



PLATFORMS  
4CPS



## Recommendations for future research priorities and future innovation strategies

Final Consultation Event – CPS Innovations for the Future

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# Platforms4CPS Recommendations

Platforms4CPS has identified recommendations in 4 key areas:

- Research priorities
- Supporting innovation needs
- Societal and legal issues that need addressing
- Strategic business support

In order to grasp CPS business opportunities there is a need to address these 4 key areas to ensure that:

- The right technology areas are supported
- There is successful transfer of new ideas to European companies via innovation mechanisms
- Societal concerns which are barriers to uptake of new technologies such as trust, privacy, regulation, liability, and security of employment are addressed
- European citizens can rely on trustable systems

## Timeframe: short term and longer term actions

**Short term:** Platforms4CPS findings fully support H2020 actions and Digitising European Industry strategy, particularly

- creation of a pan-European network of Digital Innovation Hubs to engage with SMEs
  - further broaden actions, improve coverage of DIHs in EU13, foster co-ordination of national and regional initiatives
- supporting partnerships, digital platforms and standards
  - encourage uptake of new platforms by SMEs via DIHs, fund further showcase experiments and large-scale pilots, harmonise and synchronise standardisation activities across Europe
- supporting regulatory frameworks
  - for applications exploiting data, to address liability issues, particularly in AI and autonomous systems, for certification for cybersecurity

## Timeframe: short term and longer term actions (ctd.)

**Longer term** actions address Horizon Europe, linking with new ideas such as the Edge 2030 vision.

Platforms4CPS workshops have identified a number of emerging themes:

- AI and autonomous systems: need for understandable and accountable systems that act ethically
- Trust and acceptance: high-quality software, better usability, resistance to cyber attacks, explainable AI technologies
- Processing at the Edge: to support localised intelligence, guarantee safety and predictability, data privacy and security
- Sovereignty across key value chains, e.g. Aerospace and Automotive

## Research Priorities

- **CPS Engineering: manage complexity of CPS**
  - at both the design stage and in the operation of systems
  - to provide trustworthy systems for the future
  - heterogeneous components and complex interactions with humans
  - requires new approaches to Systems Engineering for CPS: “Science of Design for CPS”
  
- **Co-engineering of CPS system-level attributes**
  - particularly safety, security, performance and usability
  - need to link these attributes to manage traceability in the product lifecycle and deal with trade-offs between conflicting attributes.
  - automation can be used to track the impact of system changes during the product lifecycle
  - strong linkages with incremental certification and agile system engineering.

## Research Priorities (ctd.)

- **Gaining a lead in “Edge Computing”**
  - the ability to move processing to local assets allows systems to react promptly in time-critical applications, e.g. autonomous driving.
  - coupled with increasing concerns over privacy and security makes edge processing highly advantageous.
  - requires development and demonstration of high performance computing, energy efficient computation for battery and energy harvesting powered operation and new computing techniques such as neuromorphic computing.
  
- **Humans as integral part of a CPS** interacting with the system in a number of ways
  - intensified interaction and collaboration between CPS and humans with intuitive, assisting systems and humanoid robots
  - systems need to predict and adapt to human needs, preferences and capabilities.
  - need for research and development to cross silos with respect to disciplines such as biology, computing, ethics and engineering in a variety of application domains.

# Research Recommendations

Grand Challenge	Recommendation	Potential Implementation
<b>Trustworthy CPS for Autonomous and Smart AI – Societal Scale CPS</b>	Develop a science of design for CPS with multiple links to application domains	Create a platform for trustworthy CPS, e.g. through a €20M action aiming at defining the SRIA for a Science of Design for CPS, with focus on lower TRL, more fundamental multi-domain research
<b>Co-engineering of CPS system attributes</b>	Advance techniques to manage and automate traceability and trade-off optimisation between safety, security, performance and usability	Establish a research field for co-engineering. Benefits include faster certification, system integration and modification
<b>CPS Edge Computing</b>	Support research actions on edge computing algorithms and architectures	Develop a platform for edge computing and promote this via demonstrators
<b>Humans-in-the-Loop</b>	Address the complex interactions between humans and systems with increasing autonomous functionality	Fund multi-disciplinary research that brings together human factors and CPS engineering

# Innovation Recommendations

- Address innovation barriers by **expanding EU innovation initiatives** such as I4MS and SAE
  - Digital Innovation Hubs, clusters and regional initiatives need to work together and engage with SMEs to support innovation and transfer of technology
  - develop further and expand DIHs to connect fragmented national and regional initiatives that exist
  - One such approach could be to establish a CERN-like CPS vehicle to
    - coordinate the implementation of an overarching research agenda on design and engineering of CPS.
    - create strong links between competence, demonstration, and innovation centres on an EU scale and showcase experiments and large-scale pilots
- **Support development of new tools and toolchains** to address complexity of developing dependable high-quality CPS
  - Agile (open source) platforms as well as the federation of platforms will be needed that can integrate new and legacy systems.
  - Needs development of toolchains that can support all aspects of the development cycle from design to testing and roll-out of new systems.
  - As systems will evolve over time there will also be a need to continually support systems as new functionality is incorporated.





## Innovation Recommendations (ctd.)

### ▪ Revitalise EU engineering education

- to counter the lack of engineers and skills to support future digitalisation in Europe.
- provide continual education and training for existing employees
- support the new skills that need to be developed
- the role and status of engineering needs to be raised and promoted to society
- incentives are required to encourage students to pursue STEM skills
- provide multi-disciplinary engineering background particularly at the further education level
- incorporating CDIO (Conceive Design Implement Operate) ideas with support from industry in the development of curricula

# Innovation Recommendations

Grand Challenge	Recommendation	Potential Implementation
Defragmentation/Collaboration	Link existing activities to boost communication, avoid fragmentation and silos	Support Digital Innovation Hubs, training, and coordinate via a CERN-like vehicle
Improve the uptake of Technology in CPS Industrial Processes	Build supportive approaches to migrate existing industrial engineering processes allowing swifter time to market for technologies	Joint-venture funding and incentives that support and document the evolution of new technologies
CPS Engineering, Interoperability, Complexity	Foster development of European tool chains for CPS	Coordinate projects to develop CPS toolchains via the CERN-like organisation
Skills/Competence Provision EU Competitiveness	Revitalise EU Engineering education and raise the status of engineering, embracing multi-disciplinarity	Provide incentives for engineering education based on best established practices such as CDIO (Conceive Design Implement Operate)



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