

Eco-Efficiency and **INDUSTRY4.**

Concept for Smart Eco-Efficiency Assessment in Composite Production

Composites Convention 2019: FUTURE FACTORY FOR COMPOSITES

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Department of Composite Technology

Institute of Composite Structures and Adaptive Systems



Knowledge for Tomorrow



Decision -Makers



**Decision
-Makers**



Eco-Efficiency



**Decision
-Makers**



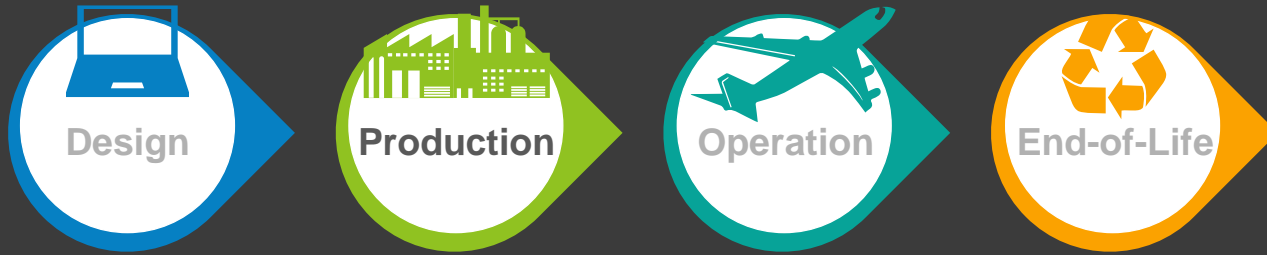
Eco-Efficiency



**Composite
Structures**



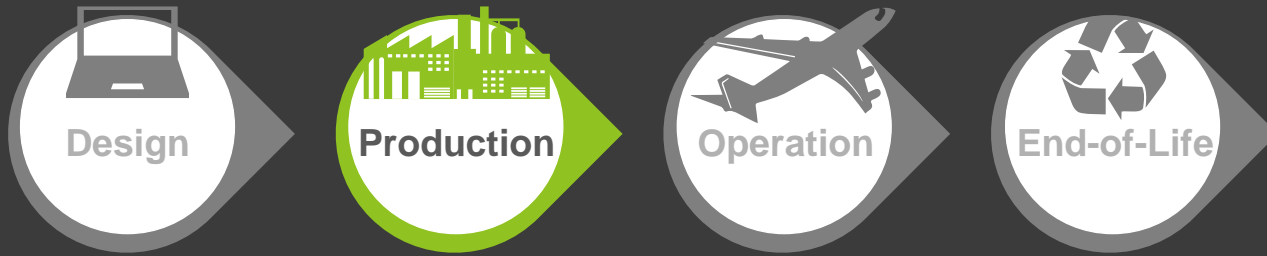
Life-Cycle Stages



Decision-Makers



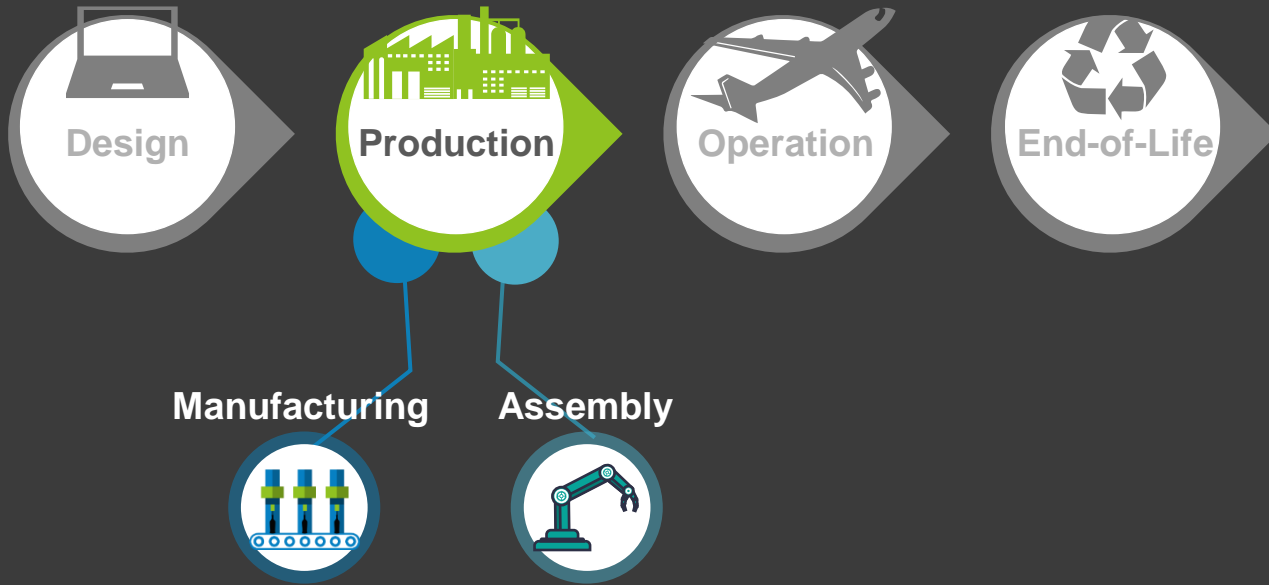
Life-Cycle Stages



Decision-Makers



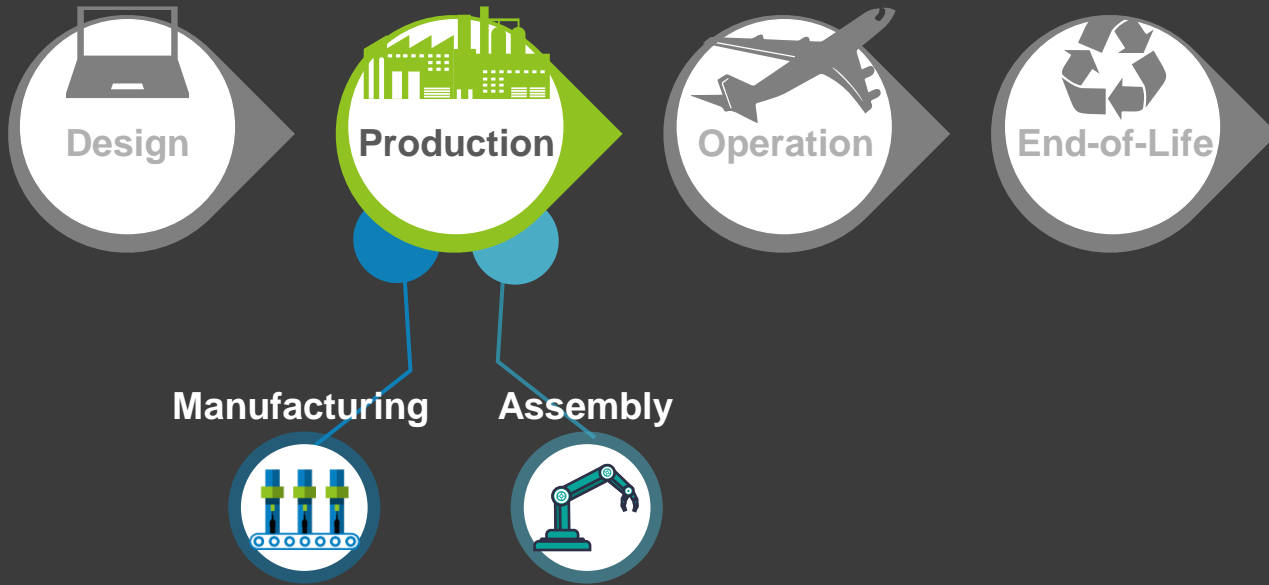
Life-Cycle Stages



Decision-Makers



Life-Cycle Stages



Key-Result-Indicators (KRI)



Decision-Makers



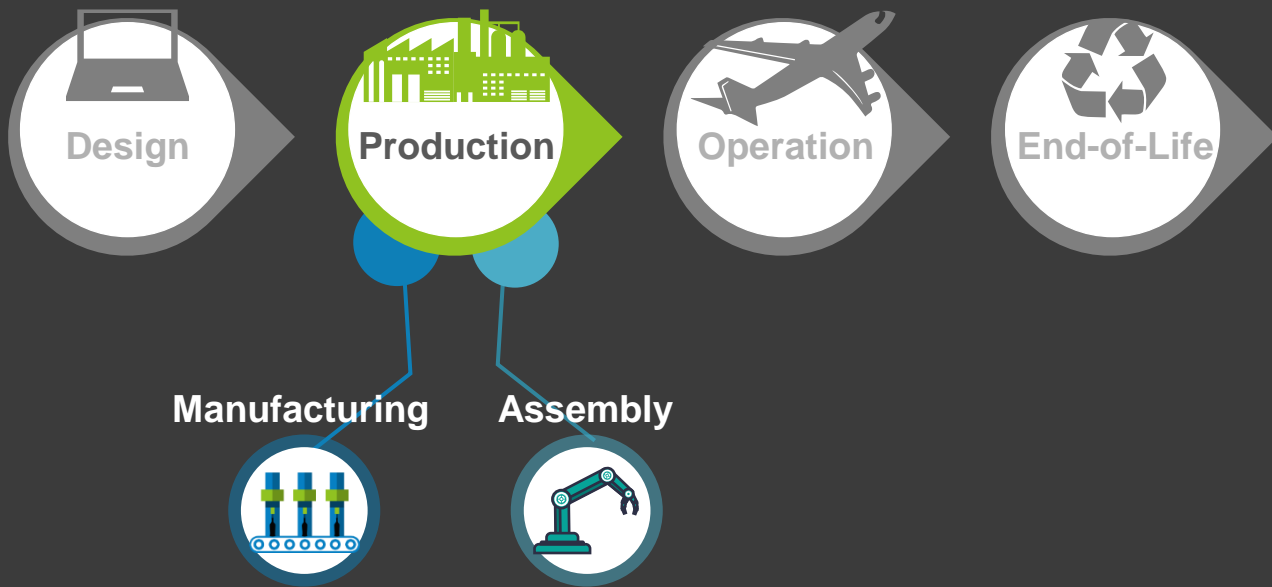
Eco-Efficiency



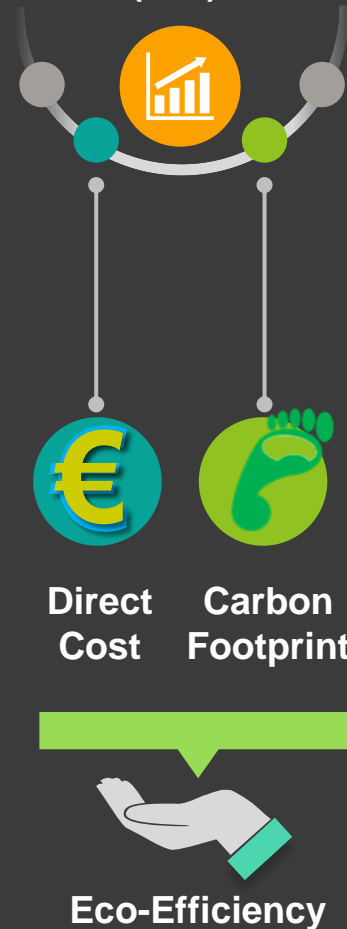
Composite Structures



Life-Cycle Stages



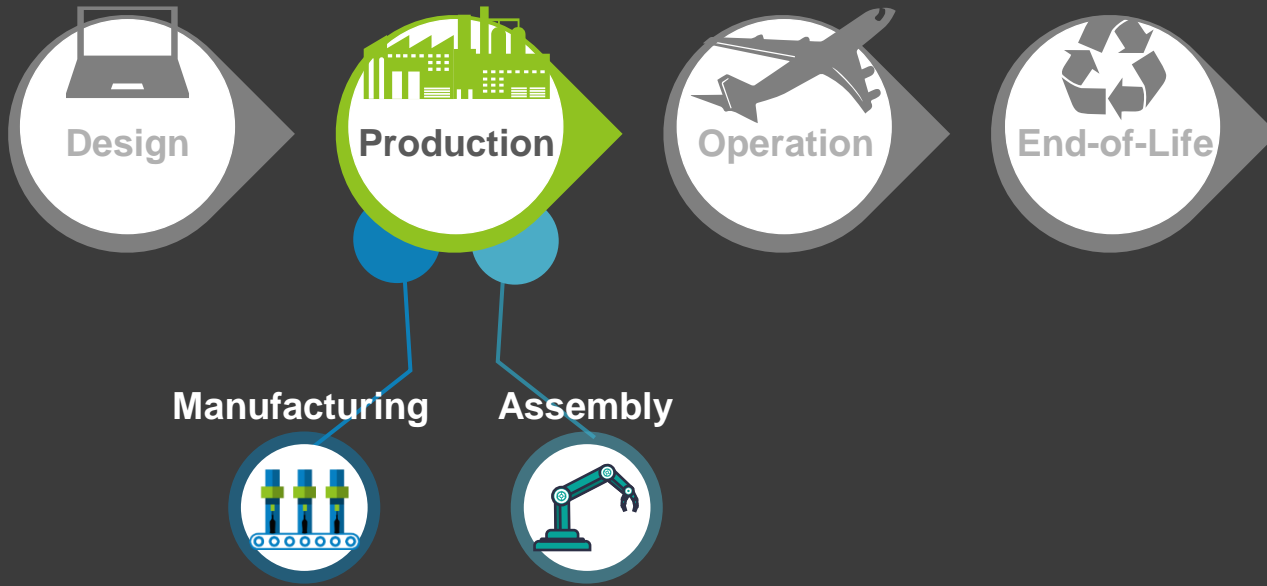
Key-Result-Indicators (KRI)



