FEDERATING EUROPEAN ECOSYSTEMS

NANO - ELECTRONICS

ELECTRONIC SMART SYSTEMS

FLEXIBLE ELECTRONICS

ECSEL Italy Day 2020

13.02.2020, Roma

Alfredo Tafuri – Mesap Innovation Cluster

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

ABOUT 5E PROJECT

30 **Months**

7 **Partners**

Coordinator: VDI/VDE-IT

CEA - FR
Euripides - FR
Hahn-Schickard - DE
Holst IMEC - NL
Holst TNO - NL
MESAP - IT

1 **m€ Budget**

4 **European Countries**

France, Germany, Italy, Netherland

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

OBJECTIVES

1. Support industrial perspectives of EU Electronics Ecosystems
2. Position Electronics as fundamental for digitisation
3. Foster collaboration and cross-fertilisation in Electronics

EXPECTED RESULTS

Joint Vision

Meta-roadmap

Joint strategy

Cooperation

Reach out

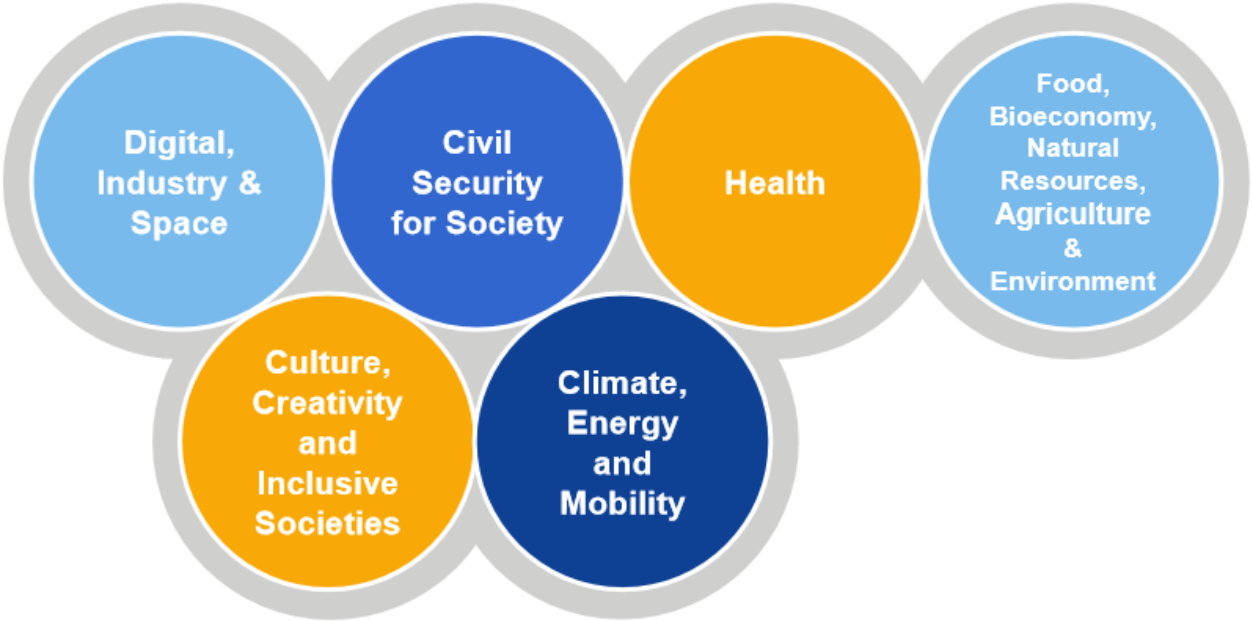
The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

6 CLUSTERS AS PRIORITIES IN HORIZON EUROPE

PILLAR 2

Global Challenges & European Industrial Competitiveness: boosting key technologies and solutions underpinning EU policies & Sustainable Development Goals

