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An A3AOs Method of Software Tools Integration in the Complex System Development

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Who is presenting

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Research interests
- Testing and verification, Systems Engineering, Product development, Robust design, Crash mechanics and Numerical simulations

Work Experience as
Specialist Engineer, Structural Analysis at FMC Kongsberg Subsea AS (2006 - 2016)
Assistant Systems Engineer at TATA Consultancy Services, Pune, India (2001 - 2002)

Educational Background
PhD in Structural Engineering, NTNU (2002 - 2005)
M.Tech in Applied Mechanics, Indian Institute of Technology (IIT) Delhi, India (1999 - 2000)

Agenda

- Introduction
- Data and methods
- Literature review
- Conceptual solution
- Case study
- Prototyping
- Demonstration
- Conclusion

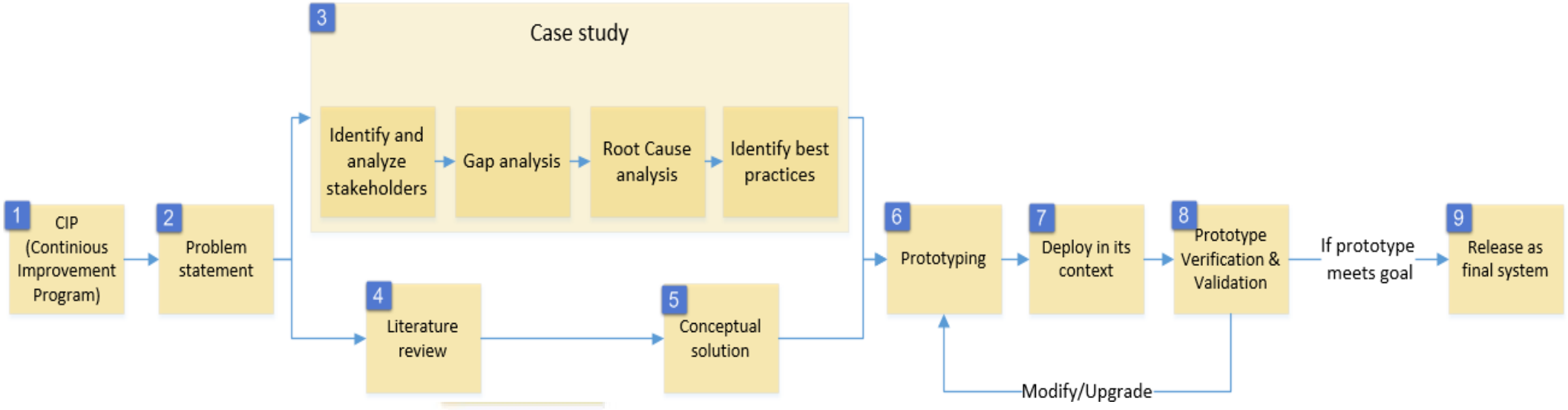
Introduction

- Company is a technology supplier in the maritime industry
- This specific case is about improving projects with integrated automation systems for advanced vessels
- Increased cost pressure and increase in competition
- Concern in a continuous improvement program: Deviations in the way the engineers works in projects
  - Especially visible in the use of software tools
  - No detailed system development process
  - Reduces efficiency, quality and consistency

Goal

- Optimize performance in department projects:
  - Reduce 200 man-hours
  - Increase quality
  - Increase consistency
- *To reach this goal we propose the following research question:*
- *How to develop a system development process that integrates software tools for optimized performance?*

