MBSE : Past developments & Future trends

Our 15-year feedback

Dec 2024

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MBSE : Past developments & Future trends

PROGRESSION OF MBSE AT OUR CLIENT'S ORGANISATIONS

As a training and consulting company in MBSE, we have been **privileged observers** of the **progression of MBSE at our clients' organisations**, from the first uncertain steps of Systems approach to the implementation of interconnected modelling tools.

In this presentation, we intend to :

Share our feedback on the evolution of MBSE practices over time

Present our vision of future stakes and associated challenges

2000 **2025** **2030+**

Analysis made on 30 companies (logos for illustration only)

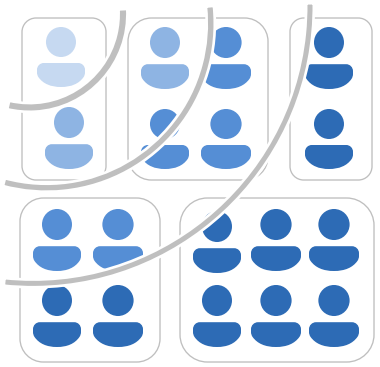
We fed our analysis on what we observed in the **companies** we have been working with for the past 15 years.

This survey is based on the aggregation of data collected from **30 SBF120 companies** in France, mainly in the **Aeronautics, Automotive, Defence and Energy** industries.

Measuring MBSE progression : how we proceed

PROGRESSION OF MBSE AT OUR CLIENT'S ORGANISATIONS

In order to describe the evolution of MBSE practices within companies, we used **following methods**:



To assess the advancement of MBSE mastery and utilization within companies, we chose to represent it through
the penetration of MBSE through the various divisions of one company :

Academic/ Research → **Methods & Tools Level** → **Systems Design Level** → **Engineering Level** → **Enterprise Level**

The components of the MBSE having not progressed in the same way, we chose to display the progression of each component separately

Systems Engineering **Method & Framework** | Modelling **Language** | Modelling **Tools**

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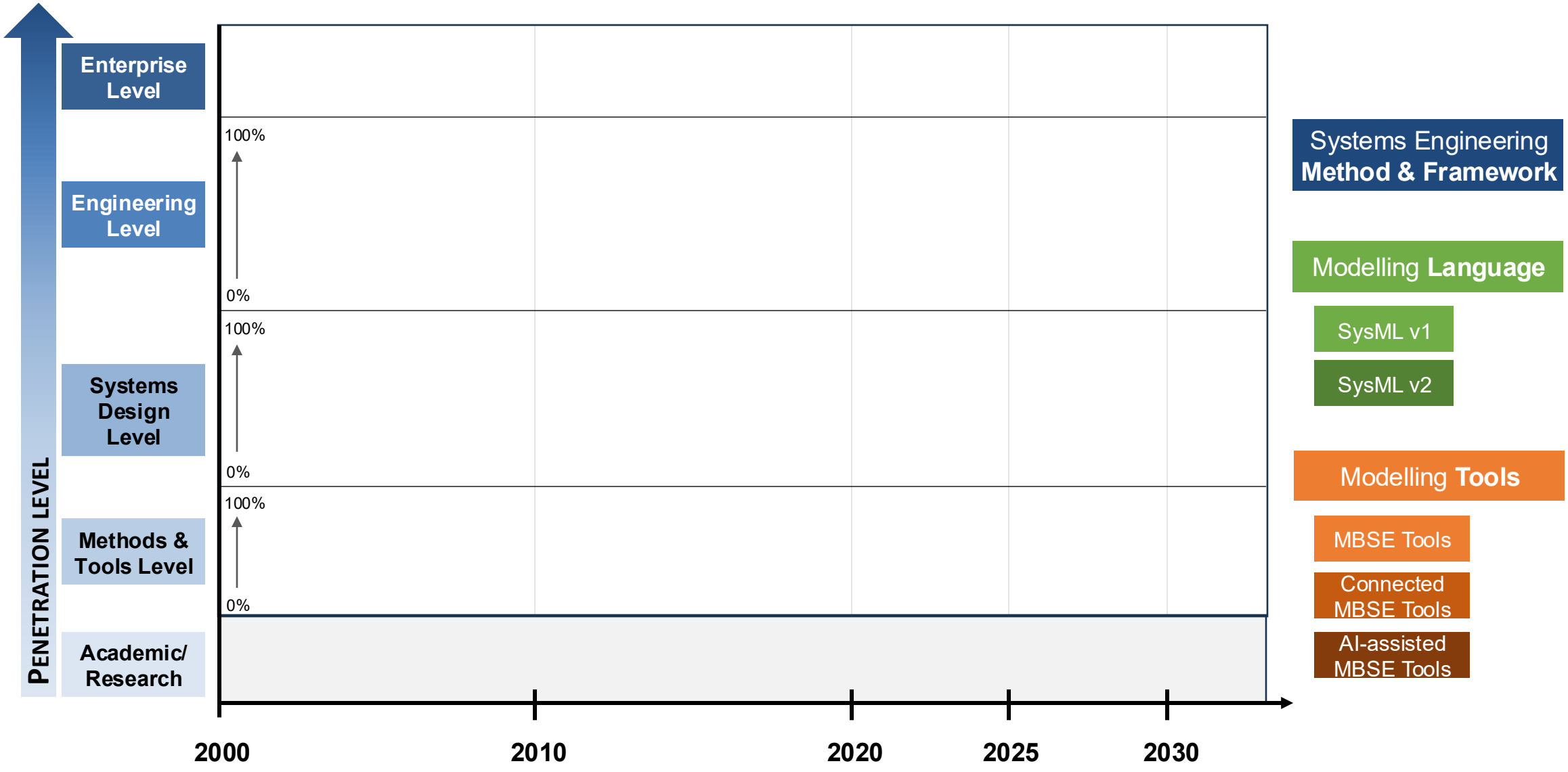

