CATRENE

Final Report

Addendum December 2019





EUREKA Cluster for Application and Technology Research in Europe on NanoElectronics

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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.

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*



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.





CATRENE labelled projects – split by work area and country





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 survey² 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 ».

DECISION Etudes & Conseil, Espace Hamelin - 17, rue de l'Amiral Hamelin – 75116, www.decision.eu Impact Assessment of EUREKA Network Projects and Cluster Projects 2017, https://www.eurekanetwork.org/content/impactassessment-main-findings-and-recommendations

2

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 \leq , 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





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 evaluation³ 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.

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

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.

				STATUS OF LABELI	ED PROJECTS
CALL	PO received	FP received	Labelled	Cancelled /merged / transferred /suspended	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			3	4
Technologies	5	3	3	0	3
	15	10	10	•	
3RD CALL	15	10	10	3	
Applications	/	4	4	2	2
Technologies	8	6	6	1	5
4TH CALL	19	14	10	1	9
Applications	10	8		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
	13	10	0	3	
Applications	0	7	6	2	0 4
Technologies	, Л	2 2	् २	2	+ 2
recimologies	_			I	Z
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		0	0	0
Ŭ	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)



3.2. Completed projects achievements

Call		PY	s Partner	s Patents	
Communication and digital lifestyle	 Power Amplifiers and Antennas for M Applications [PANAMA] 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 	obile 196	,7 21	18	
1 CA103	Energy Efficient Home Networks [HERTZ]	112,	2 9	8	
Communication and digital lifestyle	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			
CA301	High Dynamic Range Low Noise CMOS imagers [HiDRaLON]	224	, 2 18	6	
Semiconduct proce integratio	Dissemination 22 presented conference papers, one journal article	Contribution to standardization Contribution to EMVA1288 standardization for High Dynamic Range sensors and Time of Flight			
CA303	Optimisation of Mitigations for soft, firm and hard Errors [OPTIMISE]	155	,2 20	1	
Design Technolo	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
Design Technology	Communication-centric heterogeneous Multi Core Architectures [COMCAS] Dissemination 6 papers at journal and conferences, demonstration at the 2012 Consumer Electronics Show (CES)	us	273,7	13	5
	3D-TSV Integration for Multimedia an Mobile applications [3DIM3]	id	257,6	15	Undisclosed number due to specific context
De Techno	Dissemination 101 papers in International Conferences, 2 books	Contribu Contribu Standard	bution to tion to the dization gro	path finding path finding pup of SI2	lization group of 3D
Semiconductor process & integration	Perishables Monitoring through Smar Tracking of Lifetime and Quality by RF [PASTEUR] Dissemination 13 Journal articles and conference proceedings	rt FID	143,4	17	0
Equipment, Materials and Manufacturing	EXtreme UV lithography Technology development [EXEPT] Dissemination 42 Journal articles and conference proceedings		1043,4	17	53
Equipment, Materials and Manufacturing	Breakthrough in methods and flows u by the test technologies by considerin test in the whole value chain from De- to Application [TOETS]	ısed ng sign	285,1	25	4
	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")			

Call			PYs	Partners	Patents
2 CA104 Technology	Computing Fabric for high performan Applications [COBRA] Dissemination 115 contributions to international conferences and publications	ce	237,5	17	13
Safety CA305	Establishing secure, bidirectional wir channels between objects or individu in the future internet of thinks [eG0]	reless Ials	114,6	11	20
and Se	Dissemination	Contr	ibution t	o standard	ization
	2 scientific publications, demonstration of project results in several industrial exhibitions	Contrib standa	utions to E rdisation bo	TSI and Global dies	Platform
Health and the ageing society	Development of highly efficient, integrated and reliable power electro technologies for automotive, aeronau and healthcare applications [THOR] Dissemination 90 publications and news articles	onics utics	233,8	18	10
2 CA502	Solutions for Energy Efficient Lightin [SEEL]	g	231	23	3
rgy ncy	Dissemination	Contr	ibution t	o standard	ization
Ene	Over 50 publications	Contrib group o	utions to El n light sour	LMAPS and GT ces	BWorking
Semiconductor process & integration	Renewed Embedded Flash and other Innovative NVM for Extended Domain of application [REFINED] Dissemination 20 publications	IS	187	6	0

