Enterprise Modelling for Lifecycle Engineering on the Example of Sustainability

Capella Days 2023

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Agenda

Introduction | Industrial Eco-System
Context | Digital Farming Solutions
Example | Modelling of Enterprise Eco-System with ARCADIA
Summary & Lessons learned

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Summary & Lessons learned

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Siemens AG
Businesses and Services

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Industrial Business

Digital Industries

Smart Infrastructure

Mobility

Siemens Healthineers[1]

Portfolio Companies

Siemens Advanta

Services

Siemens Financial Services

Siemens Real Estate

Global Business Services

1 Publicly listed subsidiary of Siemens; Siemens' share in Siemens Healthineers: 75%

Digital Industries

72,700 employees[1]

€ 19,5 billion in revenue[2]

Software (industrial)
#1 market position

Factory Automation
#1 market position

Motion Control
#1 market position

Process Automation
#2 market position

Customer Services

1 As of September 30, 2021 | **2** For fiscal 2022

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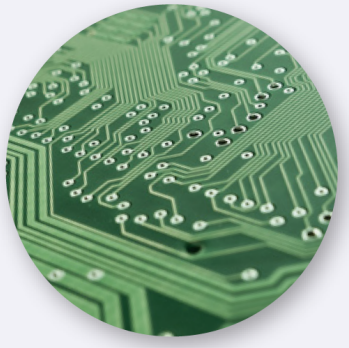
Industry Megatrends

MEGATRENDS expected to influence systems engineering through 2035.

1. Sustainability

2. Interdependent World



3. Digital Transformation

4. Industry 4.0/ Society 5.0

5. Smart Systems

6. Complexity Growth

Source: INCOSE Vision 2035

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Sustainable Development Goals

Source: INCOSE Vision 2035

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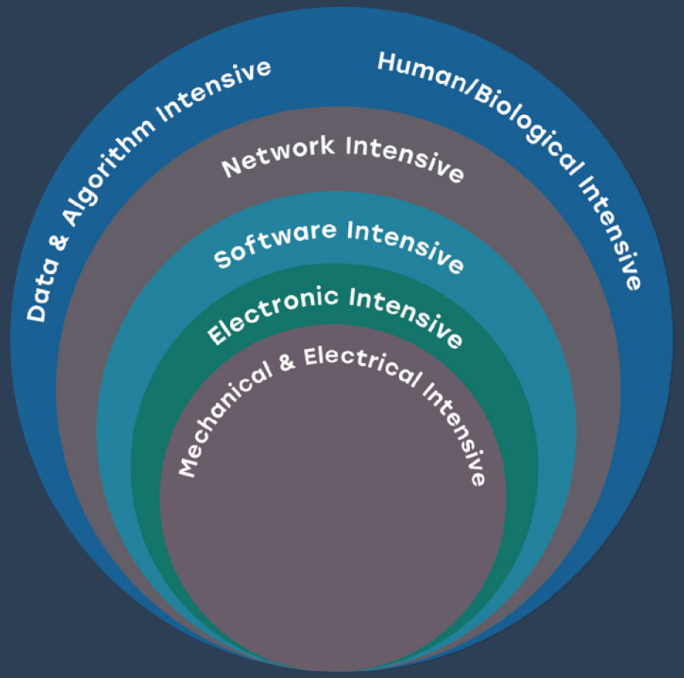
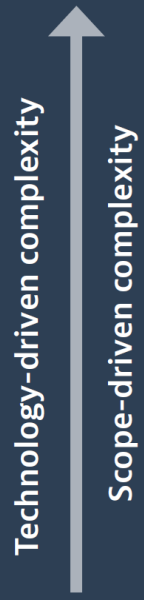
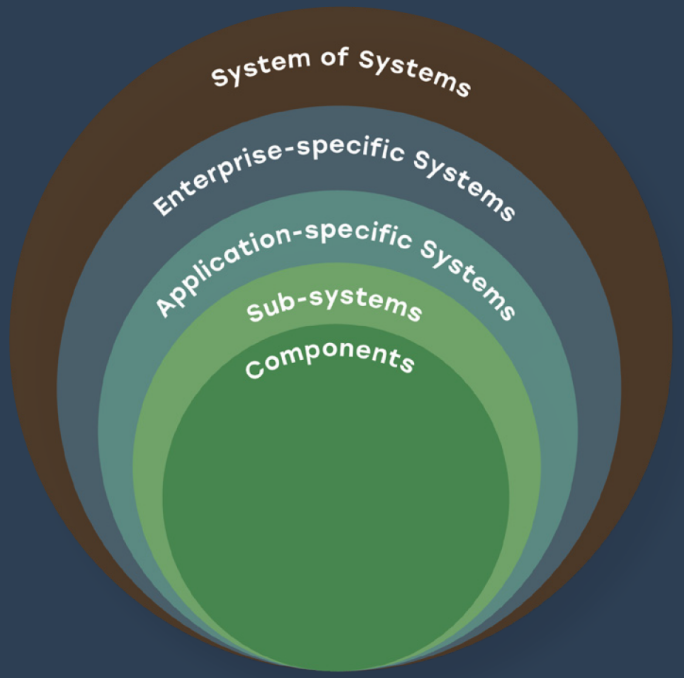
Increasing complexity requires holistic view on Eco-System

- Complexity increases over time due to the integration of ever more complex layers of technology.







- Complexity increases with systems scope expansion due to proliferation of interfaces and governance mechanisms.

Source: INCOSE Vision 2035

Global Context of Systems Engineering

Source: INCOSE Vision 2033

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Digital Farming Solutions
Industry Examples

Vertical Farming Technology

Heavy Equipment

https://www.plm.automation.siemens.com/global/de/industries/heavy-equipment/agriculture/

Smart Farming

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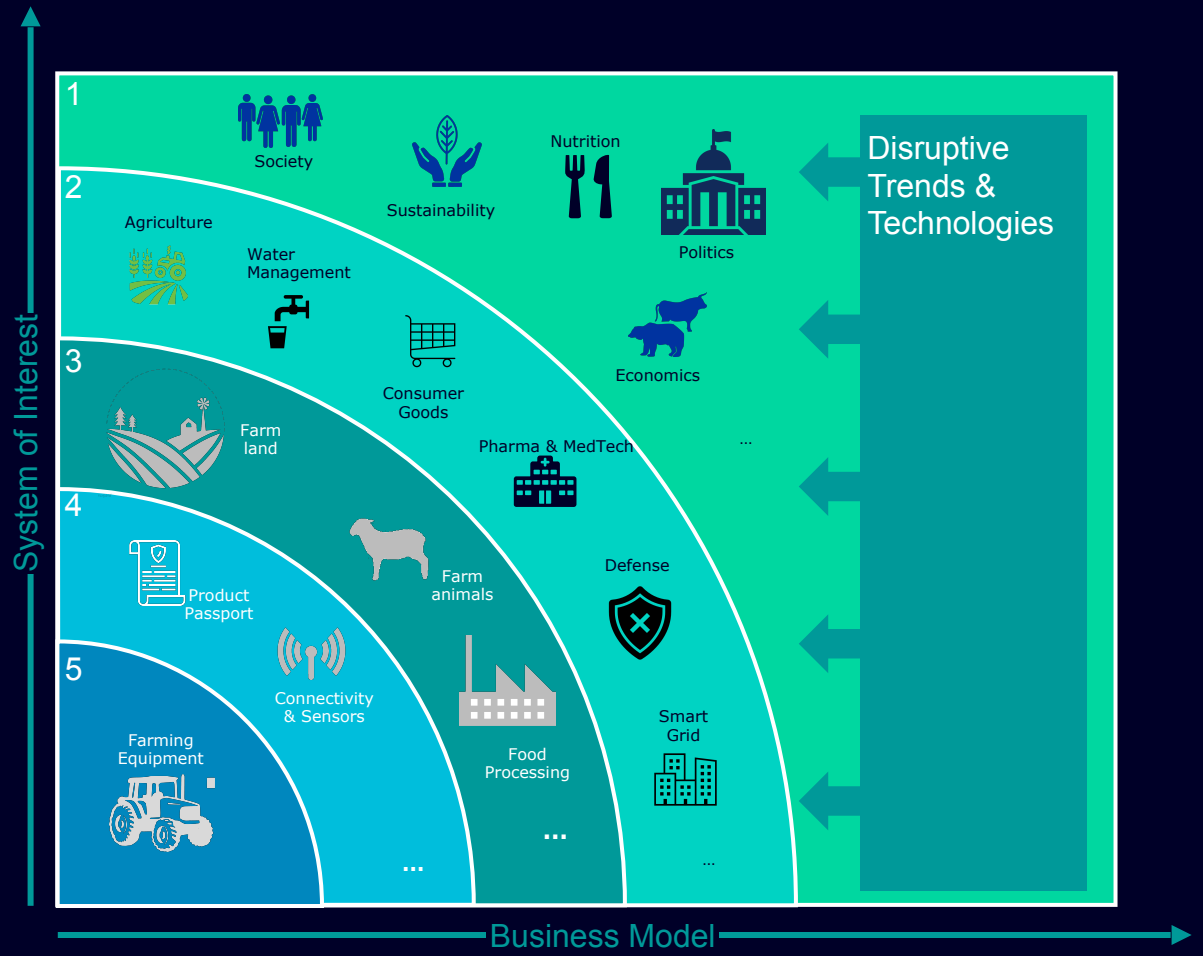
Systems Thinking and Engineering of Eco-System
Example: Digital Farming Solution



