

# ECS-SRIA 2025

**Paolo Azzoni**

Secretary General

INSIDE Industry Association

Chips JU 2025 Information Day, Rome, 01/04/2025

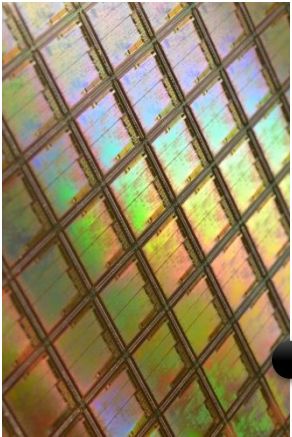


*Strategic Research and  
Innovation Agenda 2025*

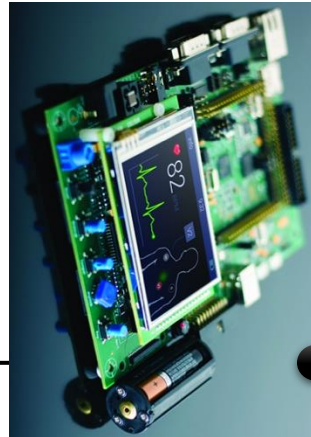


# The 2025 ECS SRIA – What ?

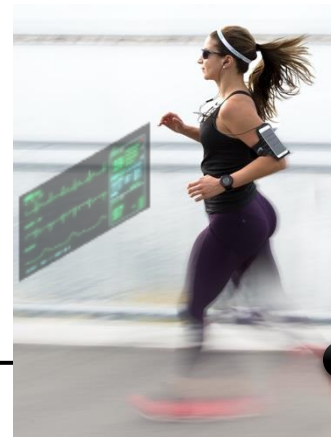
- Presenting **research topics** to be investigated over next 15 years
- To foster and accelerate our European **digital transformation** reflecting European values
- Covering the **whole value chain of Electronic Components & Systems (ECS)**



Materials, processes,  
semiconductors, micro  
& nano electronic  
components, ...



Smart sensors,  
integrated devices, edge  
AI, embedded SW, ...



Systems and applications,  
value creation, societal  
goals, ...



ECS engineering tools

# ECS SRIA 2025 – Why?

Align and coordinate  
research policies  
across Europe



# The 2025 ECS SRIA – Who ?



Patrick Coge  
AENEAS  
Chairman



Paolo Azzoni  
INSIDE IA  
Co-chairman



Matthias Küntzel  
EPoSS  
Co-chairman

## Core Team

- Arco Krijgsman - ASML
- Christophe Wyon - CEA
- Jerker Delsing - Lulea University of Technology
- Jürgen Niehaus - SafeTRANS
- Patrick Pype - NXP
- Sven Rzepka - Fraunhofer
- Wolfgang Dettmann - Infineon Technologies AG

## More than 280 European experts

- Interdisciplinary
- Across the whole ECS value chain
- Representing industry, RTO and academia
- 24 countries

# ECS SRIA 2025 is online



The screenshot shows the ECS SRIA 2025 website. The header is purple with the text 'ECS — Strategic Research and Innovation Agenda'. Below the header is a navigation bar with links: Home, ECS SRIA 2025, ECS SRIA 2024, ECS SRIA 2023, Change History, and Contributors. A search bar is also present. The left sidebar shows a tree view of the content, with '1. Foundational Technology Layers' selected. The main content area displays '1 Foundational Technology Layers' with four chapter icons: Chapter 1.1 (selected), Chapter 1.2, Chapter 1.3, and Chapter 1.4. Below the chapters is a large banner for '1.1 Process Technology, Equipment, Materials And Manufacturing' with a grid icon. The banner text reads: 'Semiconductor process technology, equipment, materials and manufacturing form the foundation of the ECS value chain producing the chip and packaged chip-level building blocks for all digital applications. Nano- and microelectronics are key to achieving digital sovereignty in Europe, and they offer a range of solutions for a green and sustainable society. If Europe wants to control the development of a digital future fitted to its citizens and their requirements, as

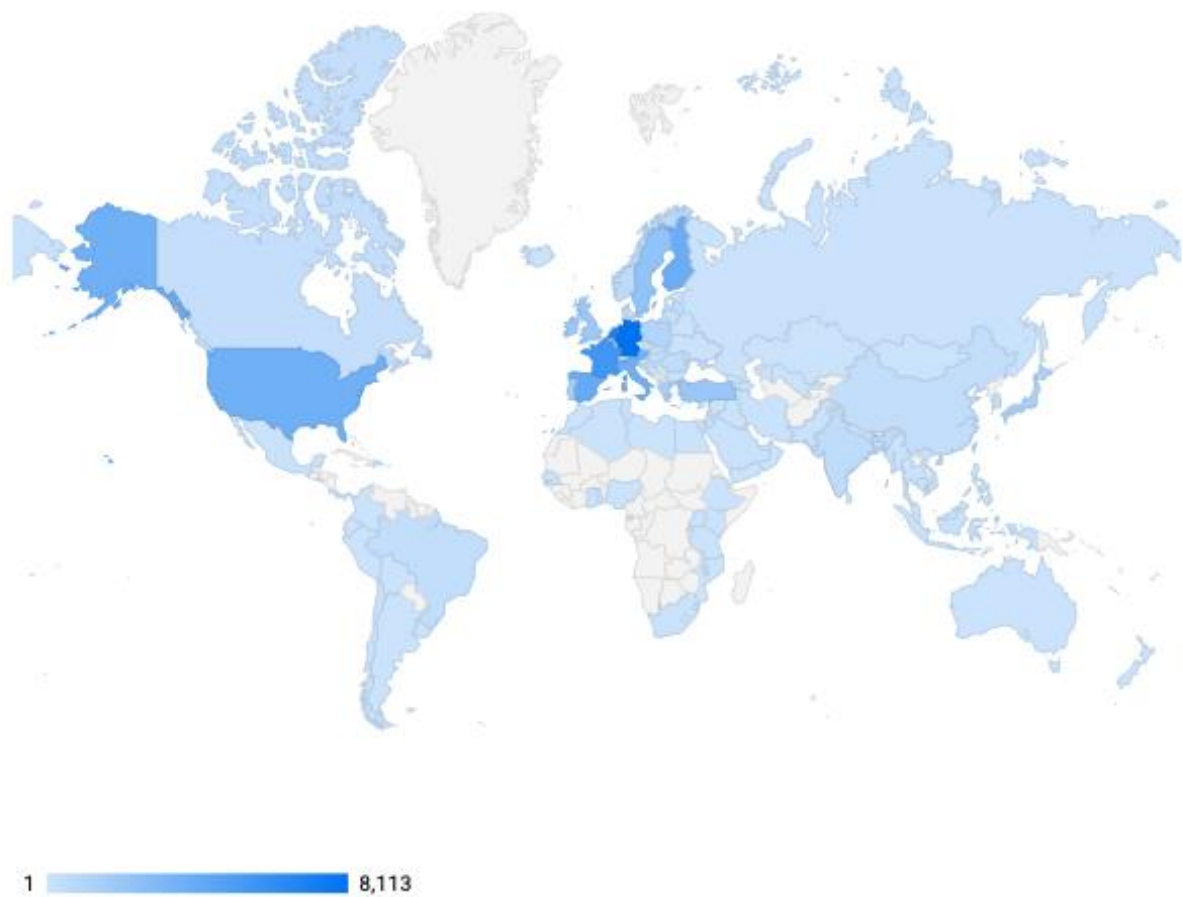
<https://ecssria.eu/>



- Native indexing and analytics
- More advanced functionalities for:
  - Topics search
  - Selective reading
- Increased visibility and accessibility
  - Attract new talents and experts



