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Developing a Configure-to-Order Product in the Subsea Oil and Gas Domain

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Master thesis paper for TechnipFMC

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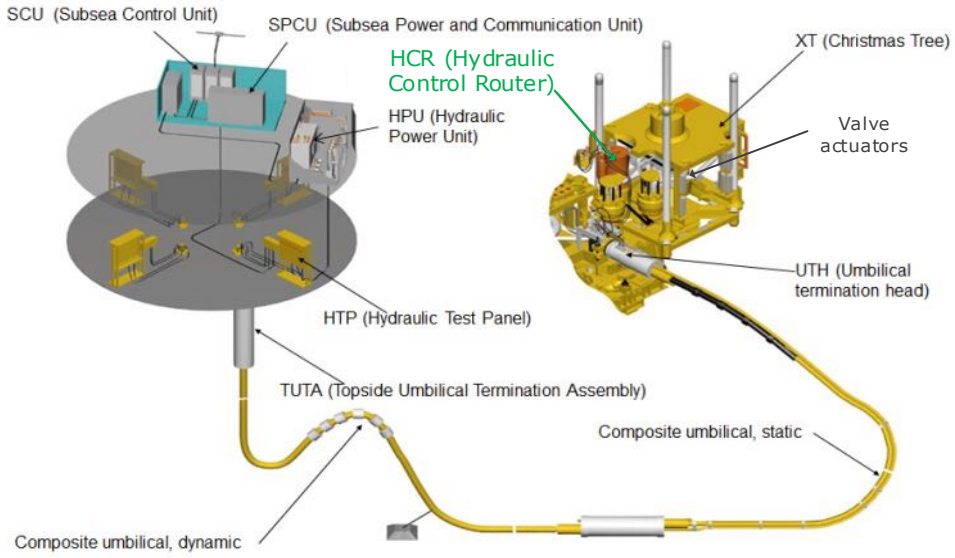
Take 5 moment

Agenda

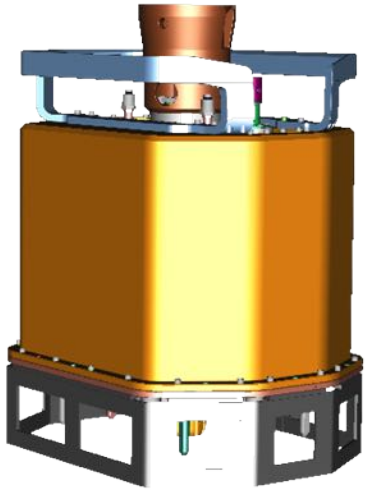
- Introduction
- Problem statement
- The theoretical approach
- Research questions
- Research methodology
- Development of the case product
- Modularity overview
- Results
- Discussion & further work
- Concluding the research questions

Introduction

- Subsea Oil and Gas Domain as Laboratory
- Increased focus on cost and lead time in the industry
  - Allow changes in how the industry thinks and do business
- Researched the Subsea Production System
  - Subsea Hydraulic control system
  - Hydraulic Control Router
- New product development project
  - No customer have experience with the product
  - Easily affect product design
  - Project wanted to research new ways to execute projects

