Using the Planning Process as a Communication Tool in Managing Complex Shipbuilding Projects

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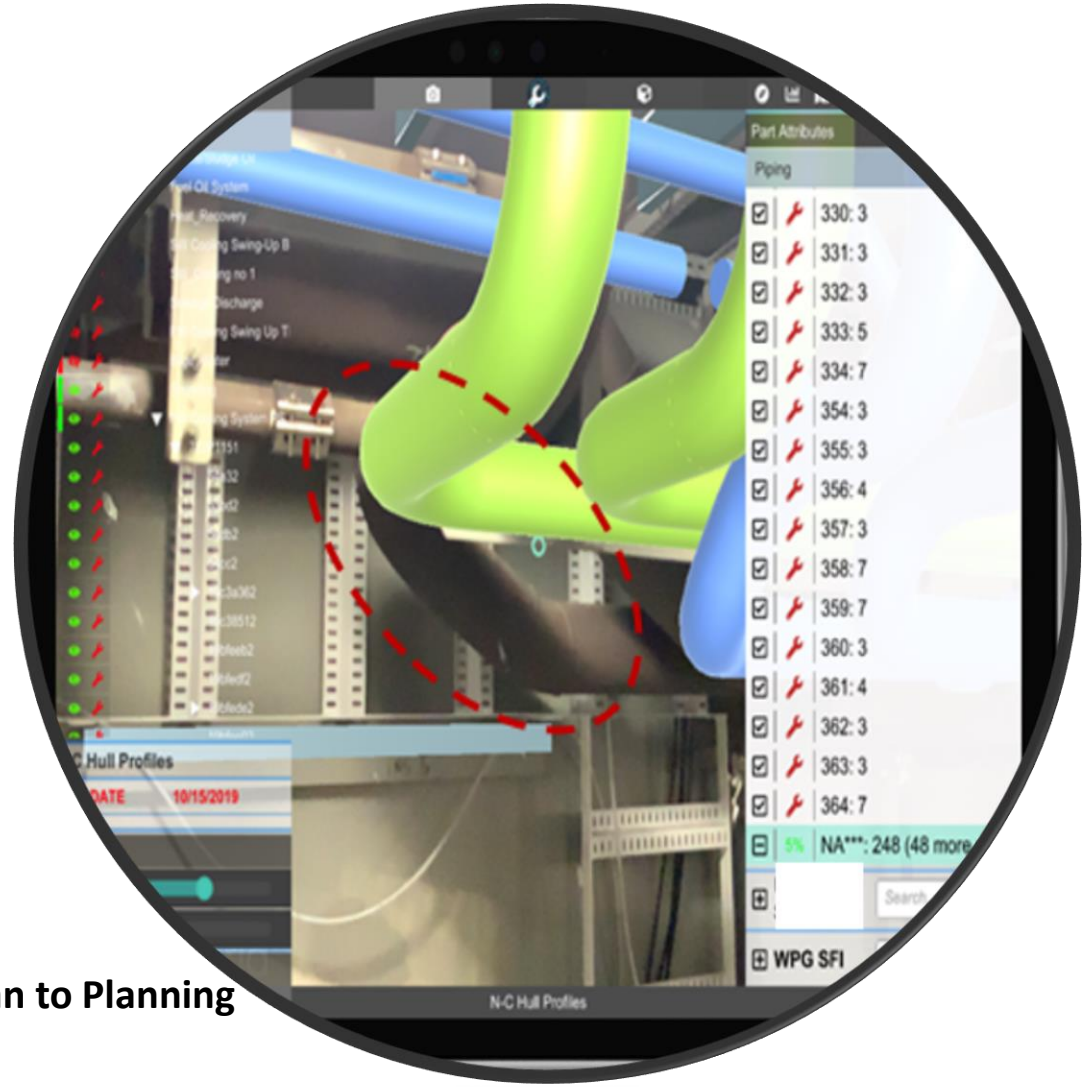
- Master thesis lean shipbuilding
- Project planner at Vard

- Researcher in Logistics and SCM at Møreforsking
  - Project planning
  - Value chain analysis
  - Lean production, shipbuilding, construction
  - Augmented Reality in production of ships
  - Circular Economy and Industrial Symbiosis
- Teaching areas:
  - Supply Chain Management
  - Logistics for Additive Manufacturing
  - Lean and Agile Methods in project-based environment
  - Innovation and intrapreneurship
  - Circular economy via Industrial symbiosis



- **PhD: Contributing to Resolving a Project Planning Paradox in ETO: From Plan to Planning**
- **Senior Advisor/ Researcher at NTNU in Ålesund**
- **Project Developer at GCE Blue Maritime**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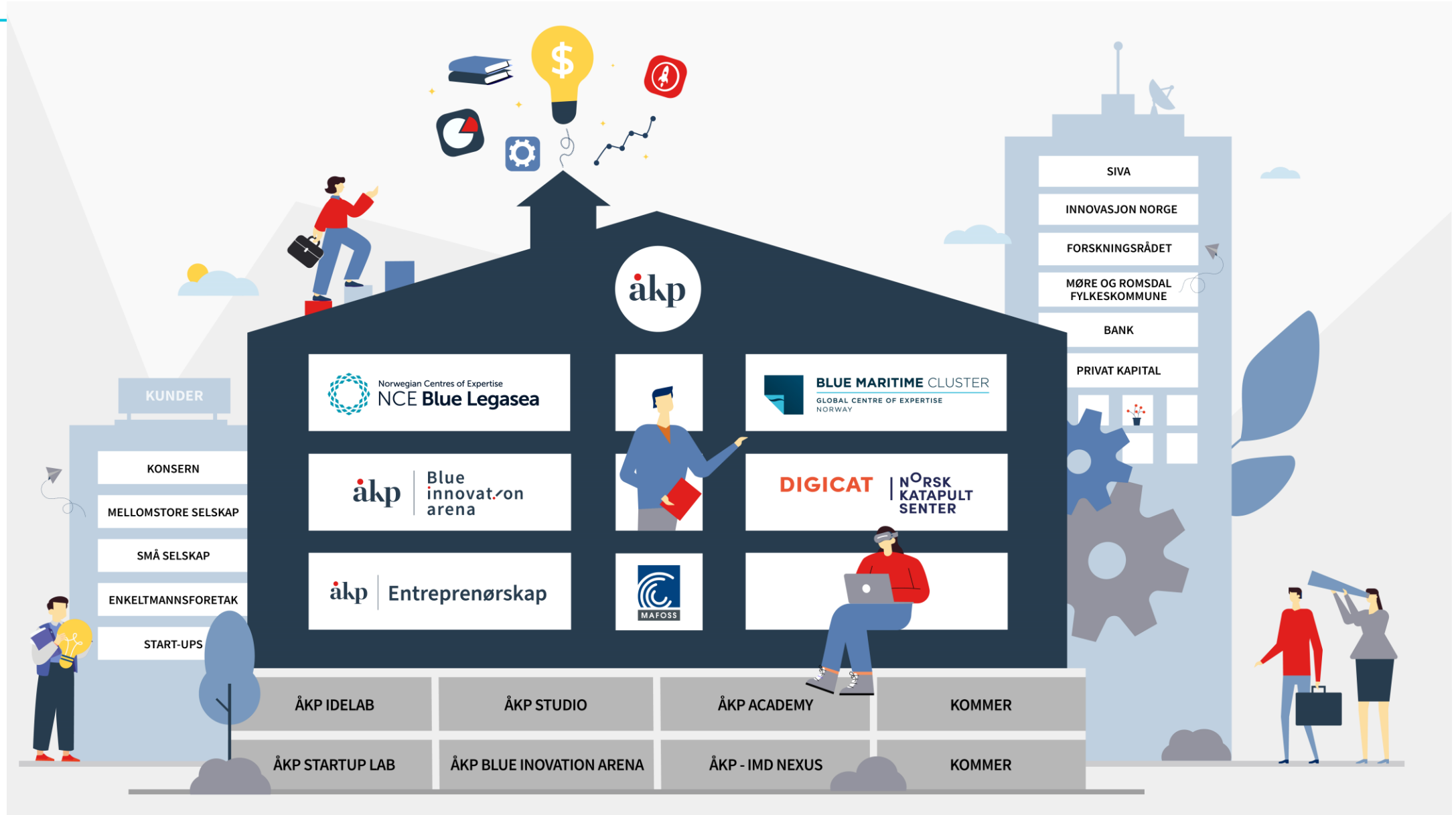
NORWAY
THE FUTURE IS BLUE
GCE Blue Maritime Cluster

ÅKP


KUNDER
KONSERN
MELLOMSTORE SELSKAP
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ENKELTMANNSFORETAK
START-UPS
åkp
Norwegian Centres of Expertise
NCE Blue Legasea
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PRIVAT KAPITAL
ÅKP IDELAB
ÅKP STUDIO
ÅKP ACADEMY
KOMMER
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ÅKP - IMD NEXUS
KOMMER