# Global reach out



	Country	Views ▾
1.	Germany	8,113
2.	Netherlands	6,551
3.	France	5,476
4.	Spain	4,023
5.	Finland	3,875
6.	Italy	3,714
7.	United States	3,680
8.	Austria	3,601
9.	Belgium	3,026
10.	Sweden	2,291
11.	Türkiye	2,008
12.	United Kingdom	1,812
13.	Ireland	1,789
14.	Portugal	1,247
15.	Japan	1,244
16.	Greece	1,214
17.	Poland	992
18.	Switzerland	780
19.	Taiwan	721
20.	Norway	554
21.	India	498
22.	Hungary	461
23.	Latvia	444

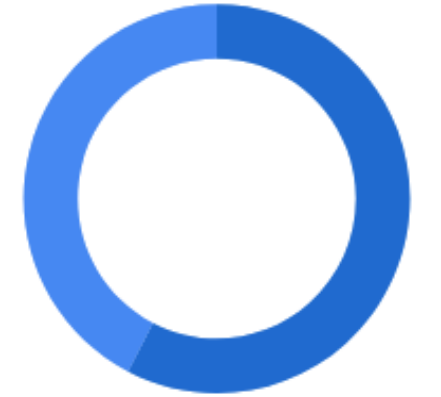
Visited from  
120 countries

# Visits and engagement index

Page	Visits			Eng. Index
Website Home	8307			
ECS-SRIA Home	12003			23
Introduction	5974			67
Outline	2392			28
CHP 1.1	3505	Part 1	9019	80
CHP 1.2	2724			86
CHP 1.3	1523			74
CHP 1.4	1268			51
CHP 2.1	3141	Part 2	6773	73
CHP 2.2	874			63
CHP 2.3	1384			59
CHP 2.4	1374			70
CHP 3.1	1214	Part 3	5731	62
CHP 3.2	988			68
CHP 3.3	937			55
CHP 3.4	1098			82
CHP 3.5	845			91
CHP 3.6	649	Part 4	909	40
CHP 4	909			58
Appendix A	814			
Appendix B	529			
... Other pages	6391			
<b>Total:</b>	<b>58843</b>			

The engagement index provides a better indication of audience interest on chapters

Nearly 60000 visits in 2024

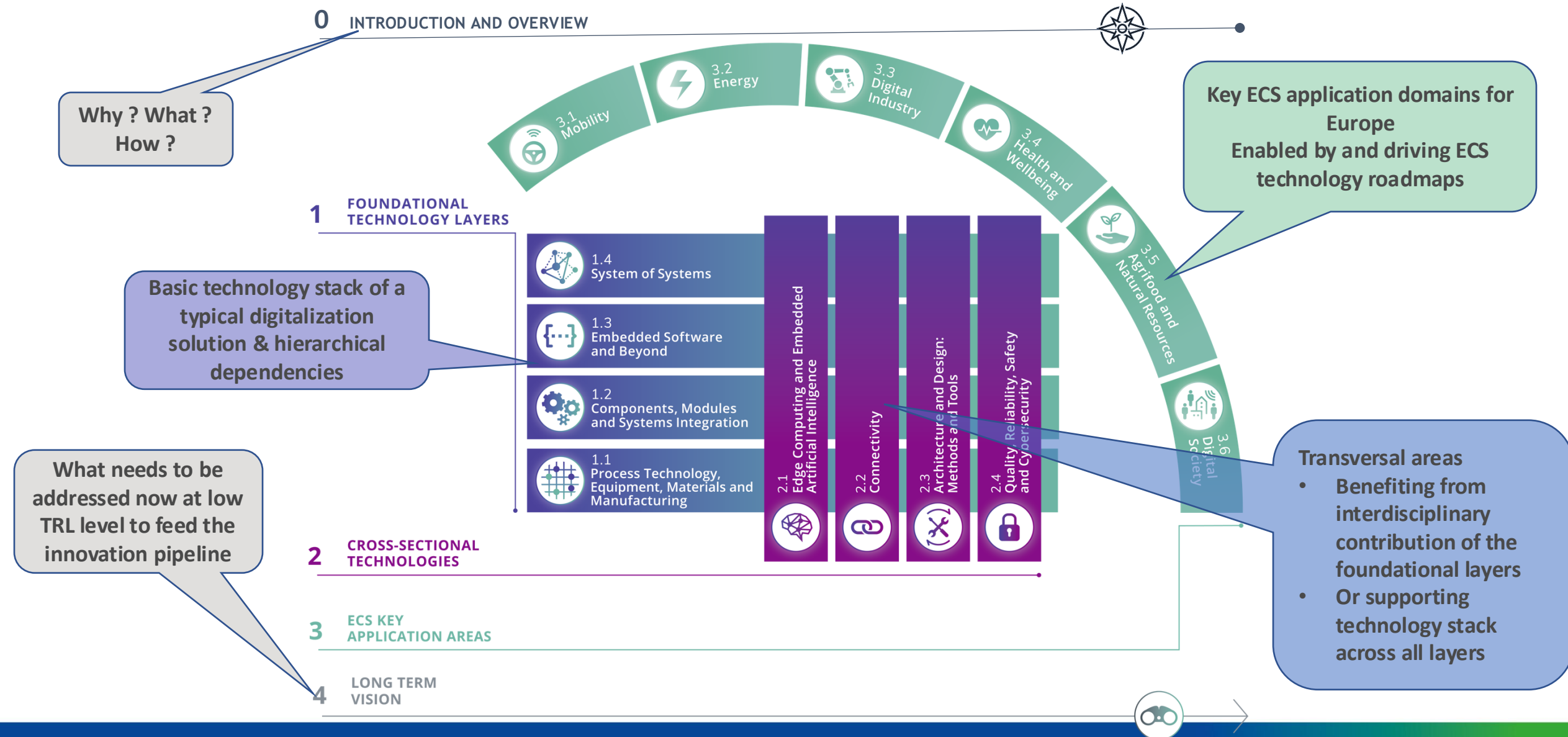


MALE 57.6% FEMALE 42.4%

Users' interests:

- Technology 51%
- Finance 38%
- Politics 32%
- Lifestyle 31%
- Sport 28%

# ECS-SRIA structure

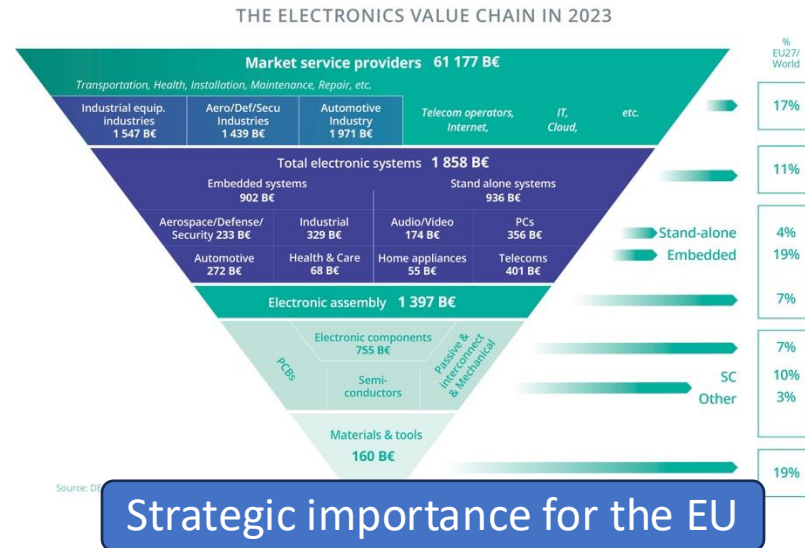




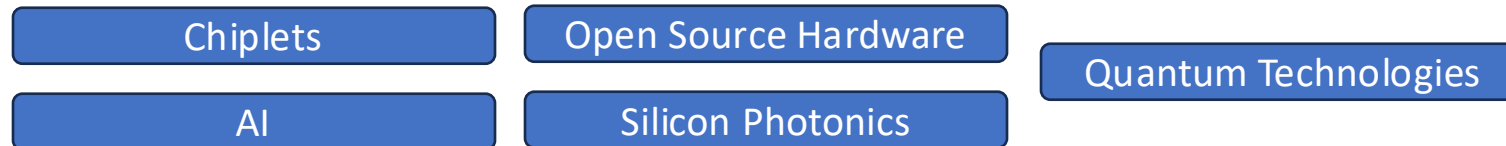
# ECS-SRIA 2025 updates

# Ch. 0 - Restructured in Why / What / How

- Why ECS matter



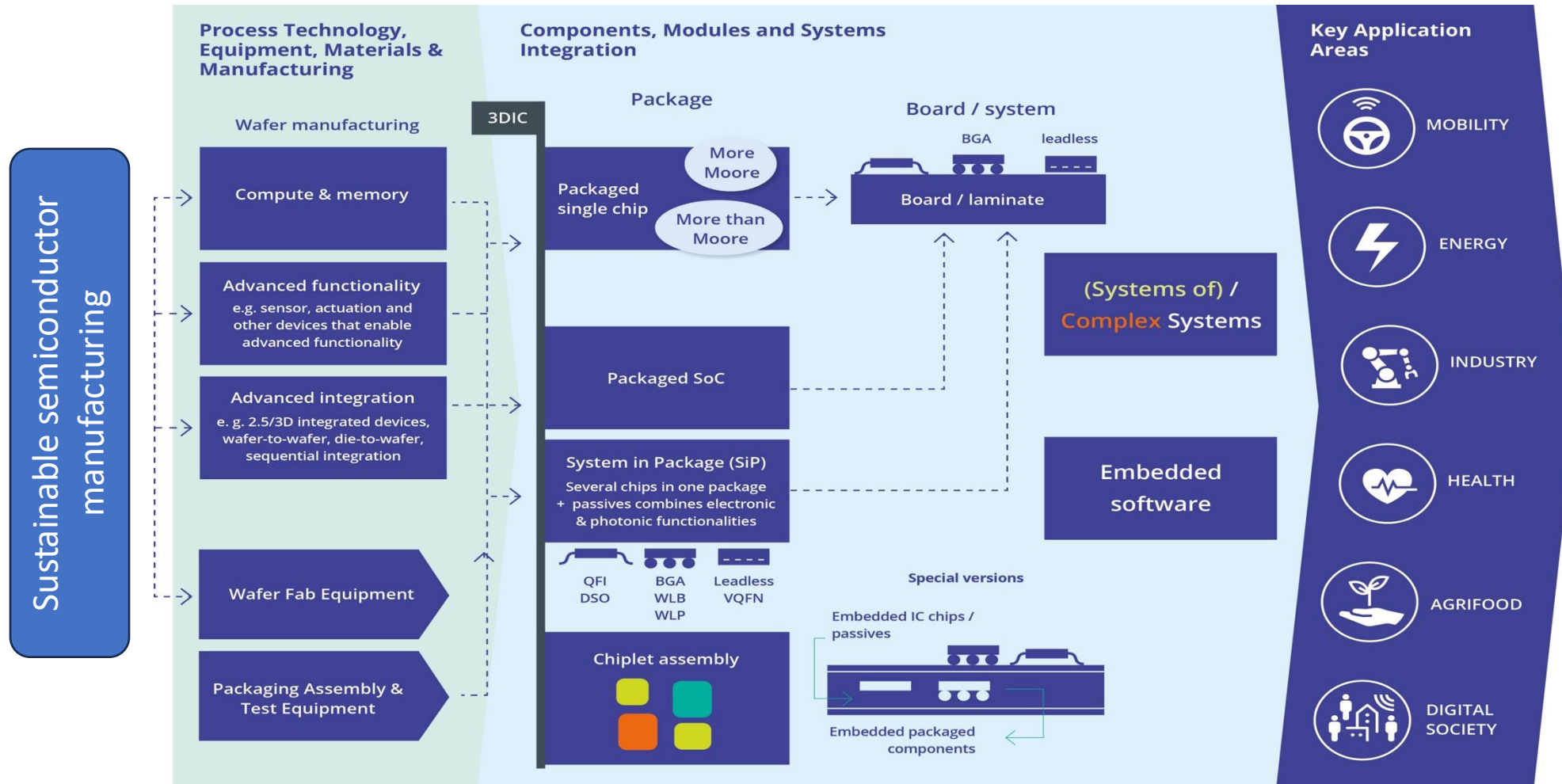
- What? SRIA content, including new and/or expanded cross-cutting themes



- How to make it happen

- Link with Pilot Lines and the Design Platform

# Ch. 1.1 - Process Technology, Equipment, Materials and Manufacturing & Ch. 1.2 – Components, Modules and Systems Integration



# Ch. 1.3 – Embedded Software and Beyond & Ch. 1.4 – System of Systems

- **Scale and complexity of System and SoS integration, monitoring and management over its life cycle**