Decision-Makers



Life-Cycle Stages



Key-Result-Indicators (KRI)



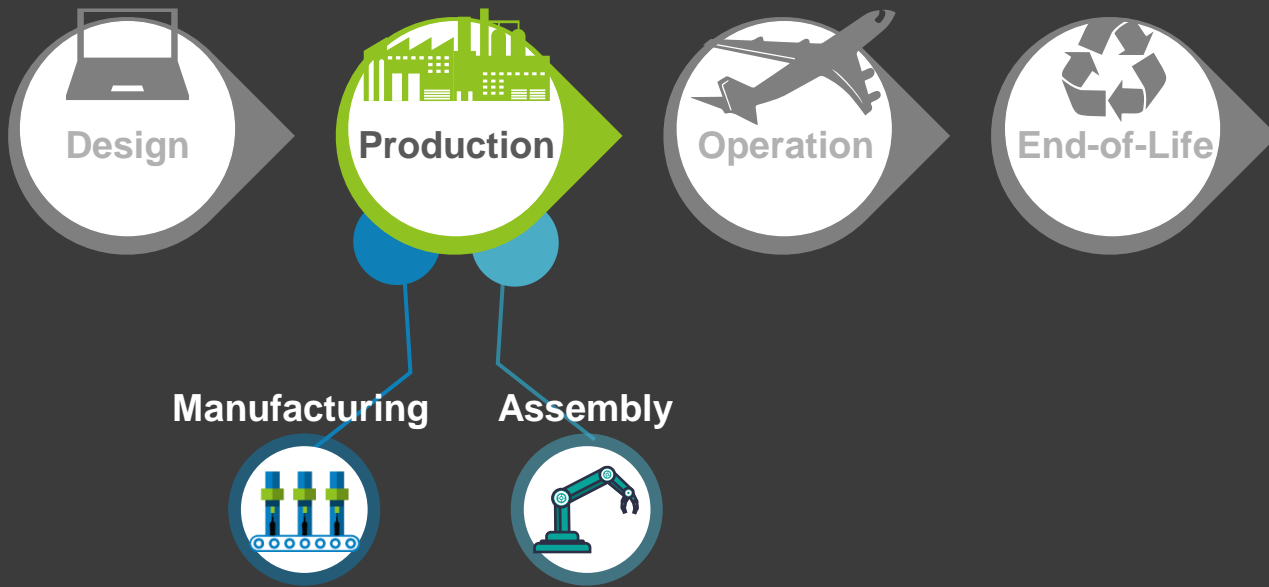
Decision Support System (DSS)



Decision-Makers



Life-Cycle Stages



Key-Result-Indicators (KRI)

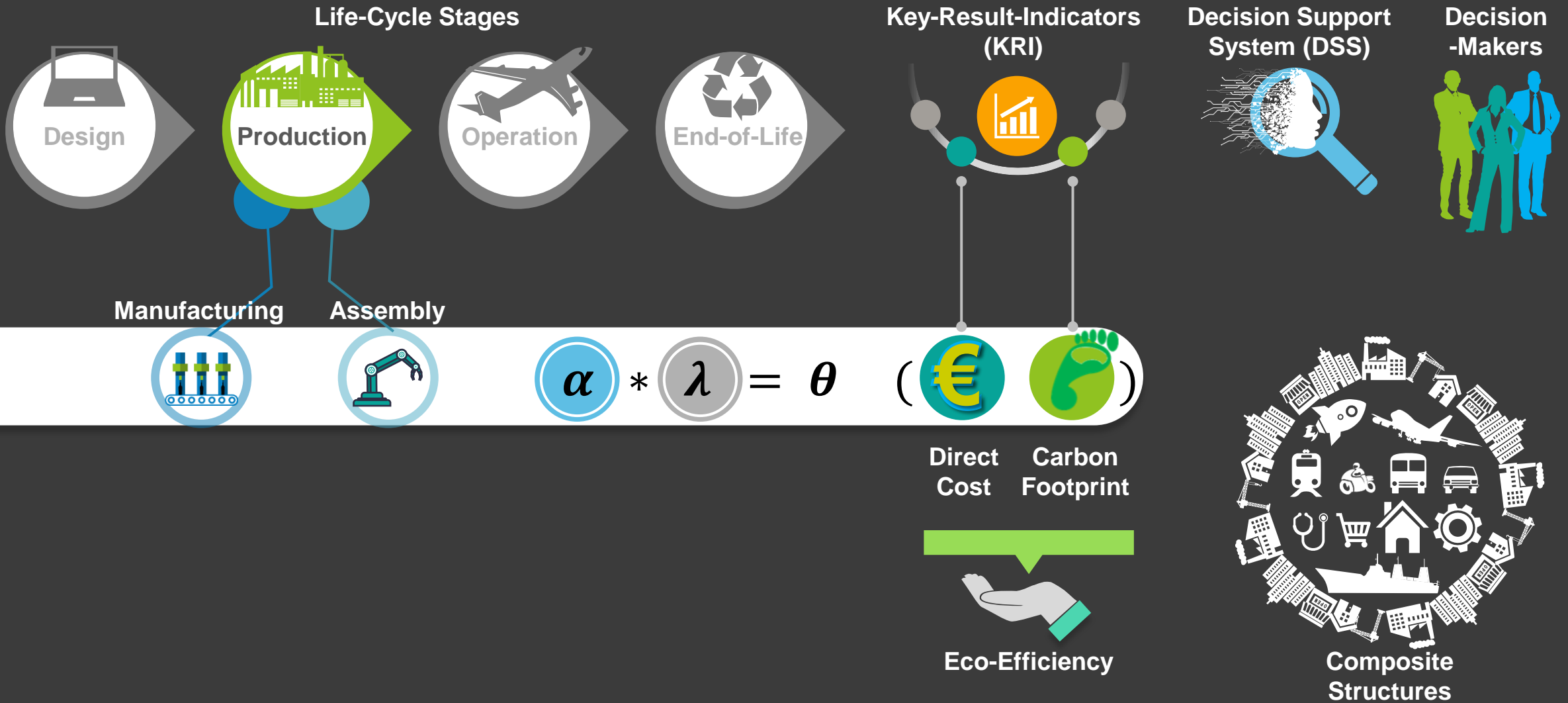


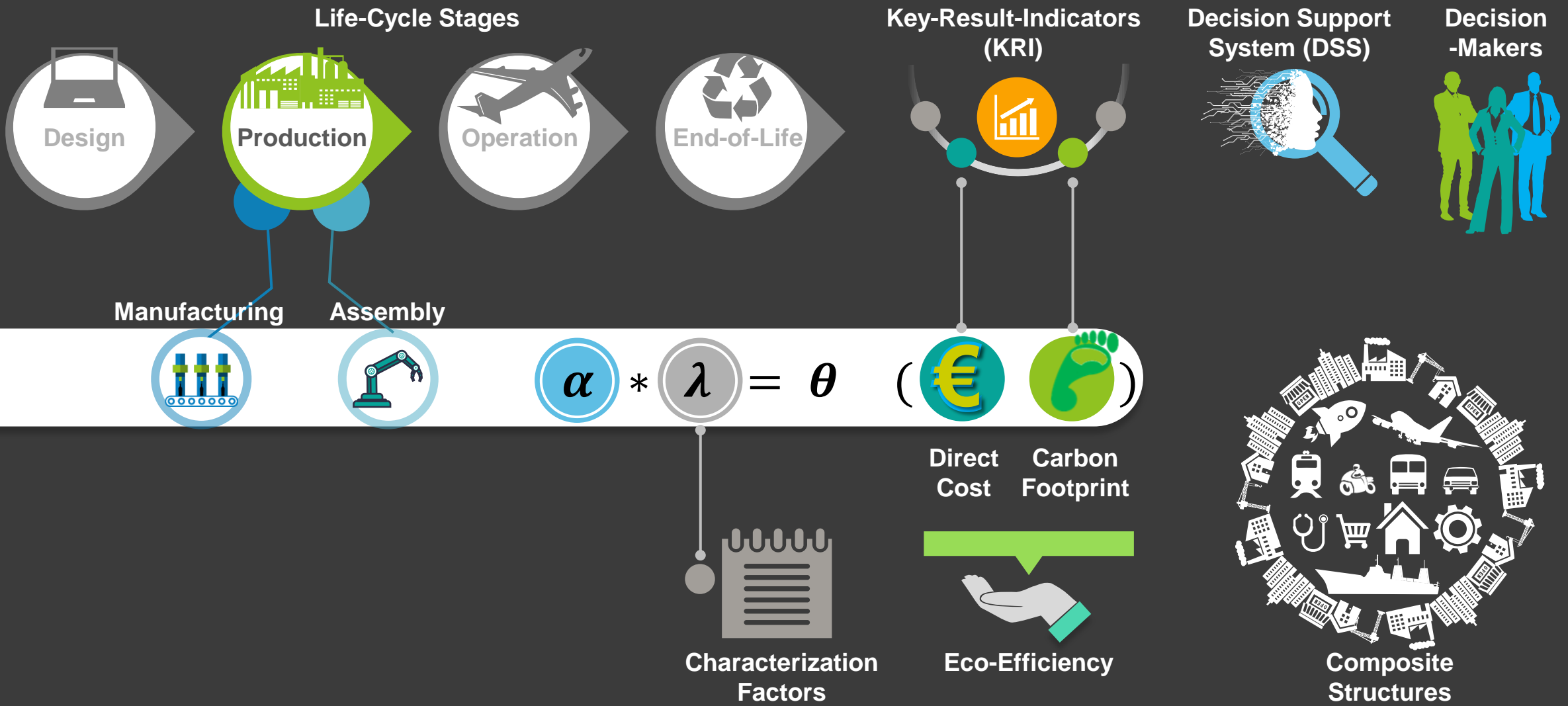
Decision Support System (DSS)