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NORWAY

ABOUT US

GCE BLUE MARITIME CLUSTER

GCE BMC is technology agnostic and non-political, but cooperates with Norwegian actors present on the political sphere such as shipowners and shipyards associations

STRONG RESULTS ARE GIVEN BY LONGTERM EFFORT

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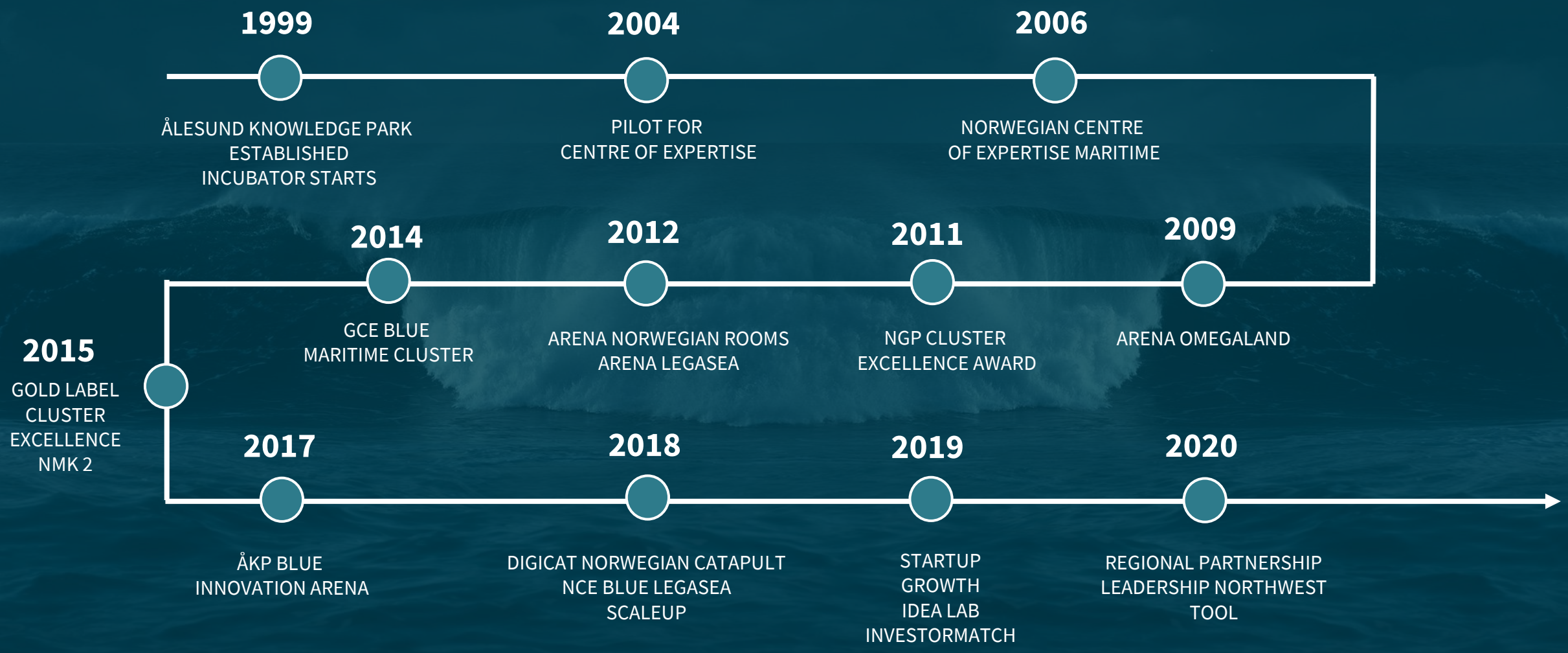


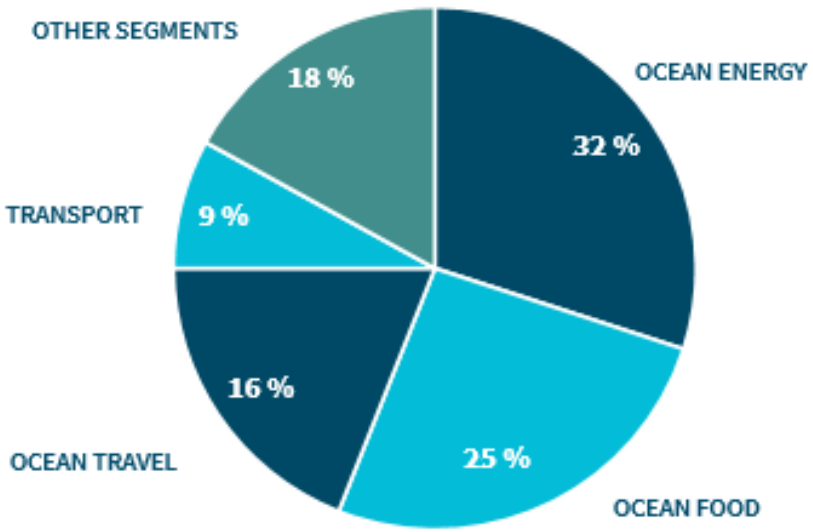
GCE BLUE MARITIME CLUSTER IN BRIEF

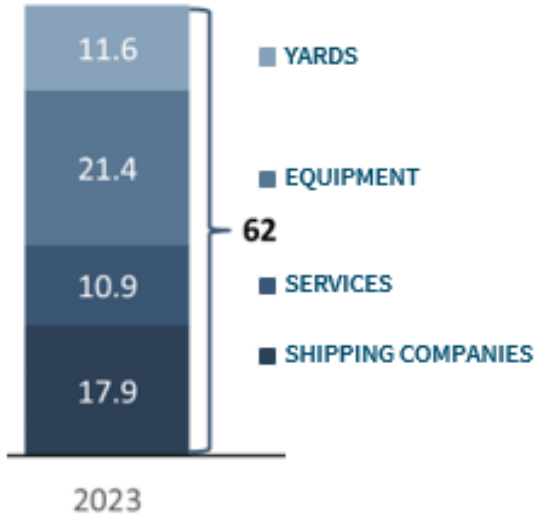
BLUE MARITIME CLUSTER
GLOBAL CENTRE OF EXPERTISE
NORWAY

180
MEMBER COMPANIES

~15,000
PEOPLE

62 BNOK*
ANNUAL REVENUE (*2023)





SOURCE: Menon 2023

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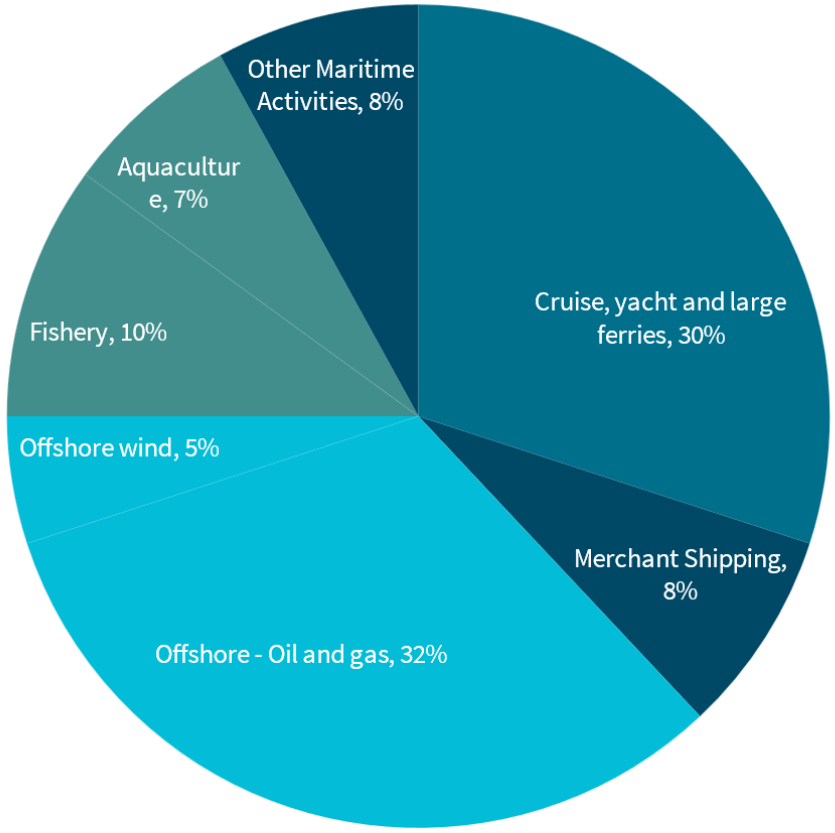
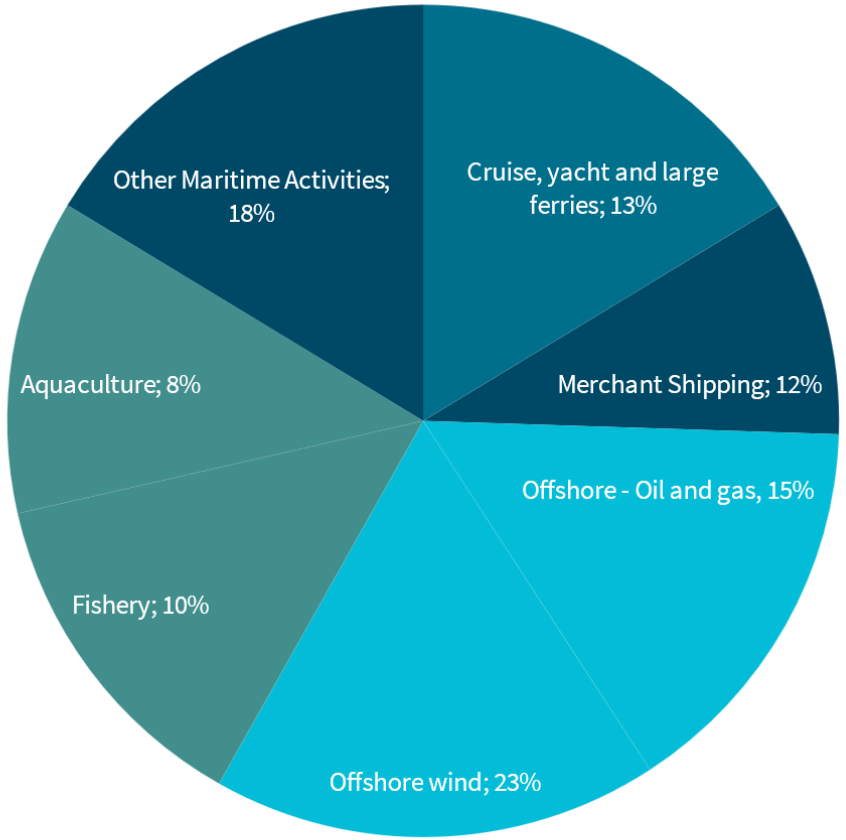


