CATRENE

Final Report

Addendum December 2019

EUREKA Cluster for Application and Technology Research in Europe on NanoElectronics

CATRENE

Final Report

Addendum December 2019

1 Introduction to CATRENE

Micro- and nanoelectronics is widely recognised as one of the most important key enabling technologies for innovative and, therefore, promising solutions in all kinds of high-tech applications. The EUREKA Cluster CATRENE ("Cluster for Application and Technology Research in Europe for Nanoelectronics") was launched as an instrument focusing on this key technology and its major applications. With the participation of more than 19 European countries in the programme, its main supporters are countries with a strong micro- and nanoelectronics industry. The general ambition of the CATRENE Cluster and its members was to reinforce the global competitive position of the European electronics value chain by leveraging and aligning its individual core competences and strengths in design as well as in its local industrial infrastructures while remaining viable and profitable. At the same time, the European micro- and nanoelectronics industry value chain should guarantee the controlled access to information and communications technology (ICT), applications and products for a smart, sustainable and inclusive European society.

In more detail, the ambition of the CATRENE Cluster was defined as such:

- to provide innovative and sustainable solutions to societal challenges in areas such as energy, mobility, health, communications and safety;
- to strengthen those sections of the value chain where Europe can achieve global competitiveness and gain new market shares through differentiation;
- to enable an adequate level of advanced CMOS manufacturing capability in Europe;
- to foster the advancement of European More-than-Moore production sites and European foundries in the most advanced market areas;
- to set up and support mechanisms to integrate the strengths and capabilities of small and medium-sized enterprises (SMEs) and research institutes;
- and to endorse the creation of R&D platforms for design, equipment, materials, manufacturing and silicon processes.

To achieve these targets, CATRENE aimed at the creation of flexible small and medium sized consortia (complementary to the usually larger consortia in the Joint Undertakings like ENIAC) with partners from at least two countries. The partners performed research and development activities with the guidance and monitoring of experts from the CATRENE Steering Groups and the CATRENE Support Group, who maintained regular contact with the Public Authorities of the participating countries.

CATRENE was launched in 2008 as successor of the JESSI and the MEDEA and MEDEA+ programmes. All 51 projects were completed before December 2019. Among these projects, SAM3 and THOR were co-labelled with EURIPIDES² and E450LMDAP with ENIAC.

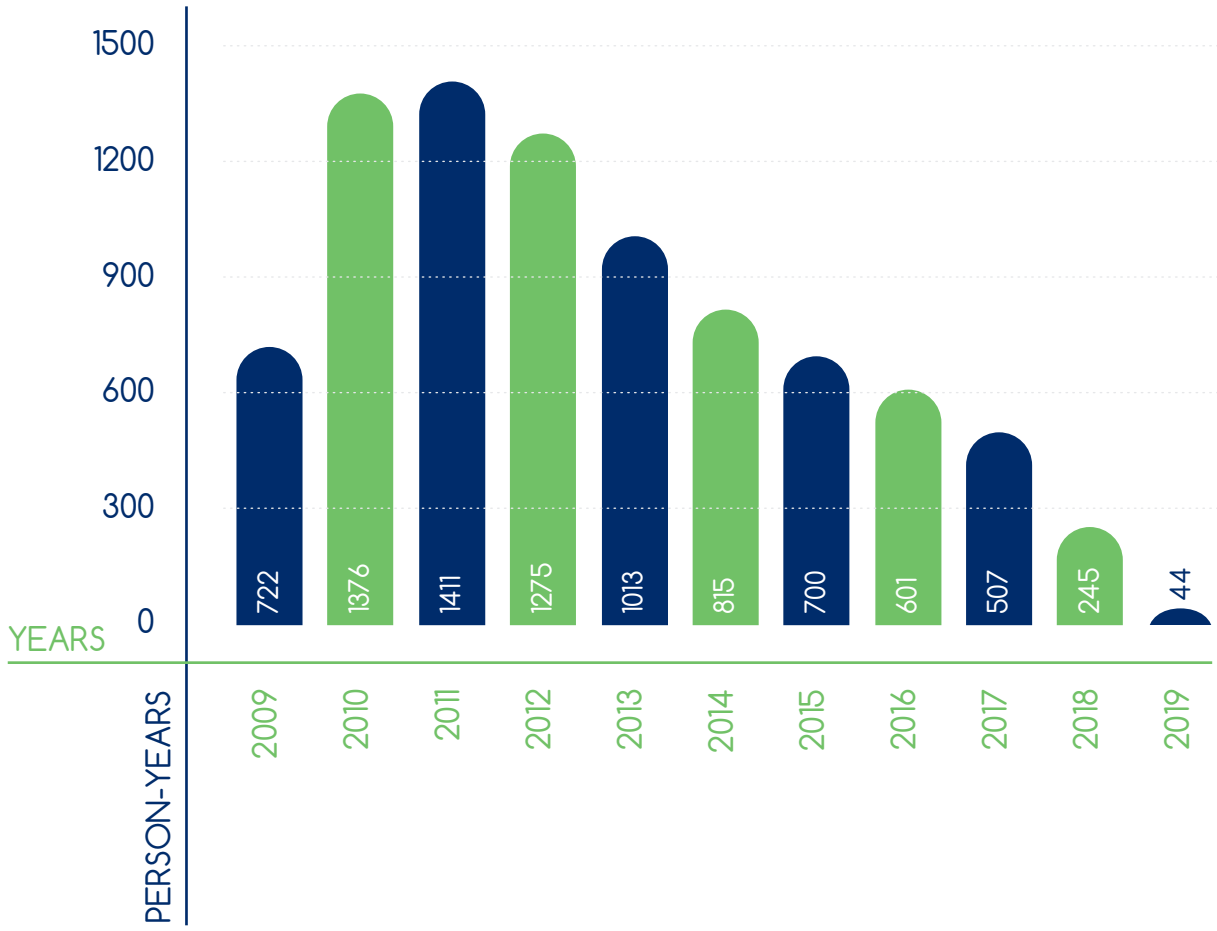
1.1. CATRENE in numbers

Resources, participants and work areas

The following figures and graphs illustrate that CATRENE was accepted and used as instrument for R&D co-operation on a European scale activating close to 9000 person years in 19 countries.