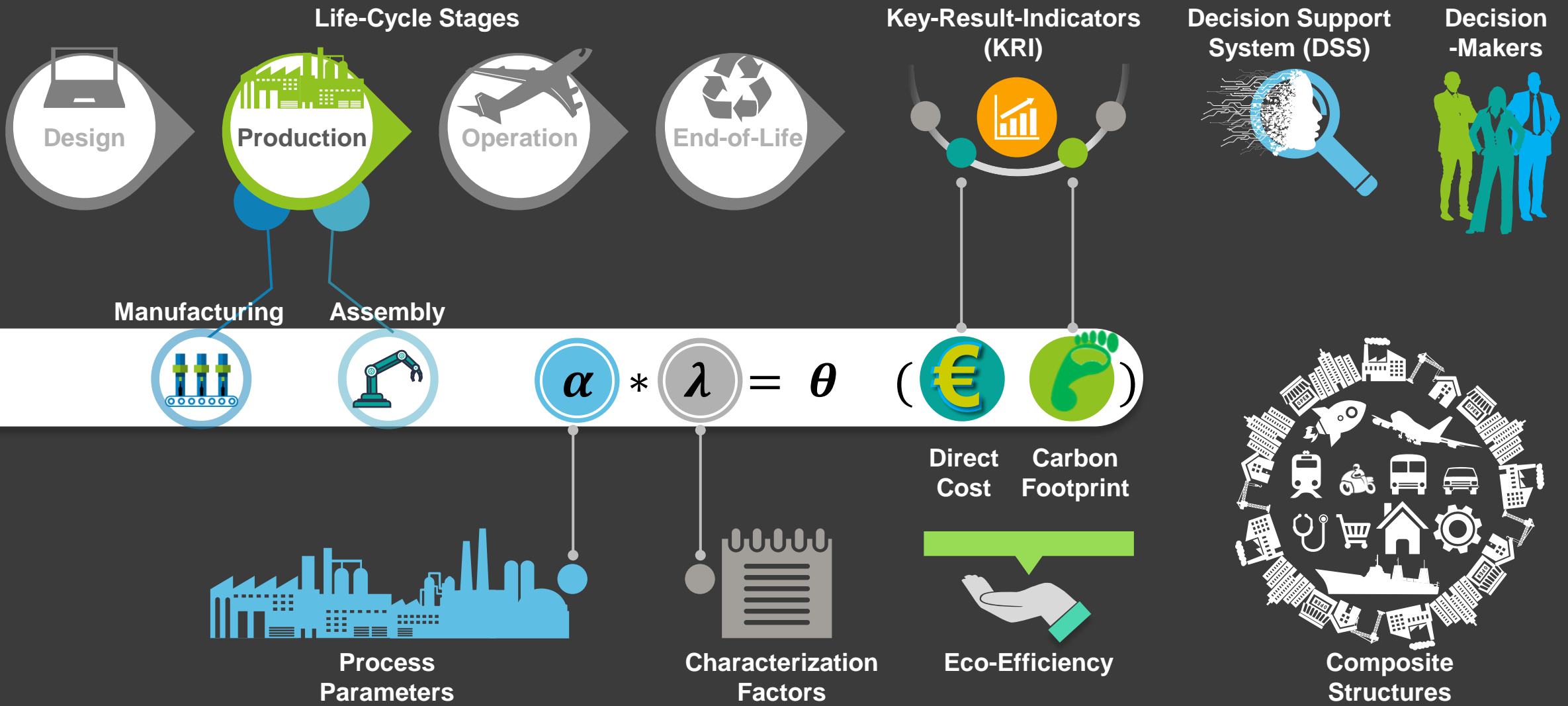


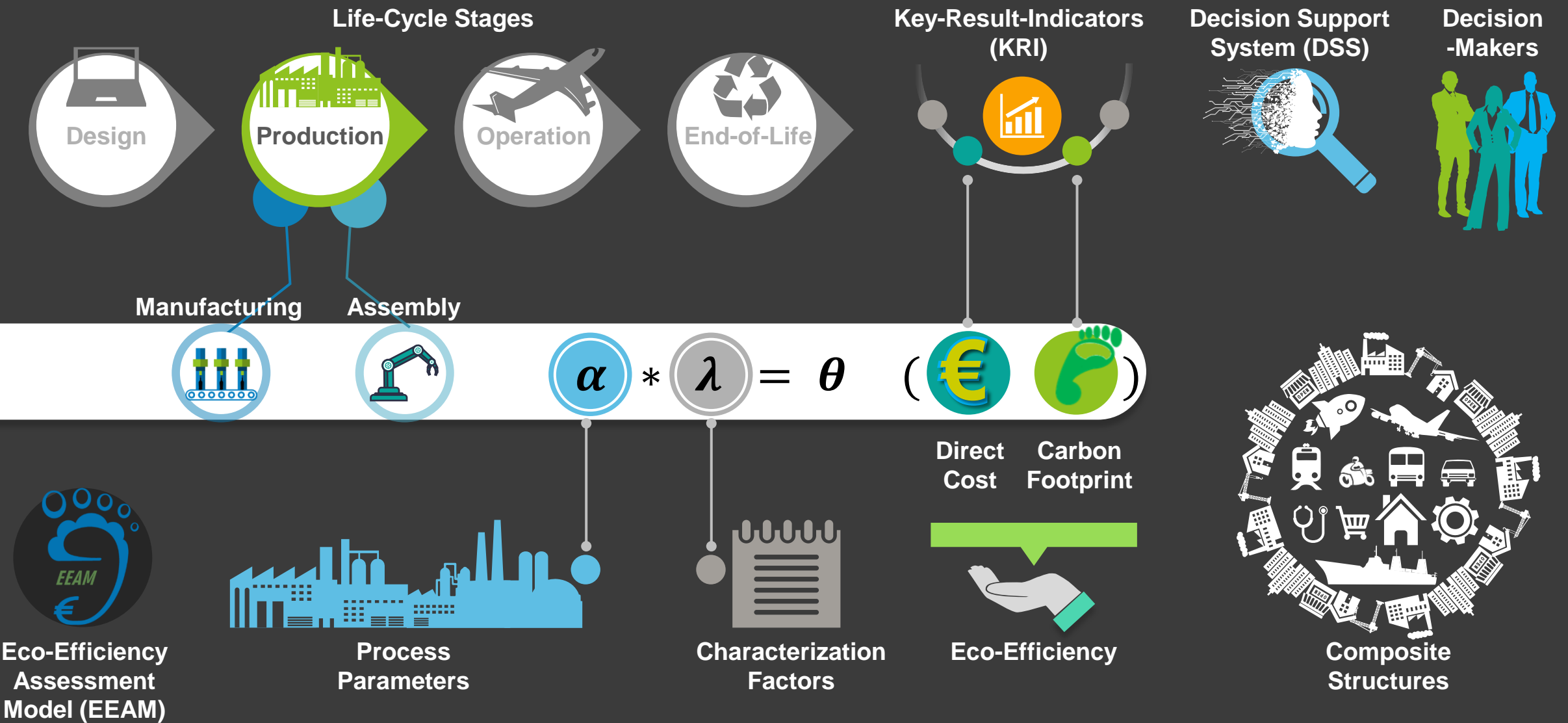
Decision-Makers











Decision -Makers



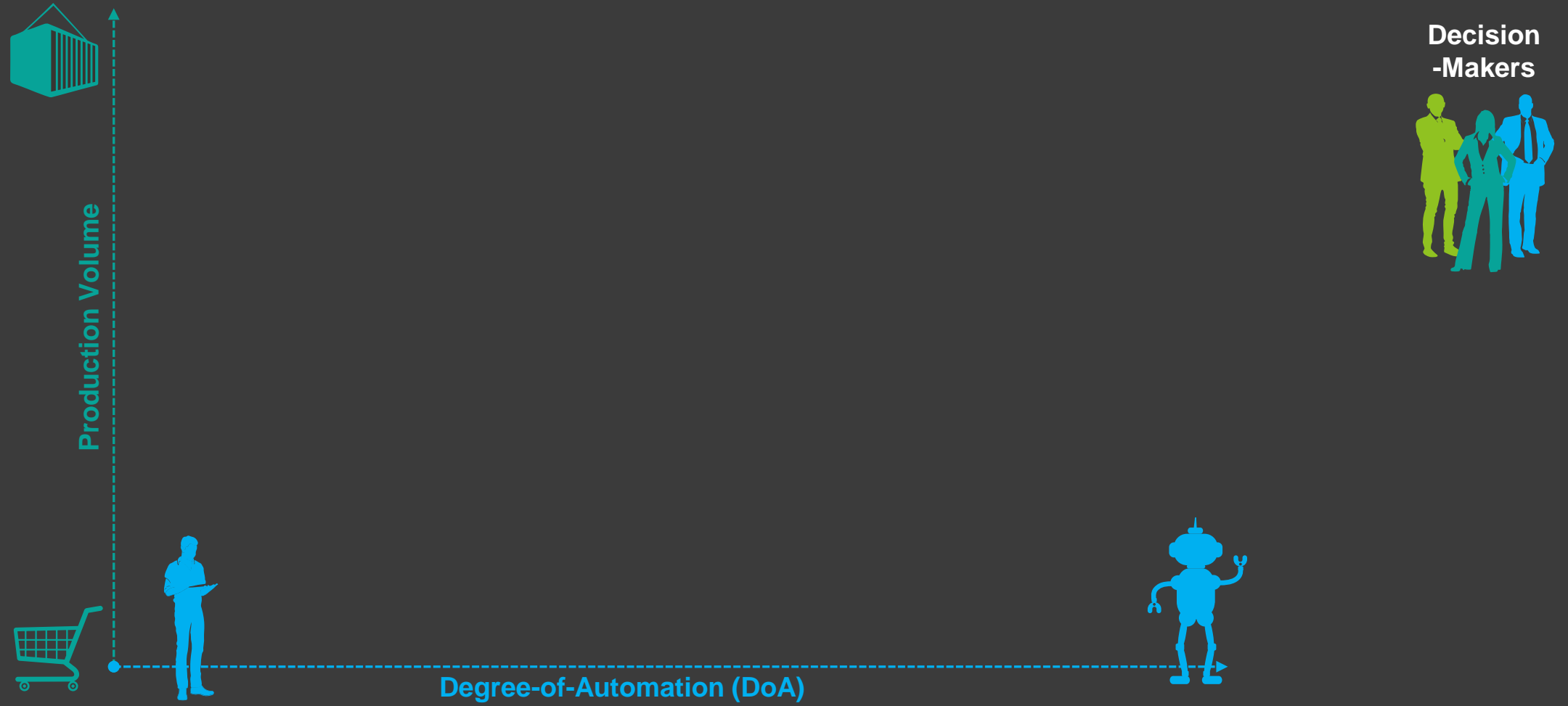


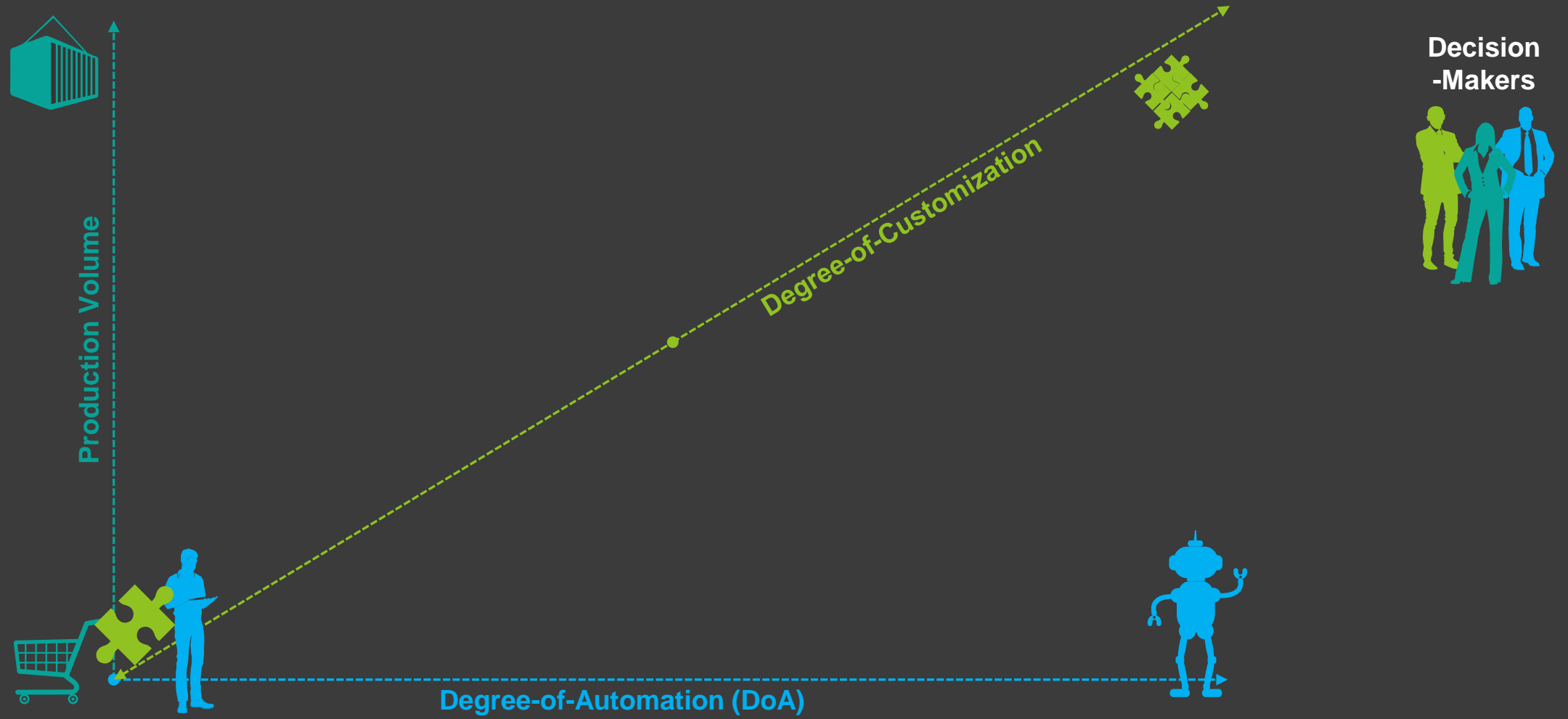
Production Volume

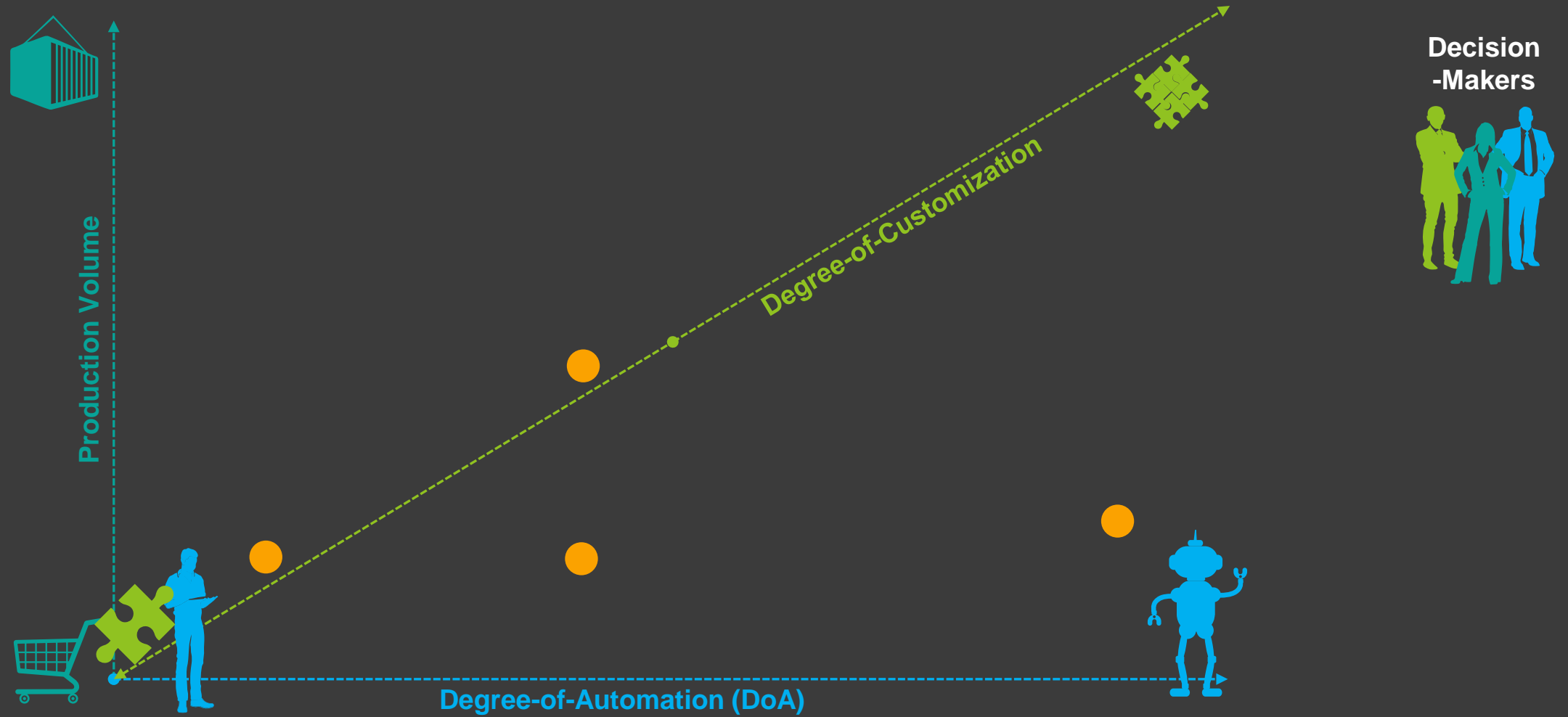


**Decision
-Makers**