2019



2023

Kilde: GCE BMC Klyngeanalyse 2024 - Menon

THE KEY TO SUCCESS

BLUE MARITIME CLUSTER
GLOBAL CENTRE OF EXPERTISE
NORWAY

Experience transfer throughout the entire maritime value chain.
=
UNDERSTANDING AND MEETING THE CUSTOMER REQUIREMENTS

Investing in people
=
OPTIMIZING LONG-TERM VALUE CREATION PER INDIVIDUAL

Encouraging people to be interested and curious.
=
UNDERSTAND COMPLEX SITUATIONS AND DRIVE INNOVATION

GCE BLUE MARITIME CLUSTER - MEDLEMMER

BLUE MARITIME CLUSTER
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NORWAY

EN KOMPLETT MARITIM VERDIKJEDE

RESEARCH & EDUCATION

MOREFORSKING · NTNU · Høgskolen i Molde · SINTEF · Fagskolen Møre og Romsdal · Runde Miljøsenter

RESEARCH & EDUCATION

Forskningsrådet · Innovasjon Norge · Geirangerfjord · Møre og Romsdal fylkeskommune · Kystverket · siva · Ålesund kommune

SHIPOWERS

ISLAND OFFSHORE · SOLSTAD OFFSHORE · BOURBON · HAVILA · Kystverket · NORTHERN XPLORER · SEA1 · OLYMPIC · VOLSTAD MARITIME · GOLDEN ENERGY OFFSHORE · Topeka · Norwind Offshore · rem

NAVAL ARCHITECTS

Skipsteknisk · VARD · HAV design · sirius · ULSTEIN · KONGSBERG

SHIPYARDS

FISKERSTRAND · VARD · aasmek · ULSTEIN

SERVICE PROVIDERS

akp · Innovatica · METROSOFT · marine manager · ASK Safety · DNV · BUREAU VERITAS · MARITIMT MAGASIN · osc · dipai · DOXACOM · Shipadmin · GAGN · KEEPTRACK PRODUCT TRACKER · SMECO · INVIG · COPSAudio · Zynk · Ålesund Data · converto · energiråd · INKSTER MARINE · AQMA · CAPSEM CONSULT · STADT TOWING TANK · GLOCAL GREEN · SUSTENI · Granne forsikring · Norwegian Hydrogen · KONGSBERG · OCEAN VISIONEERING

STARTUPS

+Aidency · AQMA · OCEAN VISIONEERING · NonePlasticOcean · SPINNING ENERGY · norsjor · Konnexus · SUSTENI

EQUIPMENT MANUFACTORS

JOHN GJERDE · UPTIME · Kvenna · pascal · FURUNO · Norwegian Hydrogen · KONGSBERG · SPERRE · ShipMed · NOGVA · ABB · OTS · HELINOR Energi · ULSTEIN BETONG INDUSTRI · OSHAUG METALL · SEACABIN · SAINT-GOBAIN · PLANY · PETRO WELL SERVICES · STADT NAVAL · HEXAGON PURUS · ELTORQUE · VARD · ACEL · WAVEFOIL · anda · AALESUND PROTECTIVE WEAR · Ocean Resource Watch AS · HAV group · HAV hydrogen · Filtra · ULSTEIN · Hydrogenious · Libra · SEAONICS · ULMATEC PYRO · Hareid Group · Glamox · JETS · Marine Stabilisation · HYDROMEA · SYKKYLVEN STÅL · norwegian electric systems · norwegian greentech · NOSTEC · POLYFORM · PEVATECH · HUSE · hps · Hydroniq · weber · GLAVA · BRØDRENE DAHL · shipnor · Corvus Energy · SPINNING ENERGY · safetyfirst · BRUNVOLL · EKORNES · SKANEL · blue ctrl · AMOGY · norsjor · HOLSTAD group · Maritime Montering · ocean THERM · MARINE SOLUTIONS · eelution · E Capital · HOWDEN · Shipadmin · Prosub

PUBLIC ORGANIZATIONS

maritimt forum Nordvest · NHO · KYSTVERKET · Ship Young · FOSNAVÅG SKIPPINGKLUBB · Norwegian Energy Partners · NonePlasticOcean · fiskebåt · ULSTEIN NÆRINGSFORUM · MARITIM FORENING

RISK AND FINANCES

Eksfin · Nordea · DNB · Sparebanken Møre · SparebankenVest · SpareBank 1 SMN · Norseman Wind as · SANDS · Konnexus · KVALE

STARTUPS

KEEPTRACK PRODUCT TRACKER · AMOGY · HOLSTAD group · CAPSEM CONSULT · WAVEFOIL · STADT NAVAL · INKSTER MARINE · pascal · seaostion

For every job on a shipyard,

5,4

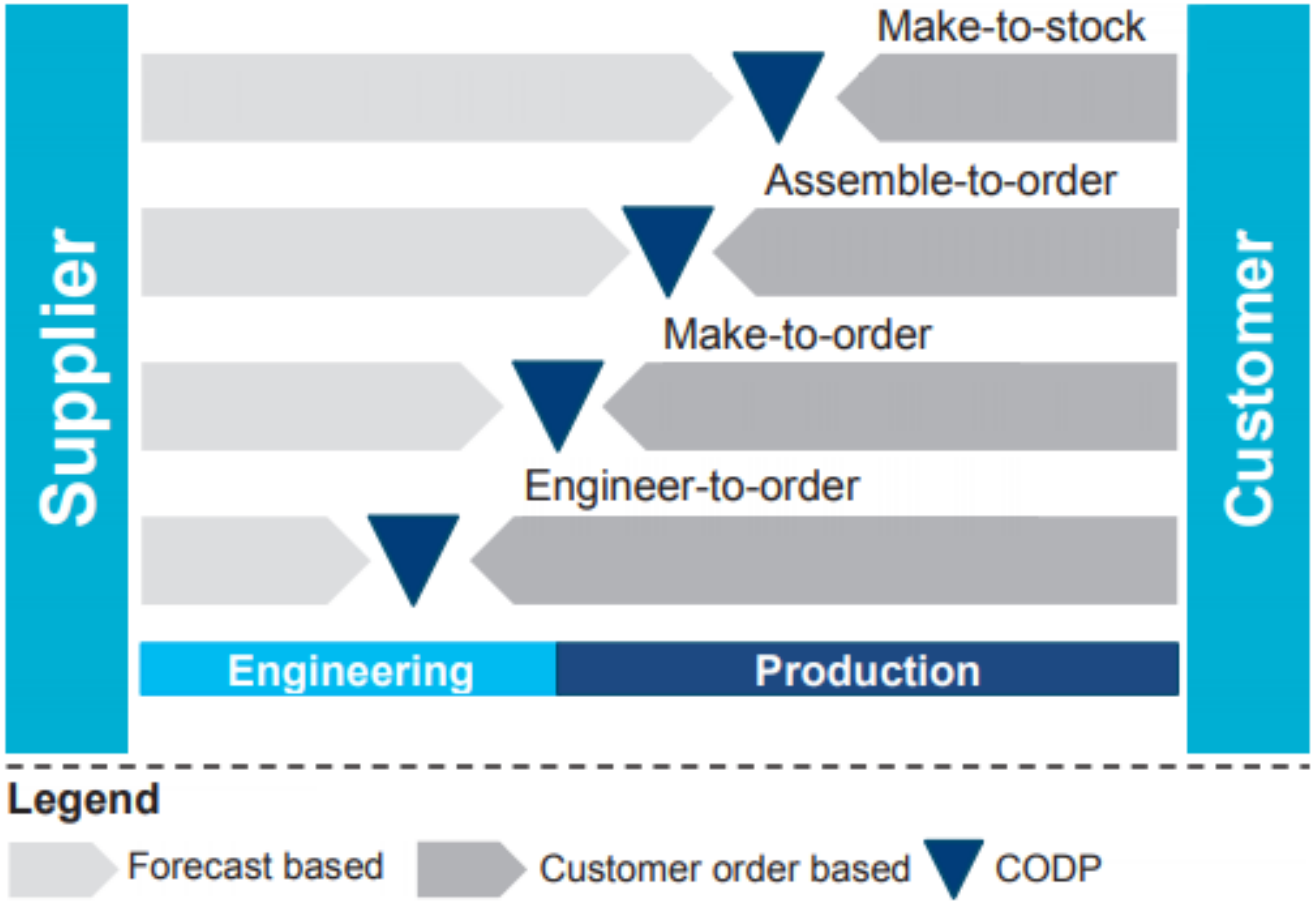
jobs are generated in the rest of the society...

