INNOVATE · ACCELERATE · CHALLENGE

R&D Excellence

- Webinar -

Some figures on an emblematic project

? WHY Taishan 1 & 2 Chinese EPRs are considered as a success?

Because they are the 1st EPRs in service so far…

EPR TAISHAN 1 & 2

- *11 years of development & construction (+5years)*
- *6.1 Bn euros per nuclear reactor (+60%)*

EPR FLAMANVILLE 3

- *16 years of development & construction (+11years)*
- *Forecasted start of production in 2023*
- *19 Bn euros per nuclear reactor (+540%)*

…and because they have only 5 years & 60% over costs!

Agenda & Presenter

PRESENTER

Timothé Delorme
Manager
Expert of the firm on R&D competitiveness

MODERATED BY

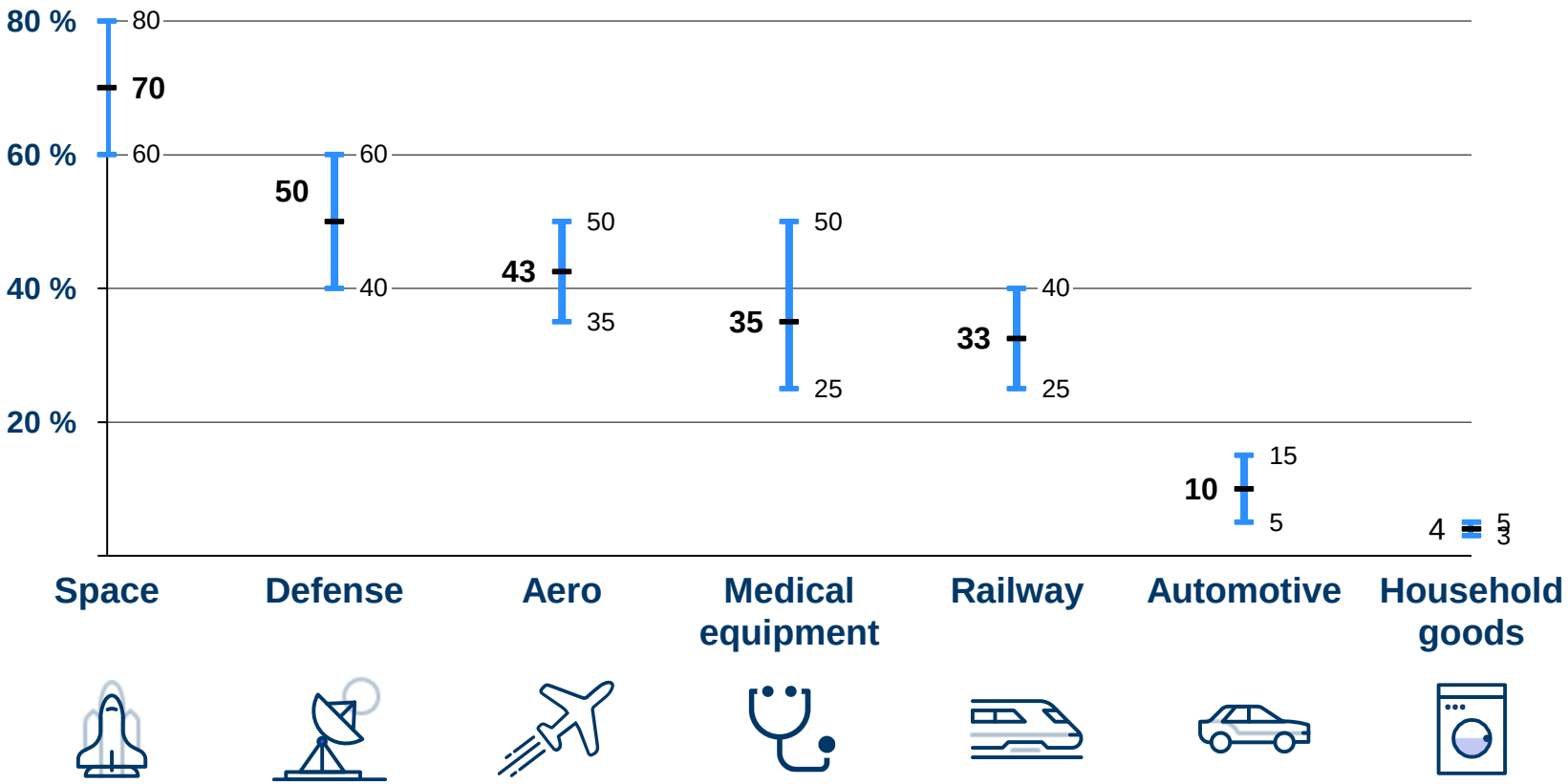
Thomas Reignard
Manager

AGENDA

1. Introduction
2. Overview of planning & budget drift root causes
3. Key axes of competitiveness for a R&D department
4. Concrete approach to reach R&D excellence & case study
5. Q&A

