Design-Driven Enterprise
From Bid to Design & Procurement

Im Projektgeschäft

14.04.2022

Our model company

Conveyor Solutions AG is a manufacturer of

- components
- equipments
- systems

for sorting and transporting of luggage or packages.

They

- configure to customers needs (CTO/MTS),
- design customer specific solutions (ETO, CTO+),
- manufacture in large quantities.

Conveyor's Challenge

Senior management would like to

- Become more **customer centric** and **agile**
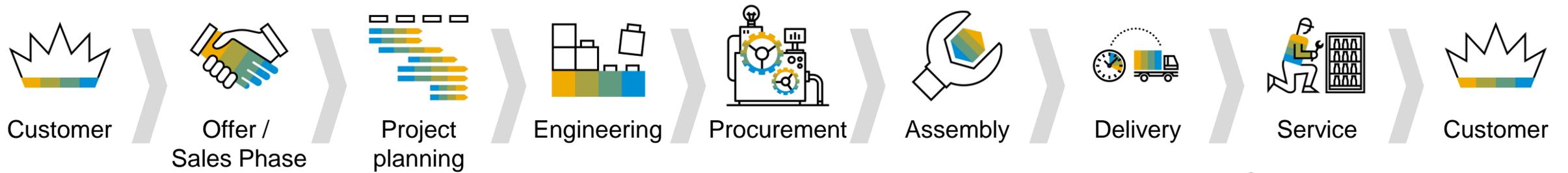- Reduce **cost** and **workload**

For their configurable business please see the three webinars for variant-rich businesses.

Now we focus on **their project business** unit. Here they would like to increase **efficiency** and **agility** without cutting back on their customer centricity.
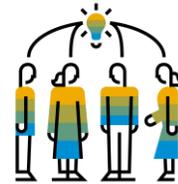
So, they engage an external consulting company to propose **a new approach**.

The challenges within the ETO process

Customer → Offer / Sales Phase → Project planning → Engineering → Procurement → Assembly → Delivery → Service → Customer

Departments involved:

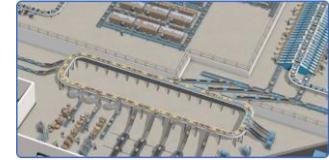|	
Sales	project management
Development	Customer service
Production & Assembly	Controlling
Purchasing	Accounting

Challenges:

Communication

Lack of overview

Silo mentality

Each phase requires special structures
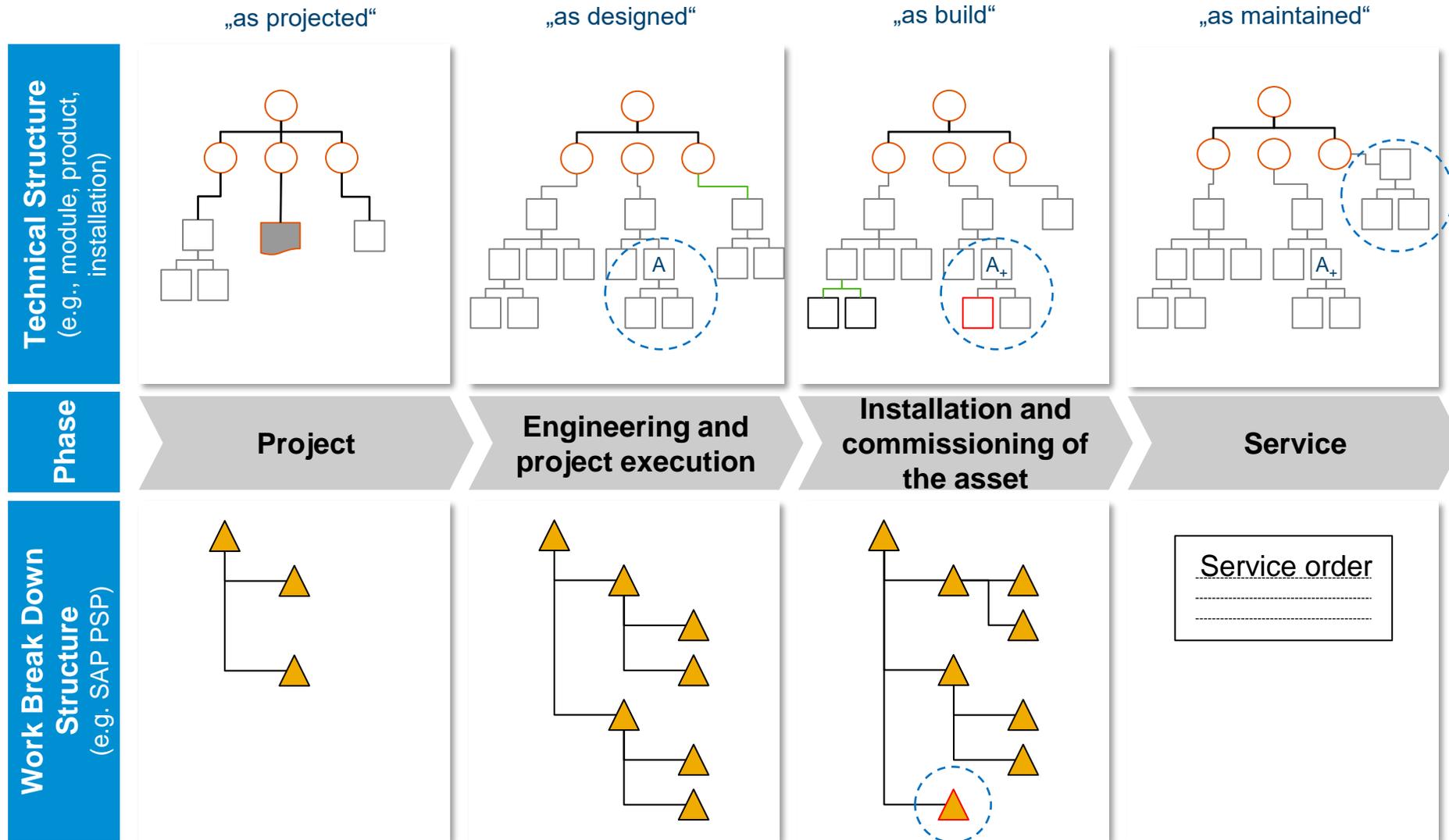
DESIGN-DRIVEN ENTERPRISE
Engineer to Order (full scope)

BID PURCHASE — **TECHNICAL PLAN** — **ENGINEER** — **PURCHASE PLAN** — **MANUFACTURE** — **DELIVER INSTALL INVOICE** — **OPERATE**

BID
- Inquiry Intake
- Design Collaboration with Customer
- Quotation Specification
  - Receive und store customer requirements.
  - Create BID-TOS (from Template, from scratch or from Excel-Input).
  - Create Solution proposal (Drawings, Specs, etc) und send them to the Customer by Document Control Center (Collaboration).
  - Negotiation of the solution proposal.
- Quotation Costing
  - Start Easy-Cost Planning
  - Calculate cost
  - Create a SAP offer/bid (SD – based on commercial product) and do the pricing based on the calculated costs.

PURCHASE
- Design & Purchasing Collaboration with Supplier

TECHNICAL PLANNING
- Basic Design for all disciplines
- Create Layouts for the plant
- Proof the bid content
- Define activities for quality and material management

ORDER FULFILLMENT
- Create customer related to quotation
- Fine tuning of work breakdown structure, the TO and its links (Networks, Milestones)
- Detailed scheduling of the project (PS)
- Cost estimation based on networks and its activities
- Cash management, invoce and billing plans, down payment processing
- Budgeting
- Release of structures (Project versions)
- Execute first down payments (if required)

TECHNICAL DESIGN
- Detailed Design for all disciplines
- 3D-mechanical engineering with PLM-direct integration
- Material take out
- Planning of production 6 procurement (PS)
- Collaboration with customer & suppliers
- Release of documents for next phase
- Manufacturing Work Instructions, Routing, Quality management
- Service-BOM, Documents, Planning

ORDER FULFILLMENT
- Release Advance Procurement
- Invoicing of Suppliers
- Confirm engineering hours
- Concurrent project costing
- Claim management

PLANNING
- Release Engineering position in TOS for production or procurement (growing structure)
- Integration of TOS and project management creates automatically production and procurement orders
- Costing based on the now available product information
- Scheduling of production orders and procurement orders
- Capacity analysis and optimization of production (PS-PPDS)
- Hand-over production orders to MES
- Change Management
- Track procurement orders

ORDER MANAGEMENT
Release of production orders

ASSEMBLY
Work Instruction

INLINE QUALITY MANAGEMENT
Recording of data collection in the product history record (digital twin)

MACHINE INTEGRATION

DELIVERY
- Delivery directly from the project
- Dispatch and transport processing
- Site Processing
- Confirmations
- Procurement of Installation Material and Services
- Project/Site Controlling
- Invoicing (vendor)
- Billing (Customer)
- Cash-Management

ORDER FULFILLMENT
- Release Advance Procurement
- Invoicing of Suppliers
- Confirm engineering hours
- Concurrent project costing
- Claim management
- Acceptance of the complete delivery by the customer
- Analysis based on POC (Percentage of Completion)
- Final Billing to Customer

INTELLIGENT ASSET MANAGEMENT
Providing Digital Twin (as installed, as maintained) to service providers and IOT services

SERVICE MANAGEMENT
- Ticketing
- Service-Ausführung
- Service Order Execution
- Visual Spareparts
- Visual Service-Instructions
- Digital Twin Insight
- Digital Twin Monetarization

THE BEST RUN SAP

What capabilities are required to solve Conveyors' business challenges?

Design-Driven Enterprise today….
Engineering, sales, service and manufacturing seamlessly integrated and operated smartly
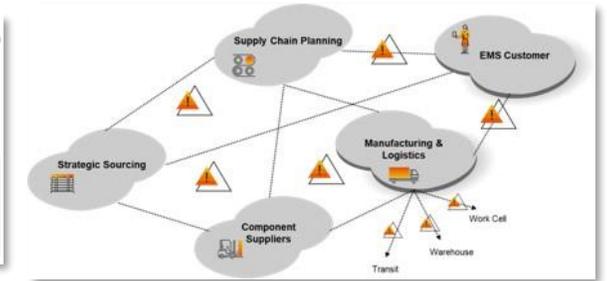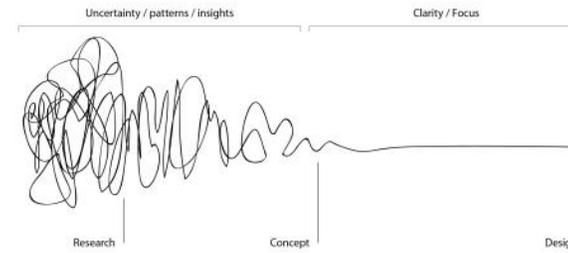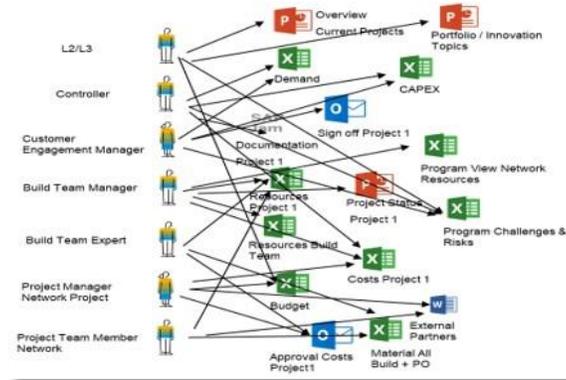
| **Bid & Customer Requirements** | **Plan & Execute** | **Design** | **Installation & Commissioning** |

100% Customer Influence on solution development

Management of customer requirements, schedule and cost

Reduction of design cost by **fast front loading of solutions templates and modular reuse**.

Automated transformation from the as-build structure to the as-installed solution.
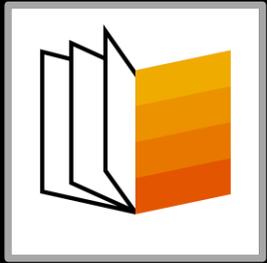
Design-Driven Enterprise

AGIL.EFFICIENT.CUSTOMER-CENTRIC

- **Increase the level of automation** in the process flow from engineering into sales, production, service via the **smart product structure**.

- **Increase the level of reuse** via templates and by embedding configurable modules and components in the **smart product structure.**

- Achieve a **high level of consistency, automation and accuracy** across all departments by utilizing **the smart product structure within the SAP core**.

BDF △ SYNTAX

We can't go on like we did in the past to manage this complexity...

We have to change the way we collaborate, exchange, interact and deliver….