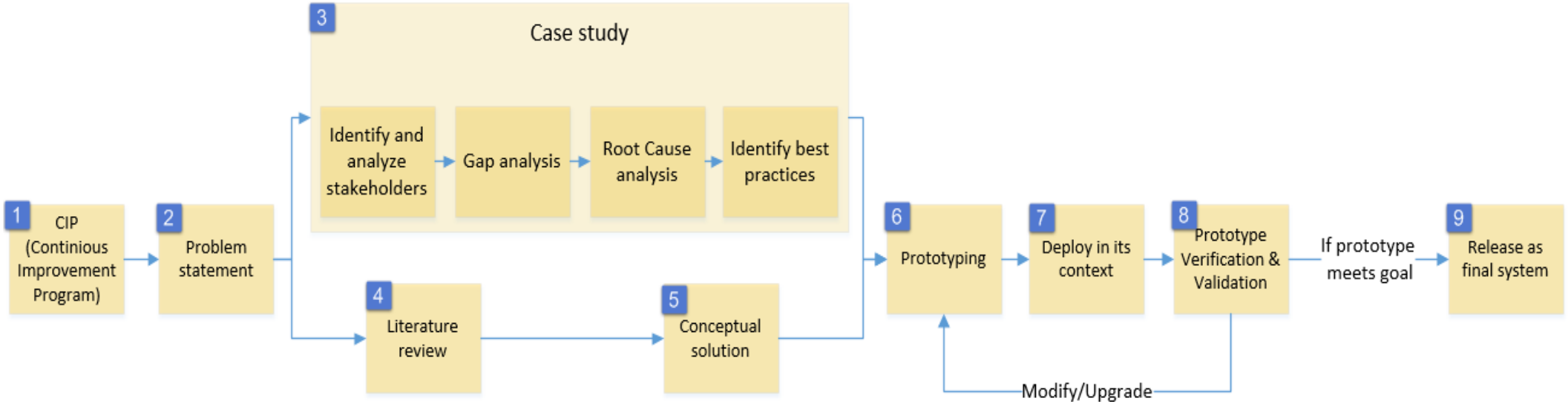
Research method



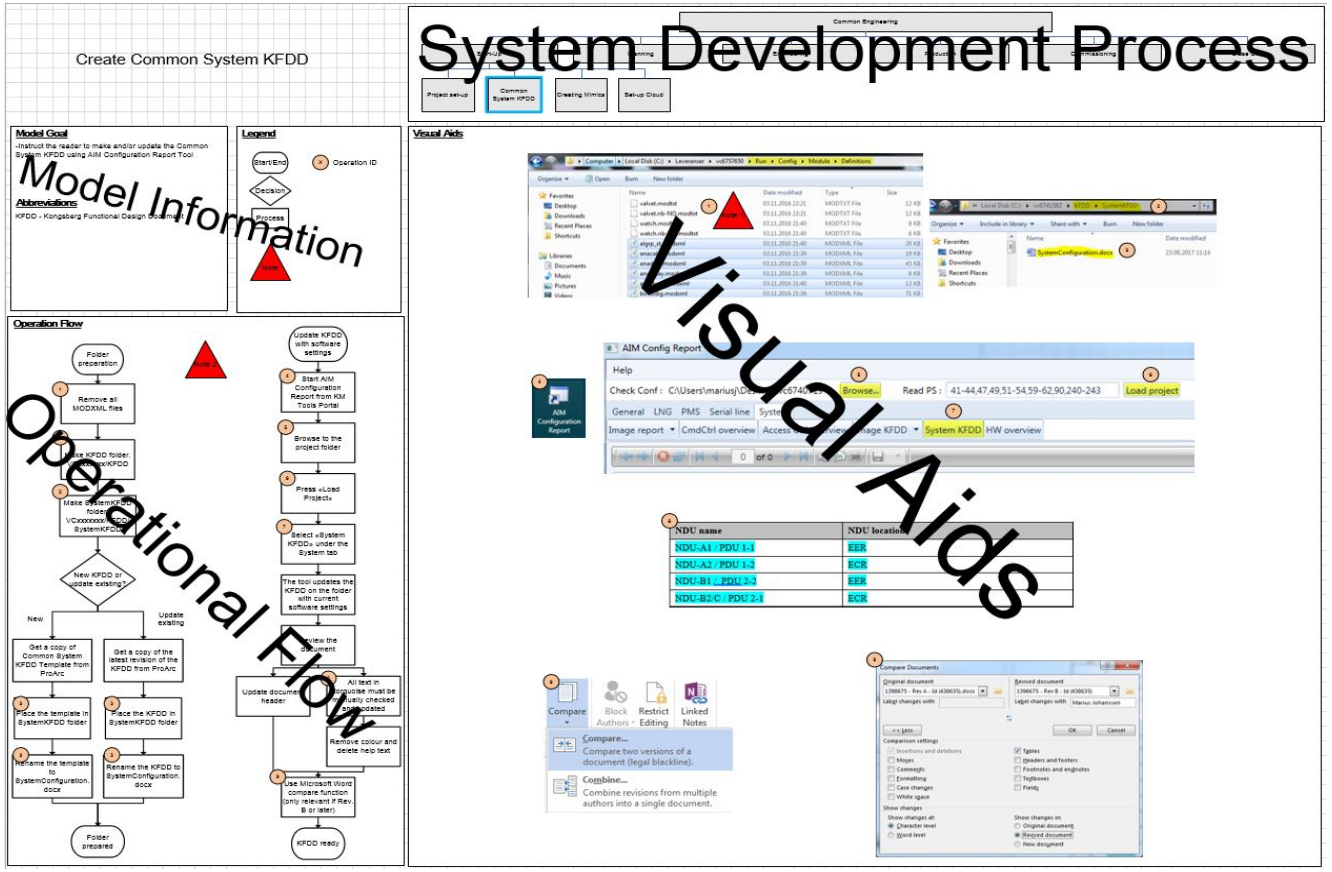
Literature Review

- System development processes
- Systems Engineering
- Systems Architecting
- A3 Architectural Overviews (A3AOs)
  - Borches (2010) communicate architectural knowledge
  - A3AO applied in several industries and domains
    - Diesel Control System (Wiulsrød, Muller & Penotti, 2012)
    - Lube oil system of a gas turbine (Singh & Muller, 2013) – Dynamic A3 Architecture
    - Interactivity in A3AOs (Brussel & Bonnema, 2015)

