McKinsey
& Company

Teams in projects

Sep 6, 2023

VIENNA PROJECT ACADEMY

Koen Vermeltfoort

Leader of McKinsey Capital
Excellence Practice in Europe

20 years at McKinsey serving organizations on Capital

Across industries: Oil & Gas, Renewables, Power, Chemicals, Metals Infrastructure, Real Estate

Concept engineering, supply chain & procurement, project management, operating model

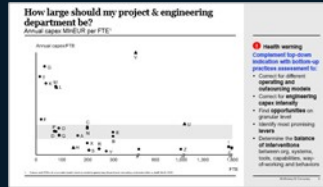10 years at VDL ETG as machining and fabrication yard manager, as well as project and procurement manager
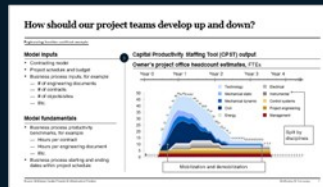
Contents

Project organization

Project teams

Project individuals

Project organization

The classic question: "How large should be Projects & Engineering department be?"

The better question: "How should our project teams develop up and down?"
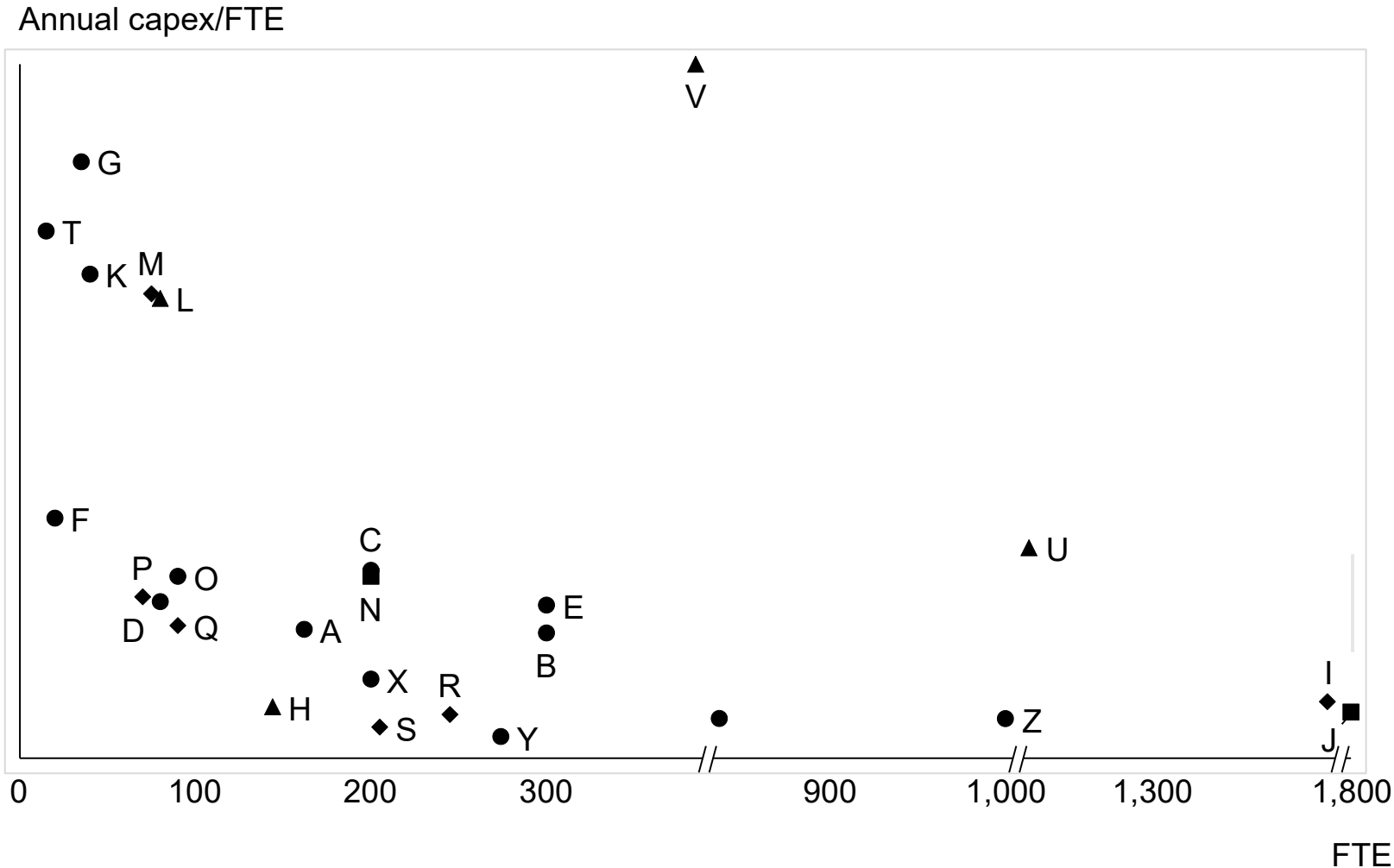

What keeps going wrong in project organizations

Typical project organization dilemma's

How large should my project & engineering department be?
Annual capex MlnEUR per FTE[1]

Annual capex/FTE

⬤ **Health warning**

Complement top-down indication with bottom-up practices assessment to:

- Correct for different **operating and outsourcing models**
- Correct for **engineering capex intensity**
- Find **opportunities** on granular level
- Identify most promising **levers**
- Determine the **balance of interventions** between org, systems, tools, capabilities, way-of-working and behaviors

1. Capex and FTEs of corporate/center-lead projects/engineering department; including contractors/temp staff; MoD 2020

Owner's team size: Companies employ four methods to plan project staffing to find balance between accuracy and complexity

Intuition	Choke model	Archetype model	Bottom-up activity based assessment
• Based on past projects and the "right" feeling	• Team makes a best estimate • Project executive "slices off" flat 10-20%	• Archetypes of projects are derived from past projects, the experience is used to estimate staffing demand	• Planning based on the actual amount of work that is expected

Planning accuracy and complexity

How should our project teams develop up and down?

Engineering function sanitized example

Model inputs

- Contracting model
- Project schedule and budget
- Business process inputs, for example
  — # of engineering documents
  — # of contracts
  — # of objects/sites
  — Etc.

Model fundamentals

- Business process productivity benchmarks, for example
  — Hours per contract
  — Hours per engineering document
  — Etc.
- Business process starting and ending dates within project schedule

Capital Productivity Staffing Tool (CPST) output

Owner's project office headcount estimates, FTEs

Split by disciplines

Mobilization and demobilization
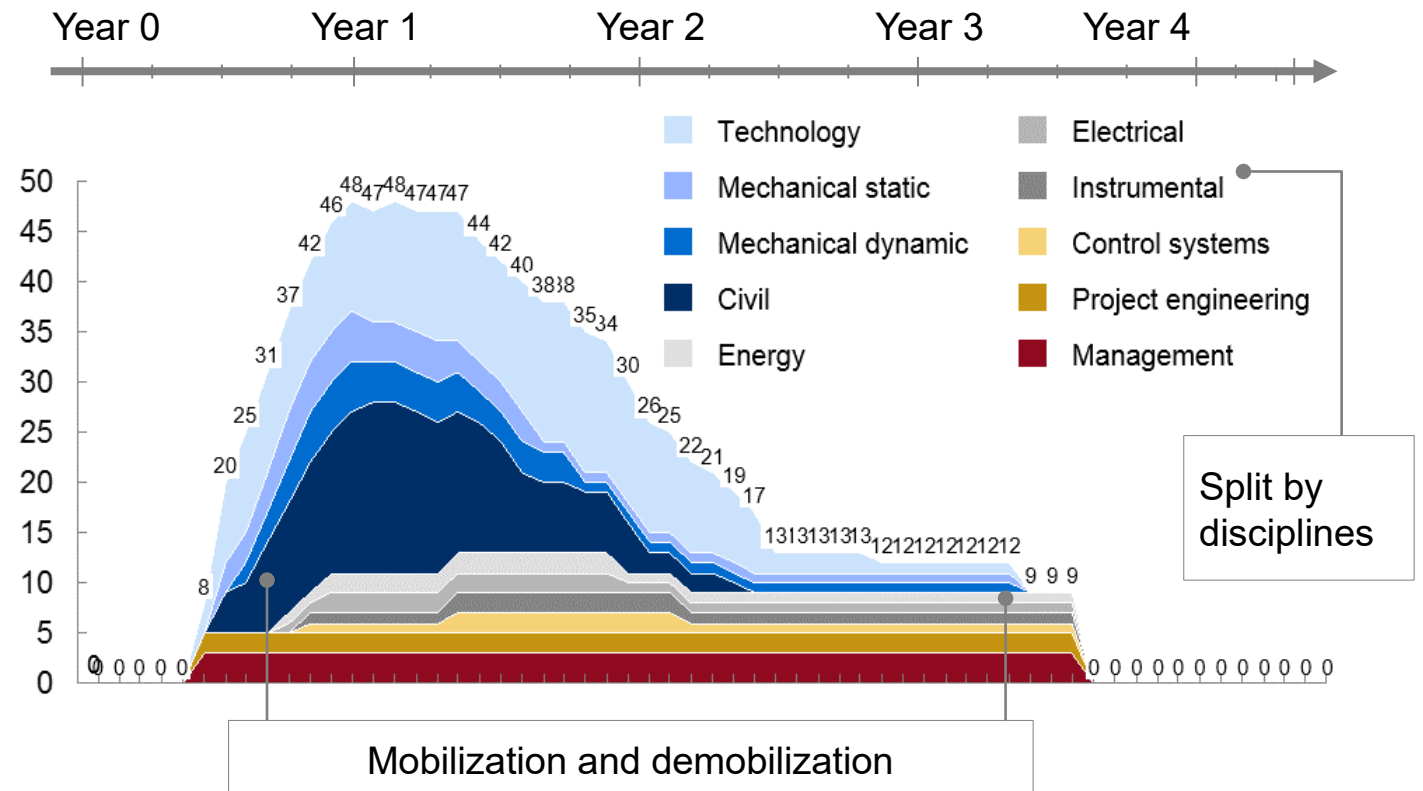
What keeps going wrong in project organizations