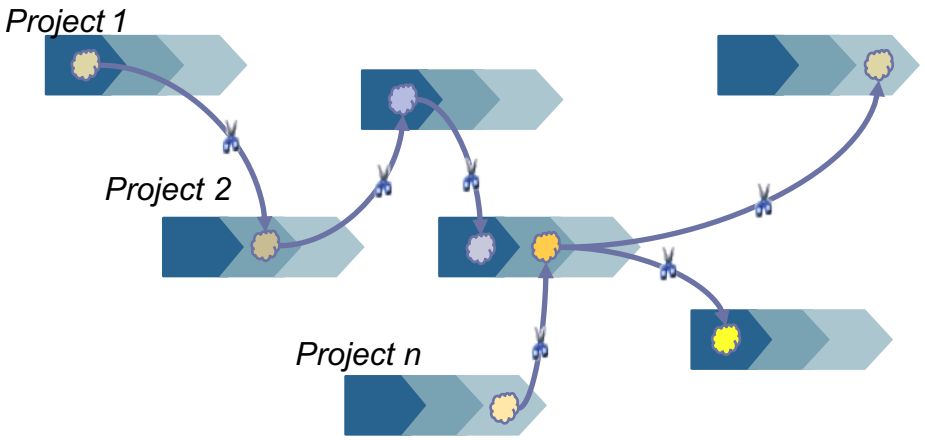


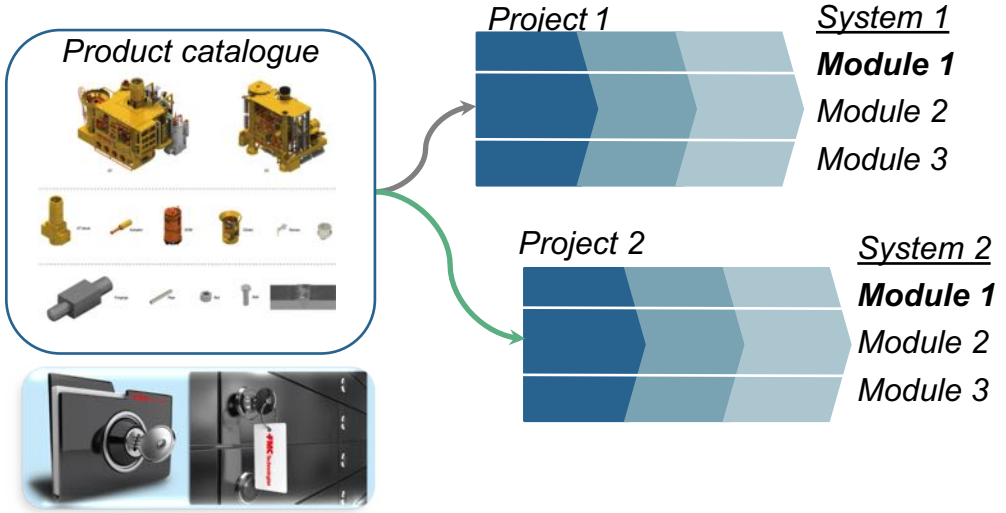
Subsea Hydraulic Control System



Hydraulic Control Router

Problem statement





Current situation

Engineer-to-Order strategy

- Customization and tailoring
- Detailed customer requirements
- Growing system and Product Portfolio
- Project focus

Future situation

Configure-to-Order strategy

- Standardization and modularization
- Functional requirements exchanges
- Controlled system and Product Portfolio
- Product focus