CATRENE Calls 1 to 8 labelled resources

Total PYs: 8706*

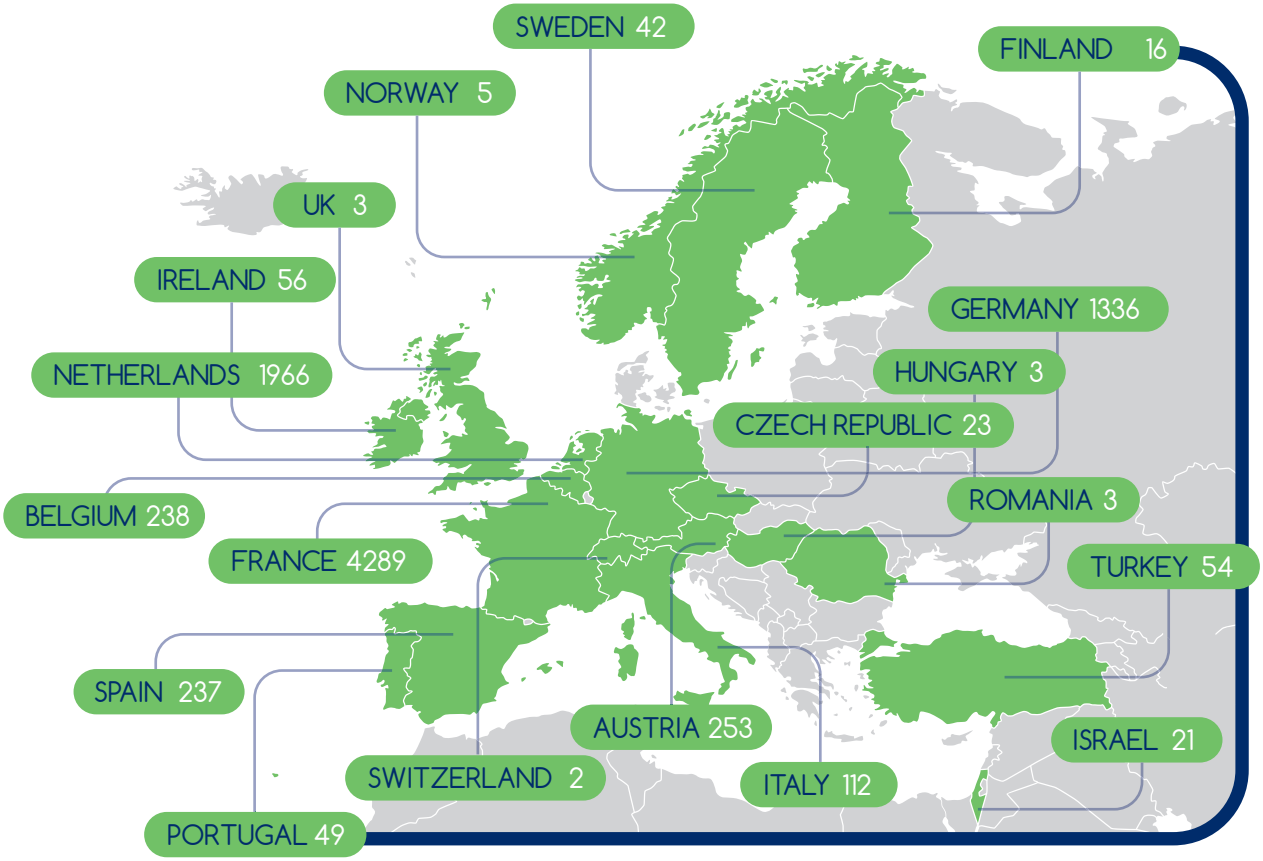


* Data approved on 31/12/2019

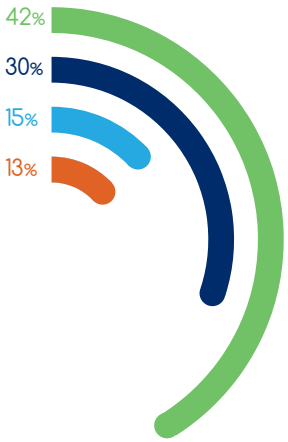
1.2. Structure of CATRENE projects

CATRENE Resources per country as per year end 2019

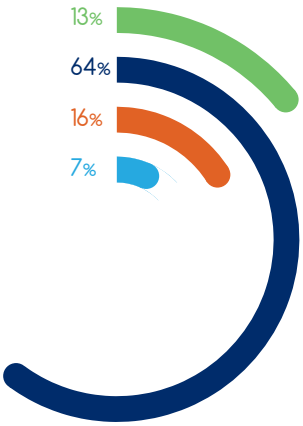
There were 51 projects, 350 participants and 19 participating countries.