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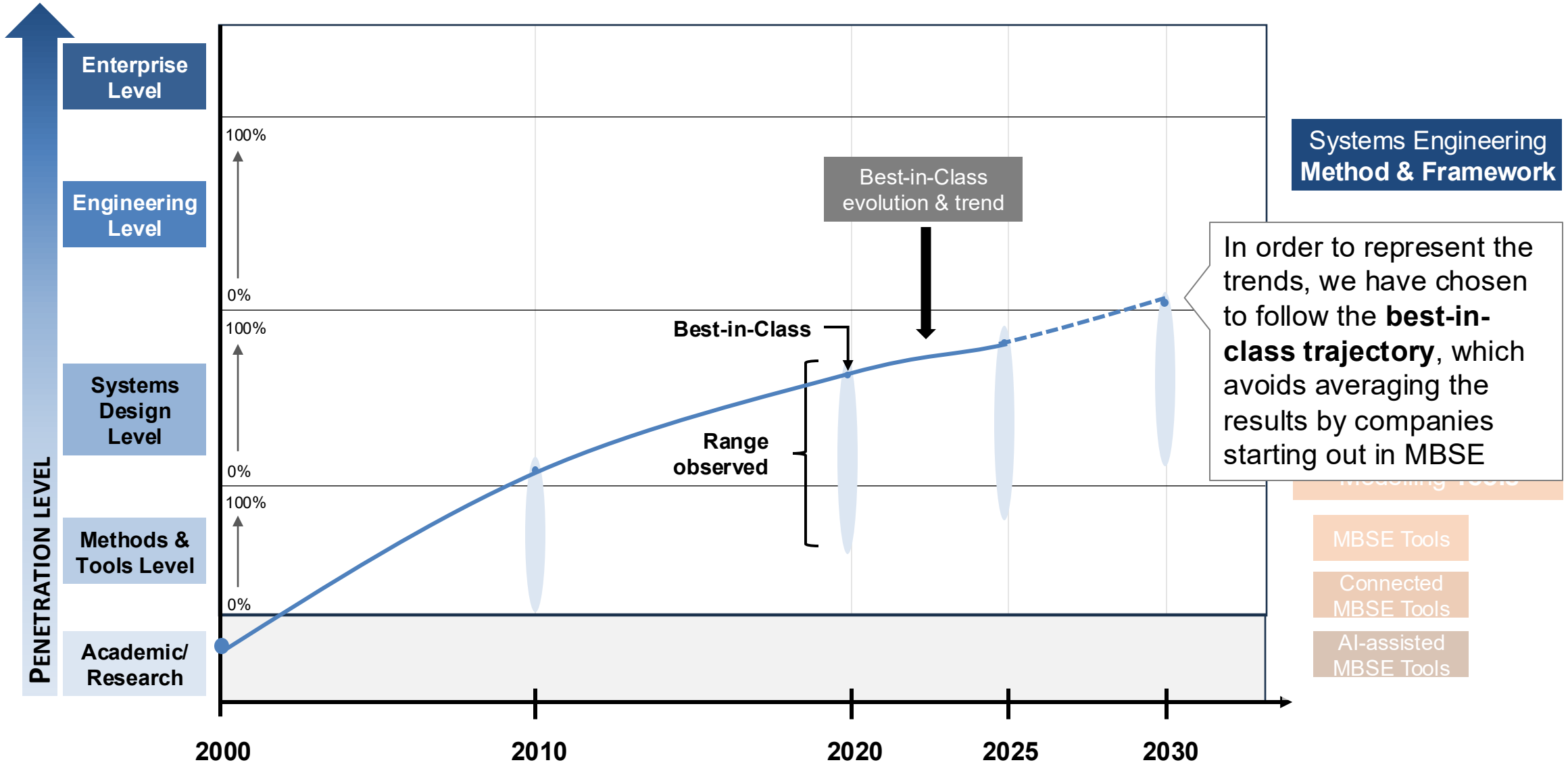