- Including sustainability dimension

- **Importance of engineering efficiency**

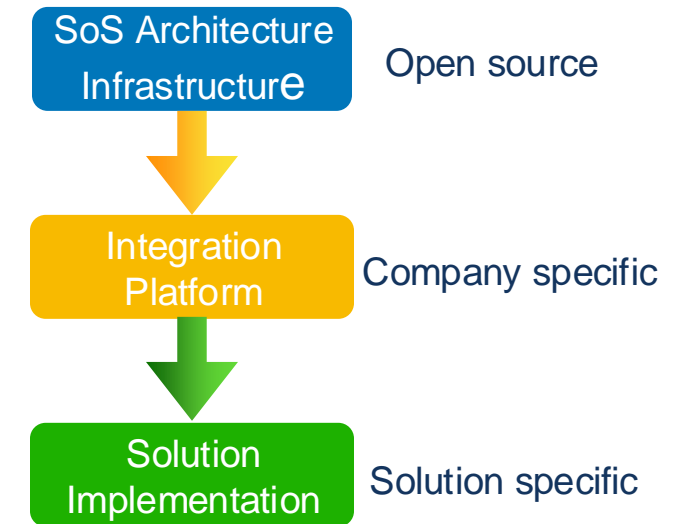
- Embedded software
  - New programming languages (Rust)
  - Virtualisation and virtual prototypes
- System of Systems
  - Model based engineering
  - Low code technologies
  - AI supported engineering tools
  - Automation of test, verification and validation processes

## Key trends in embedded Software

- Quantum Computing
- Computing accelerators
- Artificial Intelligence

## SoS infrastructure concept

- Enabling company and application specific platforms
- Enabling efficient engineering of solutions



## Ch. 2.1 - Key trends

More and more convergence between edge computing and embedded (generative) AI, but ***still a lot of edge will be without AI***

Emergence of ***Gen-AI at the edge***

New Recommendations:

- A system becomes an ***orchestration of federated services, distributed or centralized*** (Software Defined X).
- Disaggregation of complex SoC into chiplet + interposers, but still no ecosystem of interoperable chiplets and overall architecture.
- ***Memory cost is crucial for generative AI at the edge.*** New innovations required to avoid to waste RAM
- Emergence of (very) cheap Chinese Risc-V microcontrollers
- Further ***reducing standby power*** and fast on operation (stop and go for chips?)
- Still research required for ***new computing paradigms*** (neuromorphic, ***using physics to make computation*** – analog computing -, etc) and their ***validation*** in product ready solutions.



## Ch. 2.2 – Connectivity

	LAYER	DATA UNIT	FUNTION
HOST LAYERS	7. Application		Network process to application.
	6. Presentation	Data	Data representation, encryption and decryption, convert machine-dependent data to machine-independent data.
	5. Session		Interhost communication, managing sessions between applications.
	4. Transport	Segments	Reliable delivery of segments between points on a network.
MEDIA LAYERS	3. Network	Packet/Datagram	Addressing, routing and (not necessarily reliable) delivery of datagrams between points on a network.
	2. Data link	Bit/Frame	A reliable direct point-to-point data connection.
	1. Physical	Bit	A (not necessarily reliable) direct point-to-point data connection.

- Updates to the frequency scope of wireless connectivity
  - Downplaying significantly higher frequencies
- Support for efficient engineering of application solution connectivity
- Support to SoS integration and interoperability

# Ch. 2.3 – Architecture and Design: Methods and Tools & Ch. 2.4 – Quality, Reliability, Safety and Cybersecurity

## • Architecture and Design

- Ever increasing functionality and complexity of ECS based systems comprising heterogeneous subsystems and components
- Agile continuous development processes by using data collected during run-time (and production, maintenance,...)
- AI a curse and a blessing
  - Increased use of AI in components and subsystems, with corresponding challenges for quality and safety assurance
  - Advanced productivity and cost-effectiveness by using AI in Development and Test
- Need for sustainable design for sustainability

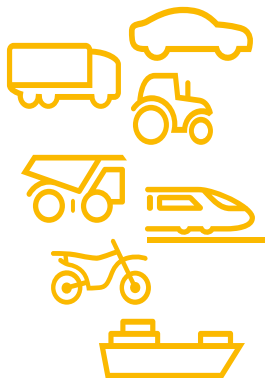
## • Quality, Reliability, Safety and Cybersecurity

- A degraded behaviour in any of these 4 dimensions or an incorrect integration among them, would affect vital properties of ECS and could cause serious damage
- Rethink many “traditional” approaches and expected performances towards safety and security, exploiting AI and ML (machine learning)
- New text on
  - Chiplet-based approach
  - AI innovation & safety and cybersecurity issues

# Ch. 3.1 – Mobility

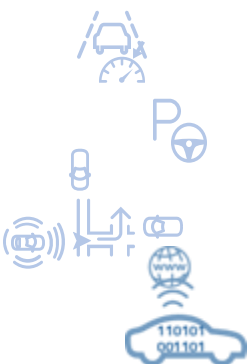
## Mobility modes considered in chapter:

- **Automotive mobility** for passengers and goods: passenger cars, two/three wheelers, trucks
- **Maritime mobility:** ships
- **Aerospace mobility** for passengers and goods: airplanes, helicopters, drones
- **Mobility on rails:** trains
- **Mobility in smart farming and off-road machinery:** smart farming machinery, smart mining, ...



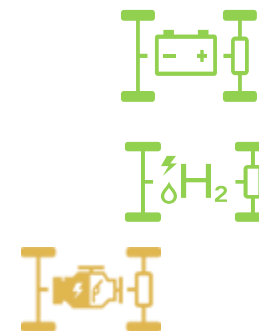
## Automation level

- Vehicles supported by **ADAS** (advanced driver assistance systems)
- **Automated** and autonomous vehicles (AD)
- **Software defined vehicles** (in-vehicle stack, off-vehicle cloud stack) (Infotainment, cockpit, ADAS/AD, Body & chassis control)



## Energy type

- **Battery electric** vehicles (trains, passenger cars, trucks, off-road machinery, airplanes)
- **Hydrogen** powered vehicles (trains, passenger cars, trucks, off-road machinery, airplanes)
- **Hybrid** vehicles



## Areas for ECS

- **HPC HW** and **SW** for **Stacks** in mobility (e.g. SDV)
- **HW** and **SW** for **ADAS/AD sensors**
- **Automated driving** for various mobility modes
- **Fast and energy efficient** power converter chips (**SiC**, **GaN**)
- **AI supported engineering tools** and **toolchains** to significantly increase development efficiency in DevOps processes



## Ch 3.1 - Major challenges in ECS for Mobility

- **Major challenge 1:** SDV hardware platforms: Modular, scalable, flexible, safe & secure
- **Major challenge 2:** SW Platforms for SDV of the future; Modular, scalable, re-usable, flexible, safe & secure, supporting edge2cloud applications
- **Major challenge 3:** Climate and energy neutral mobility: CO<sub>2</sub>-neutral mobility
- **Major challenge 4:** Digitalisation: Affordable, automated, and connected mobility for passengers and freight
- **Major challenge 5:** Edge2cloud mobility applications: Added end-user value by cloud2cloud features
- **Major challenge 6:** Validation: Methods and tools using AI for validation and certification of safety, security, and comfort in mobility



