



progetti

The role of FEED (Front End Engineering Design) in the EPC execution strategy

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ENGINEERING, PROCUREMENT & CONSTRUCTION
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Project scope



I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth.

John F. Kennedy

Project objectives and Fast-Track Projects



- **Opt.1) Compress the activity lengths -> Crashing**



- **Opt.2) Parallelization of phases -> Fast-Tracking**



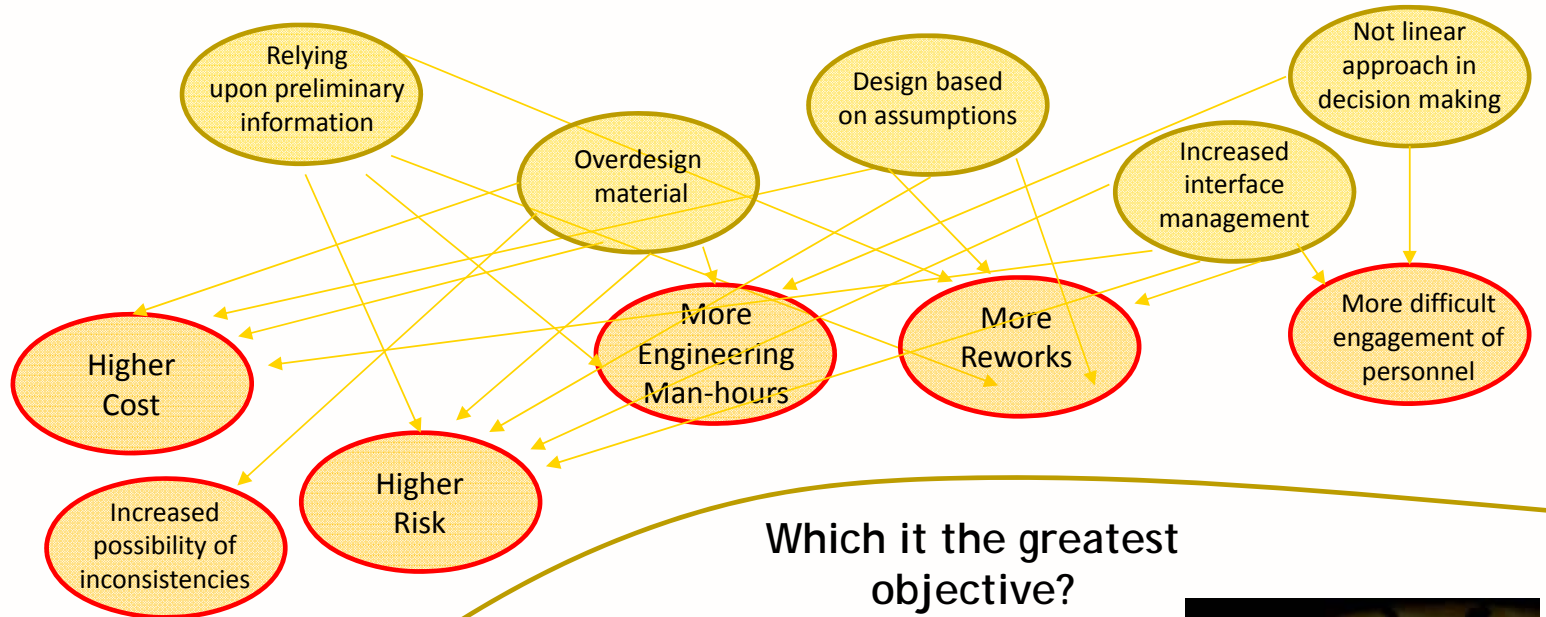
What if our goal is different?

The fast-track is a global concept which can be applied to the overall scope of a project (from exploration to commissioning, overlapping reservoir models to engineering, engineering to procurement and so on). Here is applied for the engineering phases.

Note: time phases are for reference only

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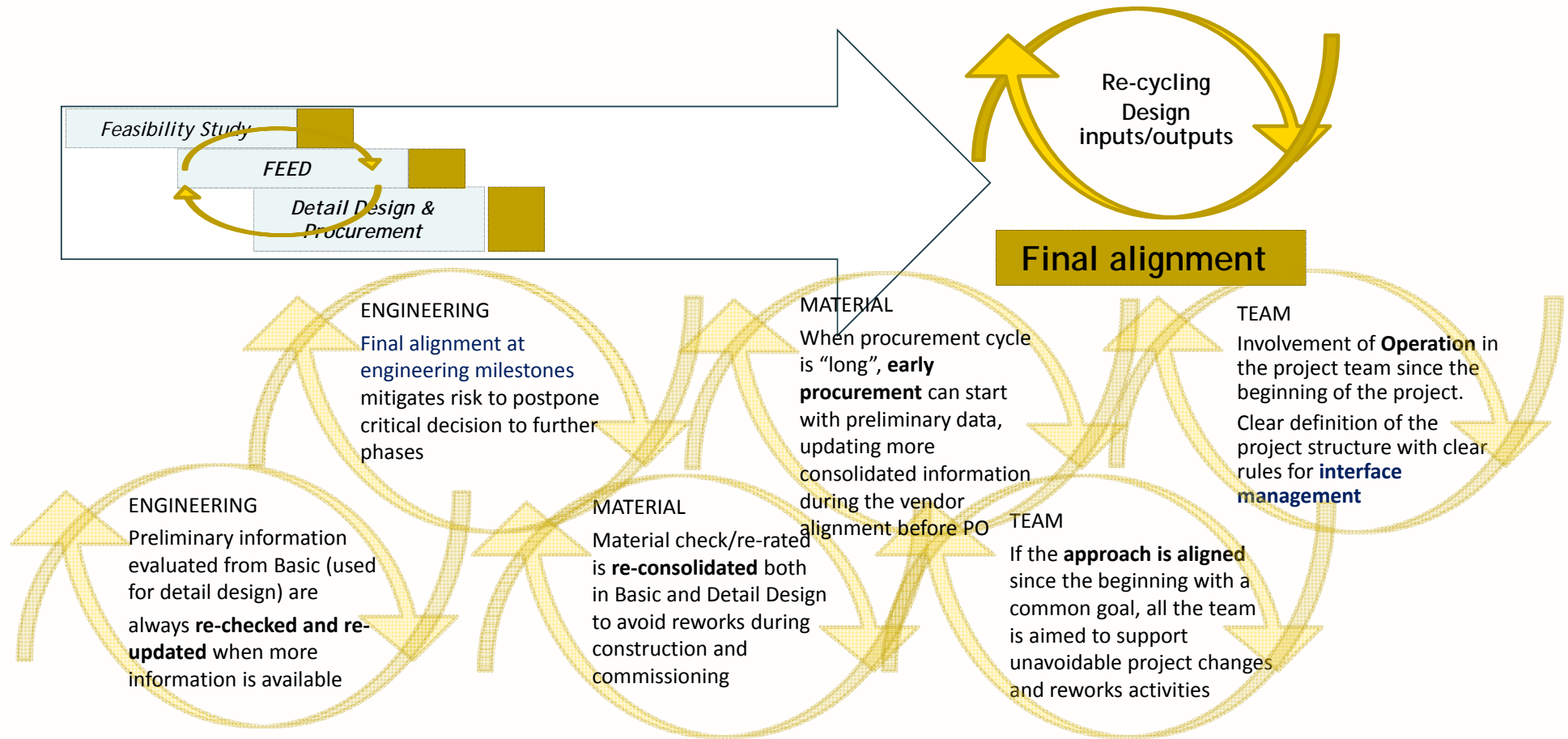
Possible outcomes when implementing a Fast-Track in a project



