kinaret, and European Commissioner Thierry Breton, who emphasized the Chips Act's role in shaping a digital Europe. It fostered dialogue on EU strategic autonomy, technology leadership, and innovation, featuring insights from leaders across the sector.

Despite the short preparation period, the event's intricate planning and its political significance posed notable challenges. It culminated in a resounding success, receiving an average satisfaction score of 8 out of 10 from the respondents. The majority confirmed the

event not only met but, in many cases, exceeded their expectations, with 87% advocating for its establishment as an annual ECS community staple event.

Press activities

Press releases

During 2023, the JU released one press release *"Key Digital Technologies Joint Undertaking strengthened as Chips Joint Undertaking."* For the first time, this press release brought together the JU, GB, PMB and PAB in a joint statement.

Interviews/Articles

During 2023, the JU released 31 news articles on its website and published two interviews:

- *"Leading-edge technology would not exist without Europe"*, with Mr. Ralf Bornefeld, Chair of the Chips JU Governing Board.
- *"Components and Systems to a coherent Electronic Road"*, with Mr. Jean-Luc di Paola-Galloni, President of INSIDE Industry Association, the European association representing the embedded systems industry and research actors in the KDT JU, for which he is the Chair of the Private Members Board (PMB).

Media Partnerships

With the goal of keeping the proper political attention on the JU and gradually involve and inform the Electronic Components and Systems community (and beyond) about current and future activities, media partnerships were initiated with two major media agencies in Brussels: Politico and EUobserver. These campaigns spanned over several months, strategically aligned with key moments for the JU.

Dynamic Banners on Politico.eu website:

- *"Leading-edge technology would not exist without Europe"*, with Mr. Ralf Bornefeld. This campaign ran from March 1 to March 22, 2023, and generated 99.9K+ impressions, 87 total clicks, 0.09% CTR (benchmark 2022: 0.07%), and 79.49% viewability (benchmark 2022: 57%).
- *"Components and Systems to a coherent Electronic Road"*, Interview with Mr. Jean-Luc di Paola-Galloni. The campaign took place from 15 May to 4 June 4, 2023, and generated 450K impressions on POLITICO.eu, 340 total clicks, 0.08% CTR (benchmark 2022: 0.07%), and 85.63% viewability (benchmark 2022: 57%).

EUobserver

- Video advertisement: advertisement of an animated video explaining the scope of work and importance of the JU on the EUobserver website.
- Magazine advertisement: A4 page advertisement for the Chips for Europe event.
- Interview with Jari Kinaret, Executive Director of Chips JU: "The smallest objects of utmost importance to the EU" . The interview focused on the importance of developing the EU Chips sector through investing in research and development(-published on 21 November 2023).
- Newsletter advertisement *"The smallest objects of utmost importance to the EU"* interview, published on 21 November 2023.

Branding

Considering the transition to Chips Joint Undertaking, a new branding of the JU was developed including a new and distinct visual identity. A company, Science Crunchers, was contracted to carry out the visual identity of Chips JU (logo, branding guidelines and website).

Website & networks

The Communication Unit was responsible for maintaining and updating the KDT JU website throughout 2023. With the goal of revising and creating a new website for Chips JU, the team conducted a traffic analysis to identify the key pages of the website. Information related to the Calls was the most sought-after content on the website.

Science Crunchers was in charge of developing the new wireframes for the Chips JU website. With the new logo and visual identity, the company carried out the design of the website. The implementation of the wireframes was executed by another external company, ShareVolt. However, due to such extensive development timeline, only a subset of the website's pages became publicly accessible by the end

of 2023. Notably, the KDT JU website, previously hosted and supported by DG-DIGIT, was decommissioned in October 2023, redirecting users to the new Chips JU website.

Social Media

Through 2023, the JU continued actively using and updating the X, LinkedIn, and YouTube accounts with the goal of building brand awareness and engage with our key audiences. The social media channels were mainly used to share updates on KDT JU, the Chips Act and the coming Chips JU, and its stakeholders.

Some campaigns were launched on LinkedIn and X, promoting the KDT JU, the launch of the Chips JU, events and updates related to the ECS community. Due to the strong presence of the ECS community on LinkedIn and the engagement observed on this platform, a bigger emphasis was given to it.

The JU's LinkedIn page followers increased with 138.9% from 1780 (December 2022) to 4252 (December 2023). On the platform X, the number of our followers went from 1632 (as of December 2022) to 1780, an increase of 9%, demonstrating consistent engagement and growth. The YouTube channel was also maintained throughout 2023 with the upload of five videos and the number of subscribers reached 78.

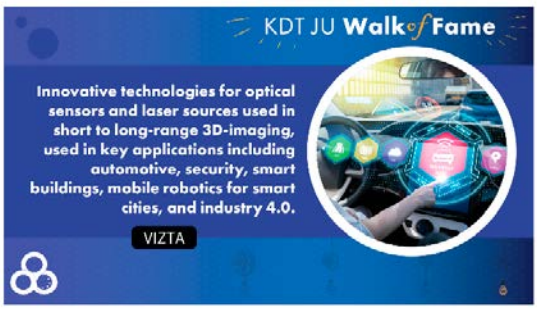
Social media campaigns (X and LinkedIn)

Interview with JU stakeholders

- *"Leading-edge technology would not exist without Europe"*, interview with Ralf Bornefeld, Chair of the Chips JU Governing Board,
- *"Components and Systems to a coherent Electronic Road"*, interview with Jean-Luc di Paola-Galloni, President of INSIDE Industry Association and Chair of the JU Private Members Board (PMB),
- *"The smallest objects of utmost importance to the* EU", interview with Jari Kinaret, Executive Director of Chips JU.

JU funded projects advertisement campaign

This campaign showcased the projects funded by ECSEL and KDT JU, highlighting their goals, achievements, significance for the Electronic Components & Systems (ECS) sector in Europe, and impact on our daily lives. To distinguish this campaign from other social media



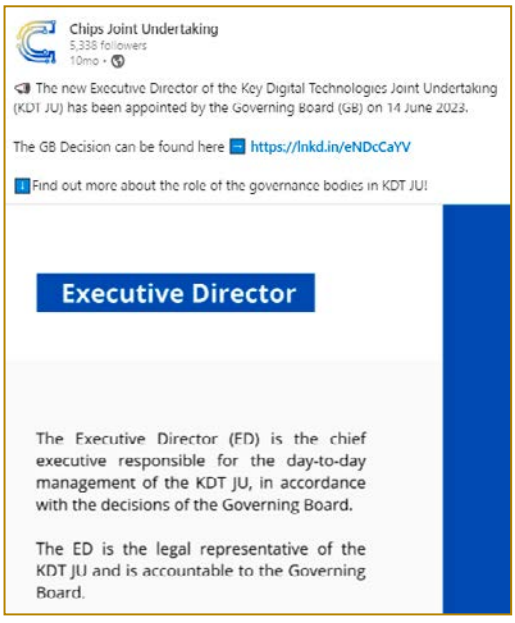
initiatives, a distinctive visual design was developed. Additionally, one of the main goals of this campaign was to translate the language related to the projects to a broader audience, bridging the gap between the scientific aspects of the projects and a user-friendly language. With this action, we also established a closer connection to our projects on social media and improved the overall engagement.

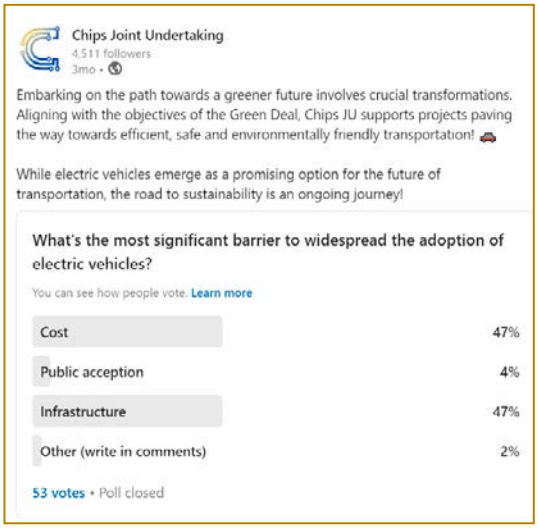
"Did you know?"

This campaign aimed to generate interest in the daily activities and operations of the KDT Joint Undertaking while building anticipation for the launch of the Chips Joint Undertaking. Through engaging visuals, informative text, interactive polls, and creative vector cartoons, we took our audience on an exciting journey into the realm of microchips and semiconductors, while shedding light on the daily functioning of a Joint Undertaking.

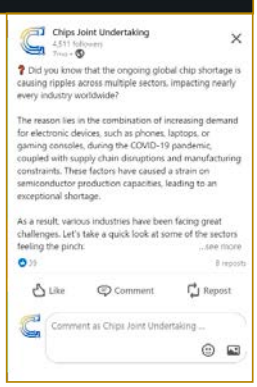
This campaign included:

- About the JU: graphics and informative text to provide a behind-the-scenes look at the KDT Joint Undertaking. These posts showcased the governance structure, objectives, information on funding opportunities & research initiatives, and collaborative efforts of the JU.





- Polls on Chips and European Policies: engaging polls were conducted to encourage user participation and interaction. These polls covered a wide range of topics, including the impact of chips on various industries, the role of European policies in shaping the chip landscape, and the significance of chip innovation for future advancements. By asking thought-provoking questions, it encouraged users to reflect on the significance of chips in their daily lives and the broader societal context.
- Cartoons and Vector Drawings: to inject creativity and fun into the social media channels, this campaign presented captivating cartoons and vector drawings that highlighted different aspects of microchips and semiconductors. These visually appealing illustrations conveyed complex concepts in a light-hearted and easily understandable manner.



Newsletter

With the beginning of the Chips JU, the need to aggregate updates and news related to the new joint undertaking emerged. In this context, the **Chips Pulse newsletter** was created.

Chips Pulse offers readers an organised source of information related to the JU and its stakeholders and ensures that the audience receives information in a structured and easily digestible format. To leverage the existing community on LinkedIn and capitalize on easy access to distribution without additional costs, the newsletter was launched on this platform.

The first edition was launched on 26 October 2023 and focused on the entry into force of the European Chips Act and the establishment of Chips JU. Subsequently, the second edition, released on 11 December, spotlighted the Chips for Europe event and the launch of the first Chips JU calls.

In a remarkably short span, the Chips Pulse newsletter garnered a substantial readership, gathering over 2000 subscribers. This rapid growth underscores the resonance of the content with the community.

Other external communications activities

During 2023, the JU actively participated in events organized by AENEAS, EPoSS, and INSIDE Industry Associations a well as "Info Day" organized in Italy and Ireland, etc.

The Communication Unit demonstrated a proactive stance in institutional communication through regular interactions with EU Institutions, conducting meetings in-person and online. This included notable involvements at the European Parliament, particularly within the ITRE and CONT Committees, and extended its engagement to various EU Regions such as Saxony, along with Permanent Representations from Italy, Cyprus, and Switzerland. These activities underscored the Chips JU's commitment to fostering dialogue and collaboration across various levels of governance.

At a Knowledge4Innovation (K4I) event at the European Parliament in October, the team showcased exceptional adaptability and public speaking skills. Unplanned, the acting Head of Unit was invited on the spot by Mrs Maria da

Graça Carvalho, MEP and Chair of the K4I, to address the audience. During the presentation, the aHoU highlighted the Chips JU's significant role in supporting the European Green Deal objectives. This impromptu speech underscored the JU's commitment to the green and digital transition, in alignment with European goals, in the presence of esteemed profiles from the European Commission, European Parliament, and other high-level representatives.

Throughout 2023, the Communication Unit provided support to the Operational Unit in organizing and conducting various seminars and workshops, both in-person and online. These events covered numerous subjects including Sustainable and Greener Manufacturing of Electronic Components and Systems (ECS), Software Defined Vehicles, among others, all within quite tight deadlines.

In early 2023, then still KDT Joint Undertaking carried out an ambitious project to visualize its successes and technological breakthroughs through an animated video. This initiative, created in collaboration with a creative agency selected from the DG Comm framework contract, was more than a mere exercise in storytelling; it was a strategic effort to showcase the direct and significant impact of its research and innovation on industry stakeholders and the broader public. By collecting and coordinating inputs from major stakeholders, the JU crafted a narrative that not only underscored its achievements in leading technology but also highlighted the concrete benefits for consumers and citizens alike.

Aimed to educate and inspire, this animated video was created as a communication tool during the transition phase towards the Chips JU, ensuring visibility for its mission, and its forward directions.

2.2. LEGAL AND FINANCIAL FRAMEWORK

Main legal and financial framework during 2023:

- The preparation of the legal framework implementing of the Chips Act,
- Executive Director selection procedure,
- The implementation of the back-office arrangements with other joint undertakings,
- Data protection,
- Governance.

The Chips Act

The Chips Act was adopted on 25 July 2023, entering into force on 21 September 2023. The Chips Act encourages semiconductor production in the European Union bolstering Europe's competitiveness and resilience in semiconductor technologies and applications by strengthening Europe's technological leadership in the relevant field.

By means of the Regulation (EU) 2023/1782 , the Key Digital Technologies Joint Undertaking was renamed the Chips Joint Undertaking which is tasked with providing financial support, through any instrument or procedure provided for in Horizon Europe or DEP, to actions funded under the so-called Chips for Europe Initiative (the 'Initiative')), in addition to continuing the earlier R&I activities of the KDT JU in the "Non-initiative" part of the JU's activities.

Executive Director selection procedure

By Governing Board Decision 2023.39 of 13 April 2023 the procedure for appointing the Executive Director of the former KDT Joint Undertaking (today Chips Joint Undertaking) was approved.

By Governing Board Decision 2023.46 of 14 June 2023, the Governing Board has appointed Mr Jari Kinaret as the new Executive Director of Chips Joint Undertaking taking up his duties on 16 October 2023.

BOA implementation

The back-office arrangements (BOA) foreseen in the SBA started being implemented in 2022 (see also Section 2.7.2 "Efficiency gains and synergies").

The first step was a delegation from the Governing Board to the Executive Director to sign Service Level Agreements with other Joint Undertakings to implement back-office arrangements. Then, the Accounting Officer of the EU-Rail JU was appointed as the Accounting Officer for the KDT.

In 2023, two arrangements have been signed among the Joint Undertakings:

- Centralised procurement to manage joint administrative procurements for the benefit of all Joint Undertakings. It aims at centralising administrative procurements in areas such as ICT, building management, corporate services, data protection;
- Human Resources arrangements focusing on three areas: recruitment, HR legal framework and digitalisation.

See Section 2.7.2 for a more detailed description.

Data protection

The Data Protection Officer's mandate is ongoing.

The Record of Processing Activities available on the Chip's website has been duly updated with all the new activities, such as the preparation for the migration to the ARES repository.

Governance

The Governing Board and Public Authorities Board have continuously enabled the Joint Undertaking to perform its actions by adopting relevant decisions, for instance: call launch and selection of proposals.

Further details are provided in Section 3.

2.3. BUDGETARY AND FINANCIAL MANAGEMENT

Overall, in 2023, the total available appropriations reached EUR 834,130,301.00 for commitment and EUR 516,870,185.66 for payment appropriations. The budget implementation reached 100% in terms of commitment appropriations and 37% in terms of payment appropriations.

Under **Horizon 2020,** the budget implementation in terms of payment appropriations reached 56%. The effects of the Covid-19 crisis have influenced the final payments of these projects. Due to Covid-19, several projects have been extended, so that their final payments did not materialise in 2023.

Under **Horizon Europe**, the budget implementation in terms of payment appropriations reached 40%. The low consumption of payment appropriations is mainly due to the late start of the Chips JU (21 September 2023) which impacted the initiative part of the Work Programme. As a result, no prefinancing could be paid for these projects in 2023 as previously anticipated.

Under **Digital Europe programme**, there was no consumption of payment appropriations due to the late adoption of Chips Act and the linked start of the Chips JU (21 September 2023) which impacted the initiative part of the Work Programme.

Statement of revenue:	Voted budget 2023		Amended budget 2023 (if applicable)	
Heading	**Commitment appropriations (in EUR)**	**Payment appropriations (in EUR)**	**Commitment appropriations (in EUR)**	**Payment appropriations (in EUR)**
EU contribution excl. EFTA	**283,007,350.84**	**220,882,507.29**	**778,816,552.05**	**412,770,743.45**
of which Administrative	2,536,900.84	2,536,900.84	3,603,287.35	3,603,287.35
of which Operational	280,470,450.00	218,345,606.45	775,213,264.70	409,167,456.10
Third countries contribution including EFTA	**8,170,695.17**	**6,046,745.83**	**22,613,733.95**	**11,621,000.67**
of which Administrative	65,099.16	65,099.16	96,191.65	96,191.65
of which Administrative third countries excluding EFTA				
of which Operational	8,105,596.01	5,981,646.67	22,517,542.30	11,524,809.02
Industry financial contribution	**2,602,000.00**	**2,602,000.00**	**2,602,000.00**	**2,602,000.00**
of which Administrative	2,602,000.00	2,602,000.00	2,602,000.00	2,602,000.00
of which Operational				
Other revenue				
SUB-TOTAL REVENUES	**293,780,046.01**	**229,531,253.12**	**804,032,286.00**	**426,993,744.12**
Reactivation of unused appropriations from administrative expenditure	270,000.00	236,000.00	270,000.00	451,590.97
Of which from 2020	85,648.67		85,648.67	17.262,71
Of which from 2021	138,351.33	236,000.00	138,351.33	359.220,93
Of which from 2022	46,000.00		46,000.00	75,107.33
Reactivation of unused appropriations from operational expenditure	**29,828,015.00**	**29,332,896.88**	**29,828,015.00**	**89,424,850.57**
Of which from 2020				
Of which from 2021	29,828,015.00	29,332,896.88	29,828,015.00	29,332,896.88
Of which from 2022				60,091,953.69
TOTAL	**323,878,061.01**	**259,100,150.00**	**834,130,301.00**	**516,870,185.66**

Statement of Expenditure (Commitment appropriations)	[Amended] budget 2023 (AWP)	[Amended] budget 2023 after transfers	Executed Budget 2023	%	Carry over to 2024	Available for future use (N+3 rule)
Title 1 - Staff expenditure	**4,574,000.00**	**4,347,000.00**	**4,063,000.00**	**93,47%**	**0.00**	**284,000.00**
Salaries & allowances	4,354,000.00	4,109,000.00	3,869,000.00	94.16%	0.00	240,000.00
Expenditure relating to Staff recruitment	40,000.00	58,000.00	23,000.00	39.65%	0.00	35,000.00
Mission expenses	90,000.00	90,000.00	81,000.00	90.00%	0.00	9,000.00
Socio-medical infrastructure (incl. training)	90,000.00	90,000.00	90,000.00	100.00%	0.00	0.00
Title 2 – Administrative expenditure	**2,048,082.08**	**2,275,082.08**	**1,928,447.00**	**84.76%**	**0.00**	**296,032.00**
Rental of buildings and associated costs	770,603.08	763,603.08.00	643,000.00	84.20%	0.00	70,000.00
Information, communication technology and technical support costs	530,000.00	650,000.00	570,000.00	87,69%	0.00	80,000.00
Movable property and associated costs	50,000.00	50,000.00	3,968.00	7,93%	0.00	46,032.00
Current administrative expenditure	100,000.00	107,000.00	97,000.00	90,65%	0.00	10,000.00
Postage/ Telecommunications	25,000.00	25,000.00	20,000.00	80.00%	0.00	5,000.00
Meetings and representation costs	45,000.00	52,000.00	52,000.00	100.00%	0.00	0.00
Meeting experts' costs	35,000.00	35,000.00	30,000.00	85.71%	0.00	5,000.00