Moving from a **document centric, disconnected approach**

To the design-driven enterprise with a **model centric & integrated** approach

We can't go on like we did in the past to manage this complexity...
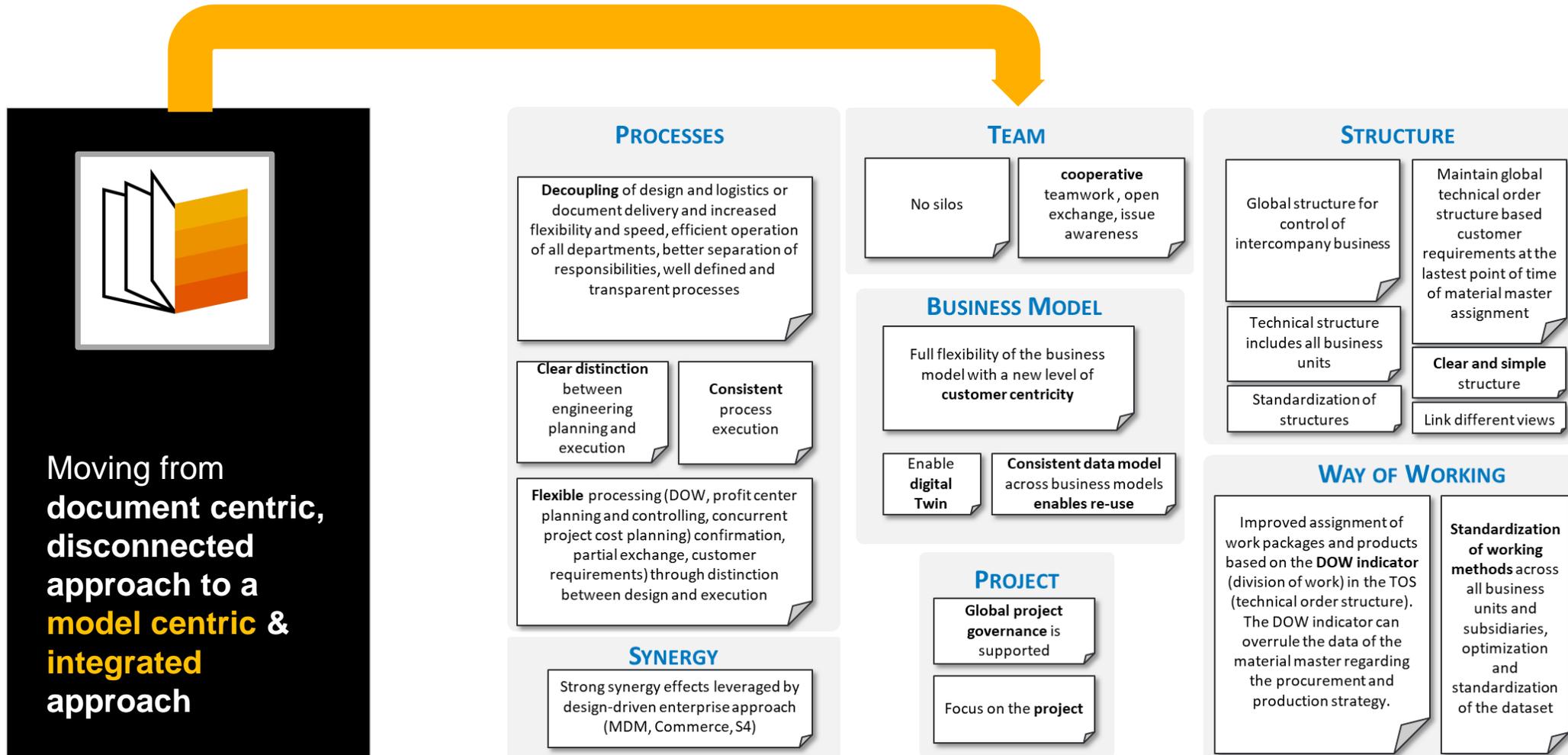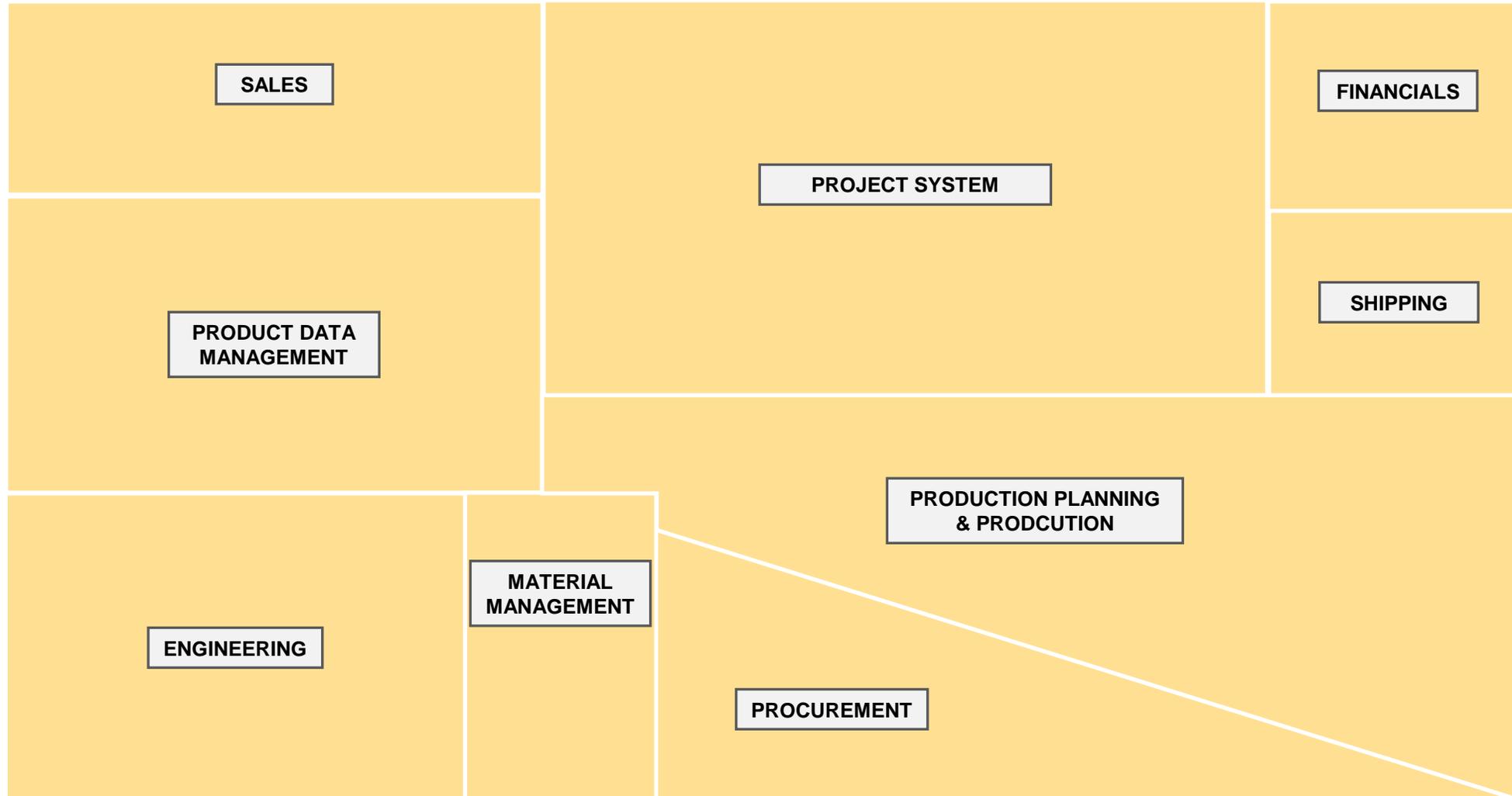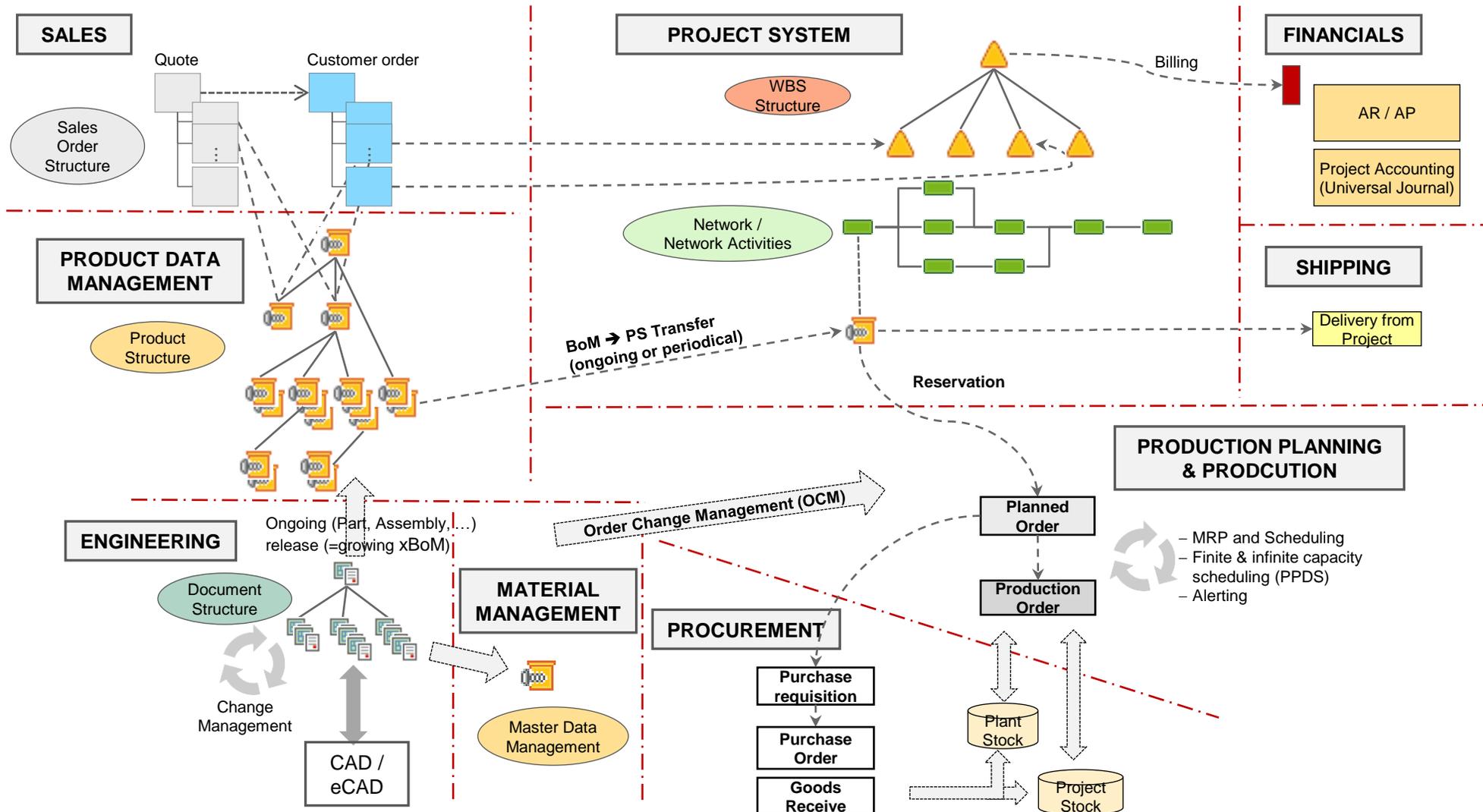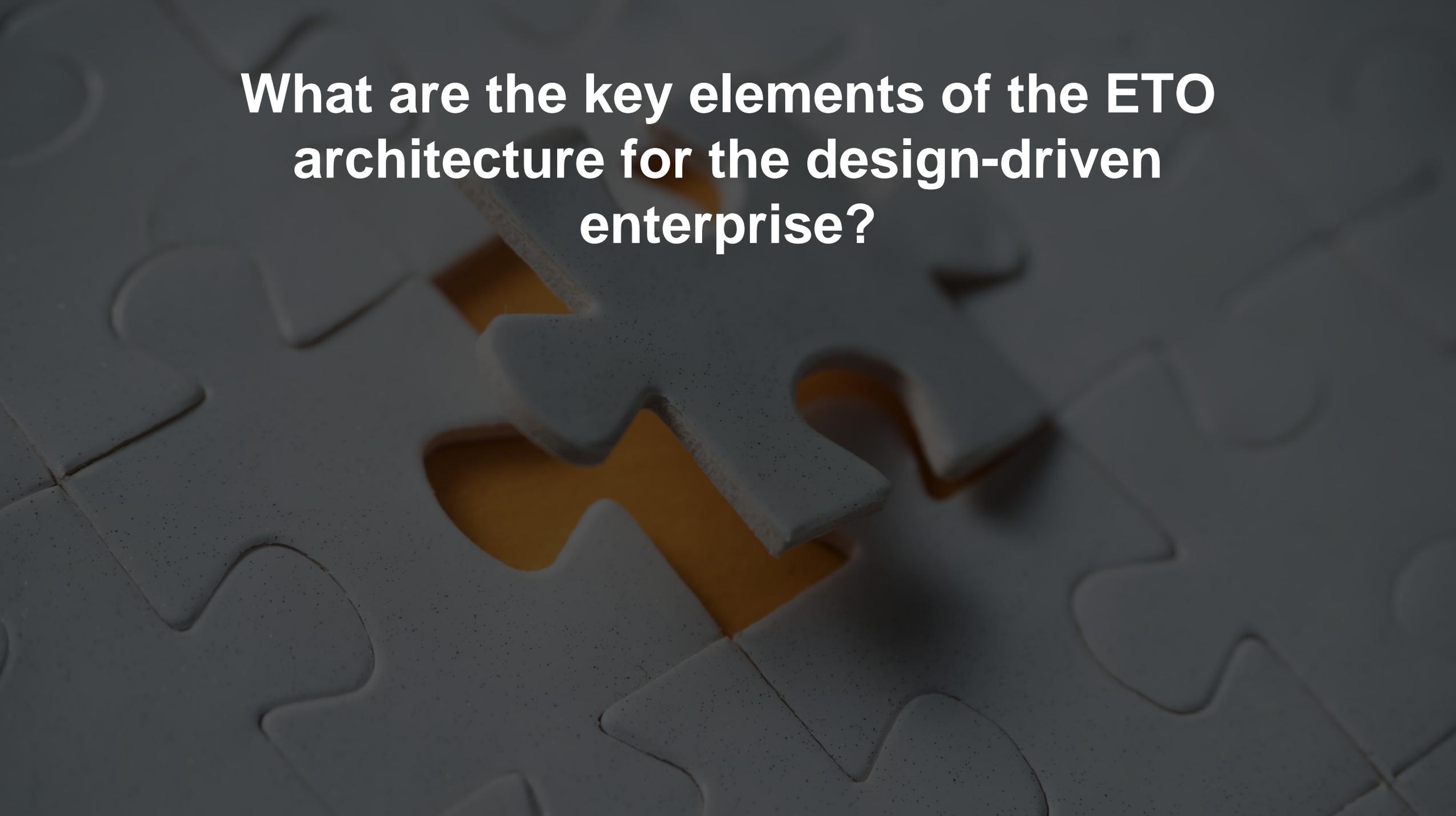## We have to change the way we collaborate, exchange, interact and deliver….

Moving from **document centric, disconnected approach to a model centric & integrated approach**

PROCESSES

Decoupling of design and logistics or document delivery and increased flexibility and speed, efficient operation of all departments, better separation of responsibilities, well defined and transparent processes

Clear distinction between engineering planning and execution

Consistent process execution

Flexible processing (DOW, profit center planning and controlling, concurrent project cost planning) confirmation, partial exchange, customer requirements) through distinction between design and execution

SYNERGY

Strong synergy effects leveraged by design-driven enterprise approach (MDM, Commerce, S4)

TEAM

No silos

cooperative teamwork, open exchange, issue awareness

BUSINESS MODEL

Full flexibility of the business model with a new level of **customer centricity**

Enable **digital Twin**

Consistent data model across business models **enables re-use**

PROJECT

Global project governance is supported

Focus on the **project**

STRUCTURE

Global structure for control of intercompany business

Maintain global technical order structure based customer requirements at the lastest point of time of material master assignment

Technical structure includes all business units

Clear and simple structure

Standardization of structures

Link different views

WAY OF WORKING

Improved assignment of work packages and products based on the **DOW indicator** (division of work) in the TOS (technical order structure). The DOW indicator can overrule the data of the material master regarding the procurement and production strategy.