In low-volumes high-tech industries, efficiency in development is a key competitiveness driver

Average observed Non-Recurring Costs share within Total Costs of a program



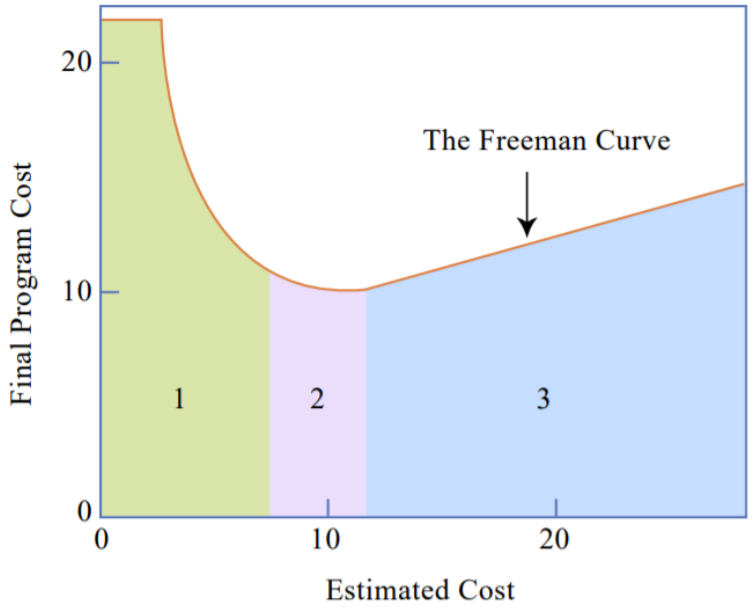
In industries with low production quantities and high technological content, non-recurring costs (engineering, industrialization, qualification) are significant & can be higher than overall recurring costs of a program

Main root causes of developments delays and over costs observed by IAC

1

Incorrect initial budget estimation

Freiman curve



1 – Underestimates lead to disaster

2 – Realistic estimates minimize final costs

3 – Overestimates become self-fulfilling prophecies

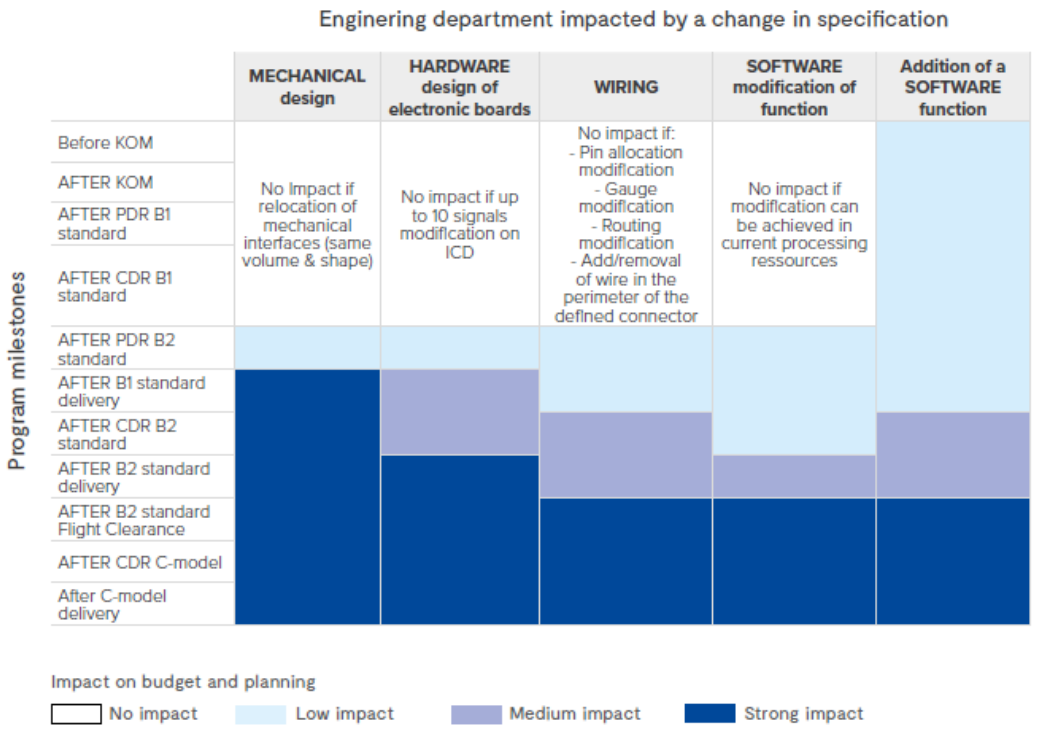
Figure by MIT OCW. Adapted from Freiman, F. R. “The Fast Cost Estimating Models.” AACE Transactions (1983).