Statement of Expenditure (Commitment appropriations)	[Amended] budget 2023 (AWP)	[Amended] budget 2023 after transfers	Executed Budget 2023	%	Carry over to 2024	Available for future use (N+3 rule)
Communication activities	452,479.00	552,479.00	482,479.00	87.33%	0.00	70,000.00
Audits and legal costs	40,000.00	40,000.00	30,000.00	75.00%	0.00	10,000.00
Title 3 - Operational expenditure	**827,558,822.00**	**827,558,822.00**	**827,558,822.00**	**100.00%**	**0.00**	**0.00**
Horizon 2020 actions	0.00	0.00	0.00		0.00	N.A.
Horizon Europe and Digital Europe actions	828,353,590.00	828,353,590.00	826,858,822.00	100,00%	99,82%	N.A.
Experts' contracts	700,000.00	700,000.00	700,000.00	100.00%	0.00	0.00
TOTAL	**835,675,661.59**	**835,675,661.59**	**833,550,269.00**	**99.75%**	**0.00**	**580,032.00**

Statement of Expenditure (Payment appropriations)	[Amended] budget 2023 (AWP)	[Amended] budget 2023 after transfers	Executed Budget 2023	%	Carry over to 2024	Available for future use (N+3 rule)
Title 1 - Staff expenditure	**4,801,590.97**	**4,574,590.97**	**3,728,688.53**	**81.51%**	**0.00**	**845,902.44**
Salaries & allowances	4,581,590.97	4,336,590.97	3,599,469.26	83.00%	0.00	737,121.71
Expenditure relating to Staff recruitment	40,000.00	58,000.00	12,458.57	21.48%	0.00	45,541.43
Mission expenses	90,000.00	90,000.00	47,783.23	53.09%	0.00	42.216,77
Socio-medical infrastructure (incl. training)	90,000.00	90,000.00	68,977.47	76.64%	0.00	21,022.53
Title 2 - Administrative expenditure	**1,997,479.00**	**2,275,082.08**	**1,730,936.17**	**76,08%**	**0.00**	**544,145.91**
Rental of buildings and associated costs	720,000.00	763,603.08	603,757.62	79.07%	0.00	159,845.46
Information, communication technology and technical support	530,000.00	650,000.00	431,287.47	66.35%	0.00	218,712.53
Movable property and associated costs	50,000.00	50,000.00	0.00	0.00%	0.00	50,000.00
Current administrative expenditure	100,000.00	179,000.00	176,286.11	98.48%	0.00	2,713.89
Postage/ Telecommunications	25,000.00	25,000.00	10,219.06	40,88%	0.00	14,780.94
Meetings and representation costs	45,000.00	52,000.00	31,307.31	60.21%	0.00	20,692.69
Meeting experts' costs	35,000.00	35,000.00	11,372.47	32.49%	0.00	23,627.53

Statement of Expenditure (Payment appropriations)	[Amended] budget 2023 (AWP)	[Amended] budget 2023 after transfers	Executed Budget 2023	%	Carry over to 2024	Available for future use (N+3 rule)
Communication activities	452,479.00	480,479.00	432,716.13	90.06%	0.00	47,762.87
Audits and legal costs	40,000.00	40,000.00	33,990.00	84.97%	0.00	6,010.00
Title 3 - Operational expenditure	**510,071,115.69**	**511,565,873.20**	**185,861,438.28**	**36,33%**	**0.00**	**324,468,995.5**
Horizon 2020 actions	72,300,000.00	73,794,757.51	41,338,445.04	56,02%	0.00	31,220,783.05
Horizon Europe and Digital Europe actions	436,979,162.00	436,979,162.00	143,915,300.99	32,93%	0.00	293,063,861.01
Experts' contracts	791,953.69	791,953.69	607,692.25	76.73%	0.00	184,261.44
TOTAL	**516,870,185.66**	**518,415,546.25**	**191,321,062.98**	**36.90%**	**0.00**	**325,859,043.85**

2.4. FINANCIAL AND IN-KIND CONTRIBUTIONS FROM MEMBERS OTHER THAN THE UNION

Two types of contribution are concerned here:

- In accordance with Article 11(1)(a) SBA, the contributions of **private members** shall consist of financial contributions and in-kind contributions to operational activities and in-kind contributions to additional activities;
- In accordance with Article 11(3) SBA, the contributions of **participating states** shall consist of financial contributions. Participating states shall report by 31 January of each year to the governing board on the financial contributions made in the previous financial year.

For year 2023, participating states have collectively reported the following amount: EUR 38,094,332.97.

Contributions from JU Members other than the Union in 2023	
Nature	**Amount (in €)**
Financial contributions (FC) reported	38,094,332.97
In-Kind to Operational Activities (IKOP) reported	200,658,035.73
In-Kind to Additional Activities (IKAA) reported	N/A
In-Kind to Additional Activities (IKAA) reported and certified	N/A
TOTAL all contributions reported	**238,752,368.70**
TOTAL all contributions reported, including certified IKAA	**238,752,368.70**

2.5. ADMINISTRATIVE PROCUREMENT AND CONTRACTS

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

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

In 2023, Chips JU ran very few procurement procedures, essentially for very low value contracts.

No procurement procedures related to operational activities were launched during 2023.

2.6. IT AND LOGISTICS

JUs co-located with Chips JU in the White Atrium building share the same IT infrastructure. The governance includes a Chips 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 Europe, Chips JU implements the common ICT tools designed, updated, and maintained by the European Commission, as well as ABAC (accounting system of the European Commission) for its financial management.

During 2023 the IKOP reporting tool is now in production and in a testing phase. The tool automates the process of Participating States making their financial contributions, through the provisioning of a portal and an application. Further automations were made, to include the process of management of the members of the 3IAs, and document signing. The application provides a modern and user-friendly platform in which to input information regarding the projects and their beneficiaries, and to 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 Chips 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 Article 11 SBA and the reporting of In-Kind contribution procedure to Operational Activities (IKOP).

2.7. HUMAN RESOURCES

2.7.1. HR MANAGEMENT

The staff establishment plan of Chips JU for 2024 foresees 19 temporary (TA) and 23 contract agents (CA).

At the end of 2023, the JU employed 33 statutory staff members, with 9 nationalities (9 BE, 6 FR, 5 ES, 3 BG, 5 EL, 2 RO, 1 IT, 1 PL, 1 FI), split in 15 male, 18 female.

Recruitment procedures

The following recruitment procedures have been launched in 2023:

Posts		Grade	Date vacancy notice
1	Internal Control & Audit Manager	CA FG IV	12/04/2023
2	Assistant to Programmes' Unit	CA FG IV	01/05/2023
3	Financial Officer - Team Leader	TA AD5	01/05/2023
4	Programme Officer	TA AD5	01/05/2023
5	Legal Officer	CA FG IV	01/05/2023
6	HR Officer	CA FG IV	01/05/2023
7	Project Officer	CA FG IV	01/05/2023
8	Programme Officer	TA AD7	05/10/2023

Above positions 1, 3 and 5 were filled in 2023. Above positions 2,4,6 and 7 have been filled by 16 March 2024. Above position 8 is on hold (reserve list created).

In addition, the recruitment of a Head of Sector in Administration (TA AD8) was initiated using a reserve list from another Joint Undertaking. The Head of Sector in Administration is being filled in the first quarter of 2024.

Recruitment of the Executive Director

The recruitment of the Executive Director, launched by the Commission, was finalised in June 2023 by the Governing Board. The newly appointed director, Professor Dr. Jari KINARET, took up duties on 16 October 2023.

Staff turnover

As for the staff turnover, the internal control and audit manager, the accounting correspondent and the budget officer resigned in 2023.

External service providers

In addition to the statutory posts, the JU relies on external service providers:

- The IT services firm shared with the other JUs hosted in the same building;
- Three trainees, providing support to the Communications team, Programmes' unit and Legal Services, and
- One interim providing support to the Communications team.

Appraisal and reclassification

In 2023, the JU conducted the 2022 appraisal exercise in accordance with decision ED 2023.133 and was able to proceed with the reclassification exercise.

As a result, 0 temporary agents and 4 contact agents were reclassified.

Staff committee

In April 2023, the staff committee was renewed following internal elections. Three staff members and one substitute have been elected for a mandate of three years.

SYSPER

The HR management system developed by the European Commission, SYSPER, has been implemented internally in 2023.

Chips JU has also started using SYSTAL (a recruitment tool) to start new advertisements and recruitments from October 2023, following Decision GB 2023.45.

2.7.2. EFFICIENCY GAINS AND SYNERGIES

Background

The SBA establishes that the JUs shall achieve synergies and provide horizontal support via the establishment of a back-office arrangements, operating in some identified areas. The SBA also underlines that these synergies should be implemented where screening of resources has proved to be efficient and cost effective, while considering as far as possible compliance with the requirement of accountability of each individual authorising office.

To obtain an independent view on the possible synergies among the JUs and the impact in terms of efficiencies, the JUs tendered a study on the Common back-office arrangements. The study was finalised in July 2022 and its specific objectives were to:

- Identify **areas, or sub-functions of areas**, for being operated under BOA, including necessary elements of cost efficiency, risks, and opportunities.
- Support the JUs to **assess the viability** (including the screening of resources) of these areas.

The study identified 21 potential synergy opportunities among the JUs for all services covered by Article 13 of the SBA. It concluded that the estimated efficiency gains in terms of FTE savings were modest for most synergies, but there were potential benefits in terms of harmonisation of current practices, standardisation of procedures, establishment of critical mass for effective negotiation, coordination, and cost savings.

Those synergy opportunities were clustered into three main groups:

- **Quick wins** (14) – Synergies that scale-up the existing collaboration among the JUs. As a result, these should be potentially implemented in a first wave.
- **Long-term solutions** (5) – These synergies require further reflection on the structuring and planning of their setup and an accurate assessment of the potential benefits, cost-efficiency and risks;
- **Low priority opportunities** (2) – Synergies which were identified as less feasible/ desirable by the Joint Undertakings due to their limitations in terms of practical applicability and value.

The largely preferred model for the BOA among JUs is a setup with one JU taking the lead and sharing coordinating tasks with one or two backup JUs, organising the work among staff of several JUs and having a clear scope and decision-making power. For other synergies, a more flexible option was chosen, with collaboration involving only some JUs, while remaining open for the others to join at a later stage.

The preparation work has led to the establishment of coordinated plans, prioritising those aspects of the BOA with the objective of bringing most value in the short term. These included as top priorities:

1. the accounting function,
2. IT deployment,
3. common synergies regarding the White Atrium occupation and other buildings that house JUs,
4. joint procurement opportunities,
5. HR support.

These topics encompass 5 of the 7 synergies, as per SBA Article 13. This approach was endorsed by the respective Governing Boards.

When these arrangements were presented, the respective Governing Boards stressed the need to have a balanced approach to the BOA implementation ensuring, as a priority, the execution of JUs' core business (ensuring budget execution and call implementation) which is very challenging in the context of a new programme with new legislation, new actors, and ambitious timelines due to the delayed launch of the Horizon Europe programme.

Arrangements in place

Started in 2022, the following arrangements are currently in place:

BOA for Accounting Services (2022)

The JUs took over the Accounting services that until 30 November 2022 were provided by DG BUDG. EU-Rail is the lead JU of this BOA. Accounting officer's services will be provided by three Accounting Officers coming from the following JUs: Clean Aviation JU, SESAR3 JU and Europe's Rail JU.

Organisation:

- The Executive Director of the Lead JU is responsible for the organization, oversight, and coordination of the accounting services to the other JUs based on an annex of the BOA SLA.
- The Head of Administration and Finance or another officer with the necessary grade, skills and competences of the Lead JU shall act as Accounting Coordinator of the BOA Accounting Officers.
- The Accounting Officer(s) of the JU Accounting Providers delivers the service to one or more JU Accounting Beneficiary and is responsible for the accounts she/ he signs off, while counting on the support and coordination with the Lead JU.

To ensure the provision of these services, it was agreed between the EC and the JUs to make use of the support of 3 additional Contractual Agents and of an external Accounting Services provider.

The first concrete output of this BOA, initiated in 2022, states that by 28 February 2023 in accordance with the Financial Rules, the 3 Accounting Officers successfully transmitted the Provisional Accounts of 8 Joint Undertakings to the ECA and the EC Accounting Officer.

BOA HR (2023)

The Governing Board signed the decision KDT GB 2023.45 BOA HR to benefit from synergies by coordinating the management of SYSPER, using a joint contract for SYSTAL (e-recruitment tool) and to harmonise job profiles and recruitment procedures.

The BOA HR will initiate a preliminary evaluation of using an external provider (TestReach)

to offer support with assessment centres (running and invigilating online tests on our behalf).

The initial quotation will be presented to the Head of Sector for Administration for her initial approval before submitted to the Executive Director for final signature.

BOA procurement (2023)

Title: Centralised procurement to manage joint administrative procurements for the benefit of all JUs.

Scope: The following elements are covered in the implementation of the synergy: centralised administrative procurement capability and process to maximise open tenders for award of inter-JUs FWCs and middle value negotiated procedures with focus on the critical joint admin procurement such as ICT, building management/corporate services, some comm support services, law firms list, data protection to be identified and be agreed via joint Public Procurement Planning (PPP).

Lead: The lead Coordinating JU is the Clean Aviation JU, the back-up Coordinating JUs are EU-RAIL and EuroHPC.

BOA ICT (2024)

The ICT area covers a list of ~50 services (service catalogue) structured in 6 service groups:

1. Inter-JU IT Governance,
2. Management of shared ICT infrastructure,
3. Management of ICT tools, services, and contracts,
4. Workplace services provision,
5. Security and compliance management,
6. ICT activities specific per JU.

The underlying concept is that, out of the ICT service catalogue, everything that is non-specific to a JU should be managed through the ICT BOA. Therefore, ICT developments and other activities specific to each JU will be under the responsibility of each ED and will not be part of the ICT BOA, that in any case will have to ensure the integrity of the overall ICT architecture. Circular Bio-Based Europe JU is in lead for this BOA.

Implementation is taking place in 2024.

GOVERNANCE

3. GOVERNANCE

3.1. GOVERNING BOARD

The Chair of the Governing Board, Mr Ralf Bornefeld, was elected for a third term in November 2023, his mandate runs until November 2024.

A list of GB delegates is provided in Annex 14.

Decisions adopted during the year:

Reference	Title
KDT JU	
KDT GB 2023.37	Amendment of the work programme 2023
KDT GB 2023.38	Organizing the appraisal of the head of programmes
KDT GB 2023.39	Selection procedure of the executive director
KDT GB 2023.40	Nominating observers to call 2023
KDT GB 2023.41	Endorsing certified in kind contribution to operational activities for 2022
KDT GB 2023.42	Annual accounts 2022
KDT GB 2023.43	Annual activity report 2022
KDT GB 2023.44	Back office arrangement for procurement
KDT GB 2023.45	Back office arrangement for HR
KDT GB 2023.46	Appointment of the executive director
Chips JU	
Chips GB 2023.47	Amendment to the GB rules of procedure
Chips GB 2023.48	Amendment Budget 2023
Chips GB 2023.49	Chips JU establishment plan-October 2023
Chips GB 2023.50	Amendment of the strategic research and innovation agenda
Chips GB 2023.51	Amendment of the work programme 2023
Chips GB 2023.53	Budget 2024
Chips GB 2023.54	Amendment of the Chips JU organigramme
Chips GB 2023.55	Appointing the internal audit capability
Chips GB 2023.56	Amendment to Budget 2023
Chips GB 2023.57	Strategic research and innovation agenda 2024
Chips GB 2023.58	Multiannual work programme 2023-2027, repealing GB 2023.51
Chips GB 2023.60	IKOP validation year 2023
Chips GB 2023.61	Phasing-out plan

3.2. PUBLIC AUTHORITIES BOARD

In January 2023, Mr Kari Leino has been elected as Chairperson of the PAB for a period of 2 years. The vice-chair is Mr Francis Deprez.

A list of PAB delegates is provided in Annex 14.

Decisions adopted during the year:

Reference	Title
KDT JU	
KDT PAB 2023.17	Launching the Call 2023
KDT PAB 2023.18	Amendment 1 funding decision 2022 (PAB 2022.15)
KDT PAB 2023.19	Amendment 2 funding decision 2022 (PAB 2023.18)
KDT PAB 2023.20	Amendment 3 funding decision 2022
KDT PAB 2023.21	Funding decision Call 2023-3
Chips JU	
Chips PAB 2023.22	Amendment to the PAB rules of procedure
Chips PAB 2023.23	Funding decision Call 2023
Chips PAB 2023.24	Opinion of the PAB on the amended work programme 2023
Chips PAB 2023.25	Launching the calls for pilot lines
Chips PAB 2023.26	Opinion of the PAB on the work programme 2024

3.3. EXECUTIVE DIRECTOR

From 1 November 2022 until 15 October 2023, **Dr Yves Gigase**, Head of Programmes, was appointed by the Governing Board as interim Executive Director.

From 16 October 2023, **Professor Dr Jari Kinaret** started as new Executive Director for Chips JU as selected by Governing Board Decision 2023.46.

3.4. PRIVATE MEMBERS BOARD

The chair of the PMB is **Jean-Luc di Paola-Galloni.**

A list of PMB delegates is provided in Annex 14.

Main activities of the PMB in 2023:

3IA/PMB meetings

Seven meetings of the three industry associations (3IA) Board/PMB were held in 2023. The main objectives were the preparation of the GB meetings as well as an exchange about the situation and the process of the Chips Act preparation and implementation of the Chips for Europe initiative by the JU.

The Chair of the GB, Ralf Bornefeld, was invited to participate in the last hour of all meetings, for alignment purposes on GB matters.

In addition, the lead delegates of the industry associations held weekly meetings to align on running matters.

Meetings with the JU Office

The JU Office representatives, mostly the Executive Director, the head of programmes, the communications officer and the legal officer, have been invited to join partly the 3IA Board / PMB meetings, for specific topics which required discussion and alignment.

Additional meetings occurred at different occasions to address specific topics, such as:

- Organisation of events: brokerage event (7-8 February), Coordinators Day (9 February), workshop on Pilot Lines (22 May), Chips launch event (30 November and 1 December)

- Participation advisory group for the selection of the executive director
- Meeting the newly appointed executive director (19 October).

The Private Members actively contributed to the preparation of the Chips for Europe event, under the supervision of the PMB. It meant mostly preparing the contents of the agenda and inviting the speakers from their constituencies.

Meetings with EC DG-CNECT

Several meetings of the 3 associations directors with the EC DG CNECT occurred in 2023.

Other meetings including EC DG CNECT took place in a bigger group and are reported in the other sections of this chapter (meetings with the JU Office and workshops).

Activities of the PMB

The main activities of the PMB were related to the following:

1. Managing the preparation of the ECS SRIA 2024,
2. Preparing the PMB Rules of Procedures for the Chips JU,
3. Co-organising/participating in KDT/Chips workshops, such as: workshop on Competence Centers, workshop on Pilot Lines, information session on KDT JU WP 2023, Sustainable and greener manufacturing Focus Topic preparation, workshop on AI-assisted methods and tools for ECS engineering efficiency Focus Topic, workshop on Advanced packaging mmWave, workshop on Software defined vehicle, workshop on green manufacturing, workshop on Design Platforms.

The Private Members actively contributed to the preparation of many workshops, under the supervision of the PMB, by preparing the agenda and inviting the relevant speakers as well as attendees.

FINANCIAL MANAGEMENT AND INTERNAL CONTROL

4. FINANCIAL MANAGEMENT AND INTERNAL CONTROL

This section reports on the control results and other relevant information that supports management's assurance on the achievement of the financial management and internal control objectives[27]. It includes information necessary to establish that the available evidence is reliable, complete, and comprehensive. It covers all activities relevant to the Joint Undertaking.

The revised internal control framework of the JU was adopted by the Governing Board (GB) in August 2020 (Decision GB 2021.02, Annex 11). 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 management of the JU and is assessed by the internal auditor and the internal audit capability. At this point in time, most controls are present and are assessed as functioning effectively.

4.1. CONTROL RESULTS

The JU has a clear control strategy, which is multiannual in nature and combines ex-ante and ex-post controls while taking cost-efficiency into consideration.

4.1.1. EFFECTIVENESS OF CONTROLS (EX-ANTE AND EX-POST CONTROLS)

This sub section describes the effectiveness of the control system. The effectiveness of the controls systems assessed is based on (i) legality and regularity of transactions, (ii) fraud prevention, protection and detection measures and (iii) other control objectives, namely safeguarding of assets and information and reliability of reporting.