Level 1	**Society Eco-System |** Society, Sustainability, Nutrition, Economics, Politics, Legal, …
Level 2	**Industrial Operating System |** Agriculture, Water, Consumer Goods, Pharma & MedTech, Defense, Energy, …
Level 3	**Customer Usage System |** Farm land, Farm animals, Factory…
Level 4	**Product Operating System |** Digital Product Passport (Conformity & Regulatory Compliance), Connectivity, Predictive Maintenance,…
Level 5	**Product System |** Farming Equipment

Product Economy | Smart Connected Products Economy | Platform Economy | Economy of Solutions | …

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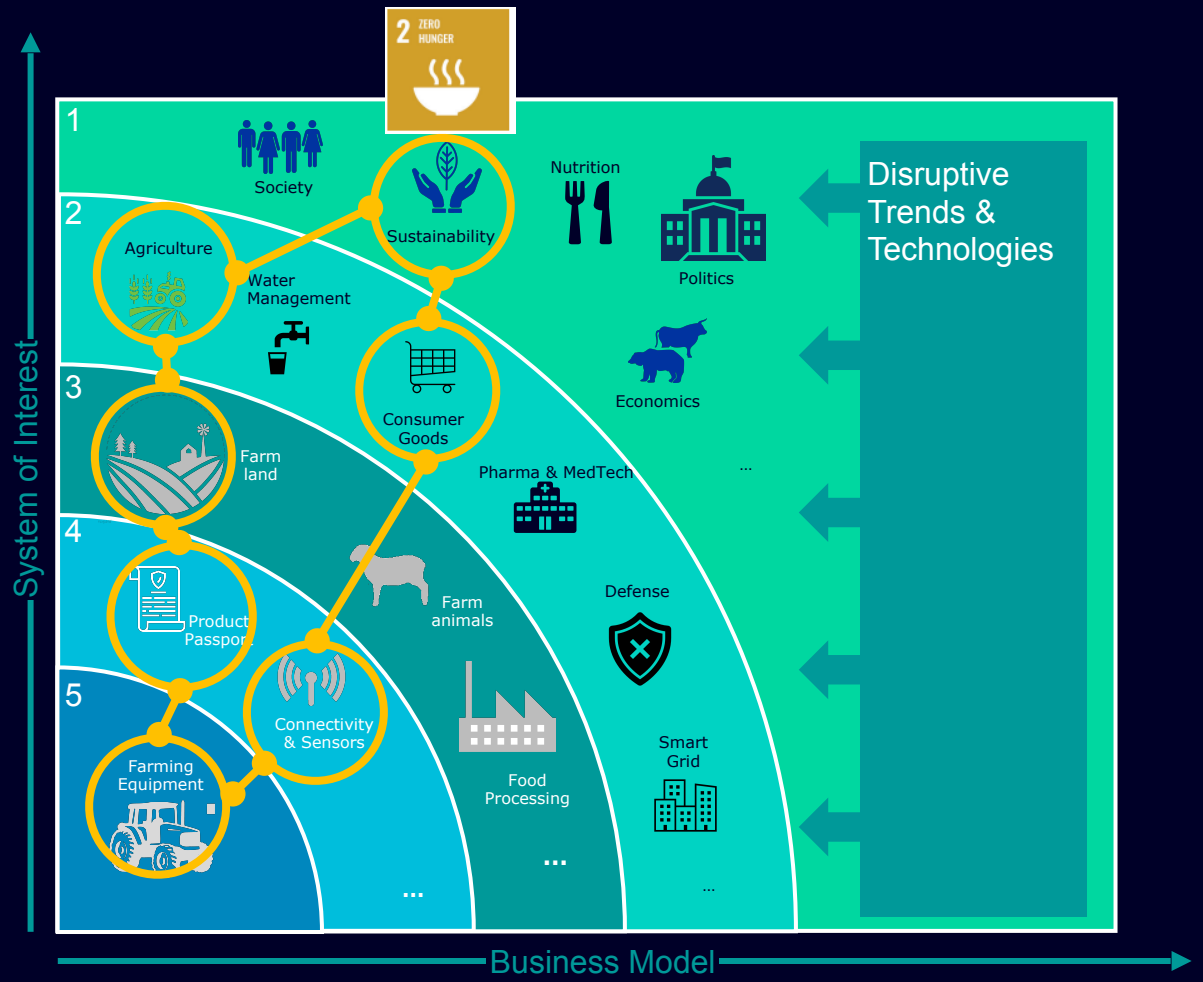

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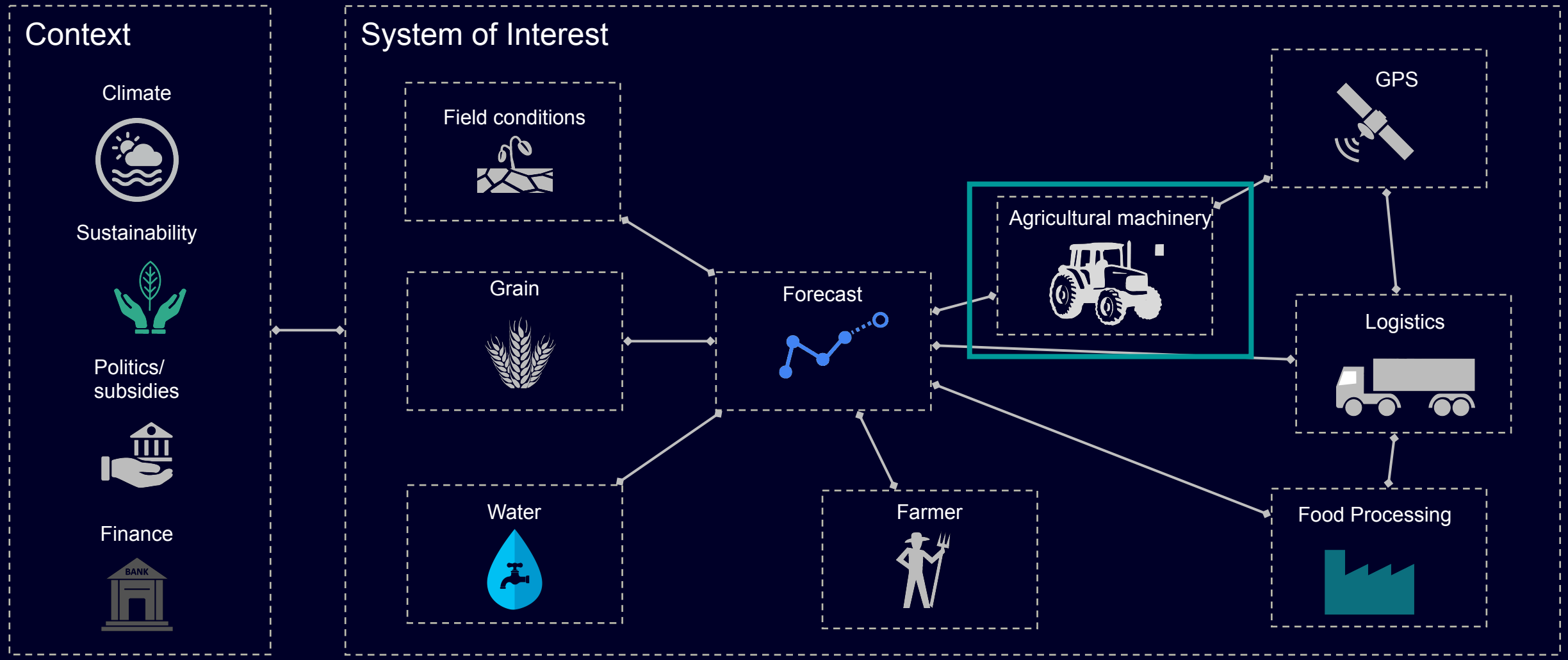
Operational Analysis | Operational Actors/Entities
Example: Digital Farming Solutions