Main root causes of developments delays and over costs observed by IAC

1 Incorrect initial budget estimation

2 **Change in specification during the project**

Specifications flexibility matrix

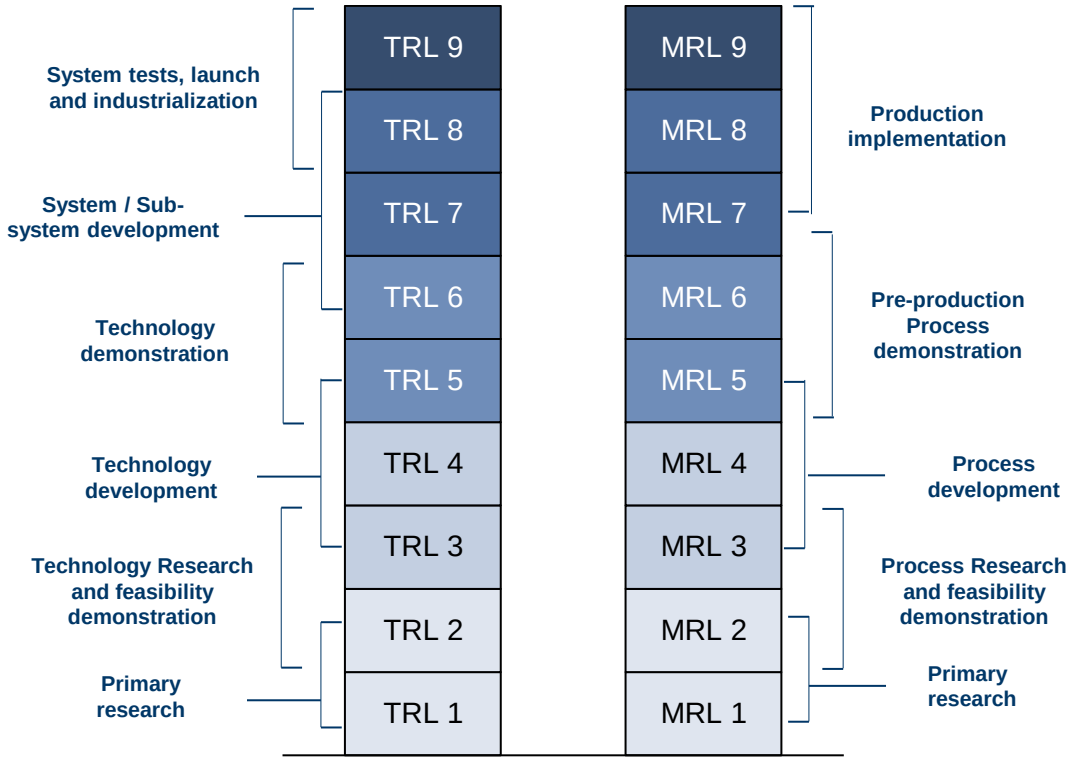


Late specification change on demanding activities can impact strongly programs costs and planning

Main root causes of developments delays and over costs observed by IAC

1. Incorrect initial budget estimation
2. Change in specification during the project
3. **Wrong estimation of the maturity level of the building blocks to implement**