Commission proposal for budget: € 52.7 billion



The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

6 CLUSTERS AS PRIORITIES IN HORIZON EUROPE

PILLAR 2

5E POSITION – ALIGNMENT OF ACTIVITY WITH THE 6 CLUSTERS

Opportunities are clearly present in:

- Topics where there is ongoing activity in line with the cluster's areas of intervention
- Topics with potential for the cluster's areas of intervention that are not yet addressed, either in Europe or elsewhere

Clusters in 'Global Challenges and European Industrial Competitiveness'

Clusters	Areas of intervention	
Health	• Health throughout the life course • Non-communicable and rare diseases • Tools, technologies and digital solutions for health and care, including personalised medicine	• Environmental and social health determinants • Infectious diseases, including poverty-related and neglected disease • Health care systems
Culture, creativity and inclusive society	• Democracy and Governance • Social and economic transformations	• Culture, cultural heritage and creativity
Civil security for society	• Disaster-resilient societies • Protection and Security	• Cybersecurity
Digital, Industry and space	• Manufacturing technologies • Advanced materials • Next generation internet • Circular industries • Space, including Earth Observation • Emerging enabling technologies	• Key digital technologies, including quantum technologies • Artificial Intelligence and robotics • Advanced computing and Big Data • Low-carbon and clean industry • Emerging enabling technologies
Climate, Energy and Mobility	• Climate science and solutions • Energy systems and grids • Communities and cities • Industrial competitiveness in transport • Smart mobility	• Energy supply • Buildings and industrial facilities in energy transition • Clean, safe and accessible transport and mobility • Energy storage
Food, bioeconomy, natural resources, agriculture and environment	• Environmental observation • Agriculture, forestry and rural areas • Circular systems • Food systems	• Biodiversity and natural resources • Seas, oceans and inland waters • Bio-based innovation systems in the EU Bioeconomy

eeeee

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

ELECTRONICS IS A TRANSVERSAL ENABLER

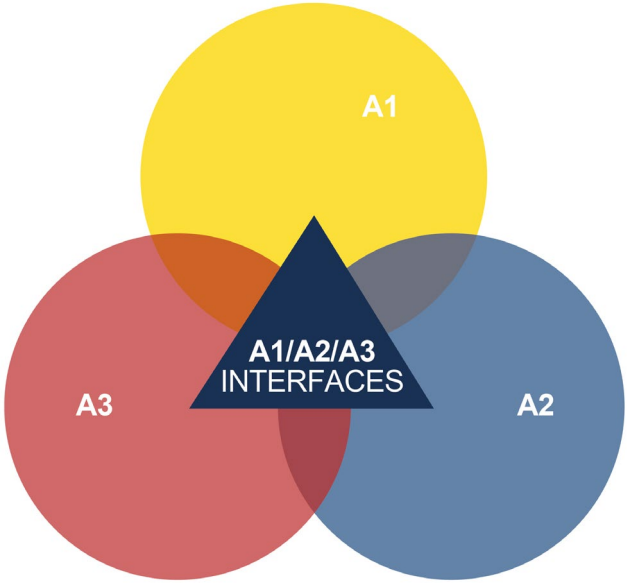
Electronics supports a multitude of key enabling technology breakthroughs from 5G and Digitalization to the Internet of Things and Artificial Intelligence (to name a few).

This will lead to a next generation of solutions that can build on Europe's expertise in:

Area 1
NanoElectronics
NE

Area 2
Flexible & Wearable Electronics
FWE

Area 3
Electronics Smart Systems
ESS



What is the added value of the <u>interfaces</u>?

→ Is there value in complementarity/synergy between the areas?