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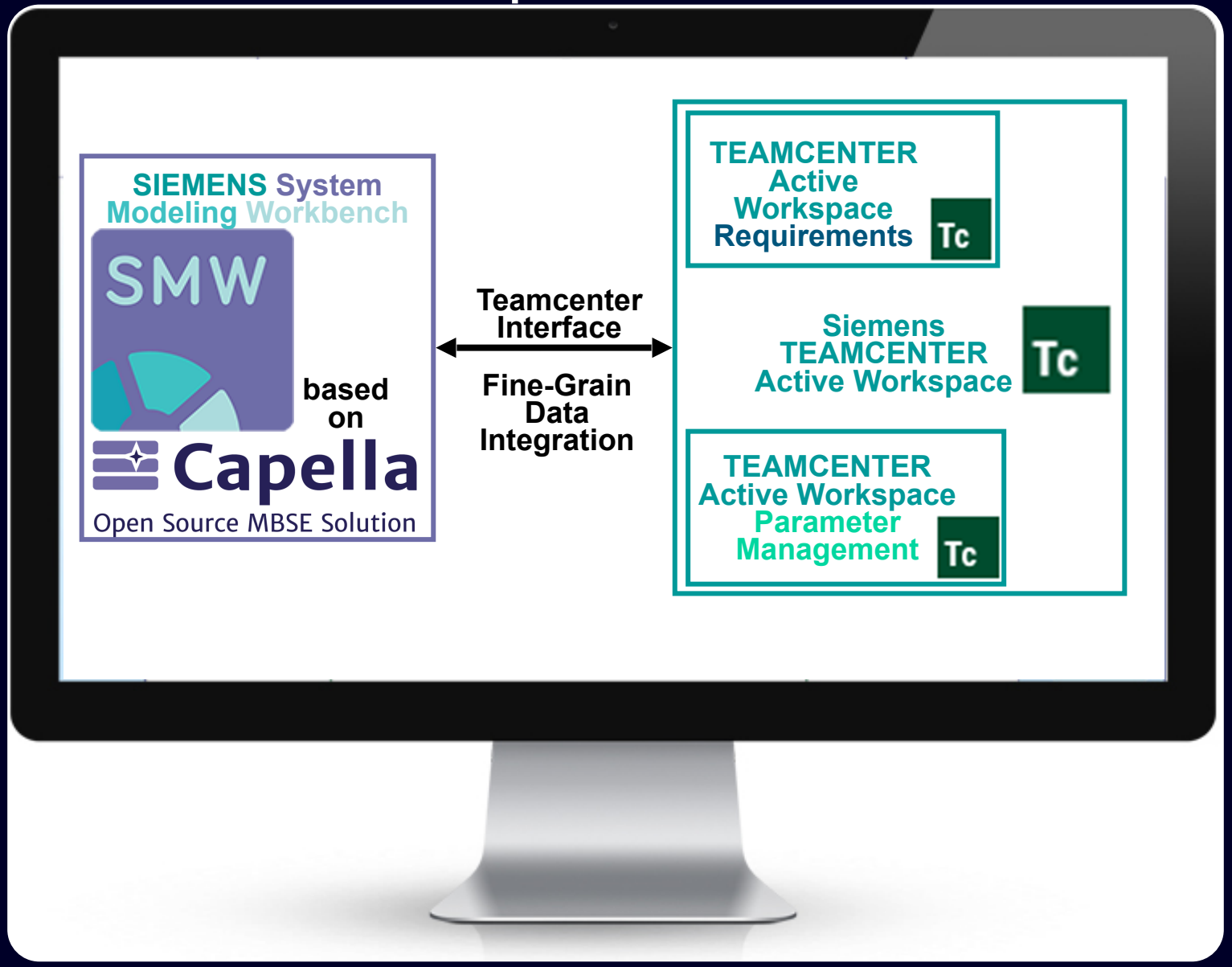
Environment used to create the Example Model



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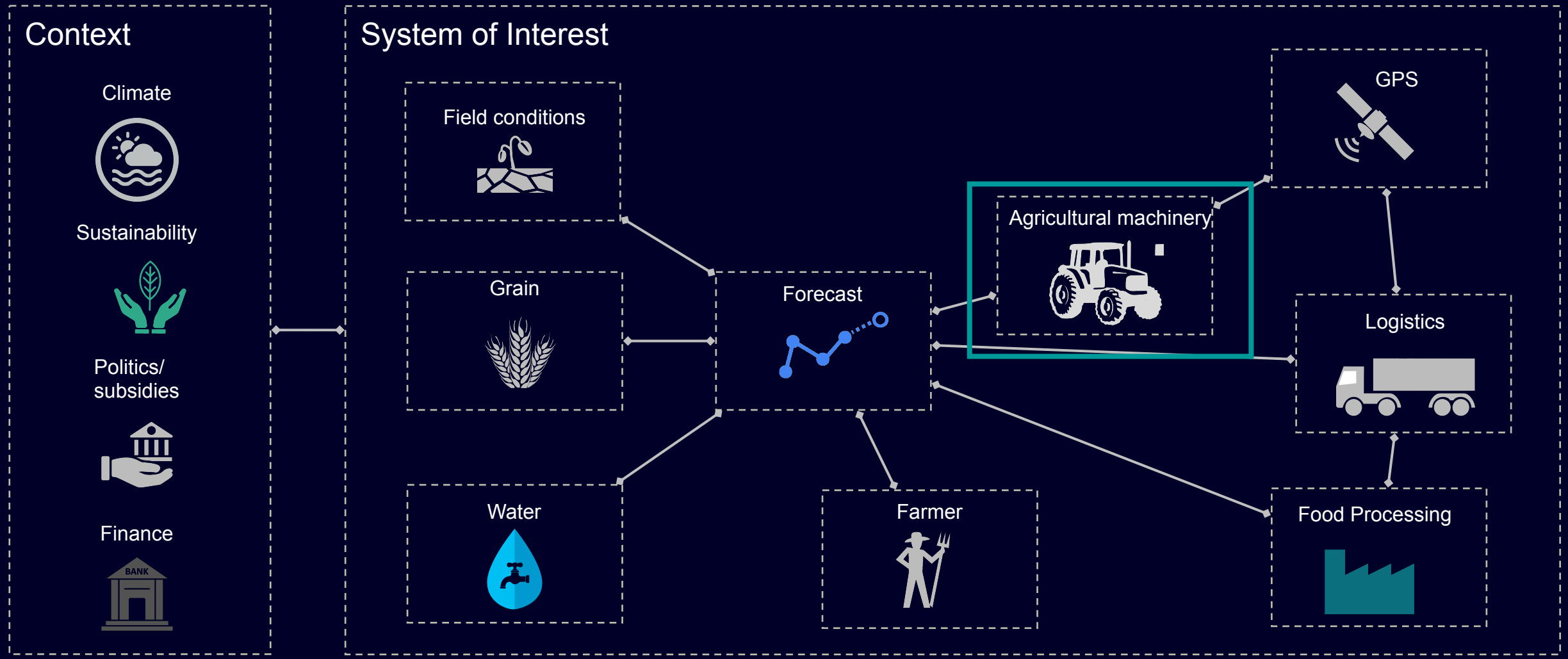