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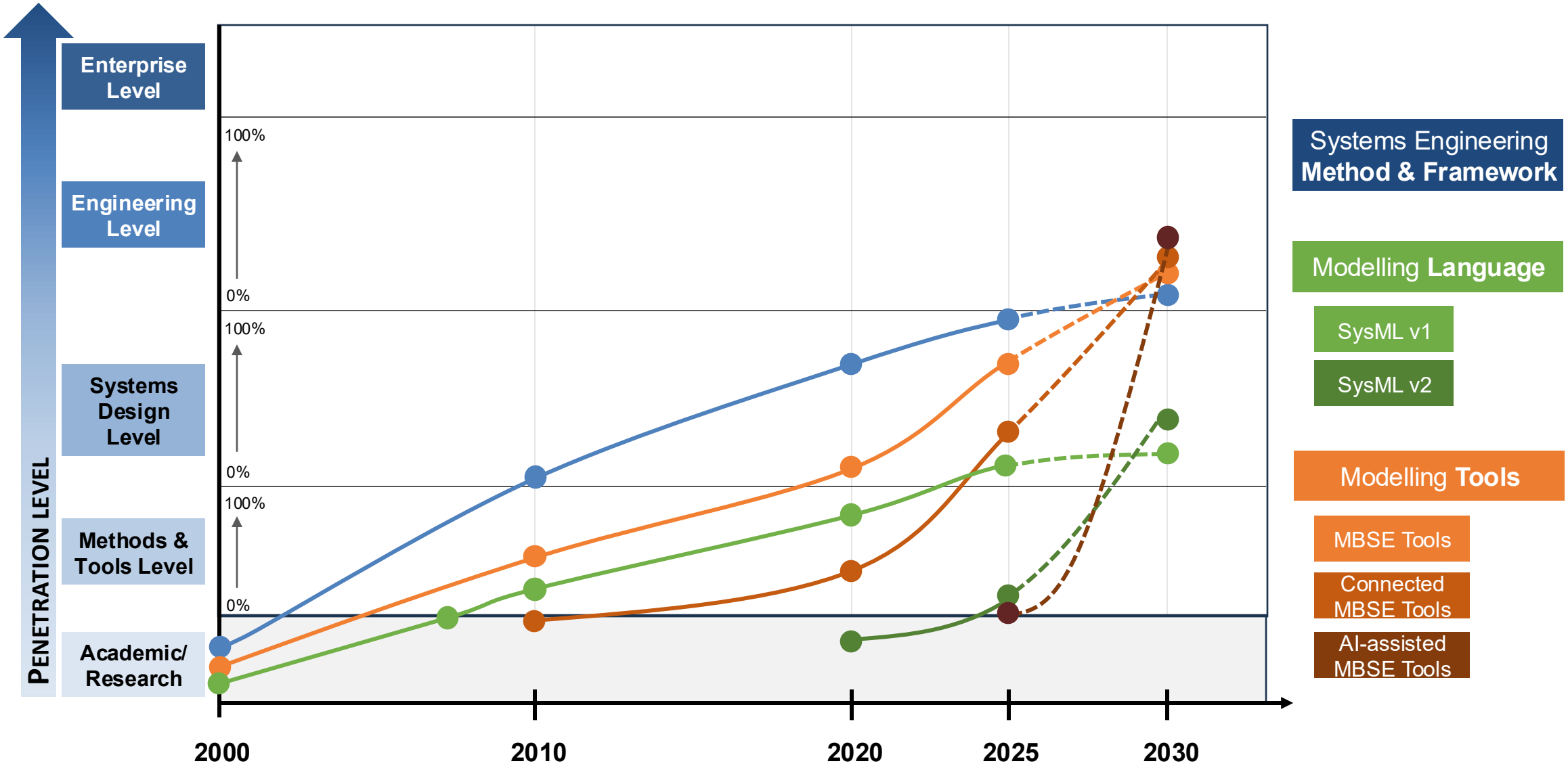