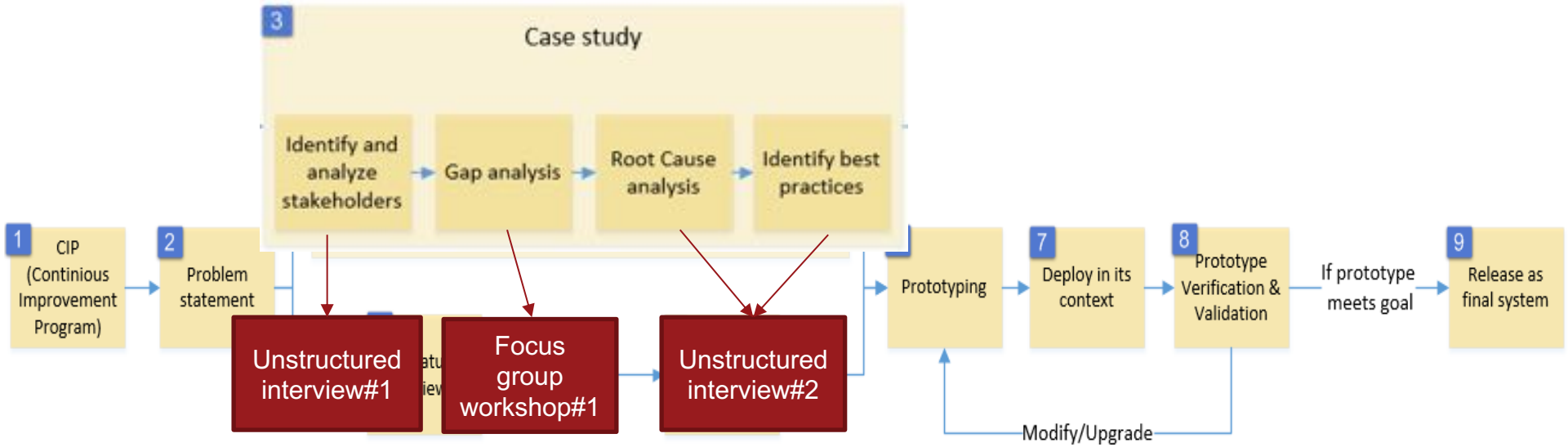
Conceptual Solution



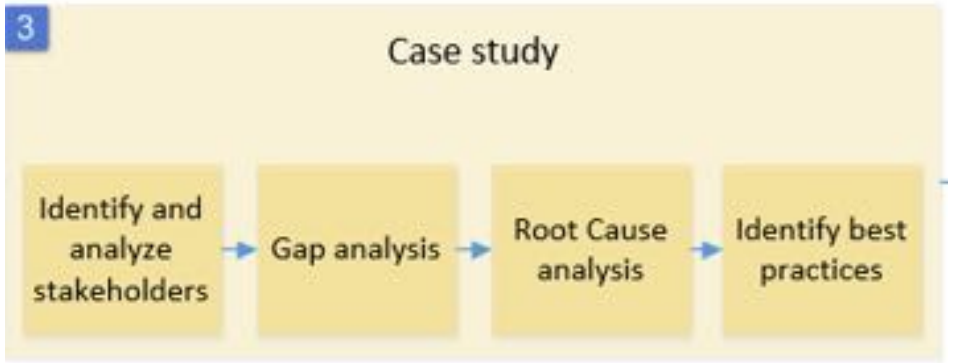
Conceptual Solution



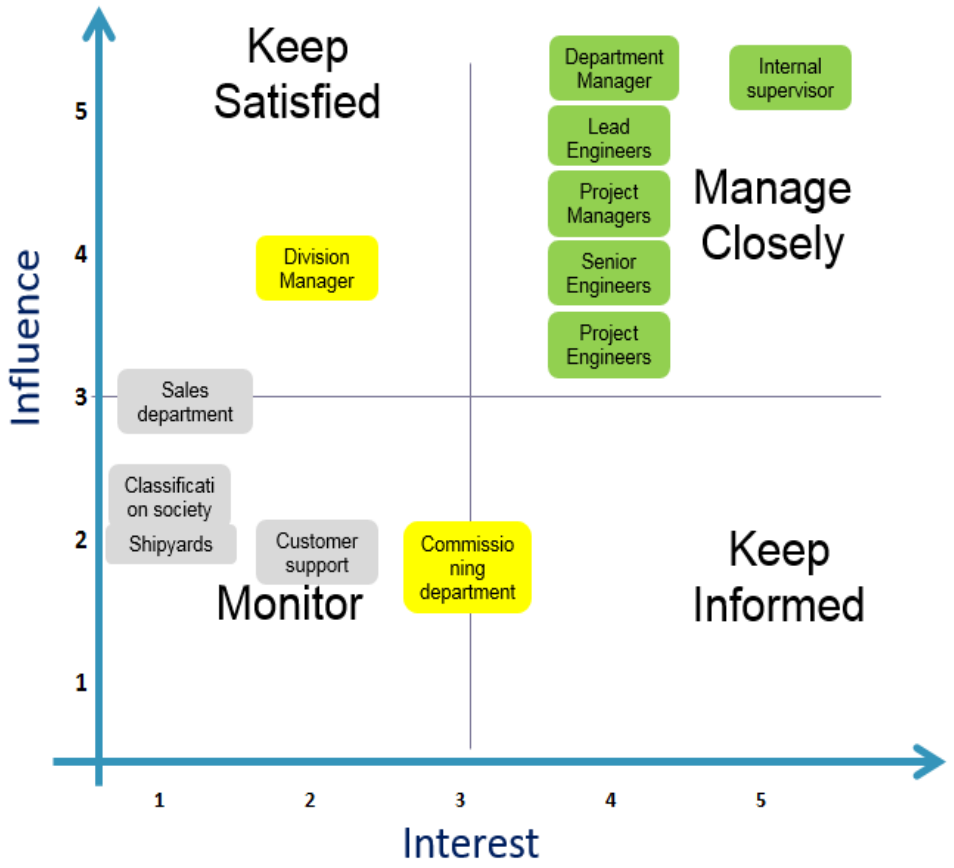
Case Study


3
Case study
Identify and analyze stakeholders
Gap analysis
Root Cause analysis
Identify best practices
1
CIP (Continious Improvement Program)
2
Problem statement
Unstructured interview#1
