

Project Management + Lifecycle Management

Lifecycle Engineering

Objective: To develop systematic and model based approaches to lifecycle engineering that builds strongly on the management of uncertainty and decision analysis, Modules:

1. Project lifecycle overview.
2. PERT and CPM.
3. Project Risk and Monte Carlo Analysis
4. Introduction to Project Management Software
5. Earned Value Analysis
6. Resource Management
7. Example Project
8. Project rework and Systems Dynamics Modelling
9. Financing projects
10. Course work + revision

Projects are getting tougher all of the time... 'more of the same' is no longer enough

- ❑ Projects play a major role in most firms - whether delivering a contract or developing new products
- ❑ The stakes are high because business success depends on a few key projects
- ❑ Performance requirements are ever increasing - customers want projects to be ***better, faster and cheaper***
- ❑ Unfortunately the track record is not good...

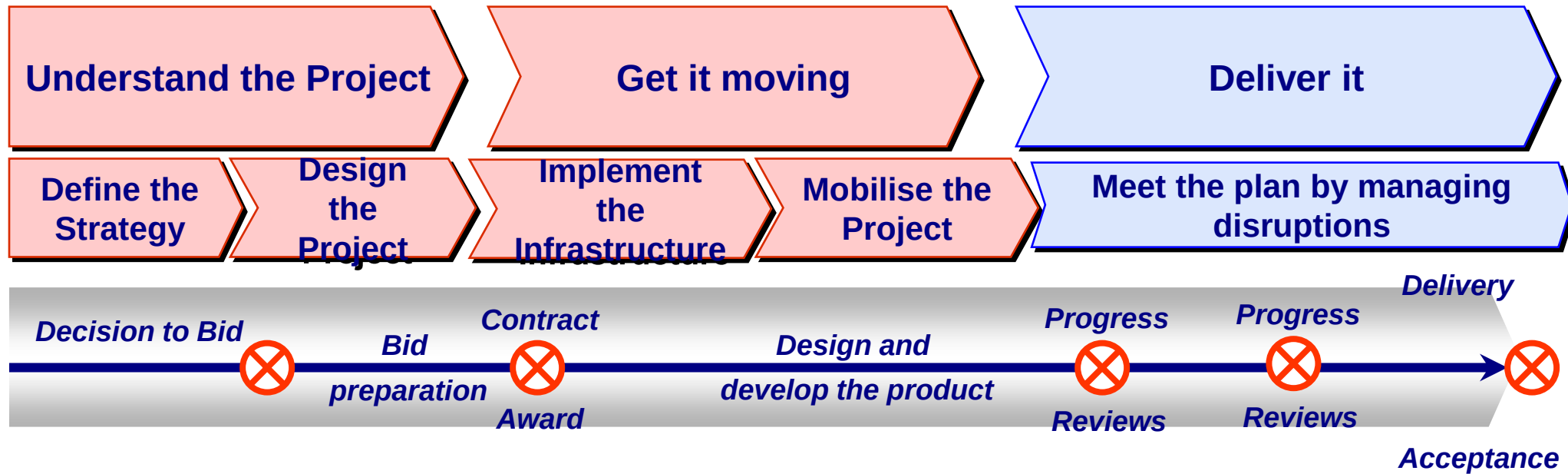
. . . research on more than 3,000 projects and direct experience of over 100 large, complex projects shows that only 10% exceeded their targets and over 50% failed to get close to their targets

The difference between project success and failure is enormous

	Outstanding	Target	Expected	Poor	Disaster
Technical Performance	Exceeds requirements, performance incentives awarded	Meets requirement	Meets requirement with some concessions	Performance shortfall: performance “penalties” applied	Major Performance Shortfall: heavy penalties /cancellation
Programme	0-10% Reduction in schedule	On schedule	0-10% Late	10-40% Late LD’s applied	30-60% Late Heavy LDS
Cost	0-10% Lower than target	Target cost	0-10% Over target	10-30% Over target	20-50% Over target
Project profit	10-20%	5-10%	0-5%	Loss of up to 20%	Loss of 20 - 50%

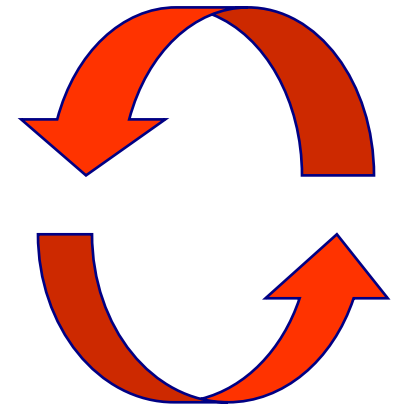
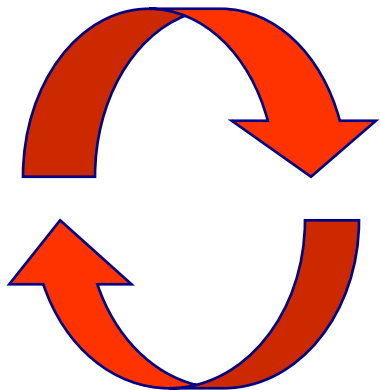
Most projects act to destroy Share Holder Value....

**Why ? - what needs to be done is clear....
it looks straightforward**



.... but it's far from straightforward

- *many interdependencies*
- *much uncertainty and risk*
- *high rate of change and disruption*



Robust project design and processes



- Is the **project design** right ?
- Can we undertake the work **profitably** on **time** and to **cost** ?
- Is our supporting **business infrastructure** appropriate for a project of this size and complexity ?
- Are our **resources appropriate** and can we mobilise them in time ?
- Are we organised to use high performance **Integrated Project Teams** ?
- Are the plans and controls built from an in-depth understanding of **Systems Engineering**, the product and work breakdown ?
- Are we confident we have learnt and applied **lessons from the past** ?

....is it really different this time ?

Ensure the 'management means' are there



- ☐ Are there enough people with the **right skills** to do the work ?
- ☐ Do you have **professional, experienced project managers** - not technical managers 'doing their best' ?
- ☐ Are **tasks properly defined** and bounded with managed interfaces ?
- ☐ Are there good '**leadership**' role models within the team ?
- ☐ Are things done at the right level - effective **empowerment and authority** ?
- ☐ Is '**power**' used effectively - knowing when and how to intervene ?
- ☐ Are terms such as 'working together', knowledge management, co-operative behaviour, empowerment, and communications **more than just words** ?

....is it really different this time ?

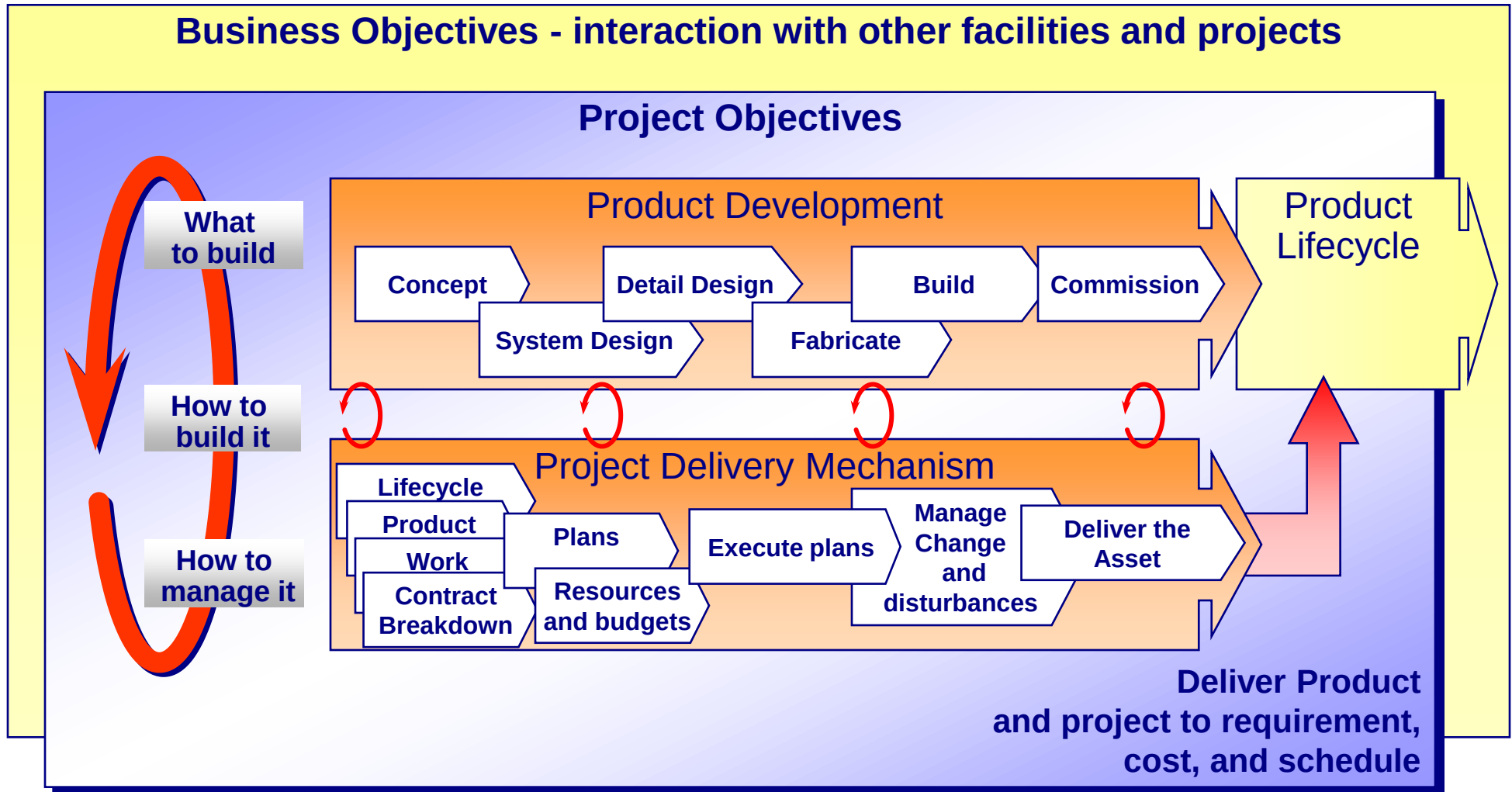
Manage the dynamics of the programme



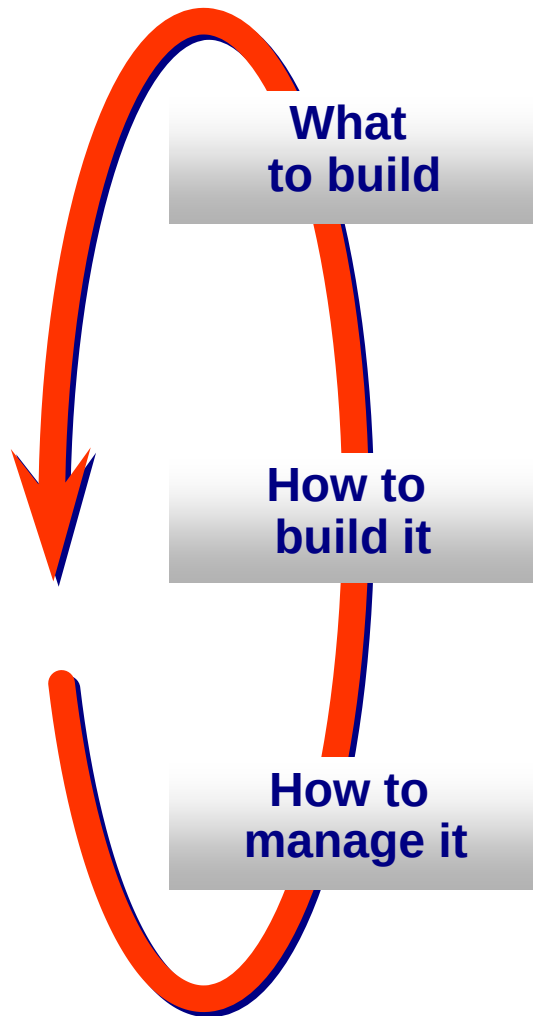
- ❑ Can you predict and manage the effects of **inevitable changes and disruptions** throughout the full project lifecycle ?
- ❑ How do you achieve the **right level of overlap** between phases ?
- ❑ Have you considered the impact of **learning and productivity improvements** that can be achieved over time ?
- ❑ How effectively are you monitoring and controlling **rework** ?
- ❑ Do you understand the true 'cause and effect' **sensitivities** and the likely results (what ifs) of management actions (some may be counter intuitive) ?
- ❑ Are you using **informed decision making** based on an insight into the **dynamics** of the project ?

.....is it really different this time ?

Good Companies will design the Product and the Project delivery mechanism - together in the context of the business



Project design must provide an optimised answer to what to build, how to build and how to manage it



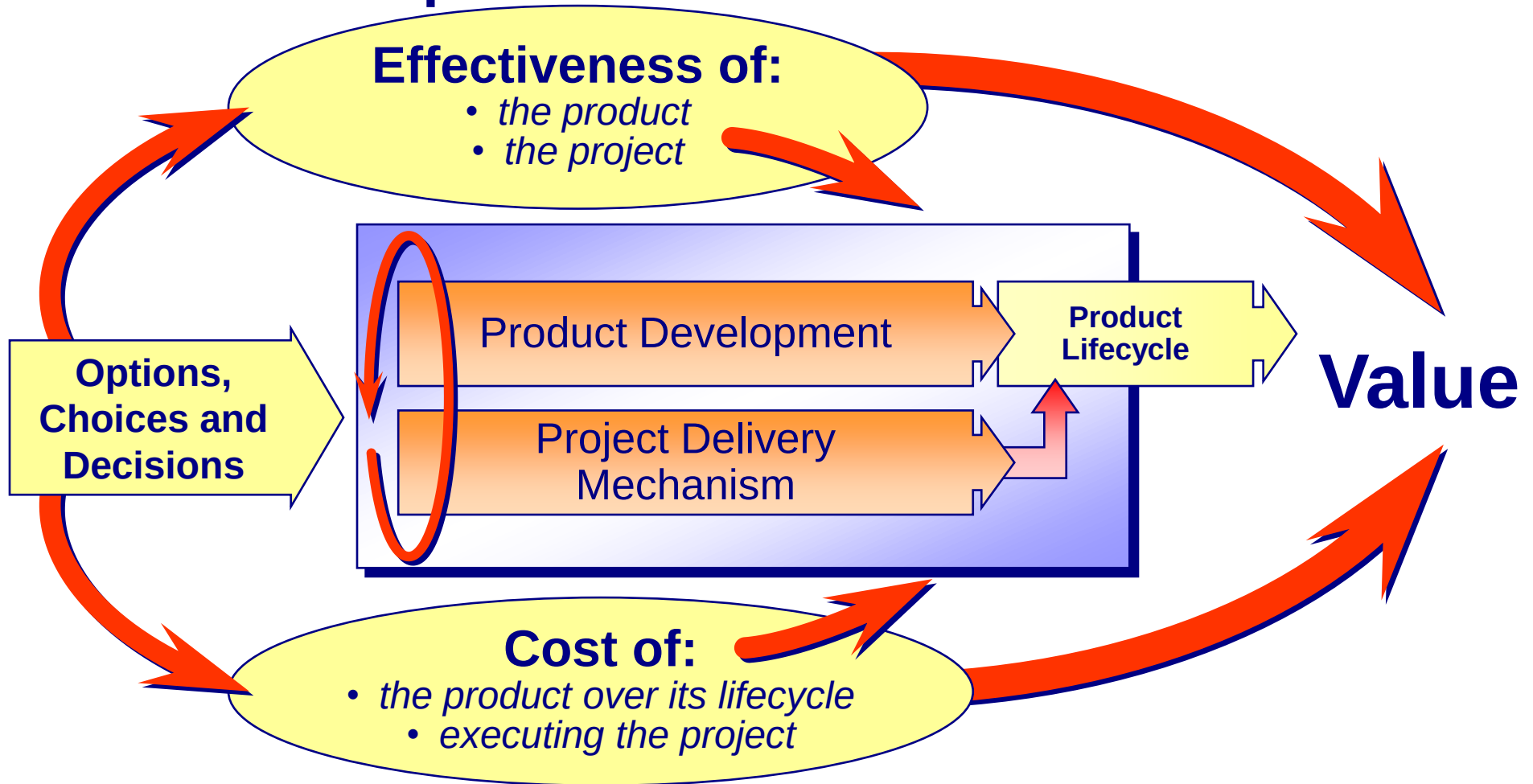
- ☐ Requirements
- ☐ Product Breakdown
- ☐ Lifecycle - what and when

