DATA SCIENCE IN MANUFACTURING

WEEK 3

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LECTURE: WEEK 3

Product Lifecycle / Material Flow

BY THE END OF THIS LECTURE YOU SHOULD:

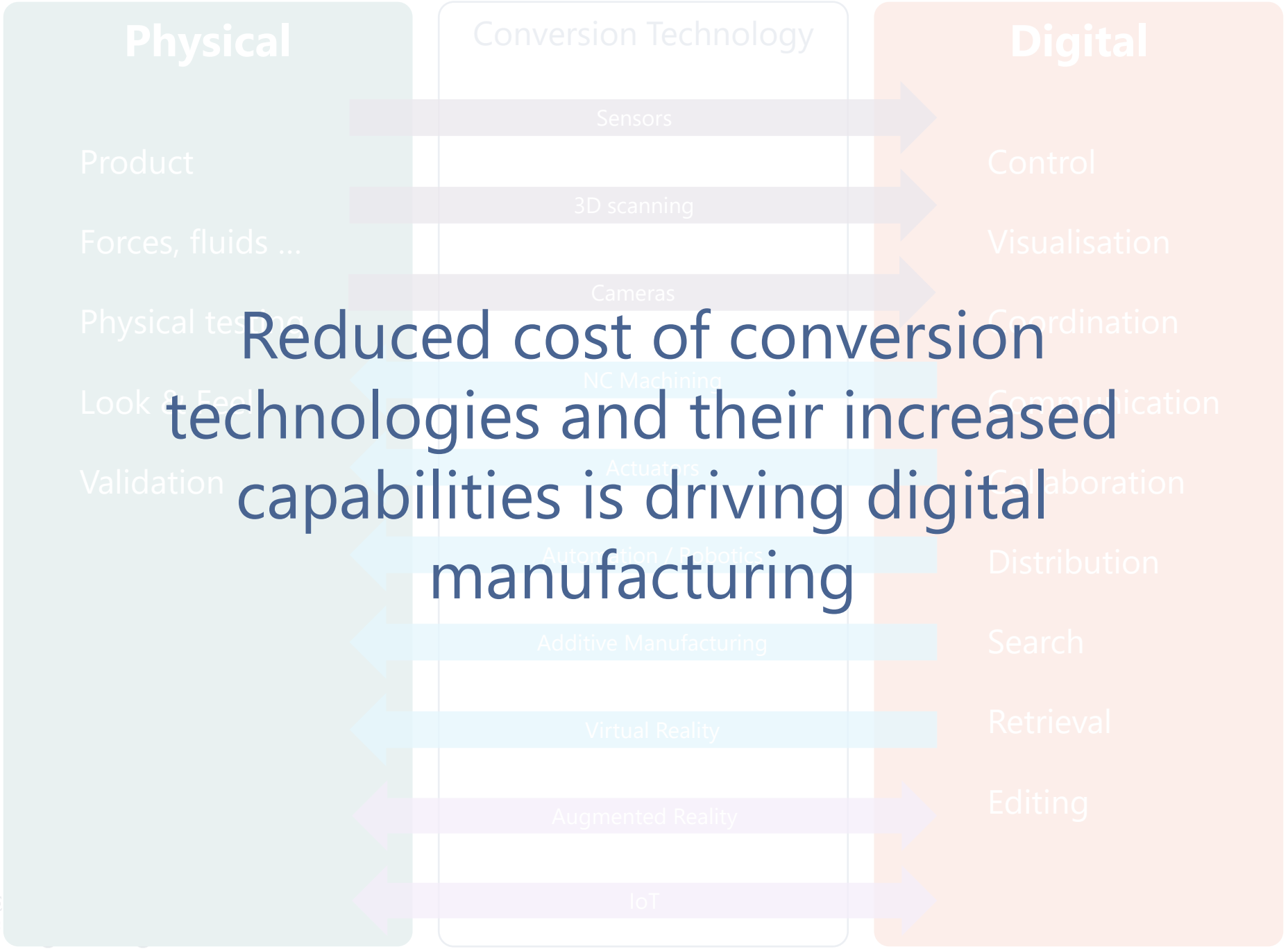
Understand product lifecycle and material flow