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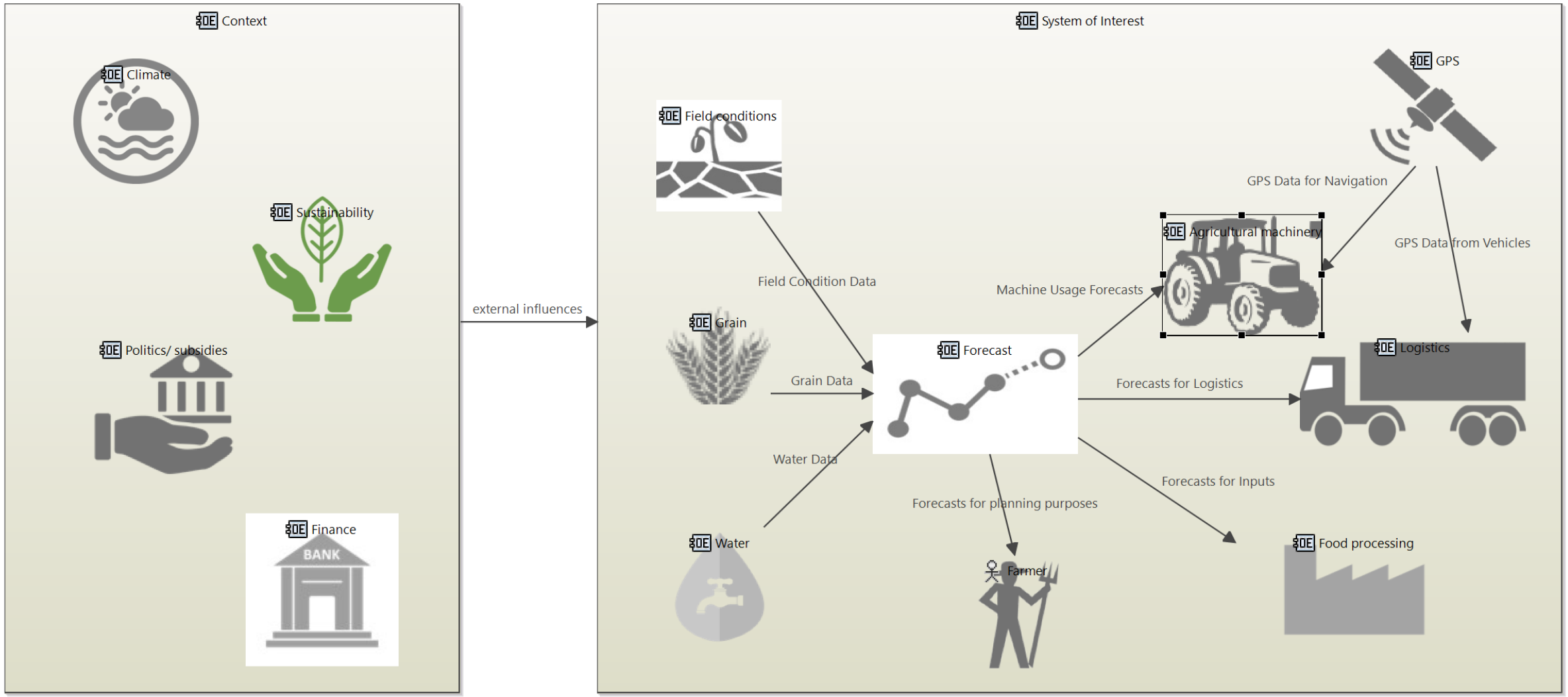

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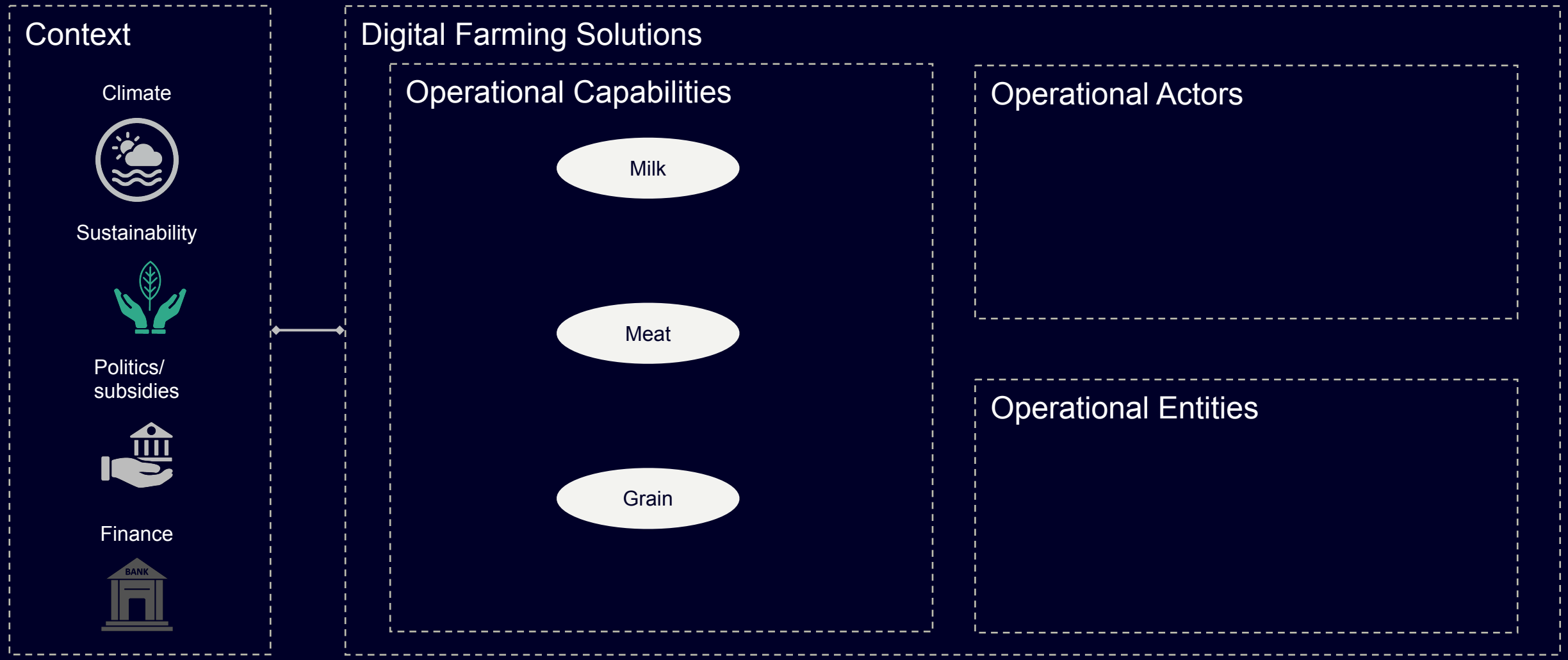

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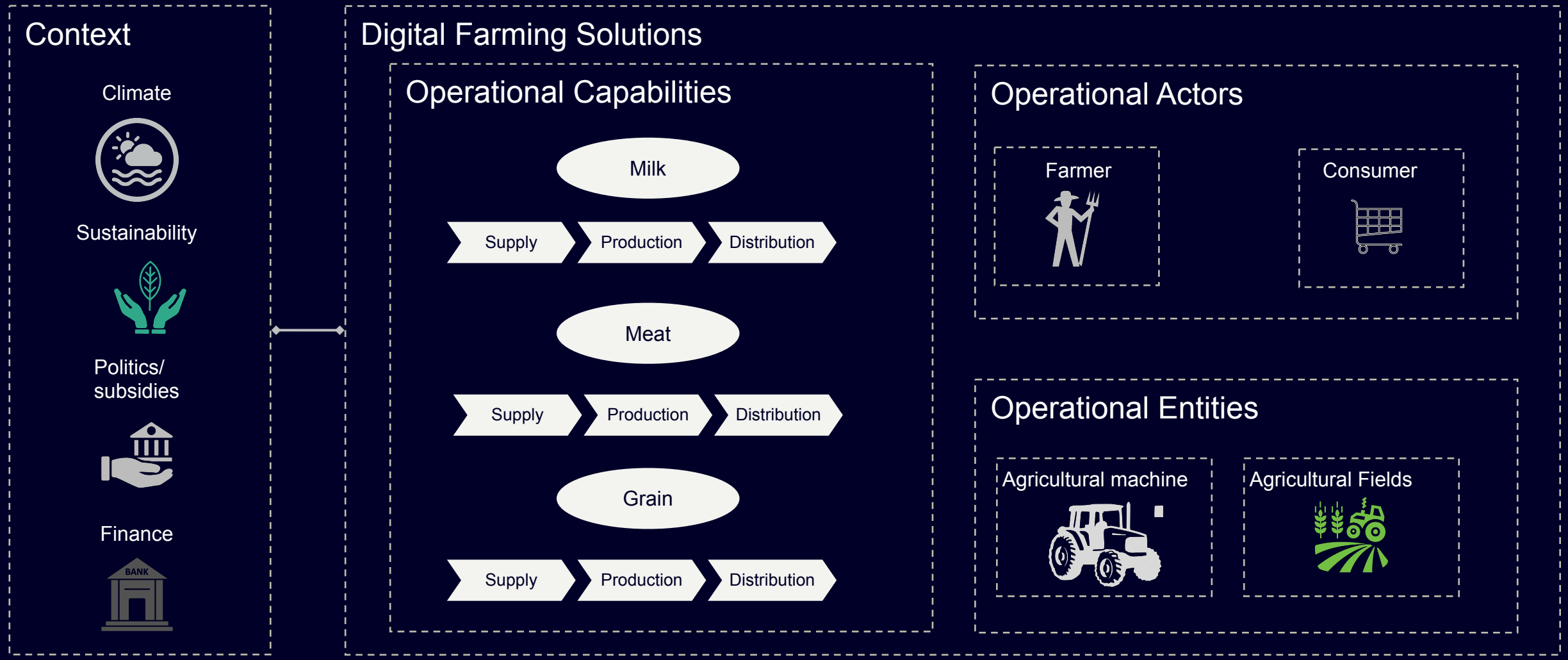