Møreforskning, 2011

Context for the planning process in shipbuilding projects

ETO type of business

ETO implies products whose customer specifications require unique engineering design, significant customization, or new purchased materials. Each customer order results in a unique set of part numbers, bills of material, and routines



Customer order decoupling point (Wilner et.al., 2014)

Challenges in ETO

- **Incorrect specifications -** a result of the combination between late changes from the customer, design errors, lack of information on the drawings, delayed drawings
- **Labor shortages** - several projects simultaneously
- **Information exchange -** getting the correct information at the right time
- **Demand uncertainty -** suppliers that are uncertain about getting the contract and they do not start the production before things are clarified. Companies search for several other suppliers and that creates again uncertainty
- **Integration with other trades -** difficult to achieve due to fragmentation of the suppliers, inconsistent project teams and trades that ignore the other's requirements

A network of organizations

Suppliers and sub-suppliers

Long communication chains

Difficult to check the real status of the project

Marketing department

Evaluation of offers
General plan
Workload/capacities
Forecasts
Follow up graphics for NB orders

Technical description
Scope of work
Scope of supply

Project Managers

Budget proposal
Detailed program
VO evaluation
Project meetings
Daily presence – preliminary & final
Bimonthly updates of detailed programs
Hours subcontractors
Building strategy – bimonthly man-hours reports

VO lists
Doc. Div. time
Buyer's supply div. time
Delivery dates
General data upon delivery of a ship
Approval of the budget proposed by Planning

Ship coordinators

Feedback

General manager

Workload/capacities
Forecasts/simulations
General data upon delivery of each vessel
Performance indicators
Daily presence, prelim. & final
Follow-up graphics for NB orders
Various reports

General plan – modifications

Subcontractors

Evaluation of order notes
Preliminary building programs
Weekly updates – daily presence
Workload capacities
Evaluation of repair works for sub-con
Details of subcontracted activities

Contract, order notes
Invoices

Planning department (estimating & planning)

Budget proposal/split on details after proposal
Detailed building program/bimonthly updating % completion/forecasts
Detailed building program-daily/weekly updating clocking system
Report man-hours consumed bimonthly
List of activities –detailed man-hours evaluation for all activities within building program, with dwg.no, VO, FM, sub-con, "who is doing what". Daily updating for all ships under construction
Checking of time sheets against clocking system (monthly)
General plan/ Modifications
Workload/ Capacities for each production area + forecast simulations
Evaluation of subcontractors – order, notes, int./ext., with or without mat., budget/closed hrs.
Evaluation repair works for subcontractors
Workload units/tons in the assembly area
Follow up man-hours consumed - Productivity follow-up
Special technological processes
Create statistic data, various reports-KPI (monthly for Board)
Opening-closing orders – Evaluation of miscellaneous orders

Production department

Feedback
Remarks for the improvements
Works were clocked sub-con are used for the weekly updating of the clocking system
Data for daily presence
All problems of the clocking system

Bimonthly updated programs
Bimonthly man-hours reports
Weekly updates on list of activities
Performance data
Building strategy

Commercial department

General plan
Preliminary detailed programs
Bimonthly updates of detailed programs
Evaluation of misc. offers

Bimonthly update of the general plan (supply part)

Production director

General plan
Workload/capacities
Forecasts, budgets, KPIs,
Workload assembly hall
Bimonthly man-hours reports

Modifications of the building program

Financial department

General plan
Budget/workload data
Hours sub-con.
Monthly reports man-hours Consumed

Technical department

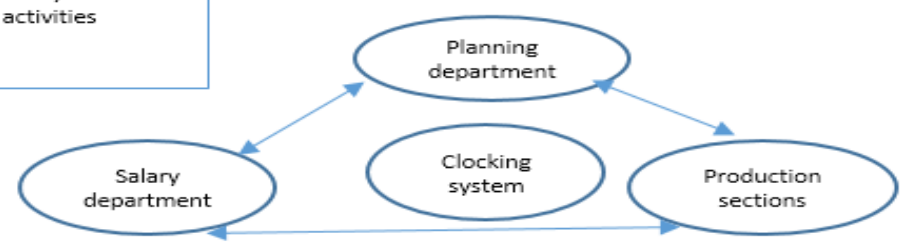
Building strategy
Unit plan
Tank plan
Special technological processes
Weight calculations
Surface calculations
Workshop documents

General plan
Preliminary detailed programs
Modifications, simulations, on programs based on documentation delivery
Updating program with the activities required for docking
Building strategy

HR department

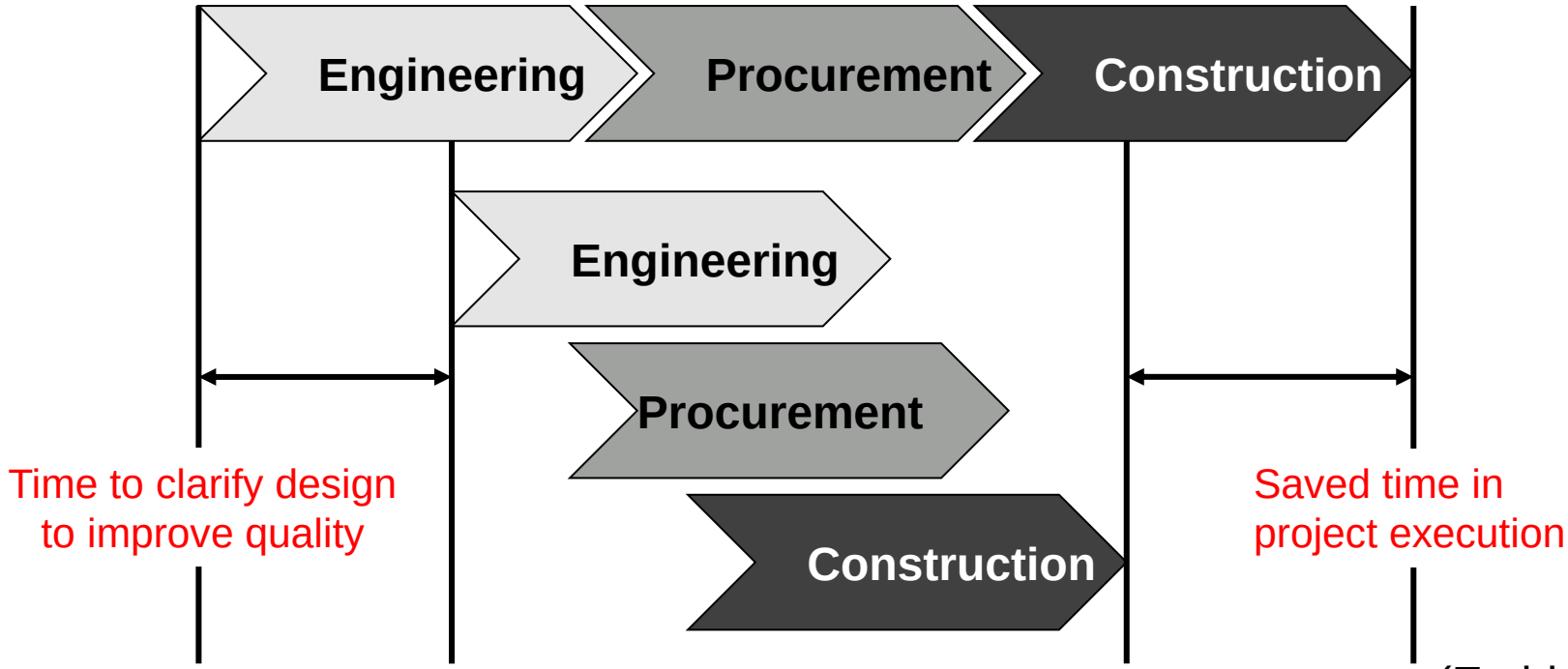
General plan – Workload/capacities
Daily presence – Man-hours consumed
Data/information subcontractors
Performance indicators