- ☐ Build Strategy / Work Breakdown (WBS)
- ☐ Partners / Contractors
- ☐ Facilities
- ☐ Locations

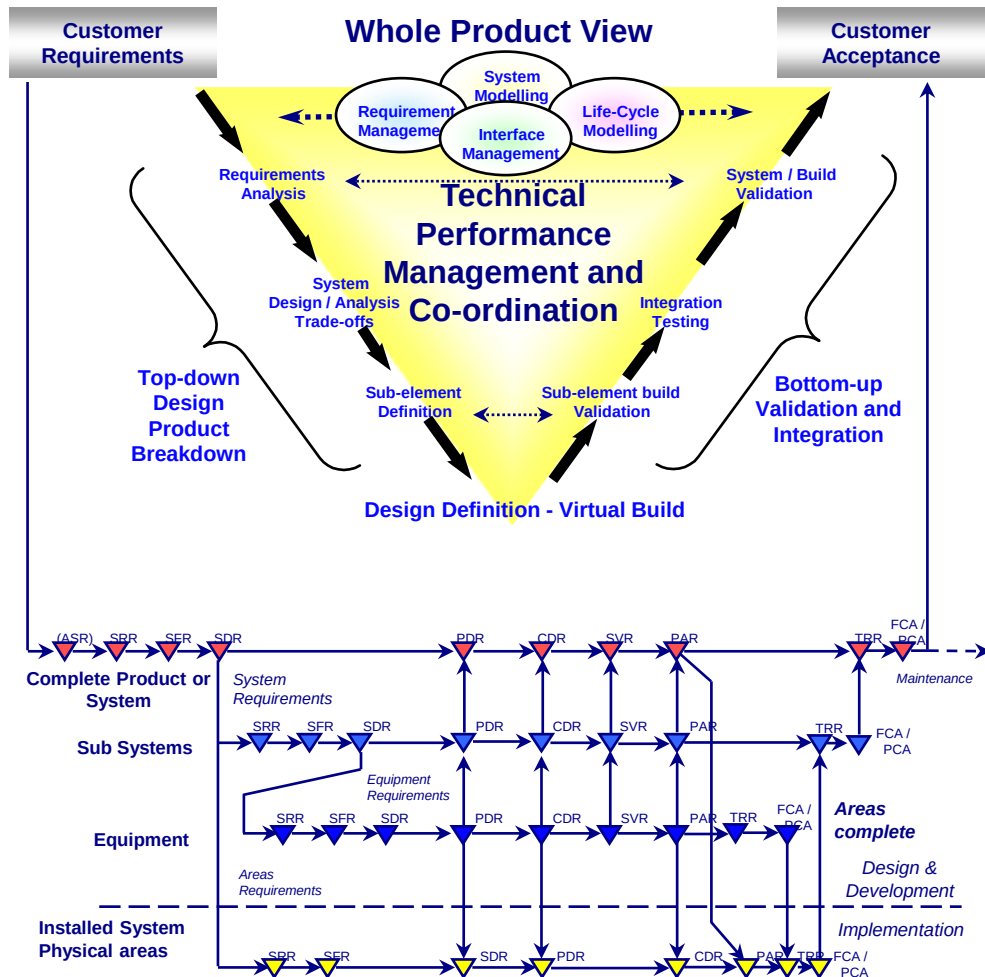
- ☐ Customer Acceptance
- ☐ Programme - Technical /Commercial
- ☐ Organisation Design/Breakdown Structure (OBS)
- ☐ Contract Breakdown Structure
- ☐ Cost Breakdown Structure (CBS)

matching the product and project design with the capability to deliver

Value - the success with which the Project and the operation of the Product meet the respective requirements of all the stakeholders



Identifying what to build and how to build it

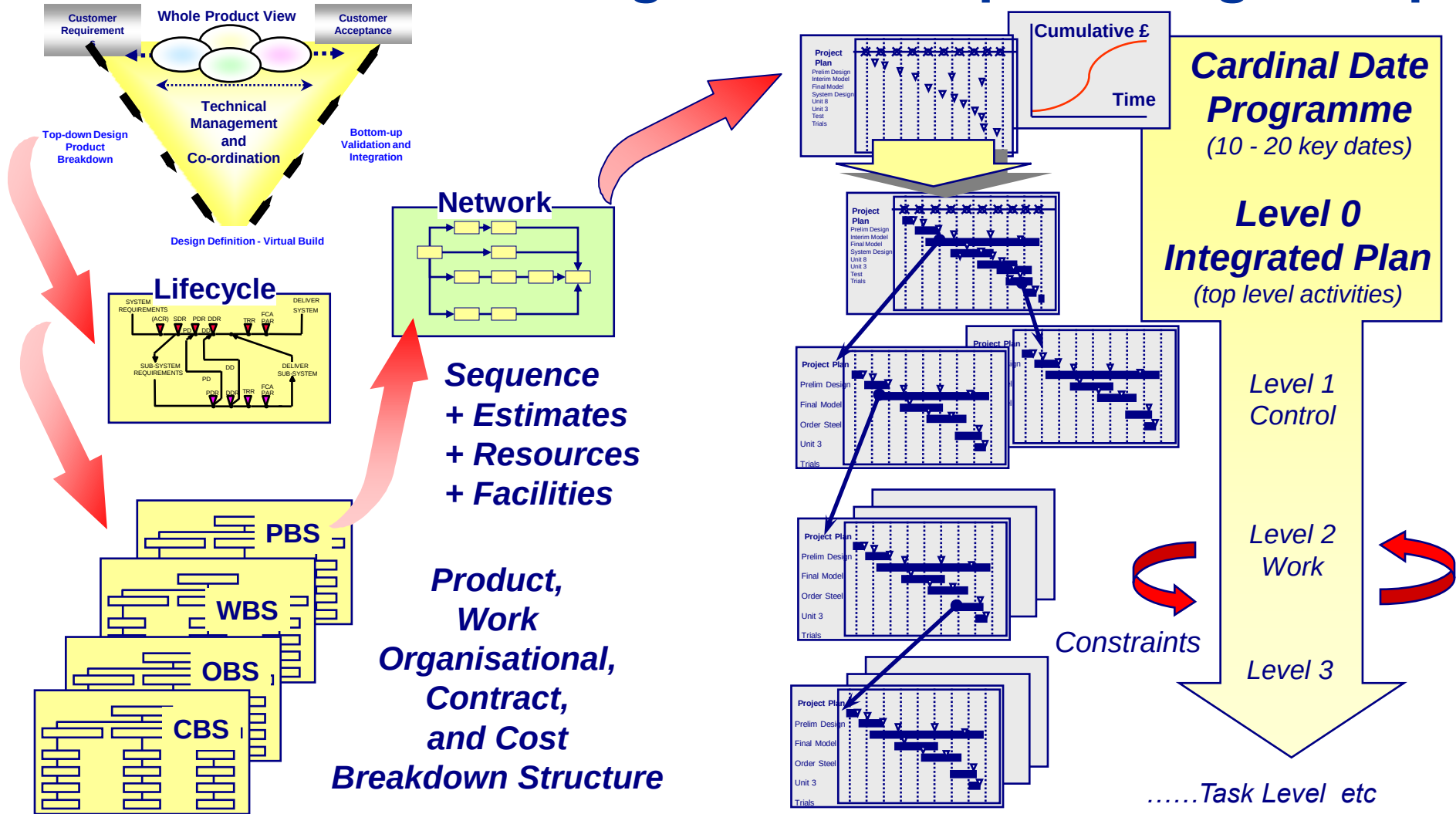


Systems Engineering and Project Lifecycle Reviews:

- *Using a Systems Engineering Lifecycle approach, break down the requirement from a whole product view*
- *Product design starts with a Product Breakdown*
- *Whole Product > Systems > Sub Systems > Equipments*
- *Consider alternative build strategies and how to integrate to meet the whole product performance requirement*

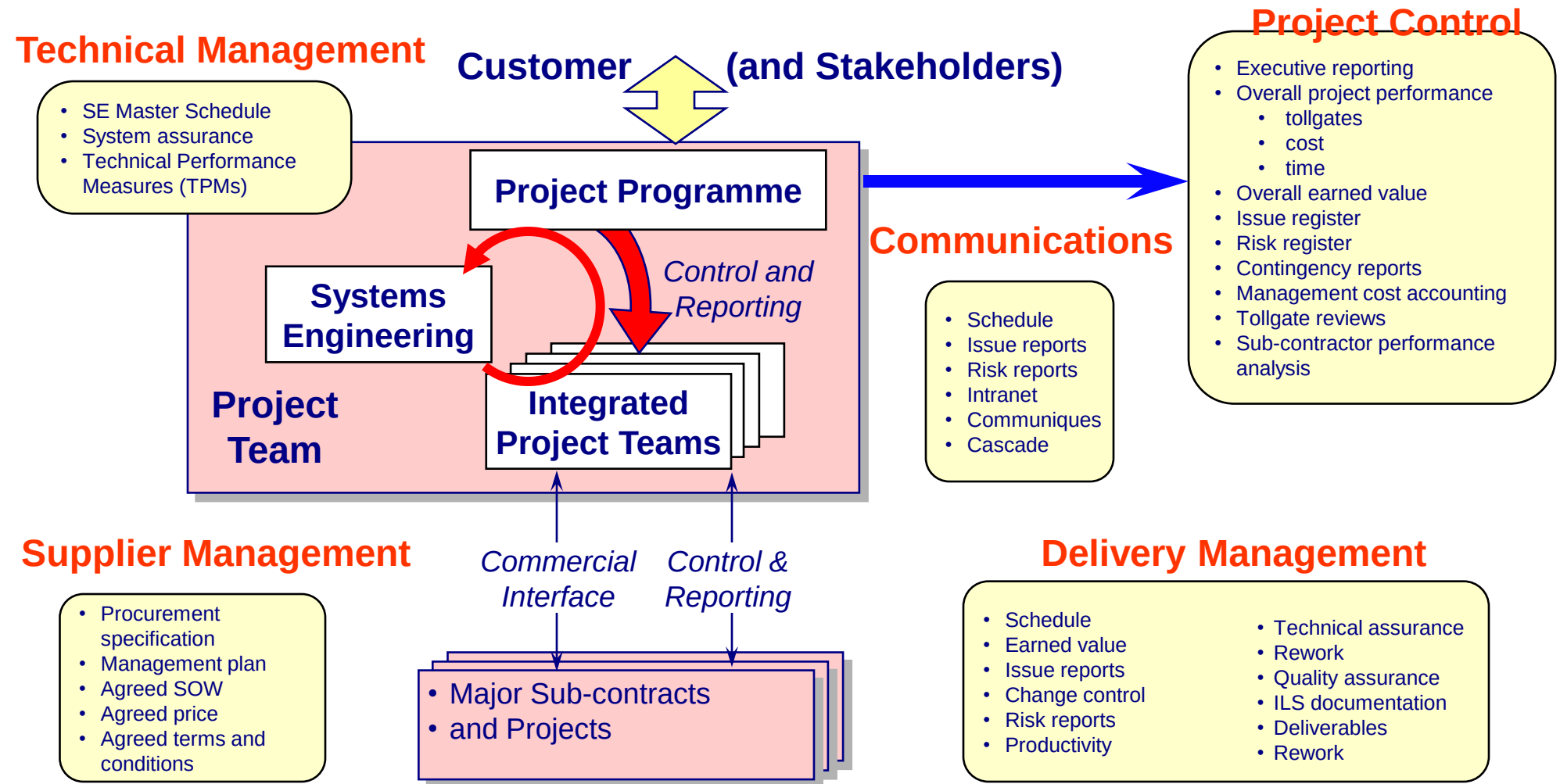
The Product Breakdown and associated Lifecycle Reviews define the sequence of activities required