Understand why coding skills are important for a career in manufacturing

Review applications on industrial cases

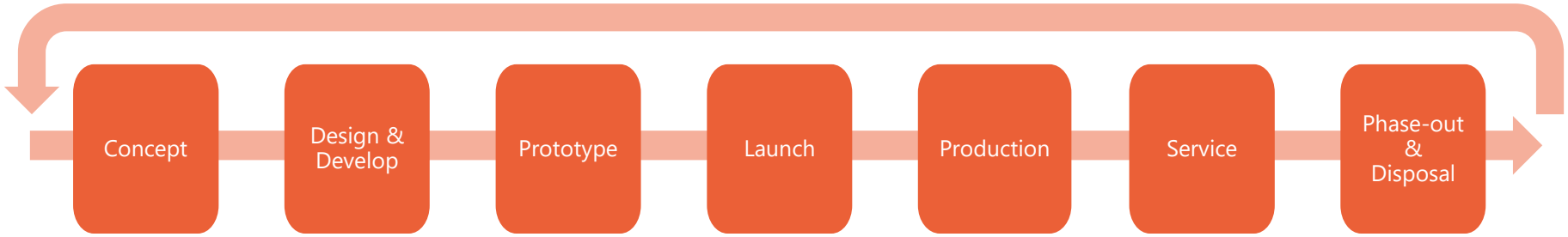
PRODUCT LIFECYCLE

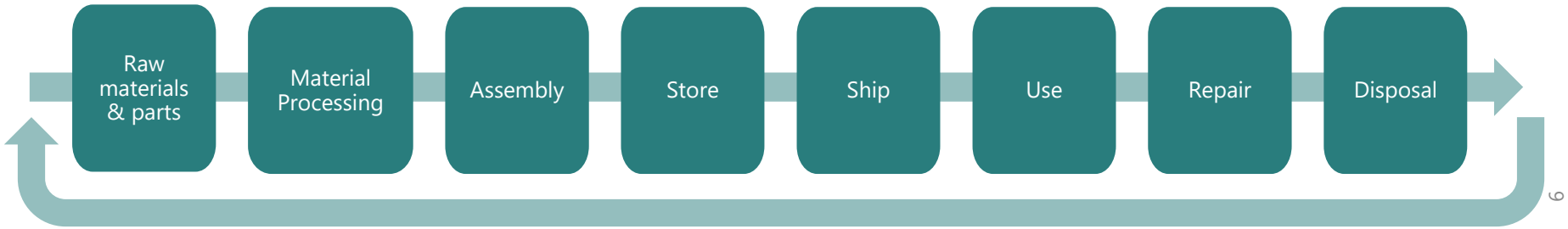
Lifecycle id defined by Grieves [1] as all aspects of a product's life, from its design through manufacture, deployment and maintenance, culminating in the product's removal from service and final disposal.



Reduced cost of conversion technologies and their increased capabilities is driving digital manufacturing