4.1.1.1. LEGALITY AND REGULARITY OF THE FINANCIAL TRANSACTIONS

Financial procedures

The Chips JU is implementing the KDT Financial Rules which were adopted by the Governing Board Decision KDT GB 2021.02, Annex 12. The Financial Circuits are planned to be updated in early 2024.

Ex-ante Controls on Operational Expenditure

In 2023, the Chips JU has been operating under two different regimes:

- For the implementation of projects selected under H2020, in accordance with the H2020 common rules, and as defined in the administrative agreements signed with Participating States: ex-ante control of operational expenditure is implemented

27 Art 36.2 FR: a) effectiveness, efficiency and economy of operations; b) reliability of reporting; c) safeguarding of assets and information; d) prevention, detection, correction and follow-up of fraud and irregularities; and e) adequate management of risks relating to the legality and regularity of underlying transactions.

using the tools and methods developed by the European Commission.
- For the implementation of projects selected under Horizon Europe, in accordance with the Horizon Europe common rules, and as defined in the administrative agreements[28] signed with Participating States: ex-ante control of operational expenditure is implemented using the tools and methods developed by the European Commission.

Ex-post Control of Operational Expenditure and Error Rates Identified

The operational expenditure of the Chips JU in 2023 can be split in two main parts: Horizon 2020 operational payments (EUR 41,338,445.04) and Horizon Europe payments (EUR 143,915,300.99 which includes only pre-financing).

For Horizon 2020 (H2020), the Common Audit Service (CAS) of the Common Implementation Centre carries out all audits. The JU has been cooperating with the other stakeholders of the H2020 research family on the implementation of the H2020 Common Audit Strategy for interim and final payments of operational expenditure and in the definition of implementing rules.

For Horizon Europe, the Audit Strategy is developed in close collaboration with the implementing services following the Horizon Europe governance working arrangements under the coordination of the Common Implementation Centre of the European Commission and of the CAS.

The Chips JU is cooperating with the other stakeholders of the Horizon Europe research family on the Horizon Europe Common Audit Strategy for interim and final payments of operational expenditure.

The Chips JU works closely with CAS in the implementation of the common audit strategy, contributes to the relevant working groups, provides inputs during the entire audit cycle from selection of audits to implementation of audit findings, and provides opinions on draft audit reports and extensions of systemic audit findings.

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 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 main legality and regularity indicators for payments made to beneficiaries, as defined in the ex-post audit strategy, are the representative and residual error rates detected through financial ex-post audits:

- The cumulative representative error rate (RepER) is the detected error rate resulting from the representative audits.
- The cumulative residual error rate (ResER) is the level of error remaining in the population after deducting corrections and recoveries made by the Chips JU. This includes the extension of audit results to non-audited financial statements of the audited beneficiaries to correct systematic errors.

The methodology applied is described in Annex 10: Materiality criteria.

The targets set for this control system are, respectively**:**

- For Horizon 2020, to ensure that the cumulative residual error rate remains within a range of 2-5 %, aiming to be as close as possible to 2%. Progress against Horizon 2020 targets is assessed annually based on the results of the implementation of the ex-post audit strategy and taking into account the frequency and importance of the detected errors along with cost-benefit considerations regarding the effort and resources needed to detect and correct the errors.

28 Whilst most of the administrative agreements were signed in 2022, there are still some countries that have not yet signed an administrative agreement.

- For Horizon Europe, to ensure that cumulative detected and residual error rates do not exceed 2%. No representative error rate for Horizon Europe are available in 2022 and 2023 as the ex-post audit campaign for the Programme is planned to be launched in 2024 by CAS.

It should be noted, however, that due to its multi-annual nature, the effectiveness of the ex-post control strategy can only be measured and assessed fully in the final stages of the EU Framework Programme, once the ex-post audit strategy has been fully implemented, and errors, including those of a systemic nature, have been detected and corrected.

Ex-post control results of the H2020 programme globally as of 31/12/2023

The Horizon 2020 audit campaign started in 2016. At this stage, five Common Representative Samples with a total of 788 expected results have been selected. The error rates for Horizon 2020 on 31 December 2023 are:

- **Cumulative representative detected error rate** for the Framework Programme: **2.57%**
- **Cumulative residual error rate** for the Framework Programme: **1.55%**

Ex-post control results specific to the H2020 Chips JU population as of 31/12/2023

- **Cumulative representative detected error rate** for the Chips JU: **2.34%**
- **Cumulative residual error rate** for the Chips JU: **1.25%**, the latter staying below the targeted threshold of 2%.

Since R&I Framework Programmes are multi-annual, the error rates, and the residual error rate in particular, should be considered within a time perspective. Specifically, the implementation of the audit results over time will tend to lower the cumulative residual error rate thus increasing its difference with the representative detected error rate.

These error rates are calculated on the basis of the audit results available when drafting the Annual Activity Report. They should be treated with caution as they may change subject to the availability of additional data from audit results.

The Chips JU audit coverage in term of audited EU contributions has reached 11.73% as of 31 December 2023.

As of 31 December 2023, 113 beneficiaries have been subject to ex-post audits leading to a financial impact worth EUR 3,608,801 of EU contributions in favour of Chips JU (excluding ongoing ex-post audits or ongoing implementation of financial audit findings).

When an ex-post audit detects findings of a systematic nature, Chips JU extends them to non-audited cost claims of the same beneficiary. As of 31 December 2023, 31 beneficiaries have been subject to an extension of systematic audit findings leading to a financial impact worth EUR 219,630 of EU contributions in favour of Chips JU (excluding ongoing extension of systematic audit findings).

4.1.1.2. FRAUD PREVENTION, DETECTION, AND CORRECTION

The Chips JU follows and implements the Common Anti-Fraud Strategy in the Research family (RAFS) which was last updated in 2019 and most recently in December 2023. The Governing Board last adopted the Common Anti-Fraud Strategy in the Research family by analogy in 2021 (GB Decision 2021.02 Annex 15) and will update its strategy in 2024. The Chips JU is represented in the Fraud and Irregularities in Research (FAIR) Committee. The FAIR Committee remains the main network and forum on anti-fraud matters, in which the JU participates. Furthermore, most of the JU staff members have participated in anti-fraud trainings with the latest one organised in November 2023.

In 2023, the JU's activities focused on: raising awareness about fraud risk across the JU, continuing its cooperation with OLAF by providing updates to the regular monitoring and cooperating with the FAIR Committee activities.

In 2023, the JU did not identify any new cases of irregularities or suspected fraud while managing its project portfolio.

Based on the above information, the Chips JU has reasonable assurance that the anti-fraud measures in place are effective overall.

4.1.1.3. ASSETS AND INFORMATION, RELIABILITY OF REPORTING

Assets and information

The assets reported by Chips JU in the balance sheet 2023 mainly concern current assets, that represent around 82% of the total assets, specifically short-term and long-term pre-financing related to Horizon 2020 and Horizon and short-term exchange receivables and non-exchange recoverables concerning central treasury liaison accounts and customers.

During the year 2023, a write-off was registered for a total amount of 157 assets and a purchase value of 232,612.51EUR. The write-off was a consequence of the fact that the asset register was replaced, and the inventory list had not been updated, it is deemed essential to carry out a Write-Off of assets in Chips JU. Additionally, part of this write-off is related to a correction of expenditure that had been registered as intangible assets (software) for an amount of 28,751.85EUR.

During 2024, the asset stock take will be encoded in ABAC assets. Therefore, simplifying the process of reconciliation of asset accounts as well as a less manual procedure of calcu-

lation of the depreciation. The Net Value of

Property, Plant and Equipment is not material compared to the overall accounts. Therefore, Chips JU considers that its safeguarding of assets is effective and appropriate.

Reliability of reporting

The findings and recommendations of the DG BUDG reports on the validation of Local Systems are subject to follow up by the Chips JU.

4.1.2. EFFICIENCY OF CONTROLS ("TIME TO")

Based on an assessment of the most relevant efficiency control results, the Chips JU has assessed the efficiency of the control system and reached a positive conclusion.

The main efficiency performance indicators for the activities carried out in the Chips JU in Horizon 2020 and Horizon Europe are namely:

- Time-to-Inform (TTI) represents the time needed by KDT to manage the evaluation and selection phase from the Call deadline to informing the participants.
- Time-to-Grant (TTG) represents the maximum of eight months between the Call deadline and grant signature.
- Time-to-Pay (TTP) represents the outcome of the process for the payment of pre-financing to newly signed Grant Agreements and costs claimed by beneficiaries.

As in previous years, the Chips JU made all its payments on time.

Based on the assessment of the key indicators presented above and control results, it is considered that an efficient control system has been put in place.

The summary of these indicators is presented below:

Indicator	Target	2022	2023
Average Time to Inform (TTI)	153 days	99 days	71 days
Average Time to Grant (TTG)	245 days	218 days	221.5 days
Average Time to Pay (TTP) for cost-claims and final payments	90 days	67 days	65 days
Average Time to Pay (TTP) for pre-financing (Horizon Europe)	30 days	14 days	15 days

4.1.3. ECONOMY OF CONTROLS

In this section, we report on the cost of the controls put in place in the JU.

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 (in EUR)	185,861,438
% in total budget	97.1%
Estimated cost of controls ex-ante	1,847,929
Cost of ex-ante controls as % of expenditure	0.99%
Estimated Benefits of controls (EUR)	2,369,365
Total estimated FTEs (ex-ante & ex-post)	9.81
Total costs controls	2,032,179

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 and evaluation phase, Grant Award, Grant management	8.75	1,228,385	619,544	1,847,929
Total cost of ex-ante controls	**8.75**	**1,228,385**	**619,544**	**1,847,929**
Total Ex-post control	**1.06**	**184,250**	0	**184,250**
Total (ex-ante + ex-post controls)	**9.81**	**1,412,635**	**619,544**	**2,032,179**

Cost of controls/Operational Expenditure	1.09%

4.1.4. CONCLUSION ON THE COST-EFFECTIVENESS OF CONTROLS

Based on the most relevant key indicators and control results, the Chips JU has assessed the effectiveness, efficiency and economy of its control system and reached a positive conclusion on the cost-effectiveness of the controls for which it is responsible.

4.2. AUDIT OBSERVATIONS AND RECOMMENDATIONS

This section sets out the observations, opinions and conclusions reported by the auditors. Brief description of the management measures taken in response to the audit recommendations are also included when relevant.

4.2.1. INTERNAL AUDIT

The internal audit functions of the Chips JU were carried out in 2023 by the Internal Audit Service (IAS) of the Commission and by the Internal Audit Capability of the Chips JU, according to article 28 and article 30 of the JU Financial Rules.

Internal Audit Service

The IAS of the European Commission performs the role of Internal Auditor of the Chips JU, as specified in Article 28 of the JU Financial Rules (GB Decision 2021.02 Annex 12).

In 2022, the IAS carried out an in-depth risk assessment that covered all the Chips JU auditable entities. This exercise constituted the basis for preparing the 2023-2025 IAS strategic internal audit plan for the JU.

The final strategic audit plan established by the IAS for the period 2023-2025 has been received by the JU in 2023 and a shortlist of audit topics have been identified. The strategic internal audit plan will be subject to an annual review and the topics may be adjusted or new topics may be added to reflect the results of the IAS annual risk assessment updates, any new and emerging risks as well as significant changes in the JU processes.

Internal Audit Capability

Based on Article 32(2) of the SBA establishing the JU, having regard to Article 30 of the JU Financial Rules and as adopted by the Governing Board decision (GB 2023.55) 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 as defined in the IAC charter (Annex to GB 2023.55).

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 KDT.

During 2023, the main activities of the ICAM in the area of audit management focused on coordinating the follow-up of the risk assessment carried out by IAS, the implementation and follow-up of the audits carried out by the European Court of Auditors, the external auditors and the 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 the self-assessment of the effectiveness of the Internal Control Framework.

In early 2024 the IAC work plan for 2024 is expected to be approved by the Governing Board.

4.2.2. AUDIT OF THE EUROPEAN COURT OF AUDITORS (ECA)

For the financial year ended 31 December 2022, the European Court of Auditors issued an unqualified ("clean") audit opinion on the accounts of the JU and on the legality and regularity of the payments and revenue underlying the 2022 annual accounts.

The report concluded the following:

- The KDT accounts for the year ended 31 December 2022 present fairly, in all material respects, the financial position of the JU, the results of its operations, its cash flows and the changes in net assets for 2022, in accordance with its Financial Regulation and with accounting rules adopted by the Commission's accounting officer.
- The revenue underlying the accounts for 2022 is legal and regular in all material respects.
- The payments underlying the accounts for 2022 are legal and regular in all material respects.

Without calling into question the European Court of Auditors´ unqualified opinion, ECA made observations on budgetary management. The report also included a follow-up of previous years' observations which were all completed except on the human resources situation. Regarding management and control systems, ECA reported that their 2022 audits of randomly selected JU payments to Horizon 2020 beneficiaries revealed no error.

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

Annual report on EU Joint Undertakings for the financial year 2022 (europa.eu)

The relevant report for 2023 is expected in 2024.

4.2.3. OVERALL CONCLUSIONS

Internal and external audit work contributes significantly to continuous improvements in the Chips JU systems and operations. In 2023, the JU has continued to follow up open recommendations either from audits carried out in the year or from previous years. Regular monitoring is established by the Internal Audit Capability and management is informed and consulted regularly. No new audits were carried out by the IAS in 2023 and the observations raised by the Court of Auditors are duly followed up.

4.3. ASSESSMENT OF THE EFFECTIVENESS OF INTERNAL CONTROL SYSTEMS

According to Article 14 of the 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, the Chips 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, the JU has implemented the new Internal Control Framework proposed by the EC (Decision GB 2021.02).

In 2023, the 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 Internal Control and Audit Manager of the JU has performed an assessment of the entire internal control system of the JU. The assessment based on an evaluation of monitoring indicators defined in the revised Internal control framework and a desk review of the analysis of information from various sources:

- the indicators set out in the Internal Control Framework of the JU;
- the 2023 annual risk assessment exercise. Risks identified through the annual risk assessment exercise (described in section 4.3.2) were also assessed and managed through appropriate controlling and mitigating actions;
- the register on exceptions and non-compliance events. The 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 2023 did not reveal any control weaknesses;
- the observations and recommendations reported by the Internal Audit Service;
- the observations and recommendations reported by the ECA;
- the DG BUDG reports on follow-up of recommendations on the validation of Local Systems;
- the error rate for Horizon 2020;
- and discussions with management on the activities and objectives of the JU.

The 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, with remarks in principles 1, 3 and 15:

- Principle 1: participation by newcomers in ethics training had been lower than expected, therefore an ethics training was organised by the JU in October 2023. All staff has now followed an ethics training.
- Principle 3: the Executive Director decision for financial circuits needed to be updated to reflect staff changes and the management of new programmes (HE and DEP) and this is expected to take place beginning 2024.

- Principle 15: the JU has identified that further improvements on the information to be publicly available are necessary to ensure that all statutory requirements on publishing key documents of the JU are complied with on time and that these documents are easily accessible through the JU´s website.

4.3.1. CONTINUOUS MONITORING

Continuous monitoring in the JU is coordinated by the Internal Control and Audit Manager. Identified improvements during the self-assessment of the internal control system are followed up during the year, as per timeframe indicated in the relevant actions.

4.3.2. RISK ASSESSMENT AND MANAGEMENT

Risk Management is one of the key elements in an effective internal control framework. The 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 JU´s, strategic and operational objectives. Lost opportunities are also considered as risks"*. Hence, risks relate to the non-achievement of objectives.

The Chips JU management performed an annual risk assessment complementary to the work performed by the internal auditor. The risk assessment exercise took place in September 2023 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.

4.3.3. PREVENTION OF CONFLICT OF INTEREST

Prevention of conflict of interests is addressed at different levels in the Joint Undertaking.

Boards members (PAB and GB) are asked to sign a declaration of absence of conflict of interests at the time of their nomination. Signature of this declaration is a condition to access the documents and be invited to the meetings. At the beginning of each meeting, the Chair makes sure that no delegate is concerned by a specific conflict of interest.

The rules of procedure of the concerned Boards include the relevant provisions on conflict of interests.

Experts in evaluation procedures are requested to sign a declaration of absence of conflict of interests before accessing project proposals to be evaluated. Potential conflicts are solved by limiting access to some proposals.

Members of opening and/or selection committees in procurement procedure have to sign a conflict of interests declaration.

Staff members of the JU, at the time of recruitment, sign a declaration of confidentiality and absence of conflict of interests.

4.4. CONCLUSION ON THE ASSURANCE

This section reviews the assessment of the elements reported above and the sub conclusions already reached. It draws an overall conclusion to support the declaration of assurance and whether it should be qualified with reservations.

In conclusion, based on the elements reported above, management has reasonable assurance that, overall, all necessary control procedures are in place and working as intended; risks are being appropriately monitored and mitigated; and necessary improvements are being implemented. The Executive Director, in his capacity as Authorising Officer by Delegation has signed the Declaration of Assurance.

4.5. STATEMENT OF ASSURANCE

4.5.1. DECLARATION OF ASSURANCE OF THE HEAD OF UNIT CONTRIBUTING TO THE REPORT

I hereby declare that the information provided in my respective contribution to the present Annual Activity Report and in its annexes is, to the best of my knowledge, accurate and complete.'

Brussels, date
(Signature)
Yves Gigase, Head of Unit Programmes

4.5.2. DECLARATION OF ASSURANCE

I, the undersigned, Jari Kinaret
Executive Director of Chips Joint Undertaking
In my capacity as authorising officer by delegation

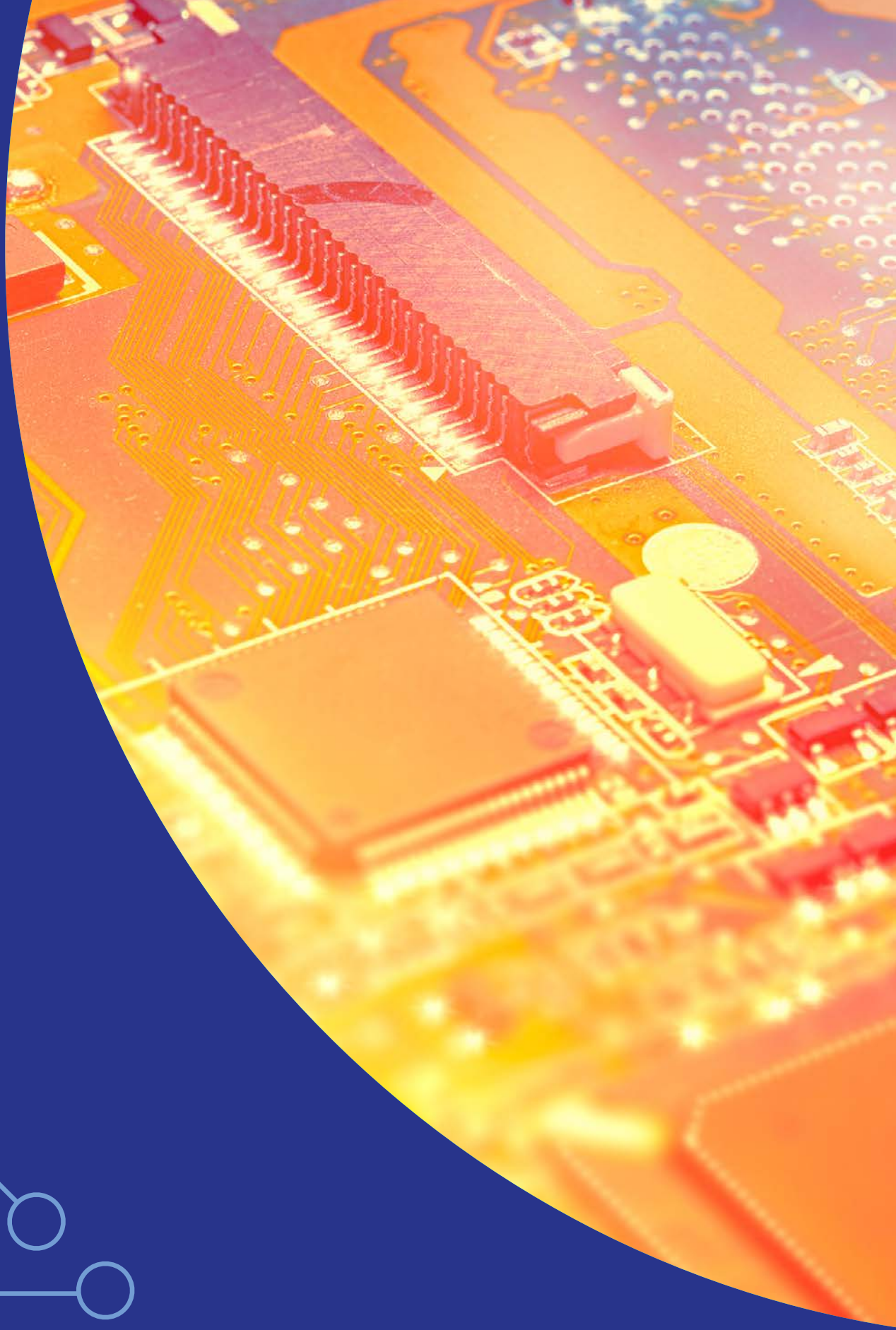
Declare that the information contained in this report gives a true and fair view.