Standardization of working methods across all business units and subsidiaries, optimization and standardization of the dataset

Design-driven Enterprise Architecture for ETO

SALES

FINANCIALS

PROJECT SYSTEM

PRODUCT DATA MANAGEMENT

SHIPPING

PRODUCTION PLANNING & PRODCUTION

MATERIAL MANAGEMENT

ENGINEERING

PROCUREMENT
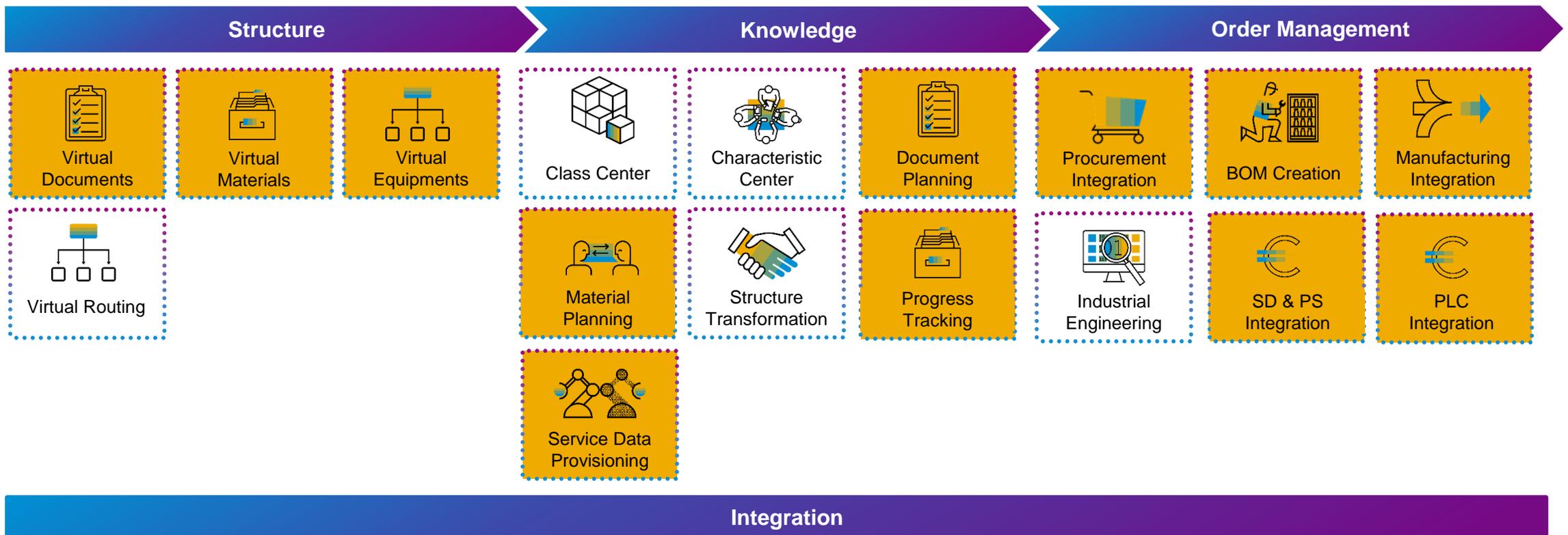
Design-driven Enterprise Architecture for ETO

What are the key elements of the ETO architecture for the design-driven enterprise?

The **business processes in SAP PPG** are designed to help our customers address the needs of the design-driven enterprise.

Business Processes in SAP Product Process and Governance

Structure	Knowledge	Order Management

Structure
- Virtual Documents
- Virtual Materials
- Virtual Equipments
- Virtual Routing

Knowledge
- Class Center
- Characteristic Center
- Document Planning
- Material Planning
- Structure Transformation
- Progress Tracking
- Service Data Provisioning

Order Management
- Procurement Integration
- BOM Creation
- Manufacturing Integration
- Industrial Engineering
- SD & PS Integration
- PLC Integration

Integration

SAP EPD | SAP ECTR | SAP Teamcenter by Siemens

Relationship between CAD, Classic BOM and Product Structure
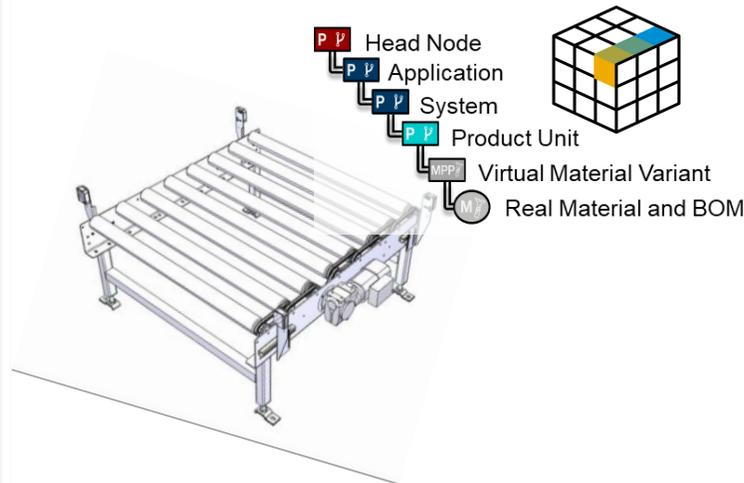Why can't I use the CAD or Classic BOM instead?
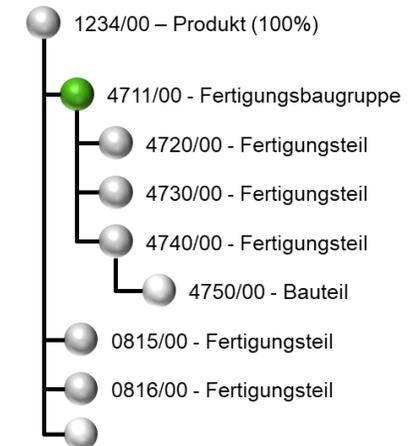
CAD Structure
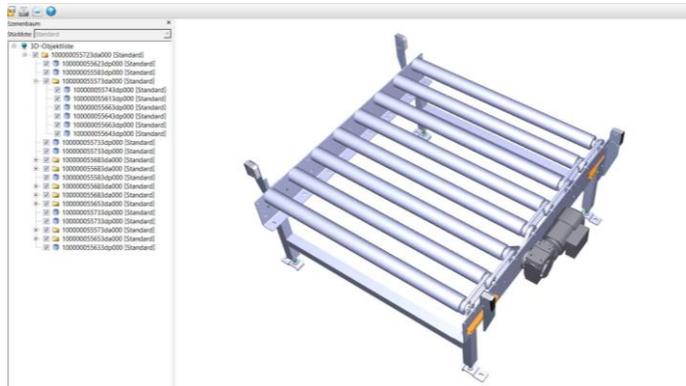
The **CAD Structure** describes the geometrical relationships between the BOM elements. The **variance** therefore is **implicitly described**.
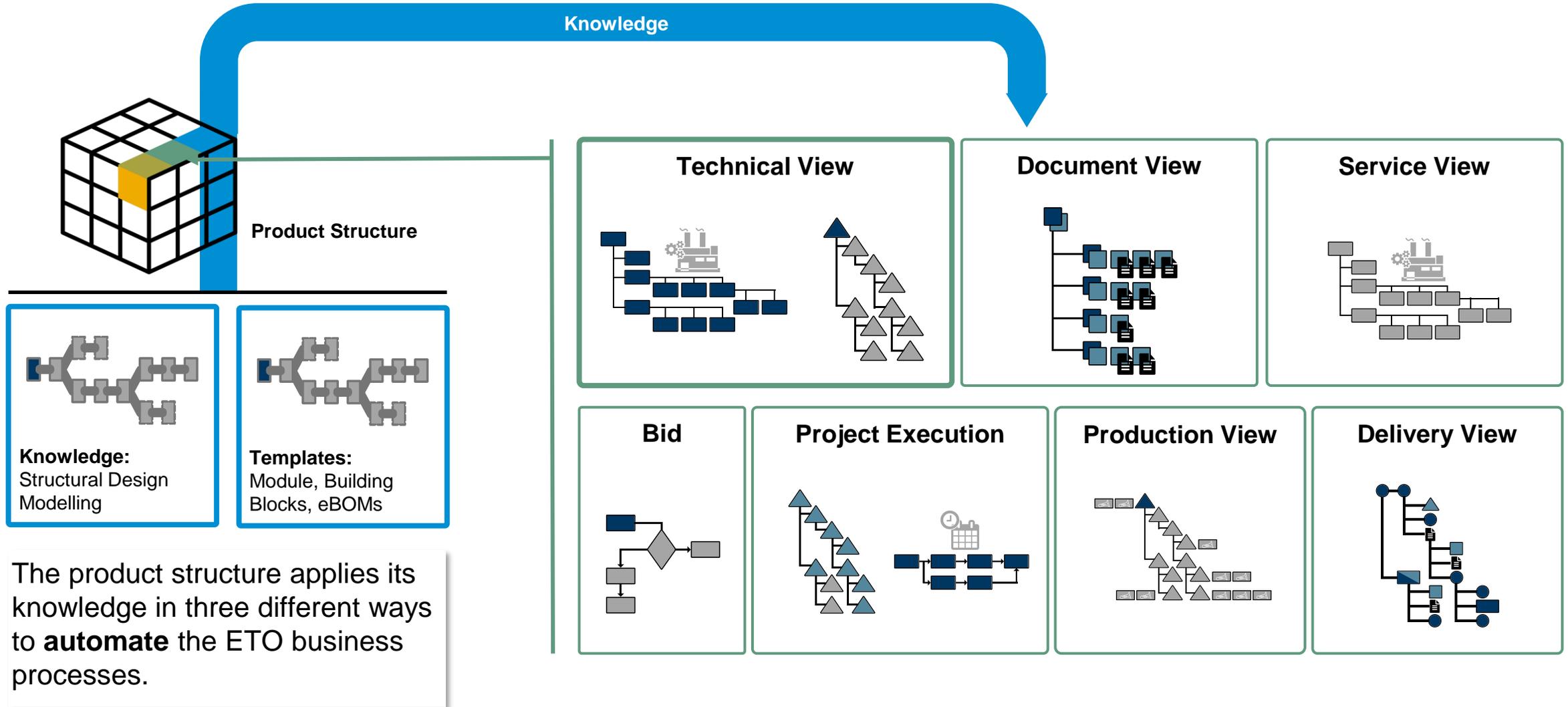
Product Structure

P ʸ Head Node
P ʸ Application
P ʸ System
P ʸ Product Unit
MPP ʸ Virtual Material Variant
M Real Material and BOM

The **Product Structure** models **templates** to accelerate and to safeguard the solution **process**.

Classic BOM

1234/00 – Produkt (100%)

4711/00 - Fertigungsbaugruppe
4720/00 - Fertigungsteil
4730/00 - Fertigungsteil
4740/00 - Fertigungsteil
4750/00 - Bauteil
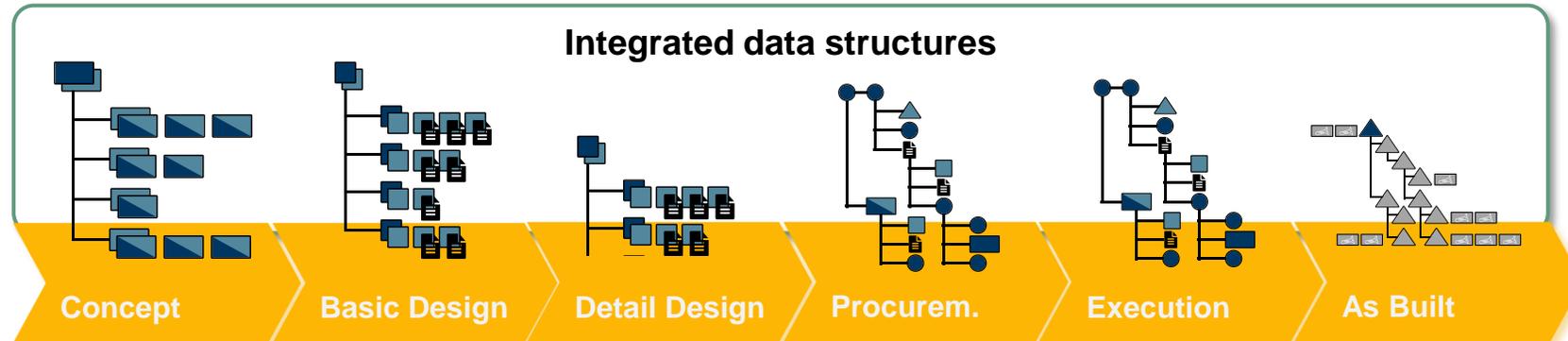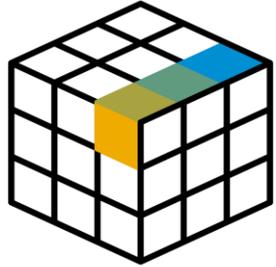0815/00 - Fertigungsteil
0816/00 - Fertigungsteil

The **Classic BOM models** variance on a material level and therefore **does not scale very well**.

Design-Driven Enterprise: Product Structure Automation

Knowledge

Product Structure

Knowledge:
Structural Design Modelling

Templates:
Module, Building Blocks, eBOMs

The product structure applies its knowledge in three different ways to **automate** the ETO business processes.

Technical View

Document View

Service View

Bid

Project Execution

Production View

Delivery View

Design-Driven Enterprise: Product Structure Integration

Integrated data structures
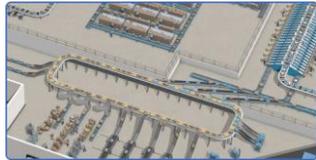
| Concept | Basic Design | Detail Design | Procurem. | Execution | As Built |

The product structure knowledge results in a **seamless integration and automation** of the ETO process.