Number of dir. persons on sections
Time sheets, DB checking



Sequential vs. Concurrent Engineering

- From sequential- to concurrent execution
- The purpose of lean planning is to secure effective coordination between those involved
- From;
- To;

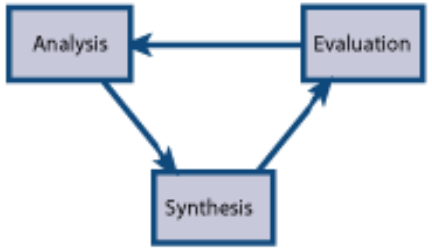


(Emblemsvåg, 2013)

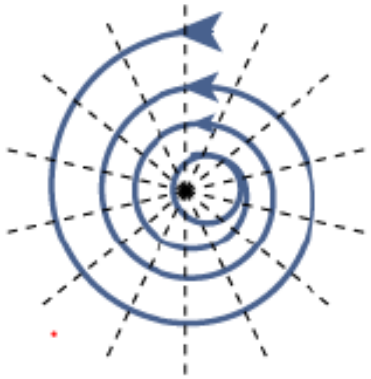
Concurrent & sequential engineering

Concurrent Engineering	Sequential engineering
Parallel design of product and processes	Sequential design
Multifunctional team	Independent designer
Concurrent consideration of product life cycle	Sequential consideration of product life cycle
Total quality management tools	Conventional engineering tools
All stakeholders input	Customer and suppliers are not involved

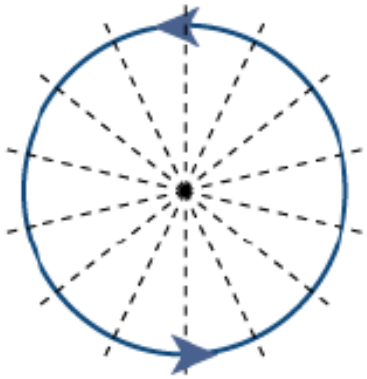
Iterations



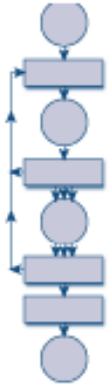
1. Exploration



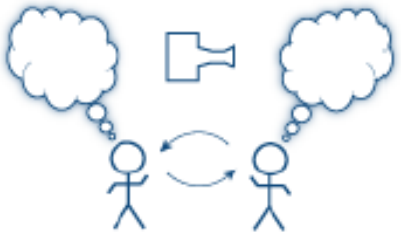
2. Convergence



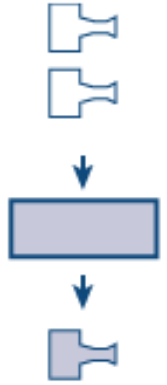
3. Refinement



4. Rework



5. Negotiation



6. Repetition

Wynn, et.,al.,2007

Outsourcing

Design

Detail engineering

Hull

Production

Outfitting

Commissioning

Inspection

Division of activities

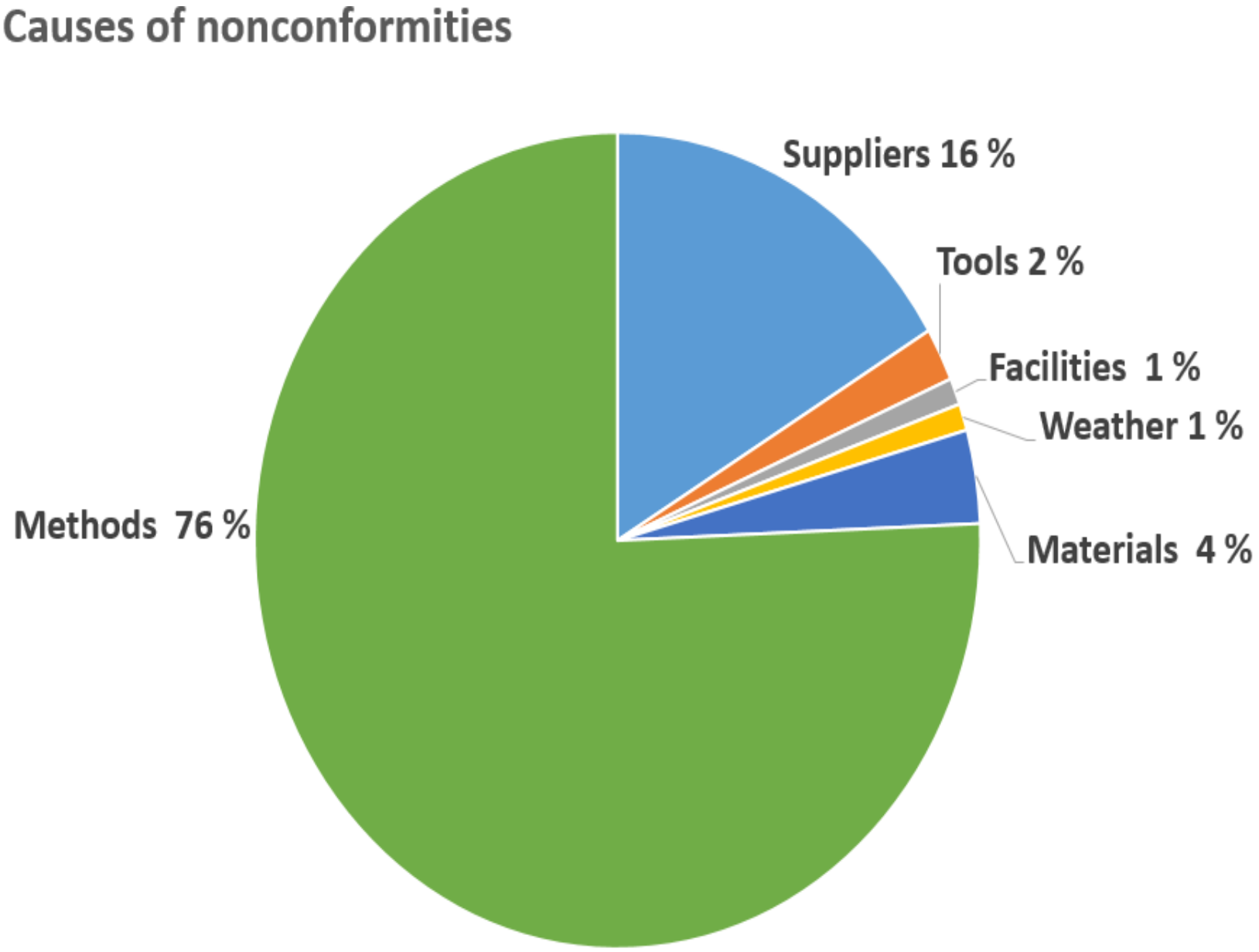
Several entities planning sometimes within the same phase due to outsourcing

Often, little coordination between participating entities

Several different 3D modeling- or planning software

Concept Design	Basic Design	Detail Engineering	Production Engineering	Verification
• Hull weight estimate • Light ship estimate • Speed calculation • Bollard pull calculation • Tank capacities calculations • Deck area calculation • Preliminary freeboard calculations • Preliminary damage stability calculations • ERN number calculation • Operational mode defined • Makers list • Tank plan drawing	• General arrangement • Reference drawings • Local vibration analysis • Noise analysis • Lines plan • Fire integrity plan • Damage control manual • Field of vision drawings • Escape route plans • Pillars in superstructure • Preliminary stability manual • Main cable routing • HVAC arrangement • Welding table • Crossover • Traverse sections • Bilge keel	• 3D model • Hull markings • Hatch plan • Doors plan • Manhole plan • Bilge and suction plan • Grinding plan • Gutter bar arrangement • Fire and safety plan • Window plan • Site plan • Clean design plan • Tank plan • System drawings • Freeing plan • DP3 • Layout of the equipment • Side and doors plan • Main mast • Lifting eyes plan • Propeller shaft arrangement • Railing • Foundations subject to class approval • Deck arrangements • Insulation plan • Stairs and ladders • Accommodation plan	• Isometric pipes spool drawings • NDT plan • Panel line info • Assembly line work stations info • Lifting lugs and lifting procedures • Cutting plan • Working procedures	• Final damage stability calculations • Final stability manual • HAT plan • Inclining test procedure • Inclining test report • SAT plan • Seal trial • Tanks sounding tables
20 work packages	65 work packages	74 work packages	20 work packages	8 work packages