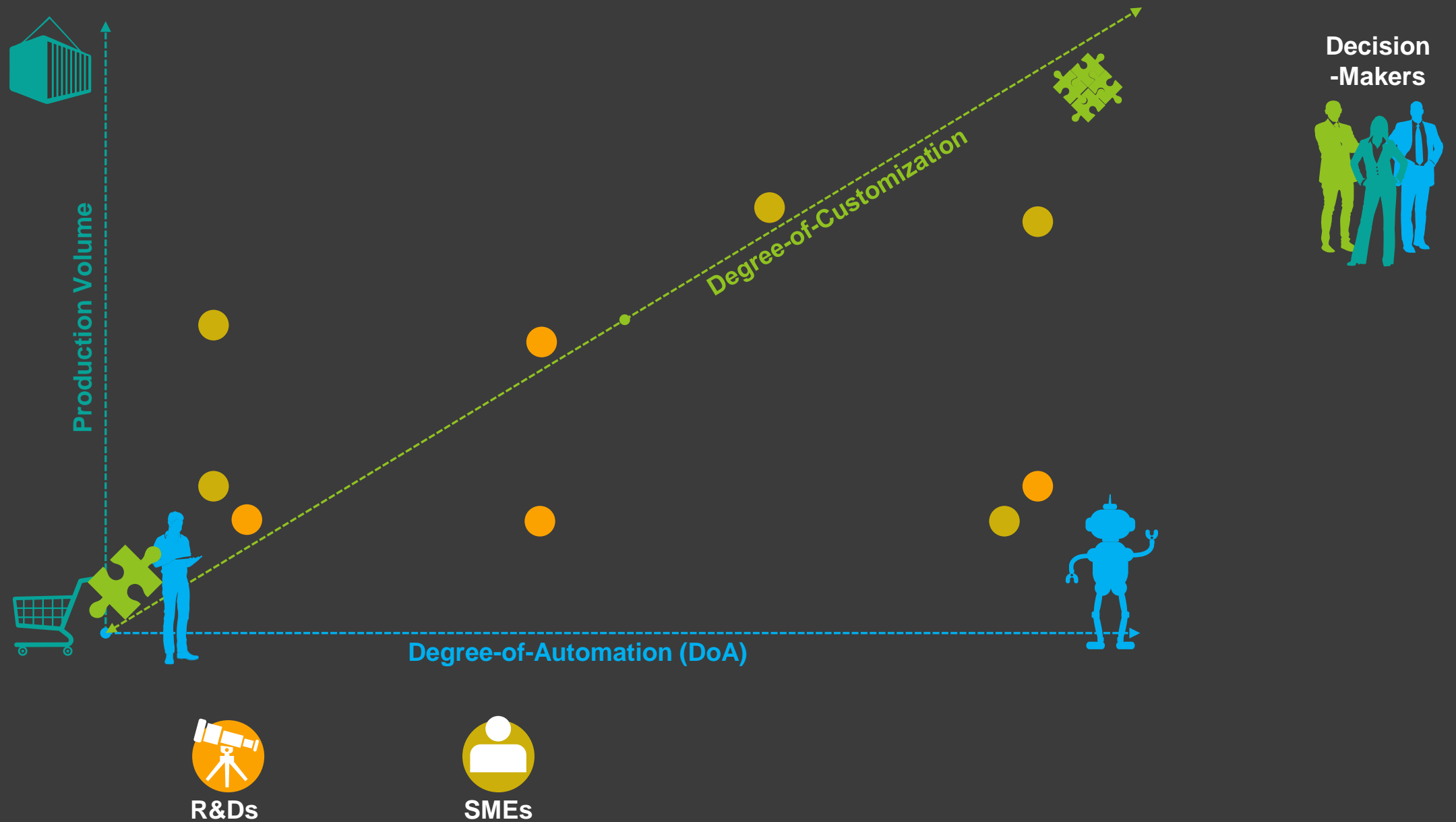


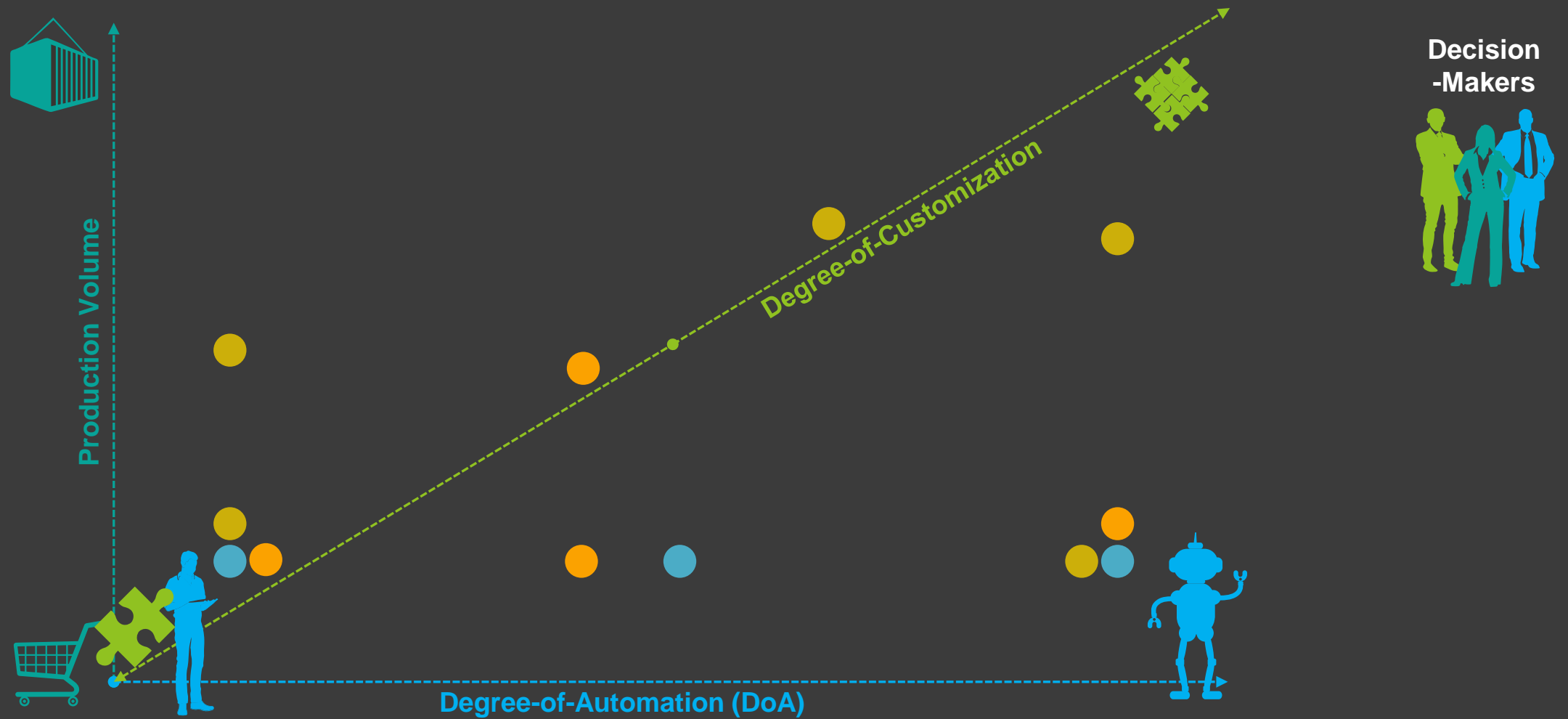




R&Ds







R&Ds

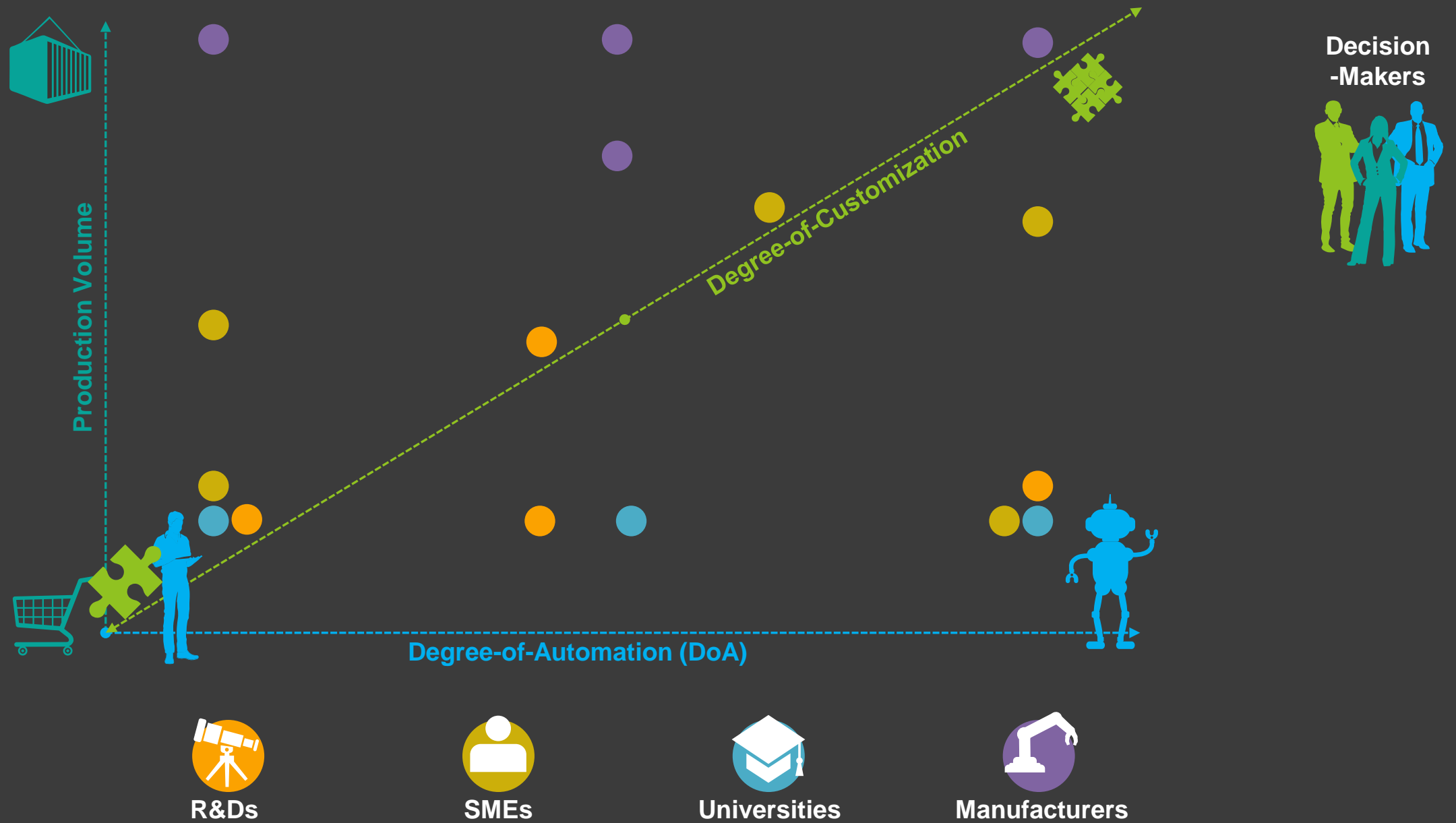


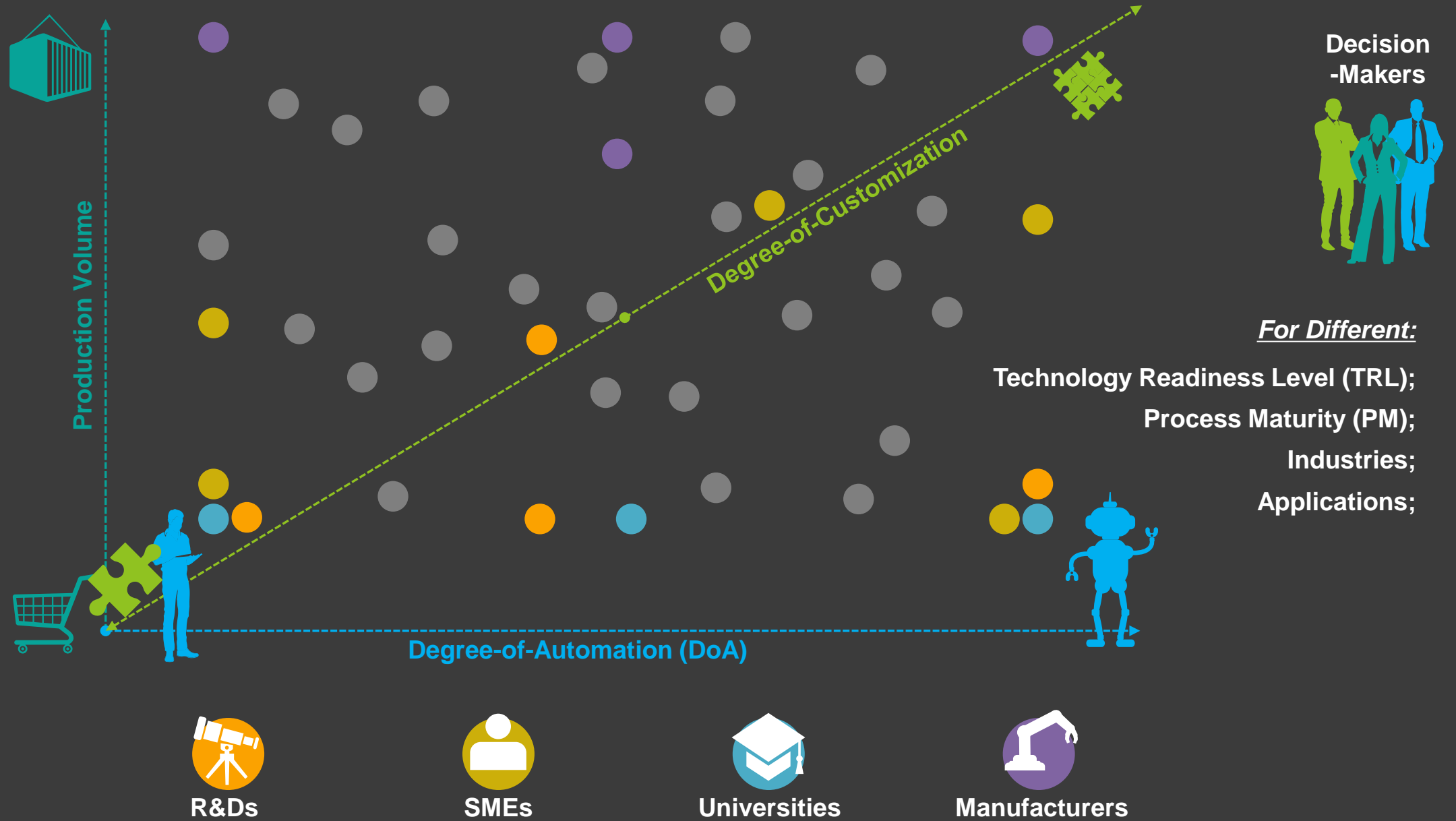
SMEs

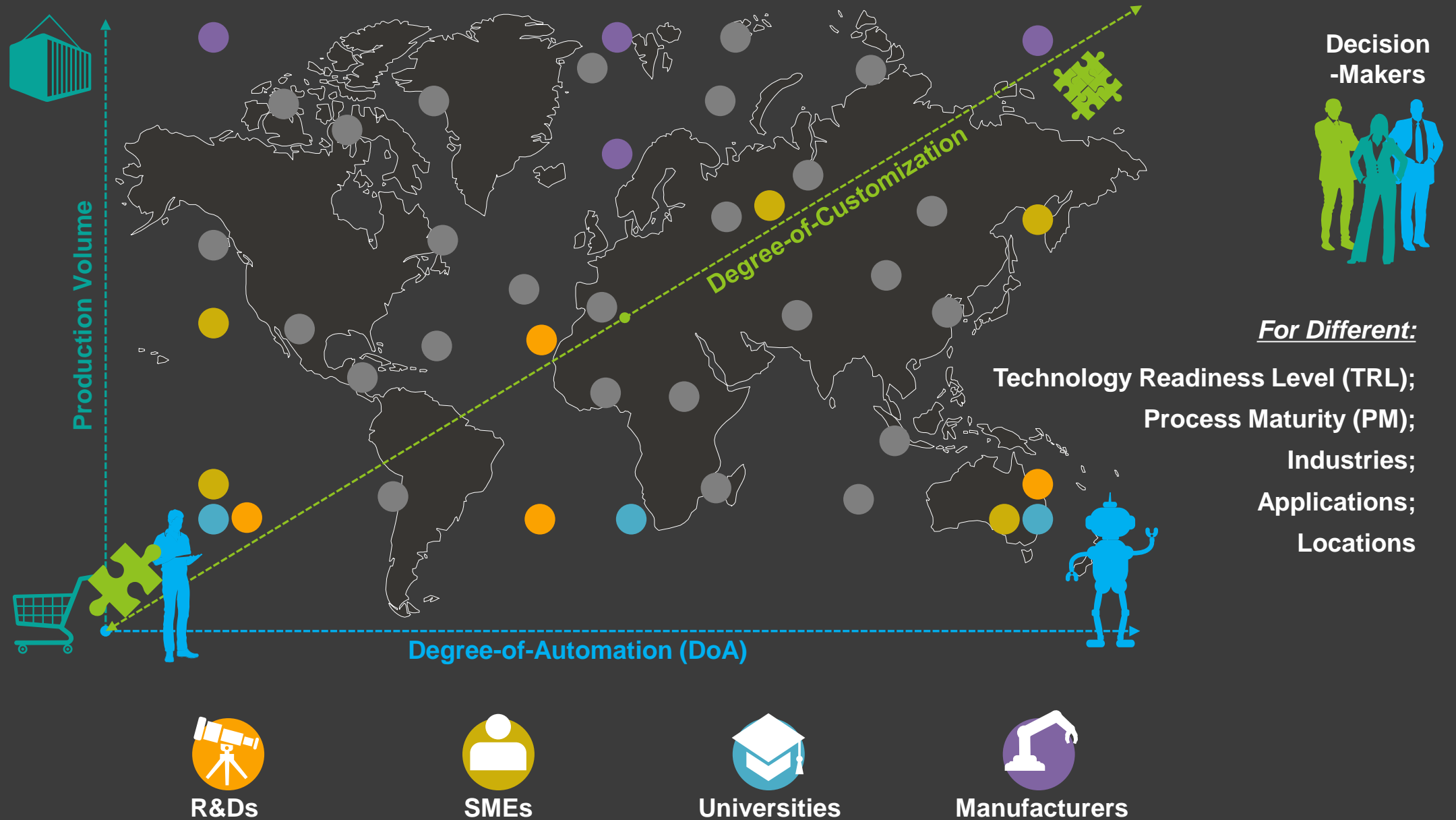


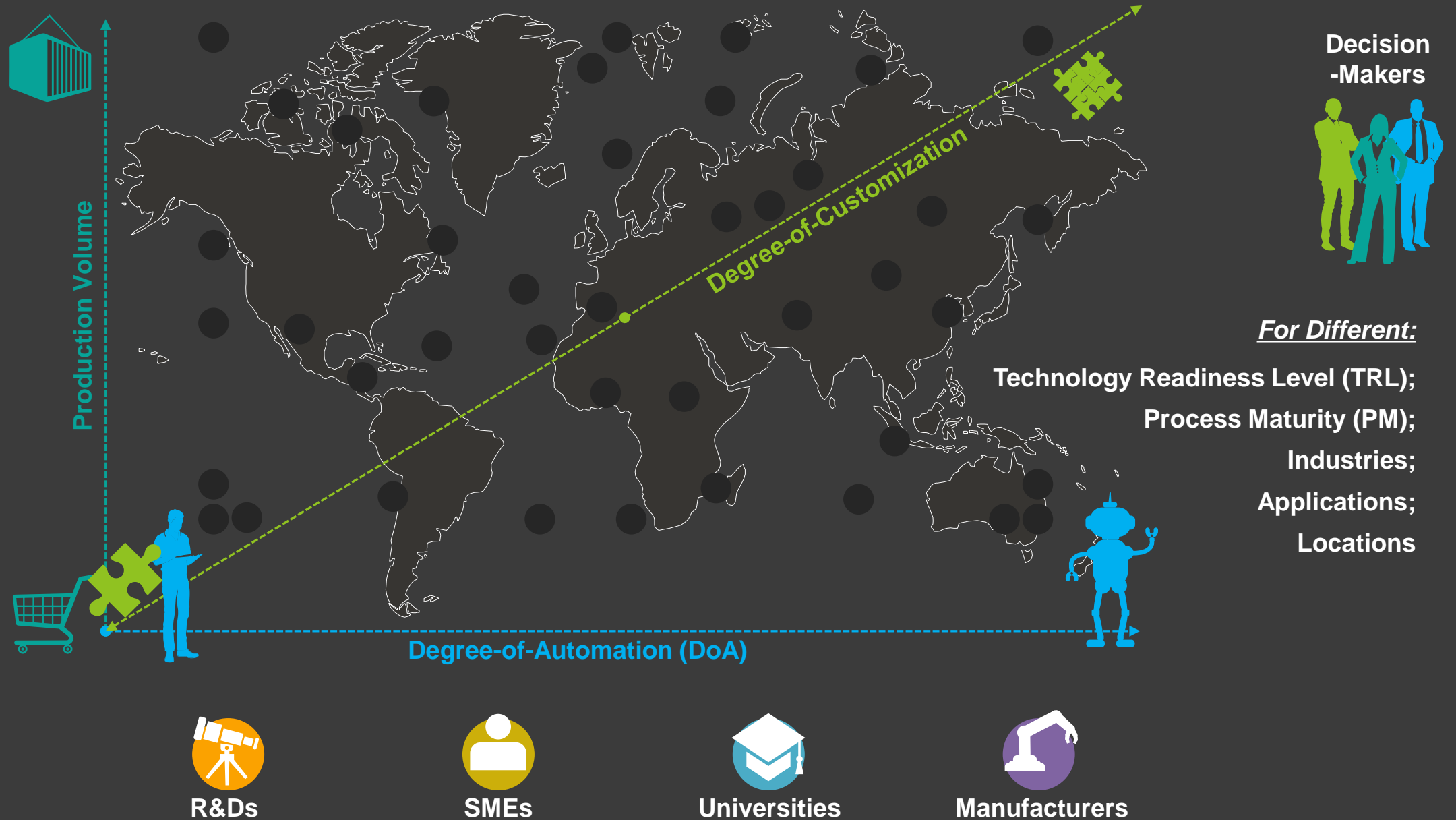
Universities

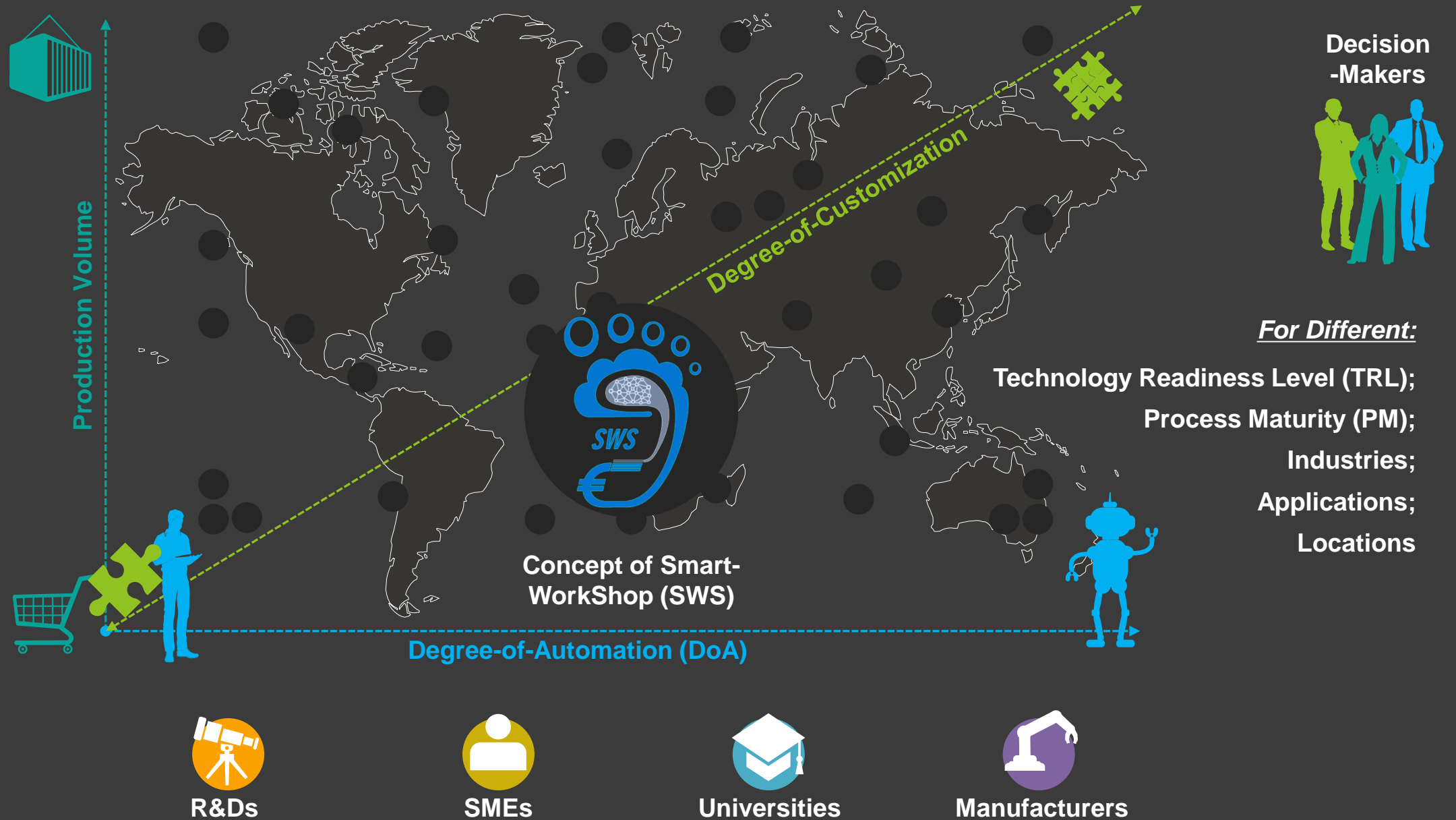