Integrated schedule management

Integrated cost management

Service

View: **functions**

View: **documents**

View: **material**

View: **schedule**

View: **costs**

View: **customer**
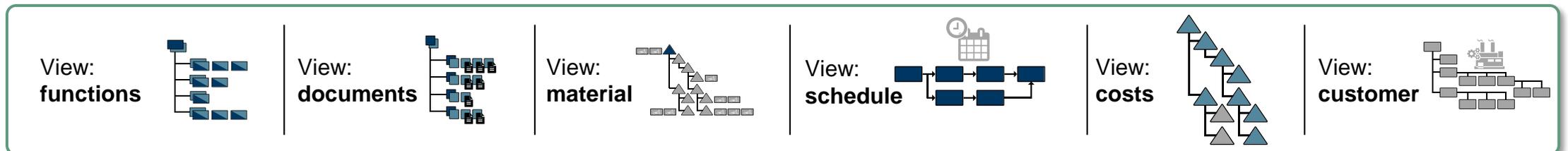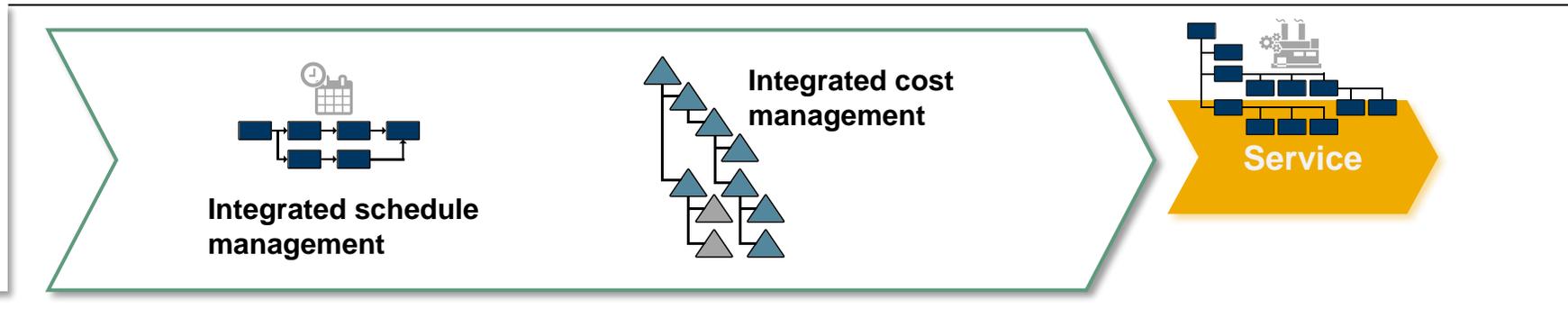
Design-Driven Enterprise: Product Structure Reuse

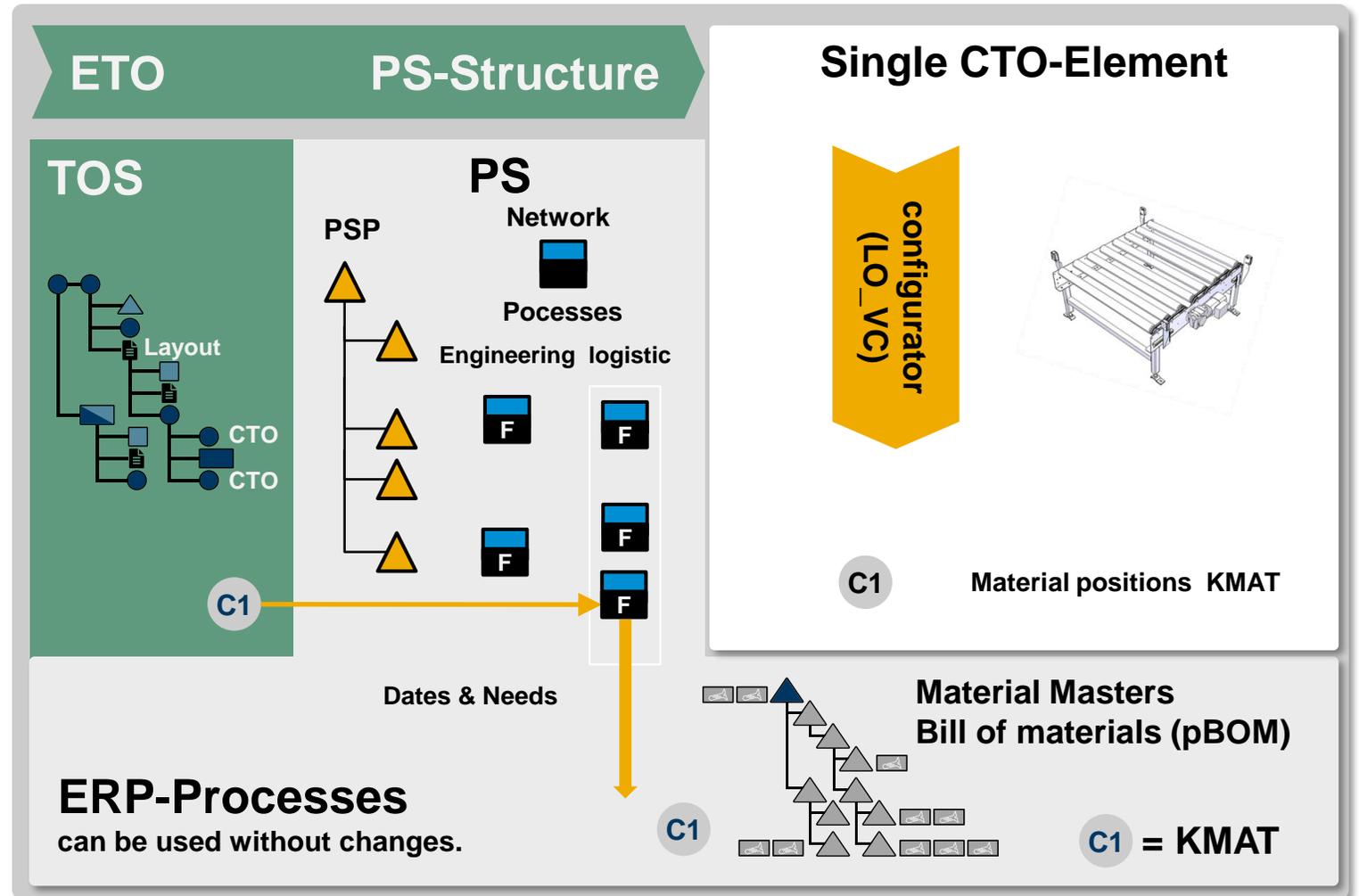**ETO Solution System**

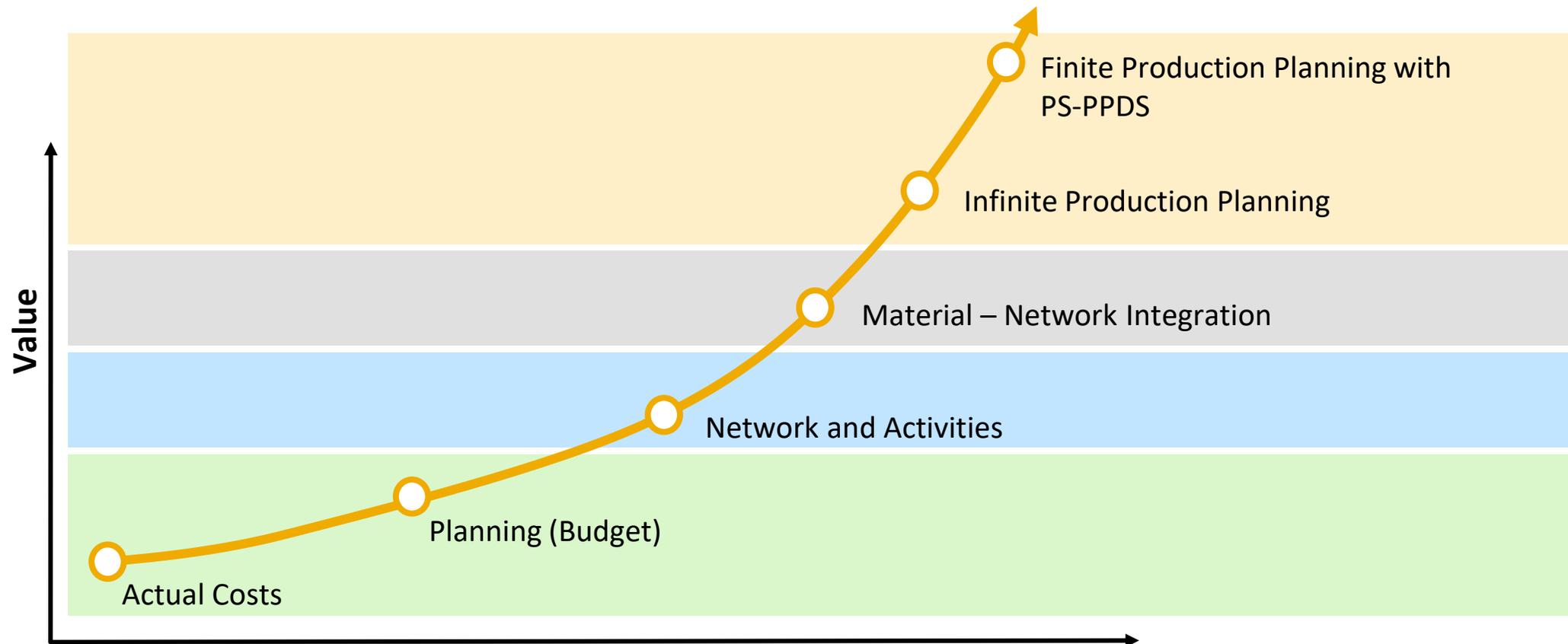**Reusable component „C1"**

Configurator (See Webinar CTO)

The component C1 can be reused

- in the SD order - as a directly configurable order item
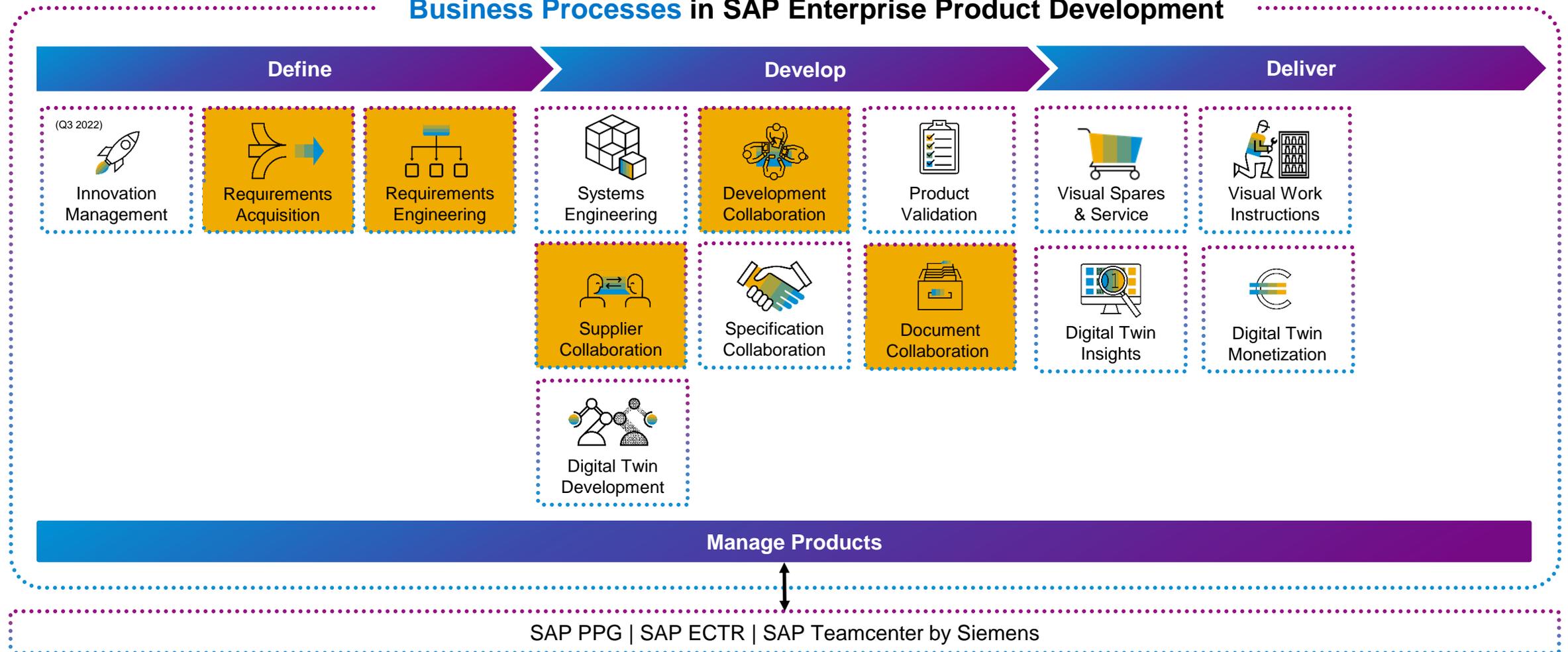- in the plant structure (TOS) as a configurable module

ETO **PS-Structure**

Single CTO-Element

TOS

configurator (LO_VC)

PS

PSP   **Network**

Pocesses

Engineering logistic

Layout

CTO

CTO

C1

C1 Material positions KMAT

Dates & Needs

ERP-Processes can be used without changes.

Material Masters Bill of materials (pBOM)

C1

C1 = **KMAT**

The business processes in SAP PS as part of ERP or S/4HANA are designed to help our customers address the needs of project management in ETO.

Value

Finite Production Planning with PS-PPDS

Infinite Production Planning

Material – Network Integration

Network and Activities

Planning (Budget)