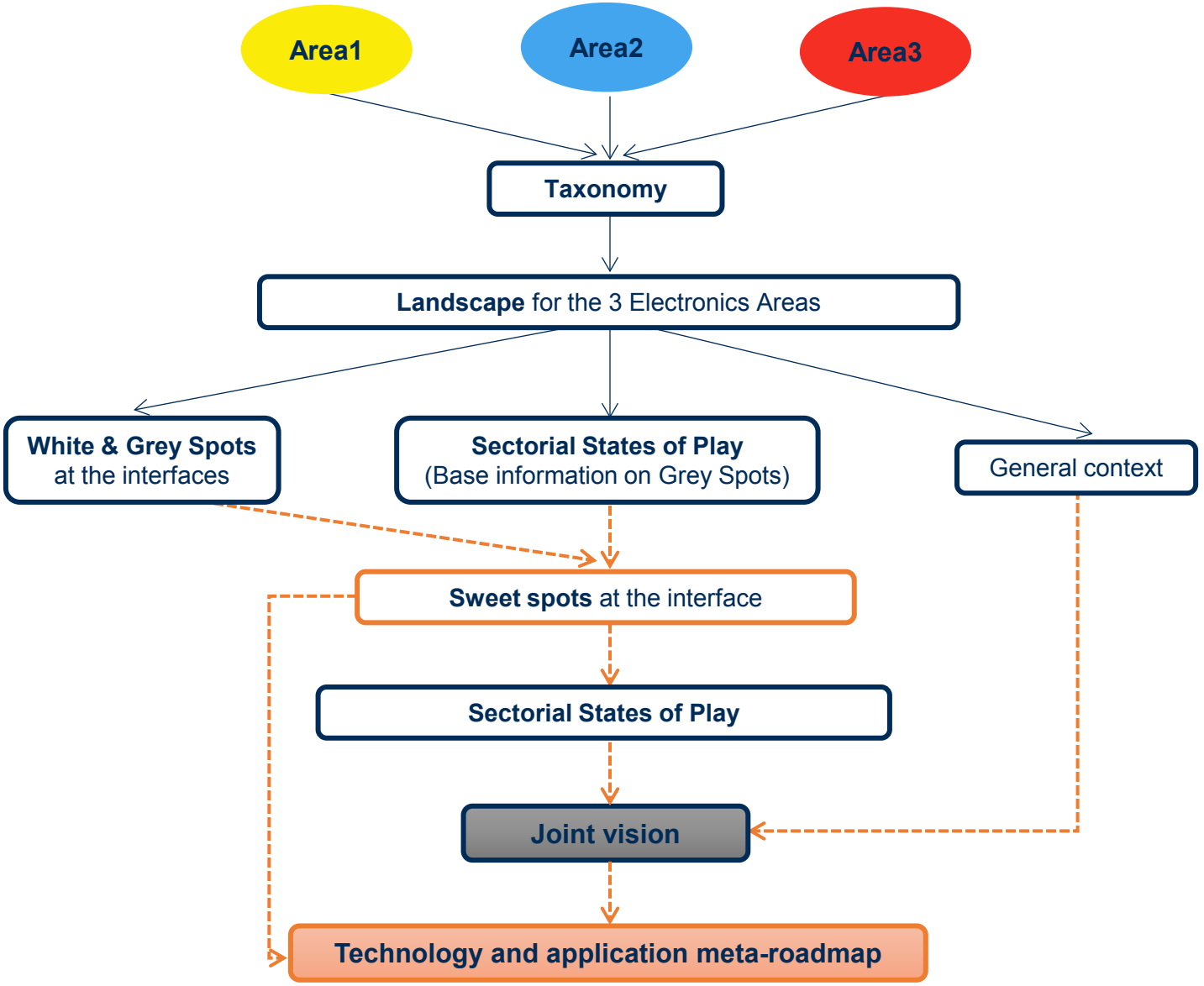
How can Europe benefit from its position in each of the <u>three areas</u>?