Focus group workshop#1
Unstructured interview#2
Prototyping
7
Deploy in its context
8
Prototype Verification & Validation
If prototype meets goal
9
Release as final system
Modify/Upgrade

Stakeholder Analysis

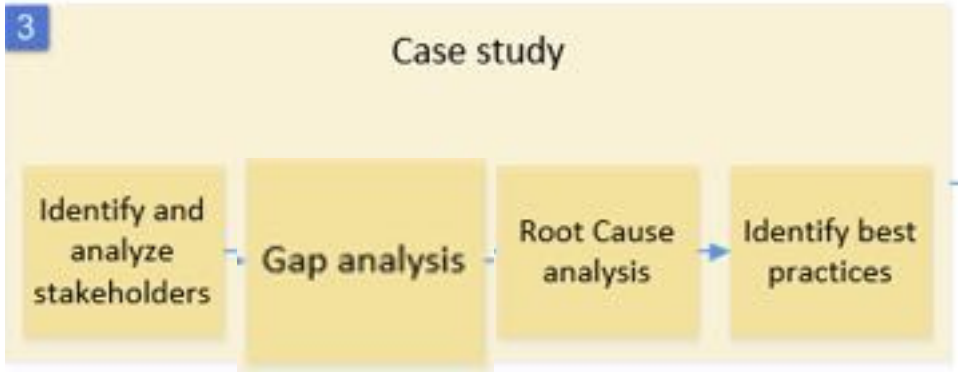


Stakeholder Analysis



Color Code
Unaware
Resistant
Cautious
Neutral
Supportive

Gap Analysis



Gap Analysis

Current State (As-Is)