Actual Costs

The **business processes in SAP EPD** are designed to help our customers address the needs of digital product development organizations.
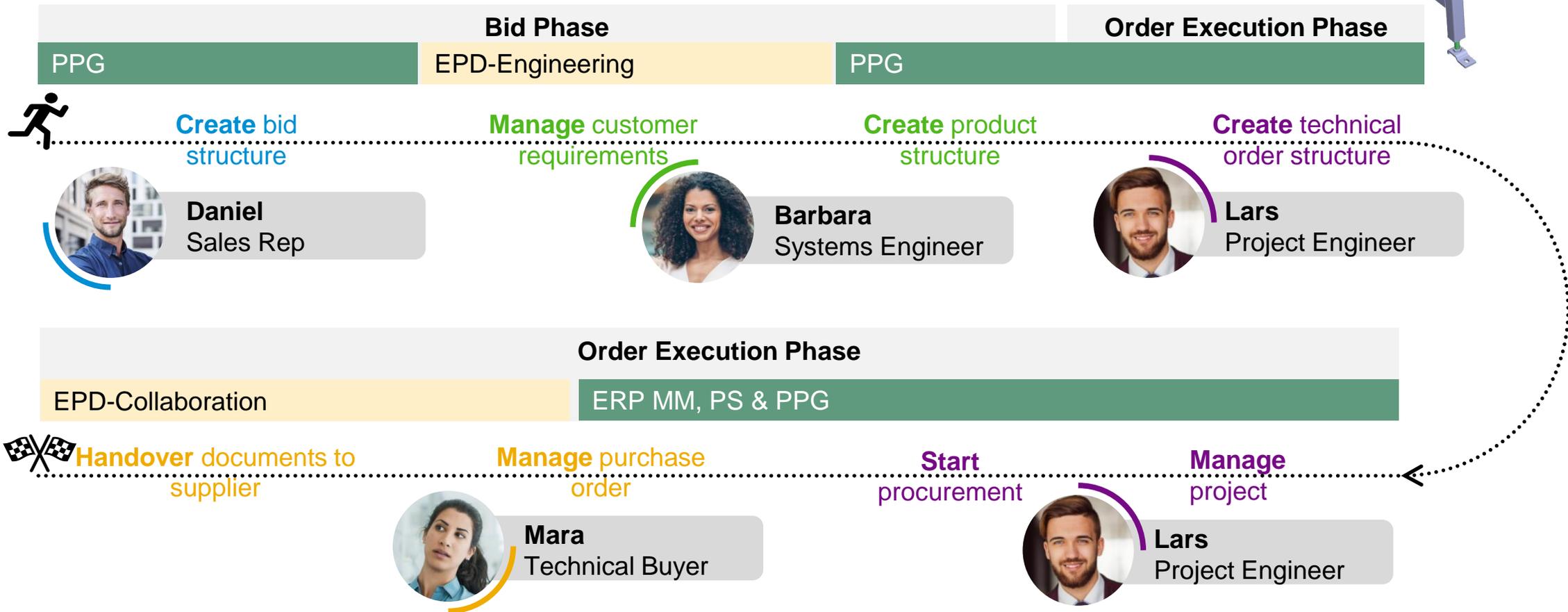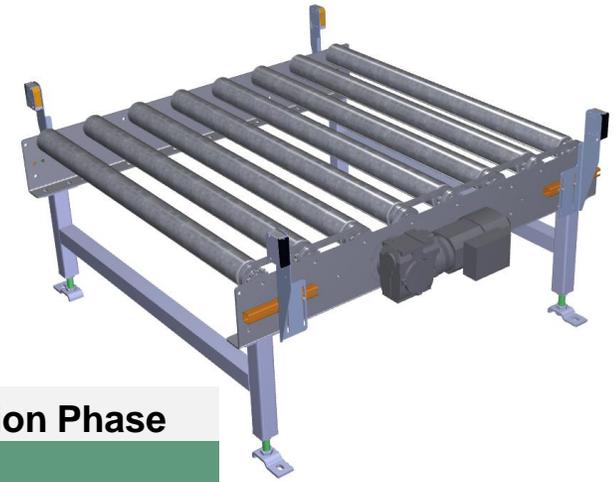
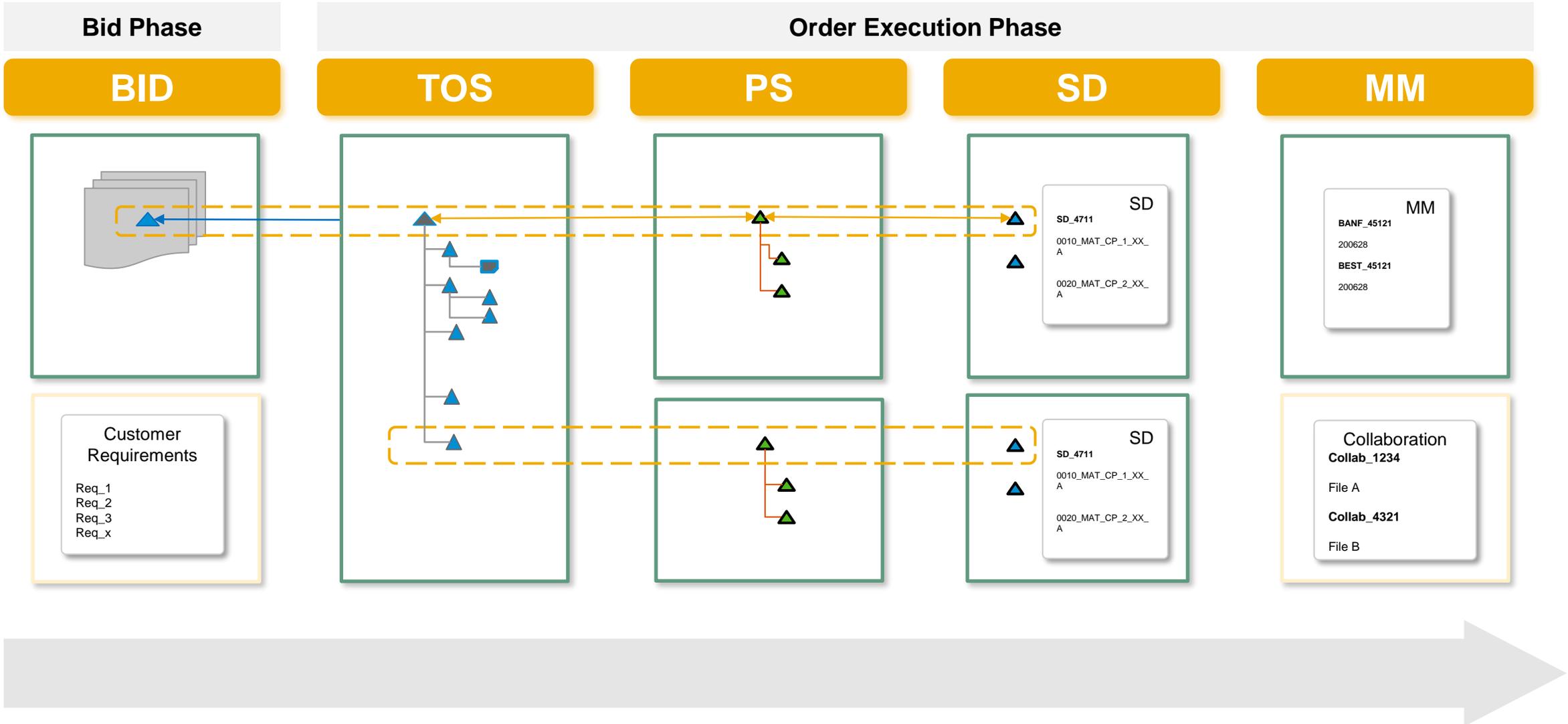**Business Processes** in SAP Enterprise Product Development

Define	Develop	Deliver

(Q3 2022)

Innovation Management

Requirements Acquisition

Requirements Engineering

Systems Engineering

Development Collaboration

Product Validation

Visual Spares & Service

Visual Work Instructions

Supplier Collaboration

Specification Collaboration

Document Collaboration

Digital Twin Insights

Digital Twin Monetization

Digital Twin Development

Manage Products

SAP PPG | SAP ECTR | SAP Teamcenter by Siemens

How will Conveyor work within SAP in the future?

From Design to Sales: Detailed Process Flow

	Bid Phase		
			Order Execution Phase
PPG	EPD-Engineering	PPG	

Create bid structure
Daniel Sales Rep

Manage customer requirements
Barbara Systems Engineer

Create product structure
Lars Project Engineer

Create technical order structure

Order Execution Phase		
EPD-Collaboration	ERP MM, PS & PPG	

Handover documents to supplier

Manage purchase order
Mara Technical Buyer

Start procurement

Manage project
Lars Project Engineer

Data Structures & Flow

From Design to Sales: Detailed Process Flow

Bid Phase	Order Execution Phase	
PPG	EPD-Engineering	PPG

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Create technical order structure

Daniel Sales Rep

Barbara Systems Engineer

Lars Project Engineer

Order Execution Phase	
EPD-Collaboration	ERP MM, PS & PPG

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Start procurement

Manage project

Mara Technical Buyer

Lars Project Engineer

PPG Bid Structure

Business Outcomes

*"As an **Sales Rep**, I want to accelerate the bid process by leveraging modularization and templates for buildings, plants, systems, machines, ..."*

Daniel
Sales Rep
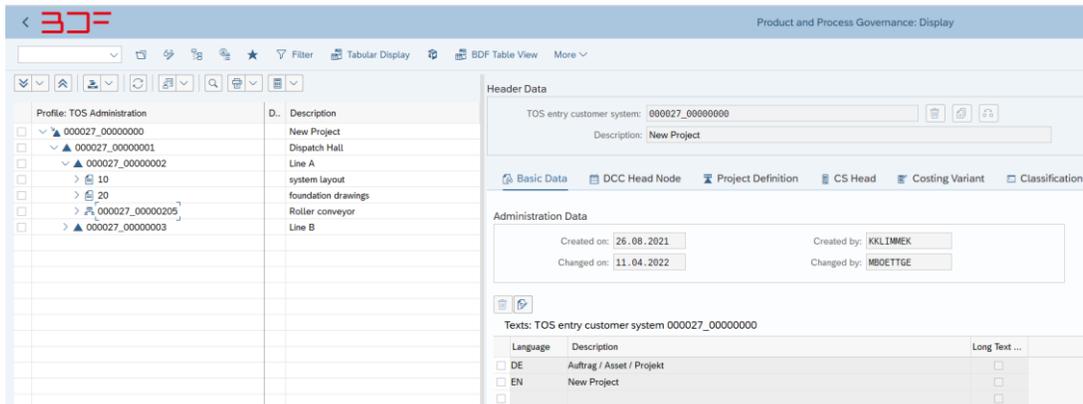
Process Highlights & Benefits

Fast front loading through modularization and templates for buildings, plants, systems, machines, ...

Start of the structure development up to a defined level without the force to have SAP Material Masters

Open interface for connecting all engineering, quotation and project planning tools.

The document supply chain can already be planned and scheduled.

Support of SAP product and project costing.

From Design to Sales: Detailed Process Flow

	Bid Phase		**Order Execution Phase**
PPG	EPD-Engineering	PPG	

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Daniel
Sales Rep

Barbara
Systems Engineer

Lars
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	Order Execution Phase	
EPD-Collaboration	ERP MM, PS & PPG	

Handover documents to supplier

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Mara
Technical Buyer

Lars
Project Engineer

Manage customer requirements

"As a Systems Engineer, I want to match the requirements with product data so that downstream processes can be executed automatically."

Barbara
Systems Engineer

Process Highlights & Benefits

Manage requirements in a central repository and share requirements with suppliers & business partners

Assess the **quality of requirements** based on defined criteria

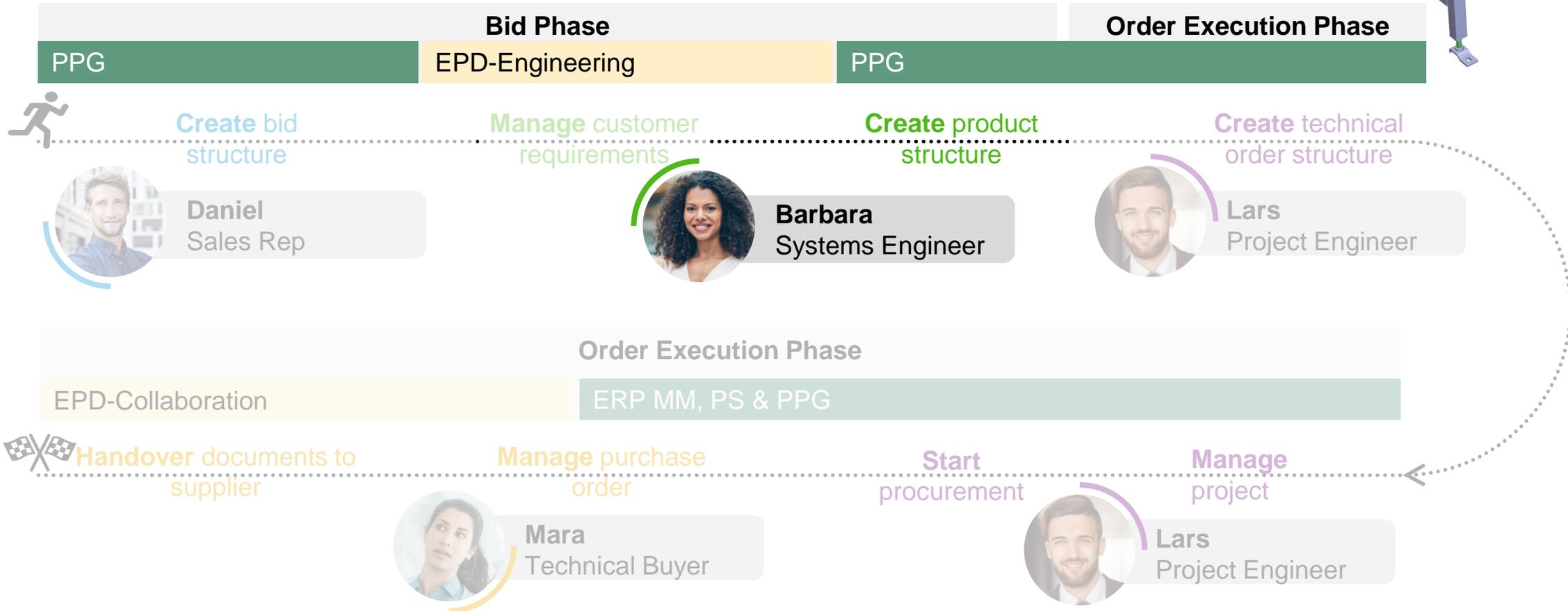**Launch an impact and lineage analysis** on requirements, model objects and associated objects
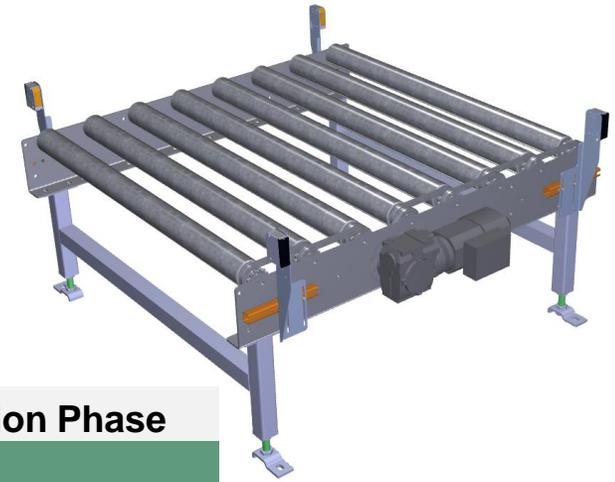
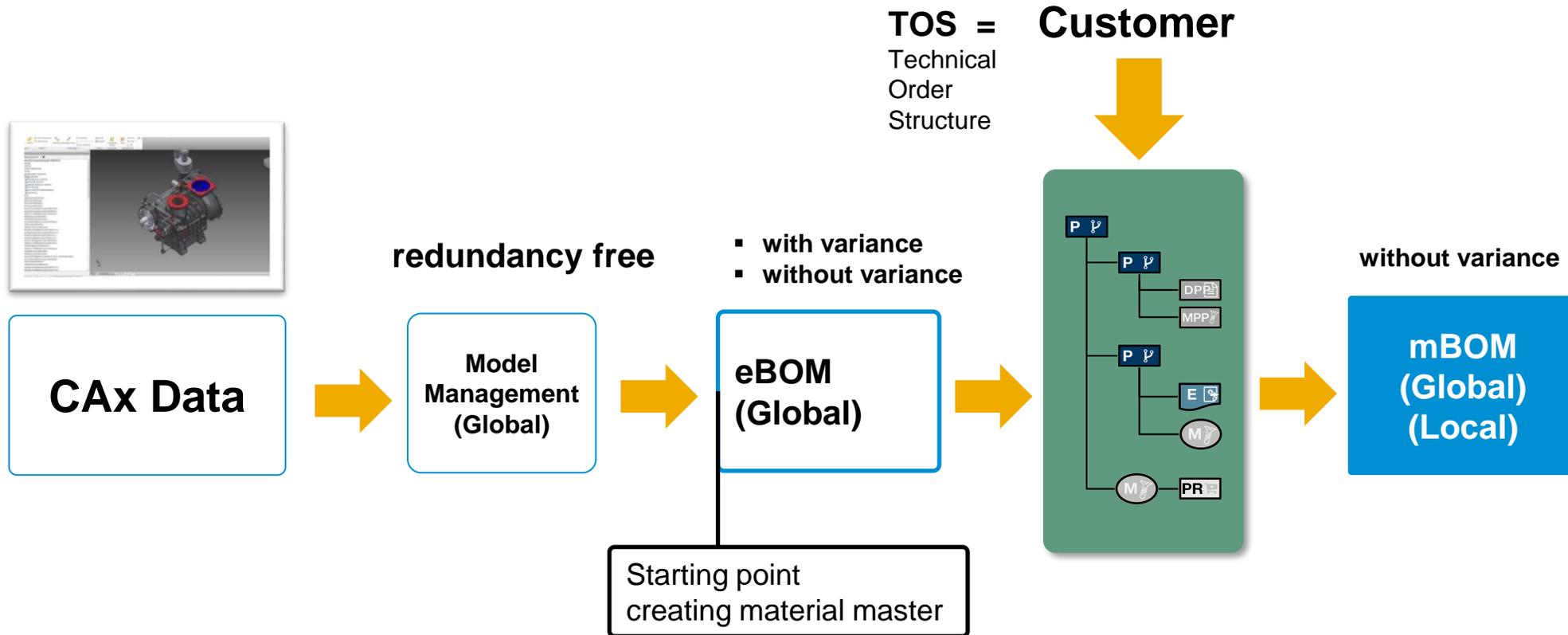**Edit one requirement model concurrently** across the extended enterprise