Technology & Manufacturing Readiness Level

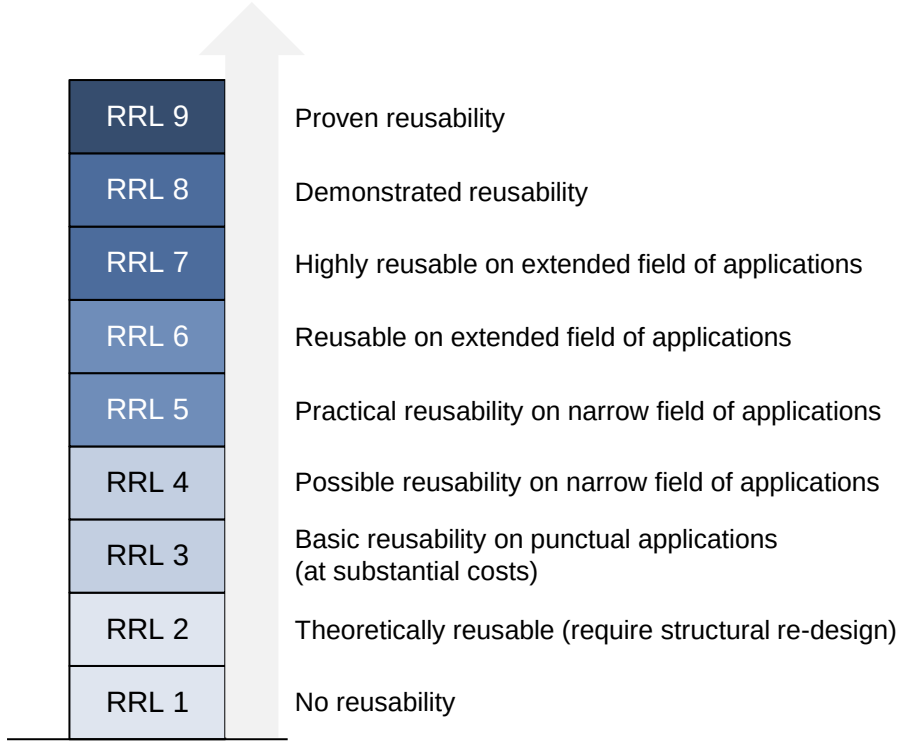


Teams misalignment on maturity assessment and misunderstanding on threshold effects lead to drifts

Main root causes of developments delays and over costs observed by IAC

1. Incorrect initial budget estimation
2. Change in specification during the project
3. Wrong estimation of the maturity level of the building blocks to implement
4. **Wrong estimation of the re-use level from a program to another**