- Mostly manual system development
- Individual-experience based development
- Software tools used occasionally
- Reduced efficiency, quality and consistancy
- 27 software tools available

Future state (To-Be)

- Mostly tool-based system development
- Standard procedure based system development
- Common understanding of the best practice
- Manual development occasionally
- Reduce 200 man-hours on LNG Projects while improving quality and consistancy

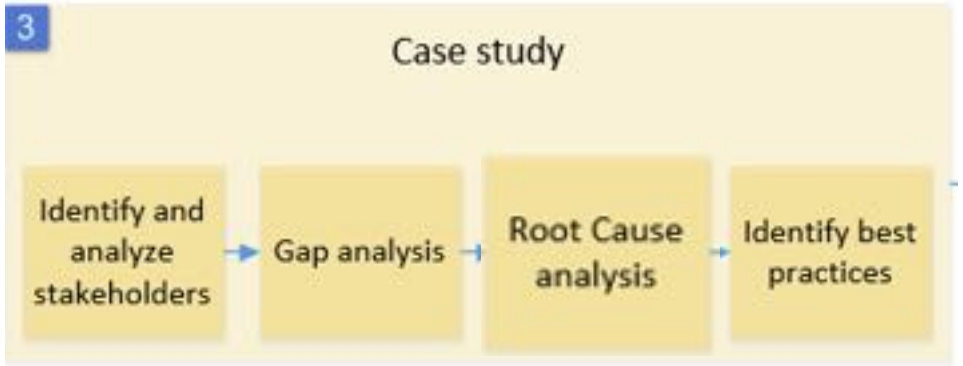
Gap

- The LNG department lacs a guide, procedures or processes that captures the use of software tools in the development process
- The LNG department lacks a common understanding of the best practice (it is all individual - experience based)
- The engineers in the LNG department lacks training in software tools

Proposed actions to close gap

- Architect a LNG specific system development process
- Integrate the best practice in a LNG specific system development process
- Integrate software tools in a LNG specific system development process

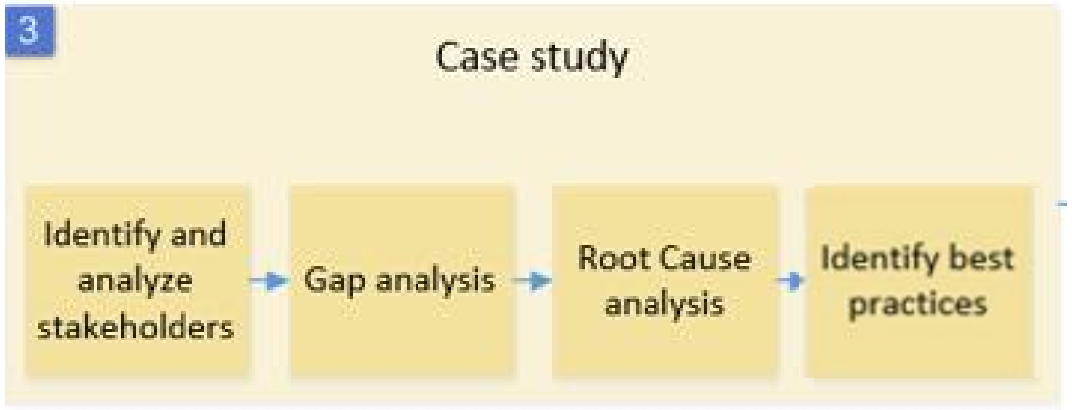
Root Cause Analysis



Root Causes – Why are software tools used insufficiently?