Import and export requirements based on standard formats, like Requirements Interchange Format

From Design to Sales: Detailed Process Flow

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PPG	EPD-Engineering	PPG	

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Order Execution Phase		
EPD-Collaboration	ERP MM, PS & PPG	

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Lars Project Engineer

Create eBOM

TOS = **Customer**

Technical
Order
Structure

redundancy free

- with variance
- without variance

without variance

CAx Data → **Model Management (Global)** → **eBOM (Global)** → [product structure] → **mBOM (Global) (Local)**

Starting point
creating material master

- Automated transfer and processing of CAx data in document BoM, parts lists and product structures
- Little effort for customer-specific order and conversion into project structure
- Full integration into the logistic processing

Create product structure

Business Outcomes

*"As a **Systems Engineer**, I want to create and design new products freely and still integrate them in the digital supply chain!"*

Barbara
Systems Engineer
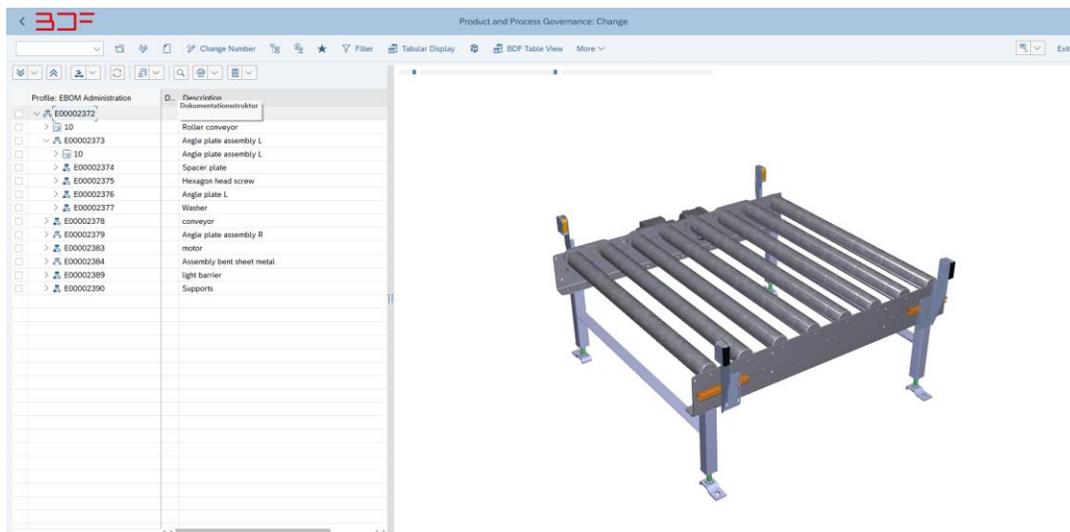
Process Highlights & Benefits

Reduced time to integrate the designed product into logistic handling

Easy product development because you do not need a material master in this phase

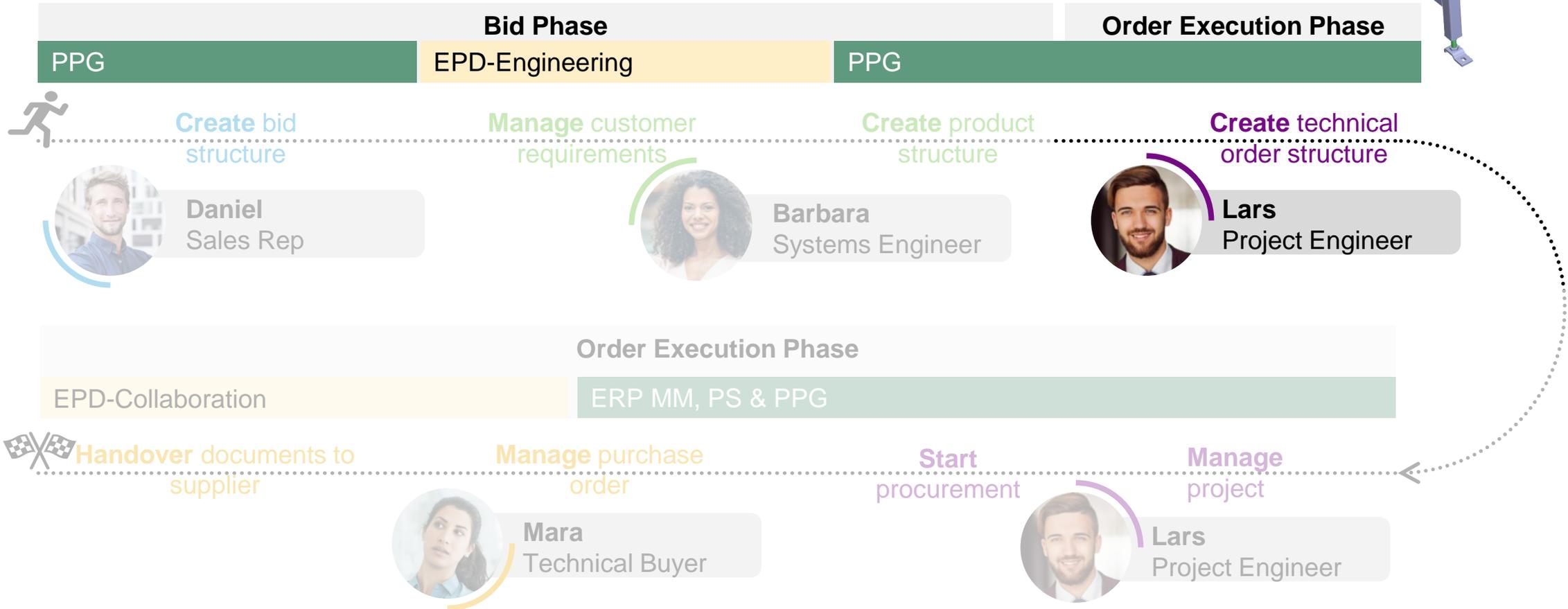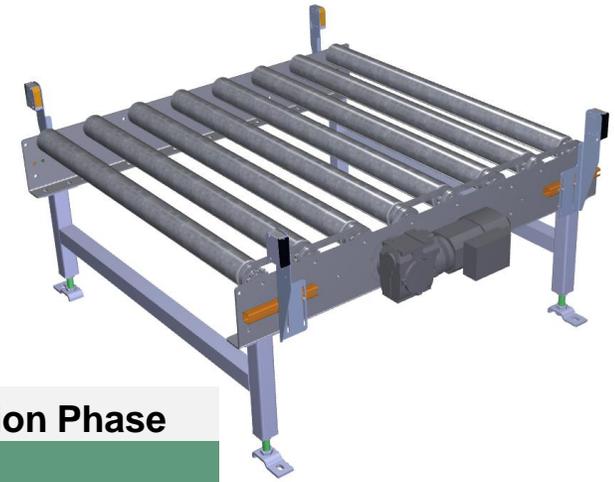**Automated** document and material generation when necessary

Provide product information for supplier requests in an early phase

Integrate the design process into digital supply chain

# From Design to Sales: Detailed Process Flow

Bid Phase		Order Execution Phase

PPG	EPD-Engineering	PPG	

🏃 **Create** bid structure
Manage customer requirements
Create product structure
Create technical order structure

Daniel Sales Rep

Barbara Systems Engineer

Lars Project Engineer

Order Execution Phase		

EPD-Collaboration	ERP MM, PS & PPG	

🏁 **Handover** documents to supplier
Manage purchase order
Start procurement
Manage project

Mara Technical Buyer

Lars Project Engineer

Create technical order structure

Business Outcomes

*"As an **Project Engineer**, I want to create the product data so that downstream processes can be executed automatically."*

Lars
Project Engineer
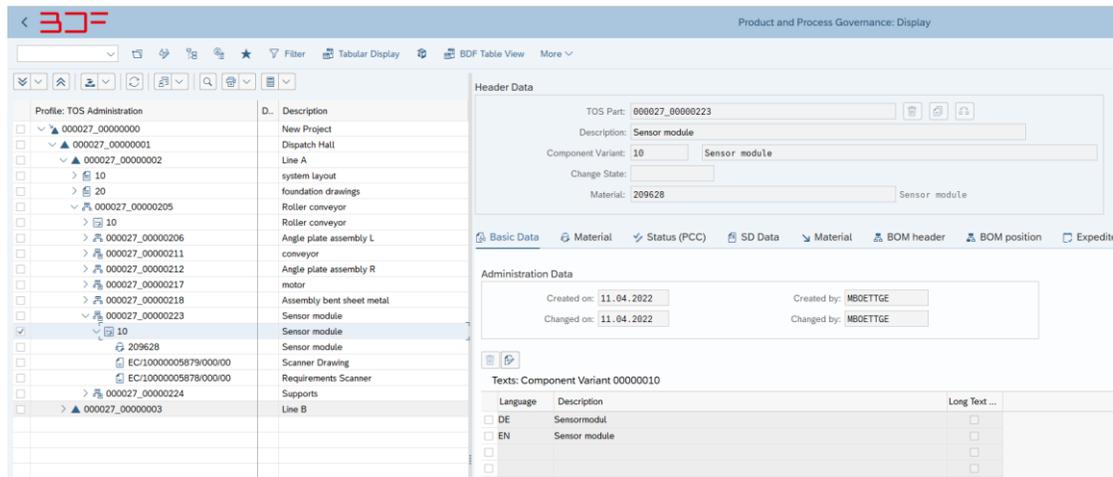
Process Highlights & Benefits

In the technical order structure (TOS) the allocation of the scope of supply and services (LLU indicator) is planned.

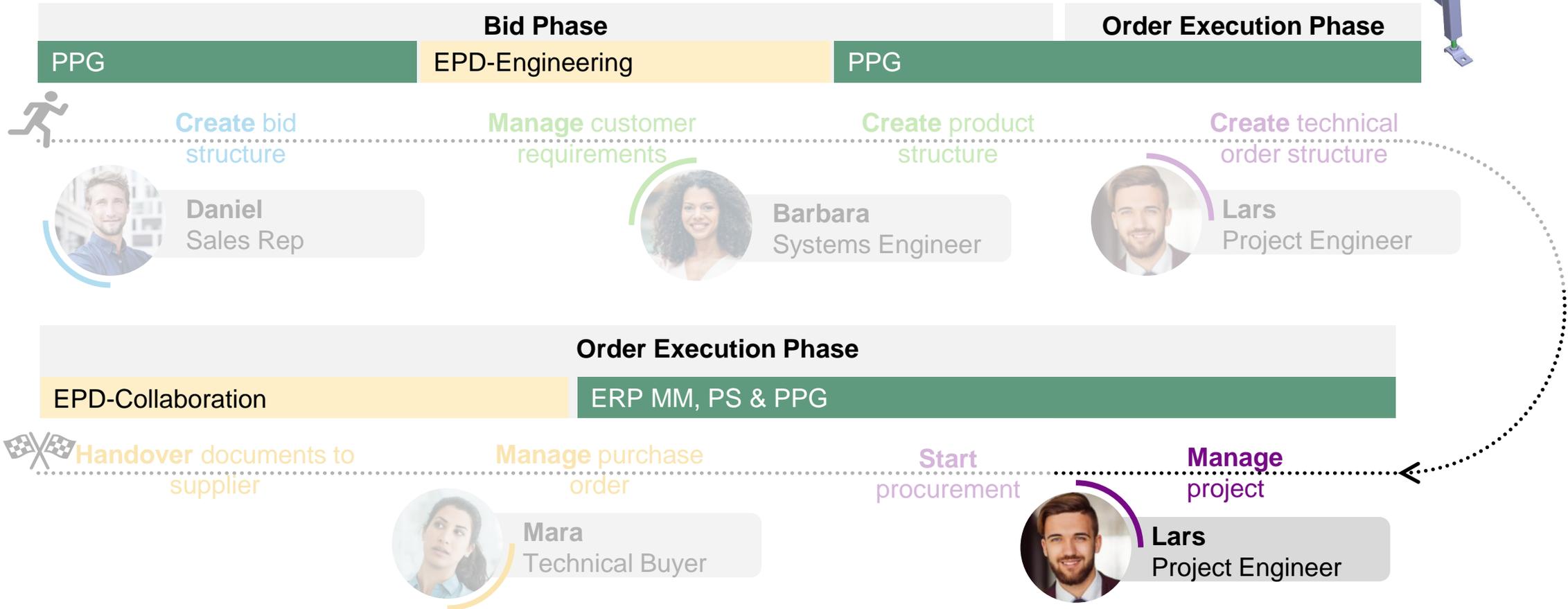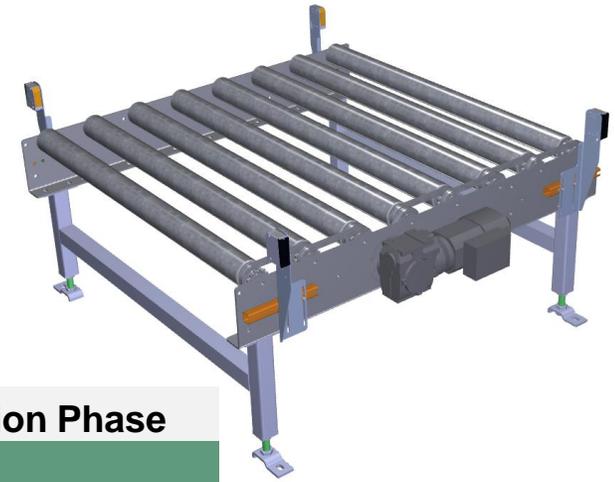The TOS determines which items are **to be procured where and how:**