Call			PYs	Partners	Patents
Semiconductor process & integration	UlTimaTe Enablement Research on 32/28nm cMOS Technologies [UTTERMOST] Dissemination 168 publications or conference papers, 1 PhD thesis		523,7	16	11
Semiconductor process & integration	Development of a complete 3D integr technology platform covering the ent range of processes required from ver interconnects (TSV, micro bumps) a robust bonding to innovative packagi approaches [COCOA]	ration ire tical and ng	167,4	12	12
	Dissemination About 70 papers or presentations	Contri Particip 3D Desi	ibution to ation to IEE gn for Test	o standard EE 1838 Workin	ization ng Group on
omotive and ansportation	Research, development, and demonstration of future image captu processing and transmission technol for Machine Vision, Security/Surveilla and Professional Broadcast. [ICAF]	re, ogies ance	117,1	9	2
Auton tran	Dissemination 9 scientific papers	Contrib	ibution to ution to 7 st	o standard tandards	ization
3 CA403	Design for Reliability of SoCs for Applications like Transportation, Med and Industrial Automation [RELY]	dical,	159,2	14	4
Health the a so	Dissemination 14 journal articles, 2 books, over 100 conference talks	Contrib Contrib Intercha	ibution to ution to RIII ange Forma	o standard ⁼ (Reliability Ir t)	ization nformation
3 CT208	Research on optimal Architecture and InteGration of 22/20nm node core dig CMOS technology [REACHING 22]	d gital	222	7	0
ond oroc itegr	Dissemination	Cont	ribution [.]	to standar	dization
Semic P	More than 20 publications	Contril a prom trade- power, under Things	bution to th hising techn off betweer) and cost, v power cons).	e developmen hology providir h performance well suited for traints (e.g., h	t of FDSOI as ag excellent s (speed, applications nternet of

Call			PYs	Partners	Patents
onductor brocess & tegration	Establishment of silicon technology platforms for emerging Radio Freque (RF), Millimeter-Wave (MMW) and TeraHertz (THz) consumer applicatio [RF2THZ SISOC]	ency	234,5	32	6
	Dissemination	Contr	ibution t	to standard	ization
ŭ	240 contributions to international conferences and publications, 3 PhD thesis	Industr model : feedbae TUDD te SiGe HE improve	y standard RF2THz ha ck from circ o validate t 3T technolo ements	HiCUM/L2 HB ⁻ ardware from S cuit design hav he model for a ogy and to iden	T compact T and e allowed dvanced tify relevant
Equipment, Materials and Manufacturing	Development of 450 mm SOI substra related technologies and equipments [SOI450] Dissemination Invited paper at 2012 SOI CONFERENCE IEEE / Napa Valley	tes, s	74,1	8	2
Equipment, Materials and Manufacturing	Development of a wafer handling platform supporting 450mm transition European Semiconductor Industry [NGC450] Dissemination Over 10 project posters and presentations in various fora	on for	39	8	0
Semiconductor process & integration	Autonomous Nine Degrees of Freedo Sensor Module [9D-Sense] Dissemination 33 journal articles and conference proceedings	m	111	10	2
CA109 echnology	Design and development of scalable and heterogeneous highperformance computing architectures mixing gene purpose multi-cores processors with more dedicated acceleration process [SHARP]	e eral 1 sors	64,1	5	3
	Dissemination	Contr	ibution t	to standard	ization
	18 technical papers, 3 PhD thesis	Contrib HW co- server s verifica	utions to s validation) software), S tion), and I	tandards PCIe , MPA and PGA SystemC (syste _inux (many-co	(SW/ S (HPC/ em-level re OS)