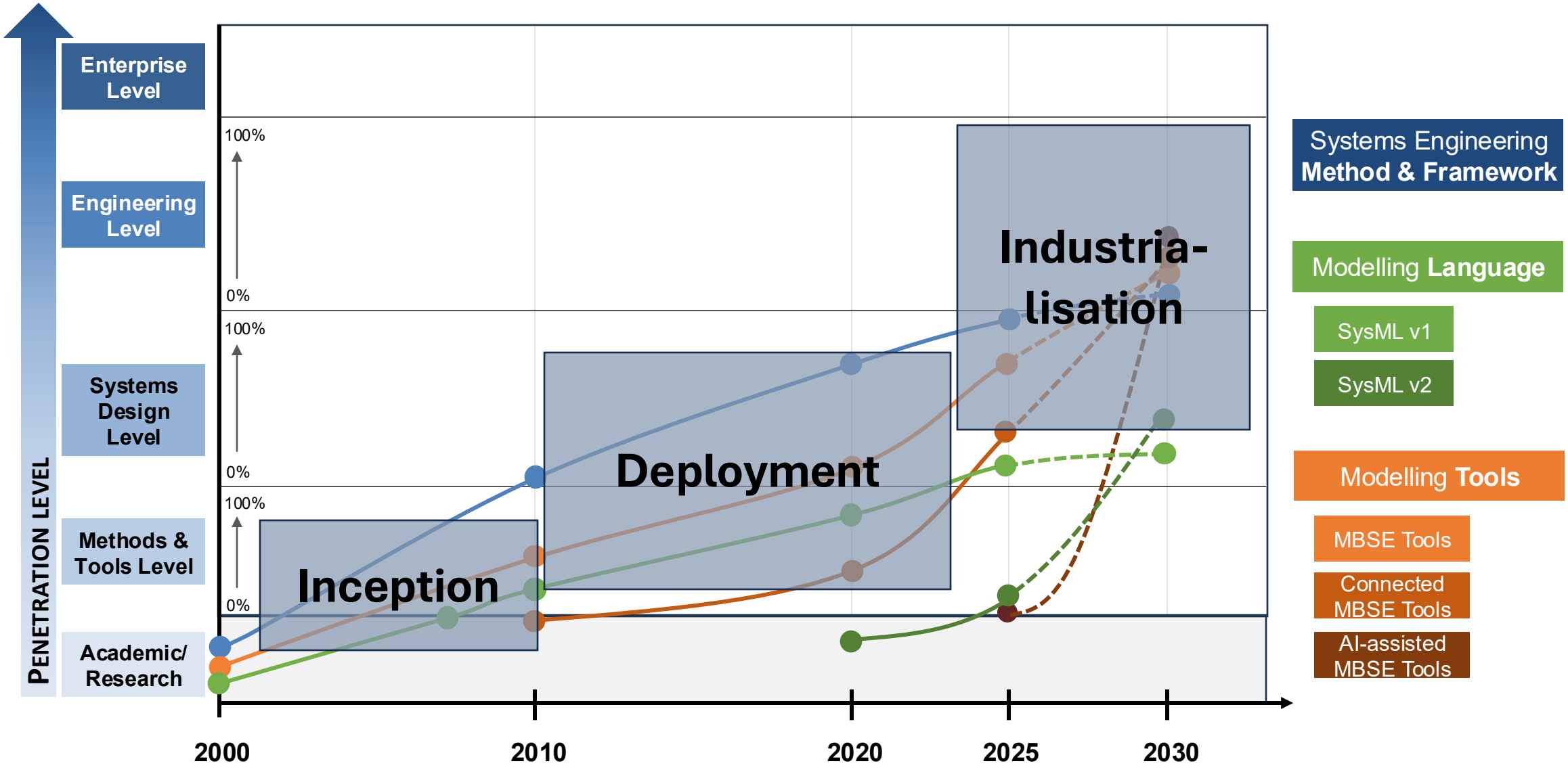
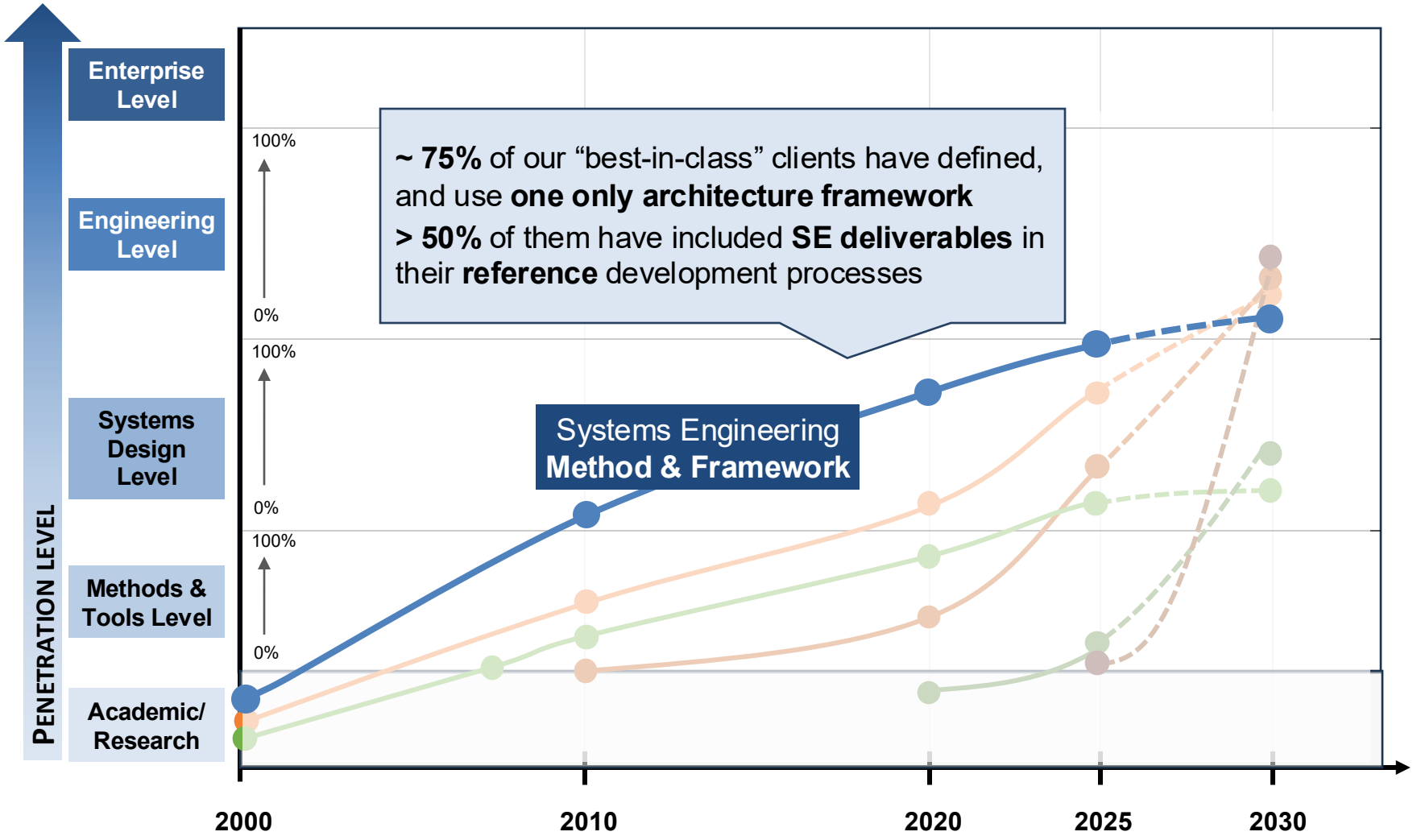