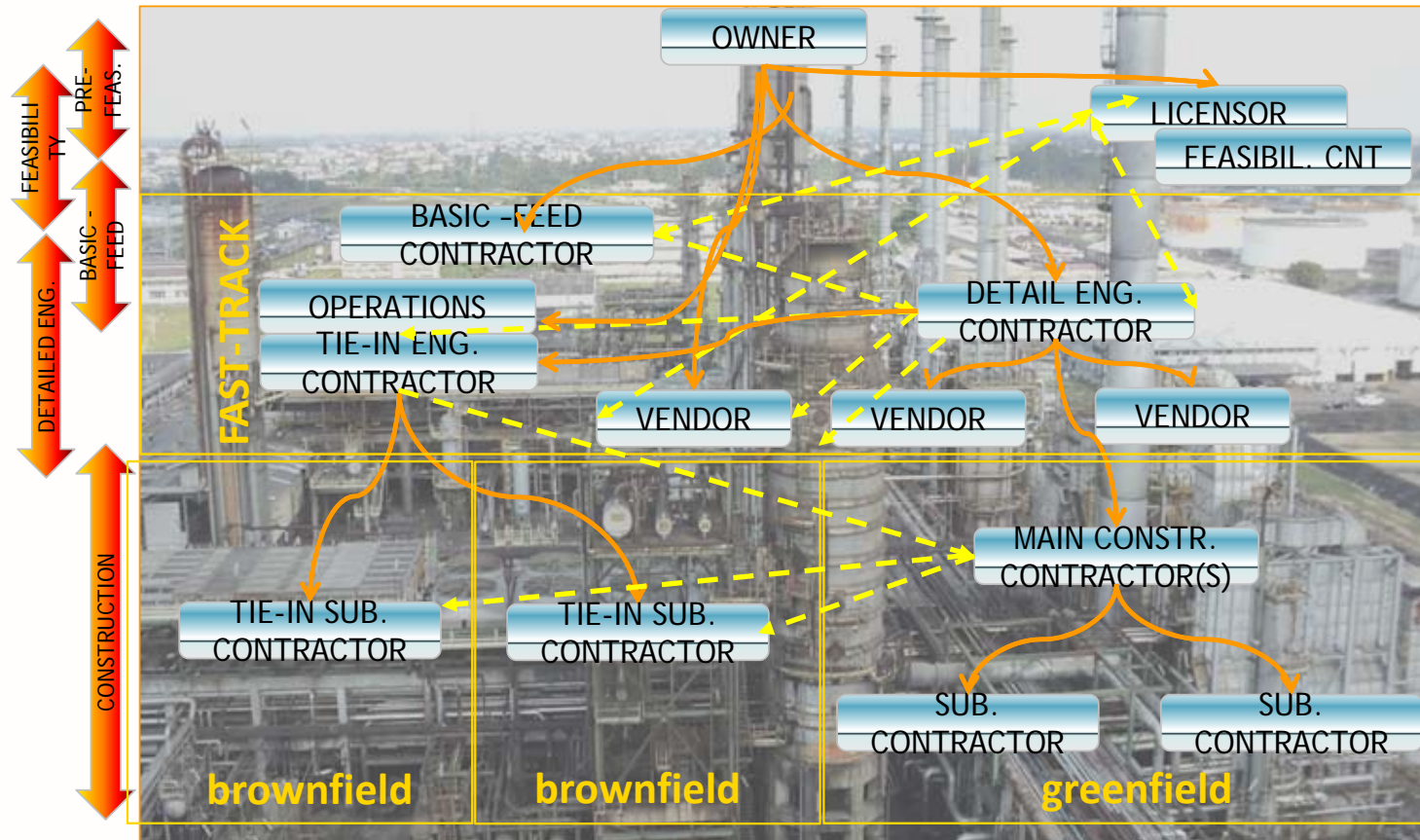
Which it the greatest objective?



How to mitigate risks in fast-track revamping projects



Interface management in fast-track



Legend

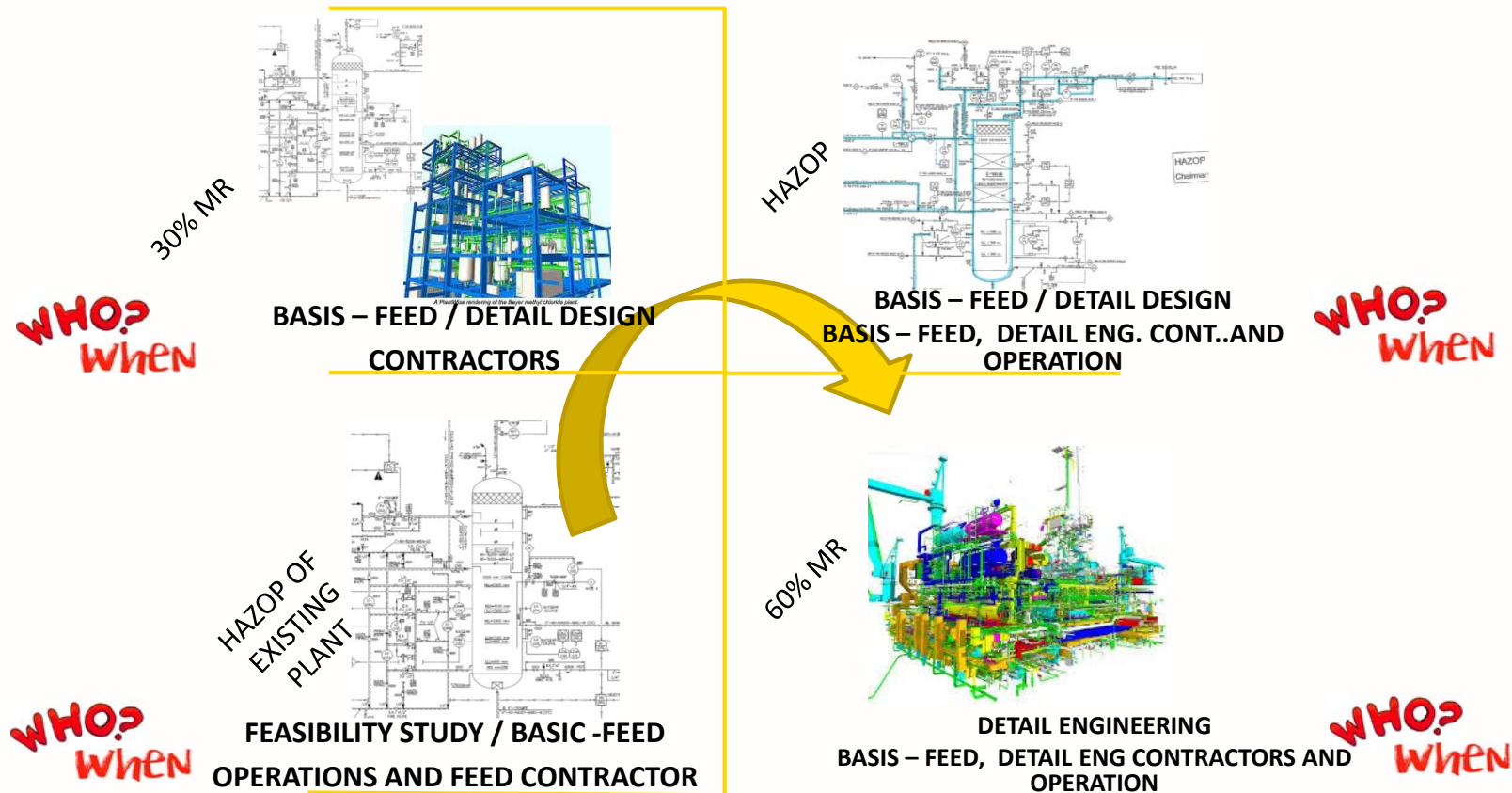
Direct (contractual) interface

Indirect interface

Interface Management

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Main Design Milestones



In practical words the recycling consist of the maximization of the availability of information to all the stakeholders such as weekly revision of P&ID and 3D model constantly updated available to all contractors