1. 'start lean'

plan

actual

2. Himalayas

Project duration:
74 weeks

Engineering hours:
8000

Number of engineers:
46

Legend:
- Circuit
- Commissioning
- Design Team Leader
- Doc Ctrl
- Primary Sys
- Secondary Sys
- Technology
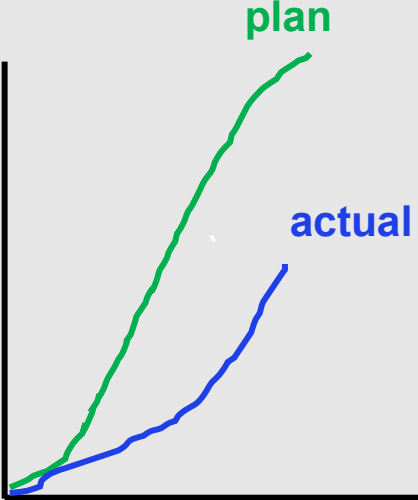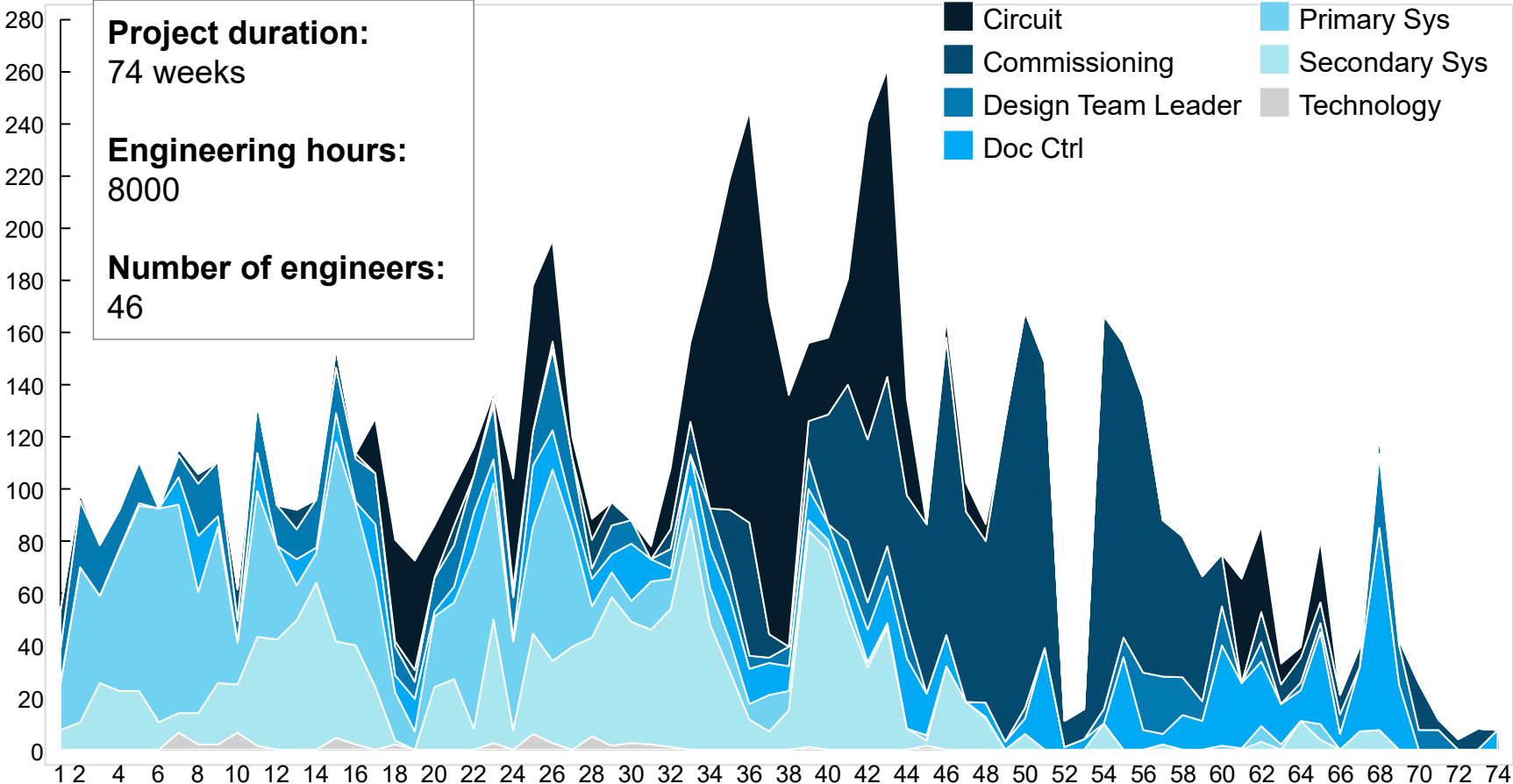
Baseline sequence demonstrated risk of inefficient labor allocation and schedule delays

—— Contractor 1   – – Commissioning   —— Contractor 2

Daily labor resource requirements and allocation by contractor
Workers per day

Crews focus on what they believe is critical path work but poor workfront access limits performance

A site decision to focus on a specific "critical path" work area limits the number of productive workfronts

Poor allocation of work between contractors leaves second electrical contractor with high idle time

Late access to workfronts creates late labor peak

Target completion date

Client target: 1st April
Model forecast: 26th May
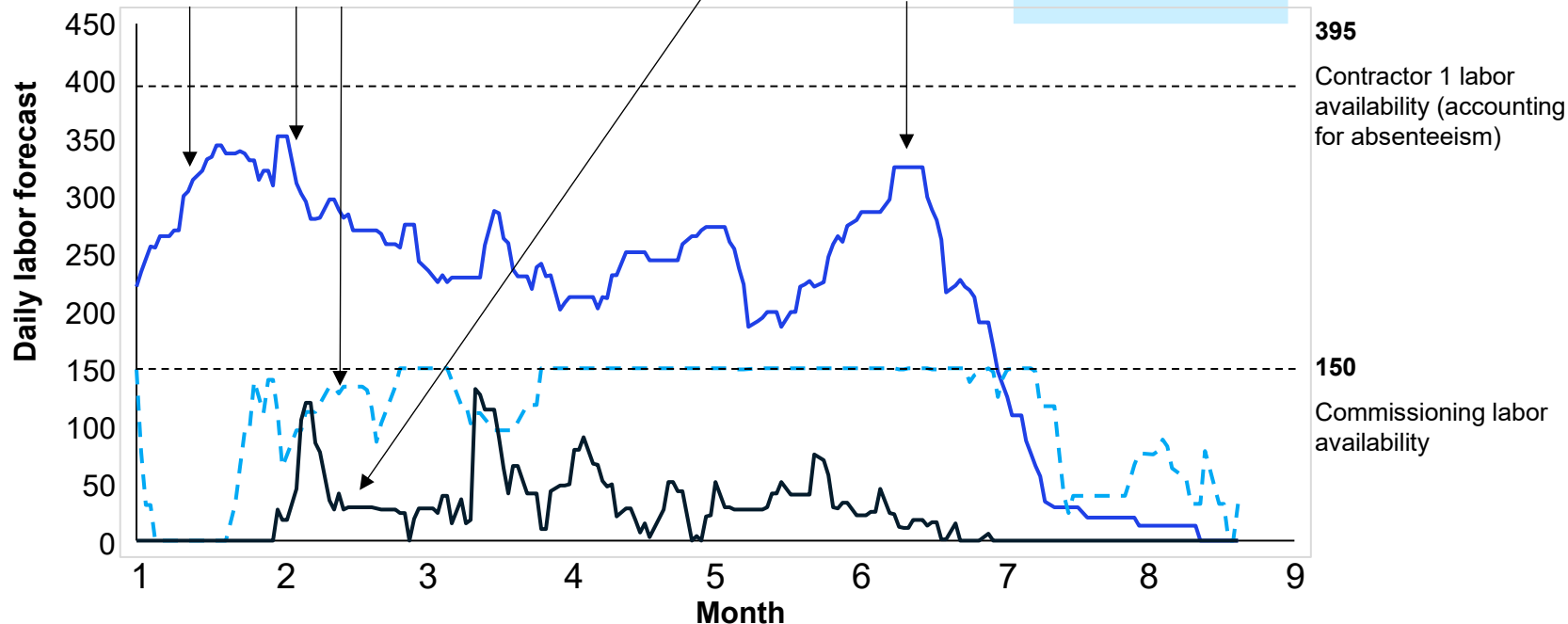
395
Contractor 1 labor availability (accounting for absenteeism)