MBSE : From Inception to Industrialisation



1. Methods & Framework as a sustainable asset



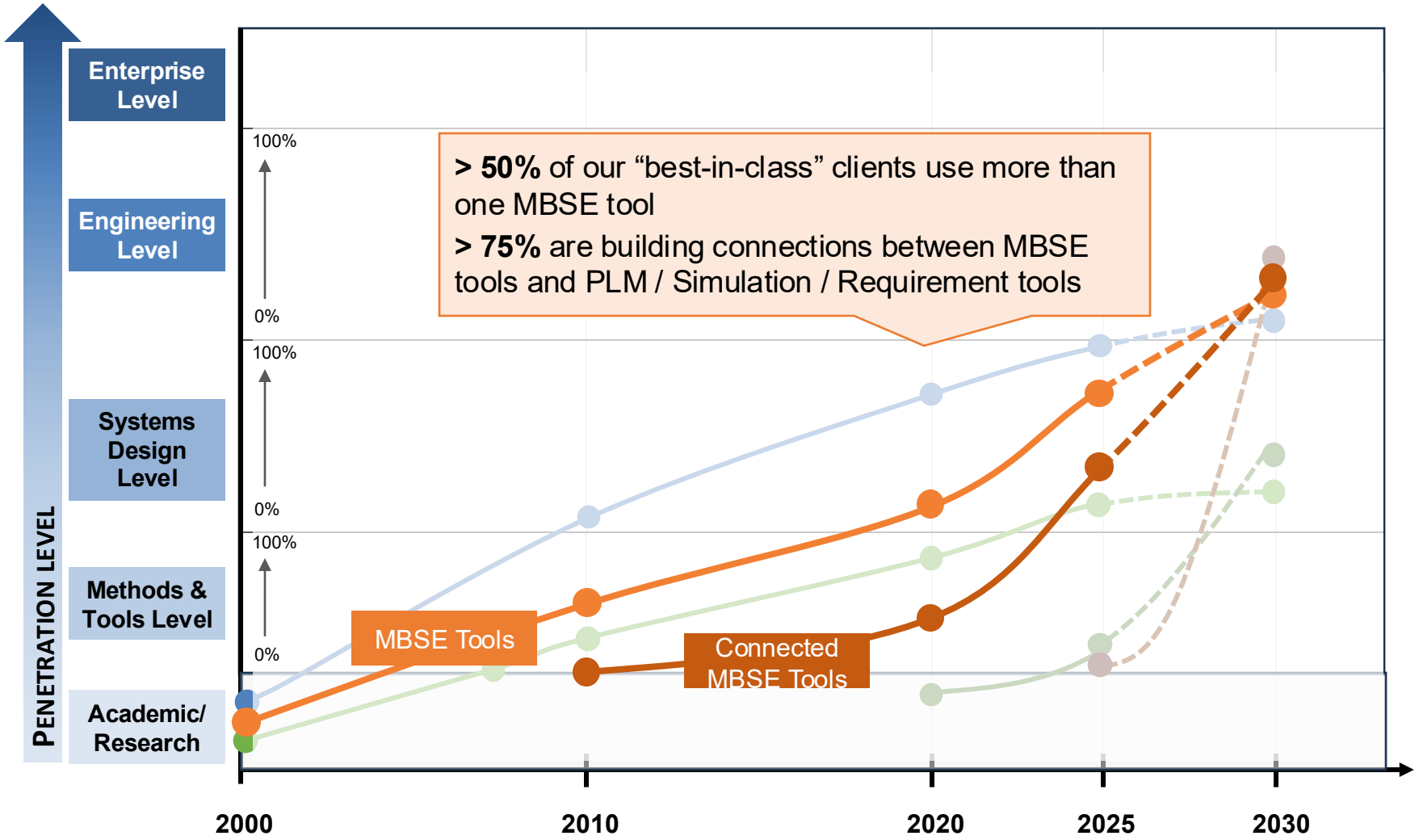
We observed a **stable and continuous increase** in use and mastery of system engineering **methods and frameworks**.