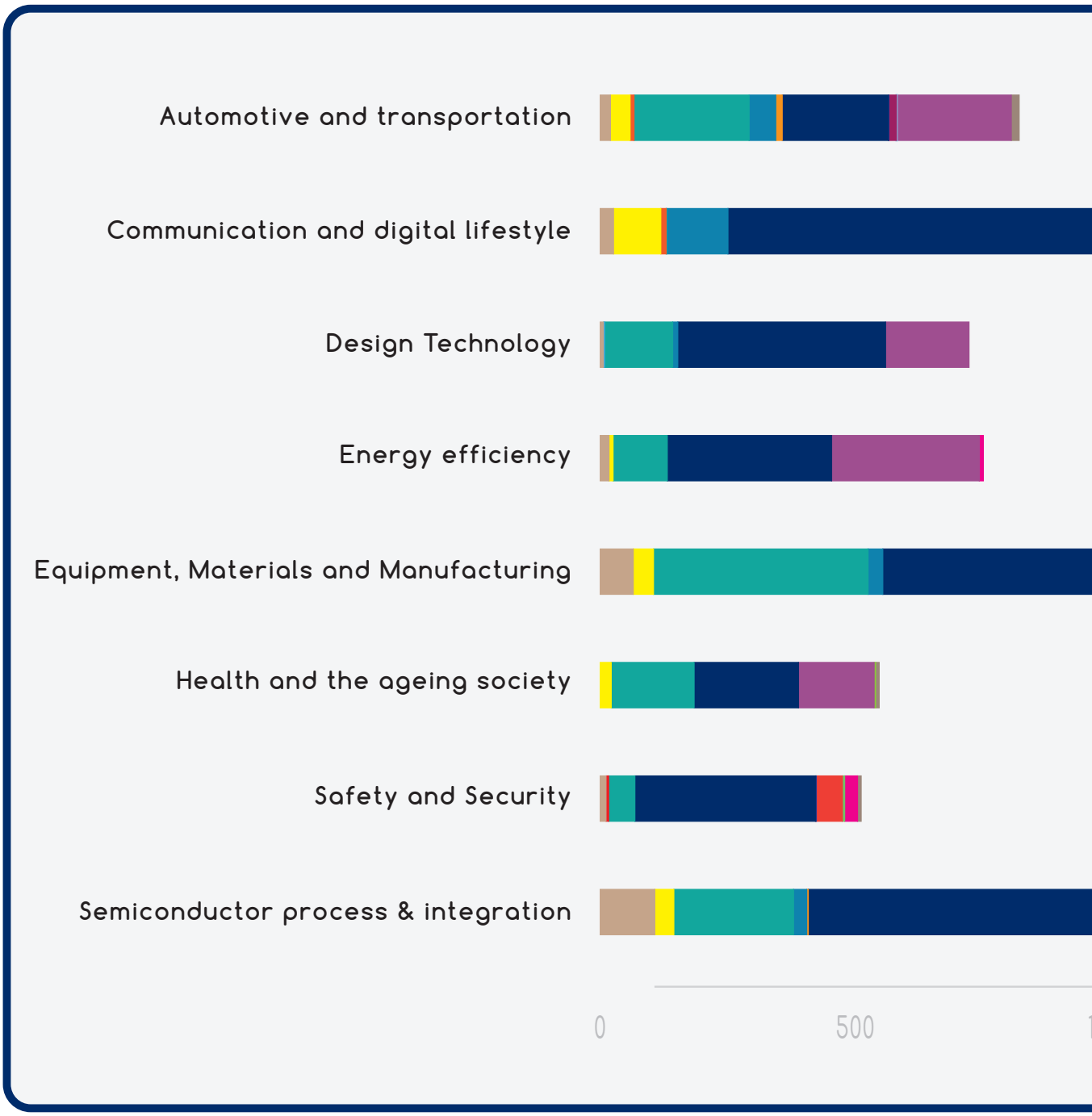
350 participants from 19 countries

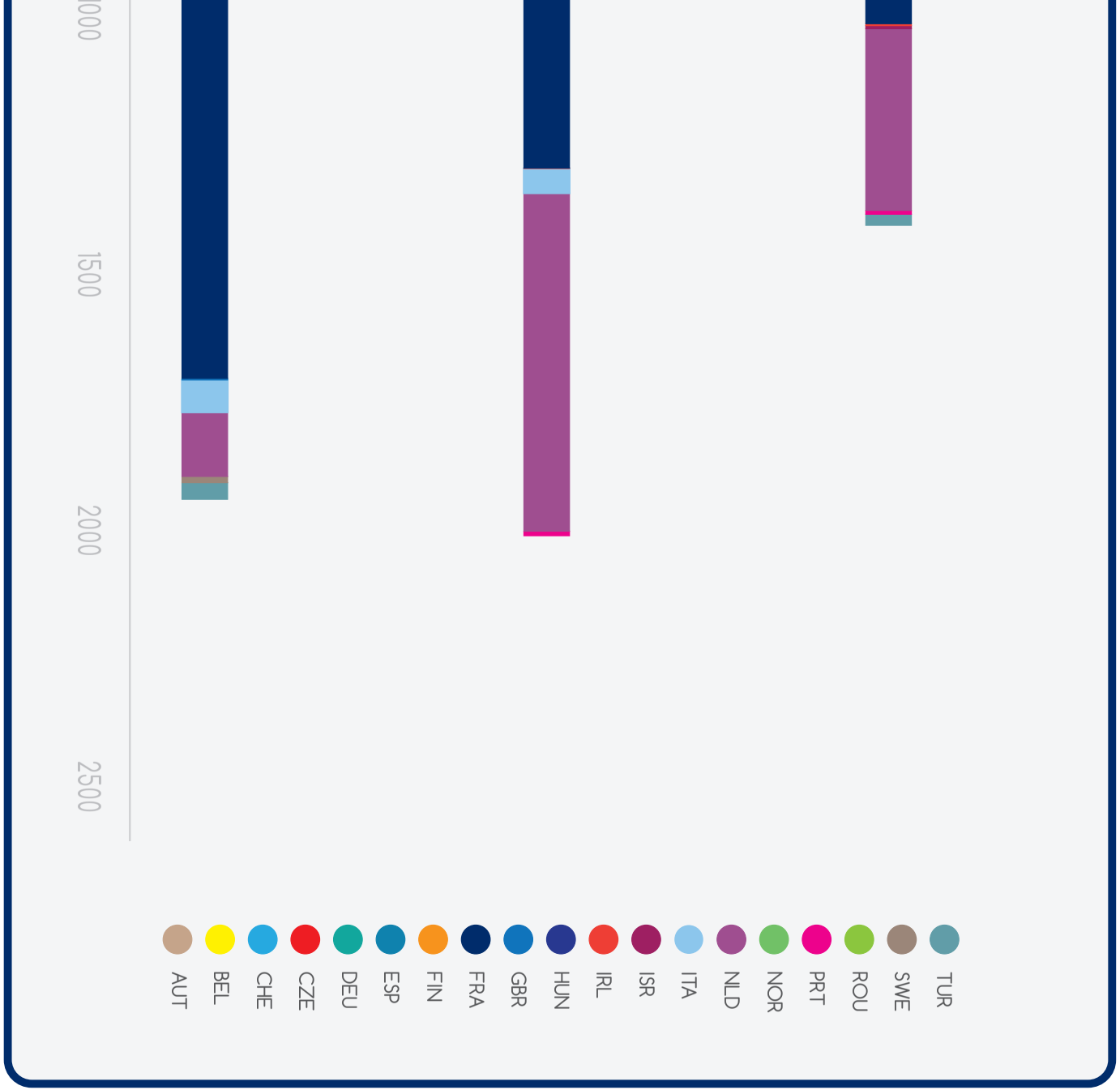


Total resources: 8706 PYs



CATRENE labelled projects – split by work area and country




1000
1500
2000
2500
AUT
BEL
CHE
CZE
DEU
ESP
FIN
FRA
GBR
HUN
IRL
ISR
ITA
NLD
NOR
PRT
ROU
SWE
TUR

2 Impact of CATRENE
(2019 update, report by DECISION[1])

The CATRENE programme aimed to support technological leadership for a competitive European ICT industry. It answered the ambition of Europe and the European companies to deliver micro and nanoelectronics solutions that respond to the future needs of society, building a comprehensive ecosystem around the semiconductor industry, and thereby confirming the ability of Europe's industry to be at the forefront of global competition.