The theoretical approach

The Operational model

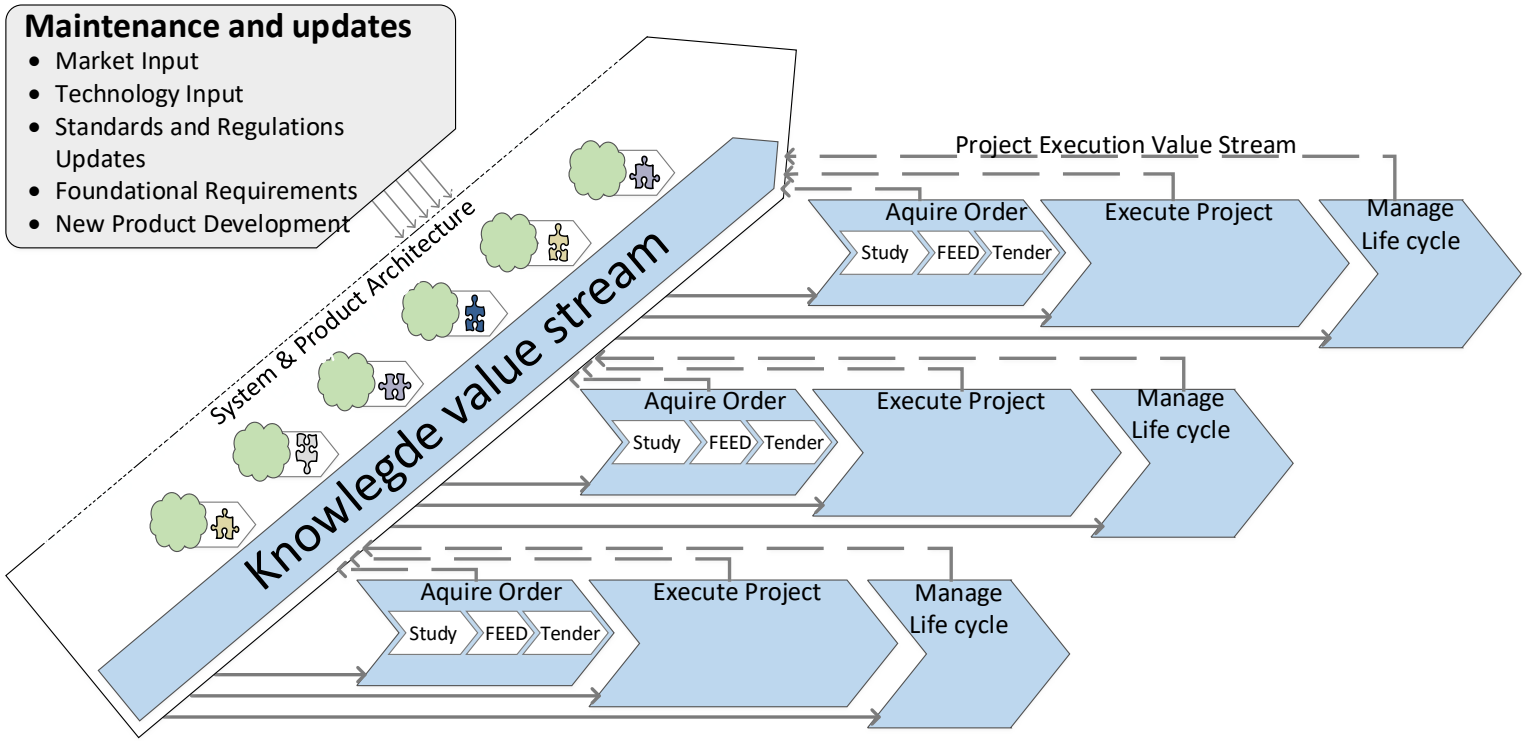
- Knowledge value stream
  - All product variance and variants
- Project execution value stream
  - Project specific variants