Reuse Readiness Level

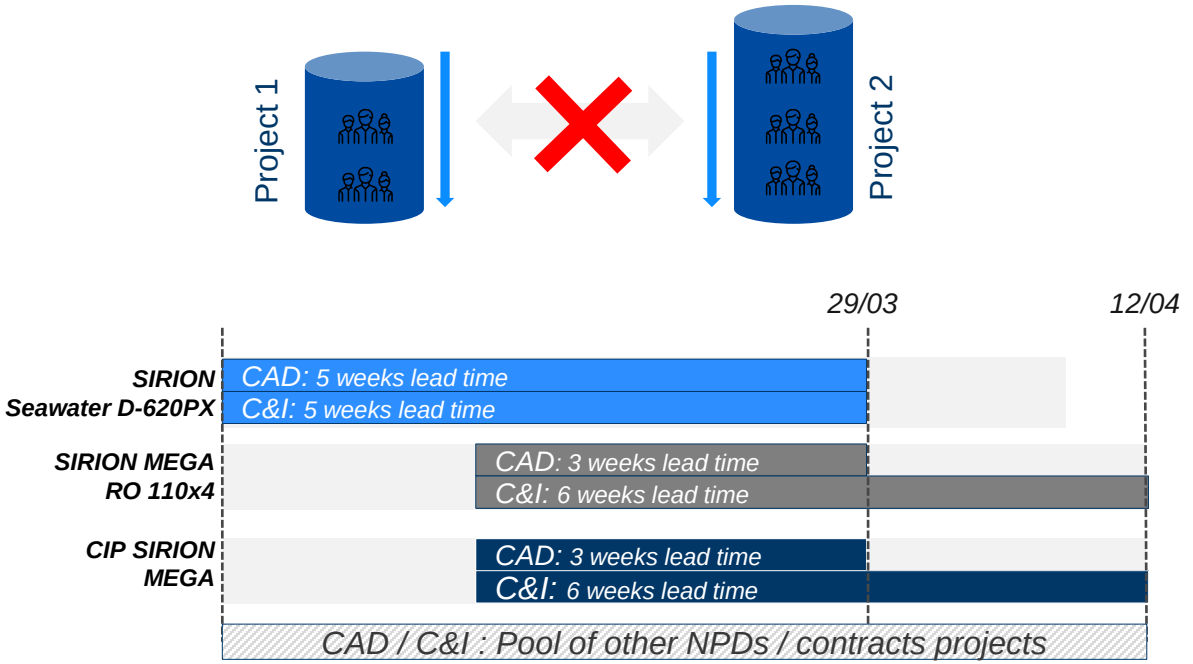


Building blocks may not be “plug and play” when re-used opportunistically

Main root causes of developments delays and over costs observed by IAC

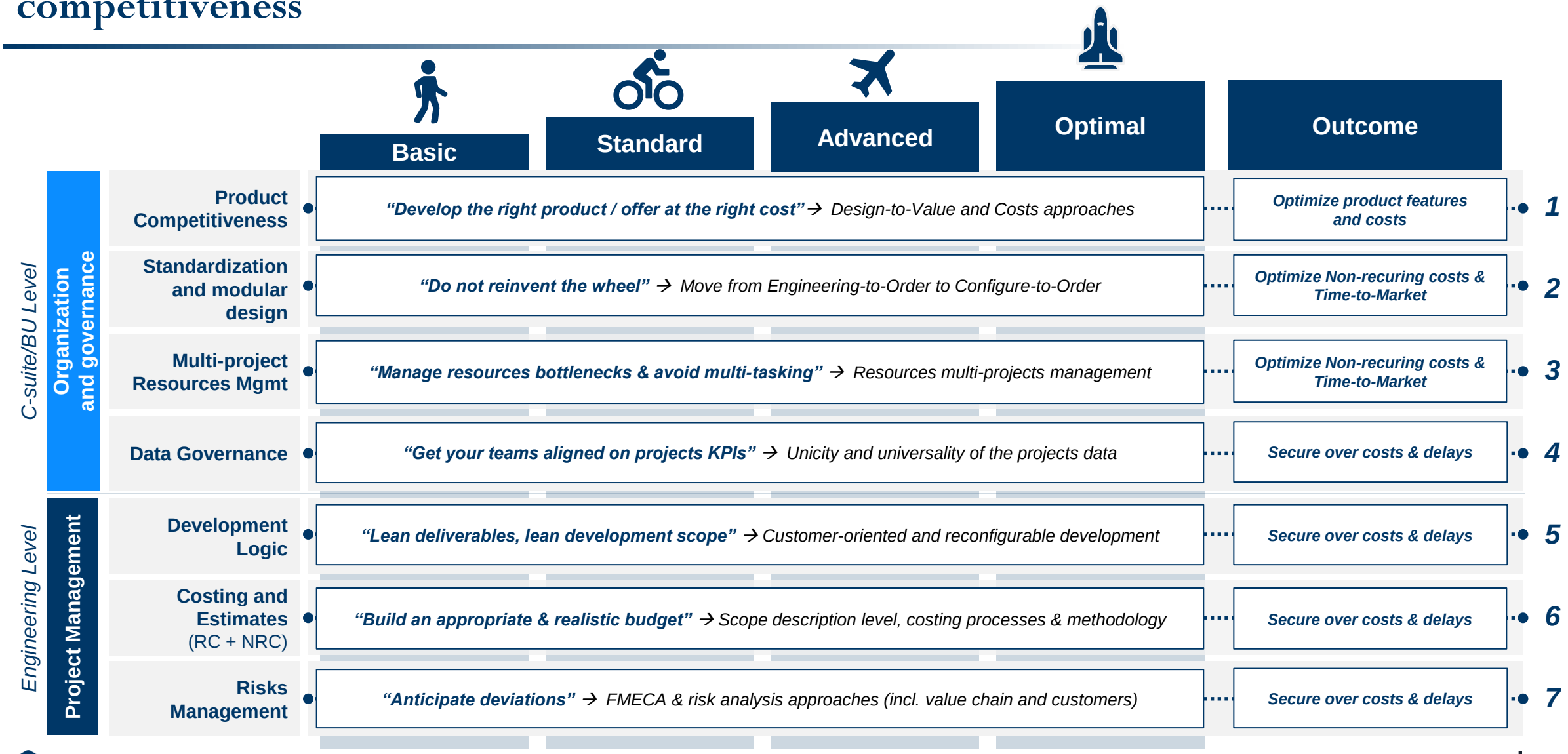
1. Incorrect initial budget estimation
2. Change in specification during the project
3. Wrong estimation of the maturity level of the building blocks to implement
4. Wrong estimation of the re-use level from a program to another
5. **Poor resources management & multi-tasking**

Resources management in a multi-project environment



Unclear view on resources bottlenecks and lack of trade-offs between programs lead to unrealistic planning & inefficiencies

We developed a methodology framework for R&D excellence based on 7 axes of competitiveness



Poor to best-in class level of maturity are formalized based on industry standards:
Example for Standardization & Modular Design

Standard

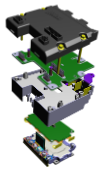
Creation of a Building Blocks catalog

Design for Variety :

- Generational Variety Index (GVI) → required redesign intensity to answer future market needs
- Coupling Index (CI) → coupling intensity between a product's components.