Developing a comprehensive ecosystem around the semiconductor industry:

The CATRENE programme, after 11 years of activity, has supported 51 projects, bringing together close to 350 participants in 19 countries, of which a large share of SMEs (42%), resulting in over 320 patents filed, and over 2400 publications and/or conference presentations reflecting significant advances in both the technologies and the applications of micro and nanoelectronics. The number of patents filed was relatively large, even though many consortia were composed of competing companies. This shows how CATRENE pushed innovation power, and helped the Industry to occupy market segments, as was successfully done in sectors like Power Electronics and Security.

The direct scientific and technical results of CATRENE also impact the European economy on other levels, first on the micro and nanoelectronics ecosystem, and on the electronics industry, as well as on the economy as a whole (in terms of activity, employment, companies, competitiveness) and on the satisfaction of societal needs.

The micro and nanoelectronics ecosystem revolves around the major semiconductor companies, associating partners, materials and other suppliers or contractors, production equipment manufacturers as well as research organisations, with some large companies and a lot of SMEs. This ecosystem is also often localised in the same region as the large company headquarters. The CATRENE projects bring together a number of these ecosystem members, and greatly contribute to strengthen the links between them, and to promote collaboration between companies. This is beneficial to all participants. According to the impact assessment survey[2] of the EUREKA programme, the annual turnover of participating firms increased by 15% for Network Projects and by 13% for Cluster projects one year after the end of projects compared to non-participating companies. In addition, annual employment showed an additional growth of 4% for Network Projects and 7% for Cluster Projects.

Four projects were selected as examples in application fields critical for Europe's future to illustrate their impact at different levels. They are shown in three inserts (EXEPT in chip production technology, eGo and NewP@ss in the security application field, and EM4EM in the automotive application field).

For example, the EXEPT project brought together 19 partners, EM4EM 16, NewP@ss 15, and eGo 11. Over the whole 51 projects of the CATRENE programme, there were 350 participants of which 148 SMEs, 105 large companies, and 97 institutes and universities. This co-operation spread over three different types of R&D actors (large industry, SME, academia) brought a lot of added value due to the combination of «science », « innovation » and « market penetration ».

1 DECISION Etudes & Conseil, Espace Hamelin - 17, rue de l'Amiral Hamelin – 75116, www.decision.eu

2 Impact Assessment of EUREKA Network Projects and Cluster Projects 2017, https://www.eurekanetwork.org/content/impact-assessment-main-findings-and-recommendations

Consolidating Europe's position in micro and nanoelectronics

The strategic independence of Europe and European industry and services relies on mastering micro and nanoelectronic technologies and competences through a local and competitive semiconductor ecosystem. Over half the work done through CATRENE's projects was targeted to develop Europe's presence and competence in the micro and nanoelectronic technologies themselves. This effort has contributed to the consolidation of the European position in semiconductors, where the European companies held 9% of the world semiconductor market in 2017. Analog and Foundry are the two-product types for which Europe preserve its best positions. In terms of Analog, Europe holds 24% of the worldwide global capacity and is the third region in terms of capacity after North America (35%) and Japan (25%). The main end-user segments of analog products are indeed the professional electronic segments were Europe holds great positions.

And at the level below in the value chain, Europe increased its world leadership in lithography equipment for semiconductor production with the ASML-Zeiss partnership, with well over half the world market.

Maintaining European leadership in key applications

Micro and nanoelectronics represents around 30% of the content of electronic devices but close to 100% of their performance, and without its contribution the modern world would not exist.

In the future, even more than over the past decades, most of the progress in industry and more still in services will come from electronic innovations enabled by micro and nanoelectronics. Thus, the satisfaction of societal needs today and tomorrow relies heavily on electronics. Nearly half of the work done on CATRENE's projects was on developing applications of micro and nanoelectronics that are at the heart of the evolution of societal needs, and that are also domains where Europe is in a leading position and where growth is strong (automotive, energy, security and health, communications).

World production of electronic devices in 2018 reached 2,018 billion €, of which Europe was 14%. But if we focus on the embedded and professional systems field, Europe's share jumps at 22%, almost four times higher than our production of stand-alone and consumer electronic product (around 6%). Even better, the embedded and professional electronics is forecasted to grow at 6.9% per year on average till 2023 compared 5% for electronic equipment on the whole.

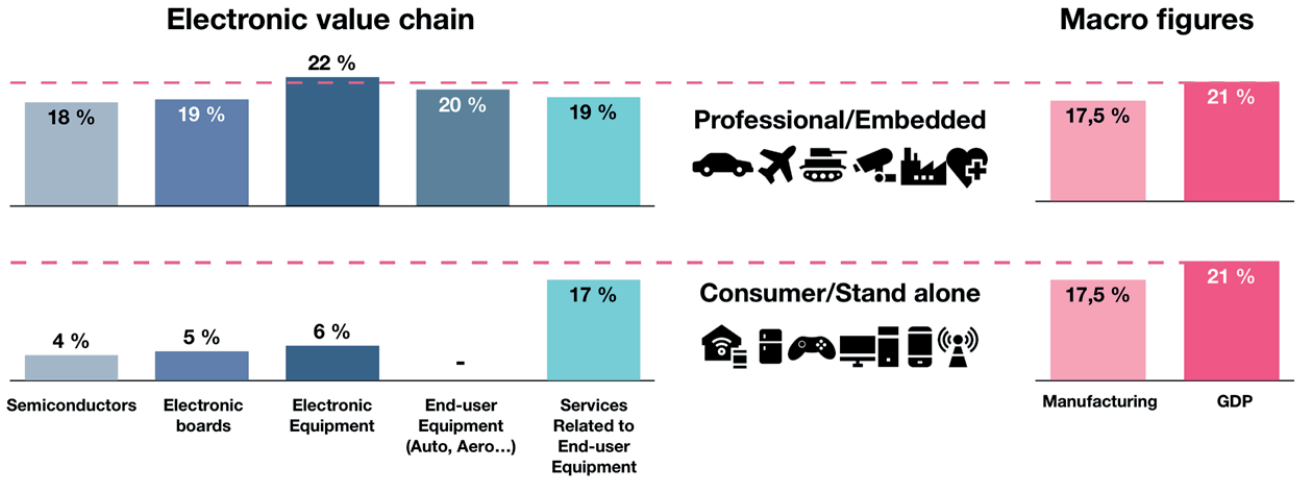
Europe is world leader in automotive electronics, not only in terms of high value-added activities (engineering, R&D, etc.), but also in terms of factory production. The EU produces 27% of the global automotive electronics. The EU is the first region in the world ahead of China (21%), and North America (17%). The EU also holds strong positions in industrial electronics, aerospace defence and security electronics, and in health electronics where Europe ranks world second for these three electronics segments ahead of China and the US.