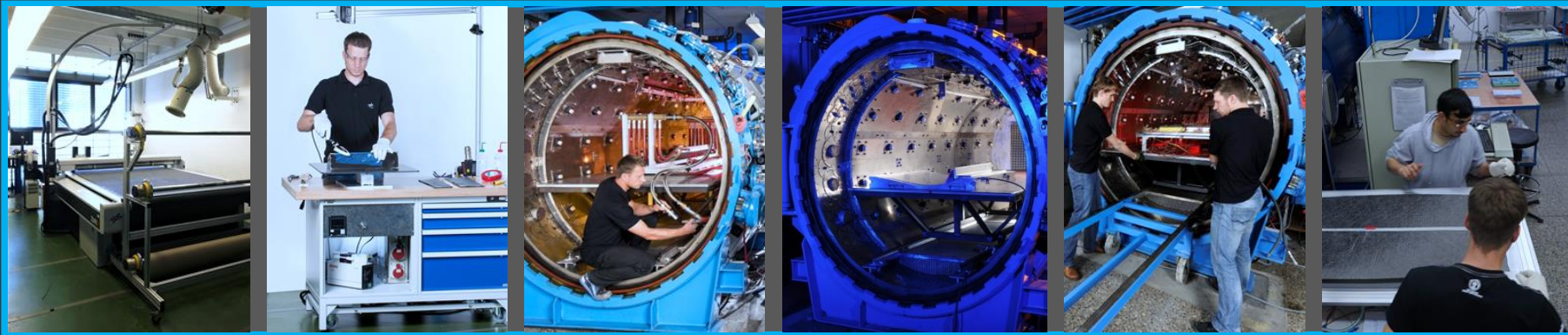








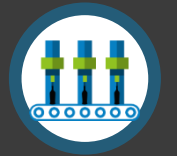




Technique 1:
Evo-Platform-
DLR Stade



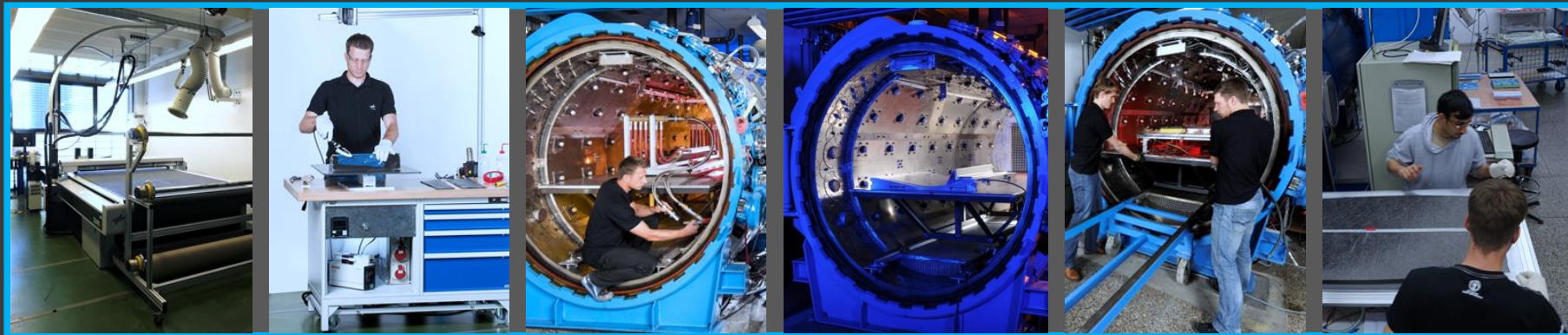
Manufacturing

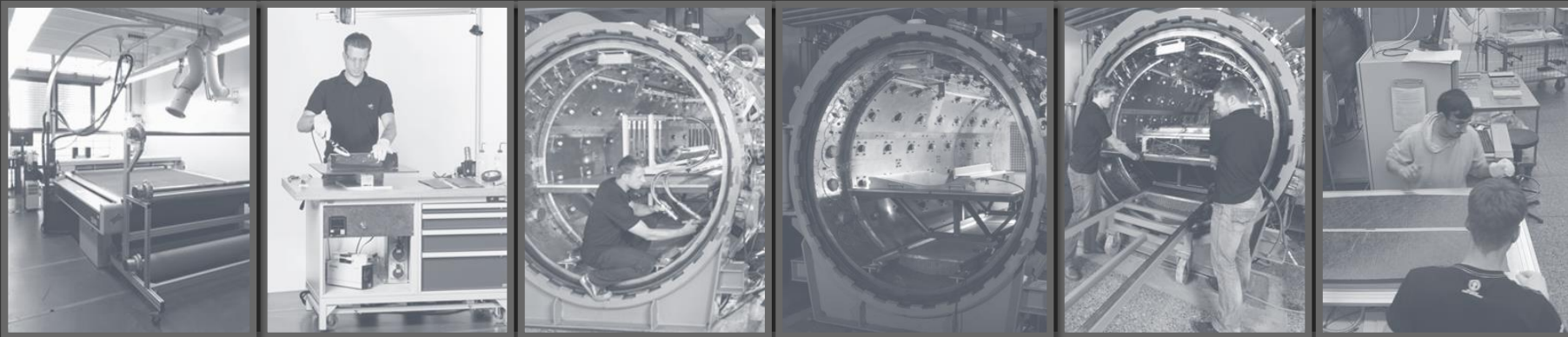
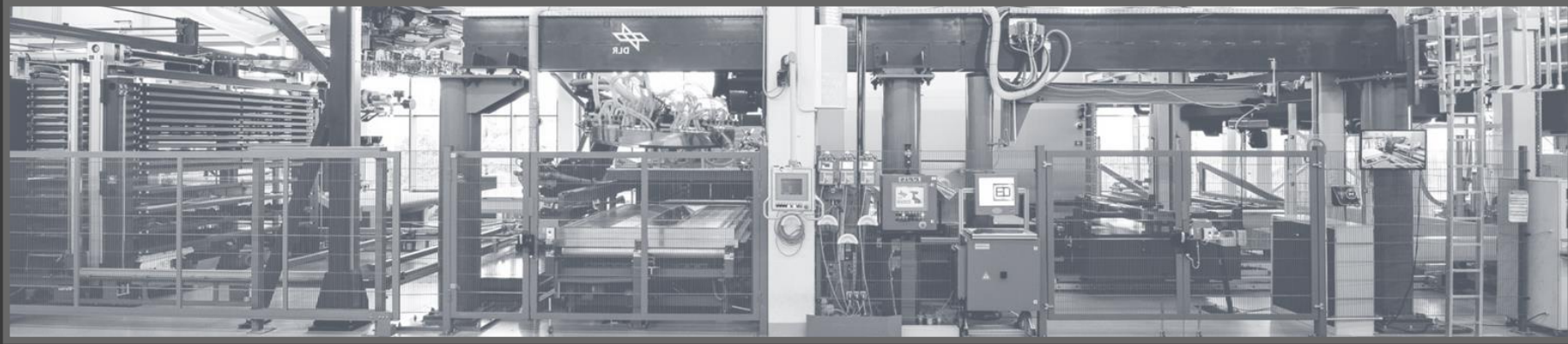


Different Techniques,