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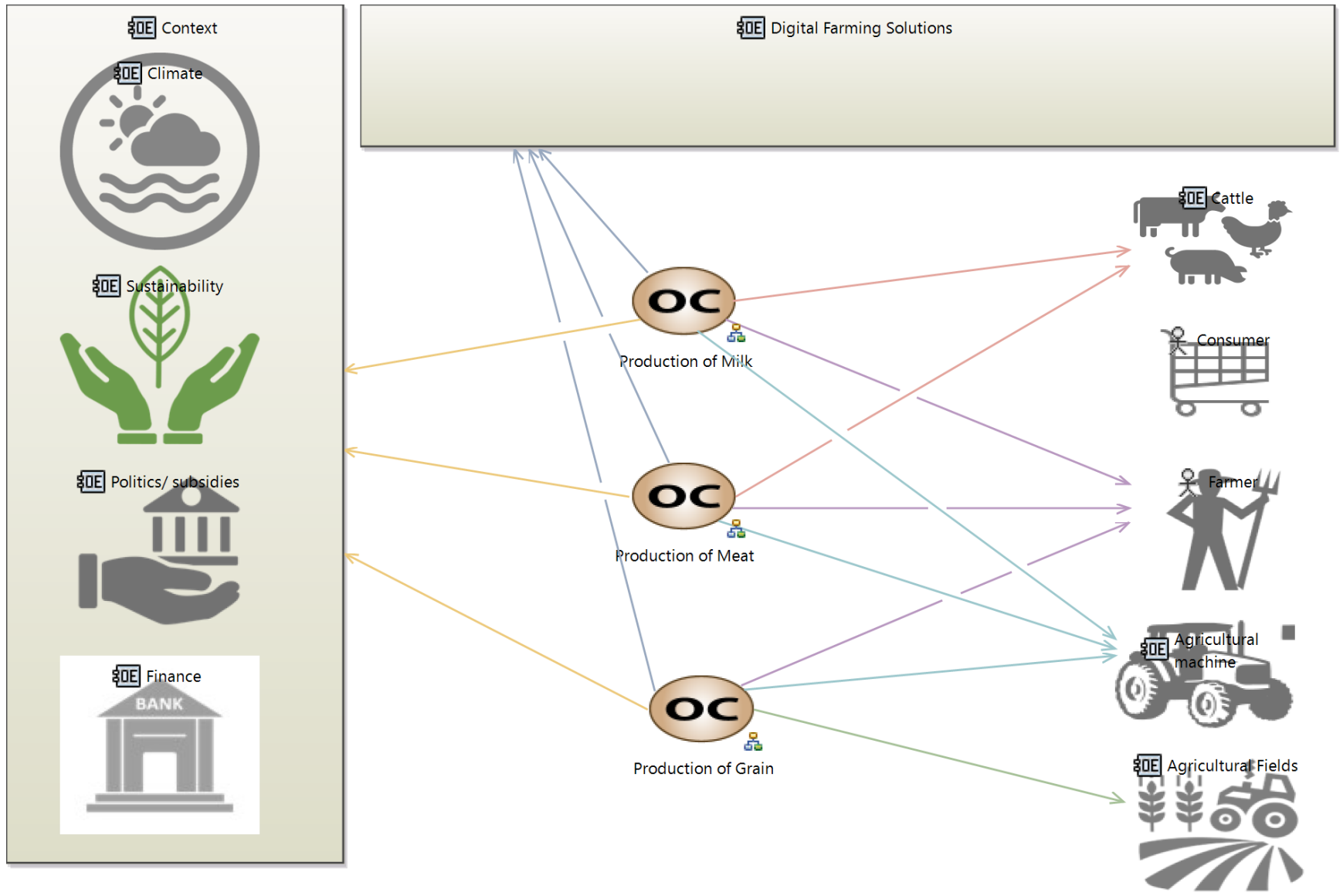

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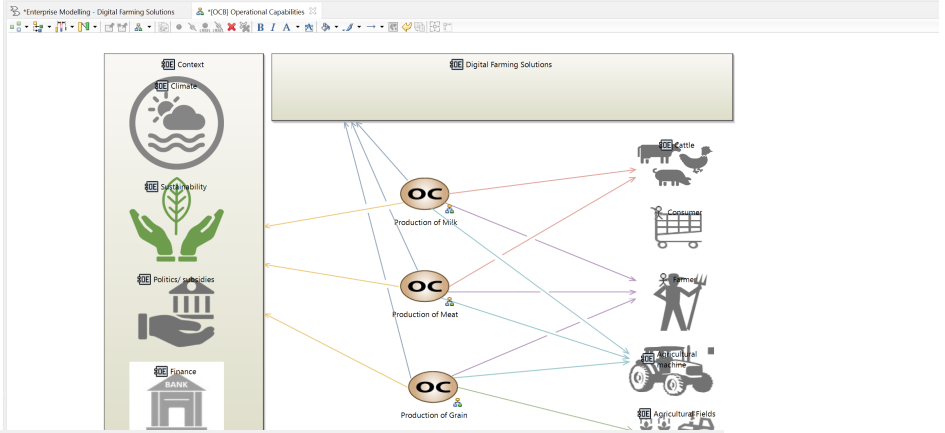
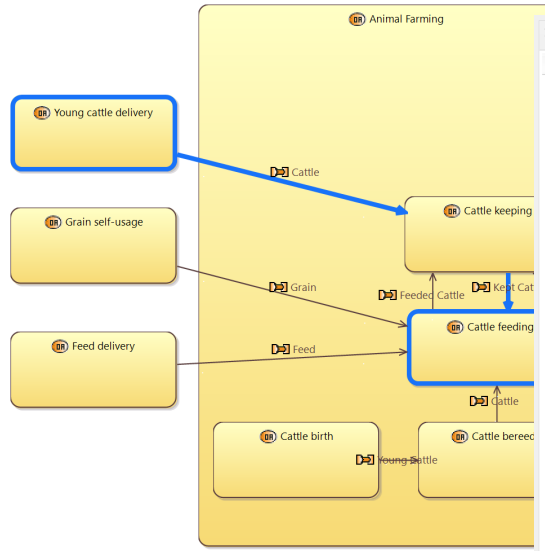
Capella Screen Shot



Enterprise Modelling - Digital Farming Solutions | [OAIB] Production of Grain | [OAIB] Production of Meat | [OAIB] Production of Milk

100%

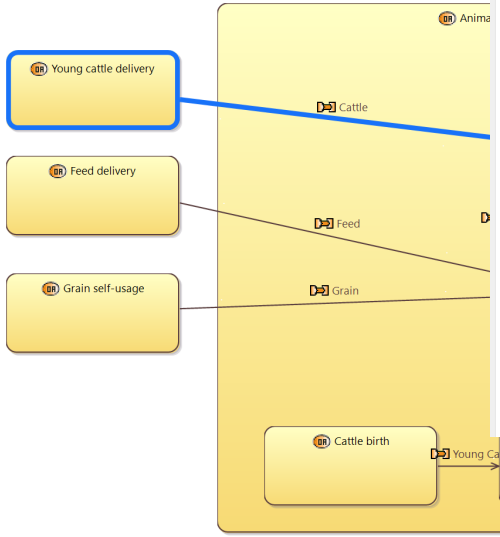
Milk Production



Enterprise Modelling - Digital Farming Solutions | [OAIB] Production of Grain

100%

Meat Production



Enterprise Modelling - Digital Farming Solutions | [OAIB] Production of Grain | [OAIB] Production of Meat | [OAIB] Production of Milk