→ **Core methods & framework** remains **an island of stability compared to the evolution of the tools and is a <u>sustainable asset</u>**

Next challenge is the **adoption by the Engineering community**

→ In order to break into the engineering world, the **user-friendliness of SE (Methods, framework) will be key** because shared by people with no system design background

2. From SE-Modelling tools to Engineering toolchain



Between 2010 and 2020, we observed a **timid take-off** of modeling tools, even **slowdowns and reluctances**.

Since 2020, the use of tools took off, particularly due to ***the digital transformation shift*** :

- the need for **connecting engineering data exceed the needs for optimizing systems engineering**. MBSE becomes a way to connect data more than a intrinsic way of designing systems.
- The need for an intrinsically efficient (stand-alone) MBSE tool become less important than having a **complete toolchain**

Next challenge :

→ **Moving up one systemic level (enterprise architecture)**

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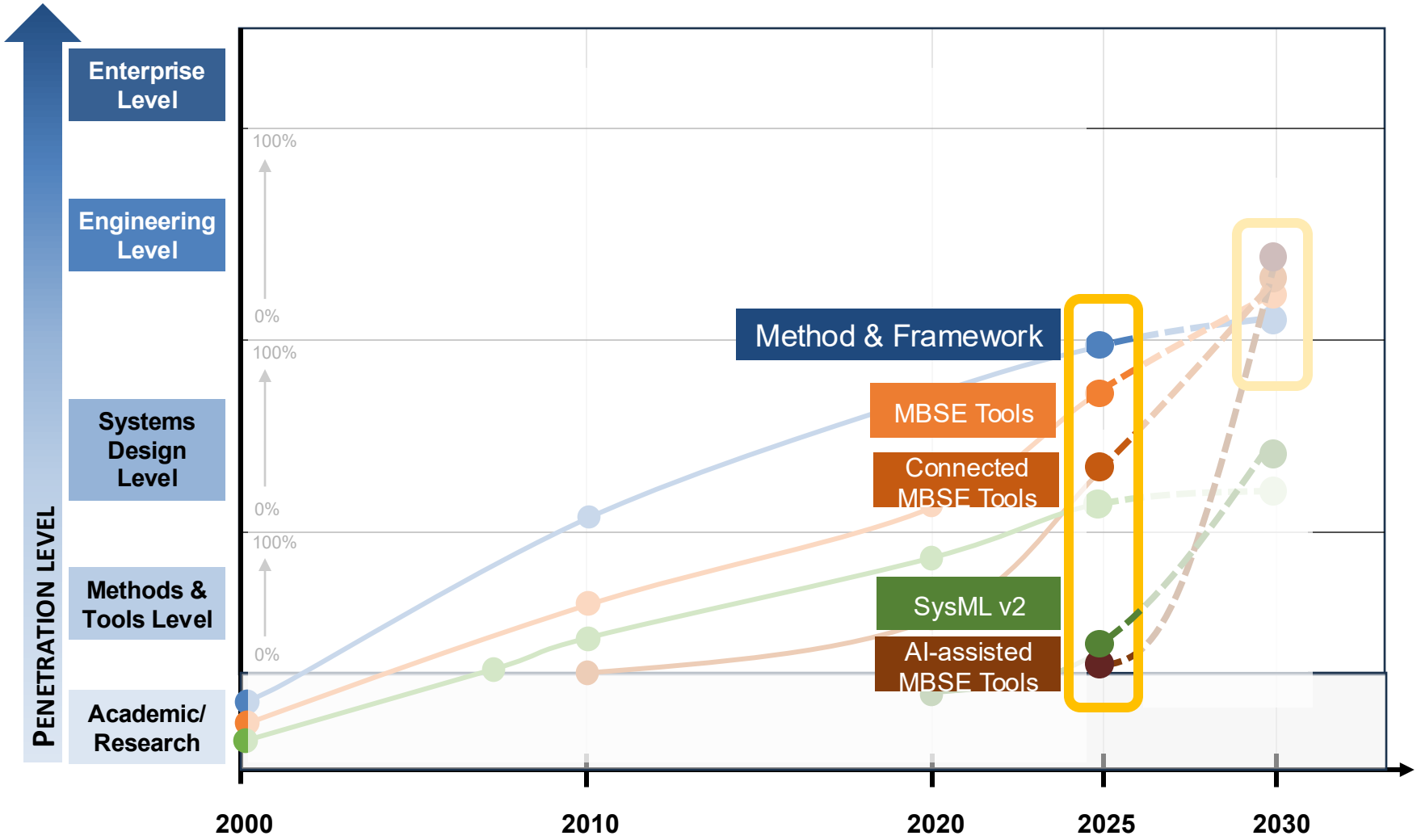
3. Industrialisation of MBSE



Until today, we have seen more people mastering system engineering concepts than users of modeling tools

With the democratization of MBSE tools, as well as the rise of **SysML2** which will help promote the advent **of AI techniques** to generate content more easily, **the number of users of tools might exceed the number of people mastering SE good practices**.