Product-type lifecycle



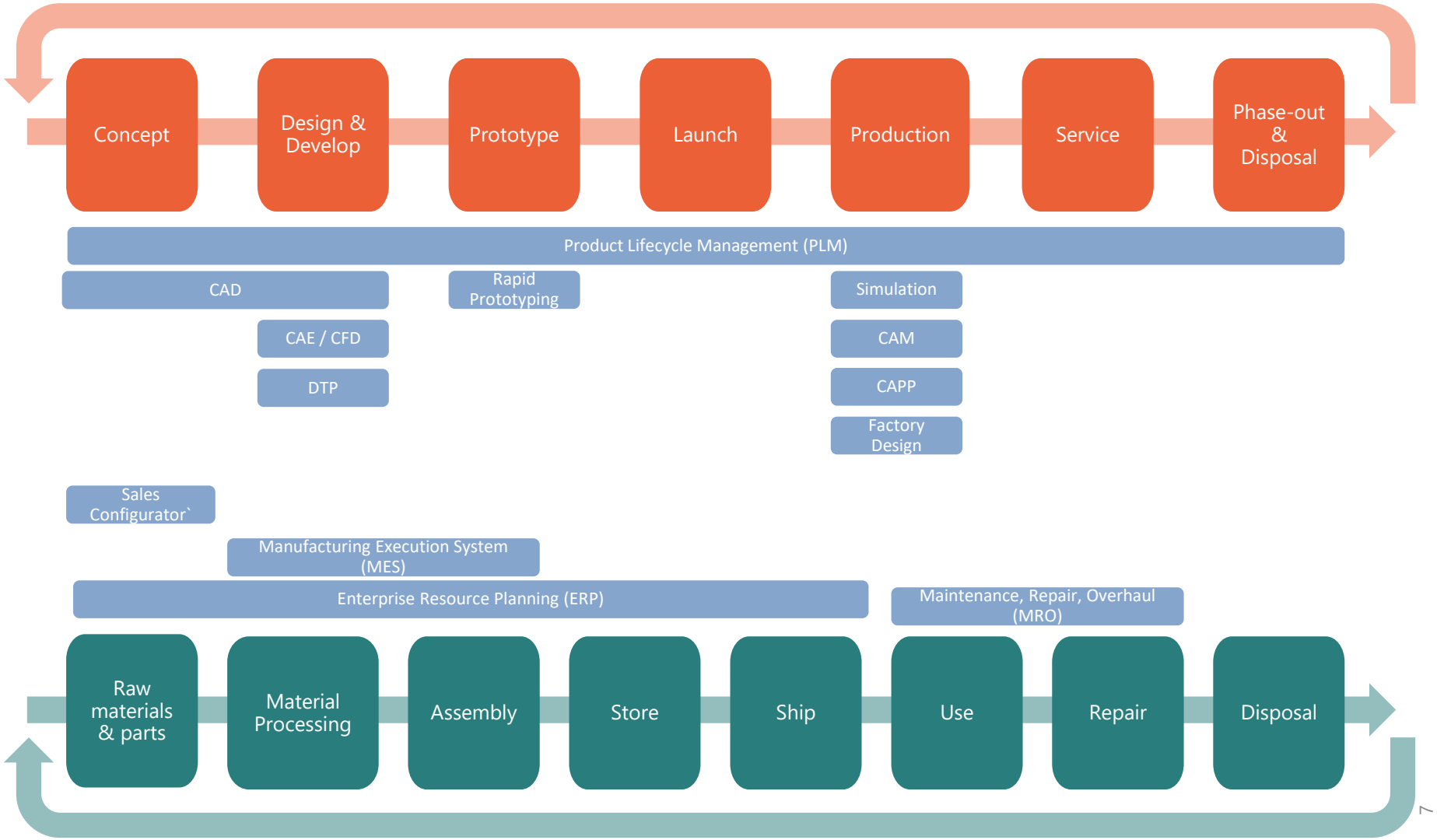


Product lifecycle / Material Flow

Suppliers

Customers

Product-type lifecycle



Product lifecycle / Material Flow

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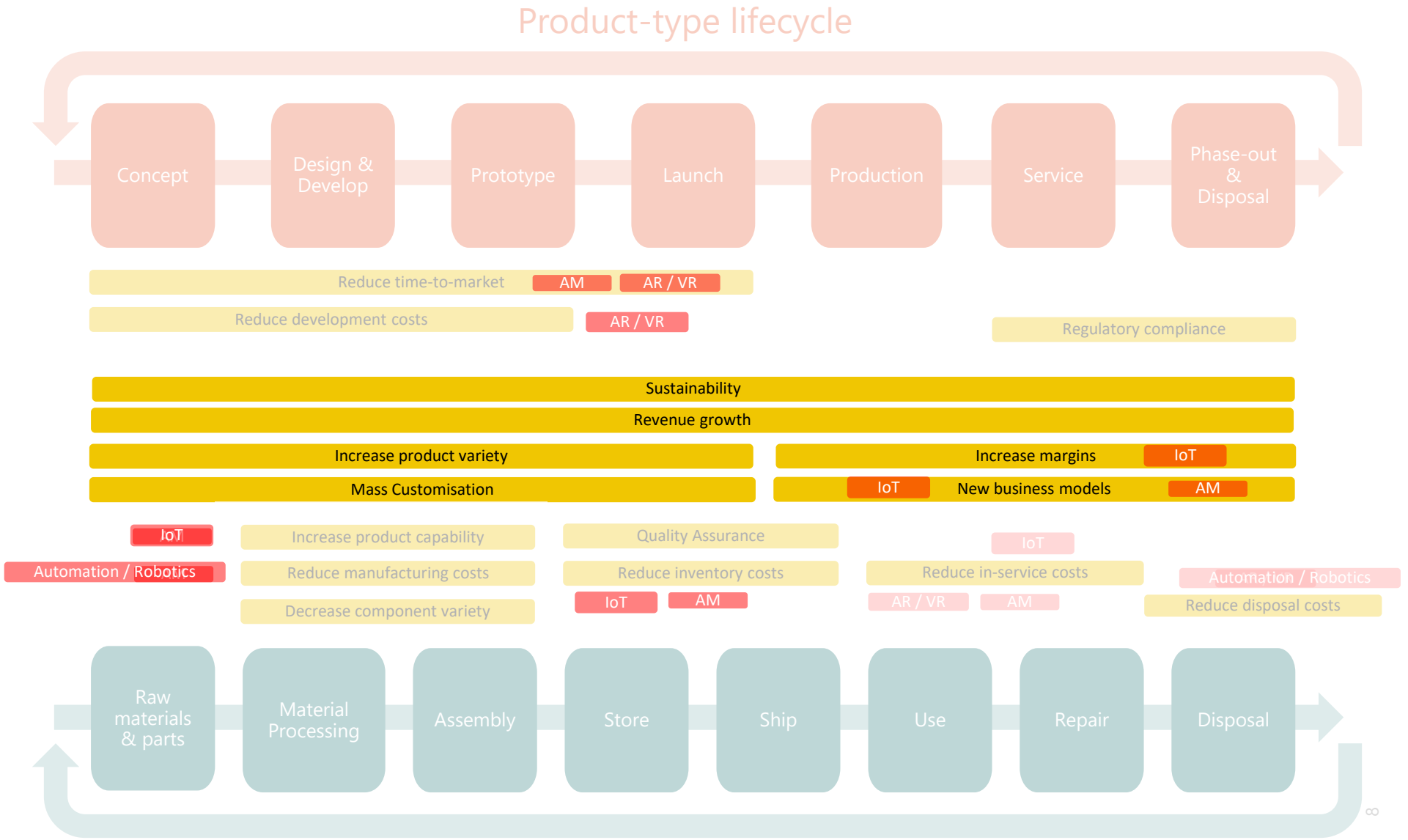

Product-type lifecycle
Concept
Design & Develop
Prototype
Launch
Production
Service
Phase-out & Disposal
Reduce time-to-market
AM
AR / VR
Reduce development costs
AR / VR
Regulatory compliance
Sustainability
Revenue growth
Increase product variety
Increase margins
IoT
Mass Customisation
IoT
New business models
AM
IoT
Automation / Robotics
Increase product capability
Reduce manufacturing costs
Decrease component variety
Quality Assurance
Reduce inventory costs
IoT
AM
IoT
Reduce in-service costs
AR / VR
AM
Automation / Robotics
Reduce disposal costs
Raw materials & parts
Material Processing
Assembly
Store
Ship
Use
Repair
Disposal
Product lifecycle / Material Flow
Suppliers
Customers