- Procurement: own / external (procure / make) / customer

- Engineering: internal / external / customer

- Differentiation of the individual locations and all combinations

Provide digital twin foundation early in design phase

From Design to Sales: Detailed Process Flow

Bid Phase

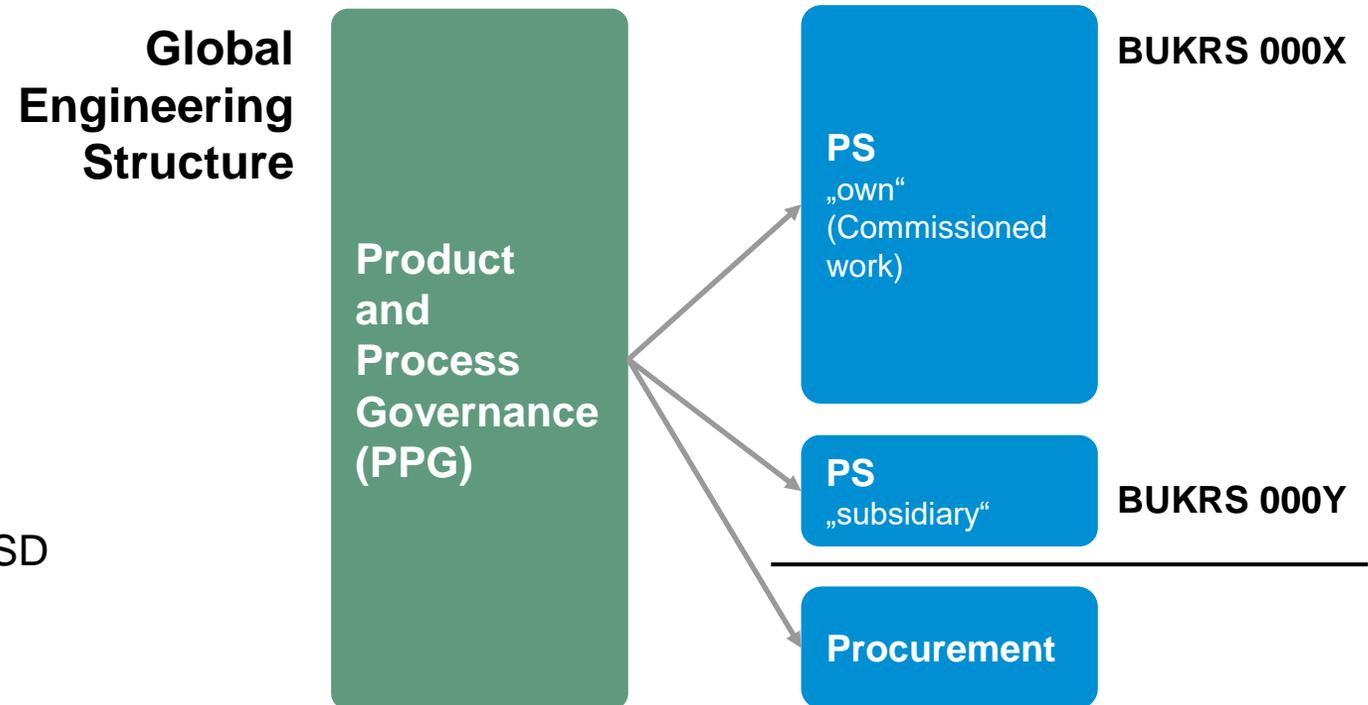| PPG	EPD-Engineering	PPG

Order Execution Phase

Create bid structure

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Create product structure

Create technical order structure

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Sales Rep

Barbara
Systems Engineer

Lars
Project Engineer

Order Execution Phase

EPD-Collaboration	ERP MM, PS & PPG

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Lars
Project Engineer

Automated PS-Integration

Example: Global cross-company code supplies and services determination

Global Engineering Structure

Control indicator:

- **Purchasing** **(1000)**
- **Engineering** **(2000)**
- **Manufacturing** **(9000)**

Assignment of different projects and SD orders

Global Project Management

Product and Process Governance (PPG)

PS „own" (Commissioned work)

BUKRS 000X

PS „subsidiary"

BUKRS 000Y

Procurement

Concurrent Project Costing

Global project controlling / cost view
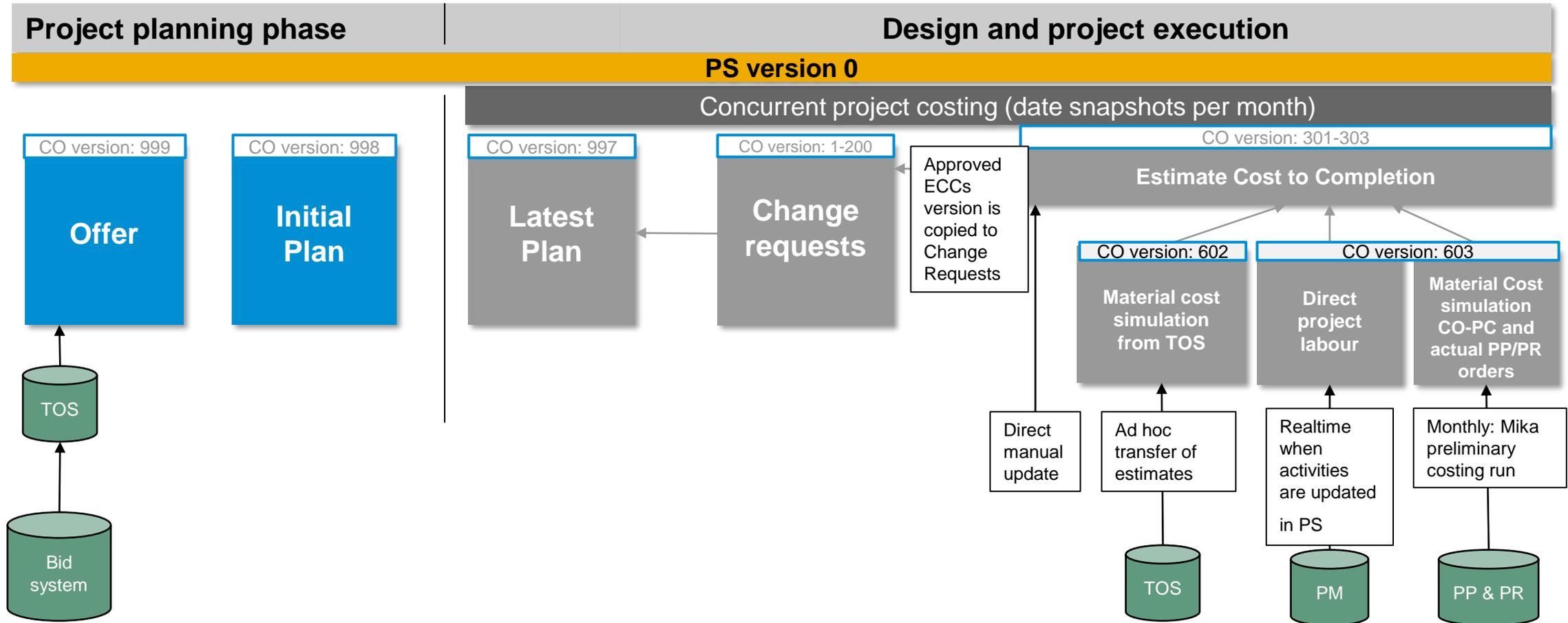
Review Product & Project Structure

Business Outcomes

*"As an **Project Engineer**, I integrate project management with product structure **to automate the process execution.**"*

Lars
Project Engineer
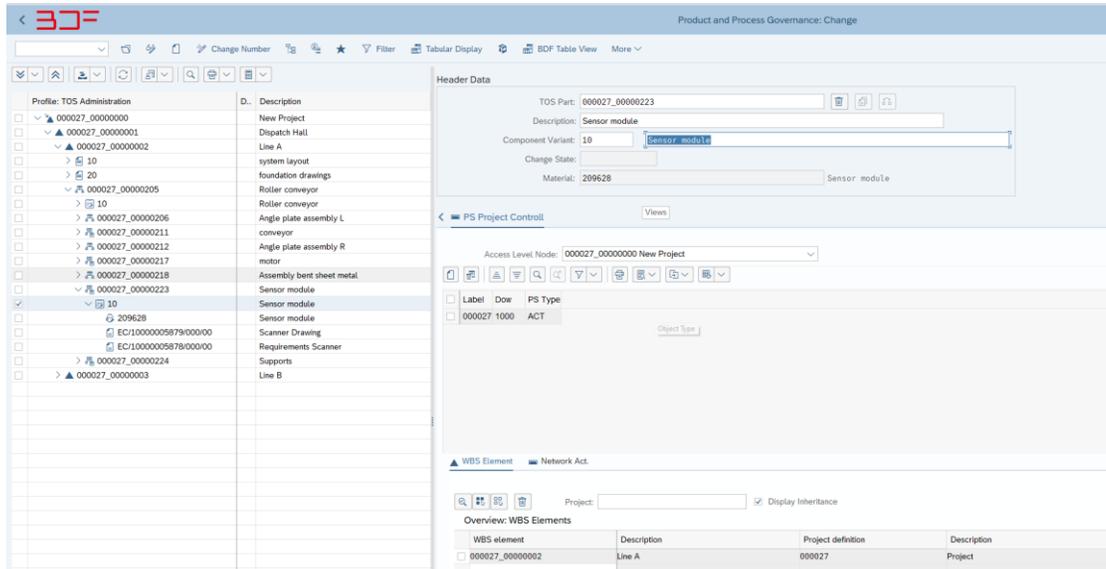
Process Highlights & Benefits

Provide integrated Information of product development disciplines including mechanical, electronic/electrical & software structures into one product definition

Plan the missing production data production aids, production documents, working instructions, …..

Synchronize product data, structures, access and documents across the extended enterprise

Provide and assign scheduling data for production and procurement

Better decision-making due to the execution of concurrent project costing

# From Design to Sales: Detailed Process Flow

	Bid Phase		**Order Execution Phase**
PPG	EPD-Engineering	PPG	

Create bid structure — Daniel, Sales Rep

Manage customer requirements — Barbara, Systems Engineer

Create product structure

Create technical order structure — Lars, Project Engineer

	Order Execution Phase	
EPD-Collaboration	ERP MM, PS & PPG	

Handover documents to supplier

Manage purchase order — Mara, Technical Buyer

Start procurement
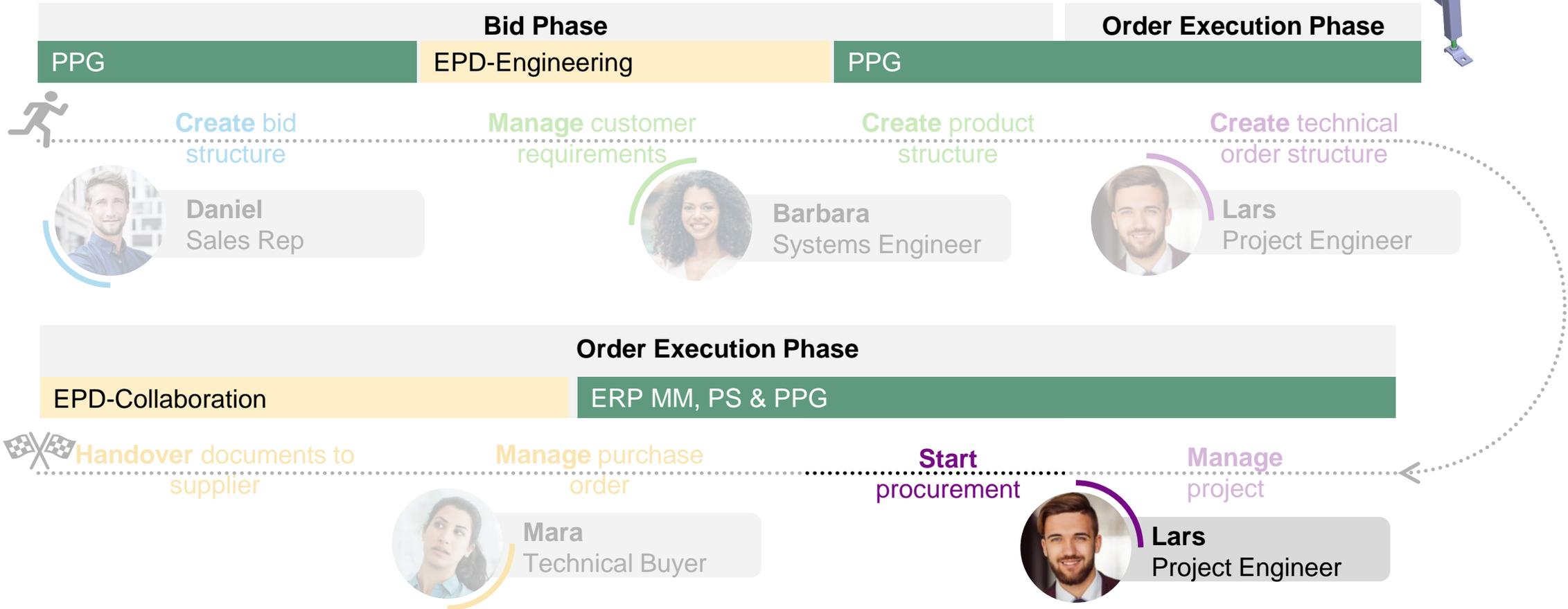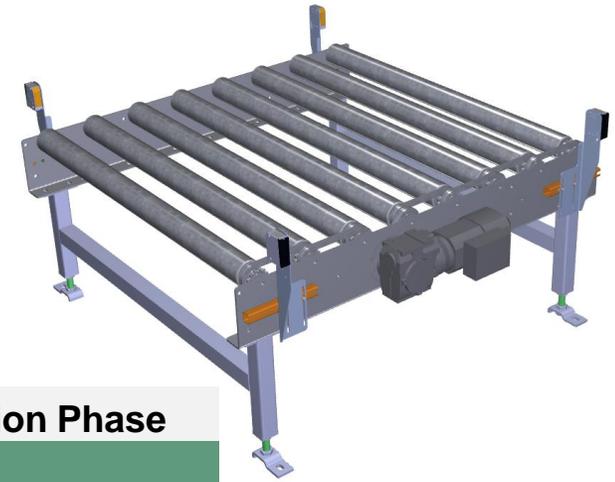
Manage project — Lars, Project Engineer

Start Procurement

*"As an **Project Engineer**, I want to manage the scope of supply and required delivery resources in a central and flexible way."*

Lars
Project Engineer
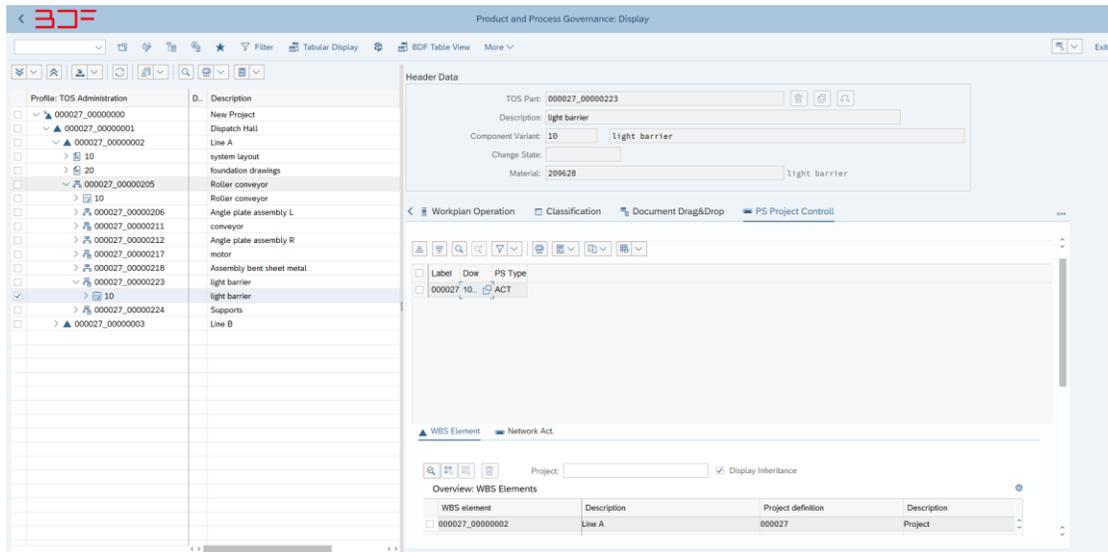
Process Highlights & Benefits

Provide integrated Information of product sourcing disciplines including production, procurement, EWM & QM into one product definition

Plan and track the missing documents, materials and personal resources production aids, production documents, working instructions, …..