Causes of nonconformities in shipbuilding projects

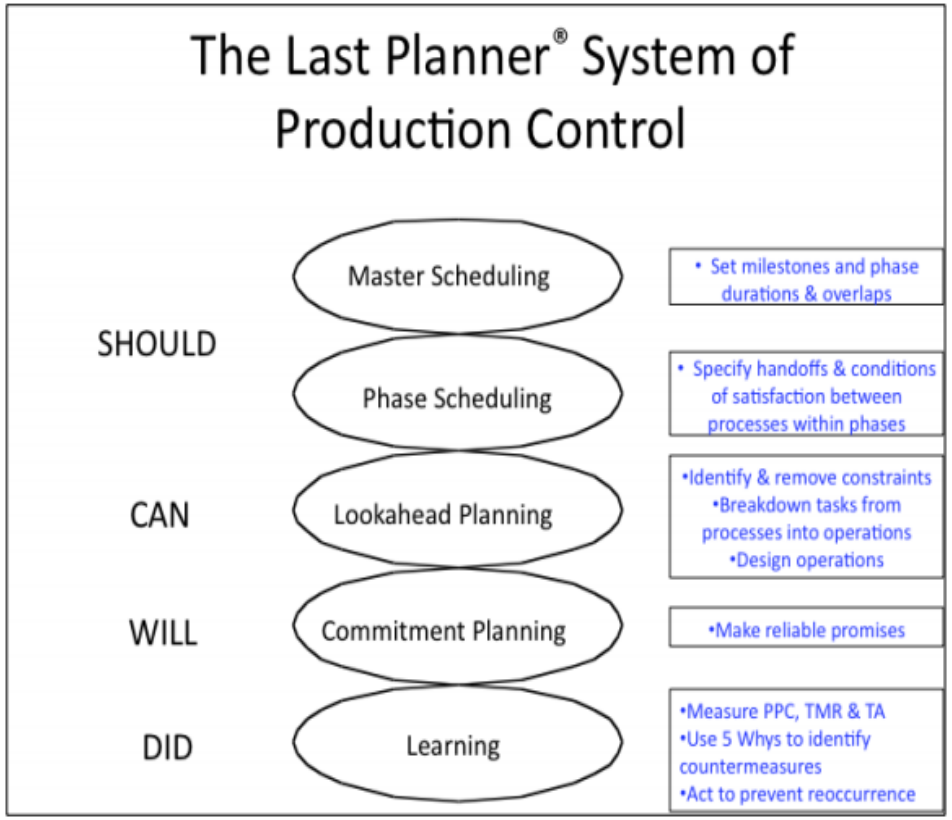


Lean Project Planning

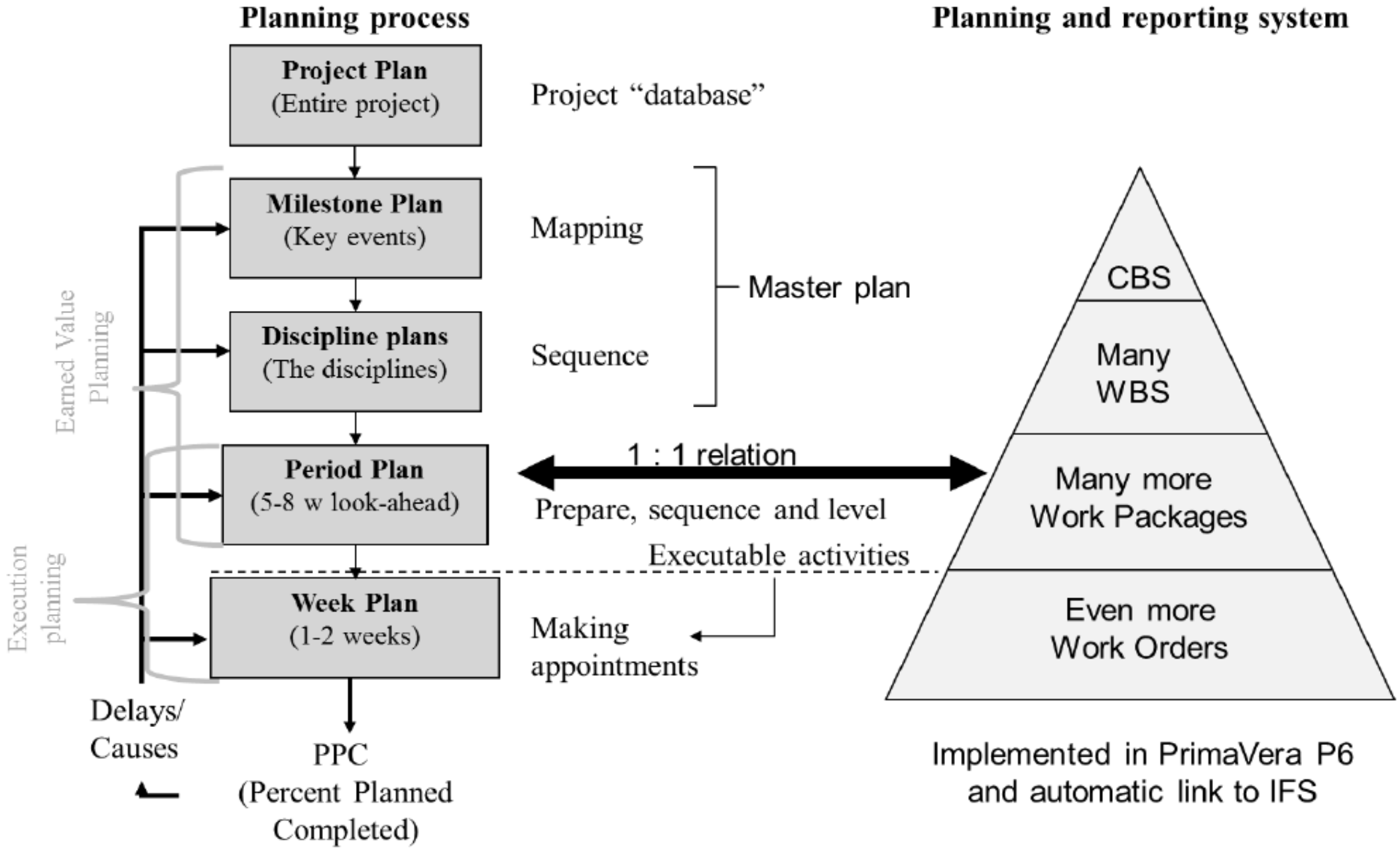
Lean Project Planning

- Planning method implemented in production (Lean, PDCA, LPS, EVM)

- Design and engineering challenges
  - Iterative nature of these activities
  - Difficult to define their activities as precise as needed in the EVM
  - Engineers work on several projects at a time
  - Engineers have less training in planning own activities



(Ballard and Tommelein, 2016)



(Emblemsvåg, 2015)

Planning, scheduling, reporting

- Planning – is a complex intellectual and social process that sets the direction and the pace for the whole project organization (Sussland, 2002)
  - A management tool which involves formulation of future activities in order to achieve an optimal balance between demand and available resources
- Scheduling– daily allocation of resources to the planned activities
  - Depends on the duration, previous activities, resource availability and estimated budget
- Reporting – weekly registration of progress on the planned activities
  - Physical percent, remaining hours per activity; eventually new finish date for delayed activities

Attributes of a proper planning process

1) Is a decision-making process

2) Is a process of anticipatory decision-making (to decide what and/or how to perform actions due at some point in the future)

3) Is a process of integrating interdependent decisions into a system of decisions

4) Is a hierarchical process evolving from general guidelines to objectives, to the elaboration of means and constraints that lead to a detailed course of actions

5) Is a process that includes parts or all of the chain of activities comprising information search and analysis, development and design of alternatives, analysis, and evaluation of alternatives and choice making

6) Is a systematic employment of standardized and formal (to varying degrees) planning procedures