Systems engineering and Systems architecture

- Requirements
- Functionalities
- Physical elements

Modularization and standardization

- Product families
- Configurators



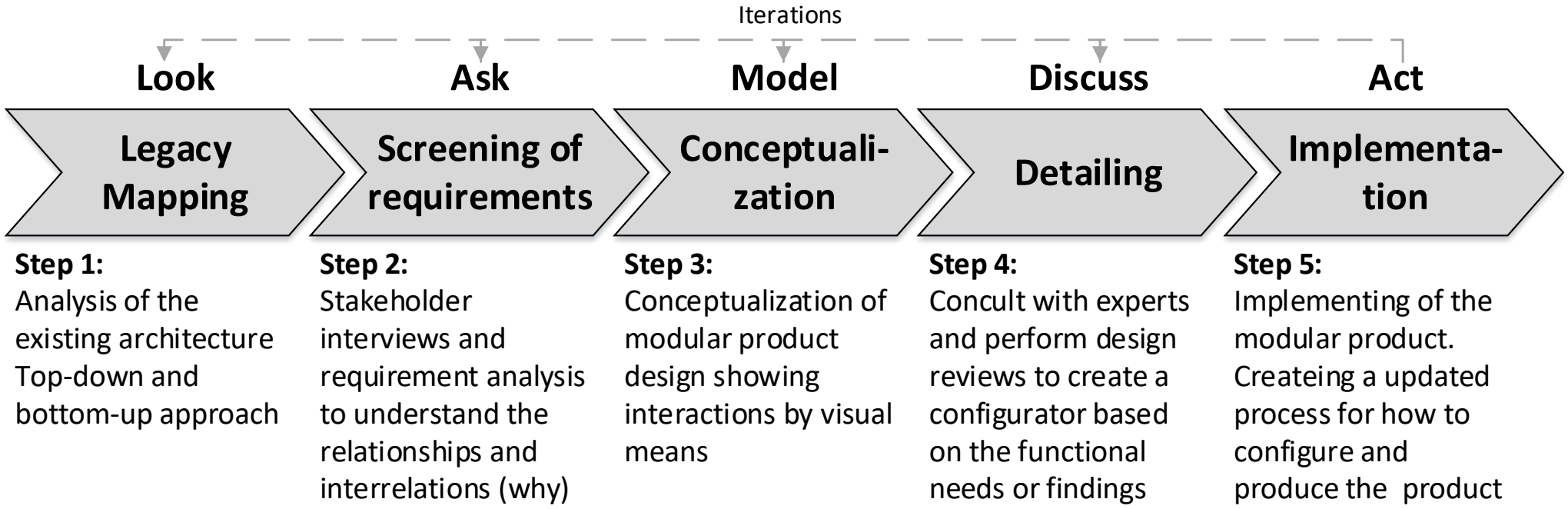
Fundamental model adapted from

- Lean product development
- knowledge based development

Research Questions

- How can we apply systems engineering framework and lean product development principles to create a configurable HCR?
- How does the Configure-to-Order strategy affect the HCR during design and project execution?