Usage of early watch capabilities in order to identify bottlenecks early

Integrated Document supply chain for transferring and receiving documents supports a proper claim management

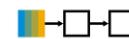**Better decision-making** due to up to date information of the status of each single position in the project
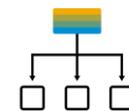
From Design to Sales: Detailed Process Flow

Bid Phase		Order Execution Phase
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Sales Rep

Manage customer requirements
Barbara
Systems Engineer

Create product structure

Create technical order structure
Lars
Project Engineer

Order Execution Phase	
EPD-Collaboration	ERP MM, PS & PPG

Handover documents to supplier

Manage purchase order
Mara
Technical Buyer

Start procurement

Manage project
Lars
Project Engineer

Digital Procurement

Manage purchase order

*"As a **Technical Buyer**, I want to see the outgoing and incoming documents and a desired delivery date from the project."*
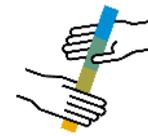
Mara
Technical Buyer

Process Highlights & Benefits

Provide integrated Information of of the sourcing process for each position within the project

Plan standardized incoming documents such as certificates, material tests, codes of conducts, …..

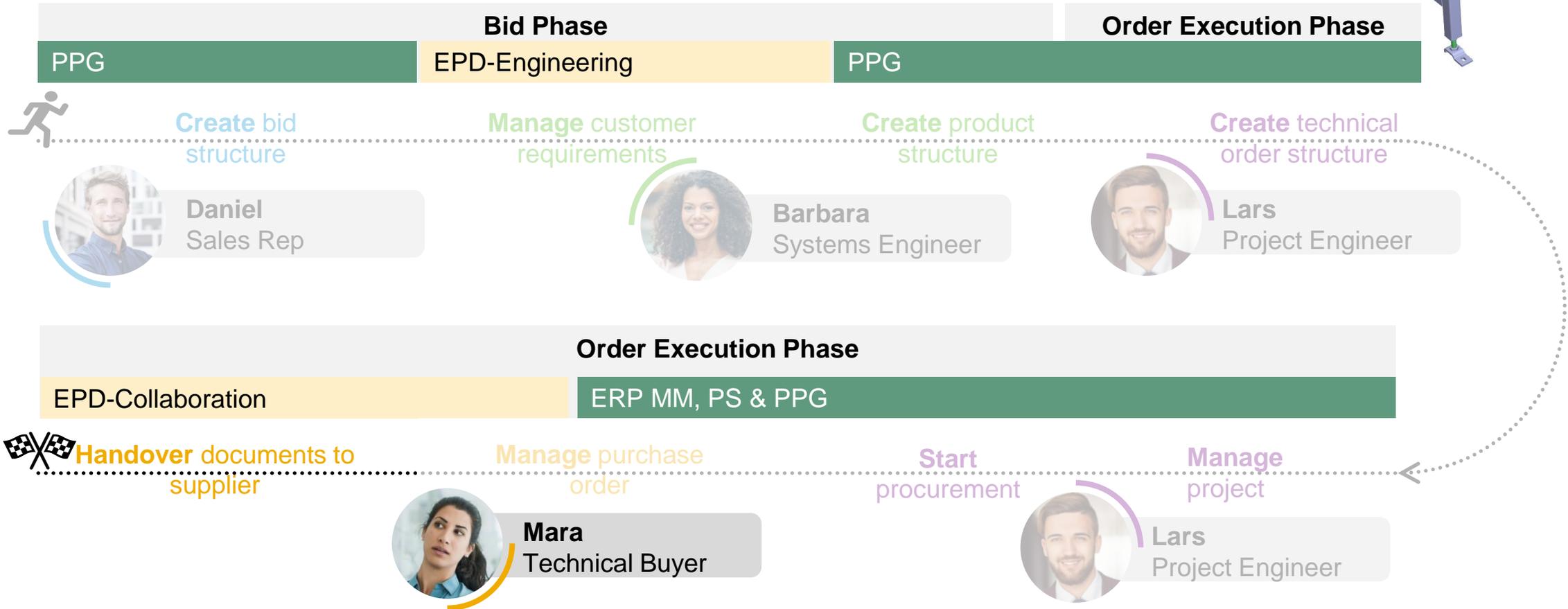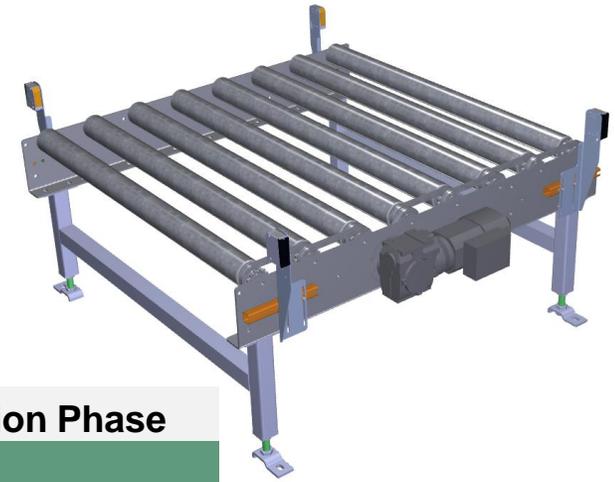**Synchronize** the time schedule of the project with the delivery dates of the purchase order

Provide outgoing and incoming documents for each position

Better decision-making due to accurate definition of the products to buy and their time schedule

From Design to Sales: Detailed Process Flow

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Lars Project Engineer

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Handover documents to supplier

Manage purchase order
Mara Technical Buyer

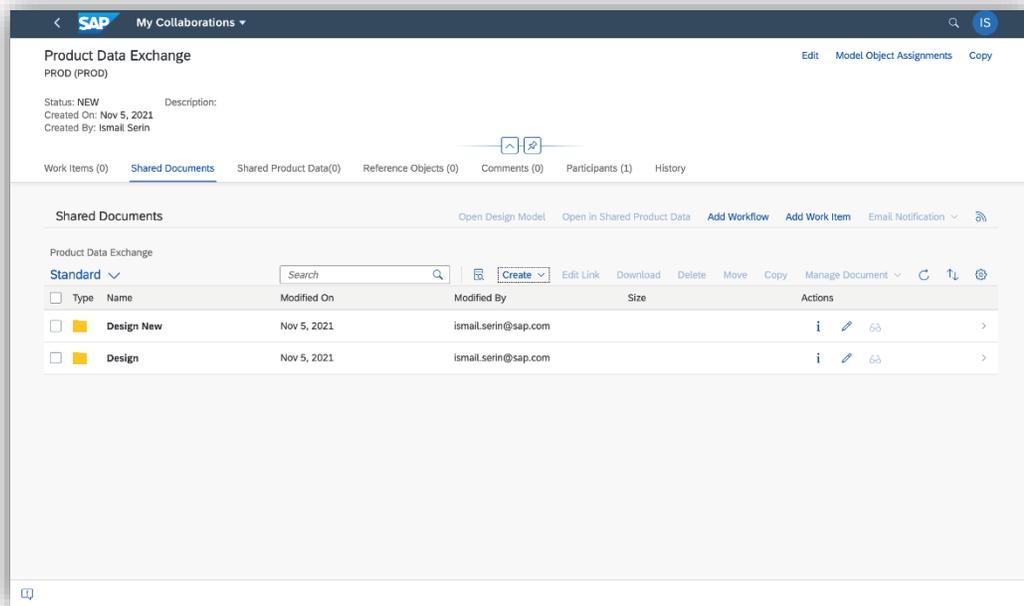**Start** procurement

Manage project
Lars Project Engineer

Handover documents to supplier

Business Outcomes

"As a *Technical Buyer*, I want to **exchange product data** (e.g., BoM's, 3D models, documents) and manage the RFx process to **lower product costs**."

Mara
Technical Buyer

Process Highlights & Benefits

Create collaborations and invite suppliers to exchange product data

Link collaborations to purchase orders

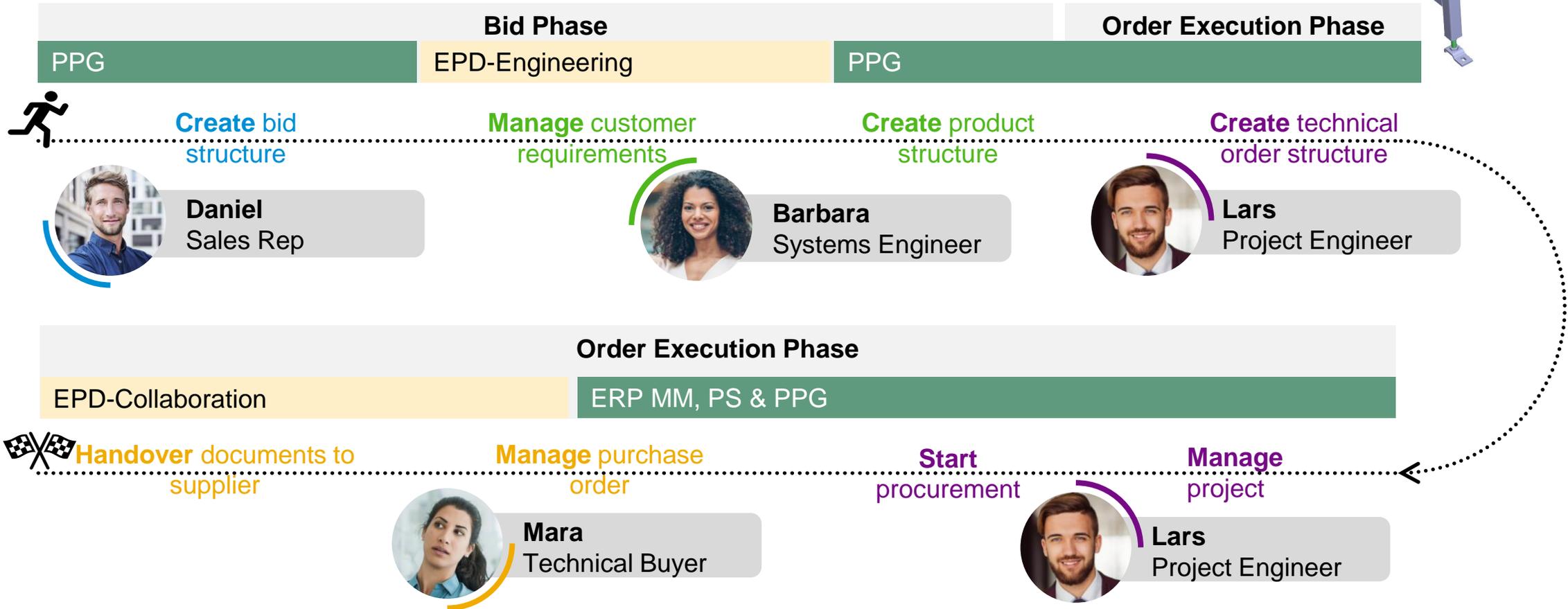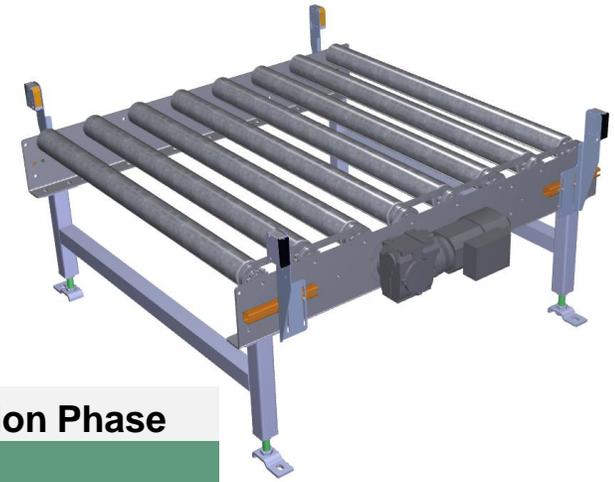**Flexible search and filter** options to navigate to the right collaboration across multiple suppliers

Workflow driven collaboration with suppliers for safe exchange of information

Bi-directional exchange of documents from S/4HANA Document Management System

From Design to Sales: Detailed Process Flow

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Handover documents to supplier

Manage purchase order — **Mara** Technical Buyer

Start procurement

Manage project — **Lars** Project Engineer

Summary

The Design-Driven Enterprise is AGIL.EFFICIENT.CUSTOMER-CENTRIC

✓ **Increase the level of automation** in the process flow from engineering into sales, production, service via the **smart product structure**.

✓ **Increase the level of reuse** via templates and by embedding configurable modules and components in the **smart product structure.**

✓ Achieve a **high level of consistency, automation and accuracy** across all departments by utilizing **the smart product structure within the SAP core**.

Design-Driven Enterprise

From Project Start to Manufacturing & Procurement for the Project Business

22.04.2022

Thank you & see you soon.