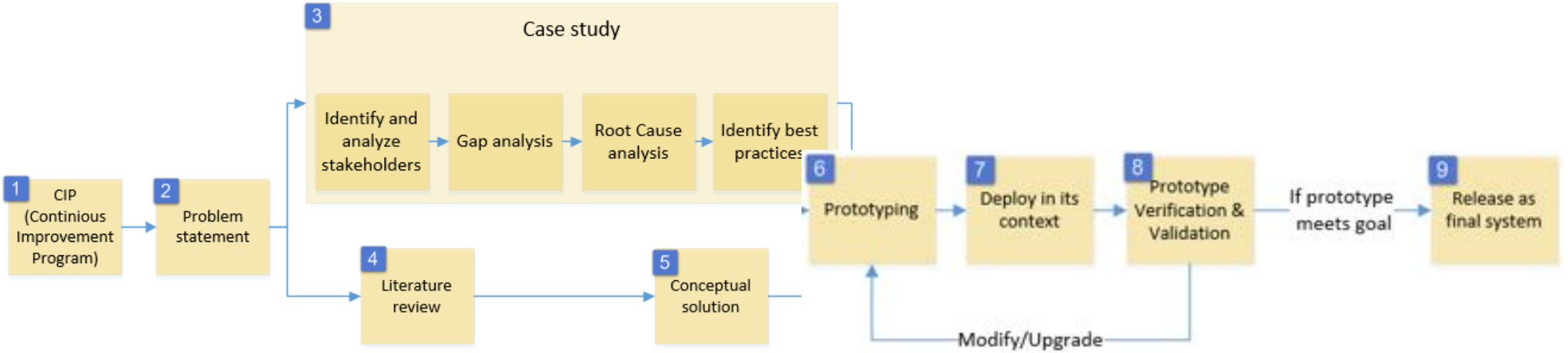
- Several software tools
- Located on different servers
- Different user interfaces
- Poor or no user manuals
- No process/guideline on what, when and how to use the software tools
- No process/guideline that captures best practices
- Lack of available time for training
- Software tools are not used on a regular basis

Best Practices



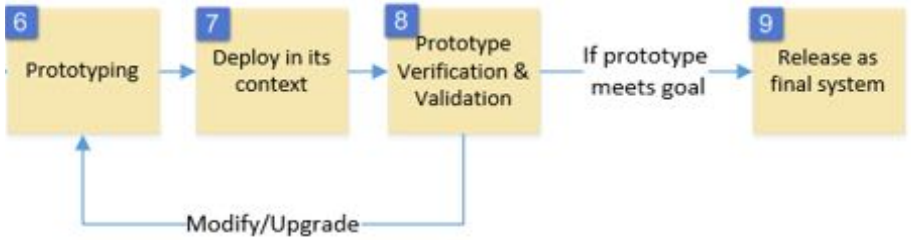
We identify the best ways of using software tools today

Prototyping



Prototyping

- Rapid prototyping
- Released to the stakeholders
- If it meets the goal it is released as final system
- 3 prototypes