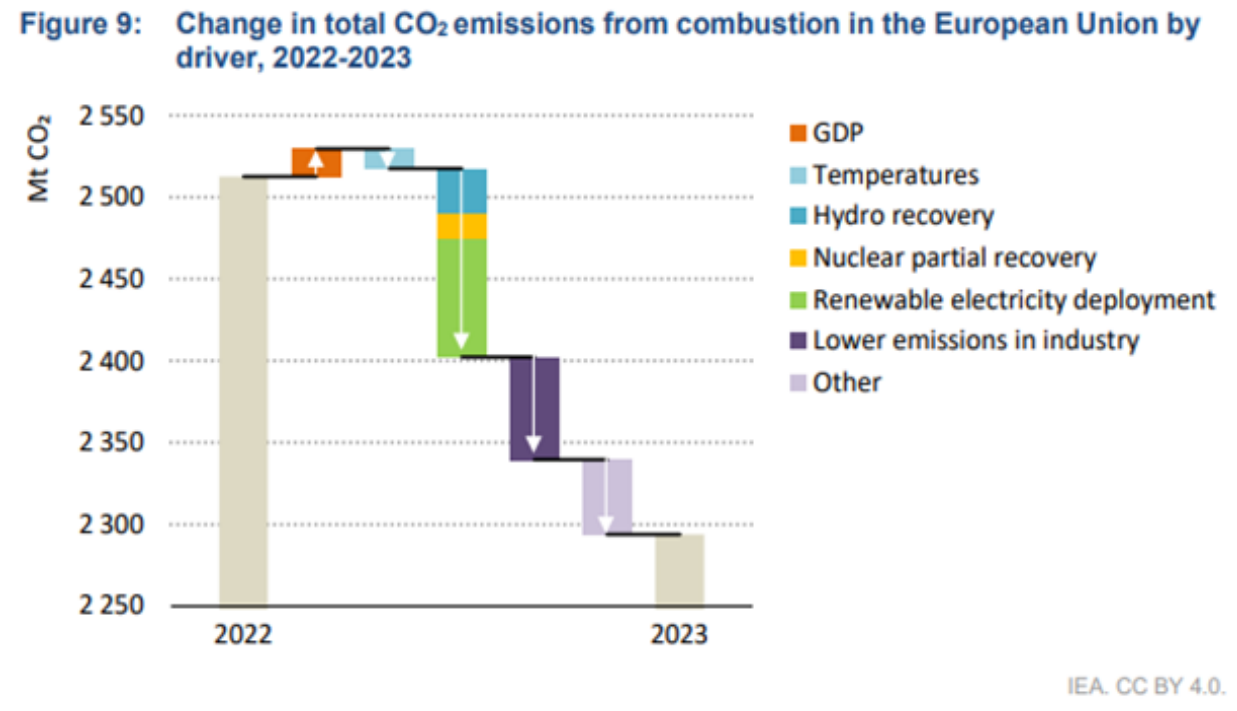
These 2 challenges were combined in one topic in SRIA 2024



- **Multimodal mobility**  **moved to chapter “Digital Society” in SRIA 2025**

## Ch. 3.2 – Energy

Electronic components and systems (ECS) are key to future energy systems being optimised in both design and operation, for high efficiency, substitution to zero emission technologies, low CO<sub>2</sub>-emissions, cost, and security of supply.

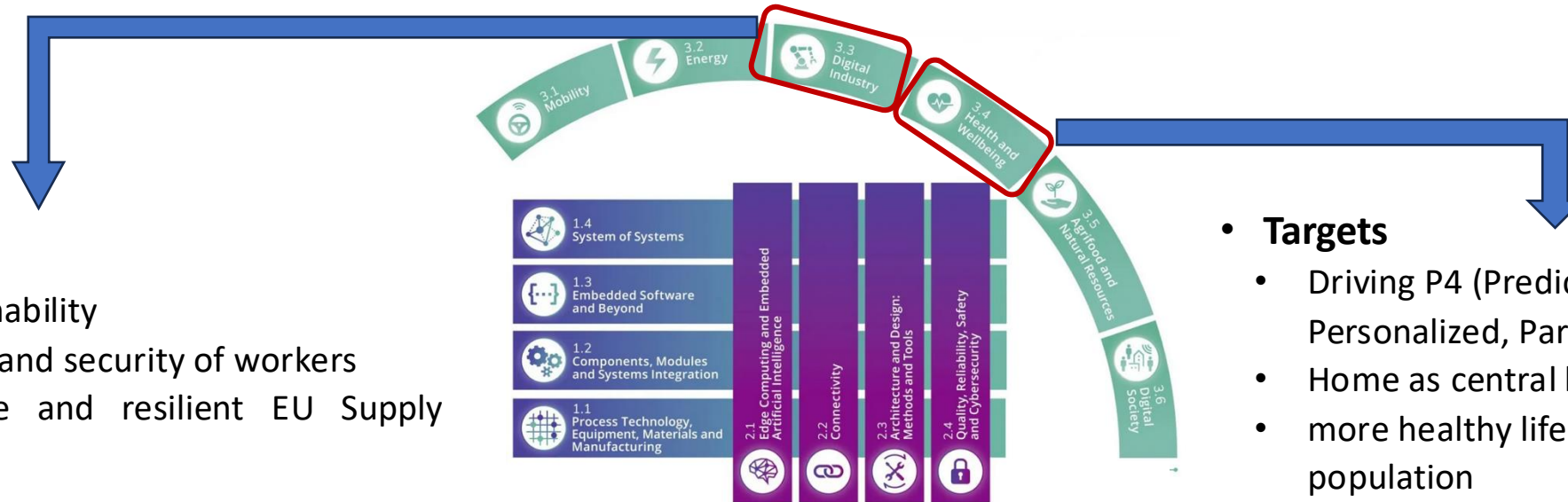


IEA (2024), CO<sub>2</sub> Emissions in 2023, IEA, Paris <https://www.iea.org/reports/co2-emissions-in-2023>, Licence: CC BY 4.0



# Ch. 3.3 - Digital industry & Ch. 3.4 – Health and Wellbeing

Impact of introduction of cutting-edge digital technologies



## • Targets

- Sustainability
- Safety and security of workers
- Flexible and resilient EU Supply Chains

## • Key ECS research threads

- Trustworthy, responsible AI, XR and robotics
- Exploitation of next generation HW architectures and new chip design (e.g. RISC-V, PIC)