→ What is needed to get beneficial interaction between the ecosystems?

eeeee

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

METHODOLOGY



The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

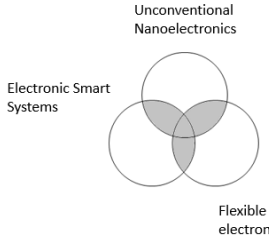
OUTPUT

11 Sectorial States of Play (SSPs) for each Sector and for all relevant Functionalities
→ Focus on Technologies and Applications

11 Fact Sheet for each Sectorial States of Play (SSPs)
→ Technologies & Applications
→ Challenges & Opportunities

33 Grey Spots

45 White Spots



	(Aero)Space	Building / Construction	Consumer electronics	Digital Manufacturing	Energy	Environment	Food & agriculture	IoT/Smart connected objects	Medical / Pharmaceutical / Life science (*)	Natural resources	Packaging / logistics	Safety / Security	Transport / Mobility / Automotive (*)
Actuating													
Communicating													
Computing / Processing													
Energy harvesting / storage													
Sensing													
Signalling (optical Imaging, lighting)													

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

OUTPUT
EXAMPLE OF LANDSCAPE/ SSPs

eeeee

Sectorial State of Play (SSP)

ENVIRONMENT

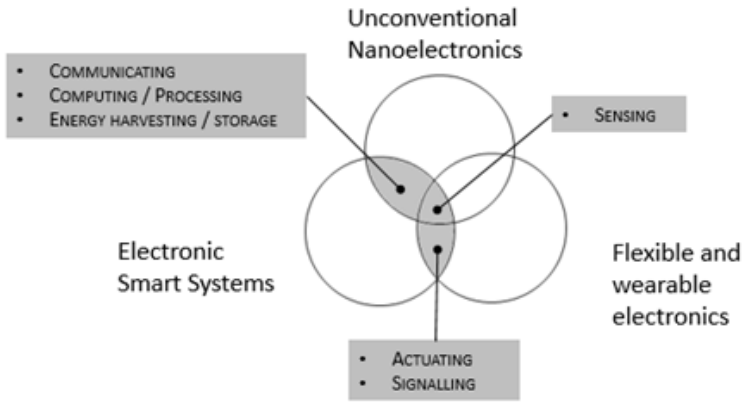
OTHER Application fields	☐ (Aero)Space ☐ Building / Construction ☐ Consumer electronics ☐ Digital Manufacturing ☐ Energy ☐ Environment ☐ Food & agriculture ☐ IoT/Smart connected objects ☒ **Medical / Pharmaceutical / Life science** ☐ Natural resources ☐ Packaging / logistics ☐ Safety / Security ☒ Transport / Mobility / Automotive ☐ Other (specify)
Area	☒ Unconventional nanoelectronics ☐ Flexible and wearable electronics ☒ Electronic smart systems
Sources	○ NEREID Roadmap ○ InSSIght Videos ○ Smart Systems Knowledge Gateway ○ Smart Systems Integrated® Trademark Products

eeeee

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

OUTPUT
EXAMPLE OF SSPs FACT SHEETS

4.9 MEDICAL / PHARMACEUTICAL / LIFE SCIENCE



M1 (Actuating): Efficient, safe and integrated actuating to improve healthcare outcome and assist professionals with advanced automation and HMI

M2 (Communicating): High-performance and secure communication building blocks to increase autonomy and efficiency of electronic devices intended for medicine and Healthcare

M3 (Computing / Processing): Advanced hardware/software processing for in-depth analysis of large and complex health-related datasets to improve decision-making and outcome of healthcare

M4 (Energy harvesting / storage): Combining energy harvesting, storage and efficiency to power complex, autonomous and interconnected medical & healthcare devices

M5 (Sensing): Disruptive & high-performance sensing capability as key enabler for Digital Healthcare and Well-being

M6 (Signalling): Advanced Signalling for immersive visualisation tools to improve interfaces with and proficiency of medical professionals

M3: Advanced hardware/software processing for in-depth analysis of large and complex health-related datasets to improve decision-making and outcome of healthcare

The large number of health-relevant parameters and the trend towards personalised medicine makes *BigData* a key topic in healthcare. The ever increasing amount of data for effective decision-making in diagnoses, treatments and rehabilitations requires advanced computing. Even if a strong focus is set on software, the heterogeneity of data and devices, the need for immediate processing and data safety also require advanced hardware.