Add the 'how to manage' to develop an integrated plan



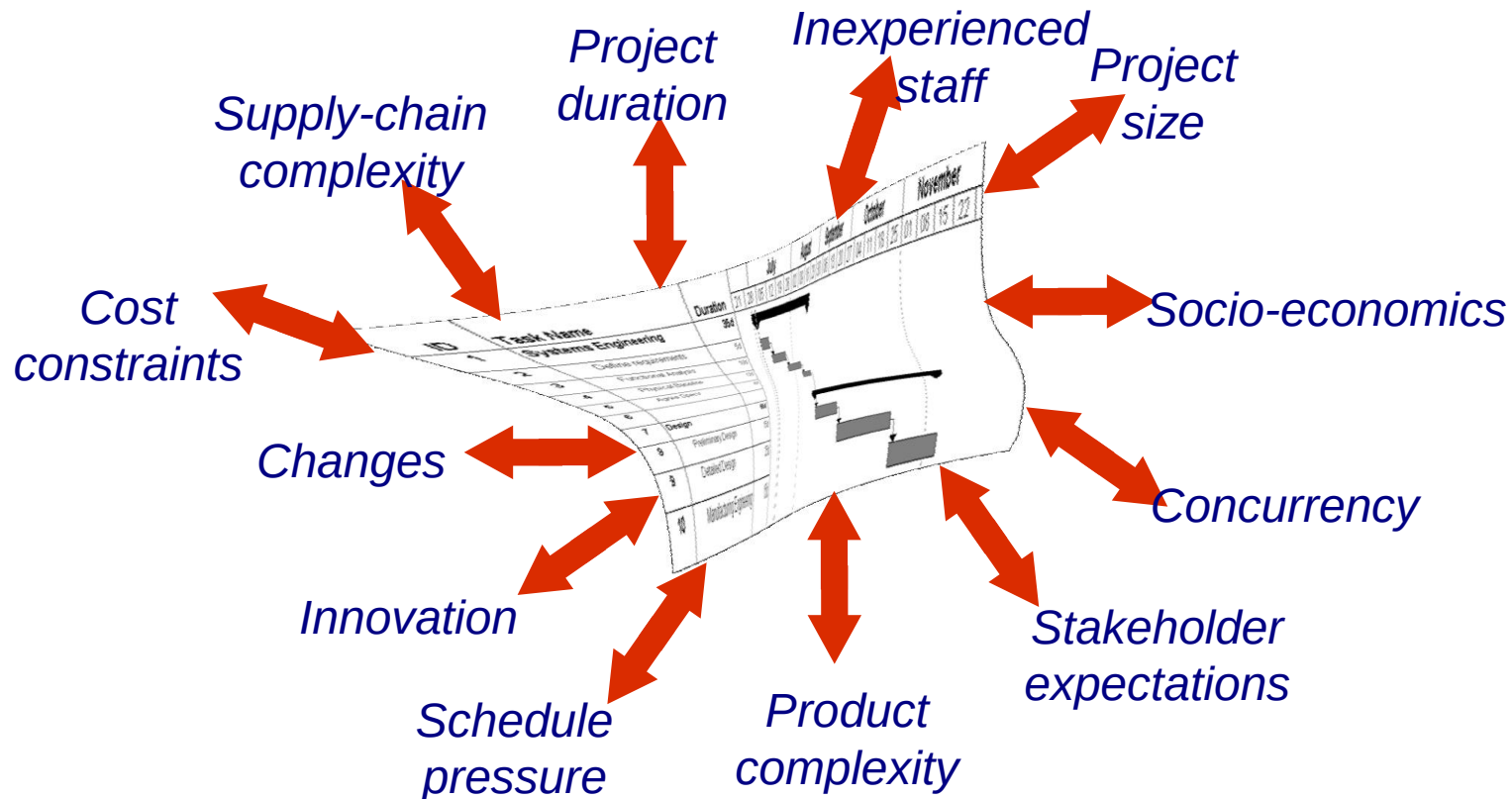
**...high quality, integrated plans reduce the risk of failure...
..... but beware of a reliance on 'static plans'**

Sound Processes provide clear controls and reporting



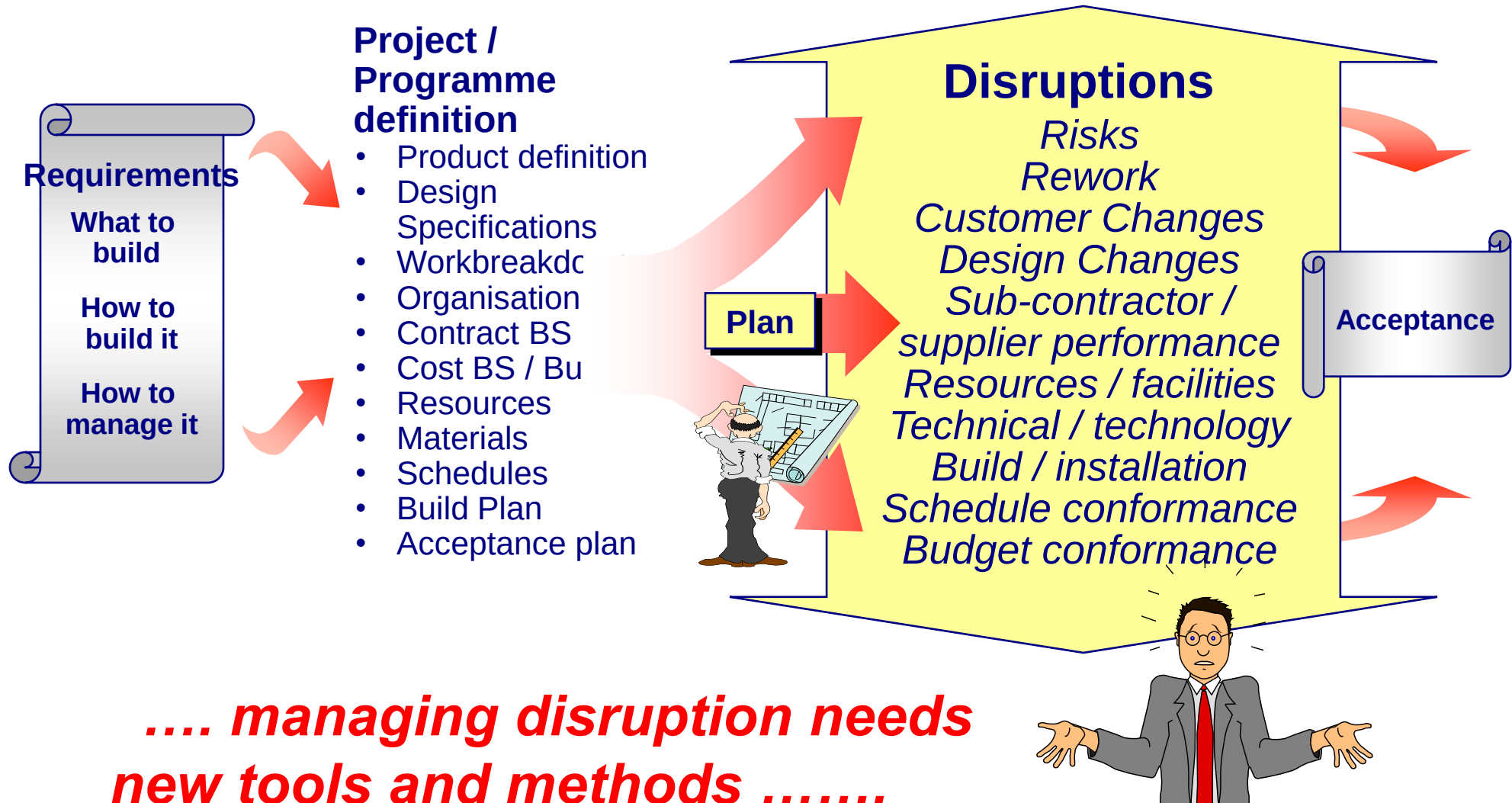
... which quickly creates the capacity for effective management

The project design must be robust enough to withstand the inevitable pressures and changes



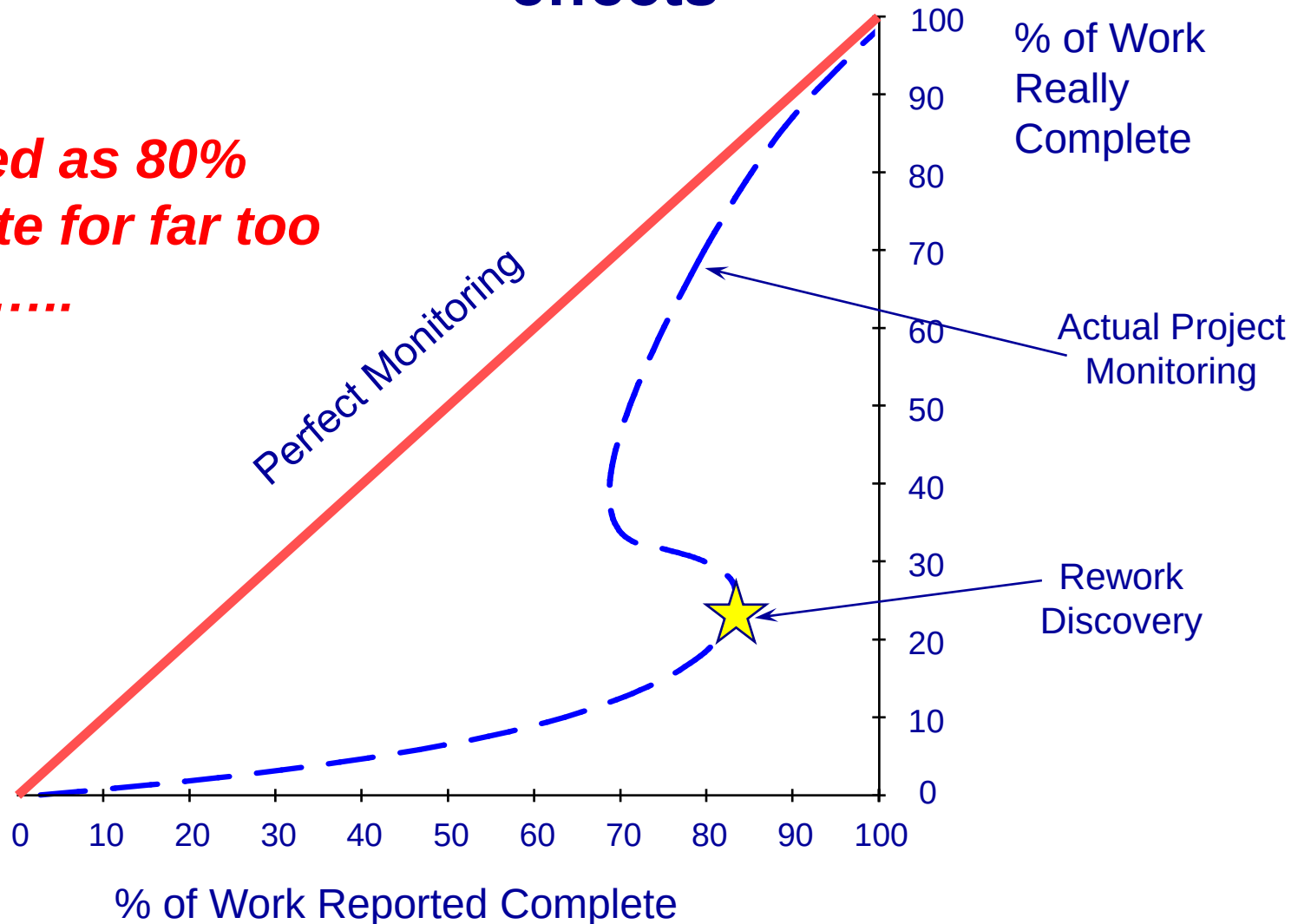
....but these are dynamic in nature!

Dynamic effects appear as disruptions

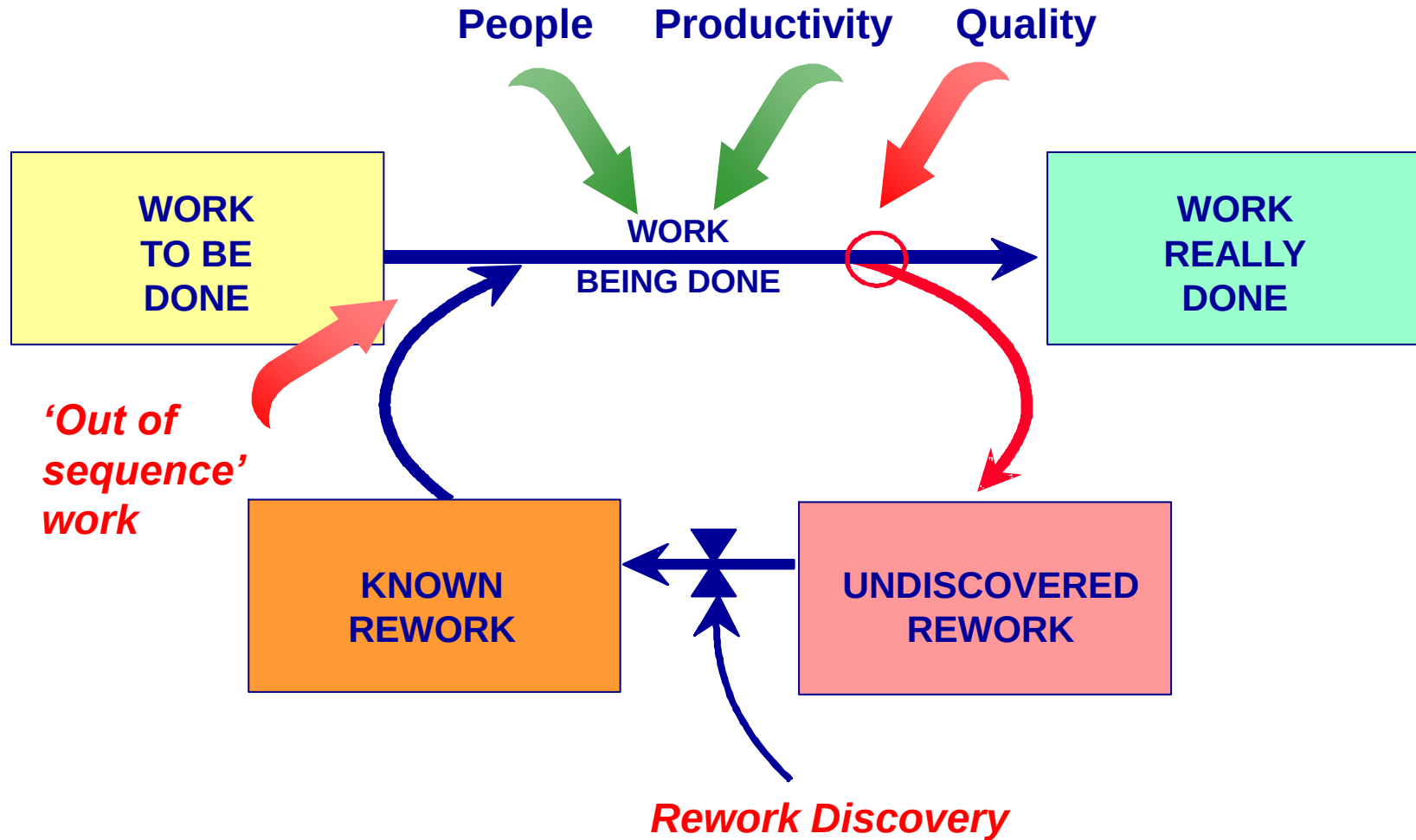


Project reporting using static structures can often hide the implications of the dynamic effects

