How Volvo Construction Equipment has successfully implemented Modularization  Our Experience
Volvo CE

- Develops, manufactures and markets equipment for construction and related industries
- Broad range of products and services
- Range of solutions in financing and used equipment
- Part of the Volvo Group
Three distinct construction brands

- Complementary offer
- Broader customer base
Our products
Our Factories

17 Manufacturing/Assembly plants globally

- Shippensburg, US
- Pederneiras, Brazil
- Belley, France
- Motherwell, Scotland
- Wroclaw, Poland
- Konz, Germany
- Hameln, Germany
- Bangalore, India
- Bangalore, India
- Konz, Germany
- Shanghai, China
- Changwon, Korea
- Jinan, China
- Linyi, China
- Kaluga, Russia
- Wroclaw, Poland
- Kaluga, Russia
- Kaluga, Russia
- Hallsberg, Sweden
- Arvika, Sweden
- Eskilstuna, Sweden
- Braås, Sweden
- Arvika, Sweden
- Eskilstuna, Sweden
- Braås, Sweden

Plant R&D
The Business Need – Optimise Complexity

Profitability

Volvo CE Strategy is for Profitable Growth

\[ \text{PROFITABILITY} = f(Sales, Price, Investments, Costs, \ldots) \]

\( \text{Complexity, Product Cost, Efficiency} \)

Minimise Internal Complexity

Maximise Commercial offering

Company vision is changing Profitability to Profitable technology shift

Technology Shift

Autonomous

Electromobility

Site Solution
Volvo CE Complexity Model

Architecture based Product Development Programs

Pre Projects process at range level to develop architectures
Financial process targeted measured and reported for platforms based on architecture
Extensive re design of the process structure

System based functional organisation
Program Based Project Organisation

To move from a traditional Project to Program Based approach requires a heavy investment in change management.
A mindset change is required across the organisation
Volvo CE history with Architecture
Big picture of CAST program

**Change and Build factories**
- Plan sites roll out
- Implement CAST manufacturing concepts at the sites

**Develop CAST capabilities**
- Develop Architecture & Modularity concepts
- Develop Manufacturing concepts
- Product Range Management
- Finance concepts

**Support**
- Manufacturing constraints
- Product adaptations

**Change products**
- Adapt products with CAST capabilities following product planning

**Capabilities ownership and maintenance is progressively transferred to line organization**

2012

CAST program

Line organization

2018
CAST Timeline

Methodology
Architecture Framework
Common Architecture
Common Assembly Flows
Standard Fabrication Methods
Compaction & Trucks Pilots

Change Management
Training Outline
Large Excavators
Medium Excavators
Wheel Loaders....
Methodology
Finance Profitability
Model

Methodology
Electromobility
Digitalisation
Autonomous / Semi Autonomous
Portfolio Management

CAST 1.0
Online lead project
CAST 0.7
Component standardization
CAST 0.5
Portable portfolio
CAST 1.1
Facts & online lead project
CAST 2.0
Company and product architecture

Comp Excavators
Excavators Medium
Compact Wheel Loaders

Methodology
Architecture Pre-Process
Market Methods

-2013 2014 2015 2016 2017 2018
The Dimensions to Manage to implement Modularity through Architecture

Architecture Model & Framework
Organisation alignment
Skills and competence

Architecture Development
Process for Early Phases of Product Development
Financial Processes to measure and track profitability of architecture programs
Adaptation of existing processes in Portfolio Planning, Product development, Operations and Aftermarket
Governance adapted & forums trained and engaged

Infrastructure & Tools
Integrated PLM tool environment (One Source of Truth)
Visual Tools to support Architecture Development Process
The Product Dimension
Architecture Data Model is the “One Source of Truth”

Anyone using the model has the capability to share

“Portfolio Management Tool leverage a X-Functional Communication model”

“To gain efficiency we have to share systems and components. In order to do so, we need to a common way of working.”
Architecture Data Model
Some Elements……..