Building-Blocks catalog and Variability Model

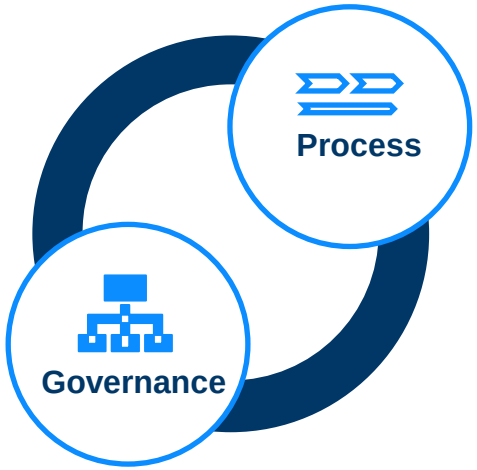
Market		Automotive		Aeronautical		Rail
Network and application		Car 250 to 450 VDC	Bus 420 to 720 VDC	270 or 740 VDC	115 or 230 VAC	590 to 717 VDC
Specific	HVAC Connector	N/A	N/A	N/A	Std. Design	N/A
	HVDC Connector	Std. Automotive design		Std. Aero design		Std. Design
	LV Connector	Std. Automotive design		Std. Aero design		Std. Design
Modular	Enclosure	Std. Small box		Std. Big box		
	AC Filter	N/A	N/A	N/A	Std. Design	N/A
	DC Filter	Std. Design			N/A	Std. Design
	DC Capacitor	Std. Automotive design		Std. Aero design		Std. Design
Generic	AC/DC Conversion	N/A	N/A	N/A	Std. Design	N/A
	Power Unit	Std.600V	Std 1200V			
	CPU	Std.12V		Std 28V		Std. 110V



- A **catalog of technological building blocks** makes it possible to meet market's needs by a modular design
- Product variation and differentiation management

Advanced

Re-use strategy defined and supported by the management



- **Reuse process is defined** and supported by the organization (governance, process, tools, and dedicated resources)
- **All departments and functional units** are aware of the reuse process and respect it

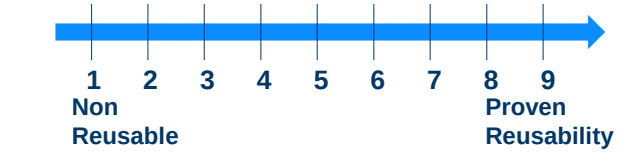
Optimal

Dynamic building blocks library management strategy

Building-Blocks Portfolio

BB	Ref.Version	Actual RRL	Target RRL
B1	R001 v1	3	5
B2	R002 v1	3	7
B3	R003 v2	5	7

RRL Scale (Reuse Readiness Level)



- **Regular RRL assessment** for each available technology building block.
- **Dynamic management** of each technological building block according to the market demand**: versioning and profiling logic**

Example of a Recent IAC Project

Project

Define an optimized organization to secure programs costs & delays

The Problem

On several of its programs, the **CLIENT is facing schedule drifts**, & **development over costs**, as well as a **lack of available resources**.

Opportunities for improvement at the organizational level have been identified…

IAC's approach to reach R&D excellence in 3 steps

Provide the competitiveness diagnosis, set the ambition & build the transformation plan

1. Evaluate

~ 4 weeks

Assess the maturity of current organization**:**

- Analysis of as-is operating model
- Deep-dive into projects
- Overall maturity assessment & preliminary recommendations

2. Design

~ 8 weeks

Build the target operating model:

- Ambition set-up
- Target processes, orga & governance, people & tools

3. Deliver

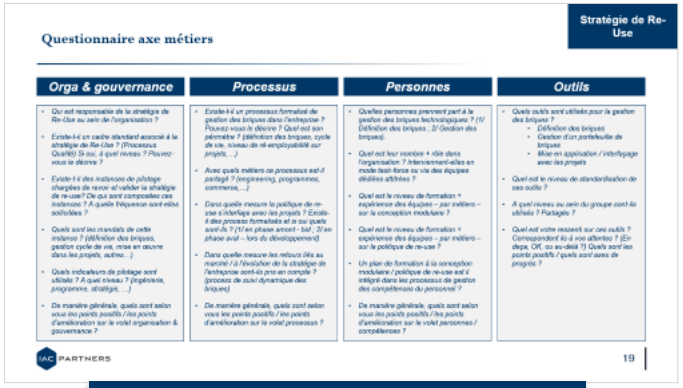
~ 4 to 6 weeks

Build the roadmap & launch:

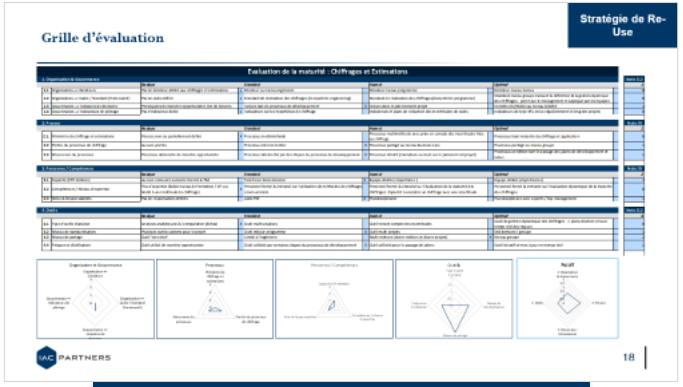
- Action plan & business cases for implementation
- Leaders appointment for transformation & management buy-in
- Change management

Experts and PMs interviews + data analysis to position our customer maturity and outline axes of work

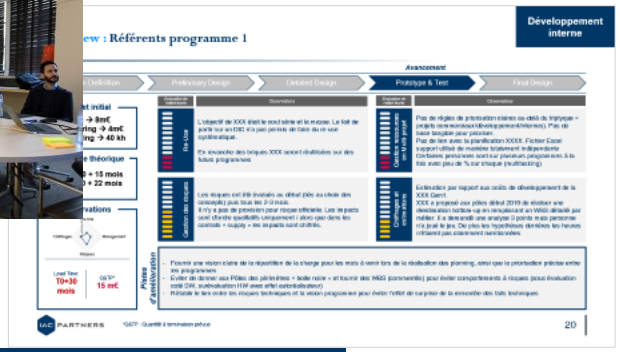
Description



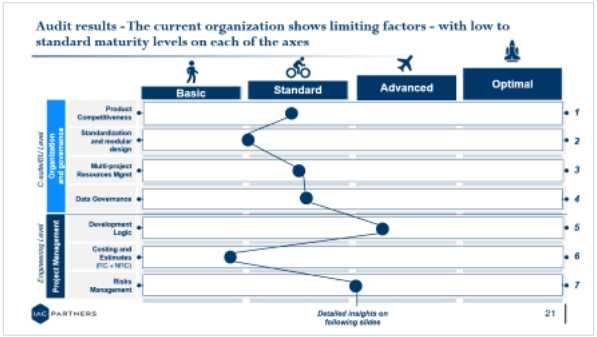
Questionnaires



Evaluation grids



Interviews



Maturity assessment

Results

1. Operating model "as-is" described (Orga & Governance, Processes, People, Tools)
2. Qualitative & Quantitative analysis of the performance
   (On selected projects, analysis QaTP vs. ref. costs, actuated vs. ref planning, issues & best-practices for each axis)
3. Overall maturity assessed, with recommendation to focus effort on 2 priority axes & preliminary improvements levers

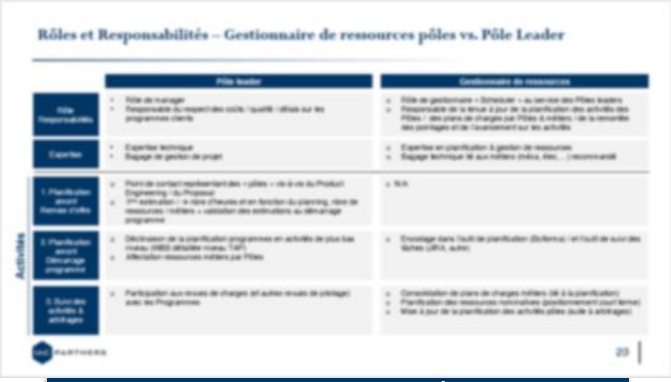
Target operating model is defined for each axis of maturity, in line with the ambition shared with the teams