Fast Track – Key points



- *The Fast Track with parallelization of phases which traditionally are developed sequentially is a possible strategy to meet Project Objectives in project when the schedule is challenging;*
- *To mitigate the risk associated to fast track (more interfaces, reworks, designing by conservative assumptions rather than consolidated data etc.) project team needs to be integrated with an interface management plan and dedicated engineering methods such as re-cycling and final alignment need to be set-up in the engineering execution plan*
- *Involvement of Operation in Project Team is key point*



Reverse planning to meet critical milestones

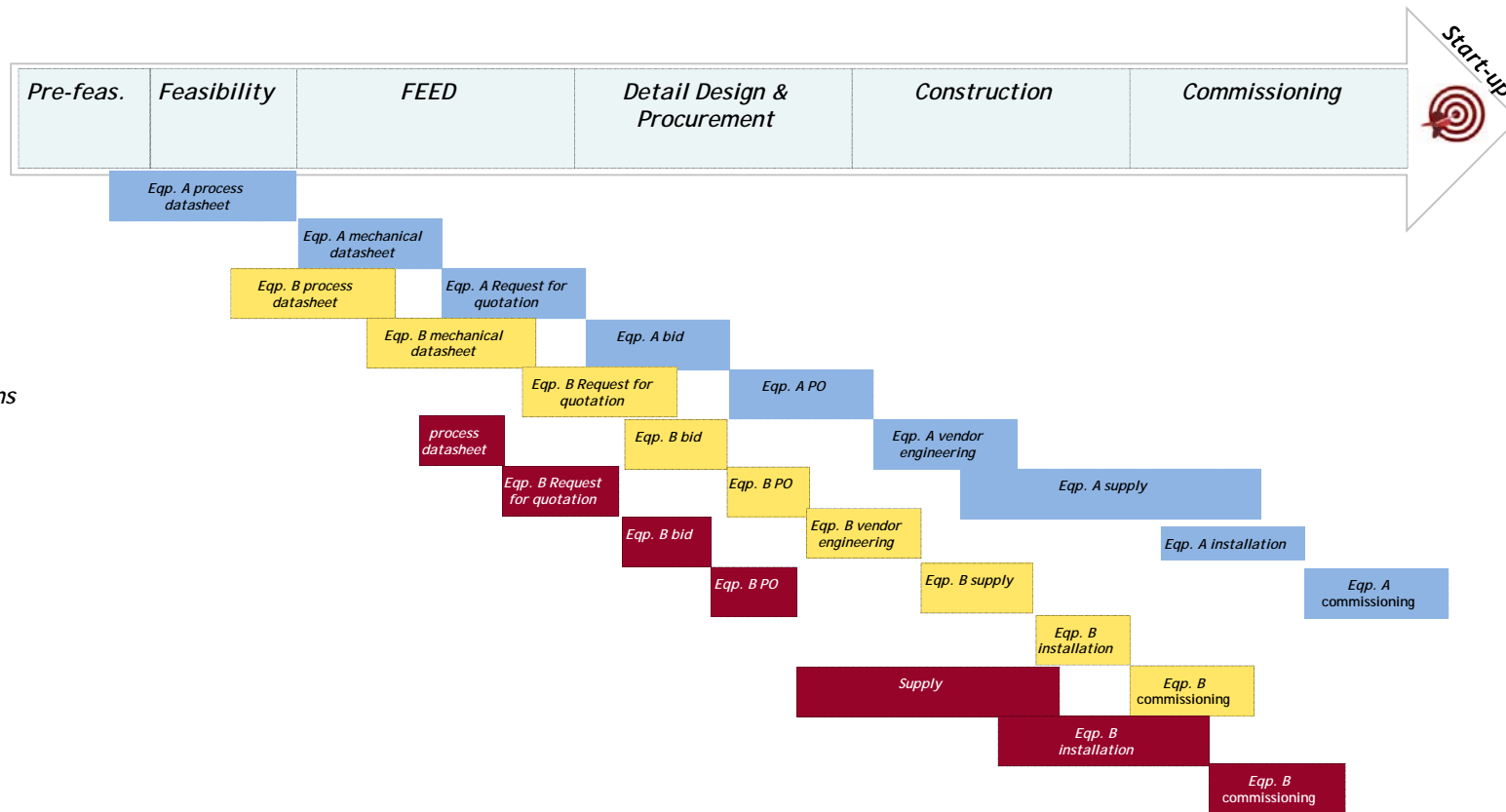


So let us then try to climb the
mountain, not by stepping on what is
below us, but to pull us up at what is
above us

M.C. Escher



Standard sequencing approach



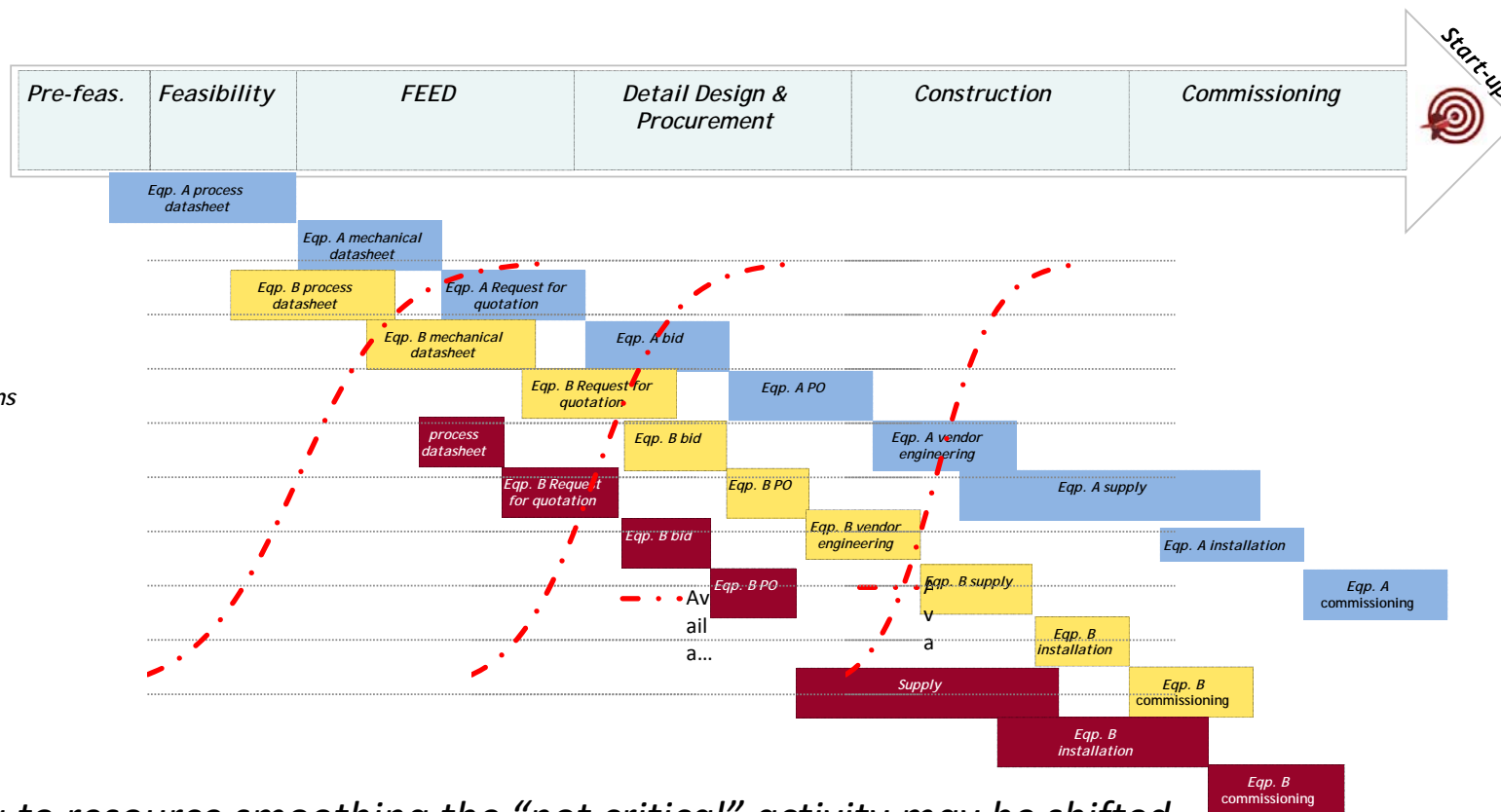
Starting from the left, each activity is estimated based on internal know-how and market investigation.