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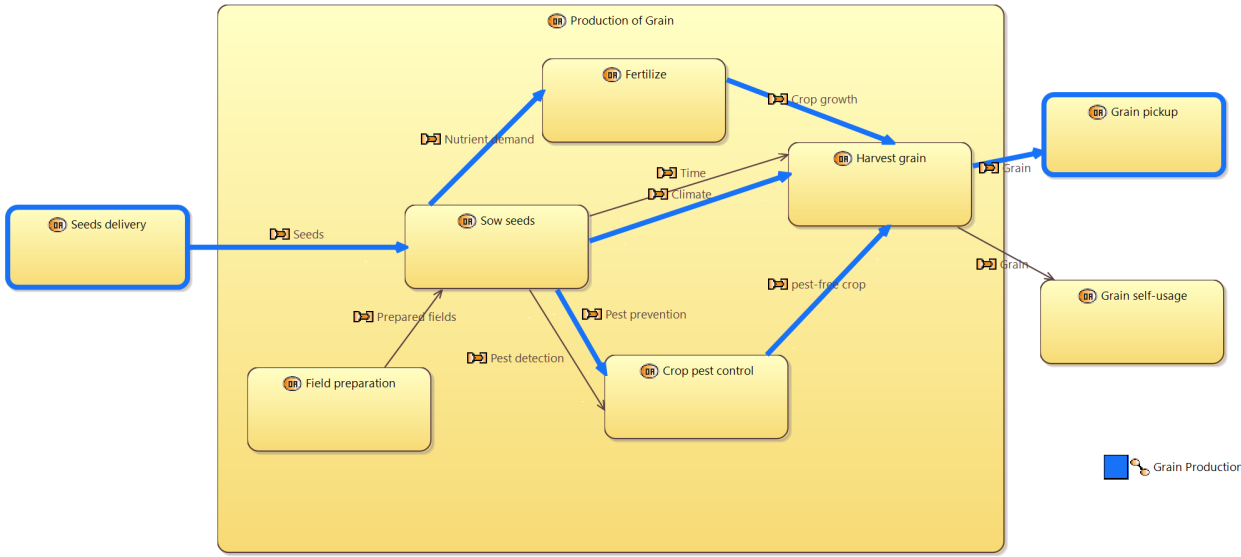
Grain Production



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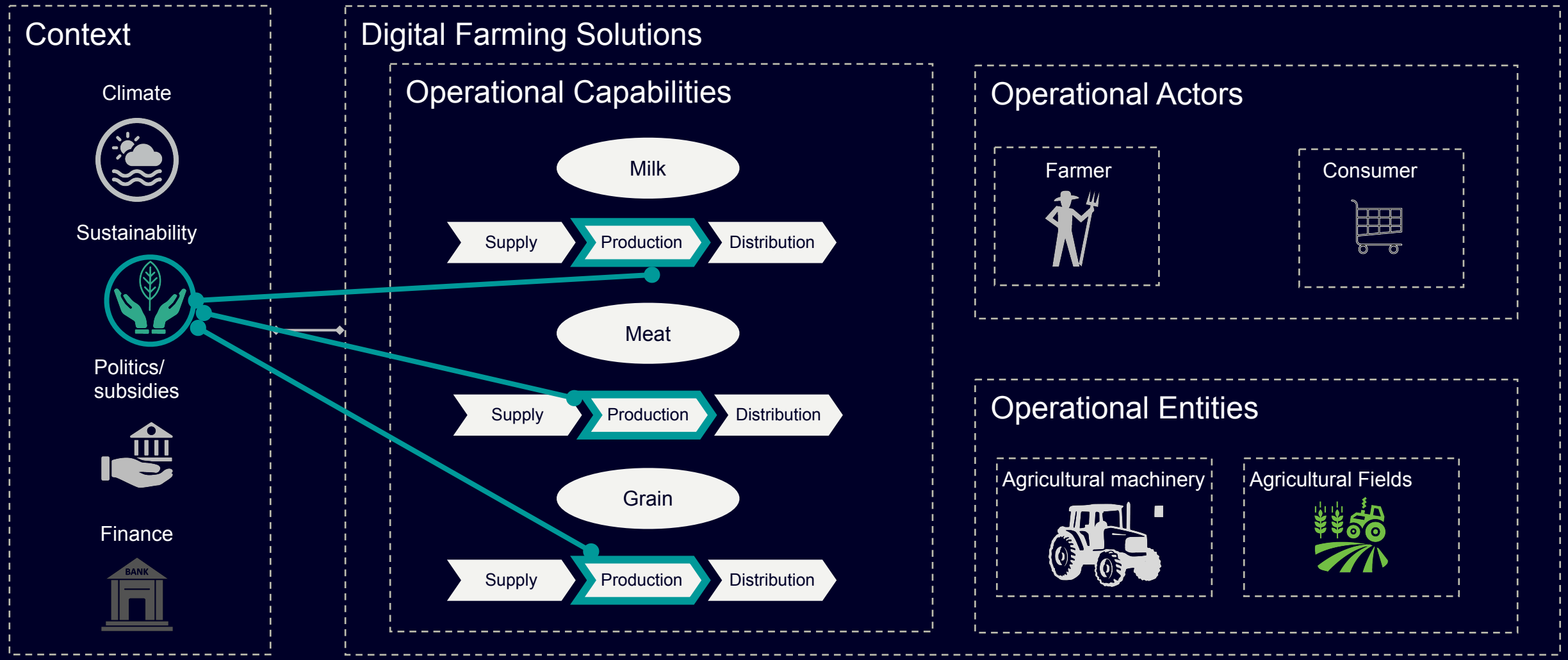

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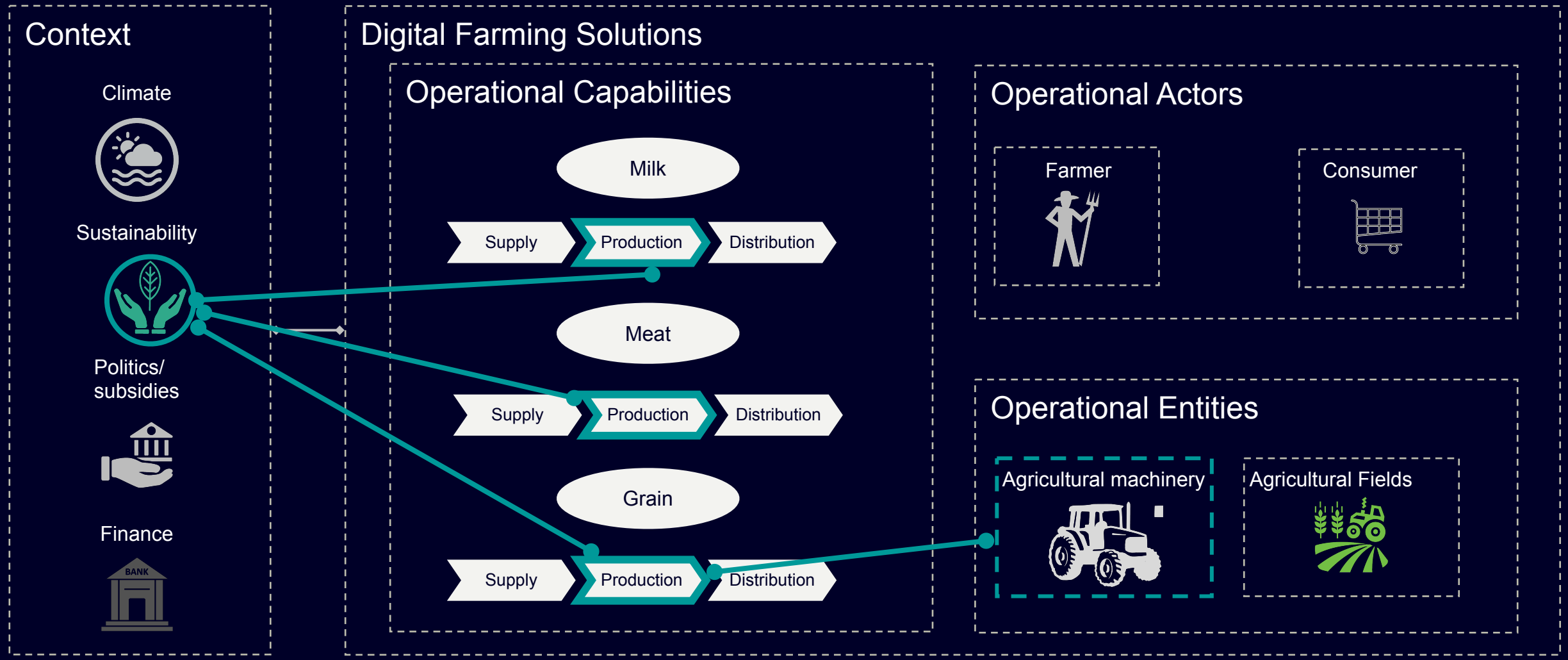