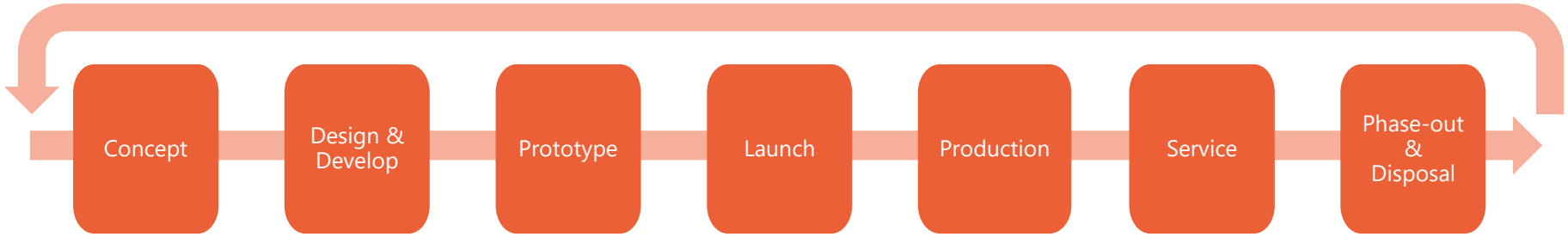
DIGITAL MANUFACTURING

Digital enhancement of manufacturing process

Digital coordination of manufacturing

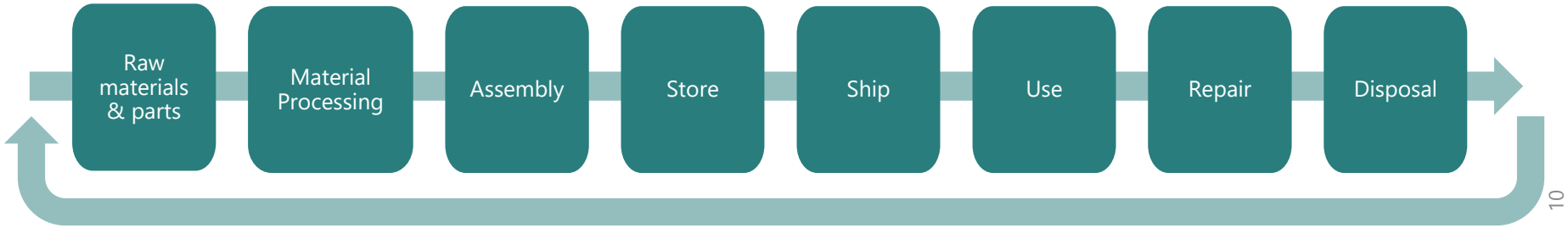
Data-driven Manufacturing and Value-chain

Product-type lifecycle



Digital enhancement of manufacturing processes

Machining
Forging
Forming
Welding
Casting
Composites
...



Product lifecycle / Material Flow

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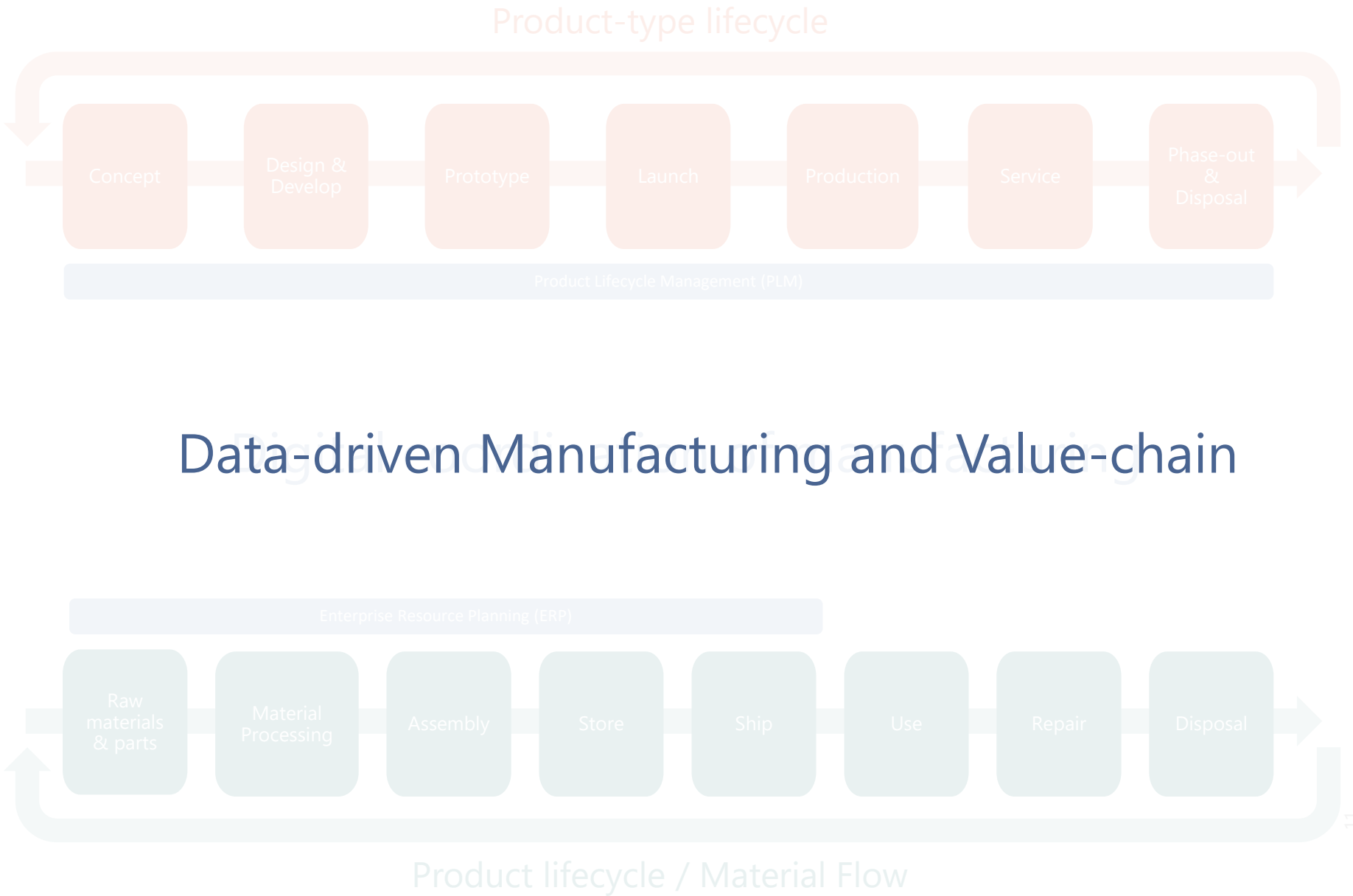
Data-driven Manufacturing and Value-chain