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Standard sequencing approach – resource smoothing

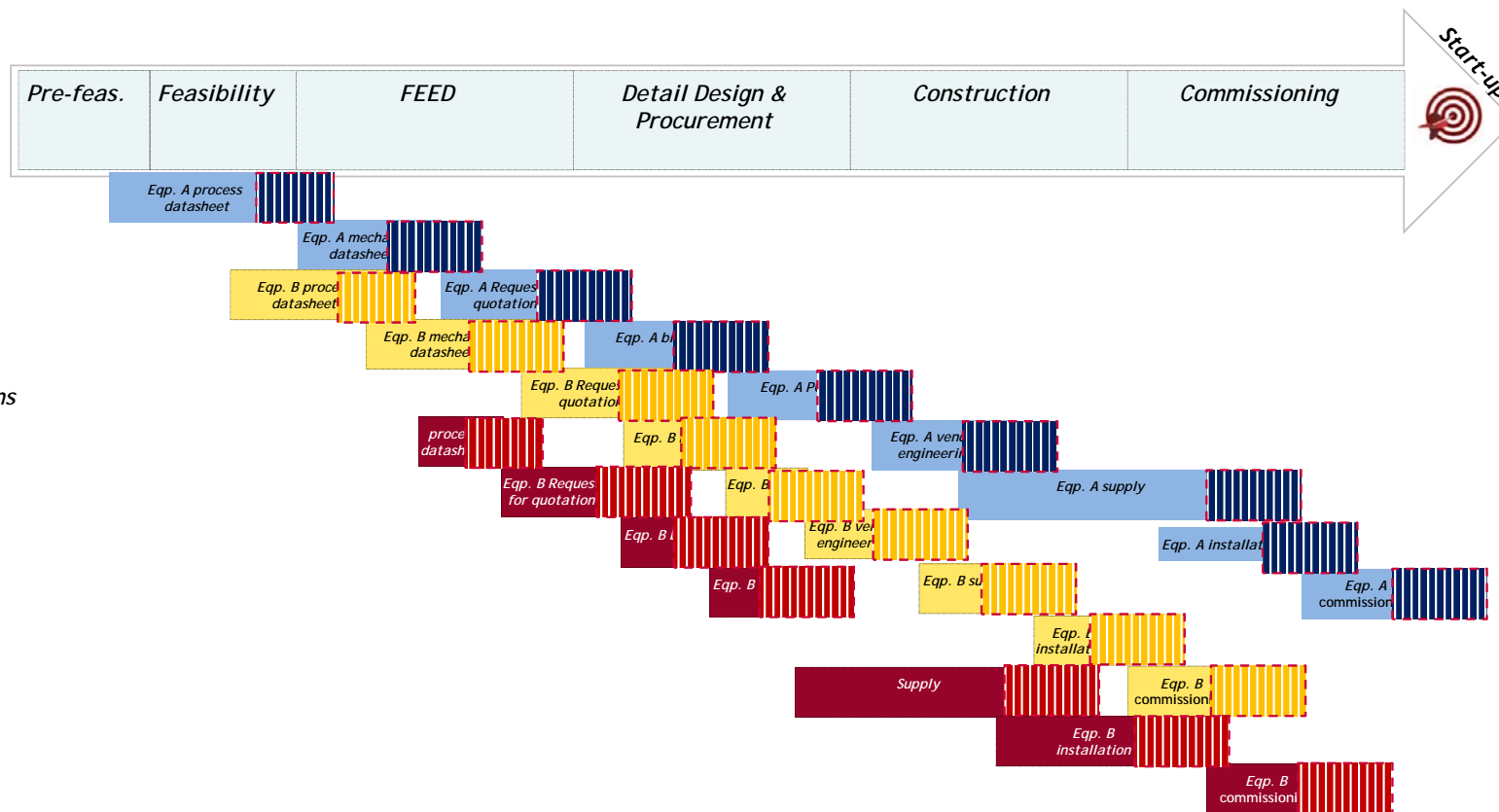


Owing to resource smoothing the “not critical” activity may be shifted.

Resource smoothing is typical for every engineering contractor, vendors, construction contractors etc.