Description

Work plan

Target process mapping

Target rules



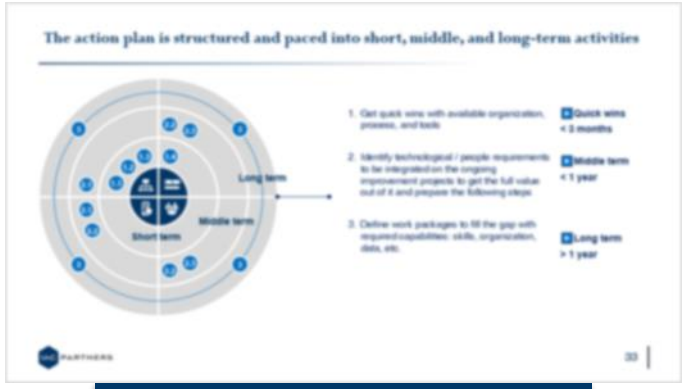
Target resources roles & responsibilities

Results

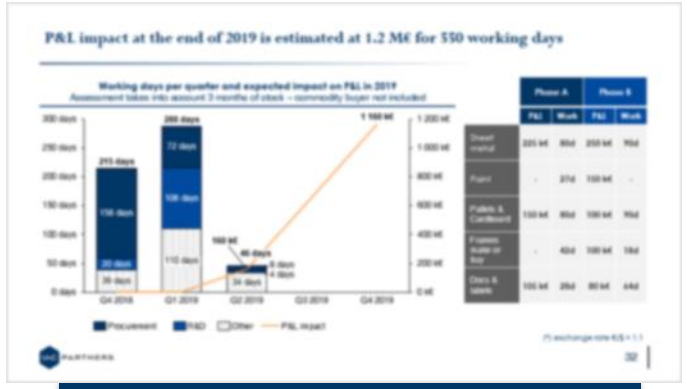
1. Task force nominated for each axis to work on (with representatives of both Programs & Departments)
2. Alignment on target ambition and related work plan to build “to-be” organization
3. High-level description of “to-be” operating model (process, organization & governance, people & tools)
4. Delivery of Quick Wins (tools, quick process changes,…)

Transformation plan roadmap to go from as-is to future organization is detailed ; Quick-wins are implemented & CLIENT implementation leaders are nominated

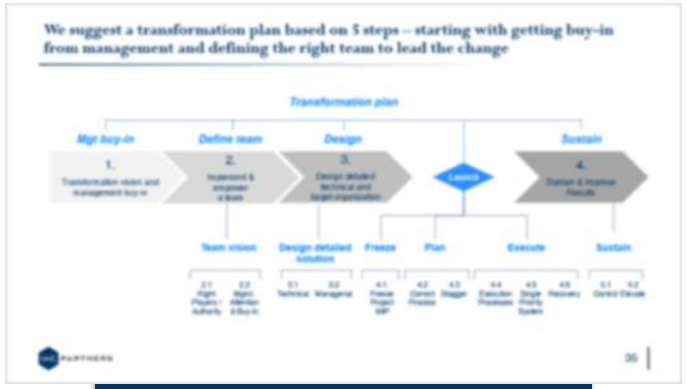
Description



Structured roadmaps



Financial objectives



Management Buy-In

Transfer to CLIENT leaders

Results

1. Short-, mid- and long-term roadmaps structured
2. Financial stakes / objectives related to the transformation plan assessed
3. Management buy-in and Transfer to CLIENT leaders

Take-aways, Q&A

1. On high-tech low volumes industries such as Space & Defense, **non-recurring costs can be higher than any other programs costs**

2. **Main observed root causes** of planning & budget drifts: **misleading estimations**, **scope evolution**, **wrong building blocks** maturity or re-use level **assessment**, and **poor resources management**

3. **7 axes of maturity should be considered** for an organization ; **starting from the competitiveness of the product to be developed**

4. Increase the maturity level for an organization means to **build a transformation plan**, with **typically 3 steps** – a diagnosis, a to-be operating model definition, and a roadmap + quick wins implementation

5. In such transformation, **change management is key** to onboard all stakeholders within the R&D department, and at the interfaces – Programs, Sales & Marketing, Purchasing, Quality,…

Q & A