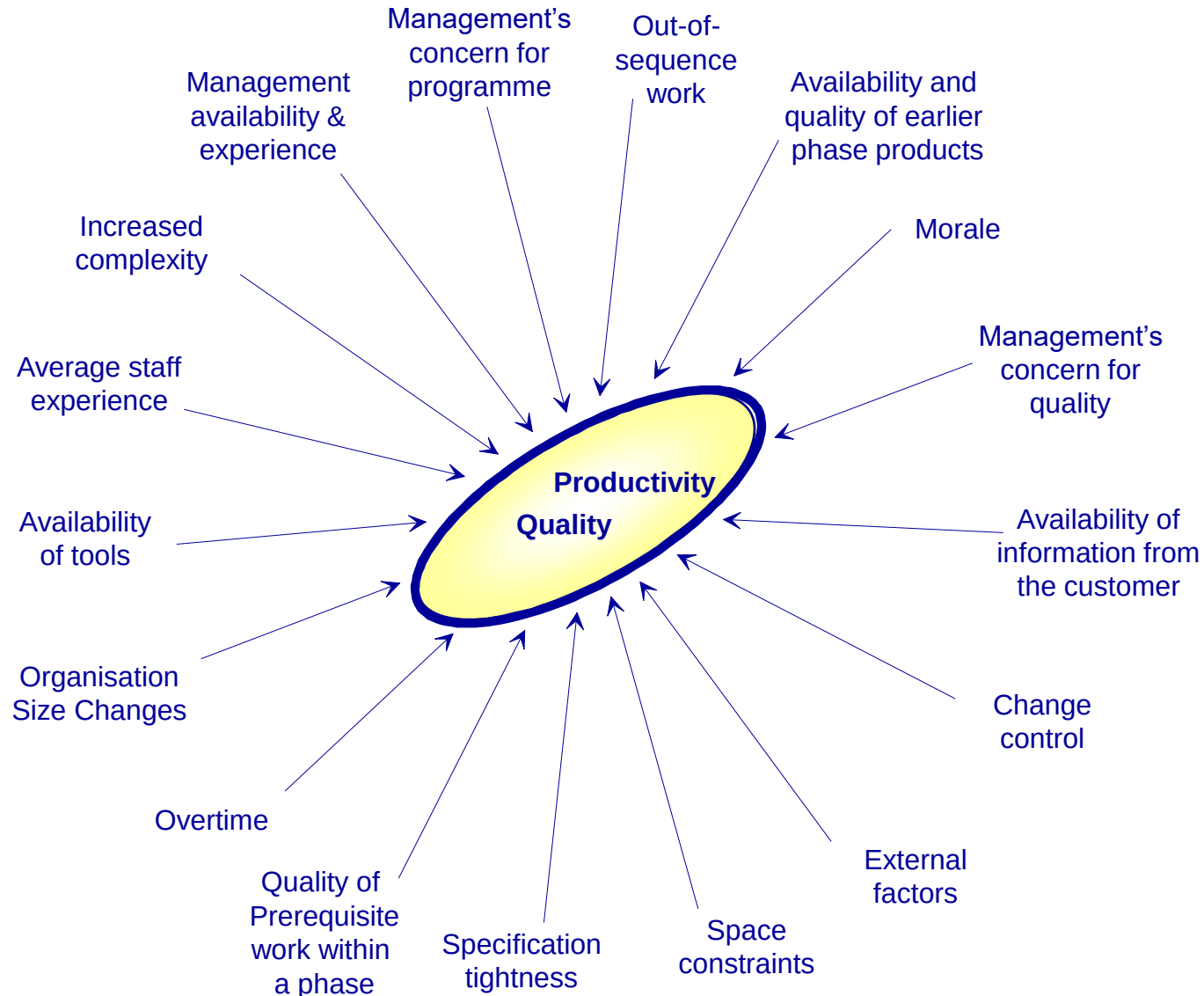
Reported as 80% complete for far too long



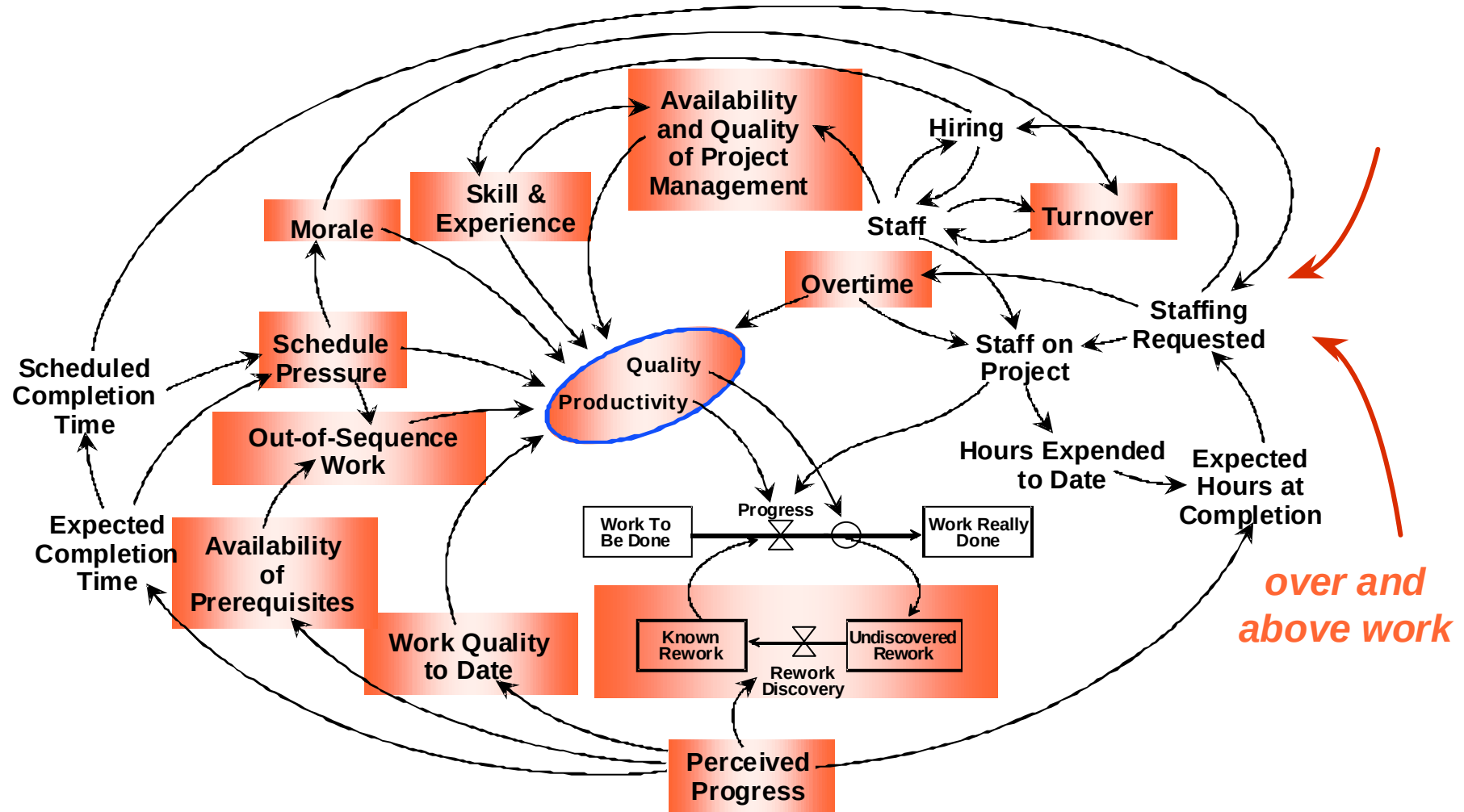
The rework cycle is at the heart of the dynamics ...



Productivity and quality are the key drivers



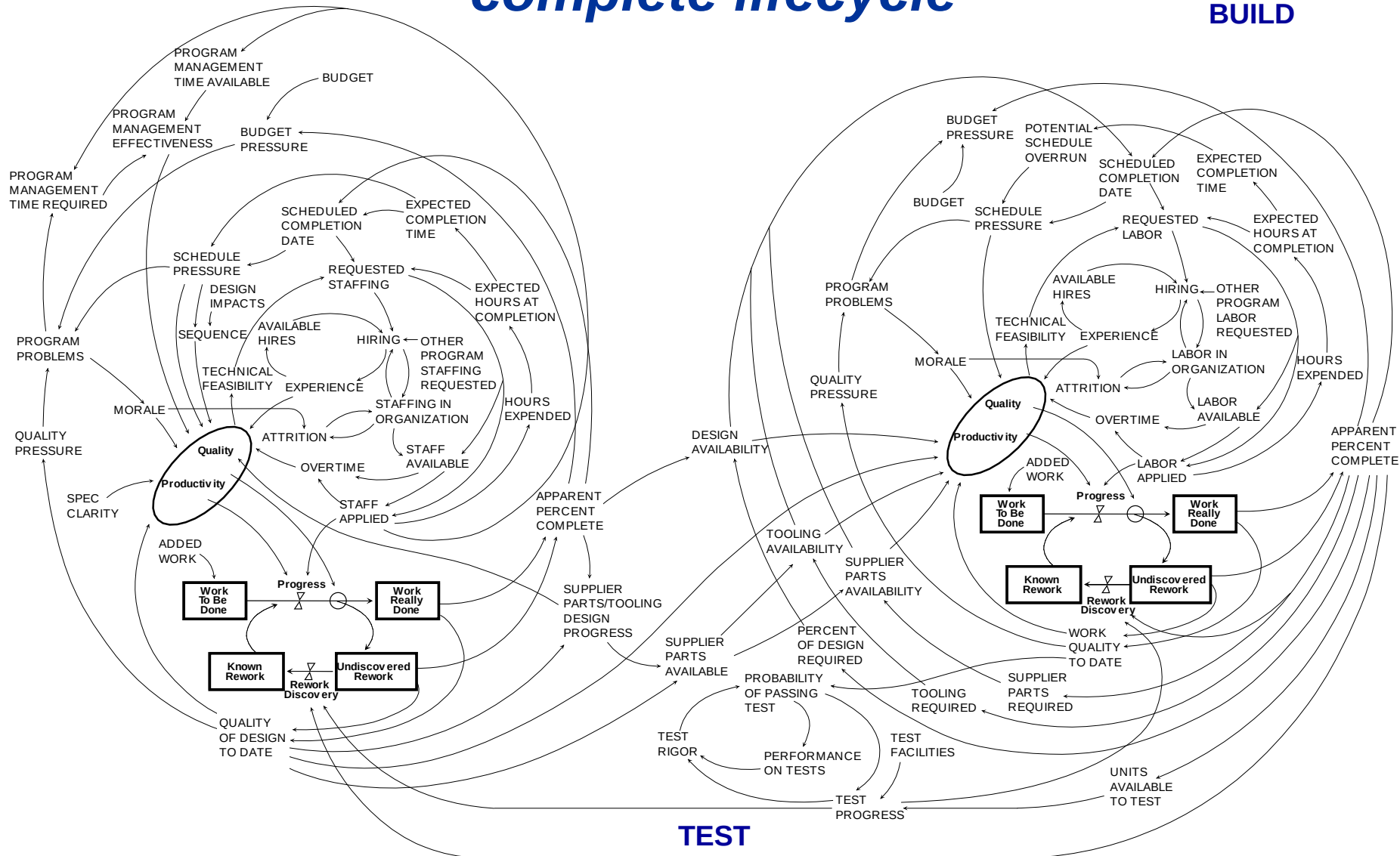
The Rework Cycle Models include important factors **beyond** traditional planning tools...



Project Dynamics - *throughout the complete lifecycle*

DESIGN

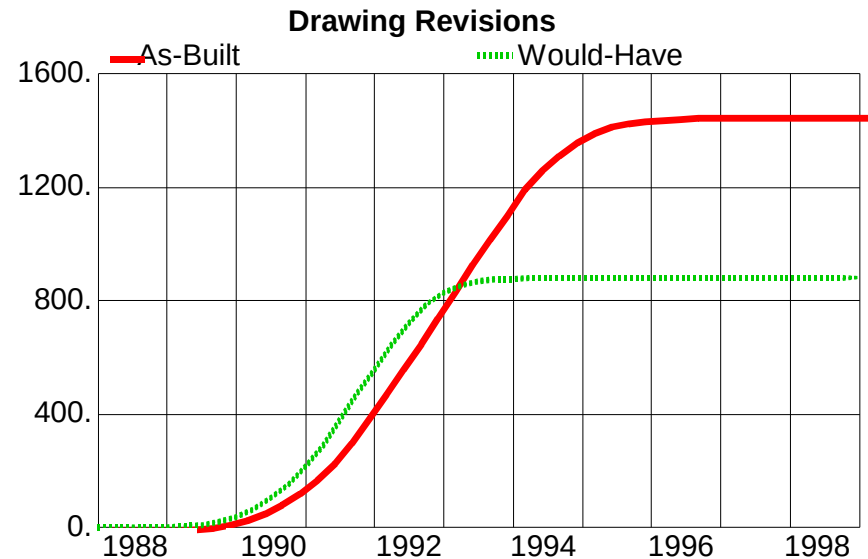
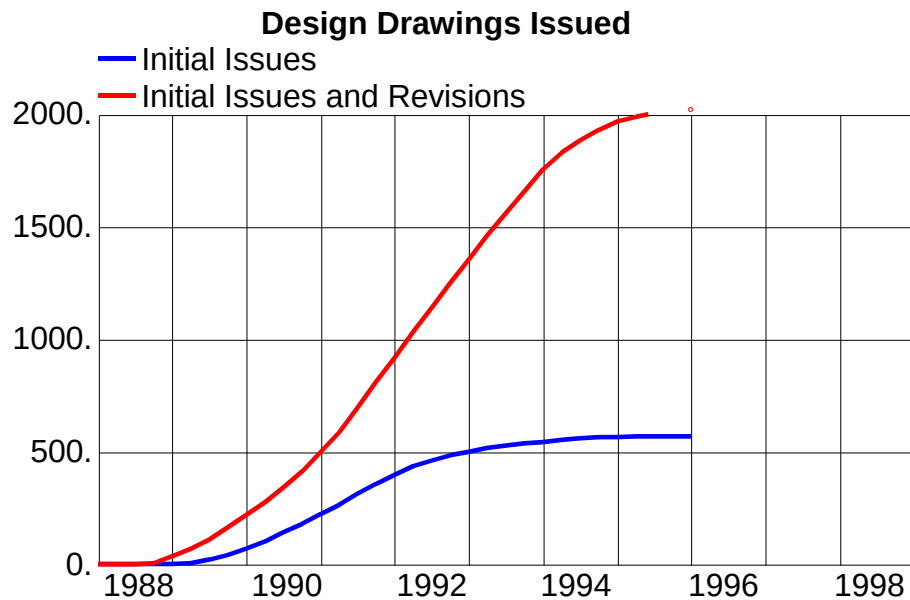
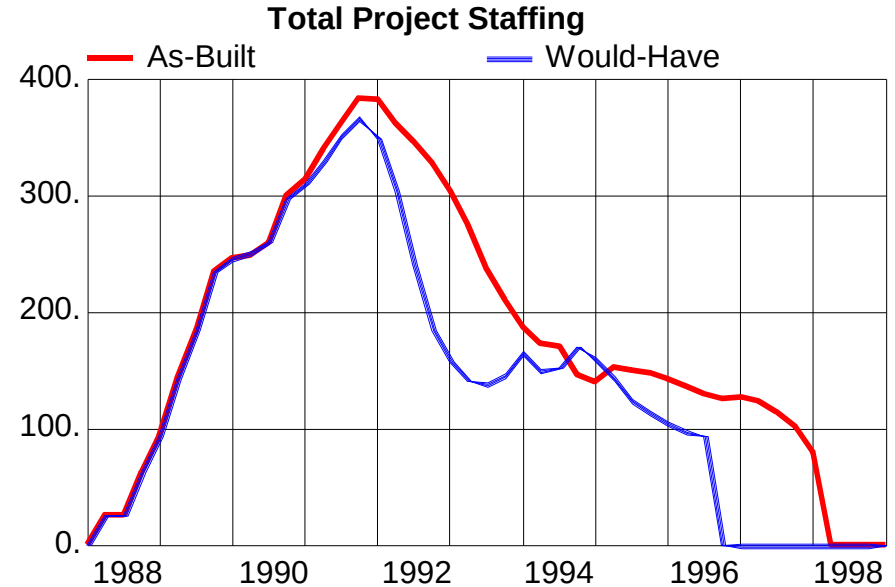
BUILD