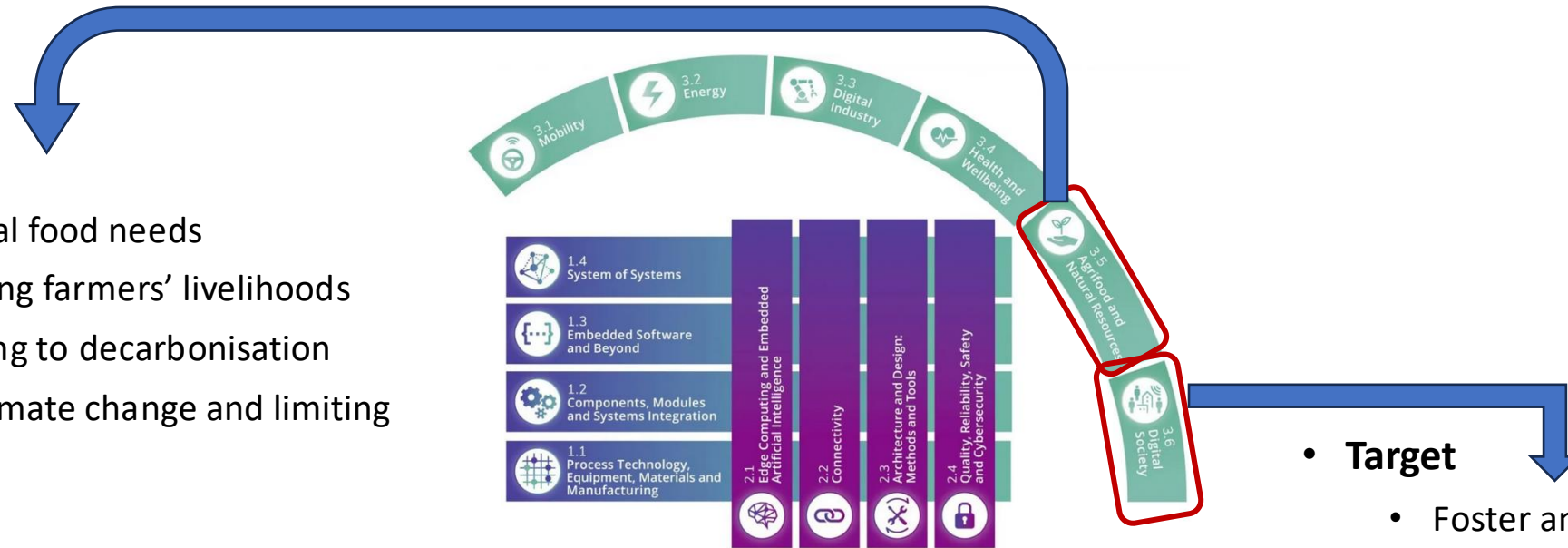
## • Targets

- Driving P4 (Predictive, Preventive, Personalized, Participatory) medicine
- Home as central location of care
- more healthy life years for an ageing population

## • Key trends

- MedTech and Pharma moving towards comprehensive healthcare platforms using smart devices, remote monitoring, data analytics, and AI
- Blurring the boundaries between Pharma, MedTech, and Chips companies, fostering cross-industry collaboration

# Ch. 3.5 – Agrifood and natural resources & Ch. 3.6 – Digital Society



## • Targets

- Meet global food needs
- Safeguarding farmers' livelihoods
- Contributing to decarbonisation
- Slowing climate change and limiting its impact

## • Accelerate the deployment of smart systems in agriculture, food production, natural resources and ecosystems

- Increase electrification and use of agrivoltaics solutions
- Increase the development of agroforestry
- Introduce IoT solutions based on AI
- Provide education and agriculture-based services
- Reducing food loss and waste

## • Target

- Foster an inclusive, sustainable, and resilient society

## • Trends

- Digitisation
- Use of AI-based tools (such as ChatGPT, ...)
- Increasing need to protect against fake video and audio
- Increasing importance of cybersecurity

# Ch. 4 - Long Term Vision Chapter

**Identify the research subjects that need to be addressed now at low TRL in order to feed the pipeline of innovation of the European ECS ecosystem in the longer term**

- **Major topics:**

- Sustainability
  - Energy, power, water in chemical processes
  - Recyclable devices
  - Environmental aspects
  - Innovative materials
- Quantum technologies and enabling ECS
- Distributed intelligence (includes "Distributed AI", "Embedded AI", etc.)
- Connectivity (Information transfer, connectivity for system integration, security issues)
- Non-conventional computing and storage devices
- Advanced packaging and heterogeneous integration technologies and tools
- Autonomous systems
- Resilient (robotic) applications
- Supply chain issues

# ECS-SRIA 2026

# ECS-SRIA 2026

- **ECS-SRIA 2026 Chaired by EPOSS**
  - Elisabeth Steinmetz – vdivde-it
  - Christoph Hesse - vdivde-it
- K.O. hold on 19/02/2025 – ECS Brokerage Event.
- **Confirmed the important role for our community, Chips JU and Xecs.**
- **High visibility and reputation / world-wide recognition.**
- EC estimates the high level of content but is **missing strategic guidance and priority setting** by the ECS-SRIA.
- The influence of the ECS SRIA as basis for the bottom-up calls in the Chips JU was reduced during the last years (more and more Focus Topic Calls and larger investments in the Chips 4 EU initiative).



# Change request process overview

## Open consultation

The community can submit change requests to the ECS-SRIA team through an online form during a consultation period (...)

- All changes are collected in a tracking system
- Approval and implementation status is tracked
- Chapter teams and Core team use the request form as well
- After the consultation period, the changes are reviewed and aligned
- The rest of the yearly process remains similar to the previous years

# The change request submission form

- Where to find it: In the ECS SRIA 2025 view
- What can be submitted:
  - Contact information
  - Formatted text including images
  - Sub-Chapter
  - Affected additional chapters
- Security check
- At each request, a new excel is created with all requests up to now.
- Email is sent to two chapter leaders

# The change request submission form (2)

ECS — Strategic Research and Innovation Agenda

Home

ECS SRIA 2025 ▾

ECS SRIA 2024 ▾

ECS SRIA 2023 ▾

Change History

Contributors

Search

ECS SRIA 2025

Introduction & Overview

Outline

1. Foundational Technology Layers

1.1 Process Technology, Equipment, Materials And Manufacturing

1.2 Components, Modules And Systems Integration

1.3 Embedded Software And Beyond

1.4 System of Systems

2. Cross-Sectional Technologies

2.1 Edge computing and embedded Artificial Intelligence

2.2 Connectivity

2.3 Architecture and Design: Method And Tools

2.4 Quality, Reliability, Safety And Cybersecurity

3. ECS Key Application Areas

3.1 Mobility

3.2 Energy

3.3 Digital Industry

3.4 Health & Wellbeing

3.5 Agrifood And Natural Resources

3.6 Digital Society

4. Long-Term Vision

5. Appendix A

6. Appendix B

6.1 Acronyms used in the document

6.2 Glossary

6.3 Main objectives: An analysis of all major challenges

Submit Your Feedback

Feedback submission opens on April 1, 2025.