DoA, Industrialization, ...

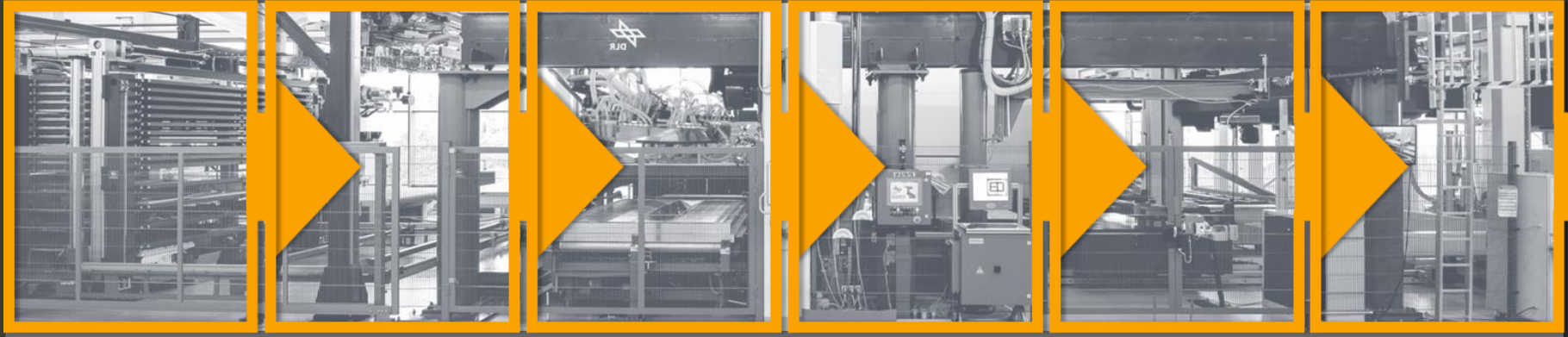
Reality

Technique n:
Laboratories
DLR Braunschweig



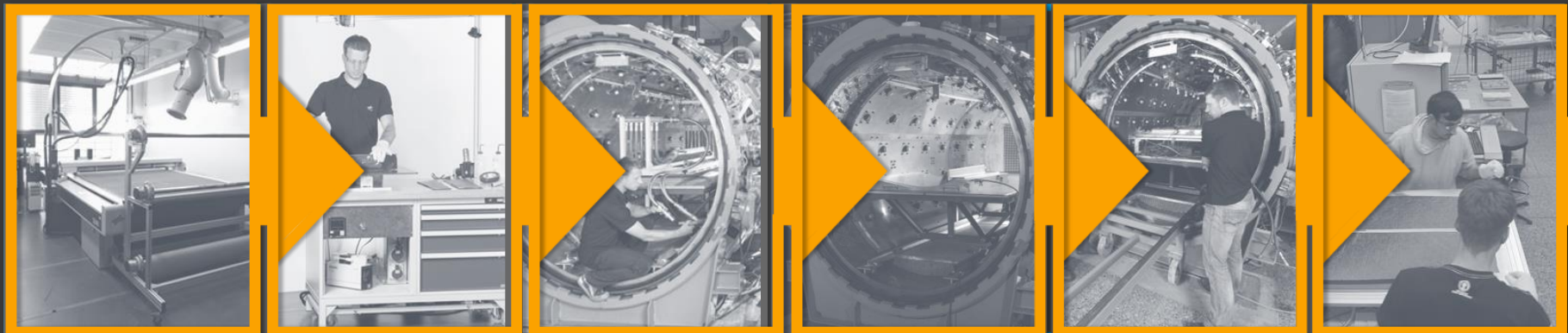


UP₁: Preparing **UP₂: Cutting** **UP₃: Preforming** **UP₄: Trimming** **UP₅: Curing** **UP₆: Demolding**



Discretization, Unit Process (UP)