Research methodology

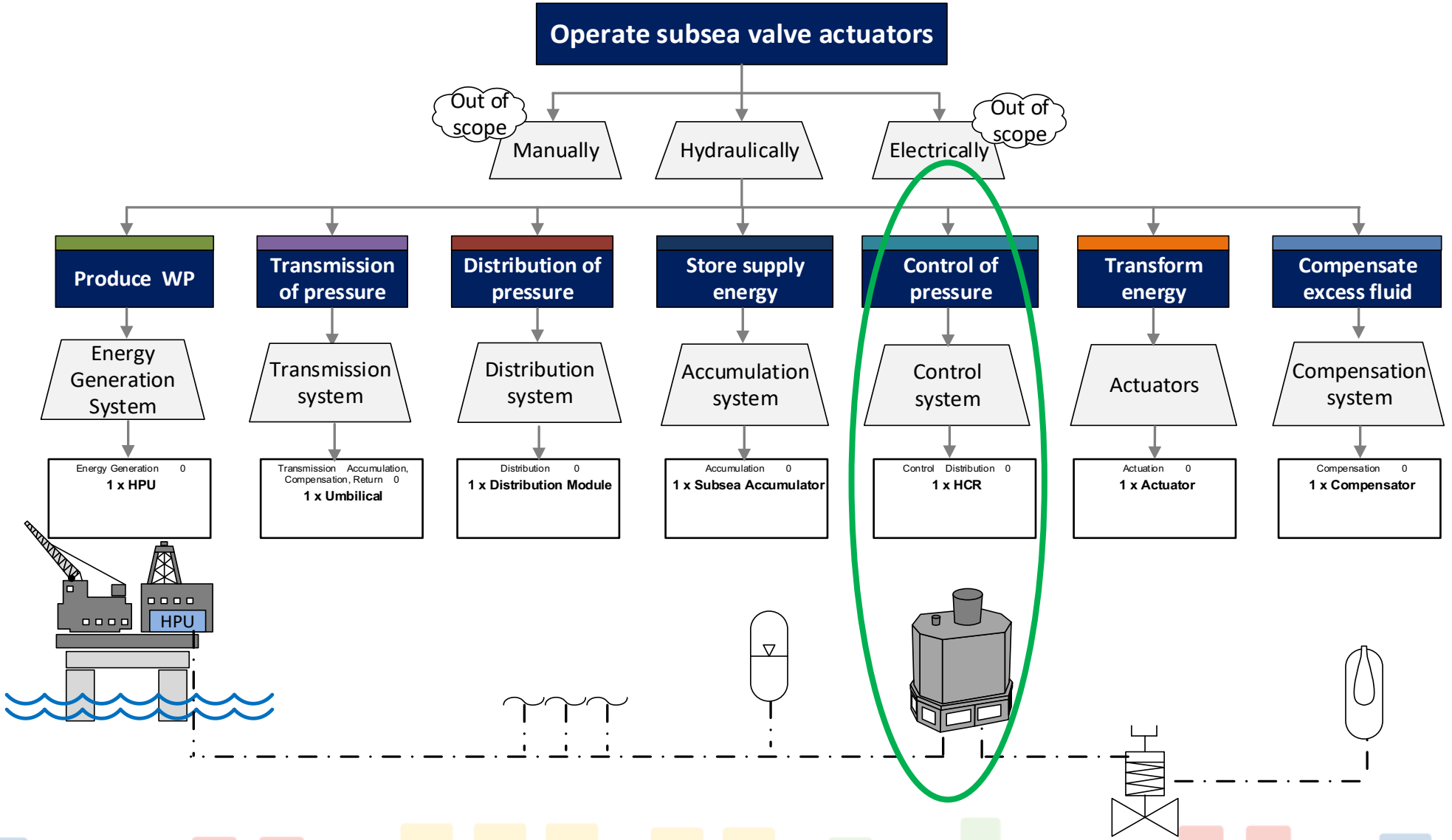


- **LAMDA**
- Understand functional requirements
- Create a modular product
- Establish a configuration process

- **Validation**
- Design reviews during product development
- Semi-structured interviews

- **Analysis of a reference project documentation**
- Documentation types
- Revisions
- Hours
- Effects of the CTO strategy