Market Deliverable Examples (Vision Phase)

1. Model Grid: Breakdown of current offering, future offering and competitors by size and region
2. Model Overview: High level overview of current and future offerings
3. Reference Model Matrix: Connection between future offerings and closest existing reference model
4. Volume Split: Volume distribution by relevant parameters, e.g., machine type, region & size class
5. Product Positioning: Dual brand positioning and positioning vs. main competitors
6. Competitor Database: Comparison on key specifications for main competitor models
7. Brand Differentiation: Identification of dual brand differentiation for Design Units
8. Customer View: Documentation of market vision, inc. main models, specifications, features and options
9. Product impact on market vision: Assessment of architecture impact on market vision for selected scenarios

Product Deliverable Examples (Build Phase)

1. Product Breakdown: Breakdown of product to visualize main modules & design units
2. Machine Layout: Overview of geometrical architecture for range of machines
3. Interface Diagram: Definition of common product structure to describe the full range of machines
4. Cost Breakdown: Investigation of product cost distribution in existing machines
5. Architecture Overview: High level overview of architecture definition for future range
6. Program Layout: Overview of current and future platform concepts for important machine areas
7. Design Principles: Definition of design principles to be supported by future architecture
8. Key Dimension and Interfaces: Definition of key interfaces and dimensions for future platforms
9. Sharing Matrix: Investigation of complexity within current and future machine range
10. Cost Assessment: Investigation of cost distribution across machine range for most critical Design Units
11. Dashboard: Benchmark between as-is situation and wanted position
The Process Dimension
Project approach to a Program approach

**Traditional: Project-by-project approach**

Execution projects in parallel, one project one model limited leverage of resources between projects.

**Architecture: Program approach**

Execution of platform projects based on architecture map, multiple models delivered from project.

*The aim of the program approach is to efficient spend R&D resources to deliver competitive offering*
Feasibility, Pre-study and concept phase are shortened or removed
The Organization Dimension
New roles to support architecture

Local roles and ownership

- Sponsors
- Architecture Owner
  - Chief Architect
    - Market Architect
    - Product Architect
    - Production Architect

Global roles

- ‘Global Architecture team’

Roles and ownership are important

Product Owners. For each product platform, hard and soft, product owners have been appointed. These owners have the technical responsibility to develop the product range to meet the business targets.

Chief Product Architects. This role is responsible to secure product and project portfolios are planned according to a product architecture and ensure technical decisions support the architecture.

Global Product Architects. Are organized as a global function, with the responsibility to develop and support architecture capabilities, also identify areas of shared architecture across product types.

Other roles established or adjusted Manufacturing Engineering, Purchasing, Product Planning, Finance, Chief Project Managers, Technical Project managers, Product Managers
Governance

Governance is a key link between the Process, the Organization and the Strategy Execution.

At Volvo CE the approach taken is to merge Architecture Governance into existing Governance rather than deploying a new governance.

To achieve this requires change management and training of existing forum members, they must have an Architecture management competence and ownership.
Cross Functional Engagement is important

Program owner

Fully engaged
Change Management
The important Change Management Levers and Tools

• Concentrate on the leaders in the organization. When the formal and informal leaders are engaged, the managers will follow.

• Executive Management Sponsorship.....

• Formulate around a change management model. We use ADKAR this allows us to know where we are in the journey to understand the ‘Soft’ steps we need to include in planning.

• Communication, this needs to be planned, phased and focused, good work here allows us to manage expectations. (Avoid “too much too early” and “too little too late”

• Training, planned training aligned with upcoming activities keeps momentum high.
Change Management

Push vs Pull

- Overcoming initial resistance: work that needs to be done involves different parts of the organization and significant effort
- “We have our way of doing work and we know how to do it: why we need architecture?”
- Understanding and buy in for most people comes with engaging them in the work, empowering them in the planning to make decisions and showing the first results of what can be accomplished
- Continuous education, sharing the results from other parts of organization, engaging and empowering

Senior Management engagement

- Is crucial to successfully introduce and implement Product Architecture. Management support and understanding of the importance of Architecture is needed both in the beginning (overcoming the resistance of the firm “non-believers”), as well as later, to fully establish Architecture

Destroying traditions and old habits
Some things which have worked not so well, things that have worked well

Not Well…

• Over communicating the vision in early stages.

• Not identifying early enough areas where we can get push back..
  • Conflicts with other improvement initiatives
  • Bringing opinion formers on board

• Not enough reinforcement of positive results.

• Underestimating the power of tradition.

Well…

• Strong Cross functional involvement at all steps. This generates a lot of pull.

• Executive and senior management sponsorship of deployment activities.

• Clear definition of business processes related to architecture and modularity.

• Actively including change management in the development and deployment planning for the initiative.
Final Thoughts....

The key characteristics needed for the development and deployment of modular architectures in the organization.

- Strategy and vision
  - Be clear of the benefits
  - Believe in the benefits

- Perseverance. Modular architecture is a simple efficient methodology, Organizations and feelings are complex.
  - We knew how to do it in 2014.
  - We are actually doing it in 2018.
  - We wont see the full benefits until 2021 +....

Thank you