Prototype 1

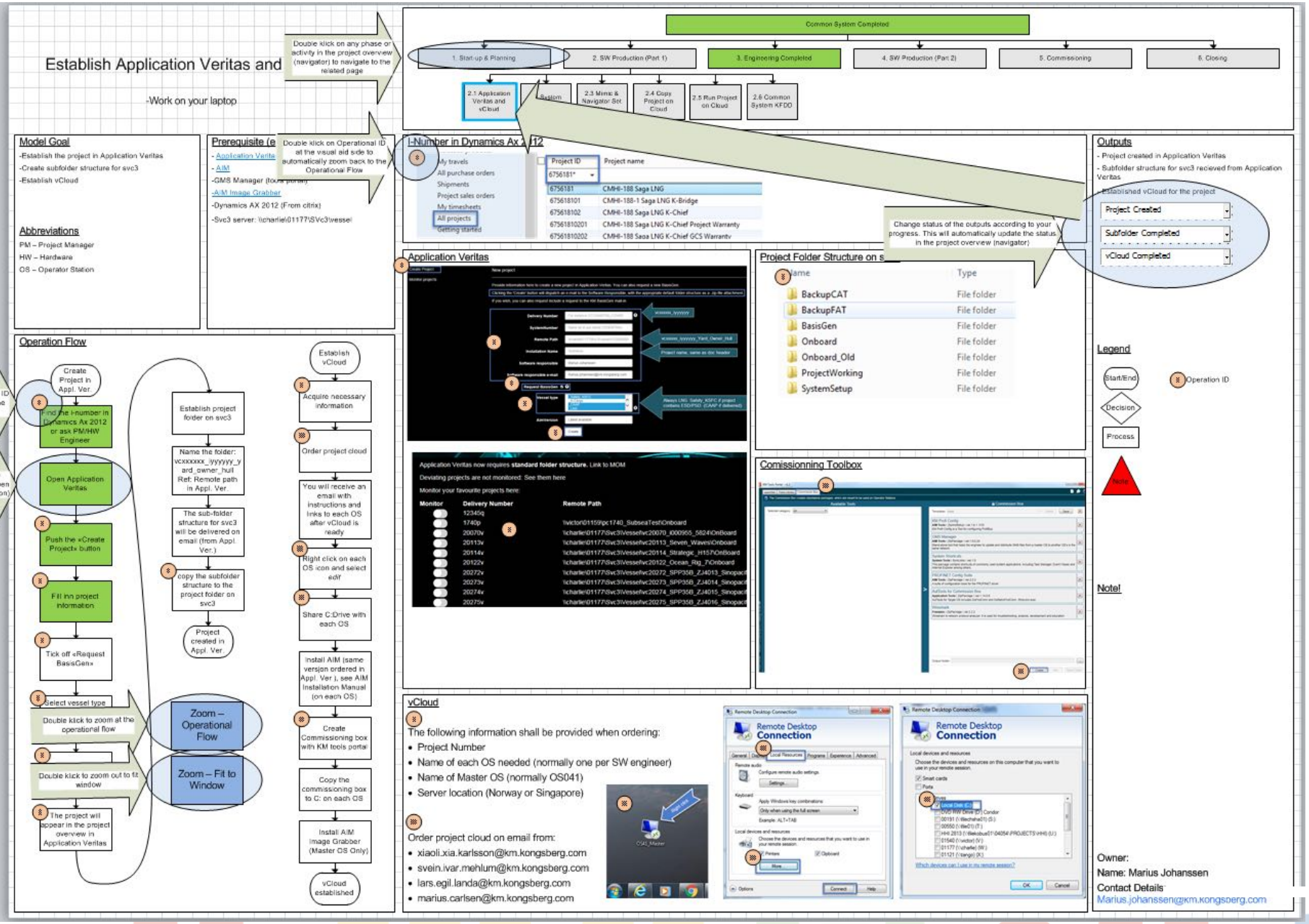
- Prototype 1 – focus group workshop#2 (non-operational)
  - 2 pages of A3AOs
- Positive feedback from the stakeholders
  - Visual nature
  - Step by step
  - Suggestions for improvement
    - 4 design modifications and 3 new functions
  - General understanding that the prototype will improve project performance
    - However, not to the level of 200 man-hours

Prototype 2

- 7 pages of interactable A3AOs
- Released to stakeholders for evaluation
- Survey was done to capture knowledge from hands-on experience personal
  - 23 participants
  - The net promotors for a solution using A3AOs was evaluated with positive results
  - Suggestions for improvement
    - 5 design modifications and 6 new functions
- Prototype 2 increases project performance however, not to the level of 200 man-hours

Prototype 3 (final solution)

- 33 pages of interactable A3AOs with two levels of abstraction
- Released to stakeholders for feedback
- Semi structured interview
  - 8 participants
    - 2 project engineers
    - 1 senior engineer
    - 2 lead engineers
    - 2 project managers
    - The department manager
  - Reduce 200 man-hours while improving quality and consistency in projects
- Prototype 3 is the final solution to this research and released for application in real life projects