Technologies / Value:

- Chip design & hardware for high-performance computing, Artificial Intelligence on chip;
- Advanced memory modules for knowledge based tools;
- Machine-learning, pattern recognition, prediction.

Applications:

- Close-loop systems for partly or fully-automated tasks (robotics, prosthesis, monitoring);
- Sensors and data fusion (imaging, diagnostics);
- Preventive & predictive medicine;
- Advanced in-silico & pharmacokinetic models (simulation, organ-an-chip);
- Advanced HMI.

Challenges:

- Scales and variety in data, devices and standards represent a major challenge, notably for processing time and "embeddability";
- Safety, security, reliability: data processing shall be at any point of the process guaranteed safe, secure and reliable;
- Ethical & acceptance aspects, notably regarding reliability and liability of decisions made by AI.

Coupling with other functionalities: Computing processing is a fundamental chain-link between sensing and actuating in order to adapt actuation to the situation (close-loop, monitoring, robotics), but as central unit, it has connections to all other functionalities.

Opportunities:

1. **Digitising healthcare and access to new health-relevant big data (genome or behaviour for instance) to develop AI-embedded chips to improve decision-making or automation in healthcare**
2. **Coupling with well-being and consumer electronics opens up new markets**

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

VALIDATION PATHS

33 Spots showing activities from 2 or more areas

→ More validation of titles and fact sheets

→ Identification of “Sweet Spots” for collaboration

Joint Vision of electronics ecosystems

→ Beyond Sweet Spots

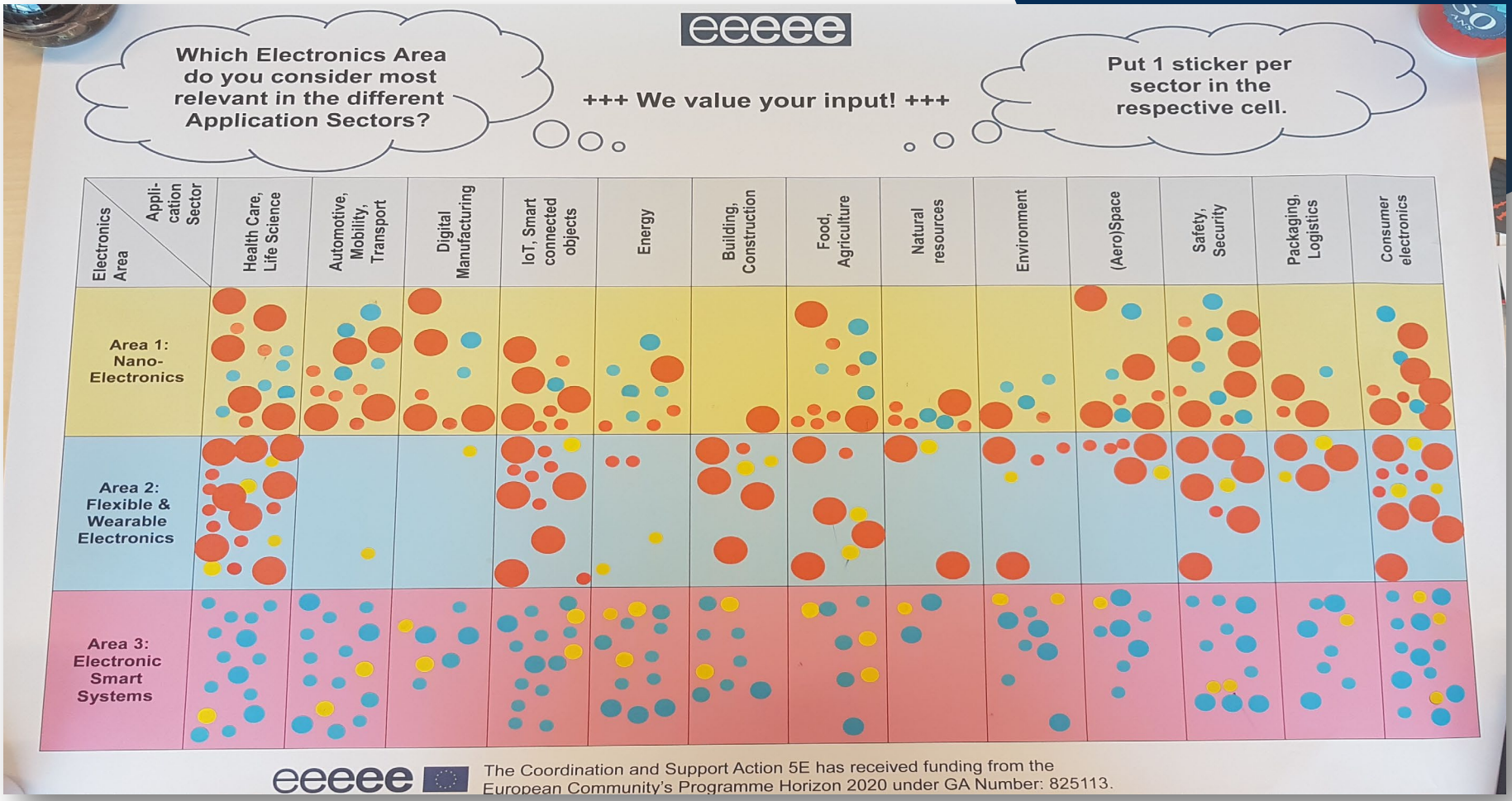
HOW

→5E Workshops and Online survey

eeeee

The Coordination and Support Action 5E has received funding from the European Community’s Programme Horizon 2020 under GA Number: 825113

INTERFACE GAME



eeeee
The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