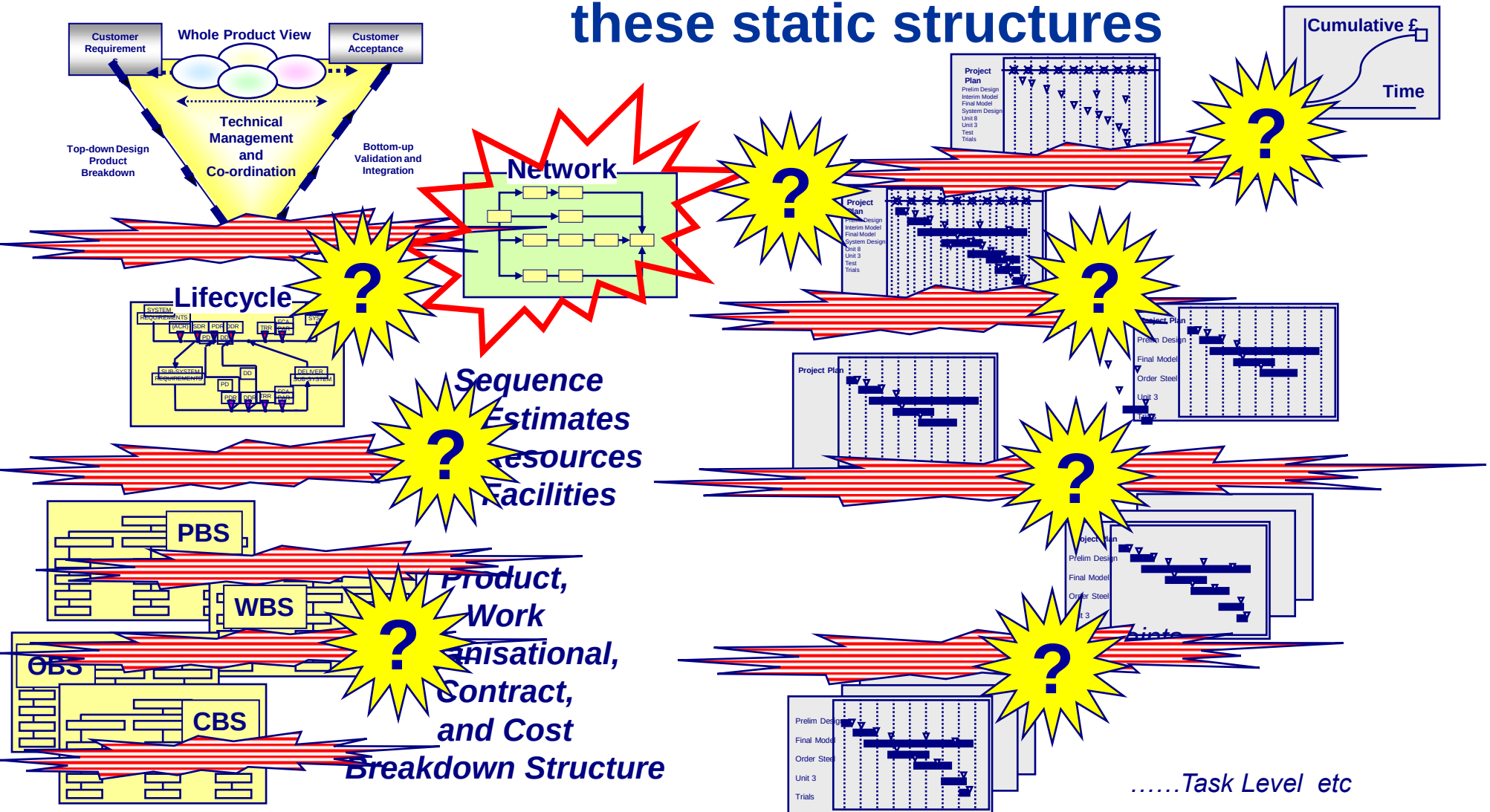
TEST

Examples of dynamic model output for Project XXX

(Disguised real data)



Disruptions break the links and fragment these static structures



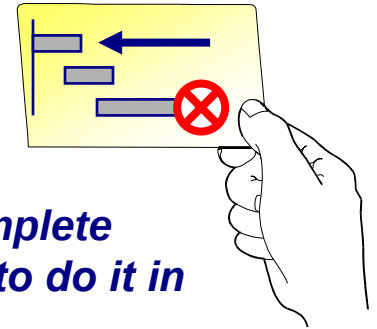
...control is rapidly lost as actions are taken in isolation and out of the planned sequence ...

Left hand and Right Hand Planning



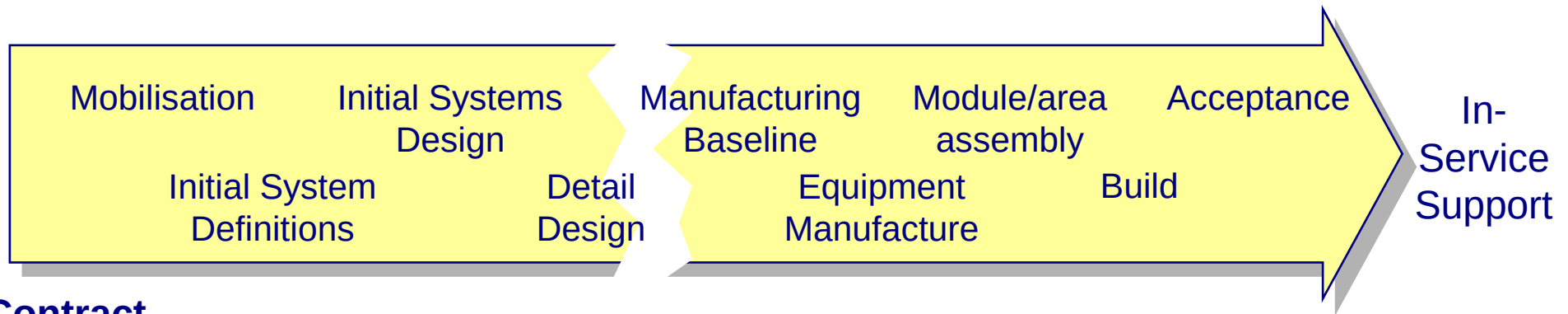
Left Hand Planning

- *This is what we have to do*
- *This is when it will be complete*
- *Timescale - too long*



Right Hand Planning

- *This is when it has to be complete*
- *This is how long you've got to do it in*
- *Pressure to start build*
- *Essential front end work under pressure*

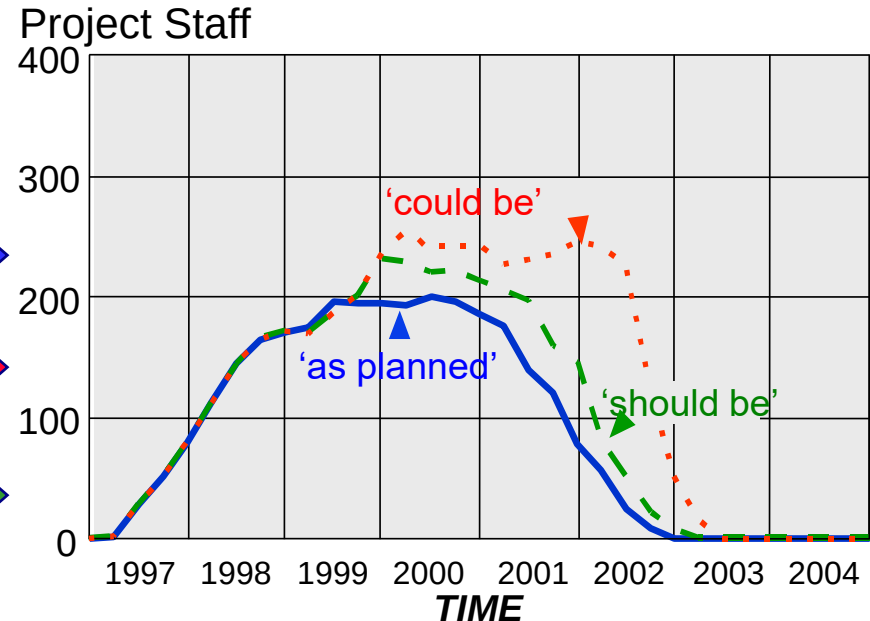
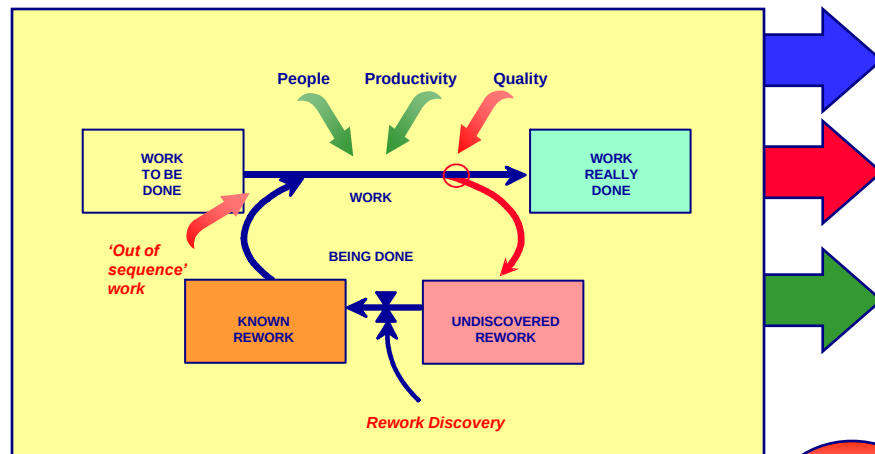


Contract
Award

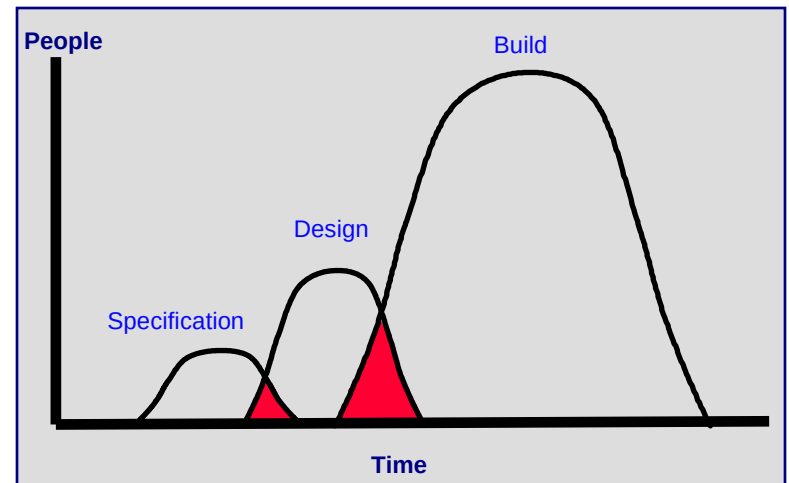


Application of dynamic project modelling to the planning of projects

Looking ahead, evaluating options, risks and the effects of change

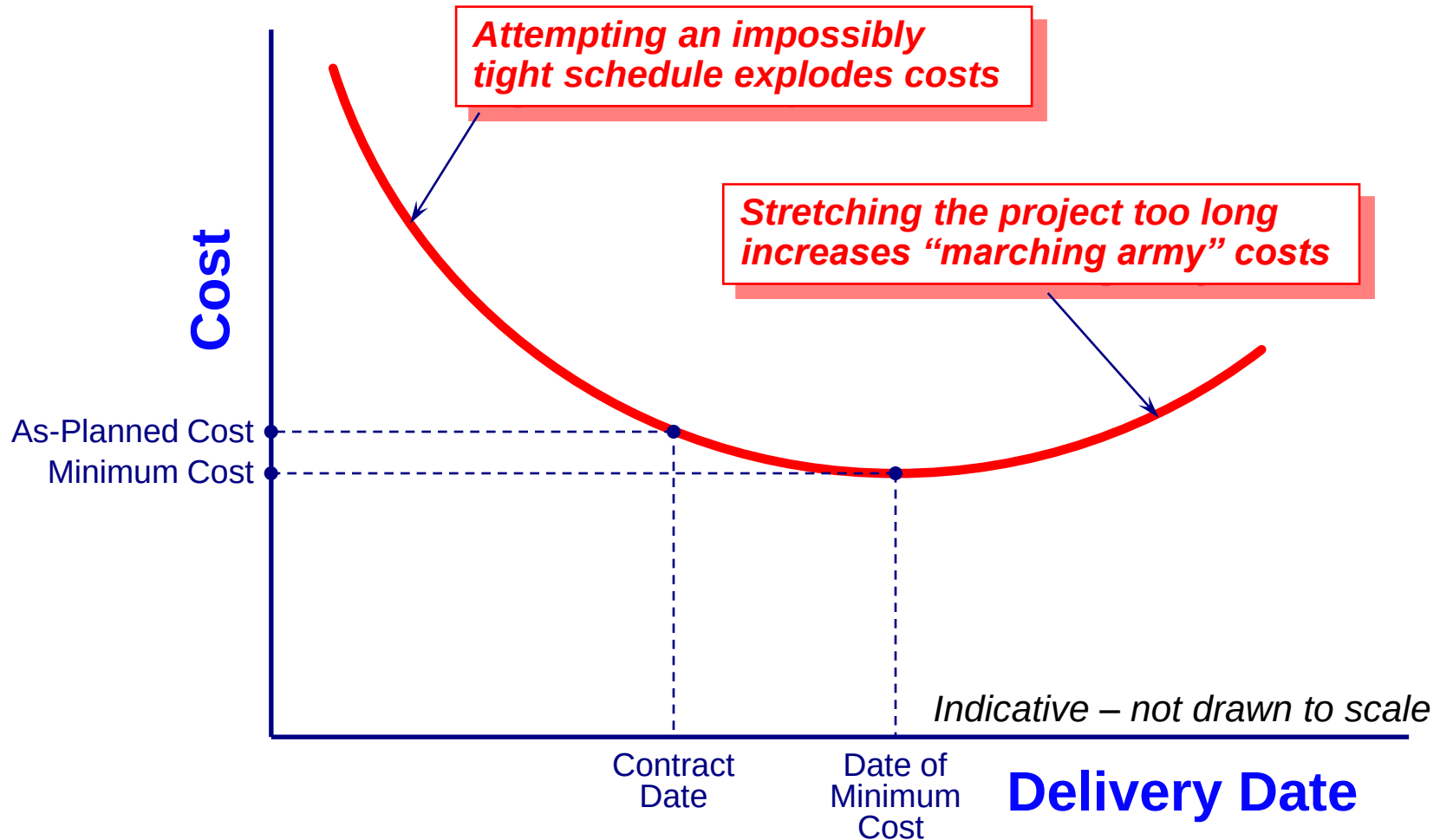


Achieving the right level of overlap between specification, design and build phasesstarting build with an immature design increases rework levels



Optimise the Cost-Schedule Trade-Off

How much change? Where in the programme?