Call			PYs	Partners	Patents	
Amunication and digital lifestyle	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	
Con	Dissemination	Contri	bution to	o standard	ization	
	Over 10 papers	As partic User Inte has cont language at multip modeling	sipant of th orface Wor ributed to es for desc ole levels o g to concre	te W3C Model- king Group, UJ the standardiz ribing user Int f abstraction f te user interfa	Based IF/LIG zation of erfaces from task aces.	
CA111	End to end 4K Ultra High Definition T Europe [UltraHD-4U]	/ for	143,3	15	2	
icati digi ifest	Dissemination	Contri	bution to	o standard	ization	
Commur and I	One book, presentations at major worldwide exhibitions or conferences from the domain (IBC, CES, NAB, MWC)	Contribu P3333	tions to M	PEG, VQEG and	dIEEE	
A CA206	Crucial improvements in security, functionality and speed for next generation e-passport platforms [NewP@ss]		169,7	15	2	
	Dissemination	Contri	Contribution to standardization			
ал	13 presented conference papers, 1 journal article	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			s to the zation d ISO/ ; Force, ropean TC 224; Forum; ISCI	
4 CA310	Electromagnetic Reliability of Electro Systems for Electro Mobility [EM4EM]	onic	90,9	16	6	
ive a	Dissemination	Contri	bution to	o standard	ization	
Automoti ⁿ transpoi	Over 57 papers	Transfer of several EM4EM results to standardization bodies, including the decoupling measurement method for electrical machines in GAKAK767.13/.14/.1			ts to g the d for 1.13/.14/.18.	

Call		PYs	Partners	Patents
CA701	Unified design methodology and tools to address the system-level design an verification needs for multi-domain microelectronics assisted systems [H-INCEPTION]	92 Id	15	0
Тe	Dissemination	Contribution	to standard	dization
	8 participations at events, 29 publications and 9 trainings	Participation in 4 Accellera and IEE contributions in S Domain Virtual Pr MDVP	working group E committees, SystemC MDVP ototyping) and	s in the with key (Multi- IP-XACT
Semiconductor process & integration	High dynamic range multiprocessor for Ultra Low Power mobile devices [DYNAMIC-ULP] Dissemination 35 journal articles and conference proceedings	or 292,4	11	5
Semiconductor process & integration	3D Flex Fluidics [3DFF] Dissemination 2 technical papers, participation to various workshops and fora	55,9	8	3
Equipment, Materials and Manufacturing	Manufacturing Solutions Targeting competitive European Production in 3 [MASTER 3D] Dissemination more than 30 papers and about 44 presentations including posters at main conferences	170,5 D	17	6
Jesign Technology CA112	Heterogeneous Architectures for Parallel Computing [HARP] Dissemination 23 publications, 6 PhD theses	101,8	6	3

Call			PYs	Partners	Patents
Energy efficiency CA202	Best Energy Efficiency solutions for heterogeneous multi-core Communicating systems [BENEFIC] Dissemination		191,2	16	7
	45 scientific publications, posters				
S CA703	Open Embedded System Level Technologies for Next Generation Embedded Systems [OpenES]		145,1	12	0
echr	Dissemination	Conti	ribution [.]	to standard	ization
F	12 publications, 3 PhD thesis, participation to over 25 conferences, several university lectures based on the project findings	Contrit	outions to C	OMG and to IEE	E 1801 SLP
5 CT315 à ≩	Embedded power components for ele vehicle applications [EmPower]	ectric	55	7	0
Ener	Dissemination				
eff	7 publications, 30 presentations at international conferences				
tion tyle CA116	Coexistence Of RF Transmissions In Future [CORTIF]	the	127,2	14	9
unica life	Dissemination	Conti	ribution	to standard	ization
Commu	11 journal papers, 29 conferences	Contrik bodies Allianc Specia	Contribution to several standardization bodies such as ETSI, 3GPP for LTE, AllSee Alliance, ZigBee Alliance and Bluetooth Special Interest Group		
6 CT217	Resilient Integrated Systems [RESIST]		144,9	20	13
Jesig nolog	Dissemination	Conti	ribution [.]	to standard	ization
Techn	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	4 contr (CMC, /	ibutions to AEC & JDEC	standardisatic C, ISO, IIRW)	n groups
Process & CA114	Non-Galvanic Contactless Connector Power and Data Transfer [WiCon] Dissemination 2 Master Thesis, 7 Papers	rs for	45,8	5	0
Se					