HOT/COLD TOPICS

Validation of Grey Spots relevance
Check whether White Spots are truly white

150+ Experts

	BUILDING / CONSTRUCTION	HOT Topic	COLD Topic
B1	High power and real-time computing facilities to support planning, construction, use and maintenance of buildings		
B2	Ubiquitous and reliable energy supply and harvesting technologies to achieve efficient construction, use and maintenance of buildings		
B3	Low power and energy autonomous sensing systems and IoT networks to monitor buildings with respect to their current status (structural health, user behaviour, occupancy, abrasion etc.)		
B4	Increase of security and comfort of users of buildings by smart signalling solutions		
	CONSUMER ELECTRONICS		
C1	Actuating as a key functionality for enhancing Human Machine Interfaces (HMI), product value and enhancing users experience		
C2	Independent high-speed connectivity and low power communication for trusted nomad consumer solutions		
C3	Low cost, reliable and recyclable energy harvesting & storage solutions for high volume consumer electronics markets		
C4	Solutions for reliable and sensitive multi-sensing and data fusion/exploitation algorithms for signals dynamic management		
C5	Signalling displays compatibility for sustainable manufacturing in Europe		
	DIGITAL MANUFACTURING		
D1	Actuating as key functionality for safe, efficient and optimised production processes in industry 4.0		
D2	Next generation sensor systems for safe, efficient, optimised and self-enabled manufacturing		
	ENERGY		
N1	High yield energy harvesting approaches for replacing or reducing primary energy uses		
N2	Flexible energy storage solutions with extended systems lifetime and multi-uses, including secondary use		
	ENVIRONMENT		
E1	Gas, pollutant, particle and waste monitoring solutions for healthy and safe working & living environments		
	FOOD & AGRICULTURE		
F1	Sensing for quality, safety and security tracing & monitoring along food value chains		