Dynamic Project Modelling

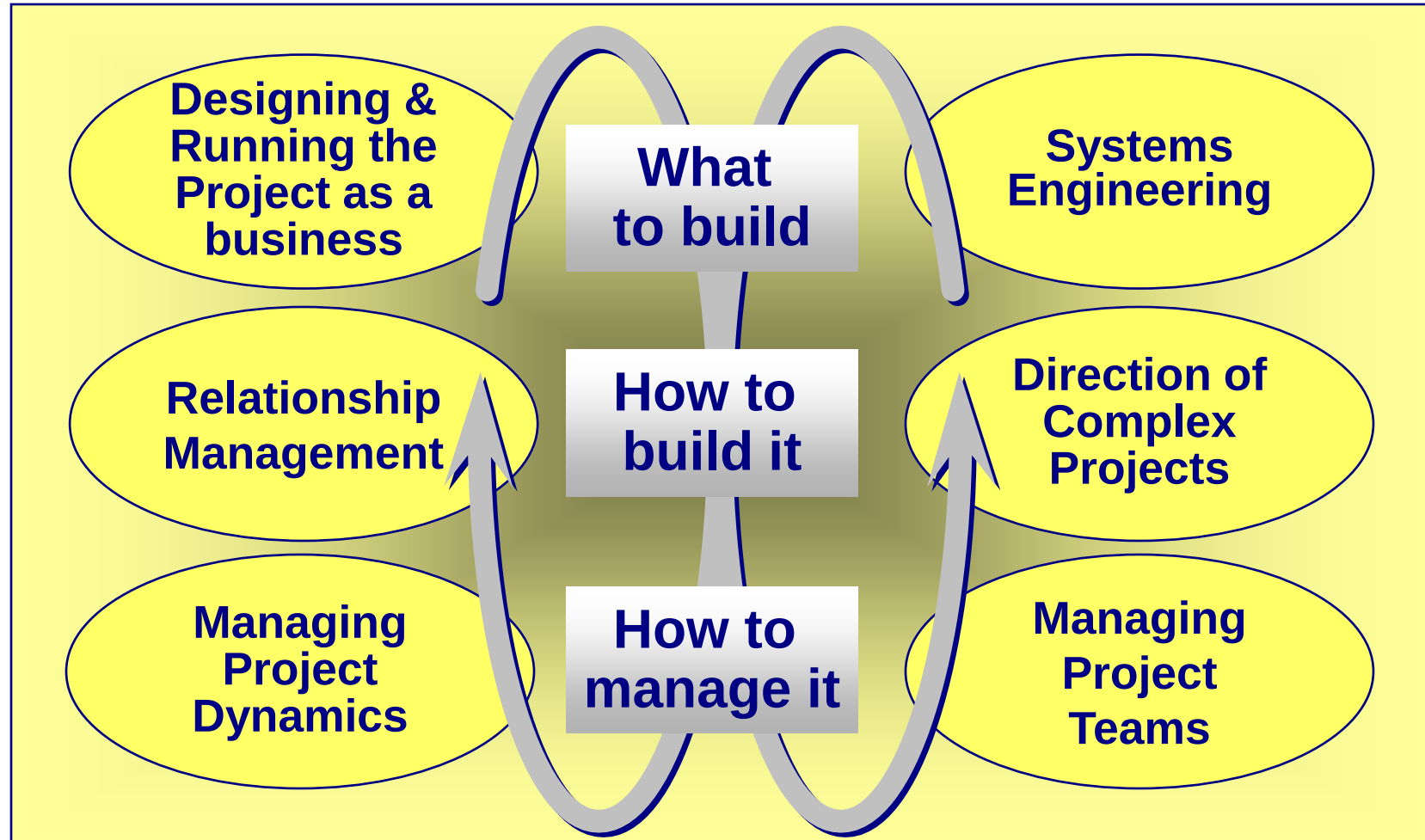
Making better project decisions based on an understanding of causes, effects and sensitivities

Dynamic modelling is used for:

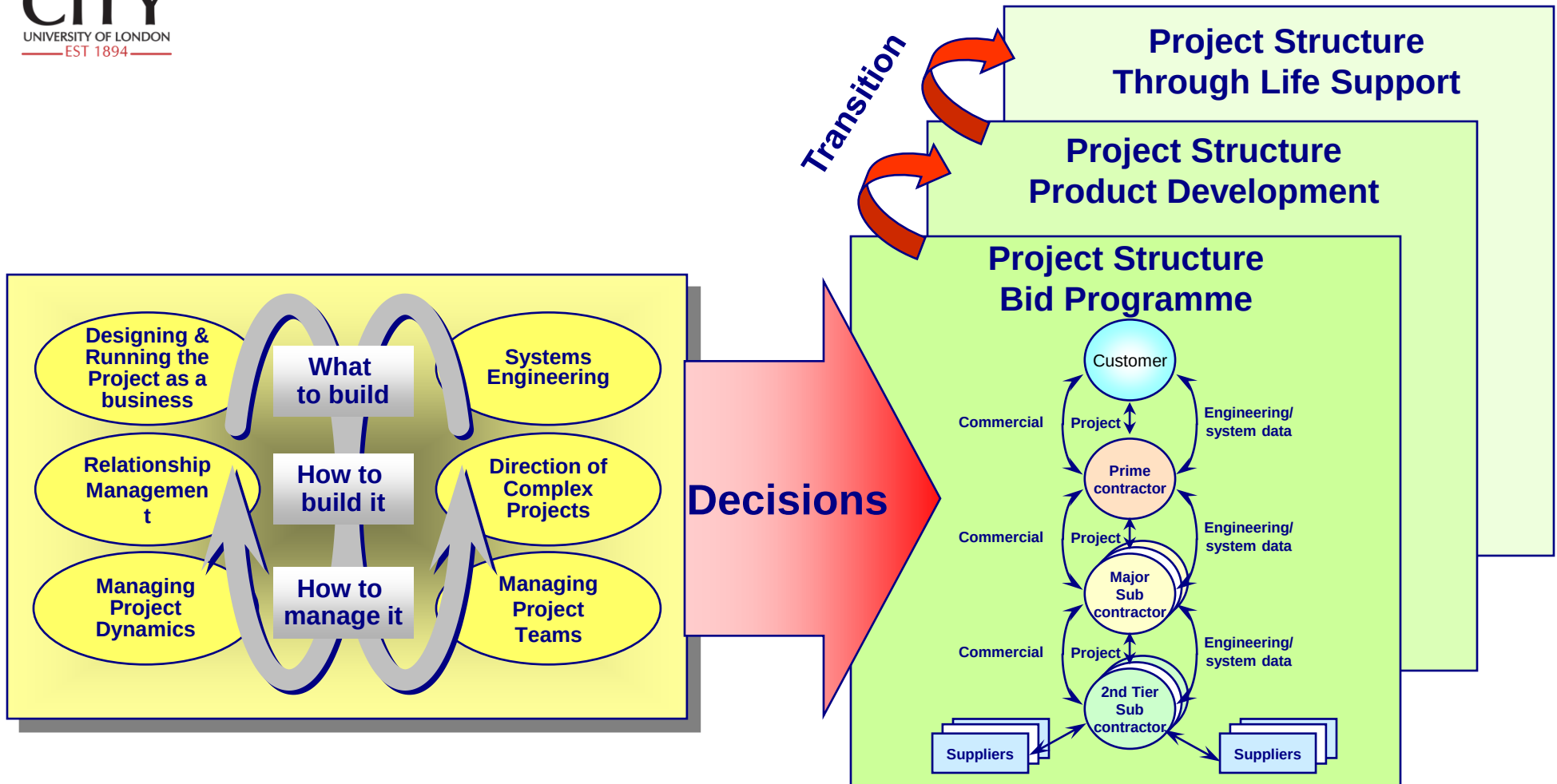
- ❖ *Identifying the right overall programme duration*
- ❖ *Achieving the right level of overlap between specification, design and build phases*
- ❖ *Understanding the degree of learning, and productivity improvement that can be achieved over time - both your own and subcontractors*
- ❖ *Monitoring and controlling the key drivers of rework that threaten the cost and schedule out-turn*
- ❖ *Understanding the true cause and effect sensitivities and the likely results of management actions*
- ❖ *Achieving better, more robust plans*
- ❖ *Using informed decision making based on an insight into the dynamics of the project*

Successful Project Design and Delivery

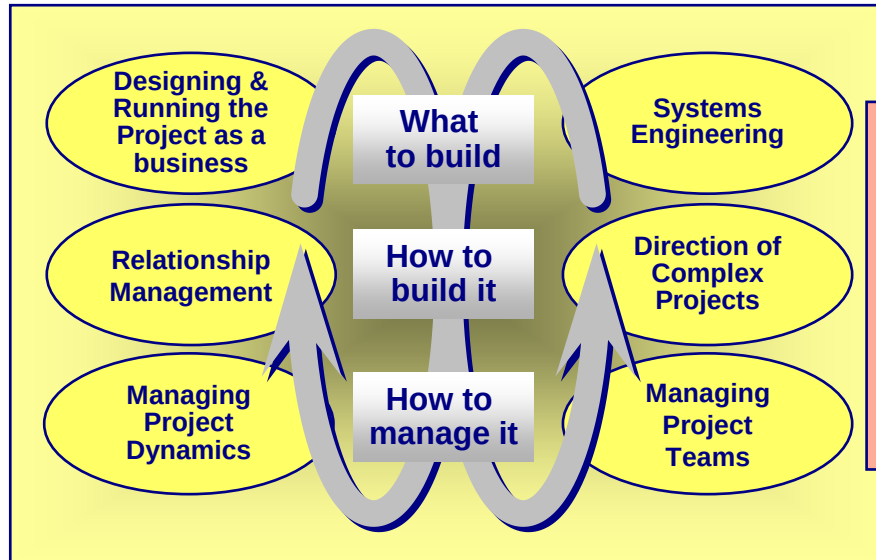
Key Leverage Points



Successful Project Delivery Design - the Project Structure



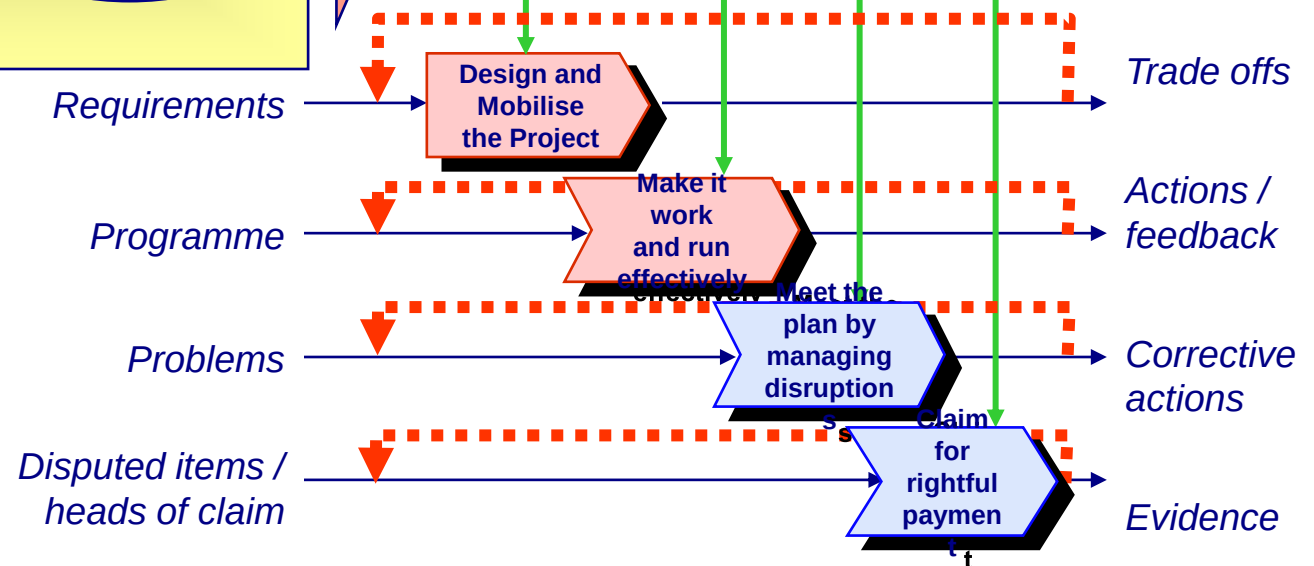
Transition of the project structure for each lifecycle phase