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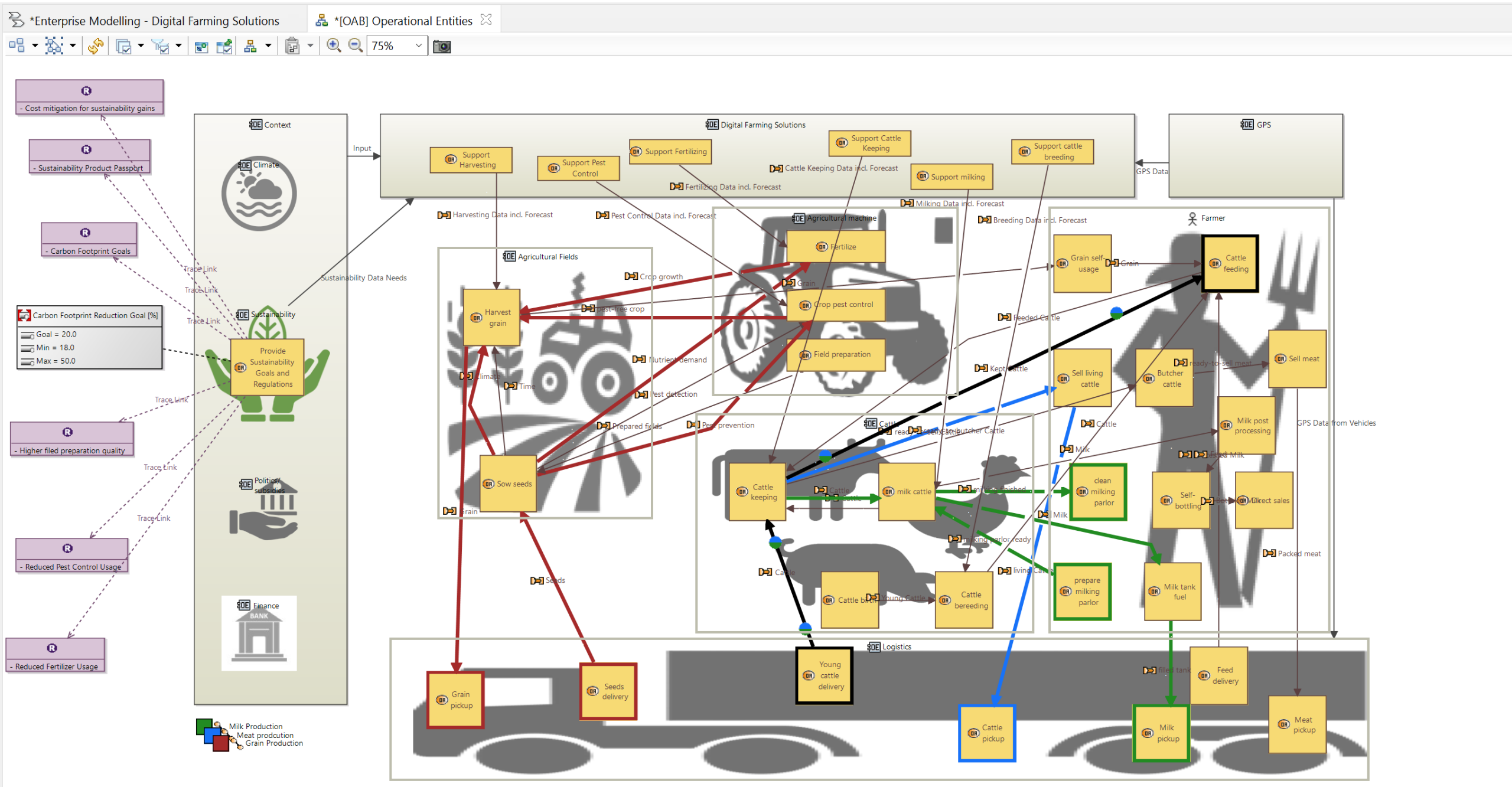


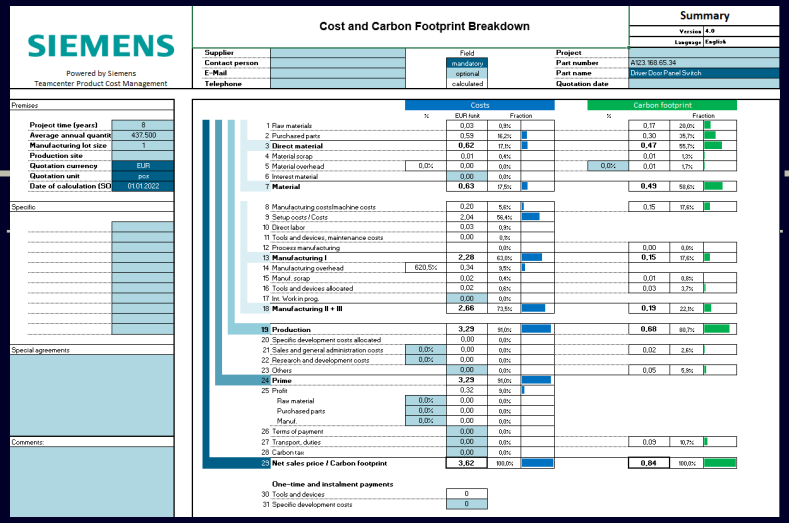
Operational Analysis | Operational Actors/Entities
Example: Digital Farming Solutions

Business Engineering

Product System

Product architecture

- Agricultural machine
  - Chassis
  - Motor
  - Connectivity
  - …



Costs

Carbon footprint

Production System

Research & Development → *Manufacturing & Order fulfillment* → *Inbound & Outbound Logistics* → *Operation & Maintenance* → *Recycling & Second Life*

Capabilities

- *Systems Engineering*
- *Mechanical Engineering*
- *Electrical Engineering*
- *Software Engineering*
- …

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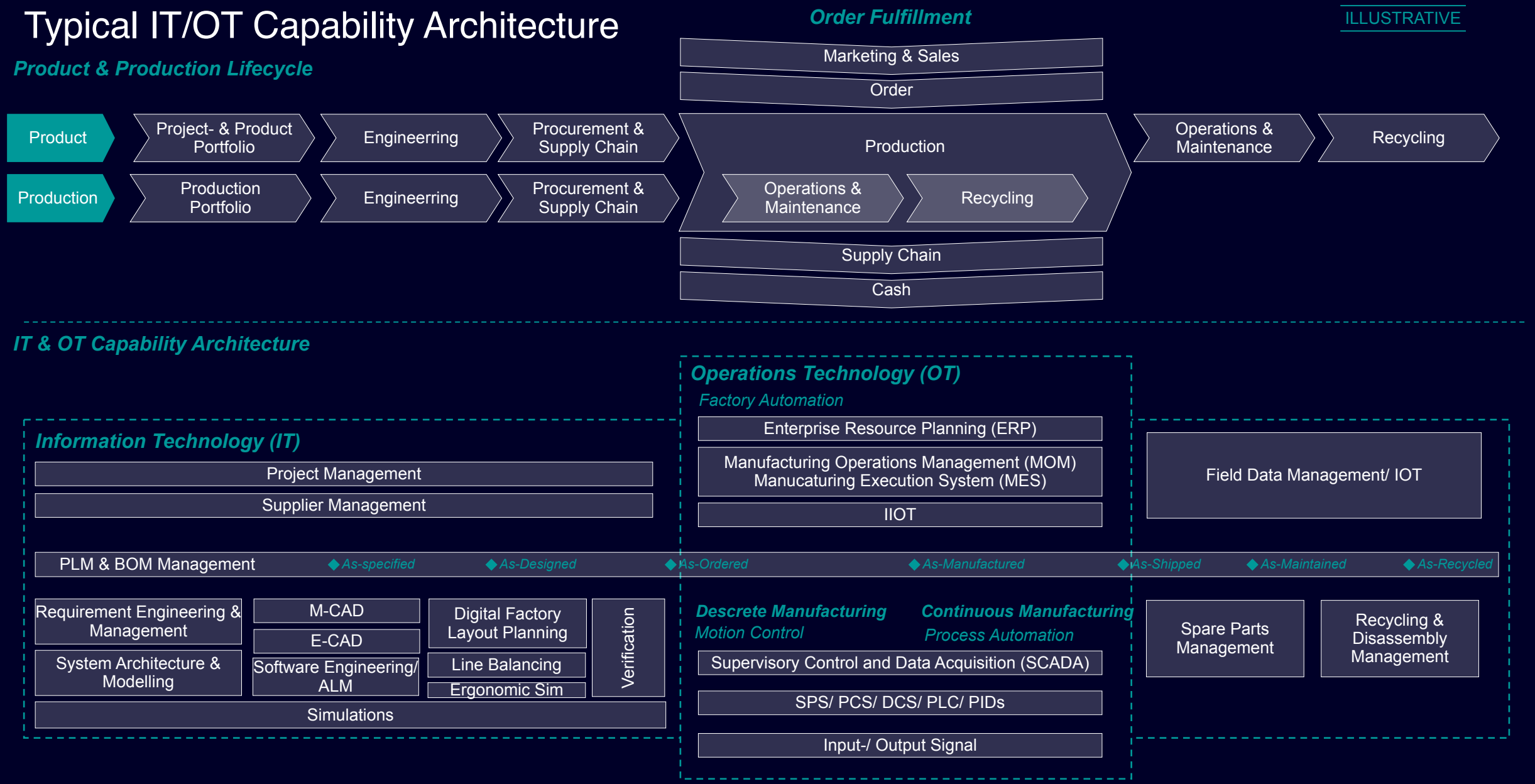
Digital Enterprise - A Product centered Approach, with synchronized Architecture Information Technology (IT) and Operational Technology (OT)