We appreciate your feedback. Click the button below to open the form.

Open Feedback Form

2 CROSS-SECTIONAL TECHNOLOGIES

Chapter 2.1

Chapter 2.2

Chapter 2.3

Chapter 2.4

2.1

Edge Computing and Embedded Artificial Intelligence

2.1.1 Summary

Edge computing and embedded AI are crucial for advancing digital technologies while addressing energy efficiency, system complexity, and sustainability. The integration of AI into edge devices offers significant benefits across various sectors, contributing to a more efficient and resilient digital infrastructure, keeping privacy by processing sensible data locally. Distributed computing forms a continuum from edge to cloud, with edge computing processing data close to its source to improve performance, reduce data transmission, latency and bandwidth, enhance safety, security and decrease global power consumption. This directly impacts the features of edge systems.

AI, especially embedded intelligence and Agentic AI, significantly influences various sectors such as productivity, environmental preservation, and transportation, enabling for example autonomous vehicles. The availability of new hardware technologies drives AI sustainability. Open-source initiatives are crucial for innovation, cost reduction, and security.

Embedded AI hardware was principally developed for perception tasks (vision, audio, signal processing) with high energy efficiency. But generative AI is also emerging at the edge; first fueled by smartphones and computers (Copilot+PC, Apple Intelligence) with the need to be able to process most of the data locally and adapting to the user's habits (fine tuning performed at the edge), and will extend into other edge applications (robotics, interfaces, high level perception of the environment). This drives new constraints not only for computing parts, but also to improve memory efficiency.

The Major Challenges are:

1. Energy Efficiency: Developing innovative hardware architectures and minimizing data movement are critical for energy-efficient computing systems. Memory is becoming an important challenge as we are moving from a computing-centric paradigm to a data-centric (driven by AI). Zero standby energy and energy proportionality to load is essential for edge devices.
2. System Complexity Management: Addressing the complexity of embedded systems through interoperability, modularity, and dynamic resource allocation in a safe and secure way. Web technologies cascade to edge (containerization, WASM, protocols, ...) forming a continuum of computing resources. Using a federation of small models in a Mixture of Agents or Agentic AI instead of a very large model allows to better manage complexity and modularity while using fewer computing resources.
3. Lifespan of Devices: Enhancing hardware support for software upgradability, interoperability, and second-life applications. This will require hardware that can support future software updates, increasing memory capabilities, and communication stacks. Aggregation of various devices into a "virtual device" will allow older devices to be still useful in the pool.
4. Sustainability: Ensuring European sustainability by developing solutions aligned with ethical principles (for embedded AI) and transforming innovations into commercial successes (for example, based on open standards, such as RISC-V, and for innovative solutions such as neuromorphic computing). Europe should master all steps for new AI technologies, especially the ones based on collaboration of AI agents.

2.1.2 Scope

This chapter focuses on computing components, and more specifically on embedded architectures, edge computing devices and systems using Artificial Intelligence (AI) at the edge. These elements rely on process technology and embedded software, and have constraints on quality, reliability, safety, and security. They also rely on system composition (systems of systems) and design and tools techniques to fulfill the requirements of the various application domains.

Furthermore, this chapter focuses on the trade-off between performances and power consumption reduction, and managing complexity (including security, safety, and privacy<sup>1</sup>) for embedded architectures to be used in different applications areas, which will spread edge computing and AI use and their contribution to European sustainability<sup>2</sup>.

This chapter mainly covers the elements foreseen to be used to compose AI or edge systems:

Submit Your Feedback

Feedback submission opens on April 1, 2025.

We appreciate your feedback. Click the button below to open the form.

Open Feedback Form

Open consultation start date to be confirmed!

# The change request submission form (3)

The screenshot shows a web page for the ECS Strategic Research and Innovation Agenda 2025. A feedback form is overlaid on the page. The form has a title 'Feedback Form' and a close button. It includes a notice: 'Feedback can be submitted from March 28, 2025 to May 14, 2025.' The form fields are: Name (required), Organisation (required), Email Address (required), Chapter Selection (required, dropdown menu with 'Introduction & Overview' selected), Sub-Chapter (required, dropdown menu), Other relevant chapters (optional), and Your Feedback (a rich text editor with a toolbar). Below the feedback field is a math question: 'Math question \* 2 + 0 =' and a text input field. At the bottom is a 'Submit' button. The background page shows a sidebar with '2 CROSS-SECTIONAL THEMES' and 'Chapter 2.1 Edge Computing'.

ECS — Strategic Research and Innovation Agenda

Change History Contributors

2 CROSS-SECTIONAL THEMES

Chapter 2.1

2.1 Edge Computing

2.1.1 Summary

Edge computing and embedded AI are contributing to a more efficient performance, reduce data latency, and improve security. AI, especially embedded in edge devices, drives AI sustainability. Embedded AI hardware was developed with the need for a low-power environment). This drives the development of edge computing. The Major Challenges are:

1. Energy Efficiency: Developing a paradigm to a data-centric paradigm.
2. System Complexity Management: (protocols, ...) forming a complex system.
3. Lifespan of Devices: Ensuring the aggregation of various devices.
4. Sustainability: Ensuring innovative solutions such as edge computing.

2.1.2 Scope

This chapter focuses on edge computing, software, and have constraints. Furthermore, this chapter covers applications areas, which will spread edge computing and AI use and their contribution to European sustainability<sup>2</sup>. This chapter mainly covers the elements foreseen to be used to compose AI or edge systems:

Feedback Form

Feedback can be submitted from March 28, 2025 to May 14, 2025.

Name \*

Organisation \*

Email Address \*

Chapter Selection \*

Introduction & Overview

Sub-Chapter

Other relevant chapters (optional)

Mention other chapters this feedback relates to, separated by commas.

Your Feedback

Please enter your feedback.