Data-driven Manufacturing: example

Large food tray manufacturer

CNC moulds like these…

…to use on machines like these

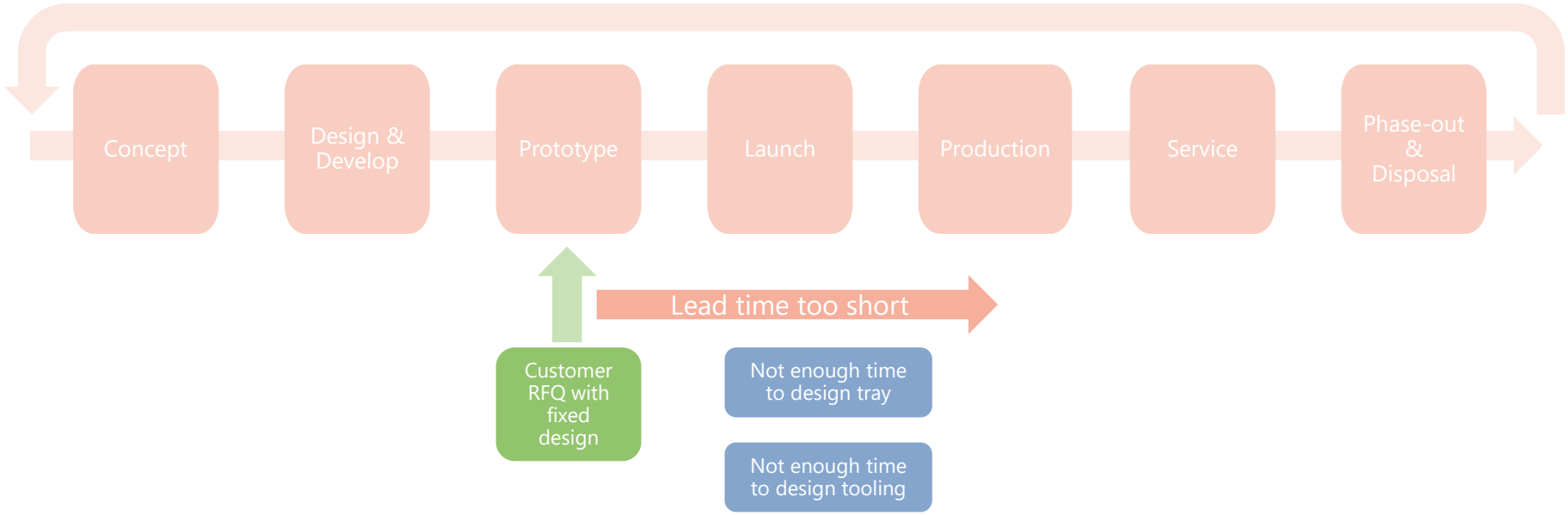
FOOD TRAY MANUFACTURER: THE PROBLEM

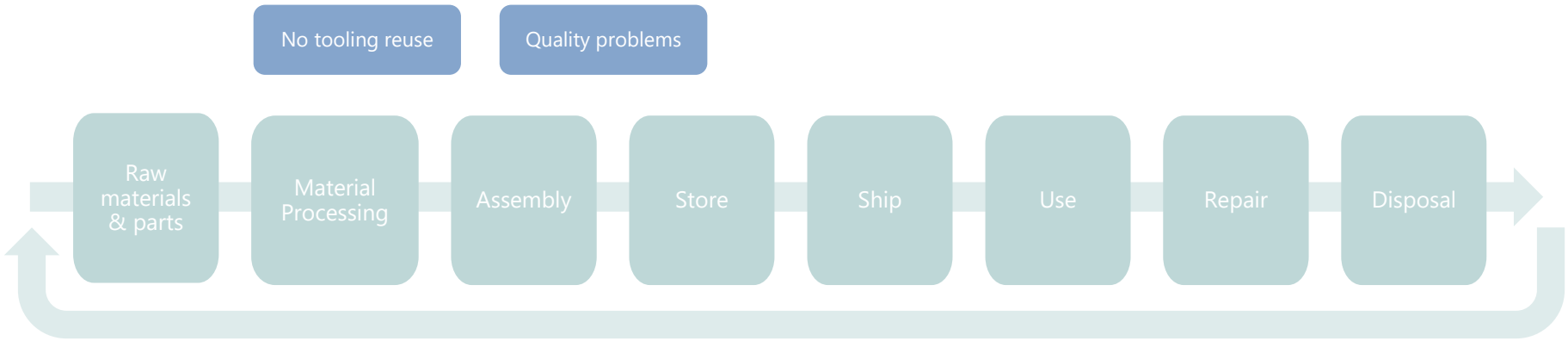
- Customer (supermarket or food manufacturer) asks for quotes for a fixed design
- Customer's design often inadequate - not manufacturable, not stiff enough, lip too narrow for bonding film
- Design requires new tooling
- Lead times too short