150
Commissioning labor availability

1. Commissioning labor limit based-on max available labor from CSU schedule assuming 2x 10-hour shifts per day over a 5-day working week

Key takeaways:

- The site was not utilizing all of its workforce effectively (workers are assigned to workfronts where they are unable to meet performance expectations)

- The site believed they had a clear understanding of the critical path

Optimized sequence allocated labor to non-obvious work fronts saving 3 weeks of schedule

— Contractor 1   – – Commissioning   — Contractor 2

Daily labor resource requirements and allocation by contractor
Workers per day

Reallocating workers to areas that were not believed to be on critical path leads to reduced idle time

Reprioritization of work opens workfronts for the second electrical contractor to allow more consistent work

Second electrical contractor released from site earlier

Late labor peak is eliminated

Target completion date

Client target: 1st April
Model forecast: 6th May
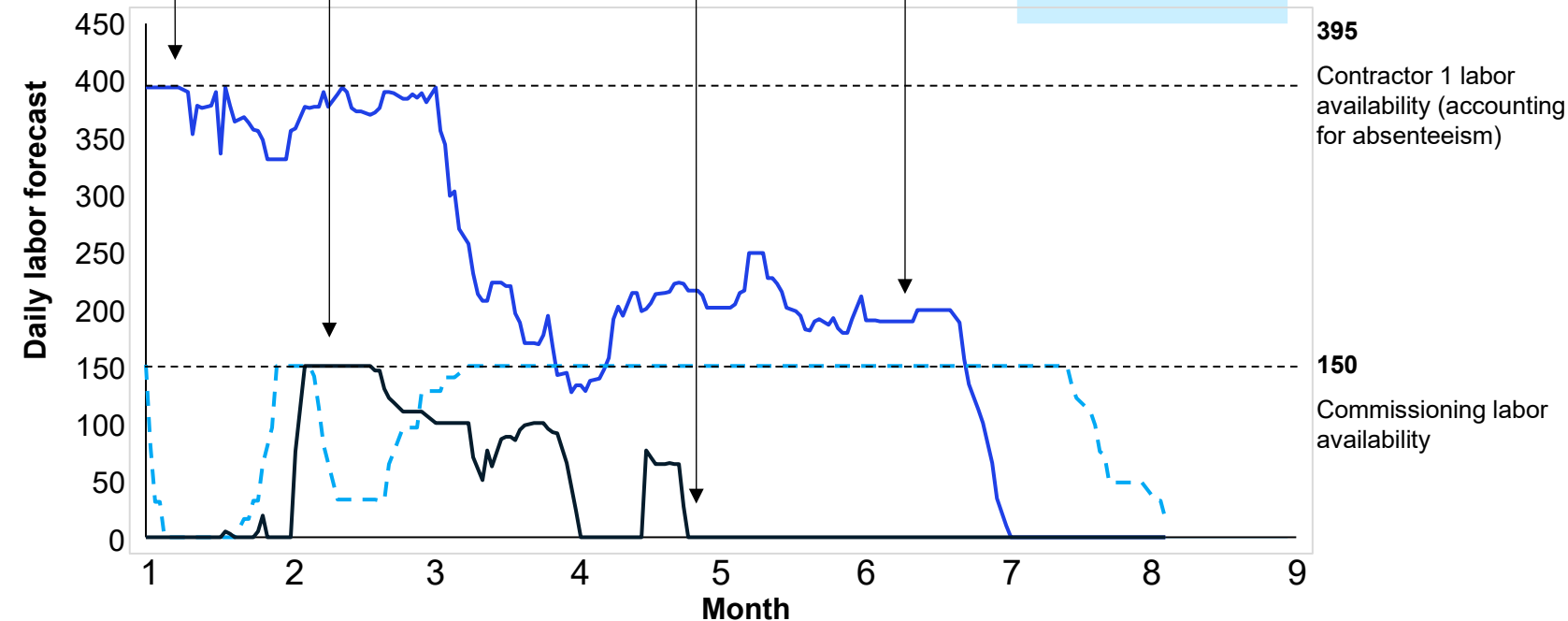
395
Contractor 1 labor availability (accounting for absenteeism)

150
Commissioning labor availability

Daily labor forecast (y-axis: 0, 50, 100, 150, 200, 250, 300, 350, 400, 450)

Month (x-axis: 1–9)

1. Commissioning labor limit based-on max available labor from CSU schedule assuming 2x 10-hour shifts per day over a 5-day working week

Key takeaways:

- The forecast completion date is brough forward by ~3 weeks by reallocating labor to non-obvious work fronts that were not believed to be critical path

- Optimal conditions suggest a labor utilization of 81%, suggesting that sourcing additional labor will not have an impact as there are no additional work fronts available, or congested work areas are fully saturated

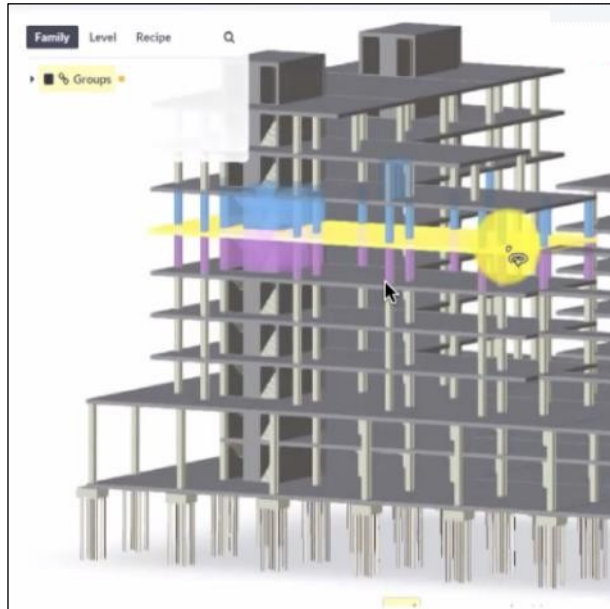# Generative scheduling to optimize resources and sequence

Illustrative

Physical and spatial constraints are defined for how the work is performed

Hundreds of thousands of configurations are generated from an advanced analytics engine