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

This reasonable assurance is based on my own judgement and on the information at my disposal, such as the results of the self-assessment, ex-post controls, the work of the internal audit capability, the observations 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 Joint Undertaking.

Place Brussels, date
Jari Kinaret Executive Director



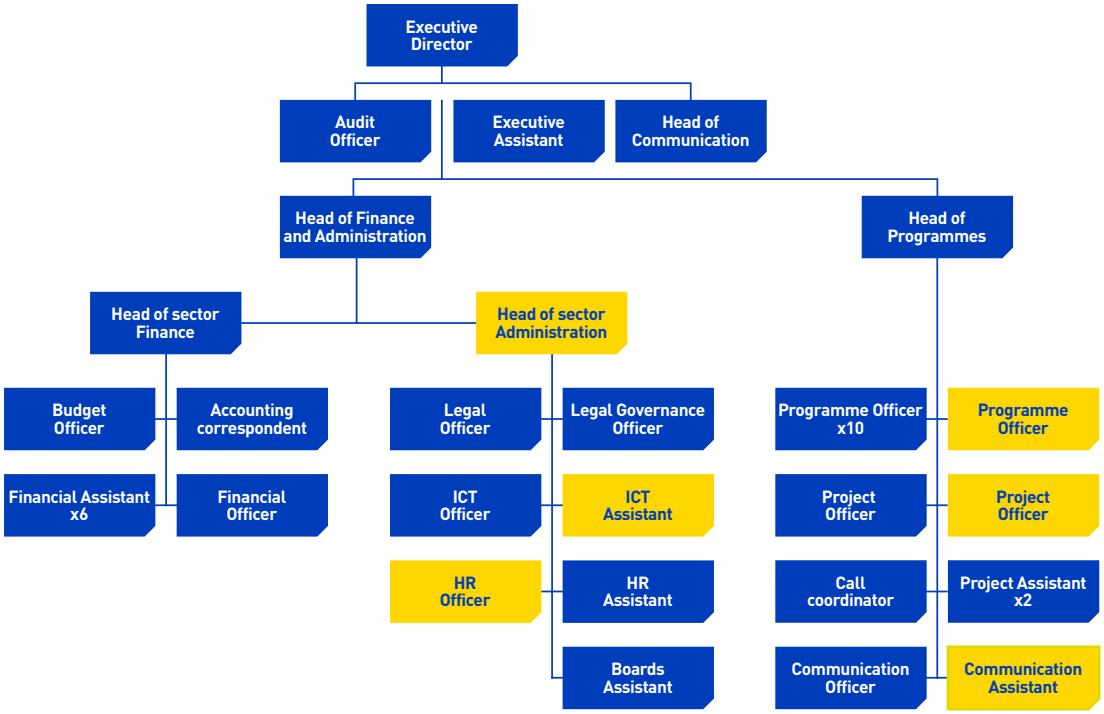
ANNEXES

5. ANNEXES

5.1. ORGANISATIONAL CHART

As approved by the Governing Board (Decision Chips JU GB 2023.54 of 6.12.2023).

In orange: new posts for year 2024



5.2. ESTABLISHMENT PLAN

As approved by the Governing Board (decision Chips JU GB 2023.54 of 6.12.2023).

Establishment plan (authorised/filled/proposed)

Staff category	2023 authorised	2023 Filled at 31/12/2023 (indicative)	2024 proposed
Temporary agents	14	17	19
Contract agents	16	19	23
Seconded National Experts	1	0	0
Total staff	**31**	**36**	**42**

Temporary agents

Grade	2023 Authorised		2023 Filled at 31/12/2023 (indicative)		2024 Proposed	
	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts
AD 16						
AD 15						
AD 14		1		1		1
AD 13		1		1		1
AD 12		1		1		1
AD 11		0		0		2
AD 10		6		6		5
AD 9		2		2		2
AD 8		2		2		2
AD 7		1		1		2
AD 6						
AD 5				3		3
AD total		**14**		**17**		**19**
AST 11						
AST 10						
AST 9						
AST 8						
AST 7						
AST 6						
AST 5						
AST 4						
AST 3						
AST 2						
AST 1						
AST total						

Grade	2023		2023		2024	
	Authorised		Filled at 31/12/2023 (indicative)		Proposed	
	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts
AST/SC 6						
AST/SC 5						
AST/SC 4						
AST/SC 3						
AST/SC 2						
AST/SC 1						
AST/SC total						
TOTAL	14		17		19	

Contract agents

Group	2023 authorised	2023 Filled at 31/12/2023 (indicative)	2024 proposed
Function Group IV	8	9	10
Function Group III	8	10	13
Function Group II	0	0	0
Function Group I			
Total	16	19	23

Estimated full-time equivalent units (FTE) on the basis of average costs.

Seconded national experts

Seconded National Experts	2023 authorised	2023 Filled at 31/12/2023 (indicative)	2024 proposed
Total	1	0	0

Estimated full time equivalent units (FTE) on the basis of average costs.

5.3. VARIOUS INDICATORS FROM PROJECTS

The table provides per project the cumulative number of publications for the ECSEL programme. Information for the Chips programme is not yet available as the projects just started.

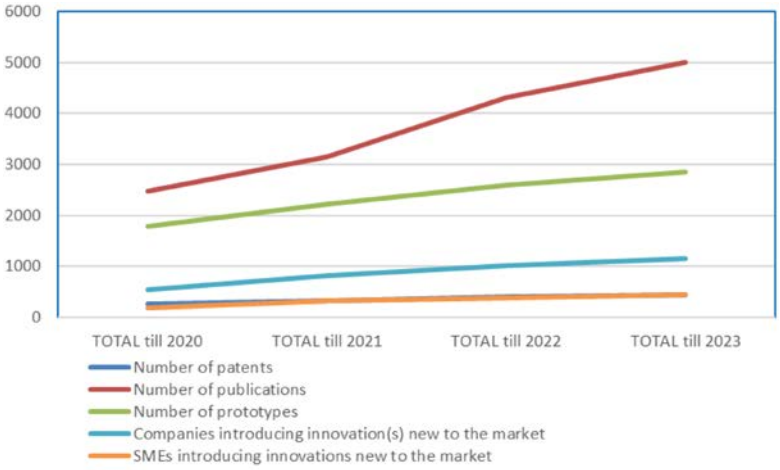
Project Call Id	Project Acronym	Number of patents	Number of publications	Number of prototypes	Number of clinical trials	Companies introducing innovation(s) new to the market	How many of these are SMEs	Companies introducing innovation(s) new to the company	How many of these are SMEs
2014-1	3Ccar	4	70	0	0	0	0	0	0
2014-1	EXIST	0	38	20	1	11	5	11	5
2014-1	MANTIS	0	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	3	7	22	0	10	2	9	2
2015-1	AMASS	0	102	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	Seml40	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	3	86	24	0	8	5	8	5
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	147	0	0	0	0	0	0
2016-1	WInSiC4AP	0	24	8	0	11	5	0	0
2016-2	EuroPAT-MASIP	8	13	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	2	13	8	0	25	7	25	4
2016-2	SCOTT	1	130	753	0	14	6	5	3
2016-2	TAKEMI5	8	29	49	0	20	4	21	4
2017-1	iDev40	1	167	24	0	13	6	15	2

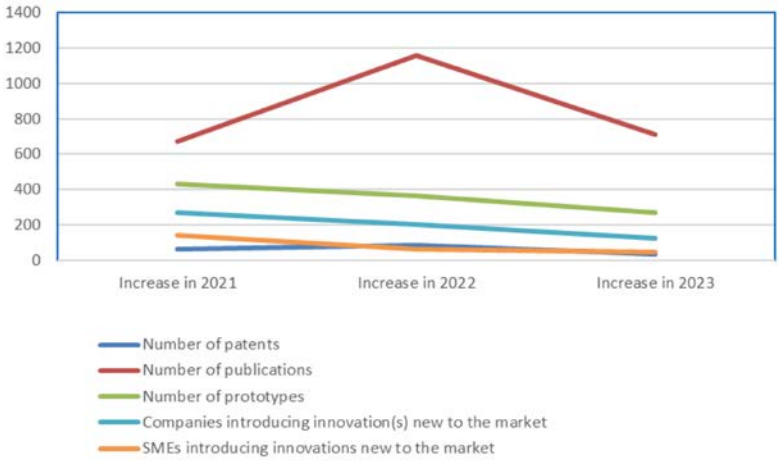
Project Call Id	Project Acronym	Number of patents	Number of publications	Number of prototypes	Number of clinical trials	Companies introducing innovation(s) new to the market	How many of these are SMEs	Companies introducing innovation(s) new to the company	How many of these are SMEs
2017-1	OCEAN12	5	37	1	0	1	0	1	0
2017-1	POSITION-II	4	27	8	0	15	6	26	9
2017-1	REACTION	0	99	7	0	17	6	17	6
2017-1	TAPES3	12	36	52	0	23	3	26	3
2017-1	WAKeMeUP	0	54	3	0	11	1	11	1
2017-2	5G_GaN2	0	20	1	0	0	0	0	0
2017-2	AFarCloud	7	16	96	1	11	9	8	6
2017-2	FITOPTIVIS	11	123	25	7	17	8	10	4
2017-2	HiPERFORM	14	33	12	0	7	3	15	8
2017-2	PRYSTINE	24	91	0	0	34	9	16	4
2017-2	SECREDAS	13	80	46	0	50	24	50	24
2018-1	APPLAUSE	4	17	15	0	30	9	40	9
2018-1	Arrowhead Tools	0	141	69	0	66	39	58	48
2018-1	CPS4EU	2	70	24	0	24	14	24	14
2018-1	MADEin4	24	63	18	0	23	7	23	7
2018-1	PIN3S	16	11	49	0	23	3	25	4
2018-1	Power2Power	4	103	0	0	0	0	0	0
2018-1	VIZTA	16	16	10	0	10	3	10	3
2018-2	AI4DI	2	123	18	0	23	11	23	11
2018-2	COMP4DRONES	0	101	74	0	25	19	28	19
2018-2	HELIAUS	3	28	46	0	3	1	3	1
2018-2	NewControl	6	58	44	4	22	10	40	12
2018-2	TEMPO	6	102	10	0	8	3	10	3
2018-2	UltimateGaN	6	76	8	0	13	4	0	0
2018-3-CSA	CSA-Industry4.E	0	0	0	0	0	0	0	0
2018-4-CSA	COSMOS	0	0	0	0	0	0	0	0
2019-1	BEYOND5	1	107	30	0	2	0	0	0
2019-1	CHARM	3	5	7	0	9	0	27	8
2019-1	InSecTT	2	157	62	0	17	3	12	3
2019-1	iRel40	3	98	42	0	33	14	40	20
2019-1	IT2	7	41	95	0	25	4	30	4
2019-1	Moore4Medical	0	76	27	3	11	5	20	14
2019-2	ADACORSA	1	75	31	0	27	11	22	7
2019-2	ANDANTE	0	14	16	0	7	4	7	4
2019-2	ArchitectECA2030	0	39	0	0	0	0	0	0
2019-2	BRAINE	0	4	3	0	19	12	10	7
2019-2	FRACTAL	0	19	3	0	11	5	5	2
2019-2	NextPerception	9	76	21	0	23	18	23	18
2019-2	PROGRESSUS	3	85	15	0	3	1	3	1
2019-2	VALU3S	1	64	22	0	3	2	13	7
2019-3-CSA	HELoS	0	8	0	0	0	0	0	0
2020-1	Energy ECS	0	13	20	0	9	5	10	5
2020-1	GaN4AP	0	5	20	0	2	0	2	0
2020-1	ID2PPAC	2	11	41	0	11	2	12	2
2020-1	StorAIge	0	57	0	0	0	0	0	0
2020-1	TRANSACT	0	25	12	0	9	6	11	7
2020-1	TRANSFORM	0	26	47	0	14	3	16	3

Project Call Id	Project Acronym	Number of 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
2020-2	AI4CSM	2	19	0	0	0	0	0	0
2020-2	AIDOaRt	0	37	43	0	0	0	10	5
2020-2	AI-TWILIGHT	0	74	1	0	3	2	18	11
2020-2	DAIS	0	33	0	0	0	0	0	0
2020-2	HiEFFICIENT	0	15	0	0	0	0	0	0
2020-2	IMOCO4.E	0	17	44	0	9	3	0	0
2020-2	MATQu	0	4	0	0	0	0	0	0
2020-2	YESvGaN	5	19	16	0	5	1	5	1
2020-4-CSA	SC3	0	6	8	0	3	0	2	0
	TOTAL till 2023	**442**	**5012**	**2860**	**35**	**1148**	**440**	**1200**	**450**
	Only 2023	**36**	**709**	**272**	**0**	**124**	**47**	**150**	**57**

The evolution of those cumulative indicators is plotted below, showing a steady increase in publications, patents and innovations.

More revealing is the yearly growth plotted below. Both the publications and patents peak in 2022, while the other indicators are decreasing. This can be partially explained due to the closing of the ECSEL programme with last calls in 2020 and the delayed launch of the first KDT calls, but it should be watched in coming years.





5.4. PATENTS FROM PROJECTS

The table under Annex 5.3 provides the patents per project.

5.5. SCOREBOARD

This annex presents the scoreboard of H2020 legacy KPIs (if relevant), the scoreboard of Horizon Europe common Key Impact Pathway Indicators (KIPs) and Horizon Europe Partnership Common Indicators.

As the ECSEL programme is closing, the KPIs for H2020 will no longer be collected.

The scoreboard of HE common KIPs is discussed in chapter 1.7.1, see Figure 1. In the future the JUs hope to get better presentable correct information.

The HE Partnership Common Indicators are discussed in chapter 1.7.2.

5.6. SCOREBOARD OF KPIS SPECIFIC TO CHIPS JU

The KPIs for Chips JU are a subset of the KPIs defined for the KDT JU and later amended to make the distinction between the initiative and non-initiative part of the programme. The KPI-guidelines are also included. The operational performance KPIs covers the efficiency of the Chips JU office in handling the activity flows: evaluation, payments, monitoring, communication. The operational performance covers all activities of the Chips JU, both initiative and non-initiative. The **p**rogramme performance KPIs cover the effectiveness of the programme for the non-initiative part of the programme. The programme performance KPIs are measured separately under 5.7.

5.6.1. OPERATIONAL PERFORMANCE

KPI	Definition	Baseline	Objective for year 2023	Achieved in 2023	Reference, comment
OP-1	Time to grant % below maximum time	100%	100%	100%	
OP-2	Time to payments % Late	2%	<2%	5.9%	
OP-3	% Projects achieving insufficiently (Monitoring)	5%	<5%	2%	
OP-4	Error rate: % common residual errors	2%-5%	<2%	1.25%	
OP-5	Events/Communication	10	>10	>16	Includes one very large event

KPI	Definition	Description
OP-1	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-2	Time to payments % Late	Percentage of payments (operational and administrative) that are past deadline
OP-3	% Projects achieving insufficiently (Monitoring)	Percentage of the project under monitoring that are assessed as insufficient at yearly review
OP-4	Error rate: % common residual errors	% common residual errors
OP-5	Events/Communication	Number of: presentations given by KDT staff at non KDT events, publications, organised events by KDT.

5.6.2. PROGRAMME PERFORMANCE KPI

KPI	Definition	Baseline	Objective for year 2023	Achieved in 2023	Reference, comment
PP-1	% EU funding committed to selected projects	n.a.	50%	46%	Objective is calculated using the LFS
PP-2	National Funding / EU Funding per year	0.92	0.95	0.92	For non initiative projects
PP-3	Participation of SME to the non-initiative part of the programme	25%	>33%	28%	
PP-4	Publications	n.a.	n.a.	709	Baseline and objectives to be determined
PP-5	International calls	0	0	0	

KPI	Definition	Description
PP-1	% EU funding committed to selected projects	Cumulative Non-Initiative as % of total budget of Chips JU[29]
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	IKOP	Cumulative IKOP
PP-4	Participation of SME to the non-initiative part of the programme	Proportion of SMEs participating in the selected projects of the non-initiative calls of that year.
PP-5	Publications	Number of publications in year
PP-6	International calls	Calls launched jointly with third country

29 One should take note that the EU total funding going to non-initiative projects changed (decreased) in 2022 with the advent of the Chips JU . For the objective one uses the latest LFS.

5.7. SPECIFIC KPIS RELATED TO THE CHIPS FOR EUROPE INITIATIVE

In the future, this annex will contain the 7 KPIs defined in the Chips Act and will be collected as of 2024.

5.8. (SECTION EXCLUDED)

5.9. IKAA REPORT

No IKAA to report for 2023, as no use is made of IKAA.

5.10. 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 applicable to the Horizon 2020 programme is also applicable to Horizon Europe.

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 Chips 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 the 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 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 sam-

ple has been drawn according to the following formula:

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

Where:

Σ (er) = sum of all individual error rates of the sample (in value).

Only the errors in favour of the JU will be taken into consideration;

A = total amount of the audited sample expressed in EUR.

Second step: calculation of residual error rate.

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

• errors detected and corrected as a result of the implementation of audit conclusions;

• errors corrected as a result of the extrapolation of audit results to non-audited contracts with the same beneficiary.

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

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

Where:

ResER% = residual error rate, expressed as a percentage;

RepER% = representative error rate, or error rate detected in the representative sample, in the form of the WAER, expressed as a percentage and calculated as described above (WAER%).

RepERsys% = systematic portion of the RepER% (the RepER% is composed of complementary portions reflecting the proportion of 'systematic' and 'non-systematic' errors detected) expressed as a percentage.

P = total amount of the auditable population of cost claims, expressed in EUR.

A = total amount of all audited amounts, expressed in EUR.

E = total non-audited amounts of all audited beneficiaries, expressed in EUR. This will comprise the total amount of all non-audited but validated and paid costs for all audited beneficiaries.