Food tray manufacturer: the problem

- Quality problems
- Very low margin business

Product-type lifecycle





Product lifecycle / Material Flow

Suppliers

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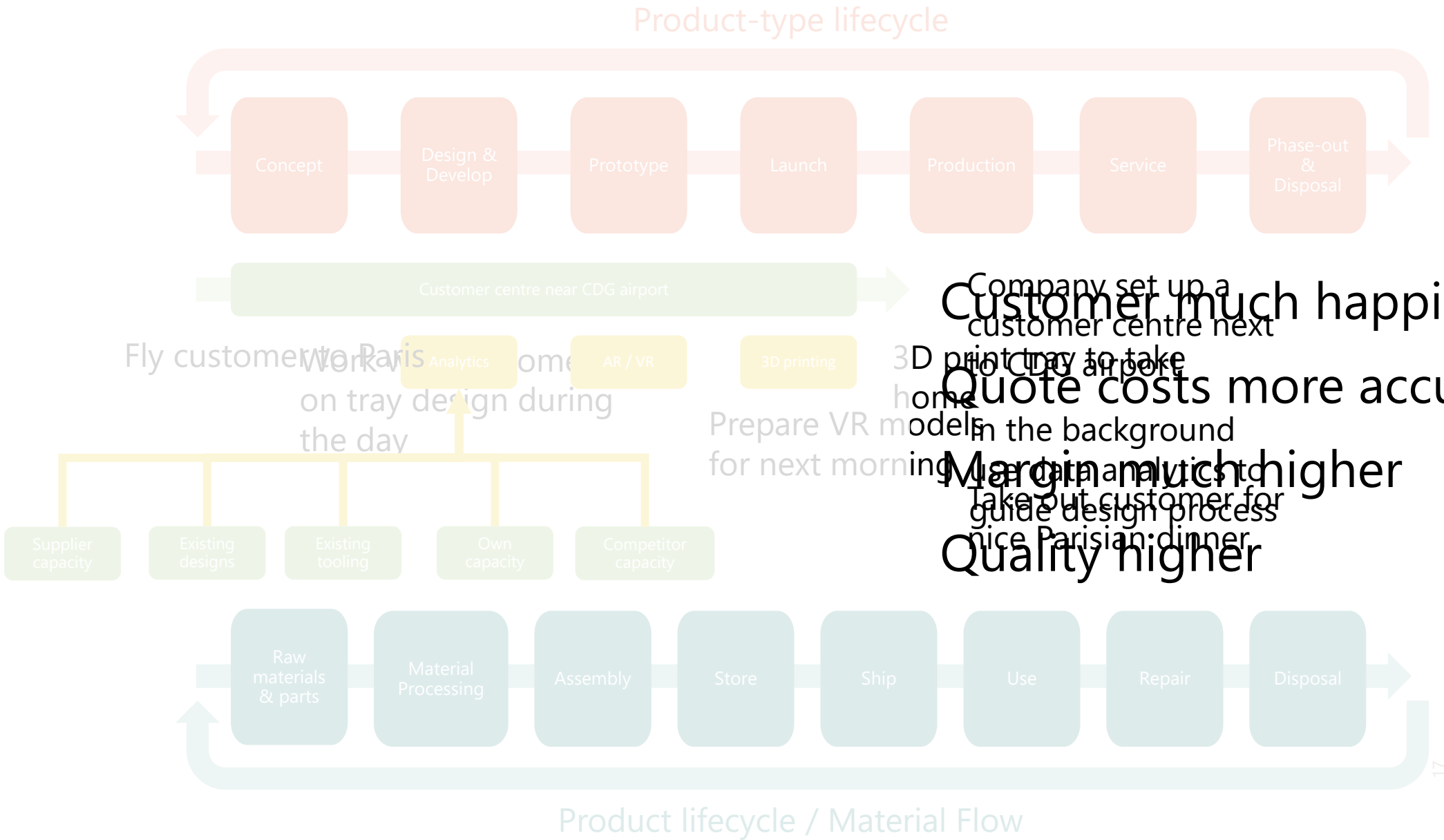
Product-type lifecycle
Concept
Design & Develop
Prototype
Launch
Production
Service
Phase-out & Disposal
Customer centre near CDG airport
Fly customer to Paris
Work with customer on tray design during the day
Analytics
AR / VR
3D printing
3D print tray to take home
Prepare VR models for next morning
Company set up a customer centre next to CDG airport
Use data analytics to guide design process
Take out customer for nice Parisian dinner
Customer much happier
Quote costs more accurate
Margin much higher
Quality higher
Supplier capacity
Existing designs
Existing tooling
Own capacity
Competitor capacity
Raw materials & parts