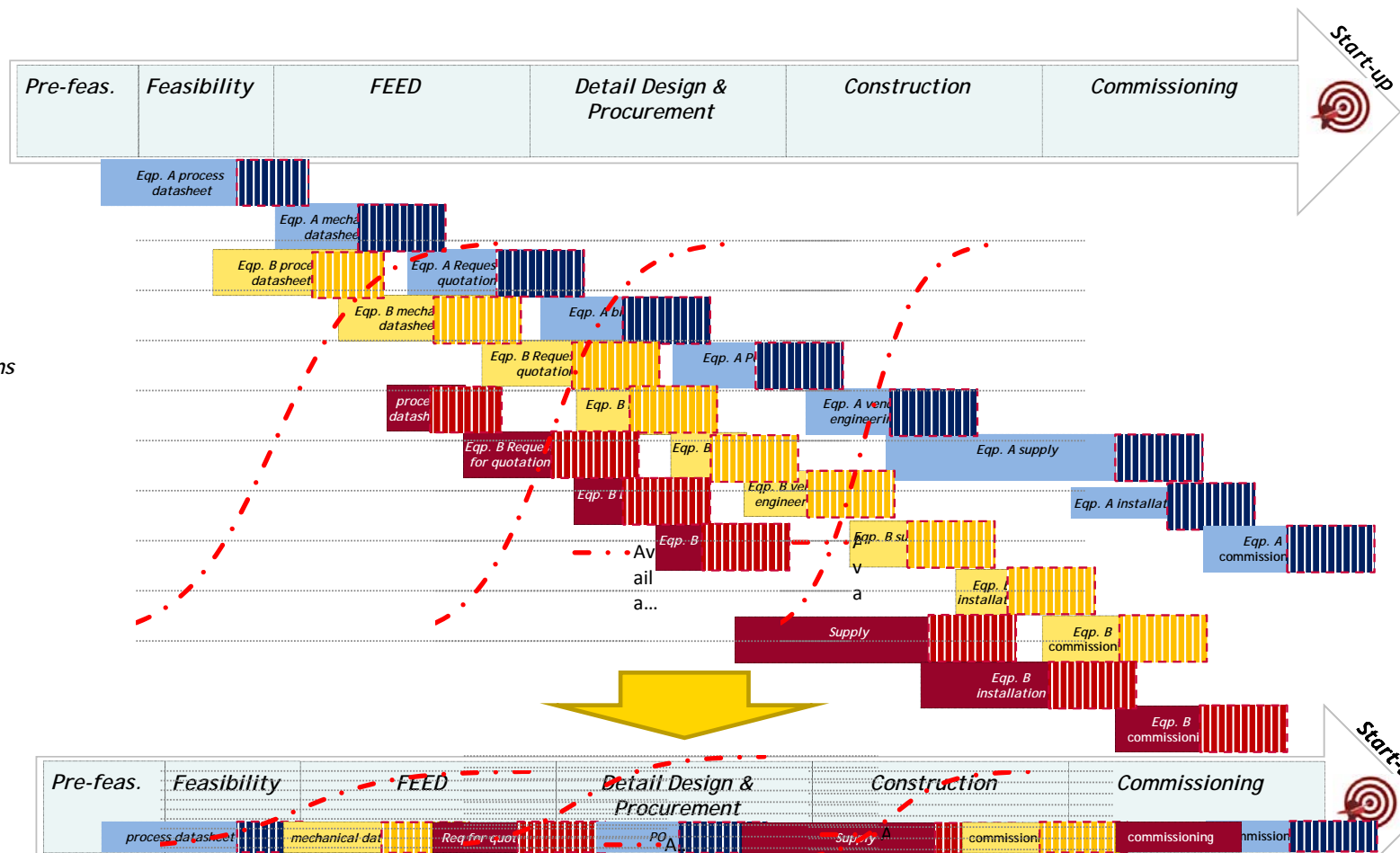
Standard sequencing approach – risk schedule analysis



For each activity, the associated schedule tolerance needs to be considered



Standard sequencing approach – resource smoothing & risk schedule analysis



- Activity 1 - LLI (Long Lead Item)
- Activity 2 - not LLI
- Activity 3 - bulk systems

Level smoothing and schedule risk to strengthen the project plan

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Float: the amount of time that a schedule activity can be delayed or extended from its early start date without delaying the project finish date.

*The critical path is the sequence of activities which has **zero** float.*

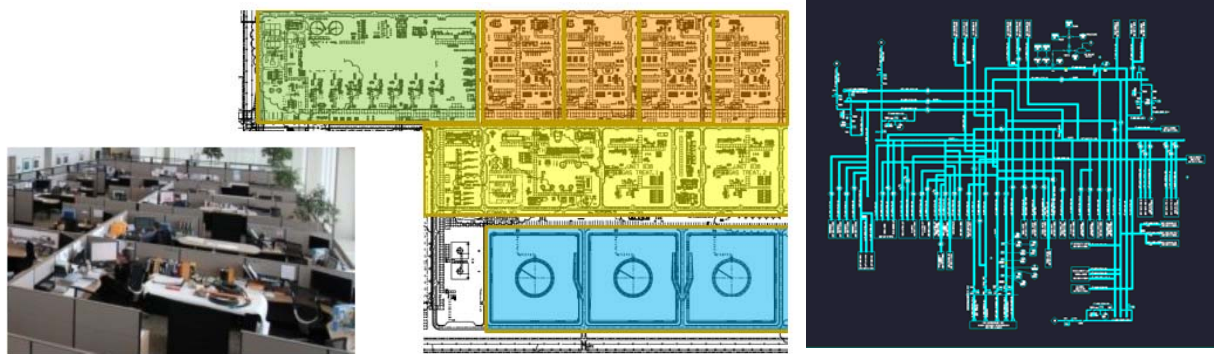
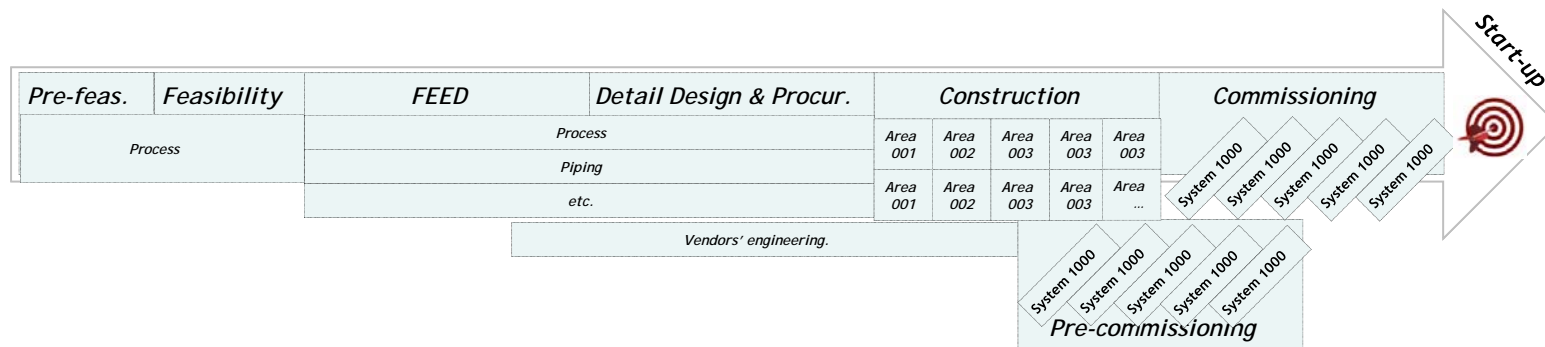
Applying the Critical Path method for all the systems of a project, even material with a rather short delivery can result to be critical, owing to that we can split LLI in two categories:

- *Typical LLI such as:*
 - *High pressure equipment*
 - *High temperature equipment*
 - *Special Material equipment*
 - *Not Typical LLI such as:*
 - *Bulk material, tie-ins, standard equipment*
- associated to early commissioning system*





Reverse planning to meet critical milestones



The main phases of a project are structured with different approaches:

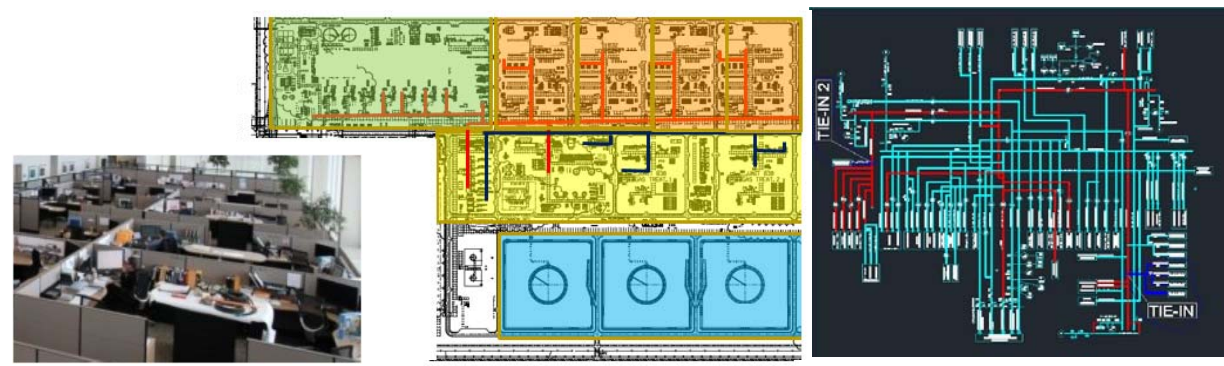
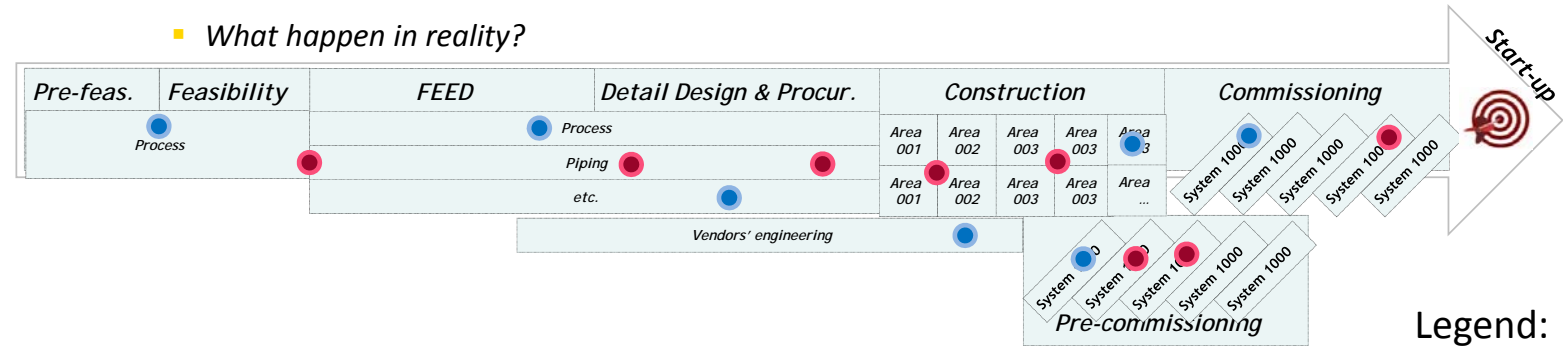
By system in commissioning, by area in construction, by discipline with incremental development in engineering

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Reverse planning to meet critical milestones

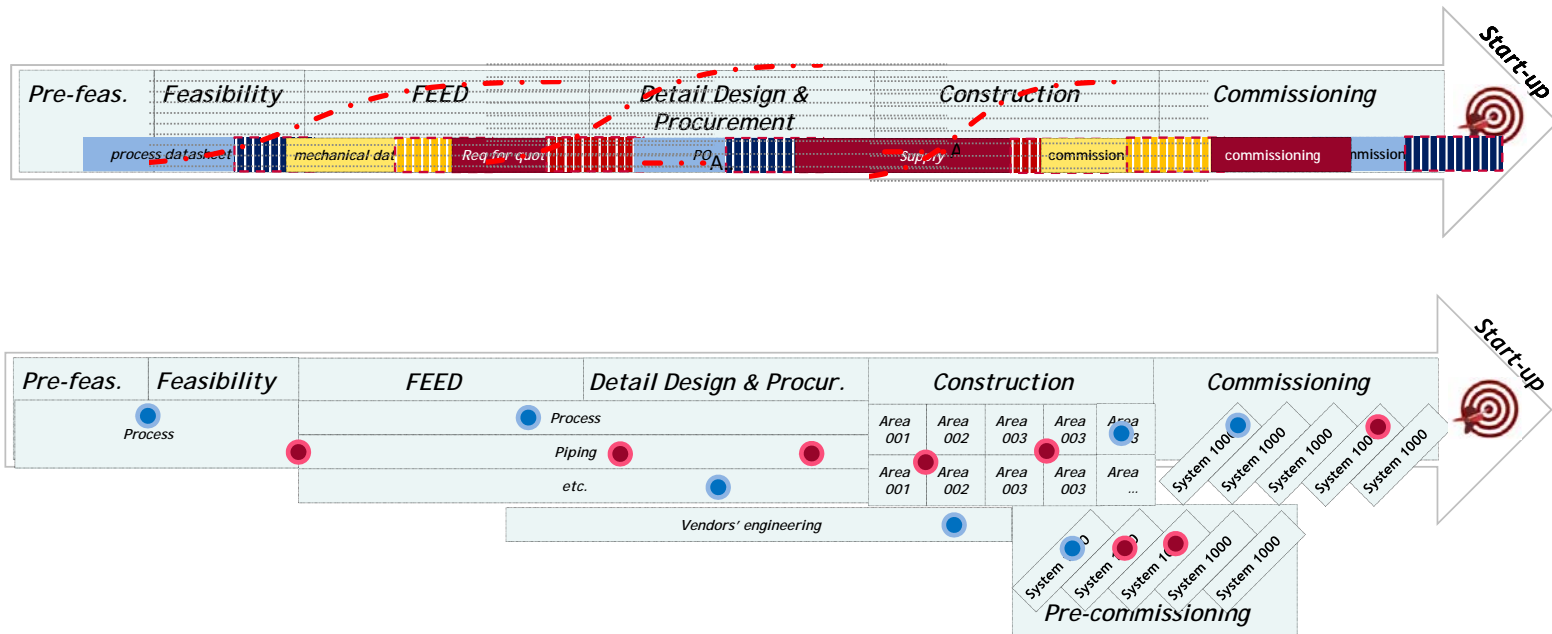


What happen in reality?



The critical path developed for all the project systems allows us to recognize critical delivery items which do not have the longest delivery (bulk material, tie-ins, concrete, steel structures etc.)

Reverse planning to meet critical milestones



Generally the “sequencing” approach is applied at the start of the project and the “reverse planning” one becomes dominant during construction:
 the challenge is to match both during the development of the FEED.

Reverse planning to meet critical milestones – Key points



- *Early identification of commissioning system is crucial for correct project planning*
- *The critical path developed for all the project systems allows us to recognize critical delivery items which do not have the longest delivery such as tie-ins or bulk material for early commissioning system, which shall be focused during the development of FEED;*