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

5.11. RESULTS OF TECHNICAL REVIEWS

The table shows the results of the reviews for ECSEL projects as well as the websites. The assessments are:

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

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

Call	Projects	1st Year	2nd Year	3rd Year	4th year	Website
2016	WINSIC4AP	GP	GP	GP+ (final)		https://www.winsic4ap-project.org/
2017	5G_GaN2	GP-	GP	GP+	GP+ (final)	https://www.5ggan2.eu/
2017	AfarCloud	GP	GP	GP+ (final)		http://www.afarcloud.eu/
2017	FITOPTIVIS	GP	GP	GP (final)		https://fitoptivis.eu/
2017	HiPERFORM	GP	GP	EP (final)		https://hiperform.eu/
2017	iDev40	GP	GP	GP (final)		http://www.idev40.eu/
2017	OCEAN12	GP-	GP	GP	EP	https://ocean12.ecsel.soitec.eu/
2017	POSITION-II	GP	GP	GP (final)		http://position-2.eu/
2017	PRYSTINE	UP	GP	EP		https://prystine.eu/
2017	REACTION	GP	GP+	GP	EP	http://www.reaction-project.eu/news.php
2017	SECREDRAS	GP	GP	GP+ (final)		https://secredas.eu/
2017	WakeMeUP	GP-	GP	GP (final)		http://www.wakemeup-ecsel.eu/
2017	TAPES3	GP	GP	GP (final)		No website
2018	CSA-Industry4.E	GP-	GP (final)			https://industry4e.eu/
2018	AI4DI	GP-	GP+	EP (final)		https://ai4di.automotive.oth-aw.de/
2018	APPLAUSE	GP	GP+	GP (interim)	GP+ (final)	https://applause-ecsel.eu/
2018	Arrowhead Tools	GP	GP+	GP+ (final)		https://tools.arrowhead.eu/home/
2018	COMP4DRONES	GP+	GP	GP	GP (final)	https://www.comp4drones.eu/
2018	COSMOS (CSA)	GP	EP (final)			https://mobilitye.eu/
2018	CPS4EU	GP	GP	GP (final)		https://cps4eu.eu/
2018	HELIAUS	GP	GP	GP (final)		https://www.heliaus.eu/
2018	MADEin4	GP	EP	GP+	EP	https://madein4.eu/
2018	NewControl	GP-	GP-	GP		https://www.newcontrol-project.eu/
2018	PIN3S	GP	GP	GP (final)		No website
2018	Power2Power	GP	GP+	EP (final)		-
2018	TEMPO	GP	GP	GP (interim)	GP+ (final)	https://tempo-ecsel.eu/
2018	UltimateGaN	EP	EP	EP	EP (final)	http://www.ultimategan.eu/
2018	VIZTA	GP	GP+	EP (final)		https://www.vizta-ecsel.eu/
2019	ADACORSA	GP-	GP-	GP (interim)	GP (final)	https://adacorsa.eu/
2019	ANDANTE	GP-	GP-	GP- (interim)	Final review in 2024	https://www.andante-ai.eu/
2019	ArchitectECA2030	GP	UP			https://autoc3rt.automotive.oth-aw.de
2019	BEYOND5	GP-	GP	GP-		https://www.beyond5project.org/
2019	BRAINE	GP	GP	GP (interim)	Review in Nov 2023, REPA starts Feb 2024	https://www.braine-project.eu/
2019	CHARM	GP	GP-	GP (interim)	Final review in 2024	https://charm-ecsel.eu/
2019	FRACTAL	GP-	GP	GP		https://fractal-project.eu/
2019	Helos (CSA)	GP	GP (final)			https://www.health-lighthouse.eu/
2019	InSecTT	GP	GP	GP (final)		https://www.insectt.eu/
2019	iRel40	GP	GP			https://www.irel40.eu/
2019	IT2	GP	GP	GP (final)		
2019	Moore4Medical	GP	GP	GP (final)		https://moore4medical.eu/
2019	NextPerception	GP	GP	GP (final)		https://www.nextperception.eu/
2019	PROGRESSUS	EP	EP	EP (interim)	EP (final)	https://progressus-ecsel.eu/
2019	VALU3S	EP	GP			https://valu3s.eu/
2020	AI4CSM	GP	GP			
2020	AIDOaRt	GP-	GP			https://www.aidoart.eu/
2020	AI-TWILIGHT	GP	GP-			https://ai-twilight.eu/
2020	DAIS	GP	GP-			https://dais-project.eu/
2020	Energy ECS	GP				
2020	GaN4AP	GP	GP			

Call	Projects	1st Year	2nd Year	3rd Year	4th year	Website
2020	HiEFFICIENT	GP				
2020	ID2PPAC	GP	GP			
2020	IMOCO4.E	GP	GP			https://www.imoco4e.eu/
2020	MATQu	EP	GP+			https://www.matqu.eu/
2020	SC3 (CSA)	GP	GP	GP (interim)		https://sc3-project.eu/
2020	StorAIge	GP	GP			
2020	TRANSACT	GP-	EP			https://transact-ecsel.eu/
2020	TRANSFORM	GP+	GP+			https://sic-transform.eu/en
2020	VALU3S	EP				https://valu3s.eu/
2020	YESvGaN	GP+	GP			https://www.yesvgan.eu/en
2021	REBECCA	EP				https://rebecca-chip.eu/
2021	RETICLES	EP				https://reticles.eu/

Below follows a more complete description of the projects that finished in 2023 with some of their achievements.

ADACORSA – "Airborne data collection on resilient system architectures"

Short project description

The aim is to provide European technology to render drones as a safe and efficient component of the mobility mix, with differentiated, safe and reliable capabilities in extended beyond visual line of sight (BVLOS) operations. To reach the vision, the available technologies will be explored. This includes the option of transferring and extend automotive sense and control technologies, as well as commercial off-the-shelf communication technologies, applying innovative security features to reach adequate safety levels for modern unmanned aviation. More in detail, the strategic ADACORSA's objectives include:

- Helping unlock potential in long-range and BVLOS drone operations
- Contributing to higher public and regulatory acceptance of drone use
  - More robust and reliable technologies through functional redundancy
  - Better sensors via fusion and more reliable communications via integration of data links
- Further strengthen the integration of automotive and drone industry
  - World-class sensors from automotive industry
  - Commercial off-the-shelf data communication technologies and services
  - Design for automotive-style efficient production of components and subsystems

Final Review results summary

The ADACORSA project has researched and developed sensor and communication technologies for drones in BVLOS (beyond visual line of sight) operations, using components and technologies from the automotive industry to build drone prototypes with higher performance, less power consumption, and lower costs.). ADACORSA results have been demonstrated in three domains: smart construction, logistics, and smart foresting.

The project as a whole delivered on its technical and technological goals. Some of the most prominent results with immediate or potential impact are for instance:

- new radar and 3D imaging sensors with better performance
- path planning algorithms for fail-safe drone operations based on redundant information from different sensors
- Federated Machine Learning for better route planning
- detect-and-avoid technologies for reliable communication, and high-accuracy positioning and secure communication technologies.

An impressive list of development, integration, testing, and validation activities have been performed within the scope of the project lifespan. These activities advanced the technology, application, and market developments.

Great potential for innovations has been demonstrated through the perception, communication, and detect-and-avoid sub-systems, including the supporting platforms and components. More specifically, the consortium has highlighted a few potential innovation ar-

eas driven by the advancements in sensing and perception technology, advanced avionics systems, safety and security in connected systems, and new software application frameworks, among others.

Project Impact

ADACORSA has made a step forward towards its visionary of autonomous, intelligent and safe drones for everyday complex tasks that will have a profound impact on several markets. In this respect, the developments in ADACORSA will have impact on the technological capabilities and therefore on potential changes in regulations.

While most results will require further investments to mature the technology, the potential for innovative products and services is undoubtedly demonstrated from a technology standpoint. These applications certainly help address some of the major challenges of our society, such as the need to increase productivity and safety and tackle the labour shortage.

An additional important aspect of the ADACORSA project is that it has addressed both, the technological and the social dimensions of drones, more specifically, public acceptance of drones as a key enabler to fulfil the potential of drones integrated into daily routines.

APPLAUSE "Advanced packaging for photonics, optics and electronics for low cost manufacturing in Europe"

Short project description

The strong drive for more complex systems and more advanced packaging, including optics and photonics, creates a chance to retain the manufacturing and packaging value chain to Europe - or even start to bring it back. APPLAUSE supports this by building on the European expertise in advanced packaging and assembly to develop new tools, methods and processes for high volume mass manufacturing of electrical and optical components. The technologies will be piloted in 5 industrial Use Cases, related to 1. Substantially smaller 3D integrated ambient light sensor for mobile and wearable applications (AMS) 2. High performance, low cost, uncooled thermal IR sensor for automotive and surveillance applications (IDEAS) 3. High speed Datacom transceivers with reduced manufacturing costs (DustPhotonics) 4. Flexible cardiac monitoring patch and miniaturized cardiac implants with advanced monitoring capabilities (GE Healthcare and Cardiaccs) 6. Optical water measurement modules with cost-effective packaging of components (Vaisala) The APPLAUSE consortium is built of a number of leading experts from European electronics packaging companies representing different value chain levels related to advanced packaging and smart system integration. The parties have complementary expertise in conception, design, packaging, testing and manufacturing of electronic components, as well as a wide range of expertise from several different end use areas. The unique European ecosystem established within the consortium represents the competitive, leading edge of the technologies available.

Review results summary

The last reporting period was less impacted by unforeseen interruptions and delays in the activities, which allowed the consortium to reach most of its objectives, at general and technical level. The project was well managed and coordinated. The mitigation effort to solve remaining hurdles was highly effective and the progress over the last period was convincing, but nonetheless not all the demonstrators could reach the planned level of technical delivery. The project output was effectively shown by the demonstrating activities performed in the final review meeting.

Dissemination activities of high quality were characterized by new publications and scientific events attendance. Particularly noteworthy are the APPLAUSE summer school for PhD students and young engineers on Heterogeneous Integration organized by the project consortium in September 2022 and the dissemination day and poster event in ESREF 2022. The APPLAUSE website is frequently updated and gives visibility to EU and ECSEL funding, and APPLAUSE publications.

The project partners have realized several innovations that could be readily implemented in their core activities and business sectors. Highlights in this final period were the progress in the development of a high-accuracy pick and place machine for optical devices and the wafer-level test for optical sensors. Other important results are the new base material TPU, used for the development work in UC4. The CONDOX process, developed in UC1, is now used for some parts of the related process

flow and a low-temperature wafer-level metal bonding process at 150°C, without using Au metallization, demonstrated for the first time in the world.

Project Impact

The development of new technological concepts and the integration and improvement of existing technologies produced a valuable scientific output and a concrete potential impact in the field of advanced packaging and advanced manufacturing in Europe. This impact is complemented by exploitation activities of which the most relevant and exploitable products are related to semiconductor equipment and materials. It includes the following prominent examples:

- a double side prober with light stimulus (Afore), new 100Gb/s O band high power EMLs , a new pick and place machine with improved precision, new transfer molding capabilities and tools for ultrathin wafers and lenses, new CONDOX process .
- Vacuum Alignment module for MEMS bonding, Laser debonding and low-temperature bonding (EV Group); Temporary wafer bonding, new soldering process .
- Unique advanced IR inspection and void inspection system ; Grey scale Automated optical inspection of Via and trench structures, updated Museic device v3.1 .
- Film-assisted molding technology .
- Wafer test of ultrathin wafers and mounting ultrathin wafers .
- Low-temperature soldering (Aalto); Laser sealing at wafer level .
- Infrared Imaging preprocessing algorithm, Microbolometer technology, ALD at reduced process temperature, Improved simulation tools, Si capping and integration of AR coating, mold based 3D preform for optics, flip chip embedded flex.

In short, APPLAUSE is expected to reach a high impact in the area of manufacturing of optical microsystems and photonics devices..

COMP4DRONES – "Framework of key enabling technologies for safe and autonomous drones' applications"

Short project description

Drones can perform air operations that manned aircrafts struggle with, and their use brings significant economic savings and environmental benefits whilst reducing the risk to human life. Drone-based service and product innovation, as driven by increased levels of connectivity and automation, is limited by the growing dependence on poorly interoperable proprietary technologies and the risks posed to people, to other vehicles and to property. SESAR JU identified that issue has a high impact on European innovation, which demands R&D investments and incentives for the convergence of shared technologies and markets as a remedy. Actions creating globally harmonized, commercially exploitable yet widely accessible R&D ecosystems should be publicly performed. The COMP4DRONES project complements SESAR JU efforts with a particular focus on safe software and hardware drone architectures. COMP4DRONES will bear a holistically designed ecosystem ranging from application to electronic components, realized as a tightly integrated multi-vendor and compositional drone embedded architecture solution and a tool chain complementing the compositional architecture principles. The ecosystem aims at supporting (1) efficient customization and incremental assurance of drone embedded platforms, (2) safe autonomous decision making concerning individual or cooperative missions, (3) trustworthy drone-to-drone and drone-to-ground communications even in presence of malicious attackers and under the intrinsic platform constraints, and (4) agile and cost-effective compositional design and assurance of drone modules and systems. COMP4DRONES will also build an open sustainable ecosystem around public, royalty-free and goal-driven software platform standards that will ease the development of new drone functionalities for multiple application domains. Lead applications driving ecosystem development and benchmarking on the fields of transport, inspection, logistic, precision agriculture, parcel delivery.

Review results summary

The technical and administrative results of the project were successfully achieved in the reviewed period, subjected final components and tools prototypes, validation of final components and tools in demonstrators, deployment of the use cases in real site with all the components, interfaces and integrations. The generic, modular, and scalable architecture to support efficient customization and incremental assurance of embedded drone platforms and systems were well developed. Especially, the reference architecture bears potential.

The COMP4DRONES project presents a clear potential to enhance the current state of art in drone technologies by applications of use case scenarios such as drone-based traffic management centre, railway monitoring, autonomous inspections and logistic support. Not only throughout the project life cycle, but also during the final review period exploitation, dissemination, standardization and training have been properly achieved to maximize the impact of the COMP4DRONES project results.

The definition of KPIs in order to measure the project progress versus a set of targets have been remarkably improved in every use case by using SMART KPI methodology. One of the main steps forward and innovation realised by COMP4DRONES project as an effective outcome is European Drone Technology Network (RODENT). Although in very early stage of TRL, the initial progress of RODENT demonstrates on Ecosystem Building by the help of wiki pages to enable common components, tools, requirements and documentations, this can be encouraging the open-source community to use and further develop their own drone for their aim by using the introduced components list on the wiki page.

Project Impact

Despite its limitations in coming up with a complete autopilot for a fully open-source drone ecosystem accessible to SMEs, COMP4DRONES has managed to gather a wide set of requirements from various important use cases in the areas of railway monitoring, digitalisation of civil infrastructure, autonomous inspections and logistic support, smart agriculture, etc. All those use cases were successfully implemented with innovative solutions.

The Project succeeded to reach all the impacts expected in the project's timeframe, most notably on: (i) the safe use of drones in business applications: the Project showcased a wide range of applications spanning from Transport and Smart Mobility to Digital Industry. It indeed demonstrated the value and the potential in realistic environments representative of the targeted business applications; (ii) technologies for safer drones: the Project has developed or improved the performances of drone components aiming at safer operations (e.g. improved navigation capabilities, secure communications); (iii) a framework and reference architecture has been devised although further work is needed for its effective use.

While only part of the use case owners will exploit the project results in future products, the project has also contributed to develop a unified community that is now much better equipped to implement the SESAR strategy on unmanned traffic management services. The project's technological efforts have a relevant impact on the European ATM Master Plan and in particular the Roadmap for the safe integration of drones into all classes of airspace. With the wide variety of the technologies and use case, COMP4DRONES has a great potential to contribute to European Standardization to enable future safe and secure autonomous UAV operations.

FRACTAL– "A Cognitive Fractal and Secure EDGE based on an unique Open-Safe-Reliable-Low Power Hardware Platform Node"

Short project description

The objective is to create a reliable computing node that will create a Cognitive Edge under industry standards. This computing node will be the building block of scalable Internet of Things (from Low Computing to High Computing Edge Nodes). The cognitive skill will be given by an internal and external architecture that allows to forecast its internal performance and the state of the surrounding world. Hence, this node will have the capability of learning how to improve its performance against the uncertainty of the environment.

Review results summary

Project has achieved most of its objectives and milestones for the period with relatively minor deviations and will likely provide results with significant immediate or potential impact in the future. The project delivered on its technical and technological goals. In addition, the demonstrators showcased the technology in multiple, overlapping combinations that covered the targeted design space. By the end, the consortium has completed the "FRACTAL System", which is poised as a modular open reference architecture that includes a set of components developed to aid the adoption of the system by the consortium members of other external users. On the technical front, the achievements include:

- the methodological framework that provides a breakdown of FRACTAL's overall goals into features, the final platform specifications (largely driven by the tar-

geted Use Cases), and a handbook for the safety qualification of FRACTAL systems;
- the integration of (SW) components in the different software platforms;
- completion of component implementation with demos prepared and demonstrated. The components include artificial intelligent-based scheduling for/of the FRACTAL System, Adaptive Time-Triggered Network-on-chip for the FRACTAL node, IoT gateway for the FRACTAL system, Time-triggered Extension Layer for the Versal Network on-Chip, software diverse redundancy for the FRACTAL node, and a Fault injector component for FPGAs);
- completion of the FRACTAL Cloud AI Platform and its components' validation. The result is a complete technology stack of AI methods and tools available to FRACTAL users and adopters and used by the project's use cases;
- completion of the design, implementation and validation of the edge controller, the FRACTAL wireless communication nodes (4G/5G, NB-IoT/LTE-M);
- eight use cases have been completed and demonstrated. Four of them address technical components and node building blocks for the reference set of FRACTAL cognitive nodes, while the other four are industrial validation use cases. In most of the cases, the use cases reached or exceeded the set goals in KPIs. A few KPIs were not met, but this is assessed to be non-critical to the use cases' success;
- a set of academic publications, event participation, fairs, and exhibitions were used to disseminate the FRACTAL;
- concepts and results. A set of training materials was prepared, and live training sessions were performed;

Exploitation plans were developed by each partner after their identification of exploitable items. A joint approach to exploitation is outlined but not deeply substantiated in the reports.

Standardization activities were held, mostly in the form of a survey to collect possible ways to address standardization activities, but not actually performing much of the latter.

The public availability of the FRACTAL system and the configuration User Interface behind it as mock-ups in an interactive format create a significant potential to onboard early adopters. The interested audience can quickly start with the FRACTAL reference architecture, its primary building blocks, and the building process behind them.

From an exploitation perspective, the proposed mock-up brings the potential to deliver a low-code tool/framework for system design in the edge-cloud continuum, design space exploration, and conducting early trade-off studies and validation activities. For instance, in the short term, the beneficiary Virtual Vehicle can enhance its support for a model in the loop or a model in the hardware loop to offer its customers more complex testing scenarios. Similarly, critical components of the FRACTAL platform are under consideration as a starting point for supporting RISC V designs in the Siemens HLS toolchain and platform.

Project Impact

The consortium has completed the "FRACTAL System", which is poised as a modular open reference architecture that includes a set of components developed to aid the adoption of the system by the consortium members as well as by other external users. An impressive list of exploitable foreground IPs has been summarized, which form a good prerequisite for enhancing the competitiveness and growth of the relevant companies. The conducted proof-of-concept studies, prototyping exercises, demonstrations, and validation tests deliver a good level of confidence that the project will likely provide results with significant immediate or potential impact soon. A solid contribution to the EU RISC V has been made by implementing new hardware extensions and delivering new or enhanced toolsets and training materials. Some of these developments are anticipated to form the foundation for developments in upcoming Chips JU projects in the RICS V area. The SMEs who participated in the project are expected to benefit in several directions:

- know-how and capacity enhancement concerning the technologies and tacit knowledge obtained while working collaboratively.
- Integration of technologies developed to expand existing product offerings.
- Setting up more aggressive timelines for the relevant technology roadmaps due to the validation of key technology and use cases KPIs.

iRel40 – "Intelligent Reliability 4.0"

Short project description

Intelligent Reliability 4.0 (iRel40) has the goal of improving reliability for electronic components and systems by reducing failure rates along the entire value chain. Trend for system integration, especially for heterogeneous integration, is miniaturization. Thus, reliability becomes an increasing challenge on device and system level and faces exceptional requirements for future complex applications. Applications require customer acceptance and satisfaction at acceptable cost. Reliability must be guaranteed when using systems in new and critical environments.

Review results summary

The project has five overall objectives:

- Definition of needs and requirements for future ECS applications
- Implementation of data values chains to speed up the learning curves by 30%
- Double the predicted lifetime for specific materials and load conditions
- Early detection of unexpected quality relevant events
- Reduction of the failure rates by 30%

The reliability assessment related to these overall objectives was presented during the review meeting. Furthermore, the contribution of the 34 use cases and industrial pilots to the five overall project objectives is clearly presented in a deliverable. Quantified measurable targets of the use cases and industrial pilots allow to assess the achievements.