Math question \* 2 + 0 =

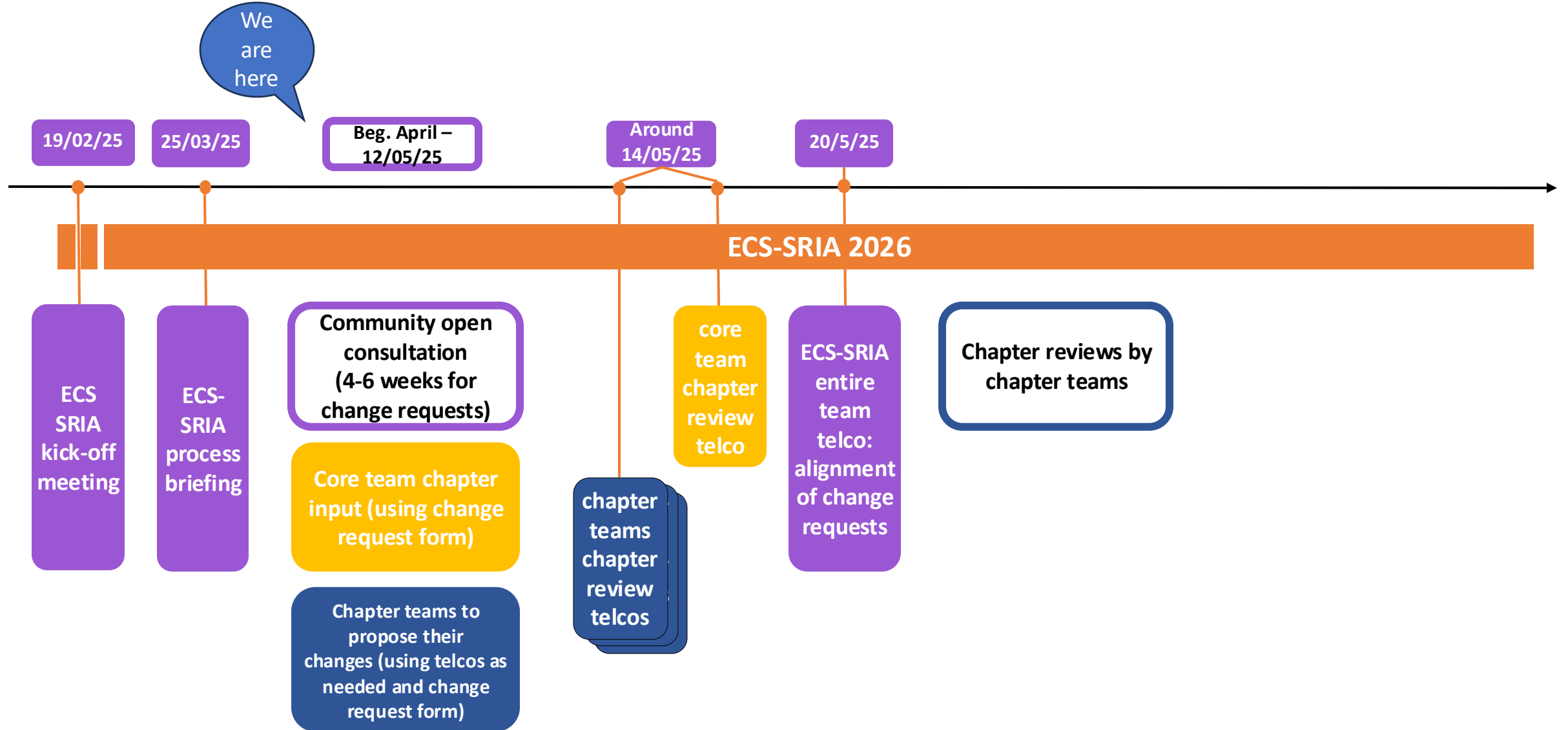
Solve this simple math problem and enter the result. E.g. for 1+3, enter 4.

This question is for testing whether or not you are a human visitor and to prevent automated spam submissions.

Submit

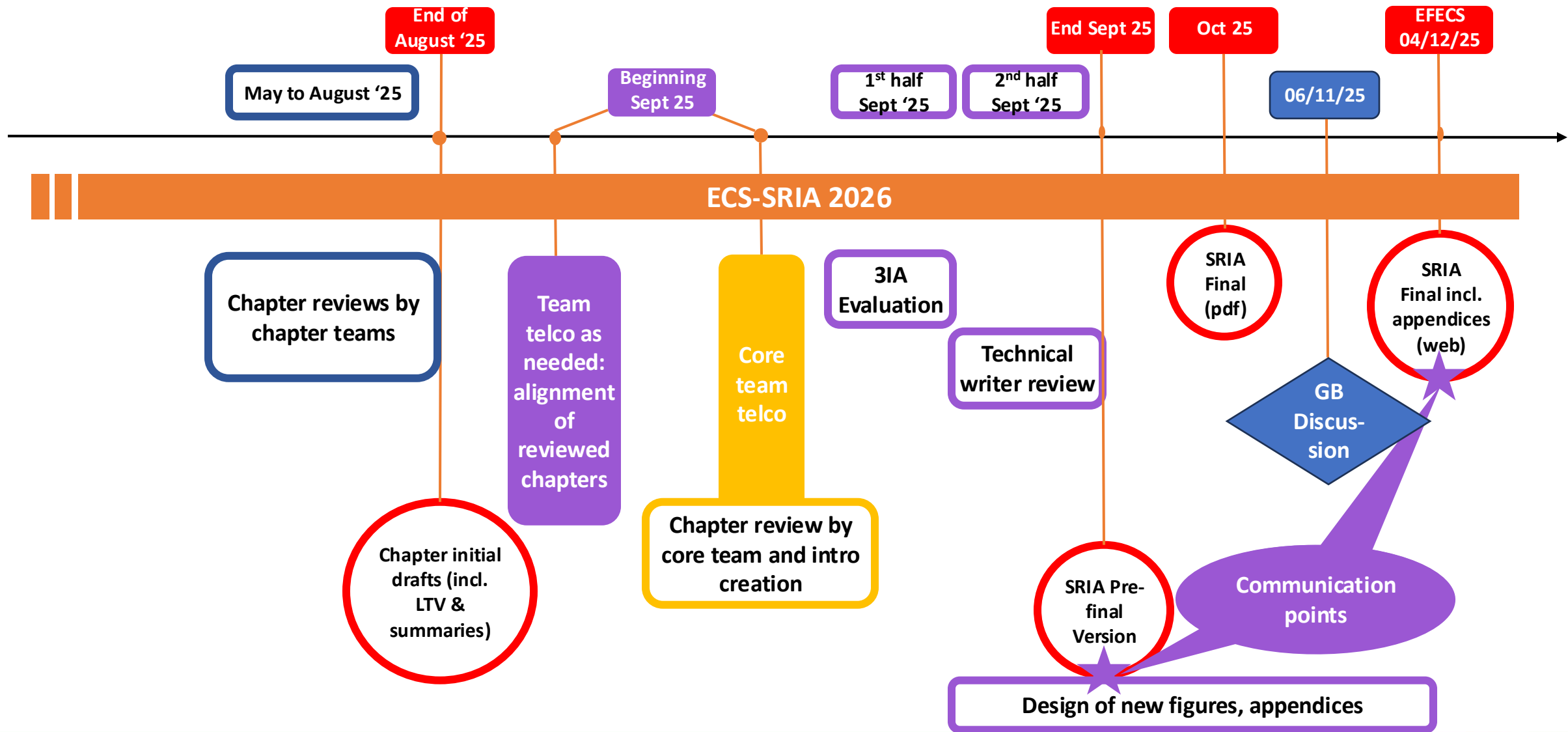
The feedback form includes a WYSIWYG editor, allowing to provide text in a rich format and include also images.

# ECS SRIA 2026 Timeline - 1





# ECS SRIA 2026 Timeline - 2 - preliminary



**Thanks for you attention**