● Decision node   —— Configuration outcome

Contractor sequence

Baseline

Stage completion optimization

Scenario 1

Activity completion optimization

Scenario 2
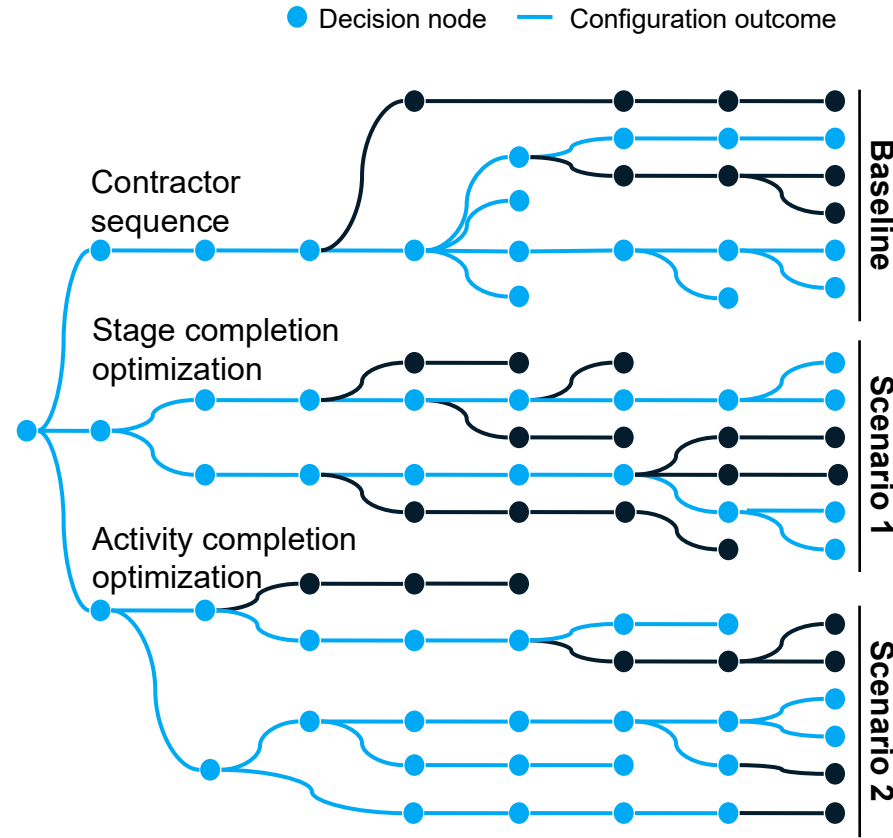
Configurations are evaluated based on predicted cost and schedule outcomes

● Scenario 1   ● Scenario 3   ● Baseline scenario
● Scenario 2   ● Scenario 4

Construction cost (Millions of USD)

Original plan

Optimal resources and sequencing

Calendar days of on-site construction
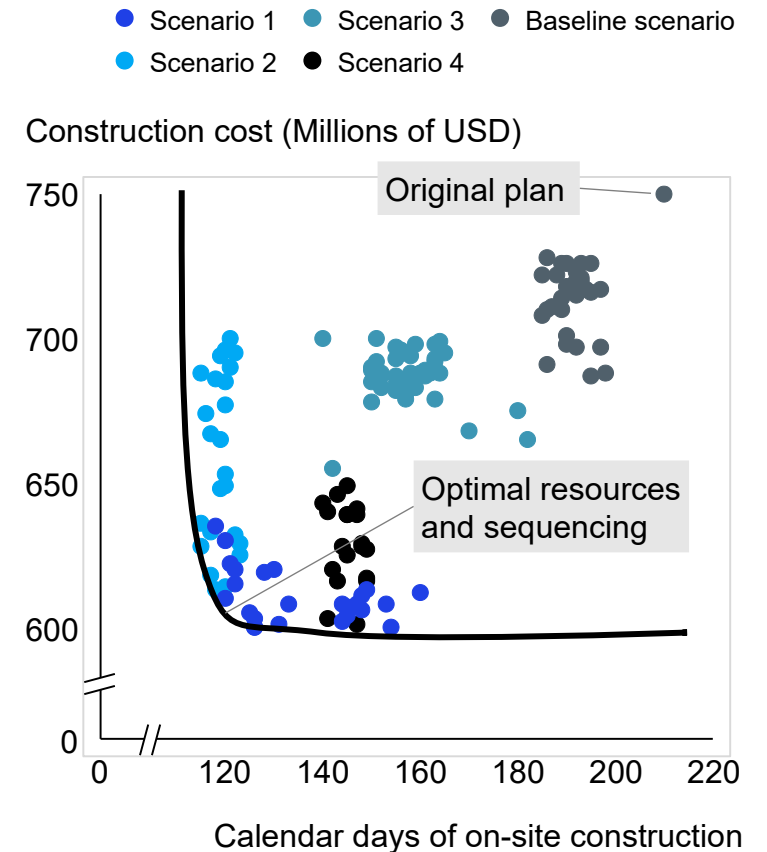
Typical project organization dilemma's

Project director involvement — Start to end **or** Front-end vs Construction

Project director scope — Top to bottom **or** Stakeholders/commercial vs Delivery partners

Project vs Functions — Dedicated team / 'strong matrix' **or** Functional set-up / 'light matrix'

Project vs Portfolio — Every project on its own **or** Module teams / standardization / central procurement / …

Project director involvement

Stage gates

Appraise △1 Select △2 Define △3 Execute △4 Operate

Interfaces involvement

Governance

100
80
60
40
20
0

Commercial

Owner

EPC (M)

Operations

Traditional project director role

| Project director | Handover | Asset mgr |

ExxonMobil

Timeline split of project director role

Handover point

| Front end project director | Handover | Execution project director | Handover | Asset mgr |

ADNOC

Gradual handover

| Front end project director | Execution project director | Handover | Asset mgr |

Functional split of project director role

| Program manager / Business opportunity manager | | | |
| Front end development mgr | Project director | Handover | Asset mgr |

Shell

Project timeline

Simplifying and managing individual complexity (how difficult is it to get things done) is correlated with creating value
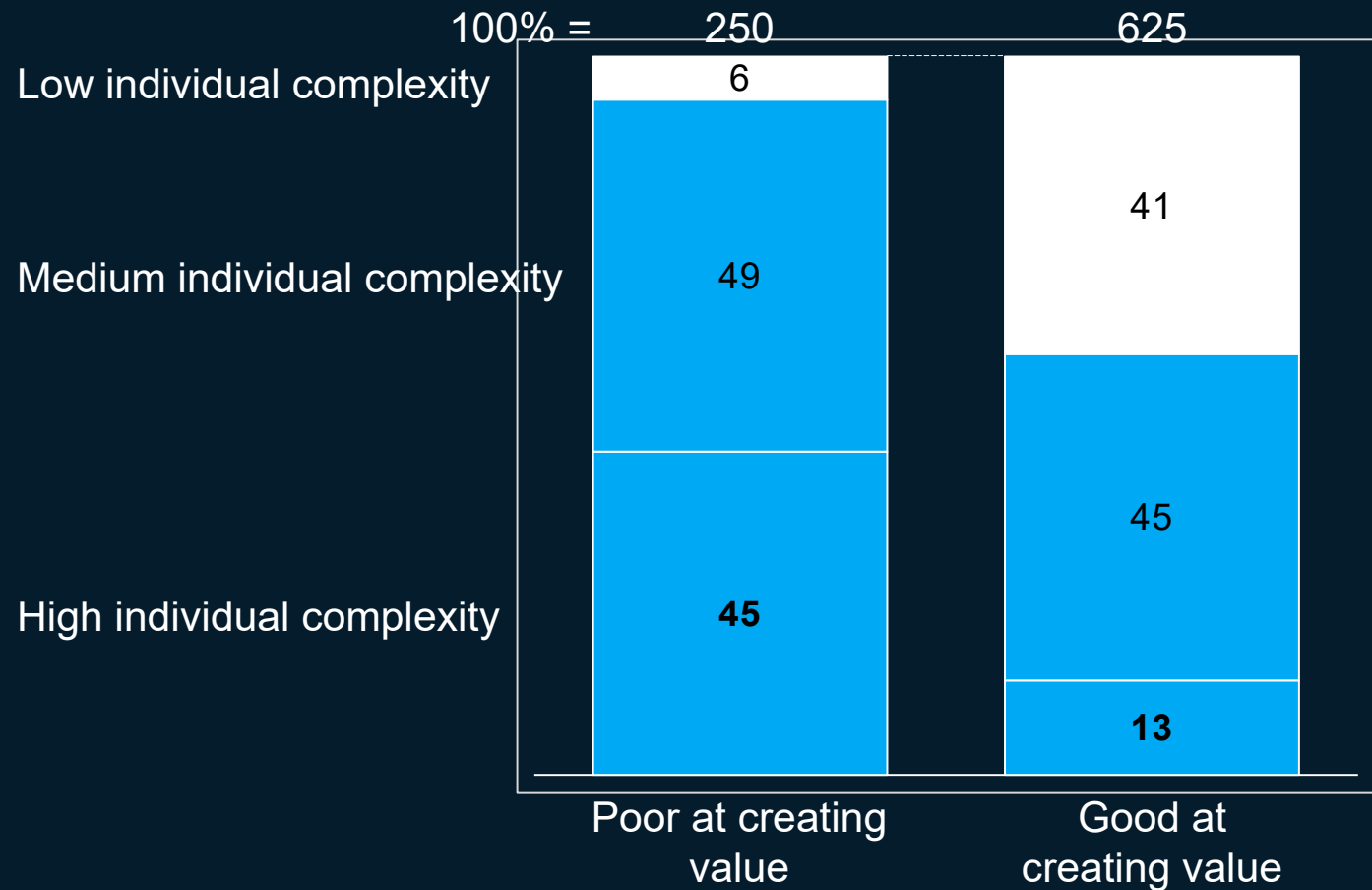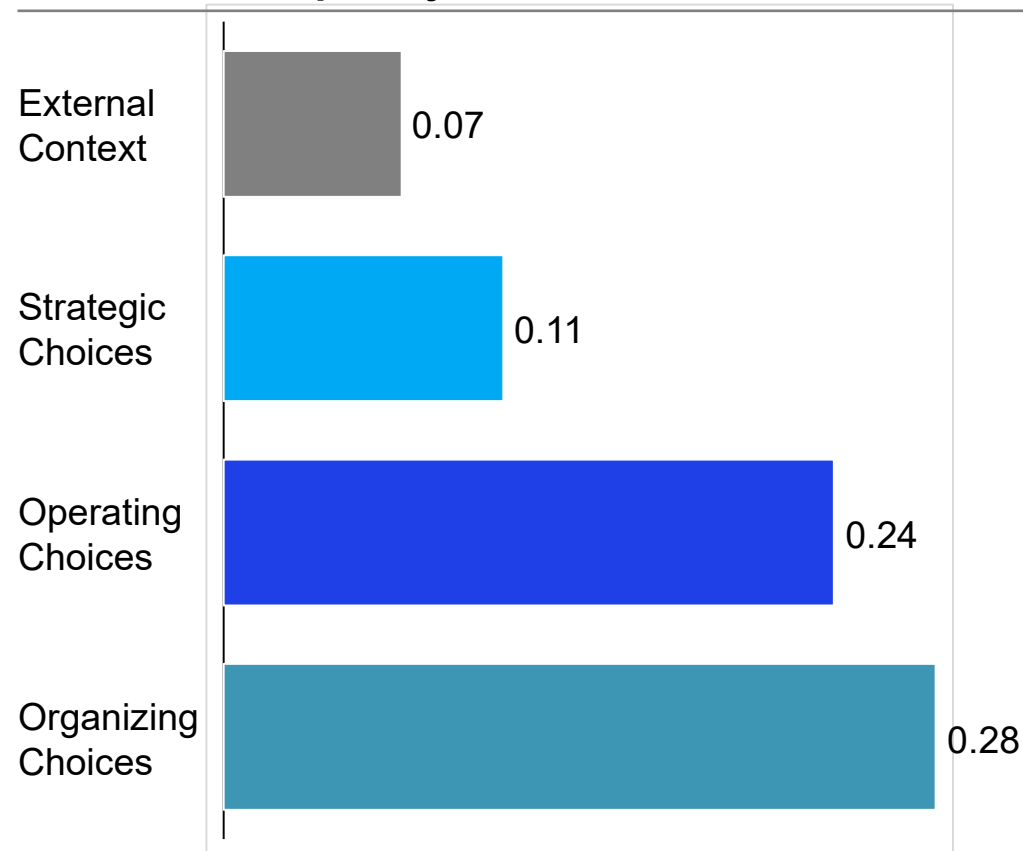
Percentage distribution of companies in our database