The overall assessment of the progress of the final period is positive. The project has significantly contributed to the higher objectives, and most of the 5 key objectives have been achieved even if it is difficult to measure now the improvement or impact of the results on product reliability. Almost all the tasks in all the WPs have been carried out according to the latest technical annex; when needed, a description of the deviations per WP is provided. The improvement of reliability is a continuous and ongoing development. The activities of the WPs have contributed to the development and demonstration of the next innovations required to bring the industry's capability to find solutions to cope with the increasing complexity in the field of reliability..

Project Impact

The major challenge in this project is to reduce the failure rates by 30%. This objective has been achieved for some use cases. However, it is difficult to assess the achievement of this objective at the level of the overall activity of the project. Progress has been achieved for the methodologies for data analysis, prediction, and improvement of reliability. Technical innovations of chip technology, package and package/board technology from the use cases are presented with clear explanations. First prototypes were manufactured for the 16 Application Use Cases (UCs) in the 3 domains and the 18 Industrial Pilots (IPs). Reliability testing provides better understanding of the critical impact of defects and the lifetime prediction. The results at the end of the project allows to conclude that the project has been an excellent framework for new knowledge generation at the different levels of the value chain (chip, package, board/system) and for the different domains addressed by the project (Digital industry, Energy, Transport and Industrial Pilots). The 112 failure types identified had been collected in the Failure Catalogue. This Failure Catalogue also identifies the mechanisms leading to each failure, being the following the most relevant ones (which represents the 86% of failures): 1. Stress-induced mechanisms (causes 29% of failures); 2. Material-interaction-induced mechanisms (causes 20% of failures); 3. Environmentally induced failure mechanisms (causes 17% of failures); 4. Mechanically induced failure mechanisms (causes 15% of failures) and 5. Thermal mechanic stress induced failure mechanisms (causes 5% of failures).

IT2 – "IC Technology for the 2nm Node"

Short project description

The overall objective is to explore, develop and demonstrate technology options that are needed to realize 2nm CMOS logic technology extending the scaled Semiconductor technology roadmap to the next node in accordance to Moore's law. These activities cover creation of Lithography equipment, new Processes & Modules and Metrology tools capable to create and deal with new 2nm node 3D structures, defect analysis, overlay and features.

Review results summary

The project has delivered excellent results in all three major areas. The submitted deliverables are of excellent quality. The communication between partners is excellent. All modules have been integrated into the first EUV lithography machine for the 2nm node multi-patterning. In October 2023, the first image in the (wafer) resist has been successfully achieved. Other key achievements related to patterning include: selection of metal organic resists for 24nm Lines/Spaces use-case hNA EUV single patterning, for holes and pillars single-patterning, successful resolution of 32nm Center-to-Center pitches, and the development of machine learning algorithm for edge placement error contributors break down.

Project Impact

The resulting innovations demonstrate strong potential for impact not only in the lithography and metrology tools markets but also in the IC industry as enablers of the 2nm technology node. The lithographic system developed in IT2 will strengthen European leadership in the market for lithography tools for advanced technology nodes. Overall, the know-how and TRL of the innovations on the addressed variety of metrology solutions has increased. The faster and more accurate metrology tools developed in IT2 will benefit the metrology partners in terms of competitiveness and market opportunities. Some of the developments are expected to be introduced into the companies portfolio in the near future. Indications for strong economic impact for the European ECS ecosystem were given by the solid exploitation plans presented by the industrial partners - the results generated in the project already attracted interest from the existing customers of the industrial partners. The participation in this project also significantly benefited the RTOs helping them to consolidate/ strengthen their position by gaining excellent know how and developing new skills.

MADEin4 – "Metrology Advances for Digitized ECS industry 4.0."

Short project description

MADEin4 project is a comprehensive Industry 4.0 ECS equipment and manufacturing framework that aims at developing ECS next generation metrology tools, machine learning methods and applications to support Industry 4.0 high volume manufacturing (HVM) of both the Semiconductors and Automotive industries.

Review results summary

The project has delivered exceptional results with significant immediate or potential impact. There has been a good progress and promising results have been achieved in all work package. Several project partners have achieved results that significantly exceed expectations and that are leading to immediate exploitation. All the objectives for the project have been achieved both within the metrology field as well as in machine learning. All partners have demonstrated commitment and have invested efforts into preparing the results for exploitation. Collaboration between partners was excellent. Overall, the progress towards achieving the specified KPIs has been good. All the deliverables, milestones were submitted and a majority of the 29 defined KPIs have been met. The coordination has worked well and has managed to handle delays due to Covid-restrictions in an efficient way. Industry 4.0 solutions have been developed, such as advanced machine learning for predicting yields and maintenance needs as well as inspecting welding and using digital twin technologies for simulations which all will have a significant impact beyond the automotive industry.

Project Impact

The project has made good progress in understanding the needs for improved metrology tools. Furthermore Industry 4.0 solutions have been developed such as advanced machine learning for predicting yields and maintenance needs as well as inspecting welding and using digital twin technologies for simulations which all will have a significant impact beyond the automotive industry.

The project has delivered results that support the growth of companies. New market opportunities were established, e.g. for the first time a design company together with a European manufacturer develop predictive semiconductors process analysis in collaboration with metrology equipment manufacturers to improve yield and cycle time to produce new semiconductors.

Moore4Medical – "Accelerating Innovation in Microfabricated Medical Devices."

Short project description

The project aims to foster innovation for smart medical devices and systems by establishing and using open platform approaches and setting standards in several domains (implants using US, organ-on-chip, drug delivery, tracking for surgical interventions and continuous vital-sign monitoring). This project aims at emerging medical applications that offer significant new opportunities for the ECS industry including active implantable devices (bioelectronic medicines), organ-on-chip, drug adherence monitoring, smart ultrasound, radiation free interventions and continuous monitoring. The new technologies will help fighting the increasing cost of healthcare by: reducing the need for hospitalization, helping the development of personalized therapies, and realizing intelligent point-of-care diagnostic tools. The outcome is validated in several demonstrators.

Review results summary

There are significant results within all the approached domains showing great impact and exploitation potential. Contributions to state of the art are well documented in an impressive number of scientific publications during the last project year in addition to patent filings.

All objectives are achieved in compliance with the proposal and the accepted amendments. The project has made good progress in all work packages. However, delays of clinical trials were present. The clinical trials have started adequately and will continue after the project ends. All the due deliverables and milestones, except for one, have been appropriately achieved.

Project Impact

The work contributes excellently to the expected impacts detailed in the DoA and develops specialized and enabling open technology platforms within the following areas:

- Wireless ultrasound power – for implantable devices: A platform that uses focused ultrasound based on MEMS technology will energize implants located near organs deep inside the body.
- Smart well plate – for organ-on-chip: A smart well plate comprising microfluidics, micropumps and electronics will bridge the gap between organ-on-chip devices from a variety of manufactures and the pharmaceutical workflow.
- Intelligent delivery – for drug adherence: Micropumps and a variety of sensors are the elements of a generic platform to administer and monitor how, when, and where expensive drugs are delivered, ensuring proper drug adherence.
- Smart 3D ultrasound – for the next-generation ultrasound: A flexible 3D ultrasound platform consisting of MEMS transducers, a programmable front-end and AI data interpretation brings non-radiative imaging from the clinic to the world.
- Optical tracking and shape sensing – for X-ray-free surgery: Optical tracking and optical shape sensing, developed in previous projects, will be generalized into open platforms so that they can be used to locate and track a variety of instruments.
- A bed monitoring platform – for continuous monitoring: An array of sensors in and around the beds of patients will be used to gain valuable patient information. In Moore4Medical it will be used to detect atrial fibrillation during sleep.

NextPerception – "Next generation smart perception sensors and distributed intelligence for proactive human monitoring in health, wellbeing, and automotive systems."

Short project description

This project will bring perception sensing technologies like Radar, LiDAR and Time of Flight cameras to the next level, enhancing their features to allow for more accurate detection of human behaviour and physiological parameters. Besides more accurate automotive solutions ensuring driver vigilance and pedestrian and cyclist safety, this innovation will open new opportunities in health and wellbeing to monitor elderly people at home or unobtrusively assess health state.

To facilitate building the complex smart sensing systems envisioned and ensure their secure and reliable operation, the new Distributed Intelligence paradigm will be embraced, enhanced and supported by tools. It leverages the advantages of Edge and Cloud computing, building on the distributed computational resources increasingly available in sensors

and edge components to also distribute the intelligence.

The goal of this project is to develop next generation smart perception sensors and enhance the distributed intelligence paradigm to build versatile, secure, reliable, and proactive human monitoring solutions for the health, wellbeing, and automotive domains.

The project brings together major industrial players and research partners to address top challenges in health, wellbeing, and automotive domains through three use cases: integral vitality monitoring for elderly and exercise, driver monitoring, and providing safety and comfort for vulnerable road users at intersections..

Review results summary

The project coordination was solid and efficient through the 3 years, which has been very challenging and complex task given the size and complexity of the project and the difficult circumstances with the COVID situation.

The defined use cases are of good quality and realistic. One important shortcoming of the use cases is the lack of ambition in terms of distributed intelligence to tackle privacy-related aspects of the envisaged applications. The demonstrators in Eindhoven were convincing and showed a pathway to real-world applications. Awareness creation and communication to wider audience was not sufficiently addressed during the project.

The project realised several realistic pilots to demonstrate the potential of the developed technology. It was expected that the project will develop overall reference methodology and tools for distributed intelligent systems, which are then instantiated in the different use cases. Unfortunately, Next Perception was not very successful in developing such reference methodological solution.

Project Impact

The project mainly enhanced the innovation capacity and will subsequently create, or has already created, new market opportunities for the partners focusing on developing novel sensing devices and components. This type of partners has quite feasible exploitation routes at the end of the project. However, application solutions providers are far from being able to valorise anything in the next 3-5 years since the developed AI solutions are not sufficiently mature.

OCEAN12– "Opportunity to Carry European Autonomous driviNg further with FDSOI technology up to 12nm node."

Short project description

Based on the innovative FDSOI technology, OCEAN12 will develop new processors and applications design that leverage Fully Depleted Silicon On Insulator (FD-SOI) technology to offer the industry's lowest power consuming processor, especially for automotive and aeronautic applications. OCEAN12 will develop a technology platform benefitting from FDSOI design's extreme low leakage and operating voltage (Vdd) scalability attained thank to reverse and forward body biasing (RBB/FBB) of the integrate circuit and it power system architecture. This high performance, low power solution will enable the next strategic generations of smart vehicles. This platform will rely on:

- pilot line facilities capable to manufacture advanced substrates compatible with 12FDX technology and define pathfinding solutions to push 12FDX technology performances and develop innovative sensors,
- development of innovative designs to enhance FDSOI capacity and guarantee the highest level of integrated solutions,
- the manufacturing of high-performance ICs using all panel of FDSOI technologies,

The produced highly integrated, reliable, ultra-low power and lower cost components will be integrated in complex embedded systems accessible to TIER-1, 2 and OEMs and answering strategic challenges of future vehicles generations. Several product demonstrators are targeted: high end microcontroller plug and play board, high performance sensors data fusion, highly integrated low power video processing, awaking systems.

A strong added value network is created across this project to enhance a competitive European value chain on a European breakthrough and secure a unique FDSOI roadmap beyond the 22FDX.

OCEAN 12 finally highlights Europe's unique leading position on FDSOI technology inte-

grating the entire manufacturing chain in this dynamic, from substrate suppliers and foundries to TIER-1 and OEM, including academia and RTO's.

Review results summary

The project has delivered exceptional results with significant immediate or potential impact. OCEAN12 has delivered successfully outstanding results to drive the FDSOI technology, starting at 28nm structures, providing samples and demonstrators in 22nm and paving the way to 12nm. The OCEAN12 consortium has not only worked on process technology but on the entire SOI ecosystem, including machinery, metrology, design tools, IP creation, supported by a powerful dissemination. All this was achieved despite the impacts of the COVID19 pandemic and related close downs. Due to the impacts of COVID and worldwide silicon shortage, a third amendment was issued whhich lead to a modified DoA with a focus on a nine-month project extension, including improved 22nm / 18nm FDSOI and pathfinding towards 12nm FDSOI. Furthermore, the development of different IP´s are now showing initial and promising results. Overall, the project has delivered very solid results in line with (amended) DoA.

The objectives are still scientifically and commercially relevant. There is still a cutthroat competition between the technology leaders of TSMC, Samsung, and Intel and the European semiconductor industry. Whereas the first three focus on FinFET semiconductors, the European chip manufacturers focus mainly on FDSOI for advanced CMOS chips.

There are some strong results with good exploitation opportunities in line with the DoA. The technology development has progressed showing very promising results on wafer characteristics and metrology. The Radar SoC has well identified exploitation opportunities, and several tasks show great power efficiency especially at low voltage levels ging beyond state-of-the-art.

Project Impact

The work carried out contributes very well to the objectives in the amended DoA. The project has progressed technologically in line with the plan, and there are good achievements on the technologies, IP development, and component and system level. There are a significant number of identified IP´s from the project on the D&R IP marketplace portal, and there are clear examples of achieved impacts from the project described in the exploitation plans presented at the review.

The project is expected to have a direct impact on innovation capacity in relation to FDSOI and the European semiconductor industry and the involved companies, both long term (FDSOI evolution) and short term (availability of relevant IP´s and technologies in existing geometries). Primarily on the sensor side, there is a strong relation also to the advancement of the European automotive industry. There are some clear examples of how the technical progression has led to growth of the companies. Also, the announced joint investment by STM and GF is well in line with the technical progress and ambitions of this project.

There are nine SMEs involved in the project. The exploitation plans were presented at the review meeting and there are clear exploitation plans based on project results from several of these. There are some examples of established relationships between SMEs and larger companies which is promising.

PIN3S – "Pilot Integration of 3nm Semiconducter technology."

Short project description

The overall objective of the PIn3S project is to realize Pilot Integration of 3nm Semiconductor technology. This covers Process Integration, creation of Lithography Equipment, EUV Mask Repair Equipment and Metrology tools capable to deal with 3D structures, defects analysis, overlay and feature size evaluation. Virtually all technology developed within the PIn3S project is beyond state of the art.

Review results summary

The project delivered impressive results. At the end of the project the first system qualification of the 3nm DUV immersion scanner took place. A second iteration of the distortion manipulator has been integrated in a DUV immersion scanner, showing record-level imaging results. Regarding the hyper-NA EUV system, the first deliveries of sub-systems have been realized and shipped such as the power cabinets and large frame supporting the EUV Source. A 3nm node mask repair prototype system was specified, designed, built, and integrated. Using the prototype system,

the feasibility of high-resolution mask repair etches was successfully demonstrated in line with 3nm node requirements. Furthermore, a first version of an Artificial Intelligence based mask defect- and repair assessment tool was developed. In Process Integration, the Gate All Around Nanosheet (GAA NS) was selected for the 3nm node.

Project Impact

There is expected a strong impact of the results of the project on the commercial activity of all the industrial partners. Several beneficiaries already pointed out commercial exploitation in a near future. The most important achievement of the project, indicative of its success, is that ASML has announced in 2023 to install the EUV High-NA lithography tool at the pilot line at imec. All developments in the projects are now the state of the art for 3nm node.

PROGRESSUS– "Highly efficient and trustworthy electronics, components and systems for the next generation energy supply infrastructure."

Short project description

Progressus supports the European climate targets for 2030 by proposing a next generation smart grid, demonstrated by the application example "smart charging infrastructure" that integrates seamlessly into the already existing concepts of smart-grid architectures keeping additional investments minimal. The expected high-power requirements for ultra fast charging stations lead to special challenges for designing and establishing an intelligent charge-infrastructure. As emission free traffic concepts are a nascent economic topic also the efficient use of charging infrastructure is still in its infancy.

Review results summary

The main outcomes include several power converters for smart grid support and EV integration, e.g. highly efficient AC/DC, DC/DC and DC/AC converters up to high power charging. Excellent system development was reached, and highly efficient wireless charging was realised. Utility needs and requirements are considered by energy management solutions, including Power Quality (PQ) and Harmonics investigations. Theoretical studies and practical measurement in the Use Cases were carried out and delivered very good results.

It is also noteworthy that software solutions were developed including machine learning (ML) and artificial intelligence (AI) for easy integration. An extensive development for data measurement, secure monitoring and data processing was completed, allowing growth of energy market development.

Scientific activities were very thorough, demonstrating major contribution to knowledge. Scientific papers of high quality were published, and different channels were used for dissemination activities. The results (publications/disseminations, etc.) exceed targets set for the project. Every project partner presented comprehensive exploitation activities during the final project meeting and the exploitation plans were described in detail with the reached TRLs quantified.

Project Impact

The work carried out has contributed to the expected impacts. For example, the AC/DC and DC/DC converters, bidirectional power flow developed, as well as the progress reported on innovative inductive charging will help increase efficiency, decrease greenhouse emission and other benefits as planned. Moreover, solutions for current measurement give exceptionally high dynamic control for power electronics. This has the potential to bring a major impact on the sector. The innovative approach in energy harvesting for sensors, as well as data management/security algorithm of data transmission and processing are other areas of strong impact.

The different prototypes developed give a great chance and benefit in better market products, which are more compact, have less losses, offer integrated solutions with storage systems. For inductive EV charging significant efficiency improvements are demonstrated.

Electrification of systems is a main tool for decarbonisation. The project supports EU goals in electrification of transport, supports convenient ultra-fast EV charging systems (AFI-Directive) and allows combination with storage systems by bi-directional converters. New, high dynamic current sensors on highly efficient power electronic chips offer benefits in comparison to competitors. Inductive charging up to 50 kW is under development for more convenience to consumers. New control architectures for self-organized grid are under development. Aspects for secure

communication and data transfer are realised at sensor level..

R3-POWER UP– "300mm Pilot Line for Smart Power and Power Discretes."

Short project description

The R3-PowerUP project goal is to set up a qualified and reliable 300mm silicon pilot line for smart power (BCD) and power discrete devices (MOSFET, IGBT) technology, including equipment selection, installation, and validation. This includes the development and demonstration of a 300mm waferfab and the improvement of productivity. The pilot line will build on digital factory and industry 4.0 principles. The development of targeted smart power technology will start from an existing 200mm BCD process and it will be demonstrated with 300mm equipment.

The R3-PowerUP project builds on the precursor project R2POWER300 (ECSEL 2014) that can be considered as the preparatory study to the big leap from 200mm to 300mm fab and from 110nm BCD9 to 90nm BCD10 technology. This project is quite large with 35 partners from 14 countries, a total cost budget of about 180M€ and the support of both the European Union through ECSEL JU and the National authorities..

Review results summary

Significant results linked to exploitation and impact potential have been achieved and presented, mainly related to the 300 mm Si pilot line for Smart Power and Power Discretes including process technology and improved equipment for front-end and back-end processing and metrology as well as advanced algorithms and tools for failure analysis and fab automation. During the project, several patents have been submitted. One of the main achievements is the release of PDKs for BCD10 and BCD 90 nm in the R3 fab.

Project Impact

The most important achievement of the project, indicative of its success, is that ST has announced to start the production of power devices in the 300 mm line based on the pilot line. In addition to the development of the full 300 mm Pilot Line for Smart Power, exploitation activities are directed towards equipment and material manufacturers, for marketing new equipment, materials and process steps developed in the 300 mm Pilot Line Application companies, using advanced Smart Power and Power Discrete processes developed in the project and prototyped in the line for innovative products.

REACTION– "First and euRopEAn siC eigTh Inches pilOt liNe."

Short project description

REACTION will push through the first worldwide 200mm Silicon Carbide (SiC) Pilot Line Facility for Power technology. This will enable the European industry to set the world reference of innovative and competitive solutions for critical societal challenges, like Energy saving and CO2 Reduction as well as Sustainable Environment through electric mobility and industrial power efficiency.