	IOT/SMART CONNECTED OBJECTS		
I1	Efficient and secure protocols for high-data transmission rate of IoT devices		
I1	Sustainable energy harvesting and energy storage solutions for low-power and autonomous IoT devices		
I3	Multi-sensing capability to monitor complex environment via extended networks of connected devices		
	MEDICAL / PHARMACEUTICAL / LIFE SCIENCE		
M1	Efficient, safe and integrated actuating to improve healthcare outcome and assist professionals with advanced automation and HMI		
M2	High-performance and secure communication building blocks to increase autonomy and efficiency of electronic devices intended for medicine and Healthcare		
M3	Advanced hardware/software processing for in-depth analysis of large and complex health-related datasets to improve decision-making and outcome of healthcare		
M4	Combining energy harvesting, storage and efficiency to power complex, autonomous and interconnected medical & healthcare devices		
M5	Disruptive & high-performance sensing capability as key enabler for Digital Healthcare and Well-being		
M6	Advanced Signalling for immersive visualisation tools to improve interfaces with and proficiency of medical professionals		
	PACKAGING / LOGISTICS		
P1	Secure data/information wireless transmission in packaging/labels for goods interconnectivity and e-services		
P2	Multi-sensing, data fusion and management in packaging/labels for goods interactivity and e-services		
	SAFETY / SECURITY		
S1	Secure data transfer technologies for flexible and adaptable IoT systems to enable trusted solutions in data communication, across wireless standards and applications		
S2	Sensors systems with a "trusted label" for protection of people and goods to be easily integrated into products		
S3	Creating visibility or convey information as informative or preventive action to promote effective operation and physical safety		
	TRANSPORT / MOBILITY / AUTOMOTIVE		
T1	Seamless integration of actuators in car interiors for human machine interaction		
T2	Technologies to secure data transfer and enable trusted solutions for people and information in car2car communicating for autonomous / self-driving vehicles		
T3	Low-power loss and energy harvesting for emission and CO_2 reduction in electrical driving		
T4	Novel sensors to act on changing situations in surrounding, varying from traffic, weather, … to assist in ADAS (autonomous driving assistance system), safety and power consumption		
T5	Seamless integration of displays for human machine interaction and signalling		

eeeee

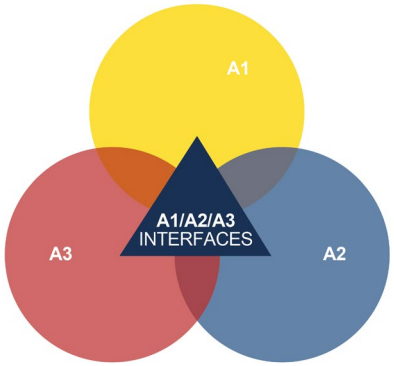
The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