Call		PYs	Partners	Patents	
6 CA208	Trusted Mobile Platforms [MobiTrust]	88,2	11	1	
safety curity	Dissemination	Contribution t	o standard	ization	
and Se	10 journal papers or conferences, 2 book chapters, 5 PhD thesis, one MSc thesis	Contributions to st CEN-CENELEC, W3 FIDO, GSM-A, NFC Electronic Signatu (ESI)	andardization 3C, GLOBALPL/ Forum and ET re and Infrastr	bodies ATFORM, SI ructures	
6 CA118	Full Integrated Transceiver for Next generation Emergency ServiceS [FITNESS]	65,9	8	3	
Technol	Dissemination 3 PhD thesis, 17 publications or conferences	Contribution t Contributions to st 3GPP and ETSI	o standard	ization bodies	
etturing CLT318	European 450mm Lithography and Metrology Development for Advanced Patterning [E450 LMDAP]	245.6/ 2746.4*	40	50	
Equ Manuf	DISSEMINATION 84 conference presentations, 10 journal presentations, one Master thesis	* A CATRENE / ENIAC co-label			
Communication and digital lifestyle	smart Everything everywhere Access to content through Small cells Technologies [EAST] Dissemination 6 publications, 13 conference presentations	62,4	8	4	
Equipment, Materials and Manufacturing	TSV - Hvm AND Yield optimization focused [TSV-HANDY]	42,8	8	0	
	Dissemination 3 publications, 3 presentations at technical conferences				
7 CAT209	Human to Objects [H2O]	138,4	15	8	
afety curity	Dissemination	Contribution t	o standard	ization	
and Sec	6 academic articles, participation to several conferences and trade shows, one PhD thesis	Contributions to G GSMA	lobal Platform	, ETSI and	

Call		PYs	Partners	Patents	
7 CAT406	New Mammography Detector [NEMADE]	14,6	3	6	
Health and the ageing society	Dissemination 10 publications or conference presentations				
7 CAT802	Smart Analysis Methods for advanced Microsystems and Materials [SAM3]	d 108,6	19	2	
omen als an cturir	Dissemination				
Equiț Materia Manufao	Contributions during CAM2017, ESREF, ISTFA and IMAPS. Publications at Materials Sciences and Applications.				
Cechnology Cechnology	Co-Design for System-in-Package- on-Board: A Must to Create Novel 3D Compact Systems [SiPoB-3D]	82,9	11	0	
	Dissemination More than 30 publications and presentations				
CAT120	Cmos Image Sensor TEchnologies' Readiness for Next generation of applications [CISTERN]	68,5	5	6	
pro pro integ	Dissemination	Contribution to standardization			
Sen	New product presentations at various fair trades	Contributions to JI	IA, EMVA and S	SMPTE	
	Next Generation of Body Monitoring [NexGen]	139	16	3	
Health an the agein societ	Dissemination Over 20 presentations at international conferences, 6 journal papers, 4 master thesis, 3 doctoral thesis	Contribution t Contributions to D	o standard IN, DKE and IE	ndardization E and IEC	
sportation 8 8 8 8 8 8 8 8 9 8 9 8 9 8 9 8 9 9 8 9	Enabling Smart Mobility and Smart Infrastructure by Development of a Technology Readiness Process for Consumer Electronics [TRACE]	232,2	37	1	
vutorr trans	Dissemination	Contribution t	o standard	ization	
4	About 160 papers and publications, 95 presentations / PhD, master and bachelor thesis (about 50 thesis	Support of GIINA / Automotive Semica along the Supply C	PASRASC (Pla onductor Requ hain)	tform for irements	



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