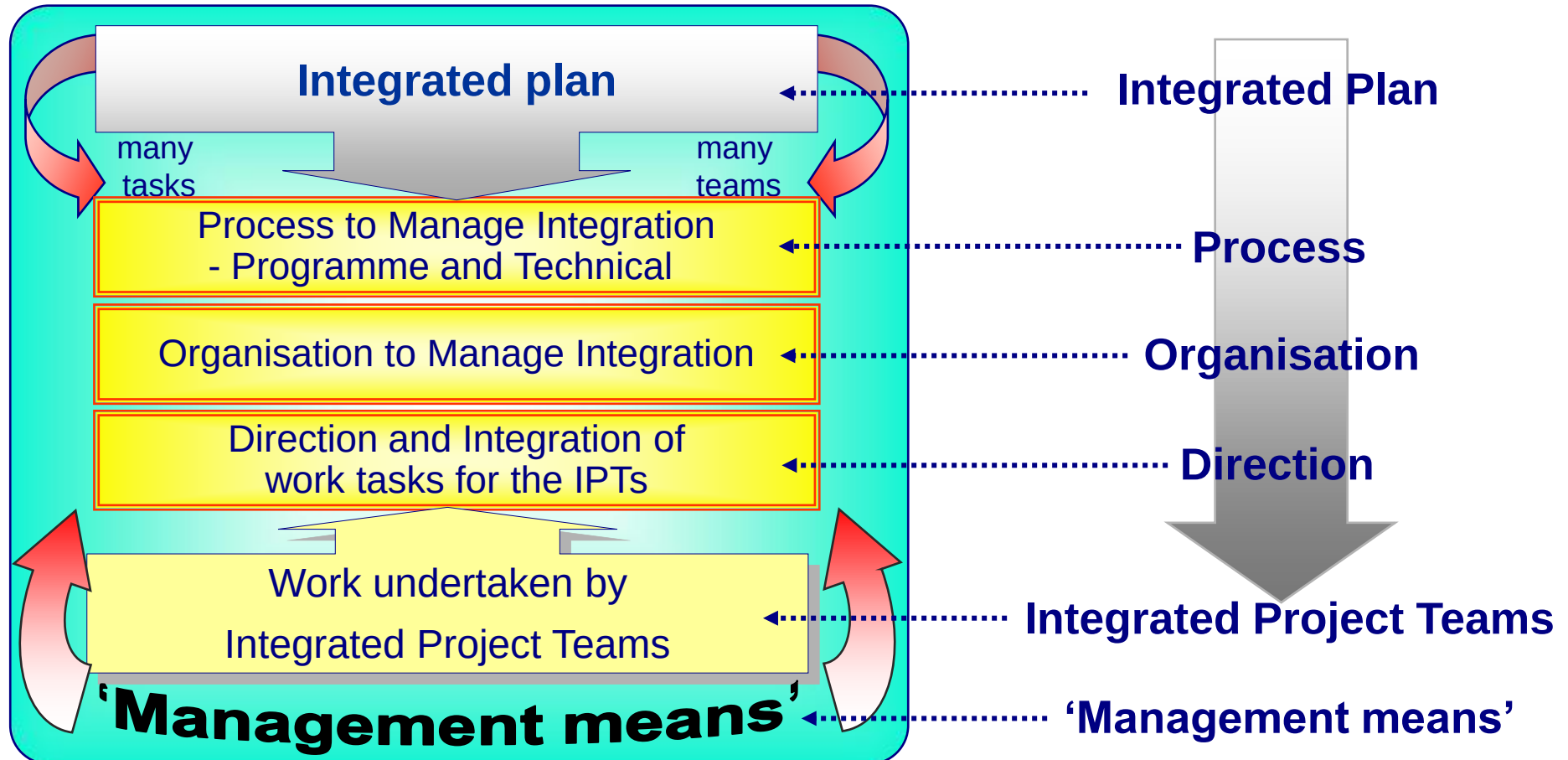
Successful Project Design and Delivery

Key Leverage Points

Programme Lifecycle

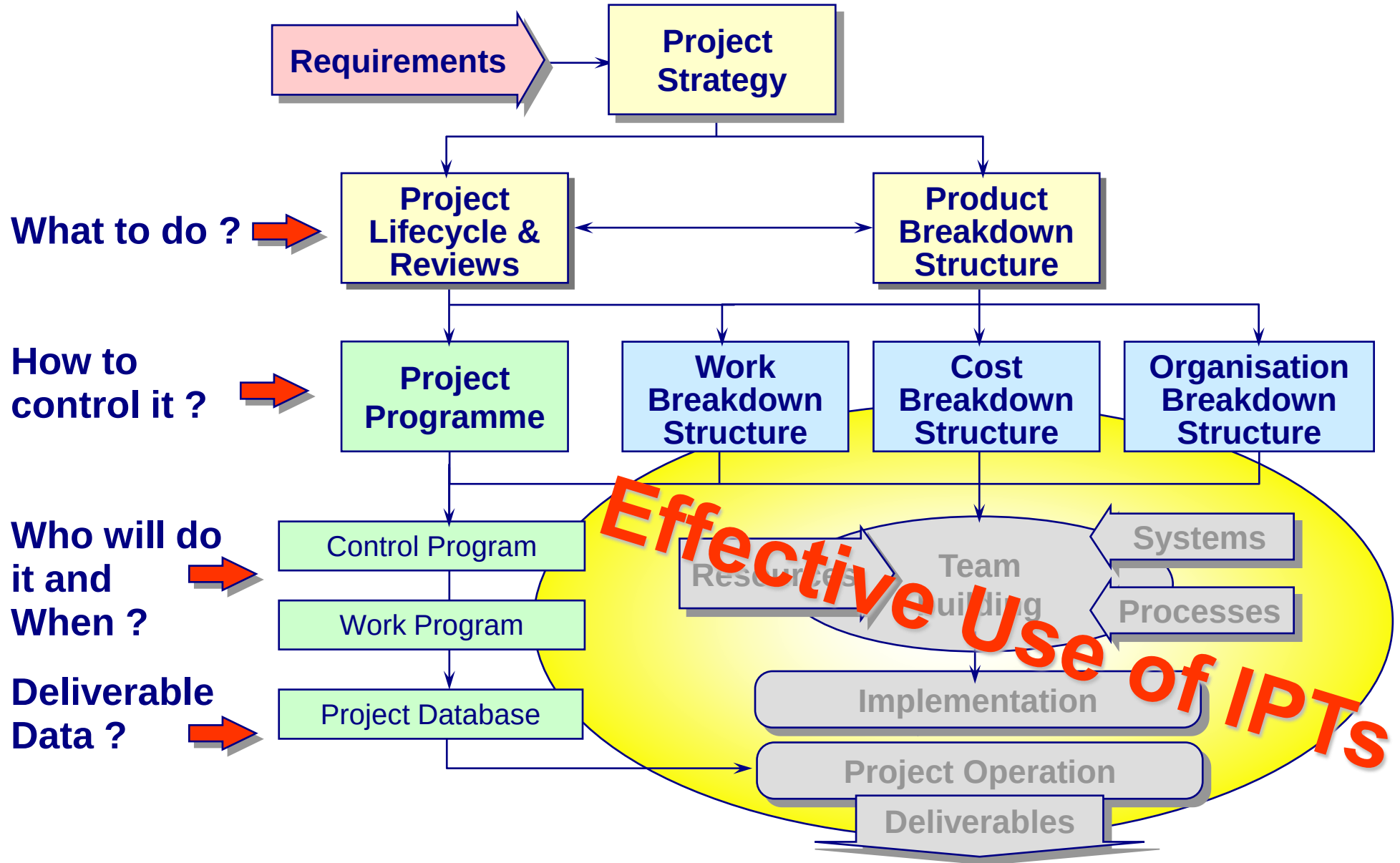


The effective Management of Integration

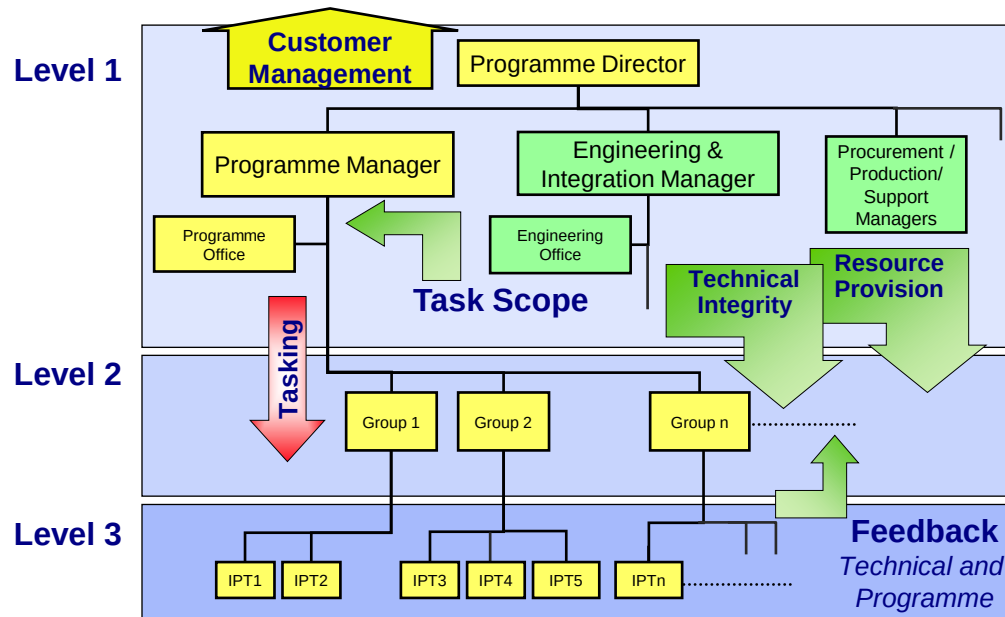


*Unlocking the potential of
Integrated Project and Programme Teams*

Planning, Organising and *undertaking the work*



Organisation to Manage Integration



The organisation must define:

- Roles and responsibilities
- Structure of the project
- The interfaces
- The key principles of operation

Three levels of management are required:

Level 1 – to direct the work and hold the ‘big picture’ view of the whole project

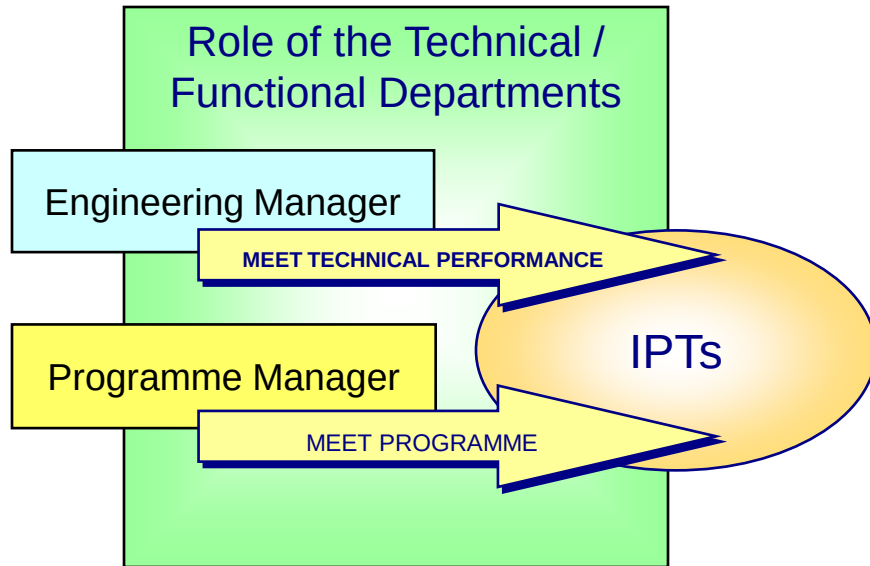
Level 2 – to manage the IPT work tasking and relationships between IPTs

Level 3 – to undertake the detailed IPT doing work and report on technical and programme progress

Levels 1 & 2 are managed through multi-disciplinary management teams, led by Project Management. Level 3 is managed by the IPT Team Leaders

Such an organisation involves creating a ‘constructive tension’

Managing the 'constructive tension' - programme and technical



The Programme manager is responsible for the delivery of the project on time, within cost and to the agreed customer requirements.

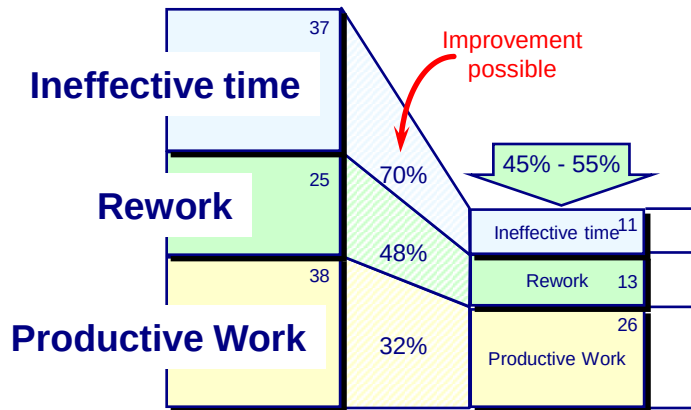
The Technical manager is responsible for the technical integrity and performance



The functional organisations within the business (as distinct to the project), eg. Engineering, Procurement, Production, Support, etc are responsible for:

- *Developing, recruiting and allocating the resources*
- *Defining and refining the processes, methods and standards*
- *Providing the Functional Authorities to ensuring the **technical integrity, quality, safety and reliability** of the project solutions*
- *Providing the infrastructure for effective and efficient project work*

Effective IPTs - the implementation experience



**Effective IPTs
(compared to
underperforming teams)
in large complex
engineering projects
can typically deliver
an 8 – 10%
reduction in man hours.**

The implementation of IPTs in five companies showed:

- Time until full implementation was 12 to 24 months
- Disruption in productivity during implementation: -5% to -15%

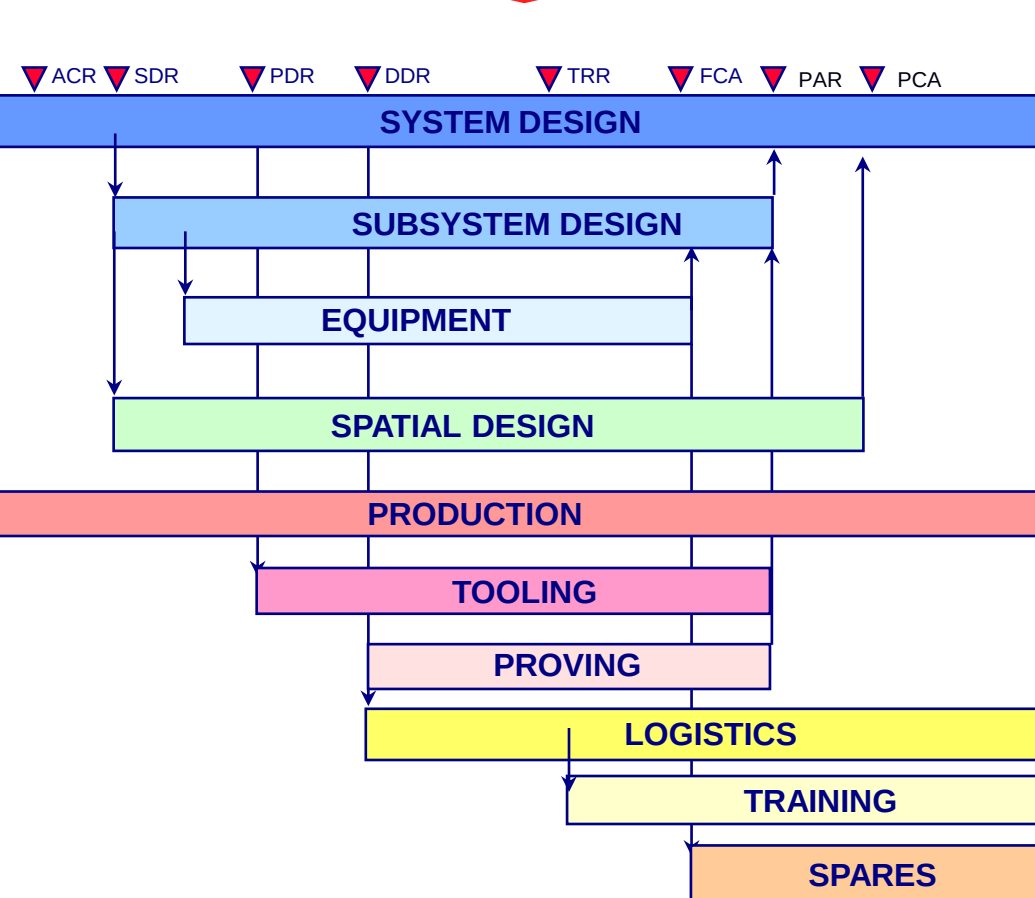
When full implementation was achieved, changes in:

- Quality (reduced rework): 15% to 40% savings
- Design Productivity: slower first releases but fewer revisions
- Build Productivity: 5% to 20% improvement
- Rework discovery times: 20% to 40% faster

System Engineering and project lifecycle



Source: IEEE Std 1220-1994



Defines the programme logic:

- Key phases of engineering activity
- Critical interdependencies
- Control / review points

Covers the entire programme:

- Whole product lifecycle
- Engineering
- Production
- Logistics
- Customer support

The Product Breakdown and associated Lifecycle Reviews define the sequence of activities required

Systems Engineering, Concurrent Engineering and Teams - *implemented through....*

Managing Requirements and specifications

- a structured process
- early investment to get it 'right'
- developed in a team environment
- clear allocation and responsibilities
- managed coherency and standards
- tracked through to acceptance with configured information
- 'design for' opportunities to reduce cost and risk identified

Planning, organising and controlling the work

- integrated plan that incorporates design, build and support
- sub-contracting philosophy of working together for 'win win'
- work sequencing defined by 'pull' planning (reflecting downstream needs)
- parallel working controlled through tollgates
- dynamic simulation to look ahead and provide early discovery of potential rework

Empowering effective multi disciplinary teams

- clearly defined tasks owned by the team
- trained and facilitated teams for maximum performance
- empowered to plan, manage and report own progress
- co-located wherever possible and appropriate
- organised for optimum use of part time specialists
- clear process for applying and integrating 'design for' principles

Providing accessible information & excellent communications

- shared information to reduce assumptions and improve decisions
- full exploitation of available technology to support sharing, exchange and control of data
- excellent open communications in a trusting environment
- a 'seamless' technical environment where the contract and project management layers do not impede the flow of information
- ensuring appropriate horizontal communications across sub-contractors

Controlling and monitoring convergence

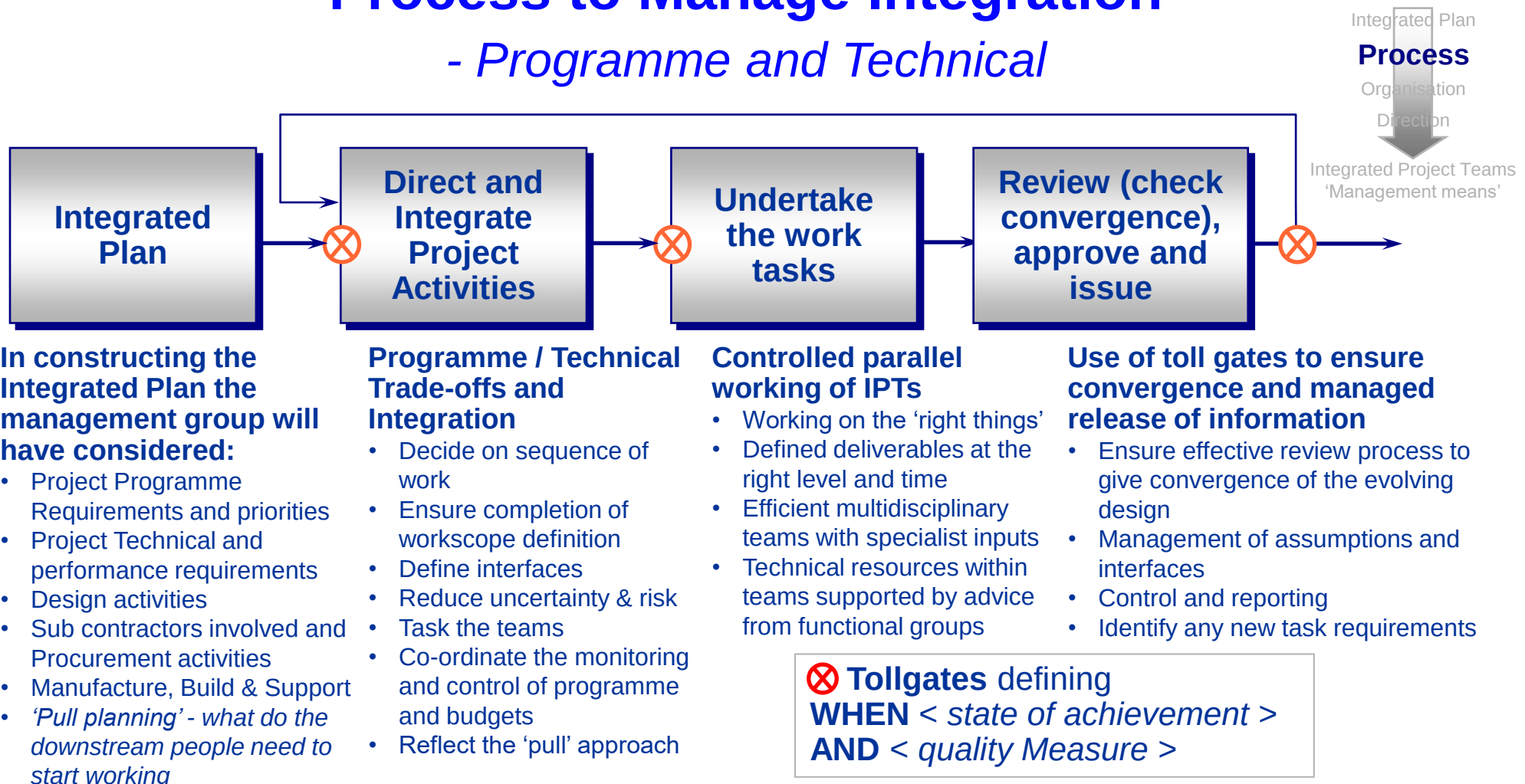
- convergence monitoring to reduce risk of nugatory work
- tolerance levels set for each phase
- processes for the control of technical performance and load budgets
- early intervention and rehearsed escalation process for any significant divergence

Validating performance and achieving acceptance

- well developed processes to validate form, fit and function
- 'working together' with sub-contractors
- full use of the visibility process to provide customer involvement and progressive acceptance
- spatial modelling to support early and progressive acceptance

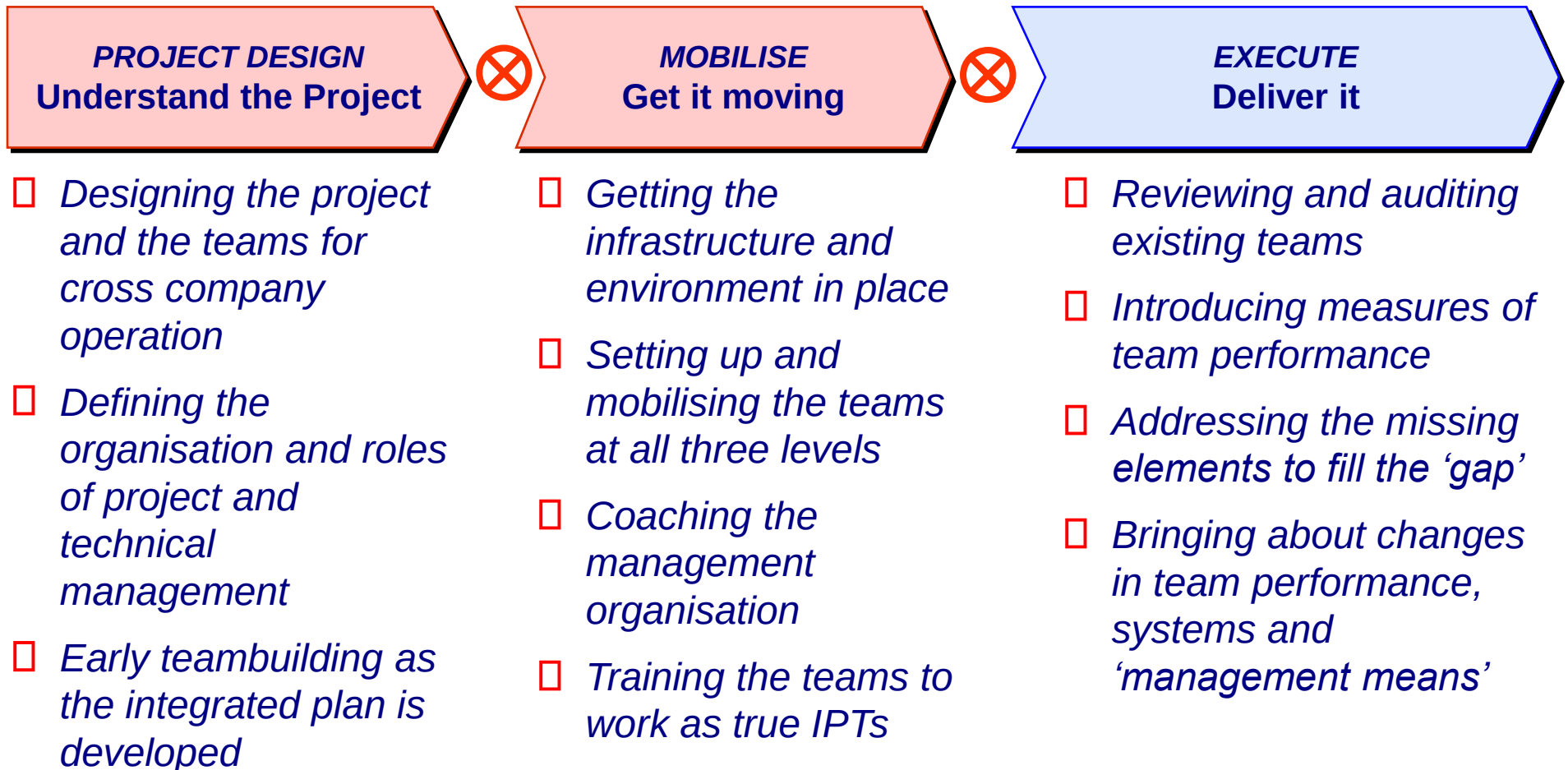
Process to Manage Integration

- Programme and Technical



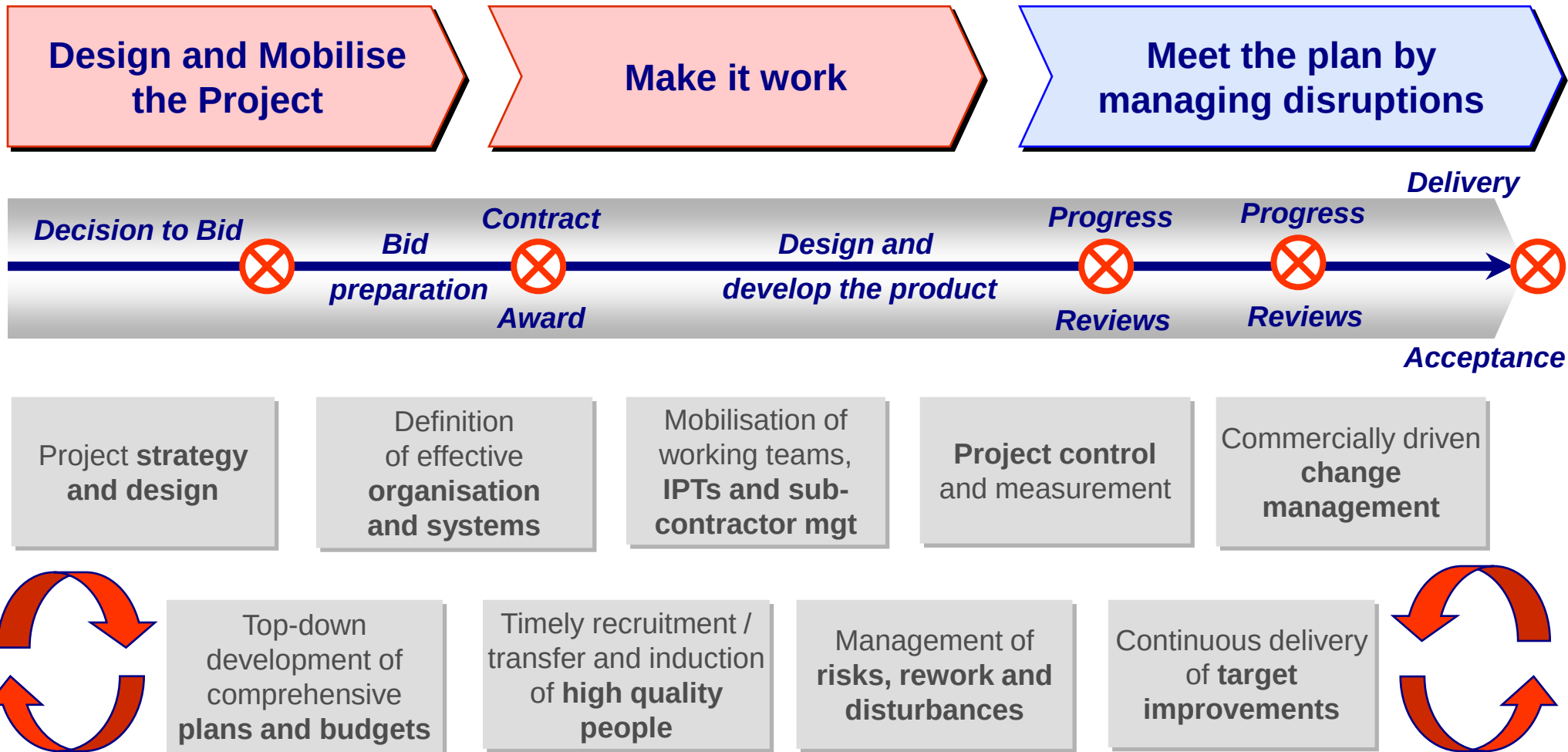
The process by which activities are integrated, trade offs are conducted, boundaries / interactions are resolved and task priorities are set giving IPTs a clear workscope

This approach helps throughout the process



An systematic approach can help you move rapidly from a number of underperforming groups to very effective Integrated Project Teams

**What needs to be done is clear....
it looks straightforward**



.....but it's far from straightforward