RANKING OF RELEVANCE

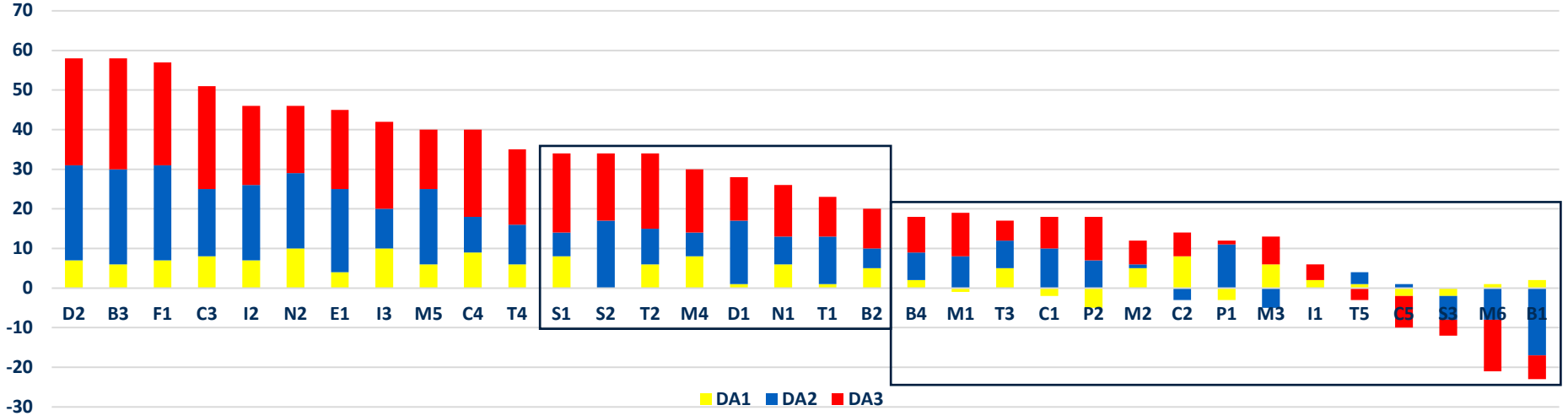
Area 1
NanoElectronics
NE

Area 2
Flexible & Wearable Electronics
FWE

Area 3
Electronics Smart Systems
ESS



Absolute difference HOT/COLD



The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

JOINT VISION

Of European Electronics Ecosystems

Based on convergence and cross-fertilisation between electronics areas

SWEET SPOTS

Opportunities with the highest promises

- Validation and ranking of 33 opportunities
- Identification of additional opportunities

150+ STAKEHOLDERS INVOLVED

- **4** Community events
- **2** Workshops at EFECS and OE-A
- **1** Online Survey

3 VALIDATION PATHS

TOP10 OPPORTUNITIES

WOULD YOU LIKE TO LEARN MORE?
SCAN ME

33 OPPORTUNITIES

- **Fact Sheets including**
  - Title
  - Technologies
  - Applications
  - Challenges
  - Opportunities

→ **DISCOVER MORE ON** www.5e-project.eu

6 FUNCTIONALITIES

- Actuating
- Communicating
- Computing/Processing
- Energy Harvesting/Storage
- Sensing
- Signalling

13 APPLICATION SECTORS

- (Aero)Space
- Building/Construction
- Consumer Electronics
- Digital Manufacturing
- Energy
- Environment
- Food & Agriculture
- IoT/Smart Connected Objects
- Medical/Pharmaceutical/Life Science
- Natural Resources
- Packaging/Logistics
- Safety/Security
- Transport/Mobility/Automotive

11 SECTORIAL STATES OF PLAY

- Landscape Analysis

Extraction of opportunities at the interfaces of at least 2 electronics areas

eeeee

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

NEXT STEPS

Grey Spots ➡ **Sweet Spots** ➡ **Roadmap**

Identification of **Sweet Spots** for collaboration and cross-fertilisation between the three electronics areas, and based on this to define a **Joint Vision** and a **Roadmap** for the European Electronics Industry that will lead to:

- widening the uptake & exploitation of key technologies across sectors and markets;
- combining electronics technologies for Smarter Electronics Systems and new products;
- truly benefit from hybrid integration based on joint development from components to systems by the three eco-systems;
- identification of required actions, support and cooperation to meet the great challenges and timescales to reach the Vision.

eeeee

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113

PROJECT CONTACT

Coordinator

VDI/VDE-IT | Petra Weiler: petra.weiler@vdivde-it.de

MESAP CONTACTS

Alfredo Tafuri: a.tafuri@advisor.mesap.it
Serena Zerbinati: s.zerbinati@mesap.it
Fabrizio Fallarini: f.fallarini@mesap.it

THANK YOU

The Coordination and Support Action 5E has received funding from the European Community's Programme Horizon 2020 under GA Number: 825113