The EU also benefits from a very great R&D ecosystem, competing with the US and the Chinese ones, and sometimes surpassing them. The main fields of excellence of the EU are often linked to the industrial strengths of the EU, which are the embedded and professional applications.

In particular, at the level of Micro and Nano components, the EU can be considered has having a scientific leadership in terms of More than Moore technologies (especially analog, power and RF), photonics (integrated photonics, photonic computing and to a lesser extent photonic interconnection networks), organic electronics and "Edge AI", that is the design of embedded chips integrating AI algorithms (to compete with cloud AI applications). Downstream the value chain, the EU is also very well positioned in terms of cryptography and blockchain, and to a lesser extent supercomputing and machine learning algorithms.

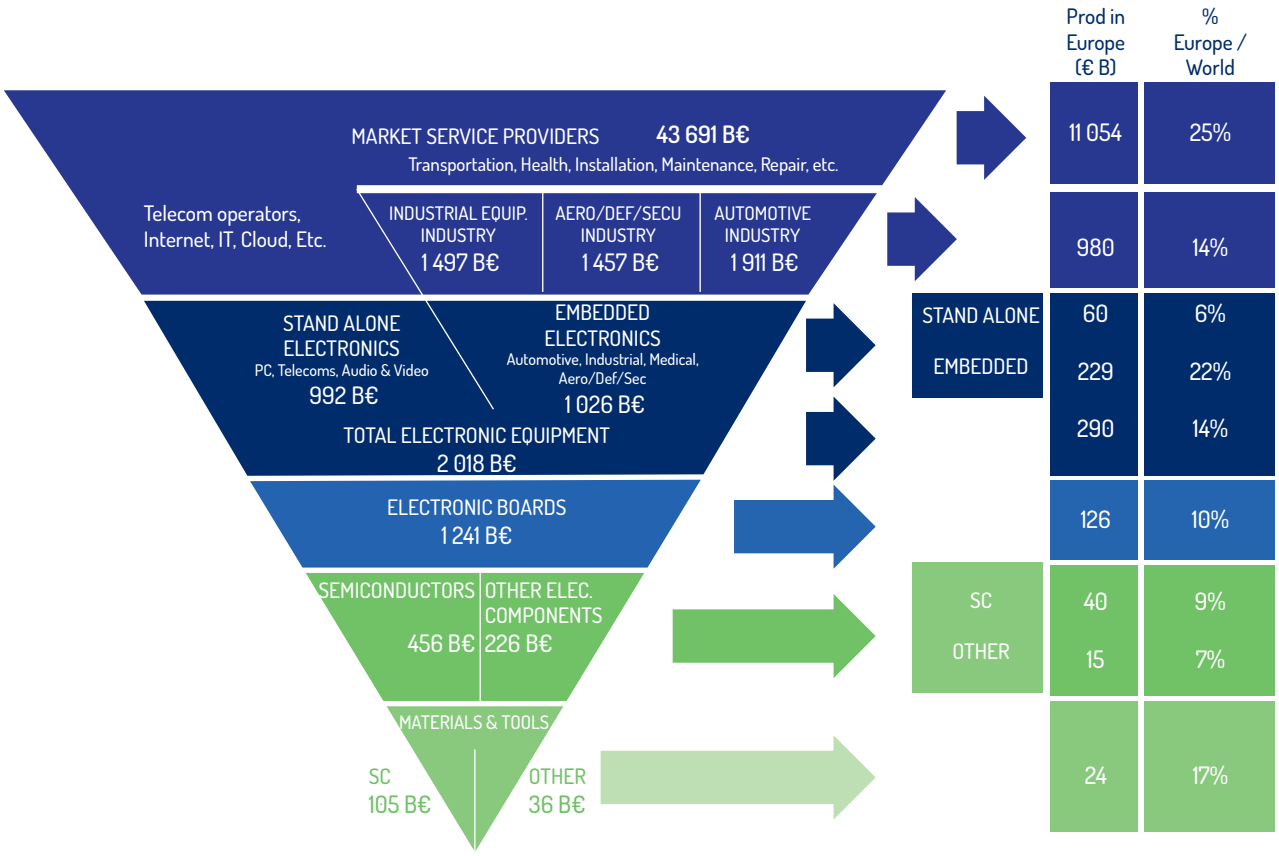
Furthermore, in terms of emerging component architectures, although the innovations currently remain at a stage of pure R&D without great potential market applications before the early 2030s, the EU holds significant assets in neuromorphic computing, photonic computing and other approaches in rebooting computing (such as approximate computing, stochastic computing, probabilistic programming and other sub-fields of research).

Share of the EU in the Electronics Value Chain in 2018



Source : DECISION Etudes & Conseil

World Electronic Value Chain in 2018



Source : DECISION Etudes & Conseil

Enabling growth, with more jobs and more sales

Impact evaluations done by Denmark, the Netherlands, Sweden and EUREKA consistently show a significant positive impact of EUREKA programmes on the turnover and employment of participants. The table gives EUREKA's evaluation[3] of the leverage effect of EUREKA projects.

Leverage of EUREKA projects for 1 million € public funds

	AT COMPLETION	ANTICIPATED AFTER 2-3 YEARS
Private investment	1.6 million €	
Additional turnover	1.9 million €	12.9 million €
Jobs created or safeguarded	10.4	28.1

These numbers neither include investment costs to realise the benefits nor all of the other benefits (cost savings, technology transfer, new competences, network, prestige, methods, customer, social and environment benefits...).

Applying these ratios, the direct impact of CATRENE on its participants would be, for the total 1,700 million € invested, 6,800 jobs created or safeguarded at completion of the projects, and 18,300 anticipated after 3 years. Additional turnover participants would be 1,242 million € at completion and an anticipated 8,434 million € after 3 years.

[3] https://www.eurekanetwork.org/sites/default/files/EUREKA_ANNUALREPORT_2014.pdf

Induced and indirect benefits on employment, turnover and growth are considerably greater, as advances in micro and nanoelectronics also bring leverage on the whole of the electronics industry, as well as on large user sectors such as the automotive industry, aerospace - defense and security, health, and industrial equipment. Naturally CATRENE's contribution is a factor among others (general and specific economic context, international competition, company strategy and decisions, etc.) that govern the actual evolution of the economy. In addition, competence and innovation power created by CATRENE projects in certain sectors like automotive, energy, security and others will boost the "normal" growth. There are many cases (for example in the security field) where CATRENE results were essential for European society to a much larger degree than their actual direct employment and turnover impact. Such benefits, however important they may be, cannot easily be rendered in figures.