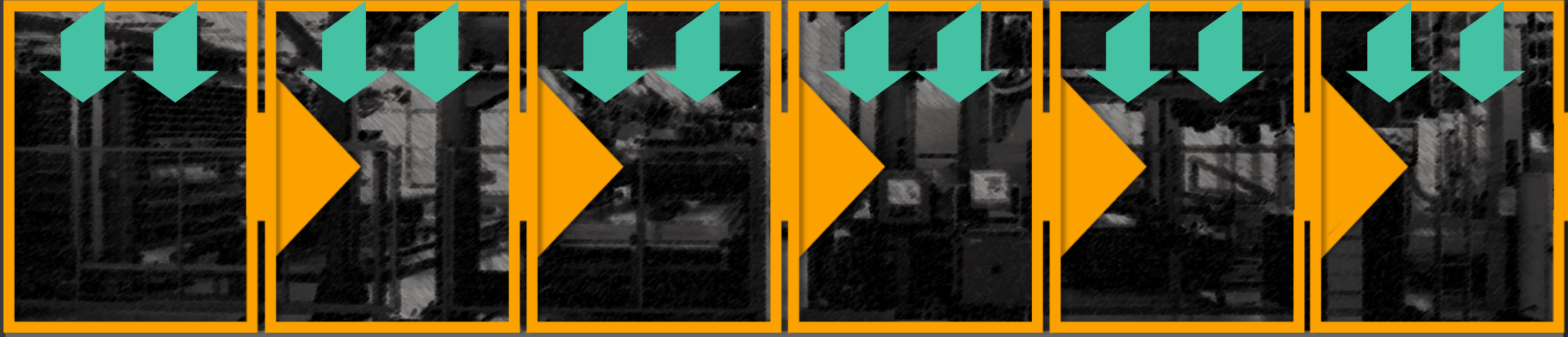
Conceptual Model



UP₂: Cutting **UP₃: Preforming** **UP₁: Preparing** **UP₅: Curing** **UP₆: Demolding** **UP₄: Trimming**

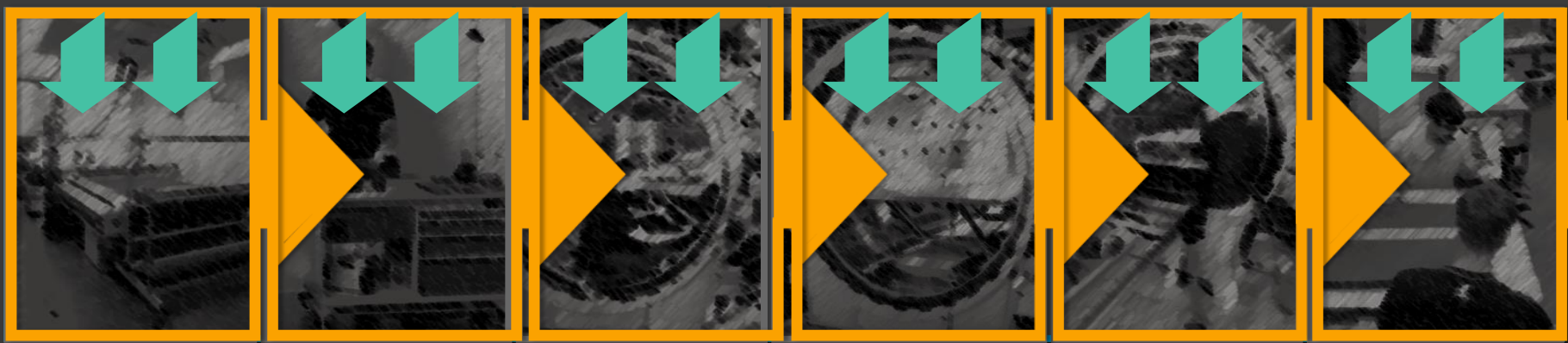


UP₁: Preparing **UP₂: Cutting** **UP₃: Preforming** **UP₄: Trimming** **UP₅: Curing** **UP₆: Demolding**



Elementary Flows
(Inputs)

Conceptual Model



UP₂: Cutting **UP₃: Preforming** **UP₁: Preparing** **UP₅: Curing** **UP₆: Demolding** **UP₄: Trimming**



UP₁: Preparing **UP₂: Cutting** **UP₃: Preforming** **UP₄: Trimming** **UP₅: Curing** **UP₆: Demolding**

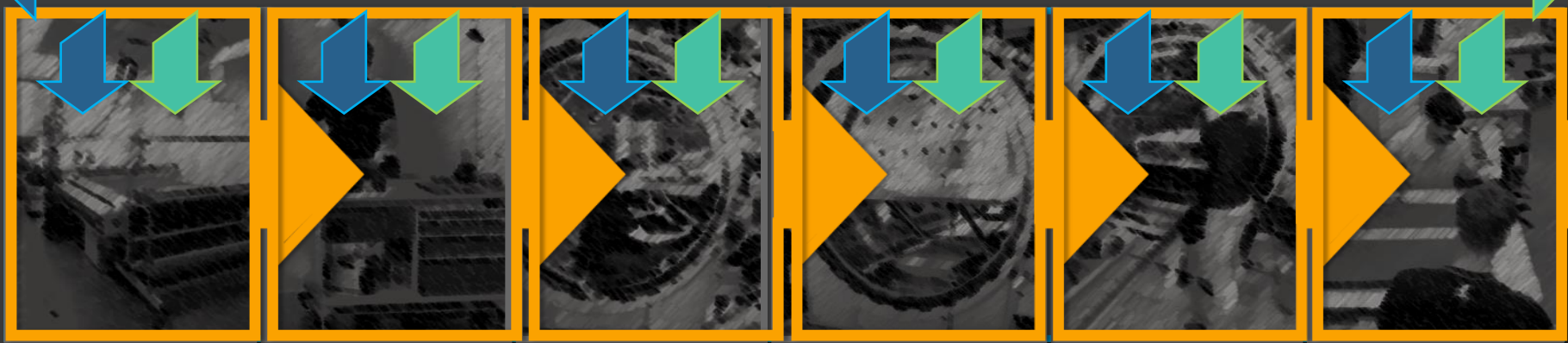


Elementary Flows (Inputs)

Conceptual Model

Material

Energy



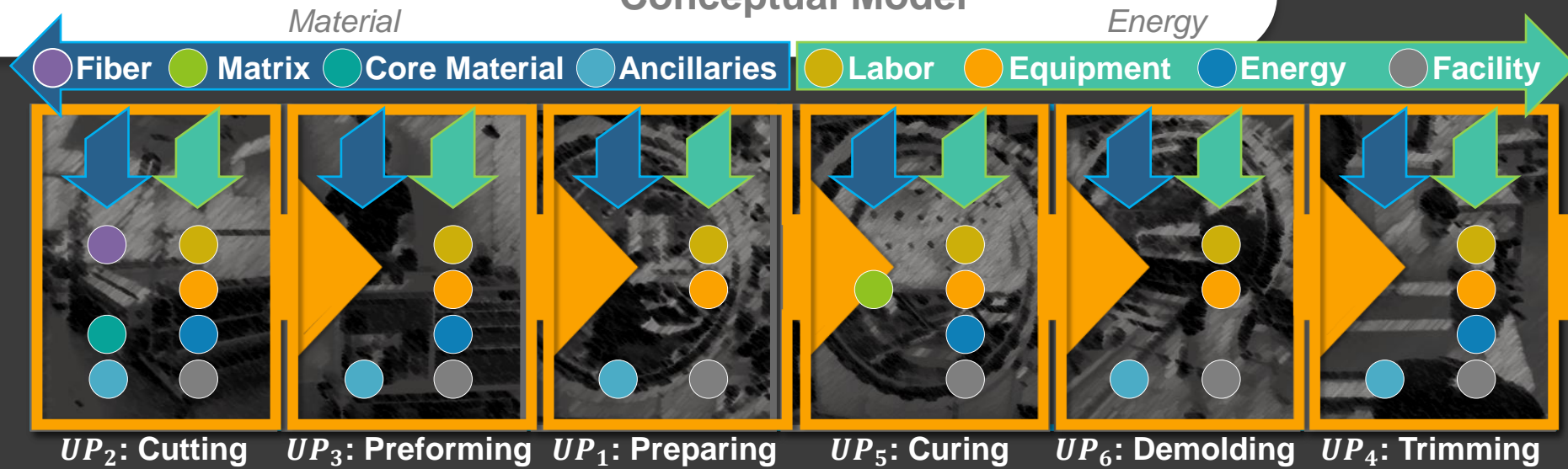
UP₂: Cutting **UP₃: Preforming** **UP₁: Preparing** **UP₅: Curing** **UP₆: Demolding** **UP₄: Trimming**





Elementary Flows (Inputs)

Conceptual Model



UP₁: Preparing **UP₂: Cutting** **UP₃: Preforming** **UP₄: Trimming** **UP₅: Curing** **UP₆: Demolding**

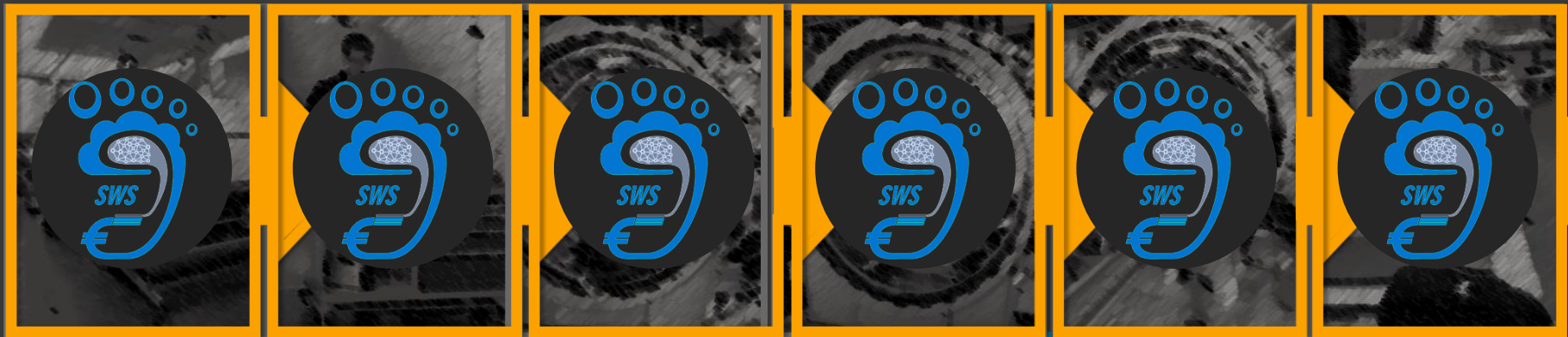


Elementary Flows (Inputs)

What? How much? When? Where?

Conceptual Model

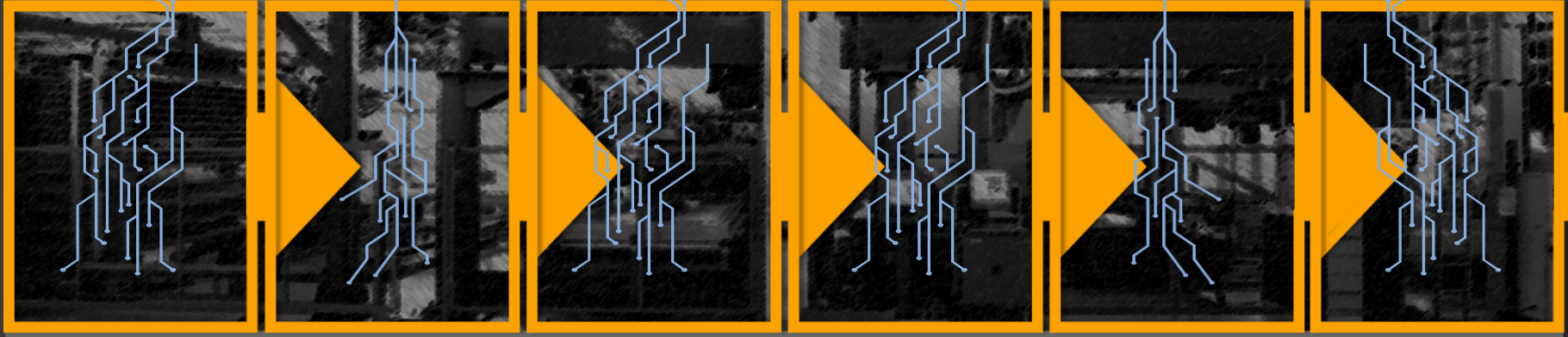
4.  INDUSTRY



UP₂: Cutting **UP₃: Preforming** **UP₁: Preparing** **UP₅: Curing** **UP₆: Demolding** **UP₄: Trimming**



UP₁: Preparing **UP₂: Cutting** **UP₃: Preforming** **UP₄: Trimming** **UP₅: Curing** **UP₆: Demolding**



Sensor Nodes

What? How much? When? Where?