Next Challenge :

→ Going from **"being able to produce SE-deliverables"** to **"being able to challenge SE-deliverables"**

MBSE : Future trends, which stakes?

1. Methods & Framework as a sustainable asset

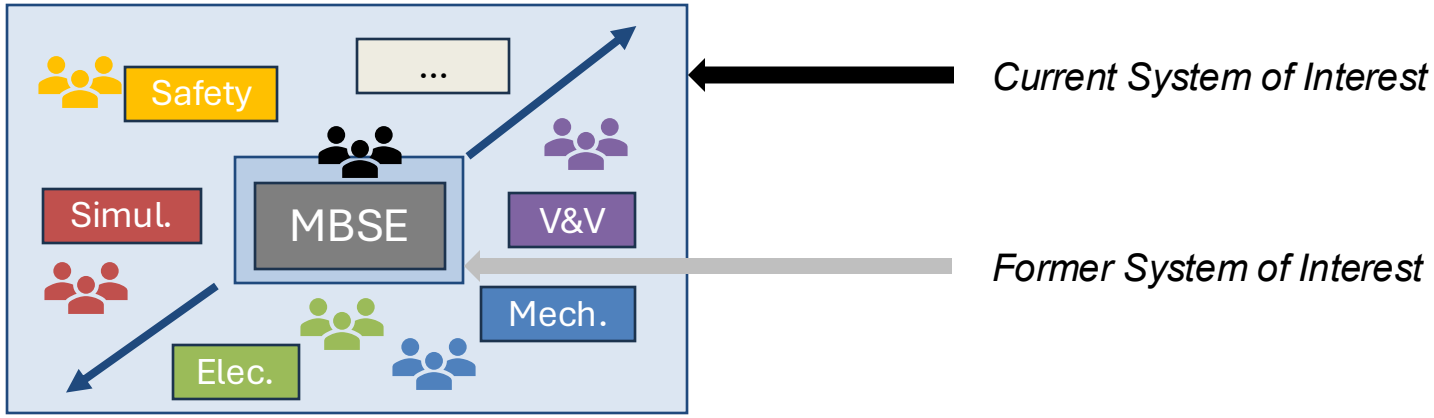
2. From SE-Modelling tools to Engineering tool chain

3. Industrialisation of MBSE

- **Semantics simplification**.
  - Systems engineering, originally conceived by and for systems engineers, must now evolve towards maximum simplicity: it will be used beyond System Design and **will not benefit from such fertile ground**
  - In an ever-growing demand for connecting engineering data, **minimizing the complexity of these connections** is essential
- **A need for broader architecture**
  - Expanding beyond the world of systems engineering requires an ever more **global approach**. The system of interest is no longer the system engineering disciplines but all engineering fields.
  - Moving up one systemic level requires a systemic approach at enterprise level : enterprise architecture
- **New roles to manage the scale-up**
  - The rise of AI and the democratization of MBSE tools will shift the balance between ***those who produce*** and ***those who understand***.

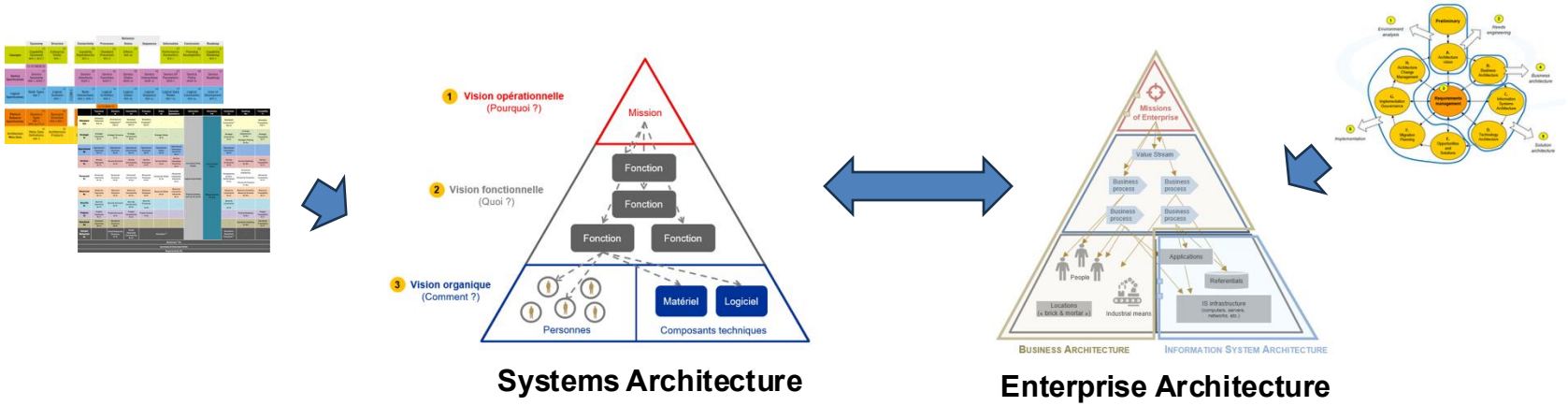
MBSE : Future trends, which challenges ? (1/3)