100% = 250   625

Low individual complexity   6   41

Medium individual complexity   49   45

High individual complexity   **45**   **13**

Poor at creating value   Good at creating value

Only a few factors (mostly organizational) really make a difference to individual complexity

Average correlation of factors to impact on individual complexity*

Factor	Value
External Context	0.07
Strategic Choices	0.11
Operating Choices	0.24
Organizing Choices	0.28

Most important factors

- The organizational ability to build capabilities
- The degree to which people take initiative and cooperate
- Clarity of accountabilities and targets
- Efficiency of management processes
- Integration of process with IT systems

Least important factors

- The number of customers
- The size of your company (# of employees)
- The rate of change and diversity of regulation
- The number of reporting lines and existence of a matrix
- Number of products/services

Actual factor correlated with outcome measure of individual complexity and averaged by grouping

Contents

Project organization

Project teams

Project individuals

Project teams

Lots of theory out there

Predictable irrationality

The answer is within us

Predictable irrationalities

A) Trust cultivation

$$\text{Trust} = \frac{R\_ \ \text{x} \ C\_ \ \text{x} \ I\_}{S\_}$$

B) Time on team building

Compare a team that manages a factory….
- Average team tenure 4 years
- Grew up in the same system

With a project team…
- Average team tenure 1 year
- Different backgrounds

But who spends more team building time?

We all know it's important, but….

C) Team practices

| Several key resource allocation and work process drivers…		…have significant impact on productivity Impact on productivity of a single project
Pulling engineers away to firefight is one of the largest productivity killers	↓ **6%**	…due to every week-long project stoppage by an individual engineer
"Over-utilization" exists	↓ **5%**	…for every 10% above 70% utilization
There are diminishing returns to increasing team size	↓ **4%**	…for every additional team member above 7
Broader communication networks are more efficient	↓ **5%**	…when communication bottlenecks are removed
Group dynamics matter a lot, and tend not to be managed	↓ **5%**	…when a team has previously worked together

We define team effectiveness in 3 mutually reinforcing areas

Performance thresholds
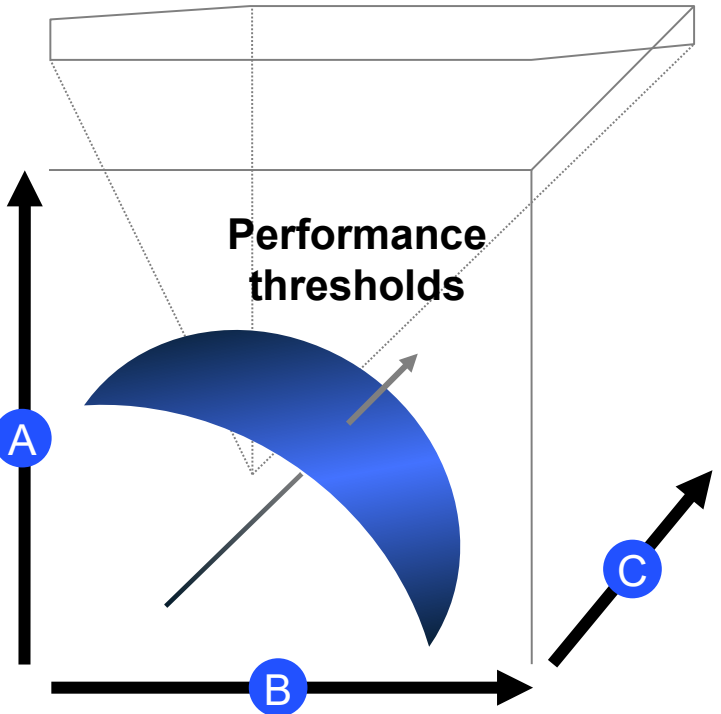
A Alignment

Sharing a view on **where** to lead the organization and **how** the team should lead it there