Conceptual Model

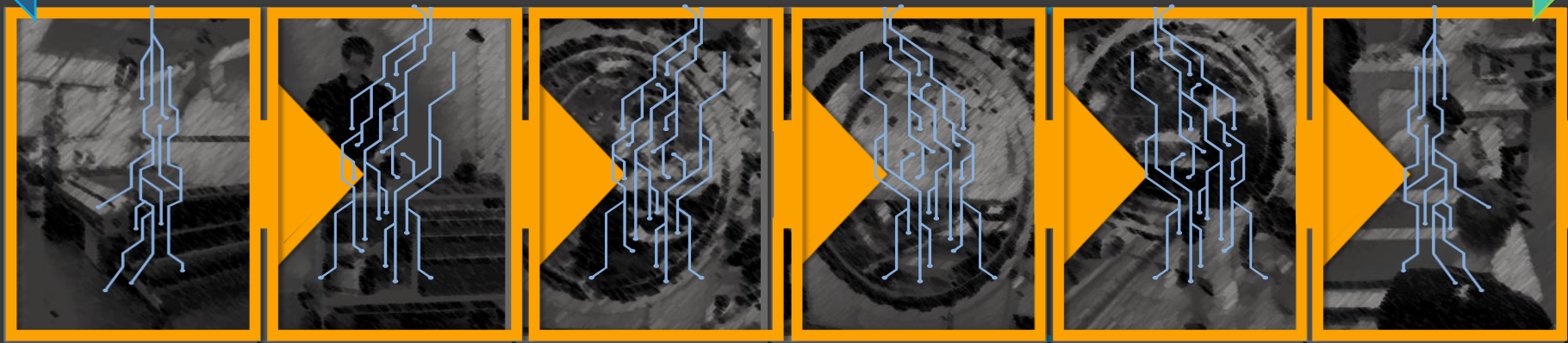
4. 
INDUSTRY

 **Optical Detection**

 **Mass Measurement**

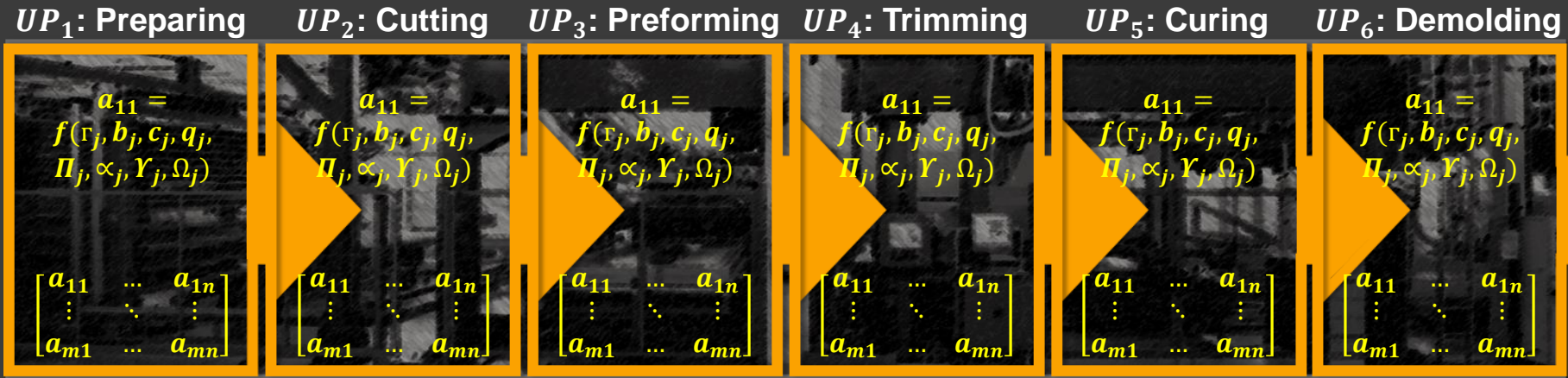
 **Thermal Detection**

 **Energy Measurement**



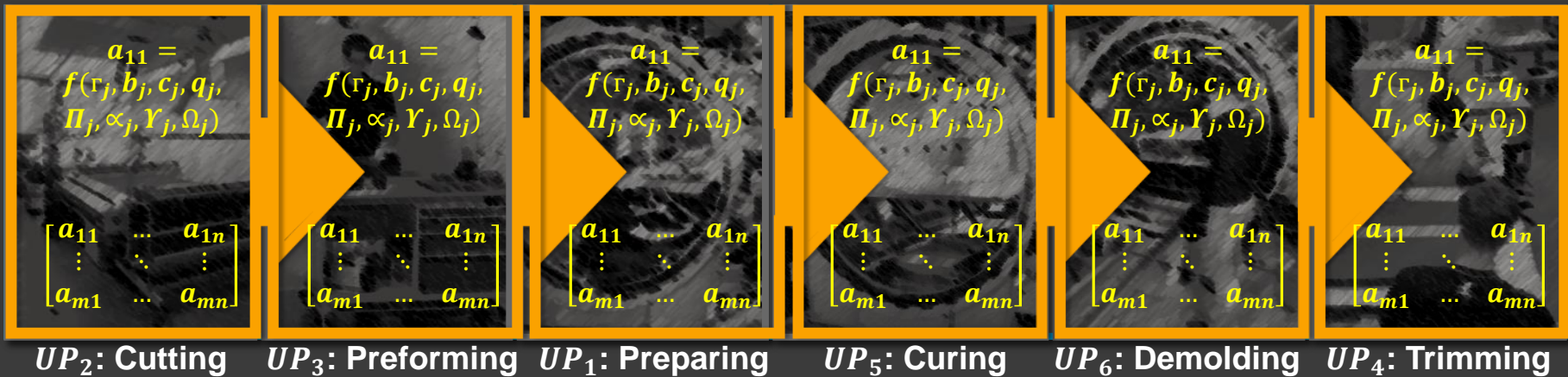
UP₂: Cutting **UP₃: Preforming** **UP₁: Preparing** **UP₅: Curing** **UP₆: Demolding** **UP₄: Trimming**

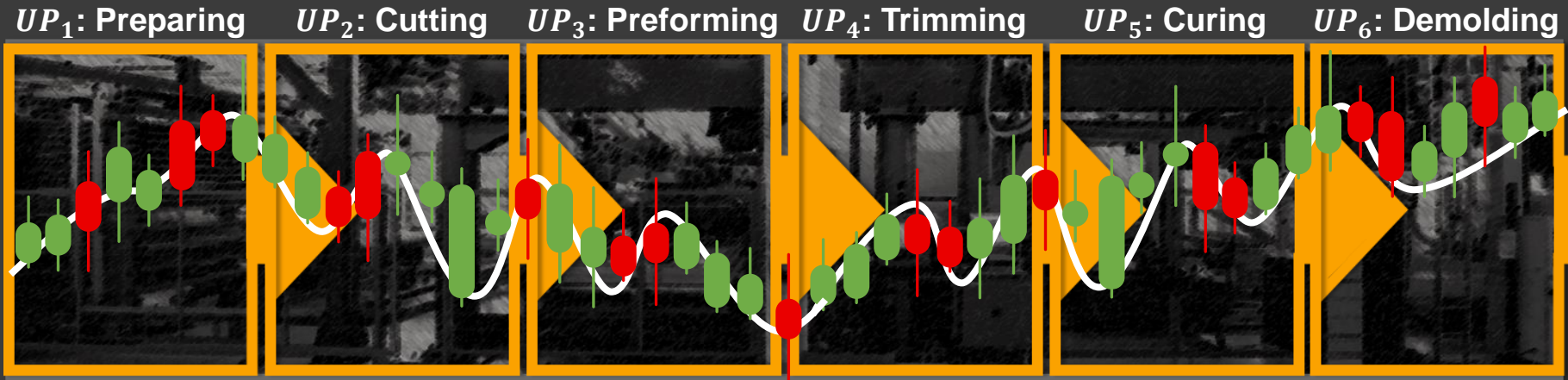




Data Processing Algorithms,
Process Matrix

Mathematical Model

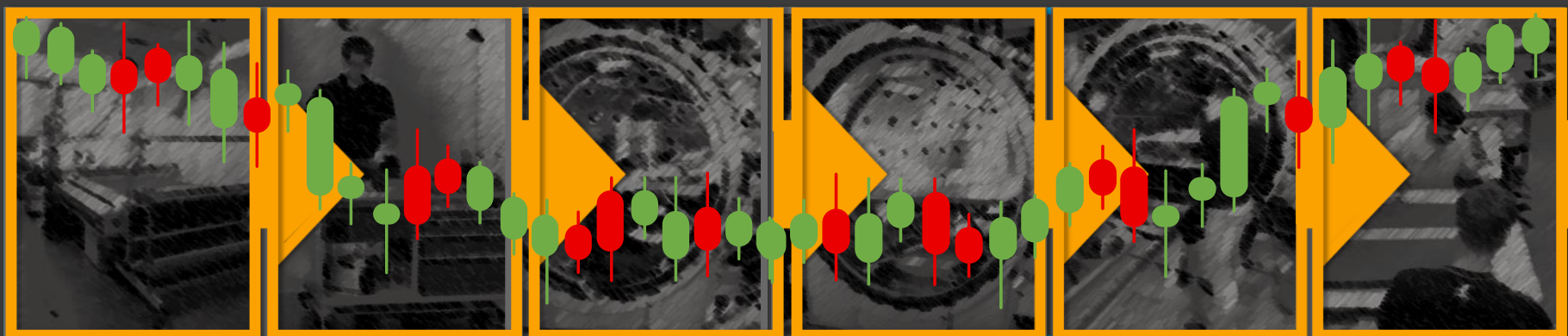




Graphical User Interface (GUI),
Real-Time Eco-Efficiency
Assessment

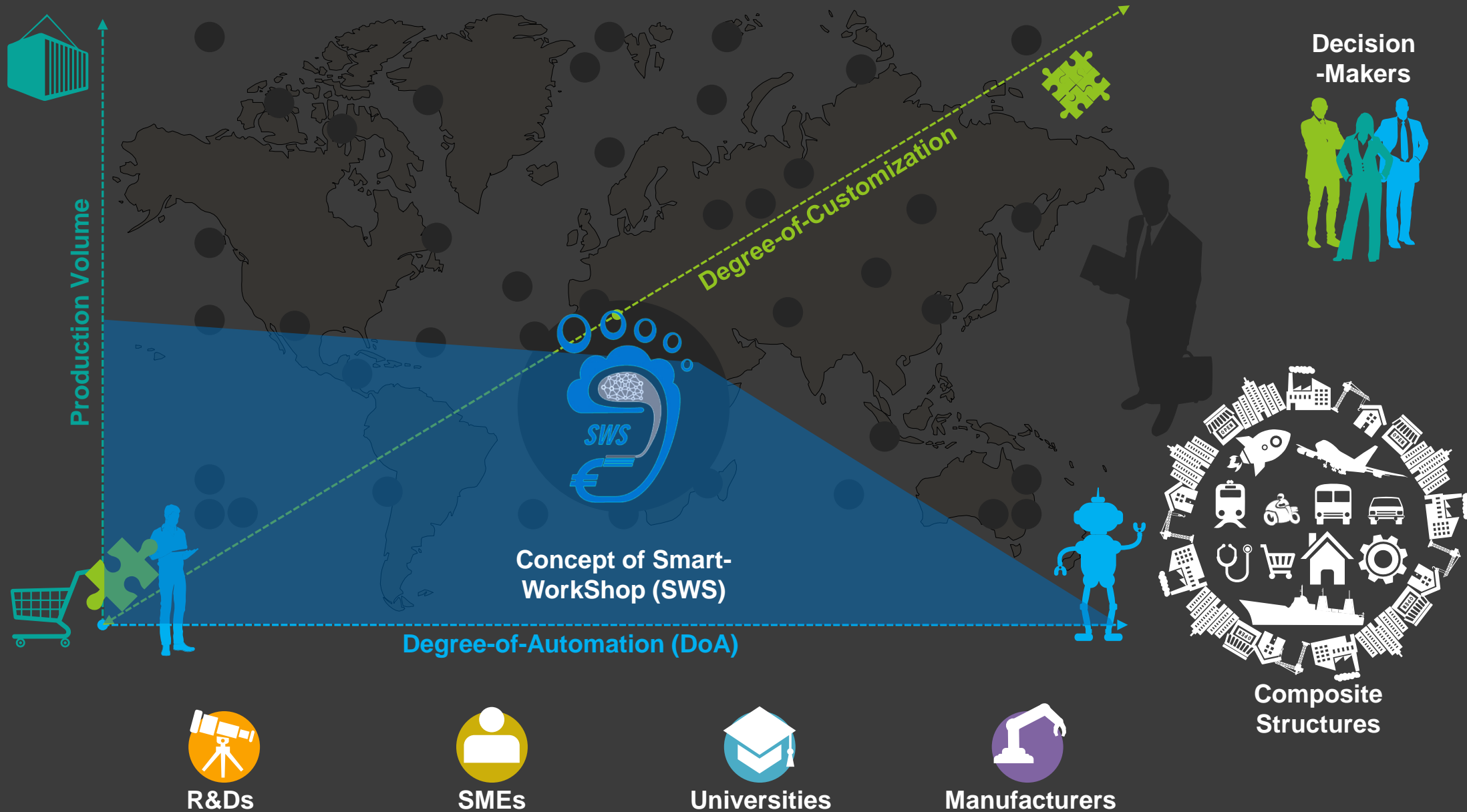
Computerized
Model

$$\alpha * \lambda = \theta \quad \left(\text{€} \quad \text{Footprint} \right)$$



Eco-Efficiency
Assessment
Model
(EEAM)





Thank You

Please don't hesitate to contact me

Smart-WorkShop



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Literatures

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