Typical IT/OT Capability Architecture

ILLUSTRATIVE



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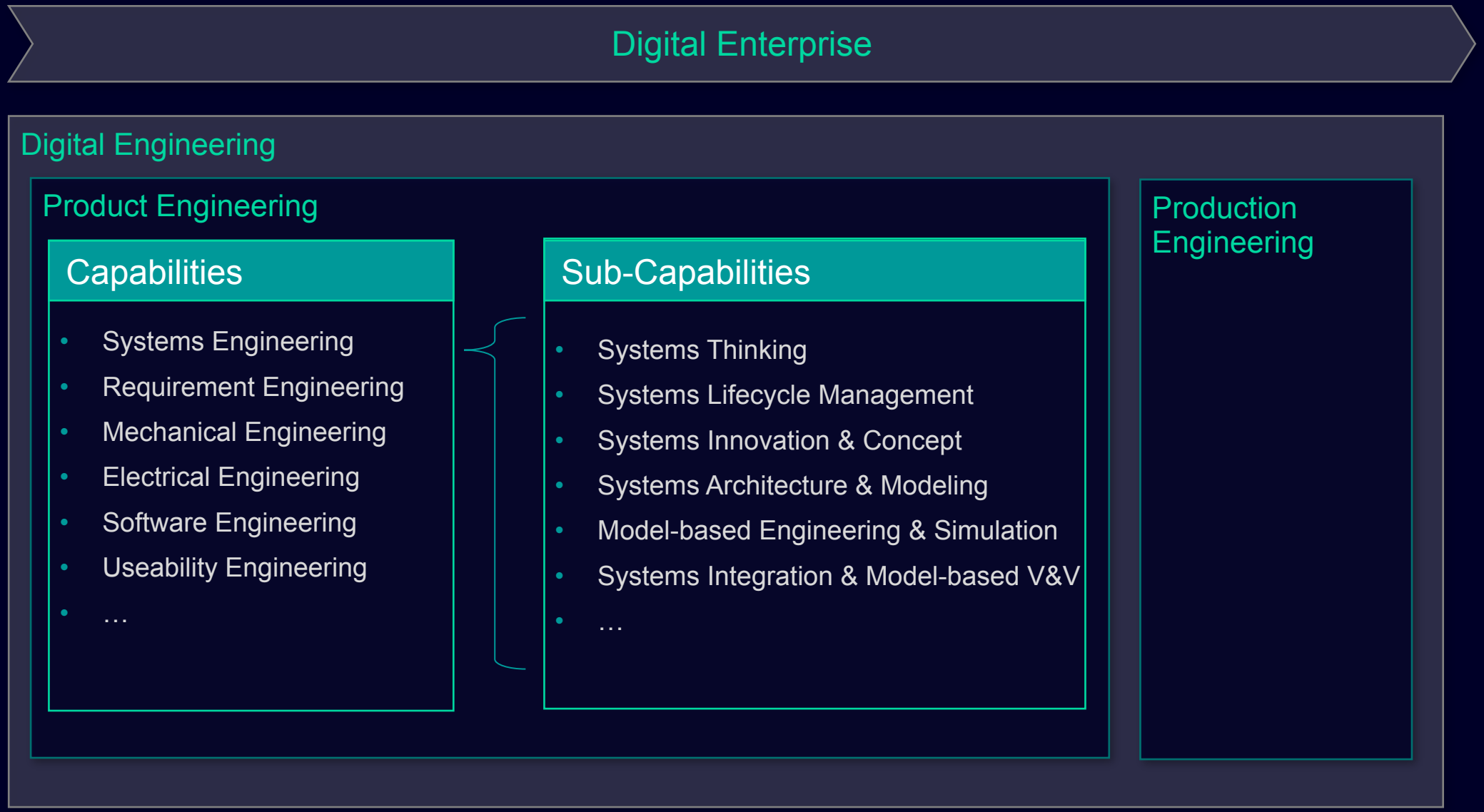
Examples of Product Engineering Capabilities



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Summary & Lessons Learned

A	**Megatrends** Industry Context is changing with higher frequency, where enterprises need to adapt faster
B	**Eco-System Modelling** Products and enterprise work in eco-systems, where enterprises need to understand the dependencies
C	**Lifecycle Engineering** For sustainable products all phases of the lifecycle are “managed”, enterprises need to consider this already in engineering

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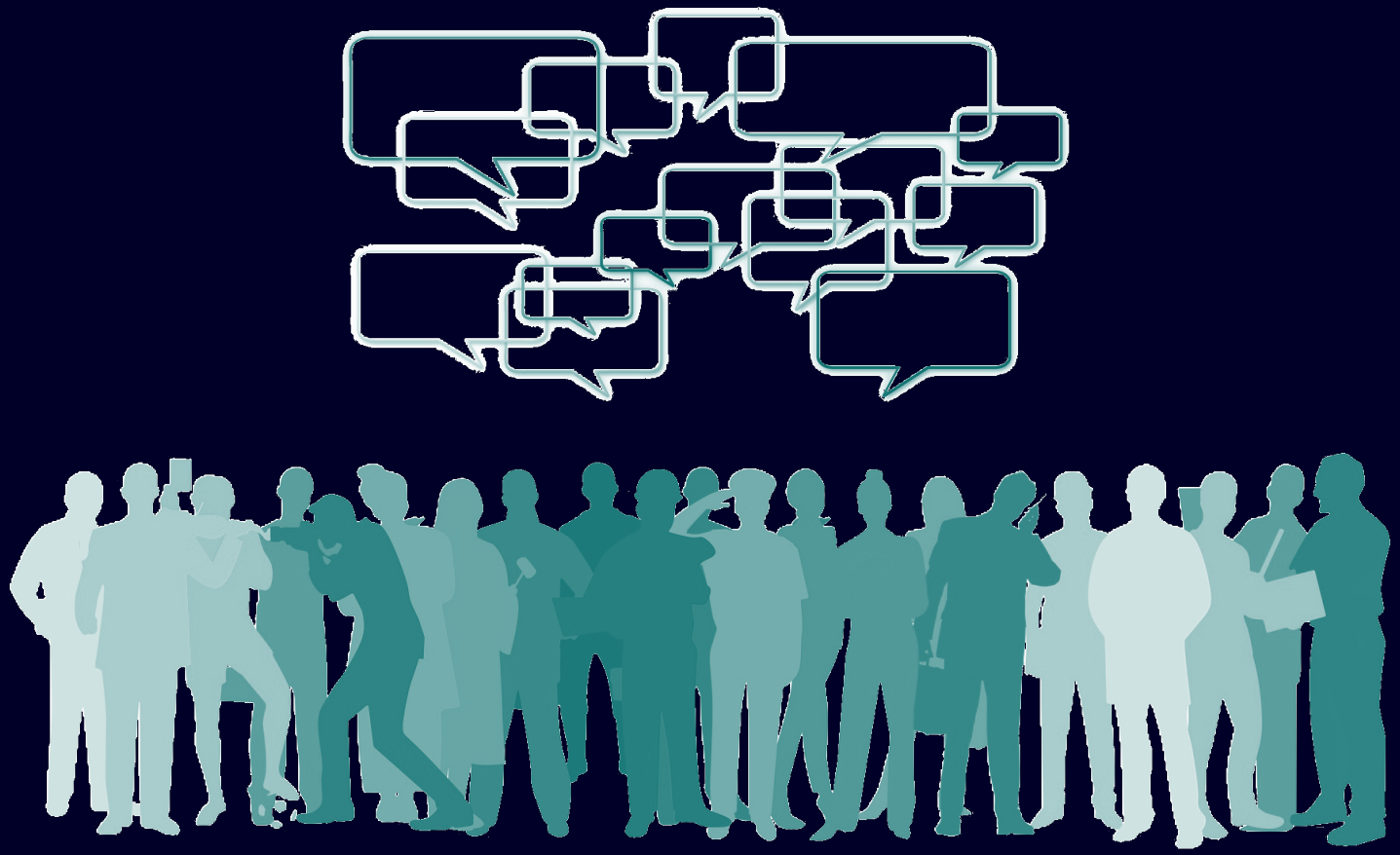
Thank you for your attention.



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