B Execution

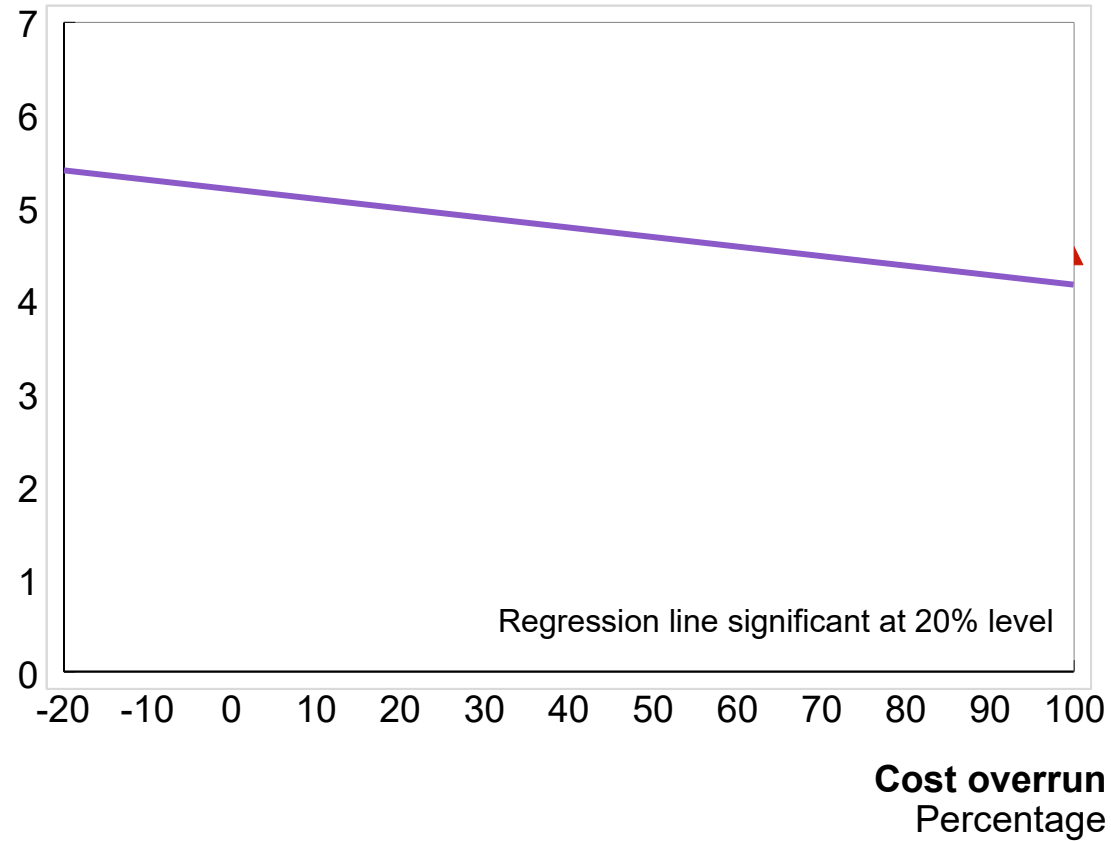Establishing an effectively designed team and high quality interactions to **drive superior performance**

C Adaptability

Sustaining productive energy and **capacity** in the team and ensuring its ability **to adapt to change**

The conclusion on organizational health also holds for megaprojects: organizational set up matters for performance

Projects

▲ Low performing[2]   ◆ High performing

Average score[1]
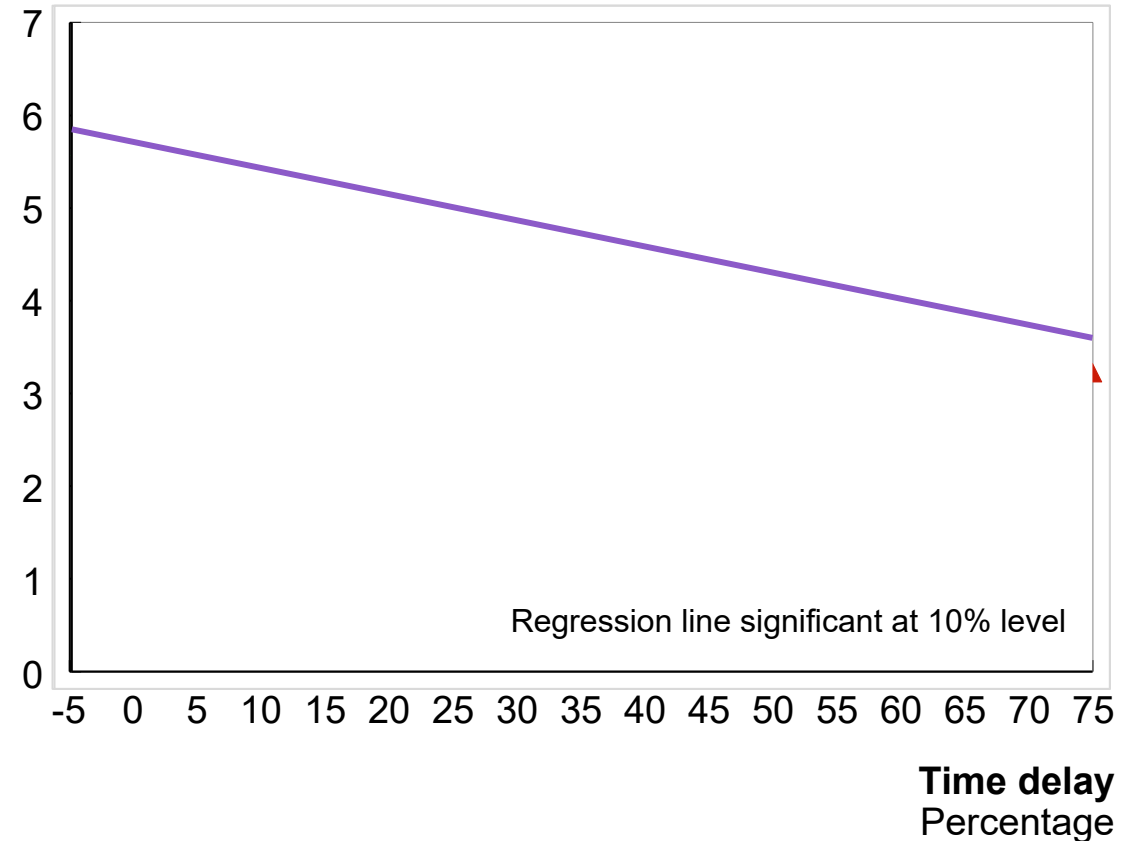
Regression line significant at 20% level

Cost overrun
Percentage

Average score[1]

Regression line significant at 10% level

Time delay
Percentage

1 Question is: to what extent are best practices applicable to your project?
1= strongly disagree, 4 = neutral, 7 = strongly agree
2 Defined on … on Capex, … on fine and …on <_____>

Source: Organizational Excellence in Mega Projects Survey; 21 projects in the database (Oil & Gas, Mining, EPNG and Infrastructure)

On what category, would you expect the biggest difference between low and high performing teams?

■ Low performing projects ■ High performing projects

	Category	Results[1]
Alignment	Project objective function and scope	
	Stakeholder management	
	Interfaces with corporate, EPC(m) and business	
Execution	Team structure, roles, and accountabilities	
	Governance and stage gates	
	Risk management	
	Performance management and KPIs	
Renewal	Independent challenge	
	Resource planning and talent selection	
	Mindsets and behaviors	
	Capabilities and continuous improvement	

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5

1 Question is: to what extent are best practices applicable to your project?
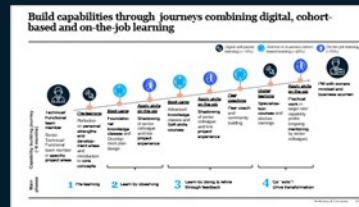1= strongly disagree, 4 = neutral, 7 = strongly agree

Contents

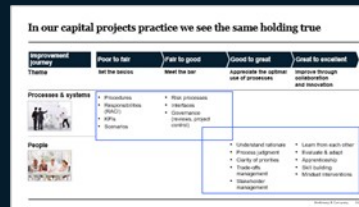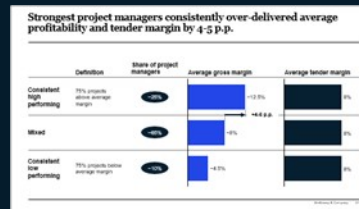Project organization

Project teams

Project individuals

Project individuals

The project director

Processes for basics, People for excellence

Building capabilities

Strongest project managers consistently over-delivered average profitability and tender margin by 4-5 p.p.

	Definition	Share of project managers	Average gross margin	Average tender margin
Consistent high performing	75% projects above average margin	~25%	~12.5%	8%
Mixed		~65%	~8%	8%
Consistent low performing	75% projects below average margin	~10%	~4.5%	8%