7) Function as a documented presentation in the form of plans

Planning Functions

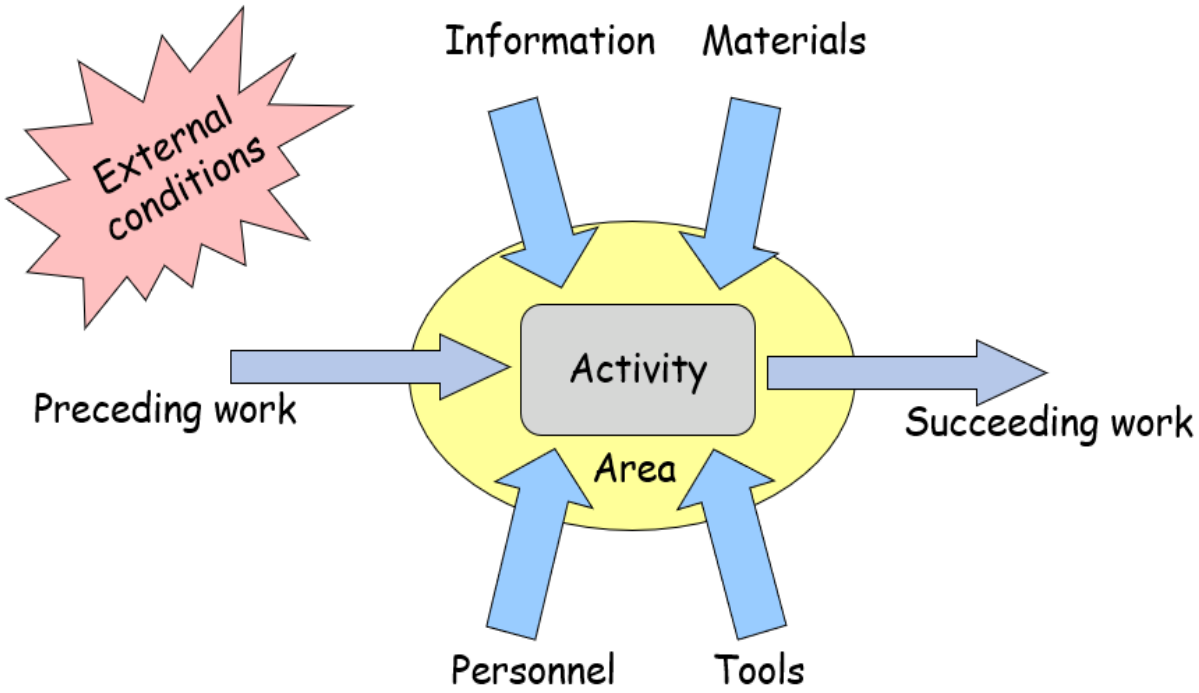
- To offset uncertainty and change
- To focus attention on objectives
- To gain economical operations
- To facilitate control
- To allocate contractual responsibilities and provide clear lines of communication
- To coordinate contribution from various groups
- To resolve delay and change order disputes on a predefined, quantifiable and equitable basis (Jaafari, 1984)

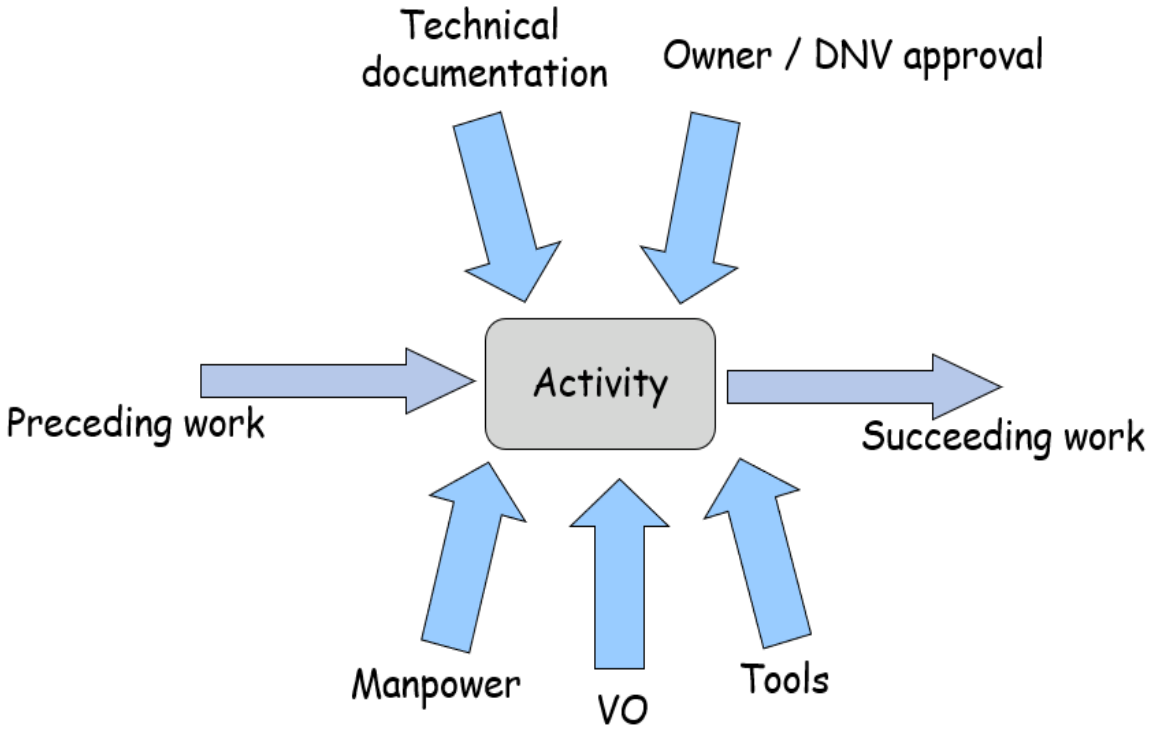
Standardized planning meetings

Production meetings conducted by PC

1) All invited are present & prepared (suppliers, discipline coordinators)
2) Deviations from the week plan
3) Re-plan for the next week or in the period plan
4) Next week’s plan
5) Period plan – sound activities (5 weeks)
6) Manning vs. planned hours
7) Comments from each participant