Funding future growth

The CATRENE programme has enabled Europe to maintain and even develop its position in critical segments of the micro and nanoelectronics ecosystem and in the user sectors further along the value chain that are fields of excellence for EU industry and companies. This has provided reinforced ecosystems all along the value chain on which to implement the ambitious European Horizon 2020 and Eureka programmes designed to help Europe meet the challenges of our changing and increasingly digital society.

And so, beyond the direct impact of the programme on its participants, CATRENE has indeed contributed to the overall leverage effect of micro and nanoelectronics R&D and innovation on direct and induced turnover and employment all along the value chain. In this highly global field turnover and employment are generated worldwide, but when European companies consolidate their global position this also brings direct and induced benefits to Europe.

3 Project Information

The CATRENE programme opened its 1st Call for Project Proposals on 29 February 2008. A total of 8 calls have been launched resulting in 51 labeled and successfully completed projects.

CALL	PO received	FP received	Labelled	STATUS OF LABELLED PROJECTS: Cancelled /merged / transferred /suspended	STATUS OF LABELLED PROJECTS: Successfully ended
1ST CALL	18	15	14	5	9
Applications	10	8	8	3	5
Technologies	8	7	6	2	4
2ND CALL	14	10	10	3	7
Applications	9	7	7	3	4
Technologies	5	3	3	0	3
3RD CALL	15	10	10	3	7
Applications	7	4	4	2	2
Technologies	8	6	6	1	5
4TH CALL	19	14	10	1	9
Applications	10	8	7	1	6
Technologies	9	6	3	0	3
5TH CALL	8	5	5	1	4
Applications	5	3	3	0	3
Technologies	3	2	2	1	1
6TH CALL	13	10	9	3	6
Applications	9	7	6	2	4
Technologies	4	3	3	1	2
7TH CALL	9	9	8	1	7
Applications	5	5	4	1	4
Technologies	4	4	4	0	3
8TH CALL	9	4	3	1	2
Applications	4	3	3	1	2
Technologies	5	1	0	0	0
	105	77	69	18	51

Detailed information about successfully ended projects is available in a separate brochure, which contains all finalised project result sheets.

3.1. List of successfully ended CATRENE projects (51)

Call 1

CA101 | PANAMA
CA103 | HERTZ
CA301 | HiDRaLoN
CA303 | OPTIMISE
CA501 | COMCAS
CT105 | 3DIM3
CT204 | PASTEUR
CT301 | EXEPT
CT302 | TOETS

Call 2

CA104 | COBRA
CA202 | eGo
CA402 | THOR
CA502 | SEEL
CT205 | REFINED
CT206 | UTTERMOST
CT207 | COCOA

Call 3

CA308 | ICAF
CA403 | RELY
CT208 | REACHING22
CT209 | RF2THZ SISOC
CT305 | SOI 450
CT306 | NGC450
CT402 | 9D-Sense

Call 4

CA109 | SHARP
CA110 | AppsGate
CA111 | UltraHD-4U
CA206 | NewP@ss
CA310 | EM4EM
CA701 | H-INCEPTION
CT210 | DYNAMIC-ULP
CT213 | 3DFF
CT312 | MASTER_3D

Call 5

CA112 | HARP
CA505 | BENEFIC
CA703 | OpenES
CT315 | EmPower

Call 6

CA114 | WiCon
CA116 | CORTIF
CA118 | FITNESS
CA208 | MobiTrust
CT217 | RESIST
CT218 | E450LMDAP

Call 7

CAT120 | CISTERN
CAT121 | EAST
CAT209 | H2O
CAT406 | NEMADE
CAT601 | SiPoB-3D
CAT801 | TSV-HANDY
CAT802 | SAM3

Call 8

CAT408 | NexGen
CAT311 | Trace

3.2. Completed projects achievements

Call			PYs	Partners	Patents
1 Communication and digital lifestyle	CA101	Power Amplifiers and Antennas for Mobile Applications [PANAMA]	196,7	21	18

Dissemination

cumulated total of publications is 157
3 awards have been obtained:
- Best PhD student in microelectronics in The Netherlands for TUD,
- DOW energy dissertation prize for TUD/ NXP,
- Innovation prize during IEEE conference on Antenna for ITB

Call			PYs	Partners	Patents
1 Communication and digital lifestyle	CA103	Energy Efficient Home Networks [HERTZ]	112,2	9	8

Dissemination

7 publications
Contributions to workshops, exhibitions, conferences: 27

Contribution to standardization

DECT ULE
- Leading new standard
- Opening sensor market for DECT RF4CE
- New command set for CL devices Zigbee
- Smartlink, easy commissioning
- Green power, harvesting sensors

Call			PYs	Partners	Patents
1 Semiconductor process integration	CA301	High Dynamic Range Low Noise CMOS imagers [HiDRaLON]	224,2	18	6

Dissemination

22 presented conference papers, one journal article

Contribution to standardization

Contribution to EMVA1288 standardization for High Dynamic Range sensors and Time of Flight

Call			PYs	Partners	Patents
1 Design Technology	CA303	Optimisation of Mitigations for soft, firm and hard Errors [OPTIMISE]	155,2	20	1

Dissemination

Over 20 conference and journal papers during the last 12 months of the project

Contribution to standardization

- Avionic: inputs to IEC working group
- Space: new standard defined (RIIF), and used to develop a standardized modelling of aging related effects (xBTI, HCI), and aging failures (TDDB and EM).