+4-5 p.p.
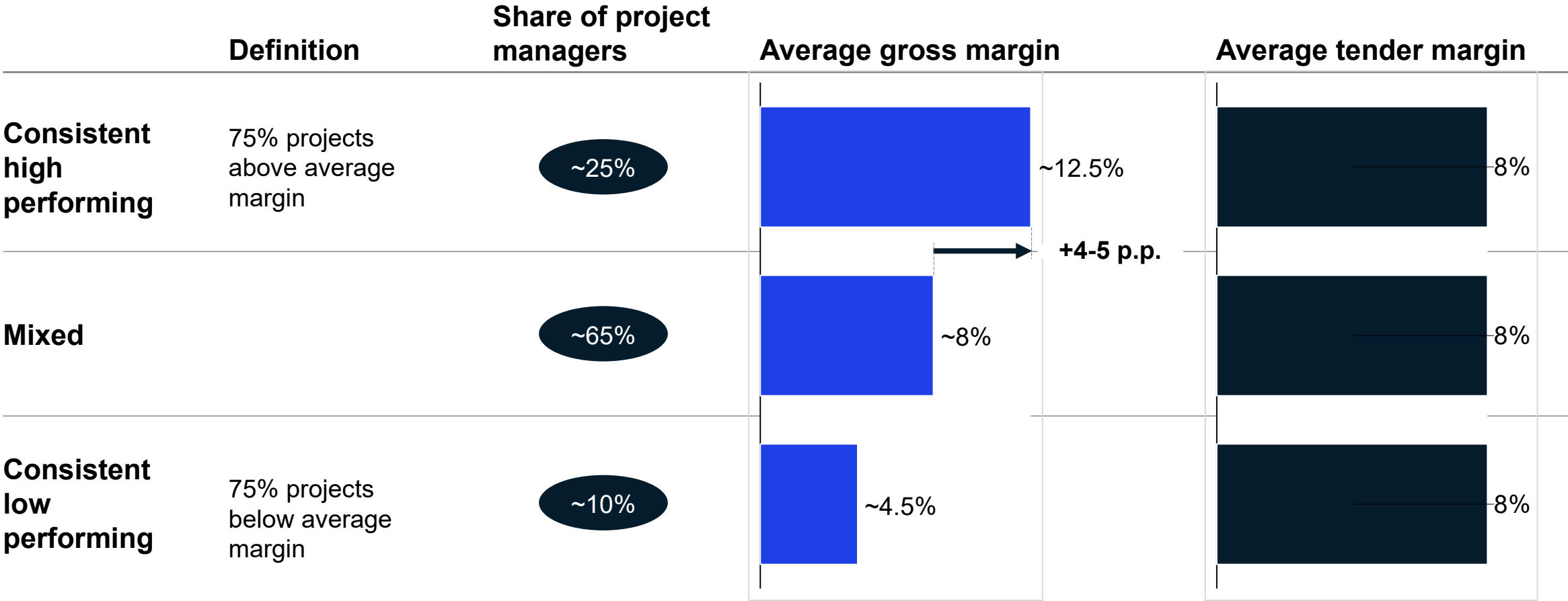
Why don't we put more effort into developing our Project Directors?

Pick your top 3

1. We develop people for our competitors – they hop with projects
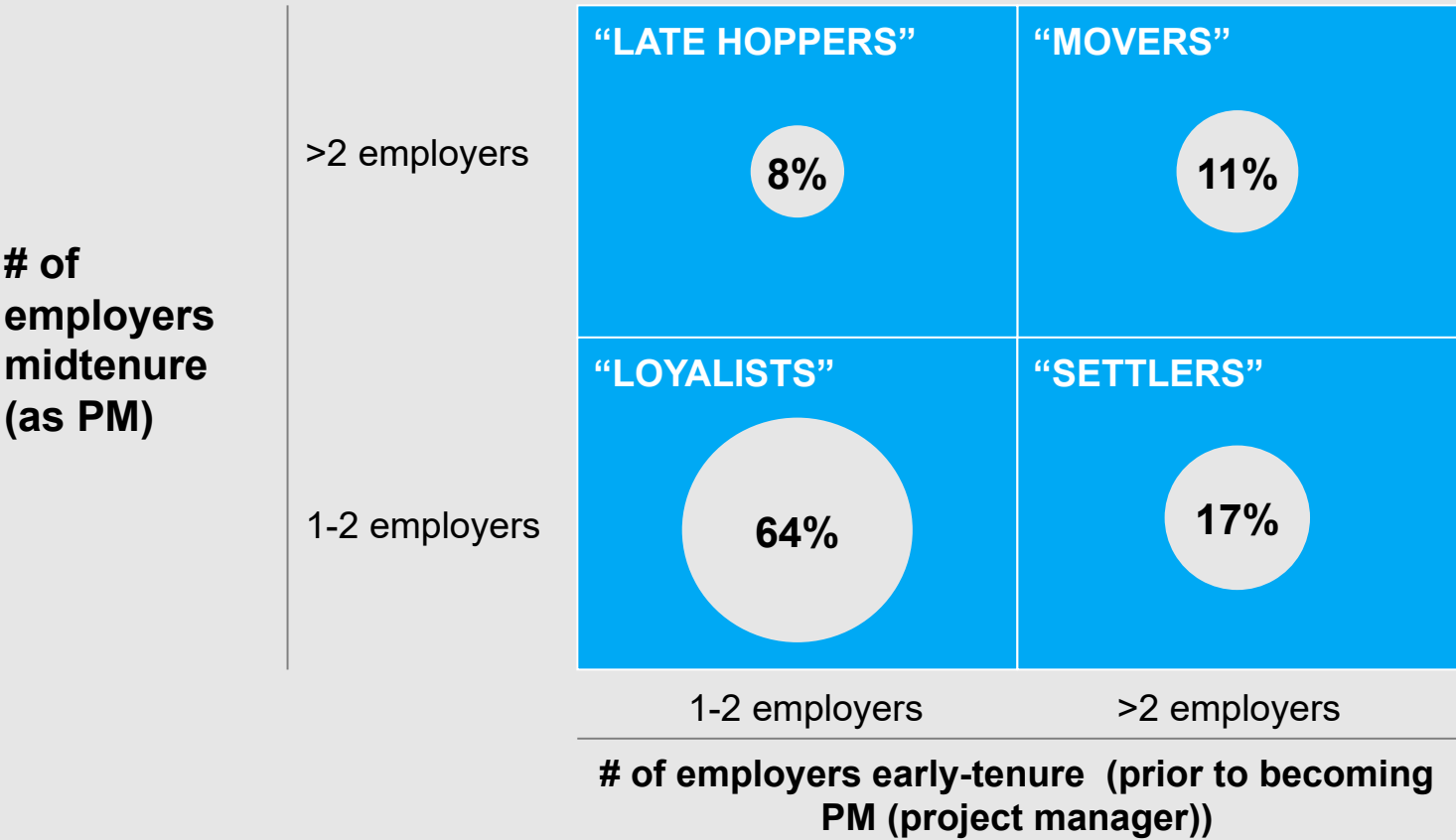
2. There is limited budget available

3. Classroom training doesn't work for this kind of skills

4. On the job training is hard to organize (remote, no peer apprenticeship)

5. Project Directors are just not interested in learning and getting coaching

6. Trainings are often cancelled last minute due to emergencies/ 'fire-fighting' (mismatch of training blocks and director availability)

7. There is underestimation of the importance of non-technical skills like stakeholder management and soft skills

8. Other…

Most project directors are loyalists

Share of Project Director profiles within each category,
percentage of total sample[1]

# of employers midtenure (as PM)

	1-2 employers	>2 employers
>2 employers	**"LATE HOPPERS"** 8%	**"MOVERS"** 11%
1-2 employers	**"LOYALISTS"** 64%	**"SETTLERS"** 17%

# of employers early-tenure (prior to becoming PM (project manager))

Project Directors with both Engineering degree and MBA tend to "job hop" more

Share of Project Director profiles within each category, percentage of total sample[1]

Engineering degree only / MBA

	1-2 employers	>2 employers
>2 employers	**"EXCEPTIONS"** 8% / 6%	**"MOVERS"** 8% / 25%
1-2 employers	**"LOYALISTS"** 68% / 50%	**"SETTLERS"** 15% / 19%