Review results summary

The project results in terms of available 8" wafers, epitaxial structures as well as devices (diodes, MOSFETs) are innovative and indicate that the developed technology will result in commercial products in the next 1-2 years. The development of 8" SiC technology requires development of new processes, tools and equipment that the work carried out by the consortium has addressed in full. A fully functional pilot line for the fabrication of SiC devices on 200mm has been demonstrated ahead of all competition. The process stack/flow was fully transferred from 6" to 8" wafer. The device performance was demonstrated up to 1.2kV and 2.2kV on 8". SiC diodes and MOSFETs fabricated on 8" wafers are of similar quality as that fabricated on 6" wafers.

Partners developed demonstrators showing the good performance of the SiC devices and the benefits brought by this technology to the improvement of the systems efficiency and power density. Most demonstrators developed in the project are focusing on this market and on the PV market, the latter being expected to become the second largest market for the SiC technology in the next 5 years. The developed demonstrators are suitable for evaluating the fabricated devices and their impact in energy-related applications.

Project Impact

The development of the 8" SiC manufacturing technology is of strategic importance for the European competitiveness of its semiconductor industry and in particular to produce power SiC devices. The project has prepared the ground for future Europe-based manufacturing of those important power electronic components. The increase capacity of SiC devices will contribute to meet the higher demand of EV and HEV industry, essential for the decarbonisation of the European transport sector.

SC3 (CSA)– "Semantically Coordinated Semiconductor Supply Chains."

Short project description

SC³ relies on enabling a collaboration of industrial as well as academic stakeholders to ensure interoperability among semiconductor companies, and further industrial domains. SC³ implements an industrial reference platform as a standard (frequently used). This framework acts as a key enabler for realising an agile development - validation -refinement loop of a top-level ontology i.e. Digital Reference (DR)..

Review results summary

The project has achieved all its objectives. The results are considered impressive, and well documented. The developed SC³ Ontology framework platform provides functionalities related to ontology governance, like the ability to host ontologies and to manage them for further processing and visualizations. The initial Digital Reference at the start of the project has been improved, both its structure and linguistic layer, and extended. For instance, the new included CO2 ontology implementation could be a possible future link towards the automotive industry. As well, the collaborative update process supported by blockchain storage works well. The work will continue in the follow up Chips project SC4EU.

Following highlights were achieved and demonstrated at the final review:

- The improvement on the ontology curation platform.
- The in-depth evaluation of the developed ontologies.
- The integration of all the different ontologies into the Digital Reference Platform.
- The integration of the ontologies into the software engineering processes.
- The good international cooperation with other projects.

SC3 solutions and its implementation have been shown in various publications, workshops, webinars, and project external meetings. Extensive video material highlighting the project achievements is available at the project website.

Project Impact

The project will lead to more efficient supply chains in the semiconductor industry and strengthen the competitiveness of European companies, especially those that are project partners. The ontologies of the SC3 portal are freely and openly accessible. The ontologies can be downloaded and installed by third parties. This will contribute to enhancing the innovation capacity.

TEMPO – "Technology and hardware for neuromorphic computing."

Short project description

TEMPO project targets advancements in neuromorphic circuits introducing emerging non-volatile memory devices (STT-MRAM, PCRAM, Ox-RAM, FeFETs) and other technology options as scaled micro-bumps for heterogeneous 3D integration,and BEOL TFT switches for dynamically configurable global buses. The main objective is to build a European eco-system around the development, production and application of neuromorphic hardware through an efficient cross-fertilization between major European foundries, chip design, system houses, application companies and research partners.

Review results summary

Project has achieved most of its objectives and milestones for the period with relatively minor deviations. Project will likely provide results with significant immediate or potential impact in the next reporting period. The project has achieved good technical progress and valuable results in all its work packages. The long list of significant project achievements indicates a

dedicated work by the partners. Some specific project highlights are:

- The most promising NVM technology options are identified and a comparison between some technology options is provided.
- Contamination protocols have been studied.
- The study on 3D interconnect technology is completed.
- The TEMPO concepts are broadly communicated.
- KPIs for various applications are analysed.
- 11 demonstrators have been developed.

However, due to delays in the design and fabrication, some ASIC circuits were not yet fully tested and analysed by the time of the review. Due to timing constraints, a shift from 22nm FDSOI to 180nm BCD-on-SOI was made by partner FhG, which enabled the validation of certain concepts and technology characteristics comparisons with the other approaches within the project duration. However, critical aspects such as technology characterisation and performance impact of technology scaling remained still to be assessed. The 22nm FDSOI ASIC was planned to be finalized and reported after the end of the project. The reviewers were impressed by the high number (32 reports) and the good quality of the technical deliverables of the final period. Overall, the independent experts assessed the project as very successful.

Project Impact

Exploitation opportunities of the results were strong on the technology side, including impact on neuromorphic computing products and concepts from various partners. On the system demonstrator side, while some of the exploitation opportunities are strong (including above examples), other exploitable results are in an earlier stage as final testing and qualification work had just been finished or was still ongoing. The potential for future successful exploitation of results was seen as positive due to the demonstrated improved performances of neuromorphic processors.

5.12. LIST OF ACRONYMS

3IAs	Three Industry Associations: AENEAS, INSIDE, EPoSS.
BOA	Back-office arrangement
CSA	Coordination and support action
CHIPS JU	Chips Joint Undertaking
EC	European Commission
ECA	European Court of Auditors
ECSEL JU	Electronic Components and Systems for European Leadership Joint Undertaking
EDPS	European Data Protection Supervisor
ESIF	European Structural and Investment Funds
EUR	Euro
FPP	Full Project Proposal
GB	Governing Board
H2020	Horizon 2020
HE	Horizon Europe
IA	Innovation Action
IAS	Commission's Internal Audit Services
ICF	Internal Control Framework
ICS	Internal Control Standard
IKAA	In kind contribution to additional activities
IKOP	In kind contribution to operational activities
IPCEI	Important Project of Common European Interest
IT	Information Technology
JU	Joint Undertaking
JUGA	Joint Undertaking Grant Agreement
KDT	Key Digital Technologies Joint Undertaking
KIP	Key impact pathway indicators
KPI	Key Performance Indicator
NFA	National Funding Authority
NGA	National Grant Agreement
PA	Public Authority
PAB	Public Authorities Board
PO	Project Outline
R&D	Research and Development
R&D&I	Research, Development, and Innovation
RIA	Research and Innovation Action
SBA	Single Basic Act
SRIA	Strategic Research and Innovation Agenda
TRL	Technology Readiness Level
WP	Work Programme

5.13.LIST OF BOARDS MEMBERS

Note that only those members signing the three relevant declarations (Conflict of Interest and Confidentiality, Annual Declaration of Interest and Code of Conduct) are listed below.

Governing Board

Delegation	Name	First Name
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EC LD	**SIOLI**	**Lucilla**
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BE/Lead Delegate	**DEPREZ**	**Francis**
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DE/Lead Delegate	**MENGEL**	**Stefan**
DE	SCHWARTZ	Gregor
DE	KRUEPPEL	Roland
DE	RITTNER	Johannes
DE	SCHMIDT	Uwe
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DK/Lead Delegate	**MARQUES**	**Daniel**
DK	LANGE	Alexandra

Delegation	Name	First Name
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EC	DRÖLL	Peter
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EC	TIEDJE	Jürgen
EC	MENDEZ BLANCK CONRADY	Enrique
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EC	CECCARELLI	Marco
EC	DRBOHANOVÁ	Jana
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ES	FERNANDEZ	Estrella
ES	MARCOS MORELL	Jesus
ES	PEREDA ARECE	Alvaro
ES	IBANEZ DE ALDECOA QUITANA	Juan Miguel
ES	PELAYO CAMPILLOS	Enrique Angel

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NL	DE BOER	Jacob Jan
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PL/Lead Delegate	**MICHALOWSKI**	**Marcin**
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PT	AZEVEDO	Sofia
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EPOSS	DONAT	Albrecht
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EPOSS	LÈQUEPEYS	Jean-René
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EPOSS	ONETTI	Andrea
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INSIDE	DELSING	Jerker
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INSIDE	ECKEL	Andreas
INSIDE	HUFELD	Knut
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INSIDE	PAULWEBER	Michael
INSIDE	PYPE	Patrick
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INSIDE	STEPHAN	Guido
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IT	LIPPOLIS	Massimiliano
IT	MACII	Enrico
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LV	MICKEVICA	Sarmīte
LV	PLIKSA	PLIKSA
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NL	DE BOER	Jacob Jan
NL	RUCK	Ben
NL	VAN DER BIJL	Robert-Jaap
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Delegation	Name	First Name
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AENEAS	SEBASTIAN	Ina
AENEAS	ZANDBERGEN	Peter
EPOSS	STEIMETZ	Elisabeth
EPOSS	BURGER	Thorsten
EPOSS	OFFENBERG	Michael
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Permanent Guests		
AENEAS	GRAIGNIC	Fabrice
AENEAS	GERAETS	Maurice

5.14. FACT SHEETS OF SELECTED PROJECTS FOR CALLS 2023 NON INITITIATIVE

For Call 2023-1 IA: 5 projects were selected:

10ACe : '10 Angstrom CMOS exploration'

The objective is to explore and realize solutions for the 10Å CMOS chip technology. The consortium covers the entire value chain for manufacturing of the CMOS chips in the 10A node, that is, from chip design to lithography to process technology and finally chip metrology. Essential parts of hardware, software and processing technology are developed pushing the boundaries of semiconductor design and manufacture to enable the new node and keep Moore's law alive. The 10ÅCe project is built based on the following four pillars.

1. Lithography Equipment: ASML and expert EUV partners Zeiss, FastMicro, IOM, Plasma Matters, TNO, TU/e, University of Twente and VDL-ETG will:
   - Increase key performance indicators of the EUV tool, to enable smaller pitches and increase yield.
   - Increase sustainability of the EUV tool, both during production as well as increasing the times a module in an EUV tool can be refurbished.

2. Chip design and mask optimization: Imec with the involvement of expert imaging , CAD and IP design partners ARM, ASML and Siemens will:
   - Assess the impact of the introduction of 3D mCFET on chip design: in terms of power, performance and area.
   - Development of new computational lithography solutions to print 10Å CFET structures, to improve imaging by next generation mask design.

3. Process Technology: As the ultimate device for logic, the CFET architecture is proposed and Imec and expert partners Coventor, EVG, IBS, Intel, JSR, LAM, RECIF, TEL, Zeiss and Wooptix will:
   - Demonstrate a fully functional monolithic CFET (mCFET)
   - Increase sustainability of the chip manufacturing process, across the manufacturing process and including resist material development.

4. Process characterization: Applied Materials and expert partners Thermofisher, Nova, KLA and Bruker will:
   - Explore and realize high throughput and sample density per wafer, for the analysis, characterization for 10Å 3D CFET devices, interconnect and materials

FastLane : 'Boosting the European Value Chain for Sustainable Power Electronics '

FastLane targets a full, highly competitive and sustainable European value chain for Silicon Carbide (SiC) based power electronics. The goal is to provide a competitive technology excellence from engineered SiC substrates to novel devices, smart power modules and converters to broadened automotive and industrial applications. The next generation of SiC materials will be developed by improved quality of the crystalline starting material, material re-use and acceleration of substrate EU-based manufacturing. Based on the new materials the next generation SiC MOSFET power devices will be developed overcoming current limitations regarding efficiency, performance, robustness and sustainability and will integrate also new on-chip sensing technology. Power modules based on the devices will be further improved by several innovations, e.g. advanced sintering which will lead to improved power module reliability and therefore better sustainability. On component level, highly efficient and reliable inverters for automotive and industrial applications will be developed, including a variety of innovations in detail. In all steps, an improvement of SiC material characterization methodologies will increase the quality and the output of EU based semiconductors. Overall, performance and reliability are expected to increase greatly in all steps. These developments will lead to an overall reduction of cost and, by reduction of the footprint (lifetime increase, CO2 decrease, water consumption decrease), to a greener economy. With the envisioned goals, FastLane will decrease the environmental footprint all along the product lifecycle and con-

tribute to the European Green Deal and ensure a sustainable European sovereignty in power electronics. Cost benefits for the end user will be achieved by the reuse of the automotive economy of scale. With these steps, FastLane contributes to the European societal goals and a greener economy.

H2TRAIN : 'Enabling digital technologies for Holistic Health-lifestyle motivational and assisTed supeRvision supported by Artificial Intelligence Networks '

H2TRAIN proposal supports the major challenge for enabling digital technologies in holistic health-lifestyle supported by artificial intelligence (AI) networks. Biosensors for e-health and smart tracking of sport and fitness are a class of devices that is dominating the consumer and professional market with an unprecedented growth. Despite the impressive capabilities of recent approaches, several prospective revolutionary improvements are still open points, mainly in relationship with four factors: sensing new biosignals and tracking new activity patterns; improving battery lifetime and energy management for continuous use; and secure, reliable and efficient data analysis with AI algorithms and connectivity with the IoT.

H2TRAIN aims at advancing the state of the art in this respect, taking profit from the remarkable properties and synergistic potential of one-dimensional (1D) and two-dimensional (2D) materials (1DM and 2DM), enabling more sensitive, efficient, and miniaturized biosensing capabilities within the established CMOS technology framework. This will contribute to the growth of e-health services assisted by AI and will fortify the development of Internet of Things (IoT) applications in health & wellbeing and digital society. H2TRAIN not only facilitates digital technology but also involves the development of new 1DM and 2DM-based devices for sensing, energy harvesting and supercapacitor storage. These innovations serve to integrate sport and health activities into IoT applications, making them accessible as wearable technology. H2TRAIN combines mature CMOS technology products for health and sport sensing with embedded intelligence as a cross-sectional technology. This combination offers a broad spectrum of technology demonstrators (TD) based on advanced sensors, such as tattoo sweat, C-reactive protein, cortisol and lactate.

SOIL : 'Solidify the European FDSOI Ecosystem Accelerating its Industrial Deployment '

The European FDSOI family of technology platforms is recognized for its low power consumption, versatility, high radiation hardness, embedded non-volatile memories and exceptional radio frequency capabilities. The objective of the SOIL project is to extend FDSOI technology platforms and broaden their use within the European industry in order to provide Europe with a real alternative to semiconductor supply autonomy using FDSOI semiconductors. The SOIL project will give Europe the opportunity to move forward with industrial and academic players spanning the value chain by joining in the risk-taking necessary for the growth dynamics of semiconductors for Automotive, Space, IOT and Edge AI domain in Europe. The SOIL project will accelerate the implementation of semiconductor manufacturing based on FDSOI technology, building, and securing the European semiconductor value chain from material to system, supporting the twin green and digital transition. SOIL will expand the family of European FDSOI technology platforms by developing production and innovation capabilities in the following key areas:

1. Advanced features: prepare next generation of FDSOI technologies and components;
2. Semiconductor Intellectual Property (SIP) core: reinforce the FDSOI design ecosystem and the supply chain around FDSOI manufacturing;
3. Digital, analog & RF single-chip integration capabilities (Microcontroller Unit; RF communication; RF sensor, e.g. radar).

The project will shape the future by developing new technology approaches as well as numerous IPs on advanced applications and will promote the capability

and benefits of the technology by providing advanced demonstrations on key applications and comparing the technology.

UNLOOC : 'Unlocking data content of Organ-On-Chips'

The launch of a novel drug to the market is preceded by clinical testing and validation both on animal in vitro and in vivo models. Animal models used in drug development have known methodological drawbacks leading to the failure of drugs. Further, animal tests are associated with ethical issues. Moreover, a strong bias in in-human testing still overlooks major population groups e.g. children, women, different ethical groups. It is estimated that 197,000 deaths per year in the EU are caused by Adverse Drug Reactions (ADRs) and the total cost to society of ADRs is €79 billion. The emerging Organ-on-Chip (OOC) field, an alternative to animal test, brings great potential for safe testing and validation: An OOC-systems consists of a 3D-microstructured channel network embedded on a small plastic device that simulates the mechanics and physiological response of an entire organ or organs. UNLOOC will develop, optimize, and validate a multitude of ECS-based tools to build OOC-models to replace animal and in-human testing. UNLOOC aims to combine three important characteristics for routine use of OOC models, i.e platforms that combine ECS-based technologies with established biological material, capitalize on AI, parallelized test set-ups allowing efficient high-throughput demands, and standardized procedures enabling reliable results. UNLOOC will develop ECS-based hardware and software tools and validate them in five Use Cases (UCs) performed in 10 European countries. The applications developed and validated will be used by academia and pharma industry to drive drug development, create cosmetics without animal test, personalized medicine and gain new insights into disease. Given the large OOC market, these solutions have great economic value, on average it would result in cost reduction of up to $169M and $706M per new drug reaching the market and will put Europe at the forefront of this booming research field .

For Call 2023-1 Topic 4 IA: "Focus topic on Electronic Control Systems (ECS) for management & control of decentralized energy supply & storage", one project was selected:

ECS4DRES : 'Electronic Components and Systems for flexible, coordinated and resilient Distributed Renewable Energy Systems '

ECS4DRES targets the ambitious objective of pursuing flexible, coordinated, and resilient distributed energy systems developing several innovation activities, specifically:

- realization of a multi-modal energy hub
- exploiting renewable energy sources
- realized by means of dedicated high-efficiency power electronics converters
- multi-modal energy storage devices
- sophisticated energy management algorithms enabling the local balances between energy production, storage, and consumption

ECS4DRES will strengthen the long-term reliability, safety, and resilience of DRES by developing advanced monitoring and control technologies including integrated sensors provided with energy harvesting functions, capable of different types of detection for safety purposes, and for monitoring of energy transfers. ECS4DRES will also achieve interoperable and low-latency communication systems, as well as algorithms, AI tools and methods, enabling the widespread interconnection, monitoring and management of a large number of DRES, subsystems, and components to realize optimal energy management between sources, loads, and storages, to improve power quality and to enable resilient system operation. Most of all, ECS4DRES commits to perform a thorough validation of all the above with a set of 5 relevant use cases and demonstrators.

By exploiting the project results, ECS-4DRES will generate a wide range of scientific, technological, economic, environmental and societal impacts of global scale, fulfilling the needs of e.g., OEMs, DSOs, grid operators, EV charging station aggregators, energy communities, end customers, academia. ECS4DRES will provide interoperable and tailored solutions

in the form of electronic control systems, sensor technology and smart systems integration for the deployment and efficient and resilient operation of DRES including integration of hydrogen equipment and components.

For Call 2023-1 Topic 3 IA: "Focus topic on Integration of trustworthy Edge AI technologies in complex heterogeneous components and systems", two projects were selected:

EdgeAI-Trust : 'Decentralized Edge Intelligence: Advancing Trust, Safety, and Sustainability in Europe'

EdgeAI-trust aims to develop a domain-independent architecture for decentralized edge AI along with HW/SW edge AI solutions and tools, which enable fully collaborative AI and learning at the edge. The edge AI technologies address key challenges faced by Europe's industrial and societal sectors such energy efficiency, system complexity and sustainability. EdgeAI-trust will enable large-scale edge AI solutions that enable interoperability, upgradeability, reliability, safety, security and societal acceptance with a focus on explainability and robustness. Toolchains will provide standardized interfaces for developing, optimizing and validating edge AI solutions in heterogeneous systems.

The generic results will be instantiated for automated vehicles, production and agriculture, thus offering innovation potential not only in the generic HW/SW technologies and tools, but also in the three target domains. These technological innovations are complemented with business strategies and community building, ensuring the widespread uptake of the innovations in Europe. EdgeAI-trust will establish sustainable impact by building open edge AI platforms and ecosystems, with a focus on standardization, supply chain integrity, environmental impact, benchmarking frameworks, and support for open-source solutions.

The consortium consists of major suppliers and OEMs encompassing a broad range of application domains, supported by leading research and academic organizations.

By embracing the opportunity to specialize in Edge AI, Europe can maintain its position in the global context, especially as it aligns with decentralized and privacy-driven European policy. Furthermore, as AI is closely connected with the Green Deal, this project can provide proper solutions for environmental issues. Ultimately, the project will enable AI to be connected with other strong sectors and industries, improving the innovation process and decision-making in Europe.

