

Session – Forum Innovation 2025

Complex Products and Systems (CoPS): Innovation Issues and Industrial Dynamics

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Description of the theme:

Complex Products and Systems (CoPS) are capital-intensive goods that are mainly characterized by high complexity (numerous components and integration) and high costs. In addition, the literature identifies other specific characteristics often ascribed to these systems, such as the fact that they are high-tech and produced in low volumes. Essential in infrastructure and strategic industries, CoPS are also heavily regulated and influenced by public policy. Common examples of CoPS include telecommunications networks, power generation systems, aircraft and spacecraft, security and defense systems, and semiconductor production lines.

Unlike mass-market consumer goods (MMCG), CoPS require the integration of technological capabilities, a high degree of customization, and close collaboration between companies, public institutions, and research centers. They also involve long innovation cycles and high barriers to entry.

Since the seminal work of Hobday (1998), Davies and Hobday (2005) and Acha et al. (2004), research on CoPS has developed by studying the impact of their characteristics on innovation dynamics. The work carried out has shown that CoPS contexts have significant differences from MMCG in various areas such as innovative project management, intra-organizational collaboration, skills management, technological catch-up strategies in emerging economies, and the role of innovation ecosystems. In this context, this session of the Innovation 2025 Forum aims to summarize the state of the art, to consider the new innovation challenges

specific to CoPS, and to take into account the transformations that certain CoPS are undergoing (notably in the space sector) through the treatment of the following themes.

1. How to manage innovation in long development cycles?

CoPS require several years (or even decades) of development.

- How can technological innovations be integrated without compromising the stability of the project?
- What mechanisms can be used to test and introduce improvements along the way (e.g. rapid prototyping, systems engineering)?

2. What is the strategy between incremental and radical innovation?

- Should we opt for incremental improvement of existing technologies or a technological breakthrough (e.g., electric aircraft vs. jet aircraft)?
- How can we prevent innovation from slowing down production and industrialization times?

3. How can CoPS innovation be financed and made profitable?

- What are the viable business models for amortizing R&D costs (subsidies, public-private partnerships, advance orders)?
- How can we justify massive investments when the benefits are often long term?

4. How can we deal with uncertainty and technological risk?

- How can we anticipate technological failures and integrate them into innovation processes (e.g. simulations, artificial intelligence)?
- What methods can be used to limit delays and cost overruns?

5. How can we foster collaborative innovation in an ecosystem of partners?

CoPS often involve multiple companies, universities, and governments.

- How can we organize open innovation while protecting know-how?
- What models of cooptation (cooperation + competition) allow us to innovate without losing our competitive edge?

6. What is the impact of emerging technologies (AI, IoT, quantum) on CoPS?

- How can artificial intelligence improve CoPS design and maintenance?
- What is the role of new human-machine interfaces (augmented reality, digital twins) in innovation?

7. How can CoPS be made more sustainable and ecological?

- How can we integrate sustainability criteria already in the design phase (recyclable materials, energy efficiency)?
- Which innovation models promote a circular economy in high-tech industries?

8. How can we standardize innovation without hindering differentiation?

- CoPS are often unique, but how can certain modules be reused to reduce development time and costs?
- Which international standards can reconcile innovation and interoperability?

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