Material Processing
Assembly
Store
Ship
Use
Repair
Disposal
Product lifecycle / Material Flow
Suppliers
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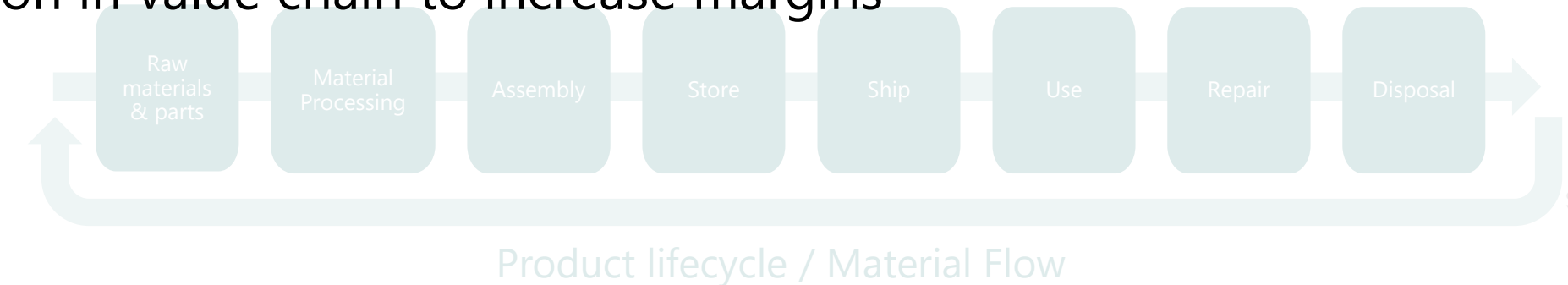
Company recognised value chain was controlled by the designer of the tray – customer able to force low price

However, customer not in best position to optimise value chain

Imaginative use of data and digital technology put company in dominant position in value chain to increase margins



INDUSTRY NEEDS: SKILLS

Computer science graduates have the coding and software engineering skills, but lack manufacturing domain knowledge

Engineers have manufacturing domain knowledge, but lack coding skills

There will be a strong demand for graduates who can operate in both domains

REFERENCES

1. Grieves, Michael. (2005). Product Lifecycle Management: Driving the Next Generation of Lean Thinking.