Call			PYs	Partners	Patents
1 Design Technology	CA501	Communication-centric heterogeneous Multi Core Architectures [COMCAS] **Dissemination** 6 papers at journal and conferences, demonstration at the 2012 Consumer Electronics Show (CES)	273,7	13	5
1 Design Technology	CT105	3D-TSV Integration for Multimedia and Mobile applications [3DIM3] **Dissemination** 101 papers in International Conferences, 2 books **Contribution to standardization** Contribution to the path finding group of 3D Standardization group of SI2	257,6	15	Undisclosed number due to specific context
1 Semiconductor process & integration	CT204	Perishables Monitoring through Smart Tracking of Lifetime and Quality by RFID [PASTEUR] **Dissemination** 13 Journal articles and conference proceedings	143,4	17	0
1 Equipment, Materials and Manufacturing	CT301	EXtreme UV lithography Technology development [EXEPT] **Dissemination** 42 Journal articles and conference proceedings	1043,4	17	53
1 Equipment, Materials and Manufacturing	CT302	Breakthrough in methods and flows used by the test technologies by considering test in the whole value chain from Design to Application [TOETS] **Dissemination** 77 journal articles and conference proceedings **Contribution to standardization** Contributions to IEEE 1149.1-2011 working group and ISO26262 standard (work on the dependability attribute “safety”)	285,1	25	4

Call			PYs	Partners	Patents
2 Design Technology	CA104	Computing Fabric for high performance Applications [COBRA] **Dissemination** 115 contributions to international conferences and publications	237,5	17	13
2 Safety and Security	CA202	Establishing secure, bidirectional wireless channels between objects or individuals in the future internet of thinks [eGo] **Dissemination** 2 scientific publications, demonstration of project results in several industrial exhibitions **Contribution to standardization** Contributions to ETSI and Global Platform standardisation bodies	114,6	11	20
2 Health and the ageing society	CA402	Development of highly efficient, integrated and reliable power electronics technologies for automotive, aeronautics and healthcare applications [THOR] **Dissemination** 90 publications and news articles	233,8	18	10
2 Energy efficiency	CA502	Solutions for Energy Efficient Lighting [SEEL] **Dissemination** Over 50 publications **Contribution to standardization** Contributions to ELMAPS and GTB Working group on light sources	231	23	3
2 Semiconductor process & integration	CT205	Renewed Embedded Flash and other Innovative NVM for Extended Domains of application [REFINED] **Dissemination** 20 publications	187	6	0

Call			PYs	Partners	Patents
2 Semiconductor process & integration	CT206	UlTimaTe Enablement Research on 32/28nm cMOS Technologies [UTTERMOST]	523,7	16	11

Dissemination

168 publications or conference papers, 1 PhD thesis

Call			PYs	Partners	Patents
2 Semiconductor process & integration	CT207	Development of a complete 3D integration technology platform covering the entire range of processes required from vertical interconnects (TSV, micro bumps...) and robust bonding to innovative packaging approaches [COCOA]	167,4	12	12

Dissemination

About 70 papers or presentations

Contribution to standardization

Participation to IEEE 1838 Working Group on 3D Design for Test

Call			PYs	Partners	Patents
3 Automotive and transportation	CA308	Research, development, and demonstration of future image capture, processing and transmission technologies for Machine Vision, Security/Surveillance and Professional Broadcast. [ICAF]	117,1	9	2

Dissemination

9 scientific papers

Contribution to standardization

Contribution to 7 standards

Call			PYs	Partners	Patents
3 Health and the ageing society	CA403	Design for Reliability of SoCs for Applications like Transportation, Medical, and Industrial Automation [RELY]	159,2	14	4

Dissemination

14 journal articles, 2 books, over 100 conference talks

Contribution to standardization

Contribution to RIIF (Reliability Information Interchange Format)

Call			PYs	Partners	Patents
3 Semiconductor process & integration	CT208	Research on optimal Architecture and InteGration of 22/20nm node core digital CMOS technology [REACHING 22]	222	7	0

Dissemination

More than 20 publications

Contribution to standardization

Contribution to the development of FDSOI as a promising technology providing excellent trade-off between performances (speed, power) and cost, well suited for applications under power constraints (e.g., Internet of Things).

Call			PYs	Partners	Patents
3 Semiconductor process & integration	CT209	Establishment of silicon technology platforms for emerging Radio Frequency (RF), Millimeter-Wave (MMW) and TeraHertz (THz) consumer applications [RF2THZ SISOC]	234,5	32	6

Dissemination

240 contributions to international conferences and publications, 3 PhD thesis

Contribution to standardization

Industry standard HiCUM/L2 HBT compact model : RF2THz hardware from ST and feedback from circuit design have allowed TUDD to validate the model for advanced SiGe HBT technology and to identify relevant improvements

3 Equipment, Materials and Manufacturing	CT305	Development of 450 mm SOI substrates, related technologies and equipments [SOI450]	74,1	8	2

Dissemination

Invited paper at 2012 SOI CONFERENCE IEEE / Napa Valley

3 Equipment, Materials and Manufacturing	CT306	Development of a wafer handling platform supporting 450mm transition for European Semiconductor Industry [NGC450]	39	8	0

Dissemination

Over 10 project posters and presentations in various fora

3 Semiconductor process & integration	CT402	Autonomous Nine Degrees of Freedom Sensor Module [9D-Sense]	111	10	2

Dissemination

33 journal articles and conference proceedings

4 Design Technology	CA109	Design and development of scalable and heterogeneous highperformance computing architectures mixing general purpose multi-cores processors with more dedicated acceleration processors [SHARP]	64,1	5	3

Dissemination

18 technical papers, 3 PhD thesis

Contribution to standardization

Contributions to standards PCIe (SW/HW co-validation), MPA and PGAS (HPC/server software), SystemC (system-level verification), and Linux (many-core OS)

Call			PYs	Partners	Patents
4 Communication and digital lifestyle	CA110	Demonstration of an advanced Set Top Box that supports entertainment, home automation, energy management and healthcare applications, on top of its usual functions [APPSGATE]	178,1	14	0

Dissemination

Over 10 papers

Contribution to standardization

As participant of the W3C Model-Based User Interface Working Group, UJF/LIG has contributed to the standardization of languages for describing user Interfaces at multiple levels of abstraction from task modeling to concrete user interfaces.

4 Communication and digital lifestyle	CA111	End to end 4K Ultra High Definition TV for Europe [UltraHD-4U]	143,3	15	2

Dissemination

One book, presentations at major worldwide exhibitions or conferences from the domain (IBC, CES, NAB, MWC)

Contribution to standardization

Contributions to MPEG, VQEG and IEEE P3333

4 Safety and Security	CA206	Crucial improvements in security, functionality and speed for next generation e-passport platforms [NewP@ss]	169,7	15	2

Dissemination

13 presented conference papers, 1 journal article

Contribution to standardization

The project allowed contributions to the following international standardization bodies : ISO JTC1 SC17, SC27, and ISO/IEC 7816; ICAO NTWG and ICBWG; GlobalPlatform Government Task Force, Card, and Device committees; European Commission DG Home art6; CEN/TC 224; ETSI SCP; NFC Forum; Java Card Forum; ISCI and JHAS

4 Automotive and transportation	CA310	Electromagnetic Reliability of Electronic Systems for Electro Mobility [EM4EM]	90,9	16	6

Dissemination

Over 57 papers

Contribution to standardization

Transfer of several EM4EM results to standardization bodies, including the decoupling measurement method for electrical machines in GAKAK767.13/.14/.18.