SMARTY : 'Scalable and Quantum Resilient Heterogeneous Edge Computing enabling Trustworthy AI'

SMARTY invokes a cloud-edge continuum, made from heterogeneous systems, that protects data-in-transit and data-in-process in order to offer a trustful fabric to run AI processes. The securitization occurs by employing novel accelerators for quantum resilient communications, confidential computing, software defined perimeters and swarm formation, offering multiple layers of security. Semantic programmability and graph-management open the door to drag-and-drop approaches in deploying services in a fast and reliable manner.

SMARTY is proposed within the context of different key sectors in Europe : automotive, fintech, telco and industrial settings; the technology proposed in SMARTY will be matured within the lifetime of the project and tested through five use cases.

SMARTY is supported by large European industry players and well as by 13 SMEs which will seek a visible platform to develop their products and gain visibility towards high-growth. SMARTY's major suppliers and OEMs and reputable academic partners provide a great opportunity for these 13 SMEs to mature their technologies in a challenging but safe environment. The results of SMARTY are applicable to different vertical sectors and can be transported to different use cases. Strong synergies with existing efforts in the area of

edge computing, European processors and trustworthy AI are envisioned and planned within SMARTY.

Scientific and Industrial ArCTIC-demonstrators and applications are driving our developments enabling the European industry to maintain and expand its leading edge in semiconductor components and processes and QT and strengthen sustainable manufacturing technologies

For Call 2023-2 RIA: 10 projects were selected:

ARCTIC : 'Advanced Research on Cryogenic Technologies for Innovative Computing'

The rise of quantum technology has opened the eyes of the ICT industry with respect to cryogenics. It is considered an enabler bringing in quantum functionalities and enhanced system performance and we are observing a massive growth of cryogenics from coolers to cryogenic electronics and photonics. ArCTIC is a joint effort of top European RTOs, industrial fabrication facilities, and leading application partners (23 industrial among which 14 SMEs, 7 RTO, 6 academic), sharing the vision to take a joint EU step towards the era of cryogenic classical and quantum microsystems. We aim to close the gap between qubit research and interfacing control machinery, highly needed for scaled-up quantum systems. The main goal of ArCTIC is to develop scalable cryogenic ICT microsystems and control technology for quantum processors. The technologies developed will have applications in many fields from sensing to communication, leading to important cross-fertilization that will strengthen the forming European ecosystem on cryogenic classical and quantum microsystems. ArCTIC will advance semiconductor technologies and materials, and tailor these for QT requirements and cryogenic applications. Multi-scale physics and data-driven models, cryogenic PDK modelling, device characterization, circuit design activities will support the development of cryogenic microelectronics. We will develop quantum processor platforms and broaden the applicability of microelectronic devices and circuits for cryogenic operation by developing cryo-compatible ultra-low loss substrates and thin-films, microelectronic and photonic circuits, semiconductor packaging and heterogeneous-integration techniques and benchmark the developed technologies.

ATHENA : 'Advanced Technologies for High value imagiNg Applications'

New strategic and growing markets related to connectivity, mobility, automotive, health and earth monitoring call for improved imaging solutions in visible, LWIR and VLWIR offering advanced functionalities and cost effectiveness. Visible imagers market is currently largely dominated by non-European countries. LWIR µbolometers imagers, fabricated above-IC, have not yet been democratized for high volume markets due to the difficulty to solve performance versus cost equation. However, Asian providers are making important progress to tackle this challenge.

ATHENA aims at strengthening European economy in high-tech imaging technologies:

- by taking advantage of 3D stacking technologies, improved sensor-processing integration, multimodal 2D/3D functionalities
- by preparing the manufacturing of µbolometers from 200mm to 300mm CMOS wafers for productivity gain and access to more advanced CMOS nodes for improved functionalities, developing cost effective LWIR wafer level optic solutions
- by using new methods of growing and doping materials for future VLWIR imager manufacturability.

This will foster new applications related to automated systems (in industry, border and security management), health and consumer markets, and earth & climate monitoring.

ATHENA gathers a strong European consortium composed of highly renowned Research Technological Organizations, big industrial players in imaging technologies and end-users to specify, design, develop,

test these technologies in use cases and set common specifications for the imagers to support their industrialization and widespread adoption.

In line with both the European Union's Chips Act and the Electronics, Components and Systems Strategic Research and Innovation Agenda, ATHENA will not only address the development of new sensors and chips, but also their integration in larger systems to pave the way to promising applications. ATHENA will strongly contribute to Europe leadership, industrial competitiveness and sovereignty.

Cynergy4MIE : 'Leverage synergy by cyber-physical systems for the convergence of the eco systems mobility, infrastructure and energy in the circular economy for the Society 5.0'

Cynergy4MIE is a visionary project poised to revolutionize Europe's industrial landscape by bridging the gap between foundational technology layers, cross-sectional technologies, and key application areas. The project addresses the pressing need for efficient resource utilization and synergy creation across ecosystems. By actively managing requirements from various key application areas, Cynergy4MIE aims to steer developments in foundational technology layers and cross-sectional technologies, enabling unparalleled collaboration and resource optimization. This approach promises faster time-to-market, efficient resource utilization, and enhanced technological exchange between key application areas. Cynergy4MIE's strategy aligns with the EU's agenda and emphasizes urgency, resilience, technological partnerships, and cross-domain integration to champion European competitiveness. The project's long-term impact rests on embracing urgency, fostering competitive resilience, strengthening technological partnerships, harnessing ecosystem synergies, promoting cross-domain integration, advancing AI competence, prioritizing sustainability, enhancing productivity, and ensuring user-centric digitalization while forming strategic alliances. Cynergy4MIE envisions a future where emergent cyber-physical systems serve human-centric needs, drive domain convergence, and secure Europe's position as a global technology leader.

DistriMuSe : 'DISTRIBUTED MULTI-SENSOR SYSTEMS FOR HUMAN SAFETY AND HEALTH'

We are surrounded by a variety of more-or-less intelligent technical devices, designed to serve you us or others. Applications in your mobile phones, wrist-worn health sensors on your wrists, autonomous vacuum cleaners, robots on the factory floor and increasingly autonomous cars – all pledge to ease your tasks and keep you safe and healthy. The seamless interplay with these devices gains more importance as these devices proliferate and grow in t with the increased autonomy and pervasive presence of the devices. We expect continuously available support fromin the services they provide – yet we want them to disappear unobtrusively in the background when not needed. To provide support in a collaborative environment with human, physical and digital players, the technology needs to be equipped with senses to grasp human presence, their mental and physical state, their activities and their intentions. This is required to ensure human safety, safeguard their health, and allow for natural interaction. This project intends to improve sensing of human presence, behaviour and health in a collaborative or common environment by means of multi-sensor systems.

MATISSE: 'Model-based engineering of Digital Twins for early verification and validation of Industrial Systems'

Thanks to the advances in information technology, modern industrial systems are becoming increasingly intelligent and autonomous; thus their requirements for, e.g., correctness, availability, traceability and reliability, are also increasing. Monitoring, analysis and diagnosis of such industrial systems became pivotal and fuelled the development of virtualization and simulation solutions such as digital twins. In a nutshell, digital twins are virtual representations of actual systems or processes that serve as real-time digital

counterparts for, e.g., prediction, analysis, testing, and simulation. Developing digital twins is a complex process. On the one hand, it includes developing digital twins at different levels of abstraction of the system to allow one to focus on different relevant aspects (e.g, behavioural, logical, physical). On the other hand, it must ensure the correctness of digital twins with respect to the system specifications and the respective level of abstraction, and the federation enabling the communication between digital twins conceived as exchange and resume of models.

This project aims to develop a model-based framework addressing the above-mentioned challenges by i) automating the creation of digital twins for the simulation, monitoring and testing of functional and non-functional properties ii) continuous validating digital twins to meet the required properties and iii) developing a multidomain and automated digital twin toolchain for the verification and validation of complex industrial systems based on digital twins. We foresee that this project will positively impact the efficiency of such systems by reducing their time to value and by increasing their final quality.

Move2THz: 'Sustainable Indium Phosphide (InP) platform and ecosystem upscaling, enabling future mass market (sub-)THz applications'

Electronic devices evolved significantly, fuelling the digital transformation towards a connected society. To growing need for performance, speed and efficiency pushes wireless applications to operate at sub-THz frequencies and beyond. Today's technologies, however, come short to efficiently and effectively utilize these frequencies, even taking into account technological evolutions. A disruptive yet commercially viable technology is urgently needed. Indium Phosphide (InP) has outstanding and unique capabilities to surpass other technologies in terms of high-frequency performance. Today, InP is only adopted in niche markets because of its costly and scarce substrates. Move2THz will transform the InP platform and build a fully integrated European value chain providing commercially attractive, ecology-friendly, mass-market technologies suitable for sub-THz frequency operation and beyond, enabling emerging applications like mobile/data connectivity, imaging and sensing.

To achieve this, Move2THz will radically innovate the manufacturing process by establishing a breakthrough InP-on-silicon (InPoSi) global standard. This facilitates to upscale the wafer size & volume compatible with CMOS manufacturing capacities, while minimizing the use of rare InP resources and ecological footprint. Further up the value chain, the European InP platform will be developed, matured, and adopted through substrates, manufacturing, design and foundry services, including integration, packaging and education.

Through Move2THz, the technical excellence provided by our consortium and the technologies developed in this project will significantly strengthen the competitive and sovereign position of Europe. It will secure its supply of semiconductors in a sustainable way for the next generations of wireless applications, generate a wealth of new market opportunities, and make significant contributions to a highly qualified European workforce.

PhotonMed : 'Pilot Line for Photonics-Based Medical Devices'

Photonics is a key enabling technology in the realization of modern medical devices with applications ranging from diagnostics to personalised monitoring and therapeutics. Characteristic nature of both photonics and medical applications is high diversity. Therefore, the more widespread use of photonics technologies in scattered ecosystems presents major challenges for the technological values chains comprising end-user companies and manufacturers. In conjunction with highly regulated validation and production processes, the timespan from the proof-of-concept to product launch takes years causing high costs. Relying on existing pilot line concept, PhotonMed aims at accelerated uptake of the latest photonics technologies in medical device applications. PhotonMed project is applied to continuously renew the technology offering of photonics pilot line and to

invite new members and countries to join the ecosystem. Within research-oriented PhotonMed project RTOs and industrial parties can develop their technology offering while the end-user companies get matured demonstrators based on the latest research results.

RIBL : 'Remote Innovations in Boolean Logic'

Europe's ability to stay master of its own future in most, if not all, of its industries rides on Europe's ability to maintain or create a fluidly functioning market for architecting, designing, verifying, and producing world class electronic components. Although Europe plays an important role in some key parts of the IC industry it is by no means master of its own destiny yet. RIBL sets out to strengthen Europe's market for integrated components by creating and benchmarking integrated open-source toolchains for RISC-V, multi signal processing and low-energy chips that will run on both desktop's and in the cloud. Furthermore, new developments such as iterative design flows and readiness for integration of AI in the design process will be evaluated and tested.

A key deliverable of the RIBL project is several benchmark projects of real chip design projects executed both in commercial tools and open-source tools. These KPI's will enable open-source projects to focus their efforts on missing features and integrations that are key for their user's success.

RIBL strongly subscribes and partly implements section 5 (appendix A) of this year's Strategic Research Agenda that addresses the need for open-source hardware and software in Europe. The consortium foresees that RIBL is the first of multiple projects focused on improving the productivity of Europe's chip industry, lowering the costs of envisioning, designing, validating, and producing a chip and shortening the innovation cycles of Europe's chip industry.

ShapeFuture: 'Ensuring European ECS Value Chain Sovereignty through Shaping the Future of ECS for Automotive Applications'

ShapeFuture will drive innovation in fundamental Electronic Components and Systems (ECS) that are essential for robust, powerful, fail-operational and integrated perception, cognition, AI-enabled decision making, resilient automation and computing, as well as communications, for highly automated vehicles. Its overarching vision is to bring ECS Innovation at the Heart of Europe's Mobility Transformation, thereby elevating Sovereignty by Perfecting Programmable ECS Solutions for Intelligent, Safe, Connected, and Highly Automated Vehicles. The project will result in the following main tangible outcomes:

- Safety, security and reliability of in-vehicle systems to levels appropriate for mass-market deployment.
- Availability and supply of leading-edge ECS for the European automotive supply chain and for OEMs to be at the forefront of technology developments in the 2030s.
- Increased Accuracy and Robustness of ECS for perception with smaller form factors and lower power consumption.
- ECS attributed with cognition features and improved human-Machine Interface (HMI).
- ECS with cognitive processing and decision-making capabilities.
- ECS for resilient automation and communications.
- Increased technology acceptance that will also lead to business sovereignty safeguard.

15 demonstrators and 2 impact studies will showcase the project's achievements and their capability to deliver innovations and secure future application advances in core markets for European society – Mobility, Green Deal, Digital Society, Safety and Industry. The project innovations will leverage the expertise of world-renowned industrial (5 OEMs, 24 Tier-1, Tier-2 and technology providers) and 12 research partners along the complete automotive and semiconductor value chains, providing Europe with a competitive edge in a growing market. Importantly, ShapeFu-

ture will contribute to ensuring European ECS Sovereignty by shaping the future of ECS in mobility.

VIVA : 'Vision optics with Integrated VCSELs and Autofocal Lenses'

Intelligent devices like smartphones, PCs, smart watches, cars and machines require active visual attention and manual interaction of the user for operation and control, such as by touch screens. This is not convenient for many applications and also causes user distraction, which may be not acceptable for safety critical situations that require full visual attention, e.g. driving, health applications or control of machines. Eye-tracking (ET) systems integrated into smart glasses can use parameters like gaze direction or motion of the eye and the eyelid to control the device. ET can therefore pave the way for completely new hands-free human machine interfaces (HMIs) suitable not only for critical applications but also in general for a more comfortable user interaction, e.g. for consumer devices, industrials applications or education. However, conventional camera-based ET systems suffer from high costs, complexity, high weights and dimensions as well as sensitiveness regarding ambient conditions. Therefore, ET is currently applied for some specific use cases but has yet not reached broad market acceptance.

The VIVA project will develop the technologies to enable a new class of eye-tracking systems, which will be light-weight, small, power efficient, fast, reliable and highly accurate under nearly all ambient conditions. The project will integrate and further develop novel sensors based on Laser Feedback Interferometry, small and light meta-optics as well as AI methods and hardware for signal processing and feature detection. The overall eye-tracking system will be verified and demonstrated by typical use cases. Along with these developments, the new ET technology will be analysed regarding privacy, data security, safety and CE conformity. All in all, the outcome of VIVA will leverage the market breakthrough for smart glasses with eye-tracking and will enable the EU economy to gain the technological lead for the next big thing regarding HMIs for smart devices.

For Call 2023-2 Topic 2 RIA: "Hardware abstraction layer for a European Vehicle Operating System", one project was selected:

HAL4SDV : 'Hardware Abstraction Layer for a European Software Defined Vehicle approach'

HAL4SDV aims to pioneer methods, technologies, and processes for series vehicle development beyond 2030, driven by anticipated advancements in microelectronics, communication technology, software engineering, and AI. HAL4SDV envisions a future where vehicles are fully integrated into smart cities, intelligent highways, and cyberspace, blurring the lines between inside and outside the vehicle. Assumptions include data-centricity, code portability, efficient data fusion, unlimited scalability, real-time capabilities, and robust cybersecurity. The objectives encompass unifying software interfaces, creating a hardware abstraction framework, enabling Over-The-Air (OTA) updates, designing platform architectures, ensuring hardware abstraction and virtualization, offering hardware support, automating integration, supporting safety features, harnessing edge computing, implementing security measures, and providing essential development tools. By focusing on these objectives, HAL4SDV aims to establish a unified ecosystem for software-defined vehicles, positioning Europe's automotive industry for continued leadership post-2030 while leveraging existing results and technologies to accelerate progress.

For Call 2023-3: 3 projects were selected:

Pack4EU : 'BOOSTER PACKAGING FOR EUROPE'

Pack4EU's objectives are (1) the creation of the "Pan European network on advanced semiconductor packaging", and (2) give guidance and deliver the awaited urgent results through policy recommendations, the "Advanced Semiconductor Packaging Master Plan for Europe", addressing investments, pilot lines, competence centers and further coordination actions dedicated to semiconductor packaging and the EU green deal. This will be worked on by a consortium gathering all the industry associations including the scientific ones supported by 40 associated partners all along the value chain. This group will first create a European definition of advanced semiconductor packaging

illustrated by visuals and glossary. The tasks are: build the "who's who" of advanced semiconductor packaging, involve SMEs, Start-ups and Scale-ups, RTOs; map the

entire supply chain from design, materials, equipment, fabs, and all the way to test and reliability; engage with MS, Regions and the specific agencies to consolidate the policies; study the other Chips Acts deployed in non-member countries and assess the existing European position in the global packaging world, for the most pertinent European needs and applications; aggregate the recent past similar actions at national or regional clusters level; engage with world leading OSATs and European stakeholders to reconsider

manufacturing in Europe; assess the gaps in education and skills required for human resources geared towards advanced packaging and citizen's awareness. Objectives for guidance also include the Chips-packaging diplomacy, autonomy but no isolation, partnering with competencies from all over the world, vulnerability and sovereignty issues, for a decade long vision and a resilient European industrial infrastructure, making it possible to create local economic strengths to create local jobs and to maintain and reinforce local advanced know-how and expertise in the long run while reinforcing European leadership.

FEDERATE : 'SoFtwarE DefinEd vehicle suppoRt And coordinaTion projEct'

The automotive industry faces tremendous challenges in addressing decarbonization through electrification, developing future solutions for inclusive, safe and affordable mobility. Many of these changes require a radical re-thinking of existing development processes, with the share of software in modern mobility solutions continuously increasing. The rising importance of the software layer results in the so-called software-defined vehicle (SDV). Automotive software will be developed and adapted in continuous cycles. Therefore, an abstraction from the underlying hardware needs to be implemented. As a result, the automotive industry is transitioning to an agile software development process. The dramatic increase of software and complexity, along with the advances of international competition in this domain, calls for an approach, in which non-differentiating software is developed jointly as open source. To address these challenges, the EU, together with industry, governments, and research institutions, have launched the European SDV Ecosystem. To turn this into reality, this proposal outlines the vision and activities for a Coordination and Support Action. FEDERATE (Software-Defined Vehicle Support and Coordination Project) aims to bring together all relevant stakeholders to accelerate the development of an SDV Ecosystem, to foster a vibrant European community and orchestrate the SDV R&D&I activities.

The consortium of FEDERATE is formed by major European OEMs, automotive tiers, semiconductor companies, relevant industry associations and industrial SDV initiatives, including the Eclipse SDV WG, and supported by a scientific board. FEDERATE will work towards a common understanding on the vision of the SDV program and create an orchestrated advice for current and future projects in the SDV program. In addition, recommendations for future calls

are prepared in alignment with a Roadmap and Joint Vision

Document for accelerated SDV R&D&I, created as part of the CSA.

SC4EU : 'True demand-driven semiconductor supply chains for Europe'

SC4EU, a collaborative Innovation Action aims at strengthening European digital sovereignty by mitigation of the chip shortage through reduction of bullwhip effect in the semiconductor industry and supply chains containing semiconductors. This will be reached via a "truer"-demand signal gained from an anonymous MPC (Multi-Party Computation) survey on coarse granularity which will be broken down via AI methods to fine granularities following the semantic web based digital reference structure. The bullwhip effect has led to a range of negative outcomes, including excessive inventory, inventory write-offs, decreased revenue, workforce reduction, and ultimately, significant shortages, as observed in the last COVID years, during the financial crisis in 08/09 and during the .com crisis in the Zero Years. The ambition of SC4EU consortium is to overcome these obstacles and to obtain high-quality, reliable data for semiconductor demand forecasting. In the solution proposed by SC4EU, data should be gathered via an anonymous survey based on Multi-Party Computing technology. Anonymity and security of data flow will encourage business partners to share their true demand data. Then, the gathered data will be mapped onto ontologies (semantic representations of the semiconductor industry) and processed with AI tools for demand breakdown of fine granularity.

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