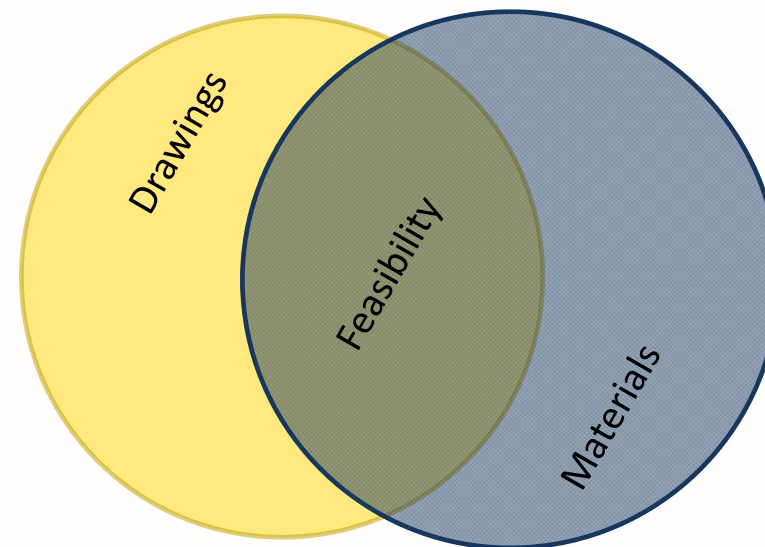
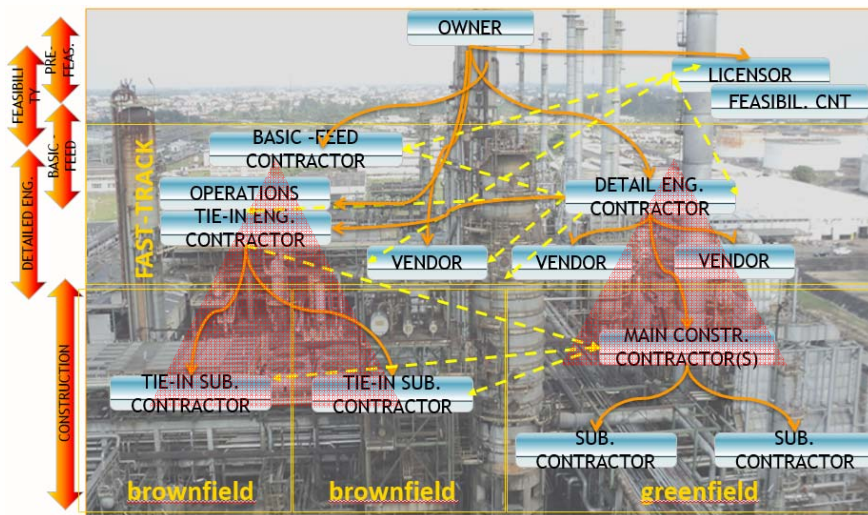
From FEED to construction: the importance of feasibility for successful execution



If you're not worried, you need to worry. And if you're worried, you don't need to worry

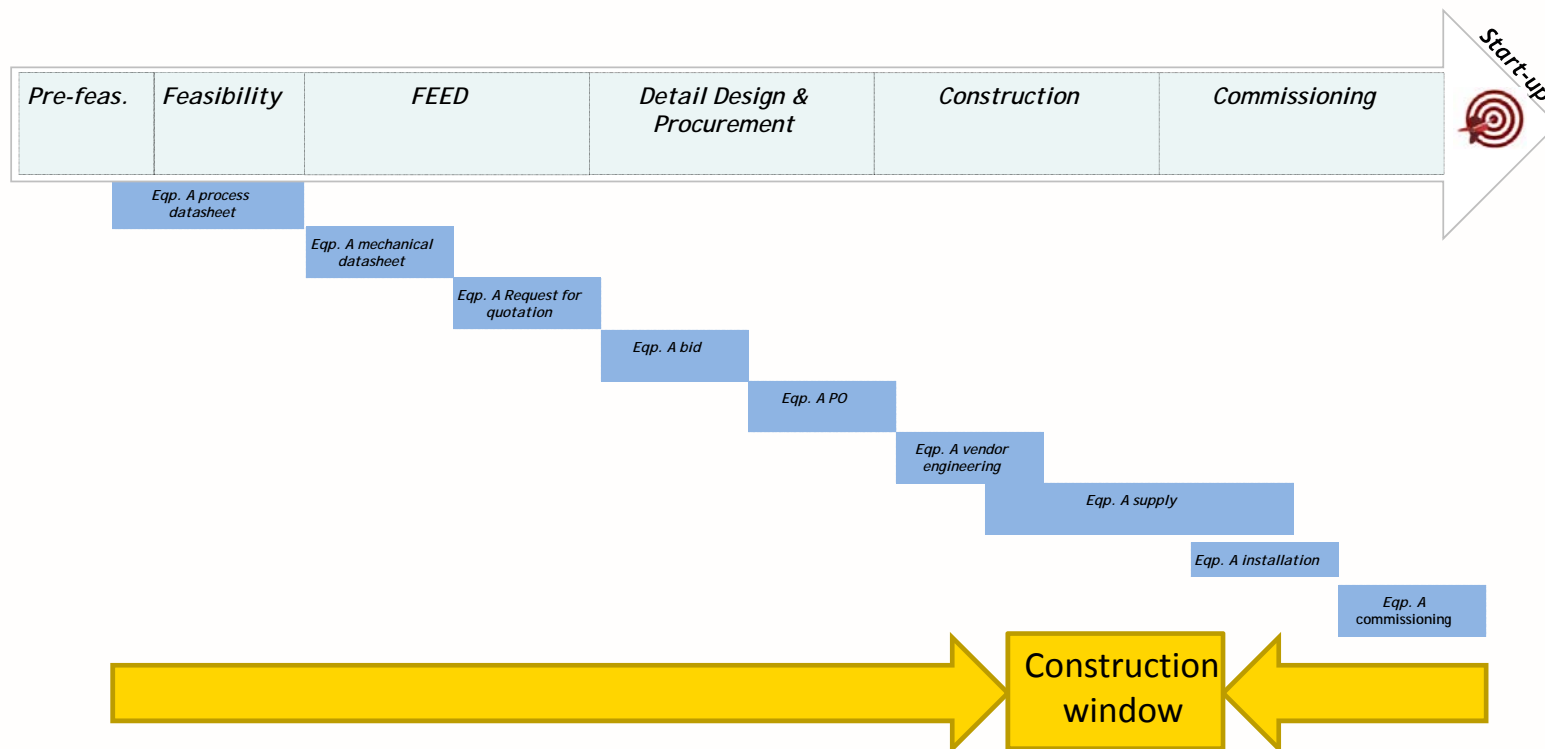
Ray Dalio

From home-office to site



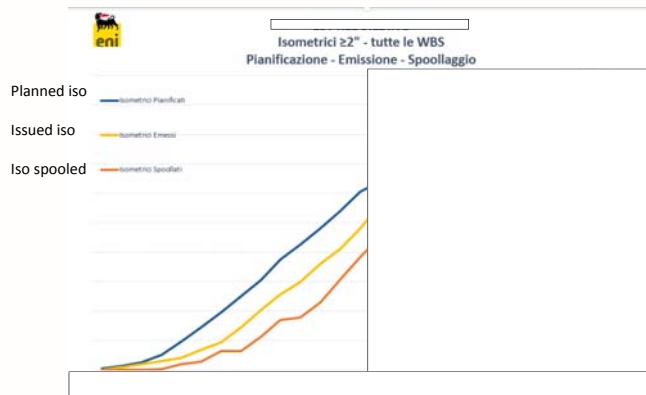
The most important responsibilities for Field Engineering are to transfer the detail design to construction contractors and assure feasibility to guarantee work-front

Critical aspects of Feasibility

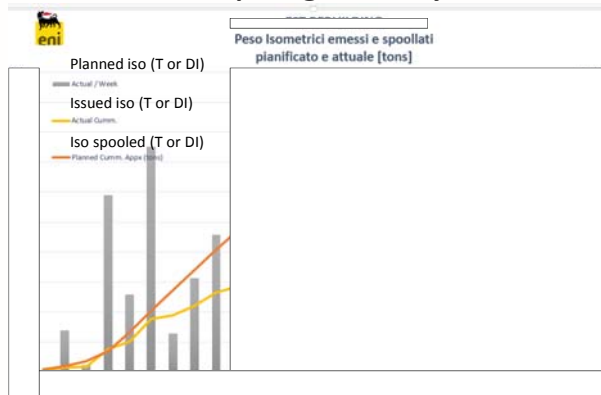


*The development of engineering is specular to construction needs:
last drawing finalized is the first need for construction
 in particular with reference to civil works and piping fabrication*