Call			PYs	Partners	Patents
4 Design Technology	CA701	Unified design methodology and tools to address the system-level design and verification needs for multi-domain microelectronics assisted systems [H-INCEPTION]	92	15	0

Dissemination

8 participations at events, 29 publications and 9 trainings

Contribution to standardization

Participation in 4 working groups in the Accellera and IEEE committees, with key contributions in SystemC MDVP (Multi-Domain Virtual Prototyping) and IP-XACT MDVP

4 Semiconductor process & integration	CT210	High dynamic range multiprocessor for Ultra Low Power mobile devices [DYNAMIC-ULP]	292,4	11	5

Dissemination

35 journal articles and conference proceedings

4 Semiconductor process & integration	CT213	3D Flex Fluidics [3DFF]	55,9	8	3

Dissemination

2 technical papers, participation to various workshops and fora

4 Equipment, Materials and Manufacturing	CT312	Manufacturing Solutions Targeting competitive European Production in 3D [MASTER 3D]	170,5	17	6

Dissemination

more than 30 papers and about 44 presentations including posters at main conferences

5 Design Technology	CA112	Heterogeneous Architectures for Parallel Computing [HARP]	101,8	6	3

Dissemination

23 publications, 6 PhD theses

Call			PYs	Partners	Patents
5 Energy efficiency	CA505	Best Energy Efficiency solutions for heterogeneous multi-core Communicating systems [BENEFIC]	191,2	16	7
		Dissemination 45 scientific publications, posters			
5 Design Technology	CA703	Open Embedded System Level Technologies for Next Generation Embedded Systems [OpenES]	145,1	12	0
		Dissemination 12 publications, 3 PhD thesis, participation to over 25 conferences, several university lectures based on the project findings			
		Contribution to standardization Contributions to OMG and to IEEE 1801 SLP			
5 Energy efficiency	CT315	Embedded power components for electric vehicle applications [EmPower]	55	7	0
		Dissemination 7 publications, 30 presentations at international conferences			
6 Communication and digital lifestyle	CA116	Coexistence Of RF Transmissions In the Future [CORTIF]	127,2	14	9
		Dissemination 11 journal papers, 29 conferences			
		Contribution to standardization Contribution to several standardization bodies such as ETSI, 3GPP for LTE, AllSeen Alliance, ZigBee Alliance and Bluetooth Special Interest Group			
6 Design Technology	CT217	Resilient Integrated Systems [RESIST]	144,9	20	13
		Dissemination 130 contributions to scientific journals, international conferences, and conferences, including 84 papers, 5 Best Paper Awards, 2 Outstanding Paper Awards. 13 PhD students, 11 Master students			
		Contribution to standardization 4 contributions to standardisation groups (CMC, AEC & JDEC, ISO, IIRW)			
6 Semiconductor process & integration	CA114	Non-Galvanic Contactless Connectors for Power and Data Transfer [WiCon]	45,8	5	0
		Dissemination 2 Master Thesis, 7 Papers			

Call			PYs	Partners	Patents
6 Safety and Security	CA208	Trusted Mobile Platforms [MobiTrust]	88,2	11	1

Dissemination

10 journal papers or conferences, 2 book chapters, 5 PhD thesis, one MSc thesis

Contribution to standardization

Contributions to standardization bodies CEN-CENELEC, W3C, GLOBALPLATFORM, FIDO, GSM-A, NFC Forum and ETSI Electronic Signature and Infrastructures (ESI)

6 Design Technology	CA118	Full Integrated Transceiver for Next generation Emergency ServiceS [FITNESS]	65,9	8	3

Dissemination

3 PhD thesis, 17 publications or conferences

Contribution to standardization

Contributions to standardization bodies 3GPP and ETSI

6 Equipment, Materials and Manufacturing	CT218	European 450mm Lithography and Metrology Development for Advanced Patterning [E450 LMDAP]	245.6/ 2746.4*	40	50

Dissemination

84 conference presentations, 10 journal presentations, one Master thesis

* A CATRENE / ENIAC co-label

7 Communication and digital lifestyle	CAT121	smart Everything everywhere Access to content through Small cells Technologies [EAST]	62,4	8	4

Dissemination

6 publications, 13 conference presentations

7 Equipment, Materials and Manufacturing	CAT801	TSV - Hvm AND Yield optimization focused [TSV-HANDY]	42,8	8	0

Dissemination

3 publications, 3 presentations at technical conferences

7 Safety and Security	CAT209	Human to Objects [H2O]	138,4	15	8

Dissemination

6 academic articles, participation to several conferences and trade shows, one PhD thesis

Contribution to standardization

Contributions to Global Platform, ETSI and GSMA

Call		PYs	Partners	Patents
7 CAT406 Health and the ageing society	New Mammography Detector [NEMADE] **Dissemination** 10 publications or conference presentations	14,6	3	6
7 CAT802 Equipment, Materials and Manufacturing	Smart Analysis Methods for advanced Microsystems and Materials [SAM3] **Dissemination** Contributions during CAM2017, ESREF, ISTFA and IMAPS. Publications at Materials Sciences and Applications.	108,6	19	2
7 CAT601 Design Technology	Co-Design for System-in-Package-on-Board: A Must to Create Novel 3D Compact Systems [SiPoB-3D] **Dissemination** More than 30 publications and presentations	82,9	11	0
7 CAT120 Semiconductor process & integration	Cmos Image Sensor TEchnologies' Readiness for Next generation of applications [CISTERN] **Dissemination** New product presentations at various fair trades **Contribution to standardization** Contributions to JIIA, EMVA and SMPTE	68,5	5	6
8 CAT408 Health and the ageing society	Next Generation of Body Monitoring [NexGen] **Dissemination** Over 20 presentations at international conferences, 6 journal papers, 4 master thesis, 3 doctoral thesis **Contribution to standardization** Contributions to DIN, DKE and IEC	139	16	3
8 CAT311 Automotive and transportation	Enabling Smart Mobility and Smart Infrastructure by Development of a Technology Readiness Process for Consumer Electronics [TRACE] **Dissemination** About 160 papers and publications, 95 presentations / PhD, master and bachelor thesis (about 50 thesis **Contribution to standardization** Support of GIINA / PASRASC (Platform for Automotive Semiconductor Requirements along the Supply Chain)	232,2	37	1

www.catrene.org