Sound Activities

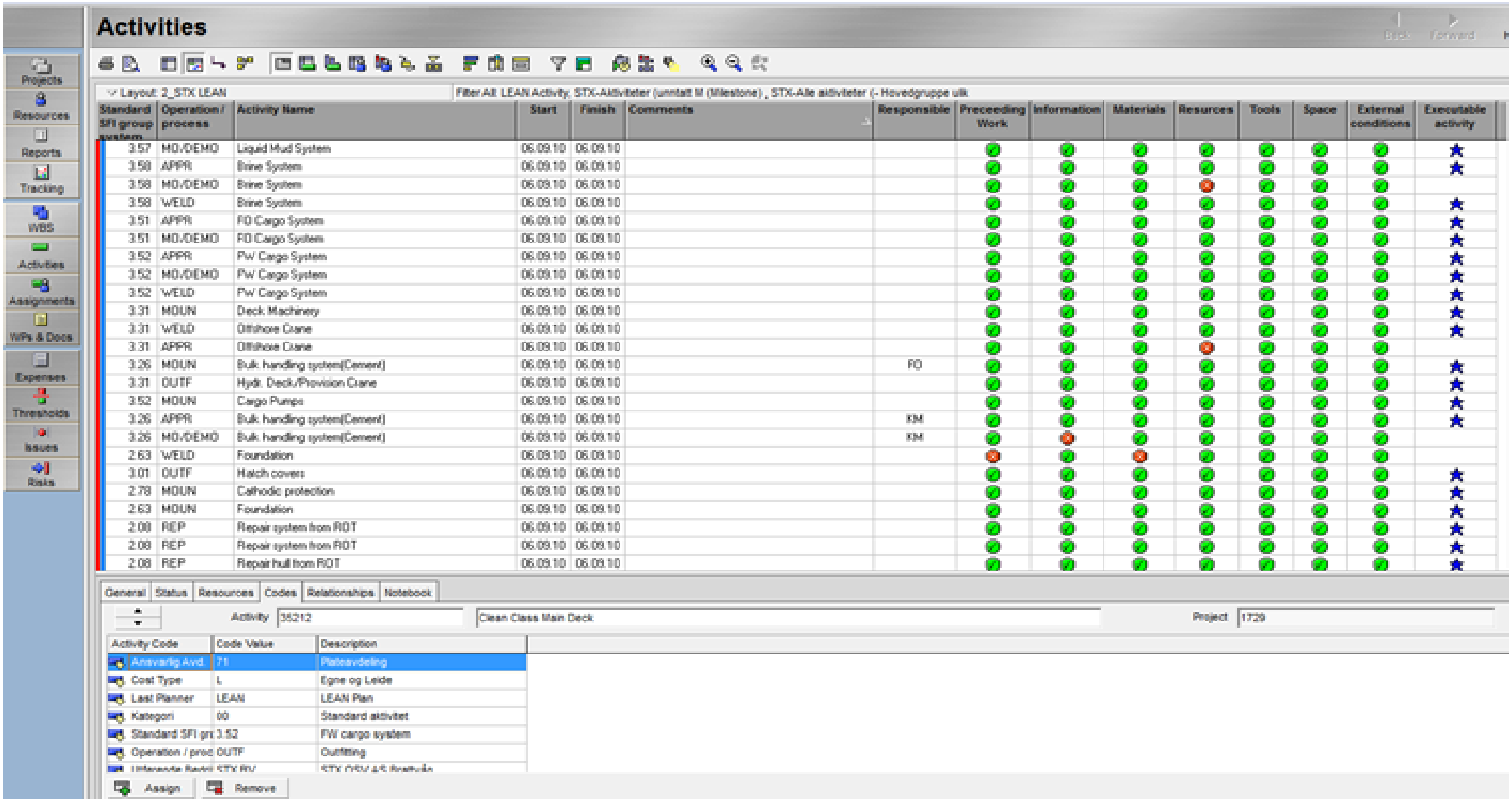




Week plan production

Ukeplan					Grunn til avvik og andel i prosent																		
	Beskrivelse	Start	Ferdig	Status inneværende uke	Tidligere arbeid	Material	Verktøy	Personell	Informasjon	Plass	Ytre forhold	Kommentarer	Teknisk	Innkjøp	Produksjon	Underleverandør	Utrustning	Sveis	Rør	Maskin	Snekker	Maling	Service
Teknisk				**0 %**	0	0	0	0	100	0	0		0	0	0	0	0	0	0	0	0	0	0
	Ikke bruk																						
Stål				**0 %**	30	20	0	0	30	0	20		0	0	0	0	0	0	0	0	0	0	0
	alu dørk decanter rom	31. mai.	5. jun.																				
	luke fra decanter rom til cr.	31. mai.	5. jun.																				
	vent under styrhus.	31. mai.	5. jun.																				
	fundament for rederi logo plate.	31. mai.	5. jun.																				
	sett inn utkapp sb.	31. mai.	5. jun.																				
	sett inn utkapp bb.	31. mai.	5. jun.																				
	sett inn 5 dører.	31. mai.	5. jun.																				
	Ikke bruk																						
Sveis				**0 %**	25	0	0	50	0	0	25		0	0	0	0	0	0	0	0	0	0	0
	Start sveising av utkapp	31. mai.	5. jun.																				
	Start sveising av A-60 dører	31. mai.	5. jun.																				
	Ikke bruk																						
Rør				**0 %**	0	0	0	71	0	0	29		0	0	0	0	0	0	0	0	0	0	0
	Trykkprøve BW/DW	31.mai	05.jun																				
	Fortsette montering av fw cooling syst nr2	31.mai	05.jun																				
	Fortsette montering av f w cooling syst nr3	31.mai	05.jun																				
	Fortsette montering av fw cooling main eng 1-2-3-4.	31.mai	05.jun																				
	Chilled water syst under bridge deck	31.mai	05.jun																				
	Starte montering av lo syst main eng 1-2.	31.mai	05.jun																				
	Fortsette fo syst main eng	31.mai	05.jun																				
	Byggesamen manøverhendler for hydraulikksystem,monter	31.mai	05.jun																				
	Trykkprøve BHS	31.mai	05.jun																				

Example Period Plan



PLANNING
DESIGN &
ENGINEERING

Engineers and planning

Little control over delivering own activities
Delayed, incomplete drawings – chain reaction
They do not se the whole picture – own delays affect several other areas
Do not like to plan (Eckert, 2018)
«Planning meetings» technical focus
Difficult to measure the completion of each activity (iterations)
Reporting – every other week
Activities allocated in the beginning of each week
Focus on scheduling & reporting – not on the planning process

Planning meetings

- Organization – how are these meetings organized?
- Content – is the content of the meeting dedicated to planning issues only?
- Participants – are all relevant people invited?
- Participation – is participating mandatory?
- Planning – is the team preparing for next periods activities?
- Scheduling – how is the team re-scheduling activities during the meeting?
- Reporting – do project participants report during the meeting?
- Root-cause analysis – is RCA applied to the non-completed activities?
- PPC and EVM – what kind of KPI’s are used during the planning meeting?
- Communication technology – how was it working?

Training

- Lack of literature on providing a structured type of training for organizing- and leading planning meetings for design- and engineering activities
- The literature offers some educational input, but, training is specific and supports people in acquiring skills through the use of what they have learned, while education is general and provides background for increasing understanding
- Even the most talented workers need development through training in order to drive continuous improvement to new levels

Management involvement

Crucial for implementing any improvement, concept, or procedure in a company

“This concept is like many others before…creates some waves now, but in a year or two it will be forgotten, and we will be back doing things as we have always done. I have been in this industry for many years, and I have tried so many concepts, but somehow, we ended up coming back to our old way of doing things”

Communication

Engineers refers to communication as a missing elements in their projects

Encourage people to bring problems to surface

Two-way communication or dialog

Use the planning process as a communication tool

Solution-oriented

Solving technical problems without discussing dependencies

Culture of blame placed on suppliers

Relevant project participants must attend the meeting

Systematic problem solving

Solving any issue in a systematic using RCA

Work for eliminating the root of the problem in order to prevent reoccurrence

Implies that every discipline coordinator goes behind the numbers or the schedule information to understand the realities of the project

Ask “why” until the root causes of every problem are identified

Background and interest

Person dependent planning process

- It refers to the person leading the meeting and his/her interest and involvement in organizing planning meetings

Motivated by example

- Well prepared coordinators led to more prepared participants
- Lack of interest from the management team led less interest from the participants

Lessons learned

Different evaluation process

Different approaches to organize and distribute the results of the evaluation

Evaluation performed at several levels: at project manager level, design phase level, detail engineering level as well as outfitting

Meetings archetypes

- Business-as-usual planning meetings
  - 115 out of 388 observed project meetings - about 30% of the total meetings
- Semi-structured planning meetings
  - 234 out of 388 observed project meetings - about 60% of the total meetings
- Structured planning meetings
  - 39 out of 388 observed project meetings – about 10% of the total meetings
- Lean planning meeting
  - a prescriptive model since the aim was to develop a training procedure that would result in implementing this type of meeting

Characteristics	Business-as-usual meetings	Semi-structured meetings	Structured meetings	Lean planning meeting
Organization	Little or no organization	Organized by the project managers	Organized by technical coordinators and project managers	Organized by project managers and technical coordinators
Content	Technical issues	Planning and technical issues	Planning issues	Planning issues
Participants	Varies	All discipline coordinators and relevant suppliers	All discipline coordinators and relevant suppliers	All discipline coordinators and relevant suppliers
Participation	Not mandatory	Mandatory	Mandatory and prepared	Mandatory and prepared
Planning	Not discussed	Discussed	Main topic	Planning and constrains elimination
Scheduling	Little	Activities to be re-planned	Re-planning and resources allocation	Re-planning and resource allocation
Reporting	Calculated by the system	Calculated by the system	Reported by each discipline coordinators	Reported by discipline coordinators and suppliers
Root-cause	No	No	No	Yes
PPC and EVM	No	No	Elements of EVM	PPC for weekly plans. EVM for period plan
Communication technology	Affected by lack of trust	Well organized	Well organized, high level of trust	Well organized, high level of trust

Our proposed solution to improving the planning process

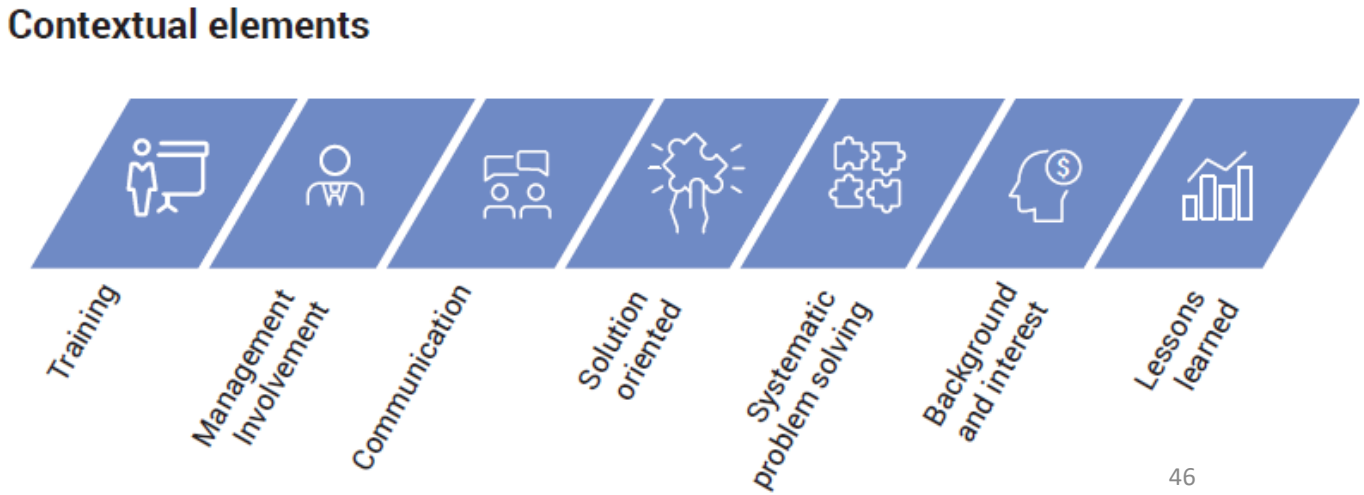
Lean meetings

Develop a training procedure based on the contextual elements

Follow up these training procedures until people have learned the routine

Involve people in the process of developing the procedures

Focus on the planning process that ensure a proactive approach



THANK YOU!