# of employers mid-tenure (as PM)

# of employers early-tenure (prior to becoming PM (project manager))
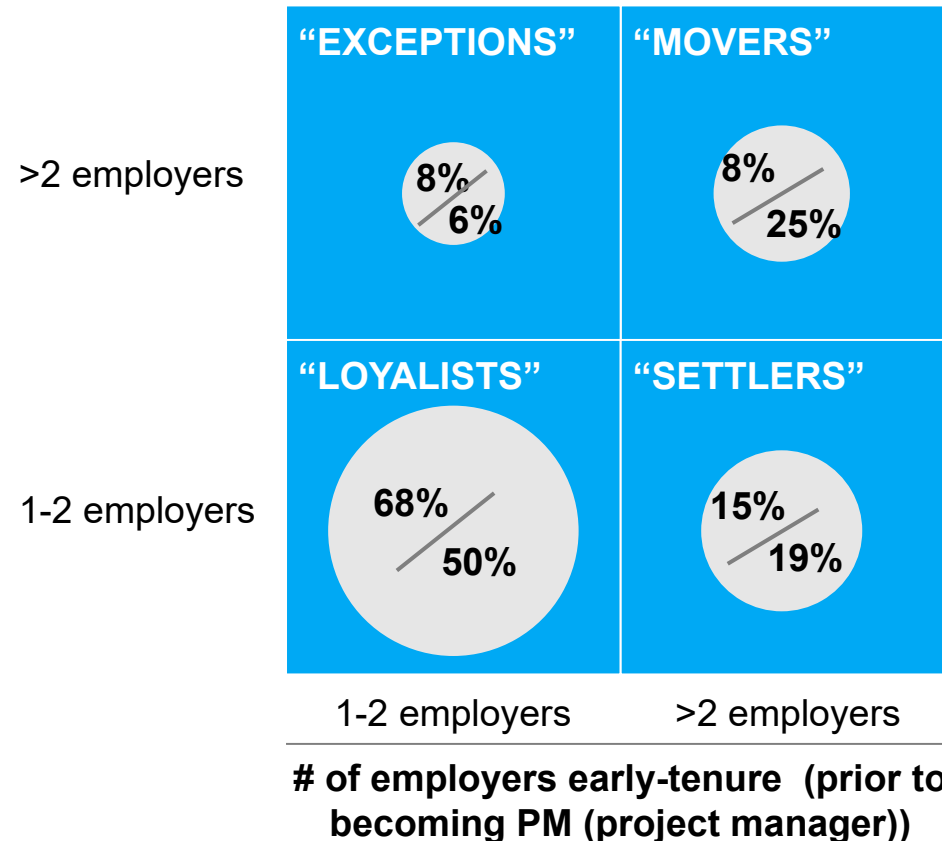
> It is a challenge for companies to find good PDs; only a **few people combine engineering and business / financial knowledge**
>
> **– Former Project Director**
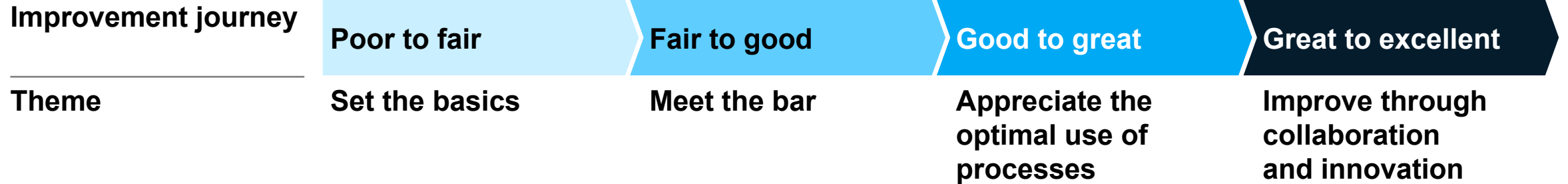
Analogy with improving education

After interviewing 200 system leaders, staff, and educators across 20 different education systems, McKinsey research indicated that education system improvements can be separated into four distinct phases

Improvement journey	Poor to fair	Fair to good	Good to great	Great to excellent
Theme	*Achieving the basics of literacy and numeracy*	*Getting the foundations in place*	*Shaping the professional*	*Improving through peers and innovation*
	Mostly 'system'-interventions:		**Mostly 'people'-interventions:**	
Intervention cluster	• Providing motivation and scaffolding for low skill teachers • Getting all schools to a minimum quality level • Ensure student attendance	• Data and accountability foundation • Financial and organizational foundation • Pedagogical foundation	• Raising calibre of entering teachers and principals • Raising calibre of existing teachers and principles • School-based decision making	• Cultivating peer-led learning for teachers and principals • Creating additional support mechanisms for professionals • System-sponsored experimentation/ innovation across schools

In our capital projects practice we see the same holding true

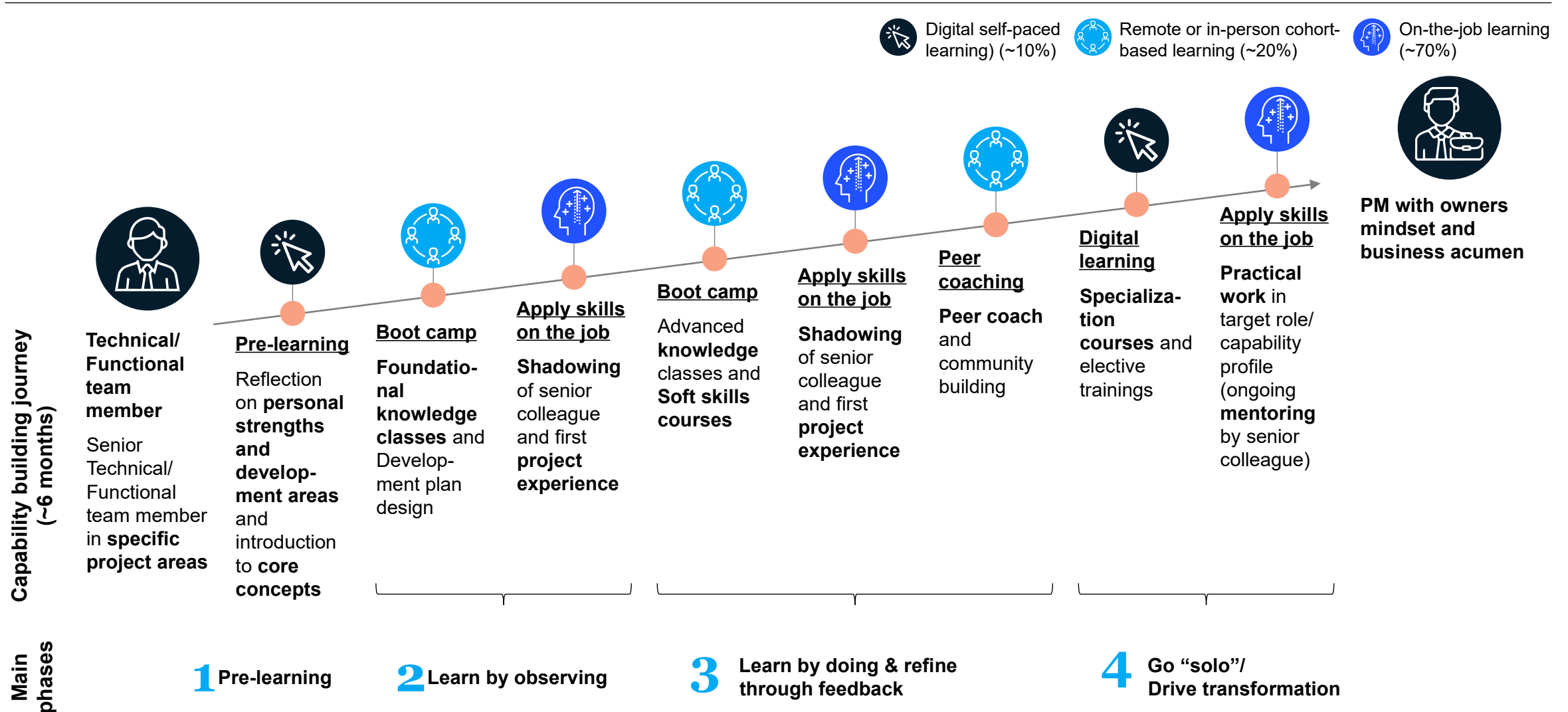| Improvement journey	Poor to fair	Fair to good	Good to great	Great to excellent
Theme	Set the basics	Meet the bar	Appreciate the optimal use of processes	Improve through collaboration and innovation

Processes & systems

- Procedures
- Responsibilities (RACI)
- KPIs
- Scenarios

- Risk processes
- Interfaces
- Governance (reviews, project control)

People

- Understand rationale
- Process judgment
- Clarity of priorities
- Trade-offs management
- Stakeholder management

- Learn from each other
- Evaluate & adapt
- Apprenticeship
- Skill building
- Mindset interventions

Build capabilities through journeys combining digital, cohort-based and on-the-job learning

Digital self-paced learning) (~10%)

Remote or in-person cohort-based learning (~20%)

On-the-job learning (~70%)

Capability building journey (~6 months)

Technical/ Functional team member

Senior Technical/ Functional team member in **specific project areas**

Pre-learning

Reflection on **personal strengths and development areas** and introduction to **core concepts**

Boot camp

Foundational knowledge classes and Development plan design

Apply skills on the job

Shadowing of senior colleague and first **project experience**

Boot camp

Advanced **knowledge** classes and **Soft skills courses**

Apply skills on the job

Shadowing of senior colleague and first **project experience**

Peer coaching

Peer coach and community building

Digital learning

Specialization courses and elective trainings

Apply skills on the job

Practical work in target role/ capability profile (ongoing **mentoring** by senior colleague)

PM with owners mindset and business acumen

Main phases

1 Pre-learning

2 Learn by observing

3 Learn by doing & refine through feedback

4 Go "solo"/ Drive transformation