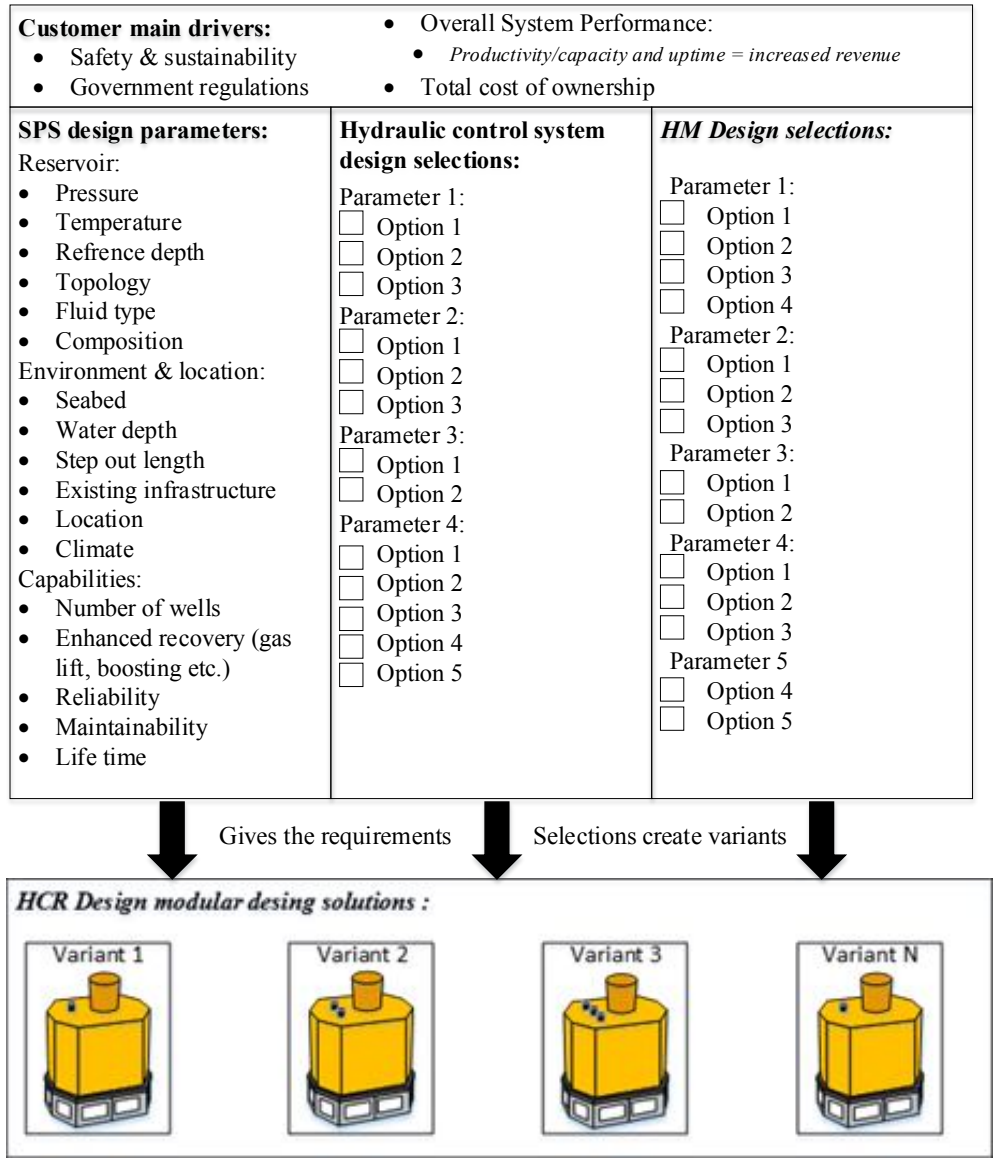
Development of the case product



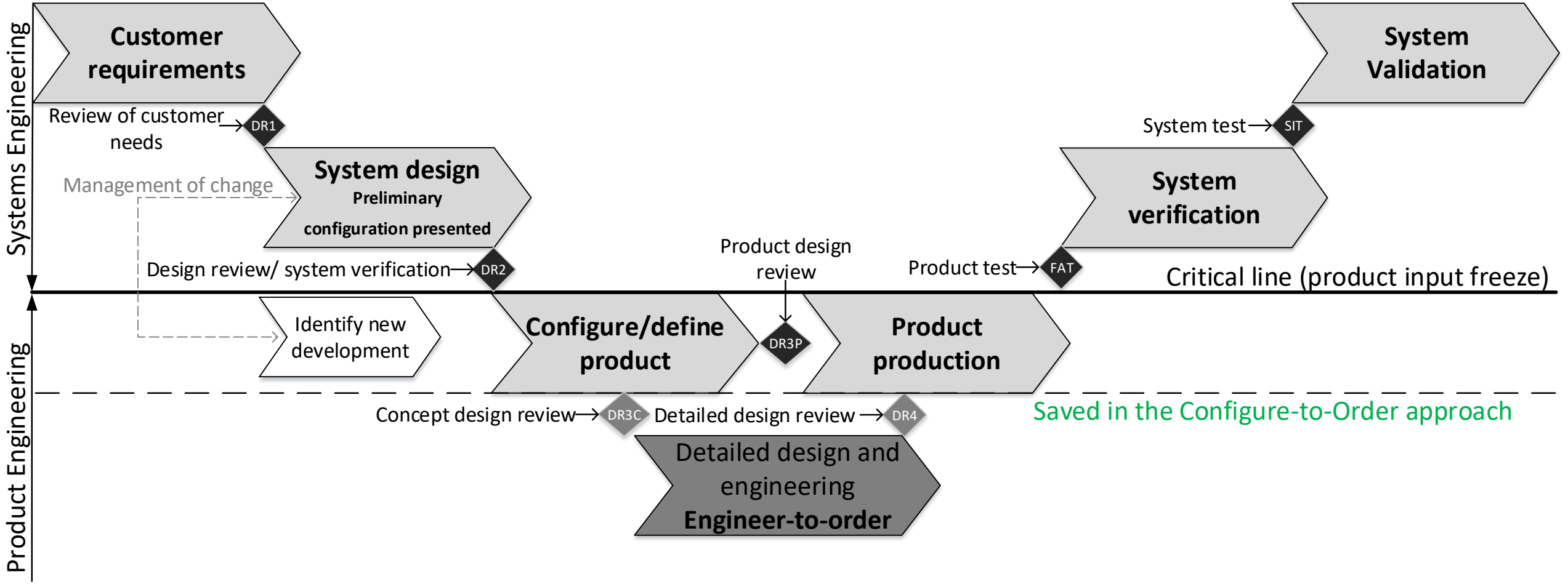
HCR modularity overview

- Customer drivers
- System selection
- Hydraulic control system selections
- HCR design sections

Configure based on FUNCTIONALLITY!



Configuration process



Results

Qualitative data from ten interviews

Benefits and reasons for CTO

- Pre-engineered solutions
- Synergy effects
  - Product specific
  - Other products
- Automated processes

Challenges for CTO

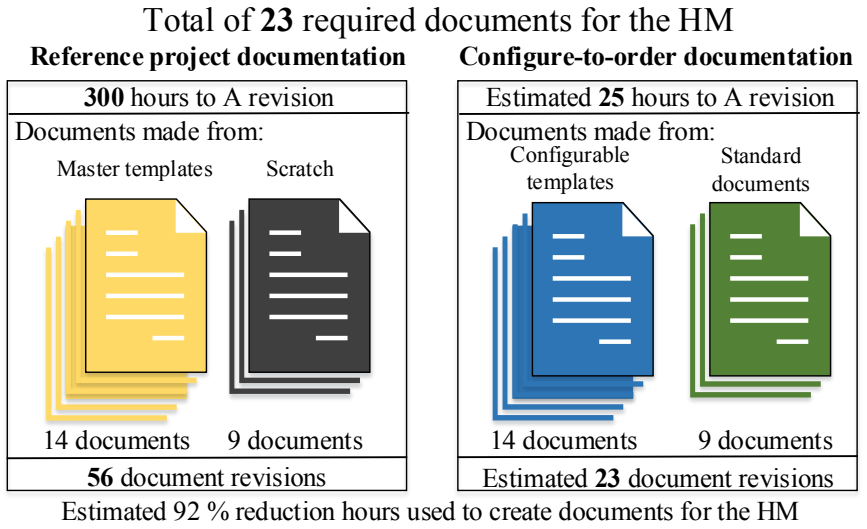
- Implementation in the company and industry, e.g Must change way of working

Data gathered during development

- Customer liked the idea
- Using functional requirements to configure
- Impacts product design
- Correct interpretation of requirements

Quantitative data from a reference project analysis

- 92% reduction in documentation hours
- From between 1 and 7 revisions per document to 1 revision
- Based on creating 14 configurable templates and 9 standard documents



Discussion and further work

- The oil and gas industry is not solving a “new” problem during their projects
  - However, performance and capabilities are changing
- New way of working in the industry
  - Culture change to become successful
  - Execute projects differently and engineer products
- Customazation versus Modularization
- The Configure-to-Order strategy on piloted in a project
  - Quantifiable data
- Research other products in the subsea oil and gas domain
- Establish a digital platform
  - Model Based Systems Engineering
  - Configurators

Concluding research question 1

RQ1: How can we apply systems engineering framework and lean product development principles to create a configurable HCR?

- Adapted the LAMDA process from Lean Product Development worked well
- Combining systems architecture together with the knowledge value stream
- Using the Systems engineering framework and the “Vee” model in the Configure-to-Order strategy

Concluding research question 2

RQ2: How does the Configure-to-Order strategy affect the HCR during design and project execution?

Indication of Cost and lead time reduction on the HCR

- Pre-engineered components
- Fewer component variants
- Efficient engineering processes because of reuse

Requirements

- Fewer requirements exchanges
- Functional requirements for product configuration

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