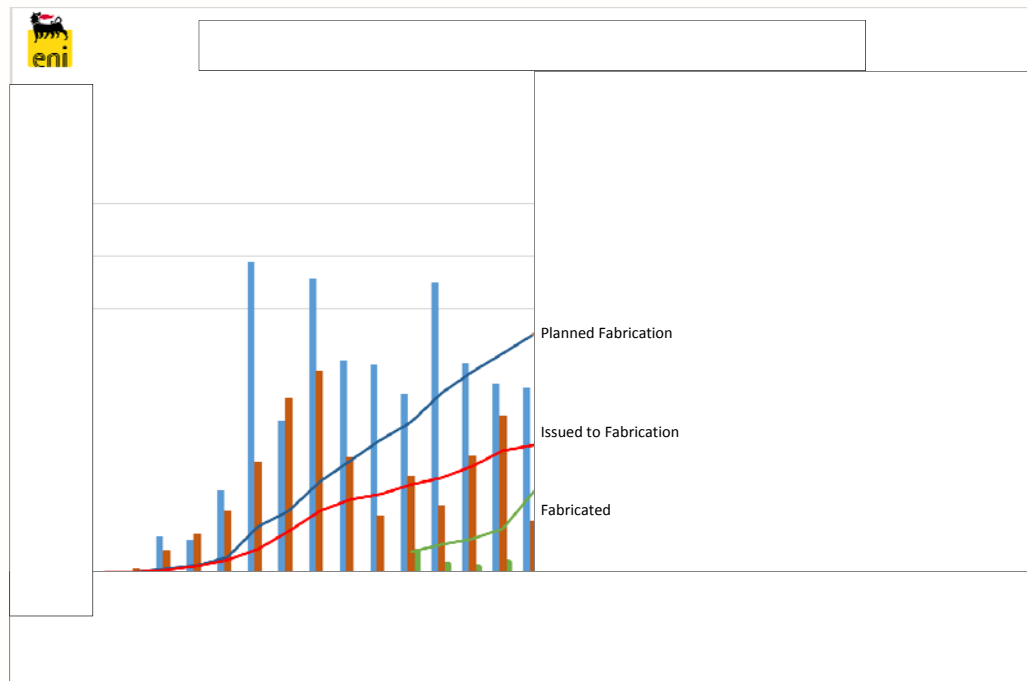
Fabrication – possible outcomes



Isometric progress by line



Isometric progress by weight

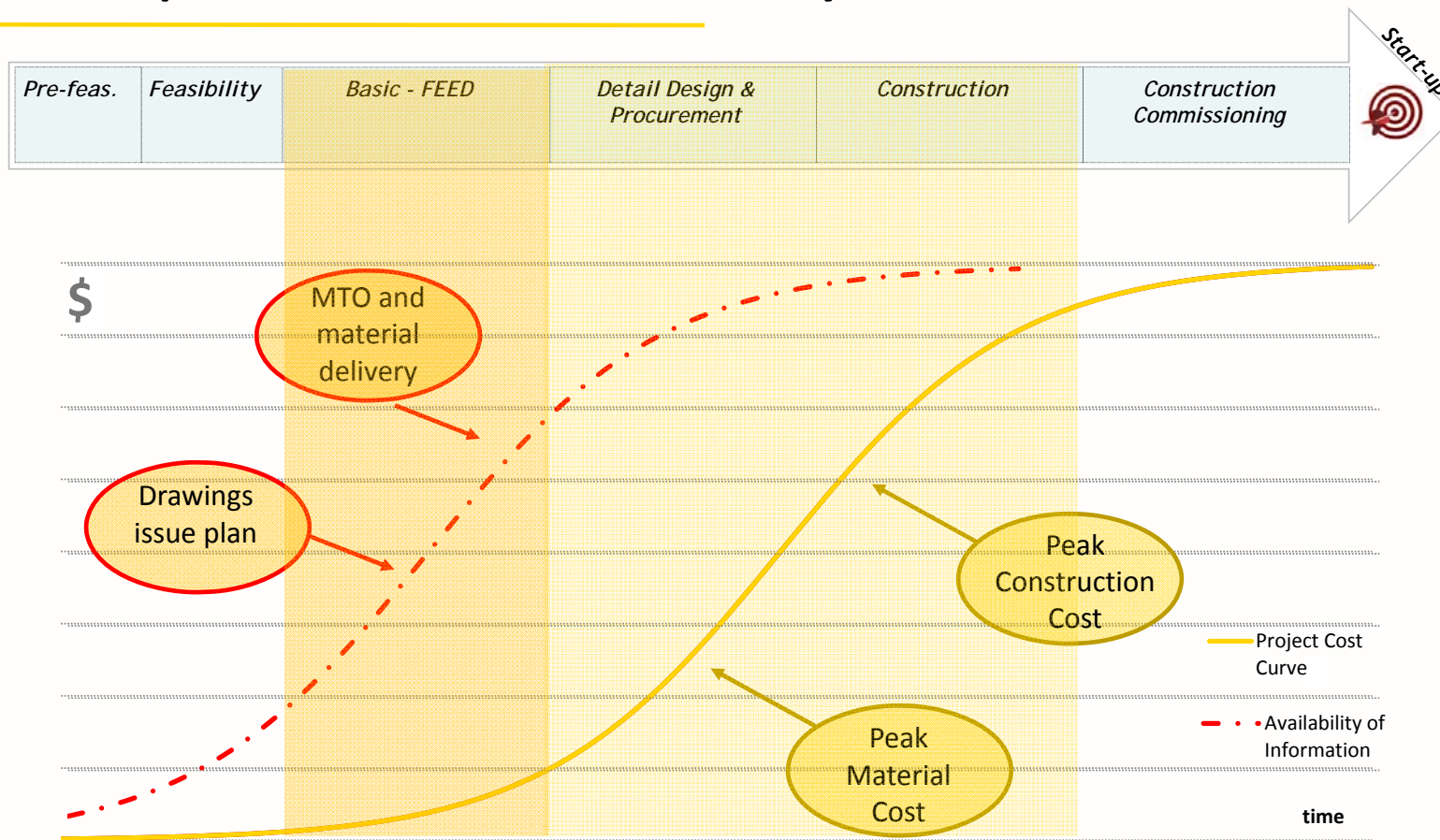


Fabrication progress by Dia-Inch (DI)

Possible outcomes for the fabrication planning and monitor & control can be related to the fact that different disciplines measure with different perspective (number of lines by engineering, tons by feasibility and warehouse, DI by fabrication)



Why is FEED the phase to endorse the feasibility?



During FEED, project feasibility curves can be properly evaluated by finalization of material take off (MTO) and procurement plan, owing to this the FEED phase is the most important for the correct evaluation of construction planning

From FEED to construction: the importance of feasibility for successful execution – Key points



- *The passage between home office and site is critical and needs to be structured in the smoothest possible way.*
- *FEED can help to verify the feasibility anticipating possible outcomes during construction*



- *Mitigation of risk associated to fast-track is a critical aspect for a successful project – including design with re-cycling and interface management*
- *Early identification of the latest stages of construction & priority commissioning systems need to be develop asap*
- *FEED is not only the most critical phase of the design of a project, it allows to easily smooth the passage between the detail design and construction*