Establish Application Veritas and
-Work on your laptop
Double klick on any phase or activity in the project overview (navigator) to navigate to the related page
Common System Completed
1. Start-up & Planning
2. SW Production (Part 1)
3. Engineering Completed
4. SW Production (Part 2)
5. Commissioning
6. Closing
2.1 Application Veritas and vCloud
System
2.3 Mimic & Navigator Set
2.4 Copy Project on Cloud
2.5 Run Project on Cloud
2.6 Common System KFDO
Model Goal
-Establish the project in Application Veritas
-Create subfolder structure for svc3
-Establish vCloud
Abbreviations
PM – Project Manager
HW – Hardware
OS – Operator Station
Prerequisite (e
- Application Veritas
- AIM
-GMS Manager (tools portal)
-AIM Image Grabber
-Dynamics AX 2012 (From citrix)
-Svc3 server: \\charlie\01177\SVc3\wessel
Double klick on Operational ID at the visual aid side to automatically zoom back to the Operational Flow
I-Number in Dynamics Ax 2012
My travels
All purchase orders
Shipments
Project sales orders
My timesheets
All projects
Getting started
Project ID
Project name
6756181*
6756181 CMHI-188 Saga LNG
675618101 CMHI-188-1 Saga LNG K-Bridge
675618102 CMHI-188 Saga LNG K-Chief
67561810201 CMHI-188 Saga LNG K-Chief Project Warranty
67561810202 CMHI-188 Saga LNG K-Chief GCS Warranty
Change status of the outputs according to your progress. This will automatically update the status in the project overview (navigator)
Outputs
- Project created in Application Veritas
- Subfolder structure for svc3 recieved from Application Veritas
- Established vCloud for the project
Project Created
Subfolder Completed
vCloud Completed
Application Veritas
Project Folder Structure on s
Name
Type
BackupCAT File folder
BackupFAT File folder
BasisGen File folder
Onboard File folder
Onboard_Old File folder
ProjectWorking File folder
SystemSetup File folder
Operation Flow
Double klick on Operational ID to automatically zoom to the related visual aid
Double klick at any step in the operational flow to change to green colour (indicating completed action)
Create Project in Appl. Ver.
Find the I-number in Dynamics Ax 2012 or ask PM/HW Engineer
Open Application Veritas
Push the «Create Project» button
Fill inn project information
Tick off «Request BasisGen»
Select vessel type
Double klick to zoom at the operational flow
Double klick to zoom out to fit window
The project will appear in the project overview in Application Veritas
Establish project folder on svc3
Name the folder: vcxxxxxxx_iyyyyyy_yard_owner_hull Ref: Remote path in Appl. Ver.
The sub-folder structure for svc3 will be delivered on email (from Appl. Ver.)
copy the subfolder structure to the project folder on svc3
Project created in Appl. Ver.
Zoom – Operational Flow
Zoom – Fit to Window
Establish vCloud
Acquire necessary information
Order project cloud
You will receive an email with instructions and links to each OS after vCloud is ready
Right click on each OS icon and select edit
Share C:Drive with each OS
Install AIM (same version ordered in Appl. Ver.), see AIM Installation Manual (on each OS)
Create Commissioning box with KM tools portal
Copy the commissioning box to C: on each OS
Install AIM Image Grabber (Master OS Only)
vCloud established
Application Veritas now requires standard folder structure. Link to MOM
Deviating projects are not monitored: See them here
Monitor your favourite projects here:
Monitor
Delivery Number
Remote Path
12345q
1740p \\victori01115\pc1740_SubseaTest\Onboard
20070v \\charlie\01177\Svc3\Vessel\vc20070_I000955_5824\OnBoard
20113v \\charlie\01177\Svc3\Vessel\vc20113_Seven_Waves\Onboard
20114v \\charlie\01177\Svc3\Vessel\vc20114_Strategic_H15\OnBoard
20122v \\charlie\01177\Svc3\Vessel\vc20122_Ocean_Rig_7\Onboard
20272v \\charlie\01177\Svc3\Vessel\vc20272_SPP35B_ZJ4013_Sinopacific
20273v \\charlie\01177\Svc3\Vessel\vc20273_SPP35B_ZJ4014_Sinopacific
20274v \\charlie\01177\Svc3\Vessel\vc20274_SPP35B_ZJ4015_Sinopacific
20275v \\charlie\01177\Svc3\Vessel\vc20275_SPP35B_ZJ4016_Sinopacific
Comissionning Toolbox
vCloud
The following information shall be provided when ordering:
• Project Number
• Name of each OS needed (normally one per SW engineer)
• Name of Master OS (normally OS041)
• Server location (Norway or Singapore)
Order project cloud on email from:
• xiaoli.xia.karlsson@km.kongsberg.com
• svein.ivar.mehlum@km.kongsberg.com
• lars.egil.landa@km.kongsberg.com
• marius.carlsen@km.kongsberg.com
Remote Desktop Connection
Legend
Start/End
Operation ID
Decision
Process
Note
Note!
Owner:
Name: Marius Johanssen
Contact Details:
Marius.johanssen@km.kongsberg.com

Conlcusions

- *How to develop a system development process that integrates software tools for optimized performance?* - A3AOs
- It is shown that A3AOs can be used for process architecting as well as system architecting
- Contribution to system architecting literature by extending the use of A3AOs
- Reduce up to 200 man-hours, improves quality and consistency in projects
- 1 man-hour costs 750 NOK– 150.000 NOK each project – 2.7 million NOK in 2019

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