- **Semantics simplification**.
- It is always more tempting, and easier, to push our intellectual approach by detailing and multiplying nuances and concepts. However, the risk is losing sight of the broader objective : **ensuring understanding is more important than optimizing (or multiplying) systems engineering techniques**
- This challenge rests solely with us, as member of the SE community, to remain vigilant and avoid unnecessarily creating additional concepts and standards that would not **facilitate the process of adoption by all (new) stakeholders.**



MBSE : Future trends, which challenges ? (2/3)

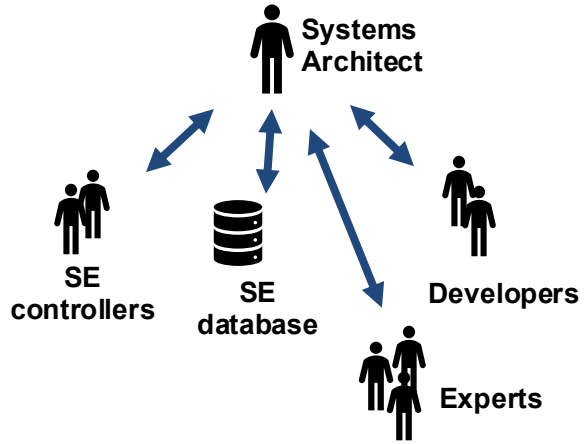
- **A need for broader architecture**
- Moving up one systemic level requires conducting **enterprise architecture**
- The worlds of enterprise architecture and system architecture rarely intersect, even though they share the same approach.
- Enterprise architecture is currently little developed among industrial companies.
  The next challenges will consist of
  - **promoting the benefits of enterprise architecture, and the role of enterprise architects**, the only ones capable of analyzes at the right systemic level to address these new challenges
  - **building bridges** between systems and enterprise architecture techniques (methods, framework, tools)



Systems Architecture **Enterprise Architecture**

MBSE : Future trends, which challenges ? (3/3)

- **New roles to manage the scale-up**
  - The challenge lies in managing a **large amount of system engineering data, much of it may be of questionable quality.**
  - However, the primary challenge will be less **technical than organizational, giving rise to new roles**:
    - SE “Producers” :
      - Artificial intelligence ☺
      - Individuals who master SysML v2 to manage **coding and associated databases, essential for operating AI tools**. This will require new roles with **developer-oriented profiles**
    - SE “Controllers”
      - Individuals responsible for **reviewing, challenging and validating** systems engineering outputs
    - SE Coordinators (~Systems Architects)
      - In this context, the system architect will take on an even greater role as **supervisor and coordinator**



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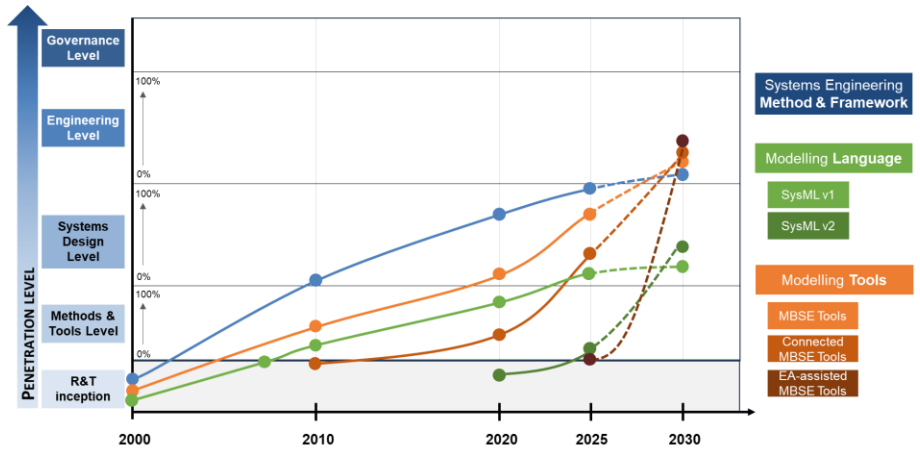

1. Methods & Framework as a sustainable asset	**Semantics simplification**
2. From SE-Modelling tools to Engineering tool chain	**A need for broader architecture**
3. Industrialisation of MBSE	**New roles to manage the scale-up**

Thank you for your attention

Any Questions?