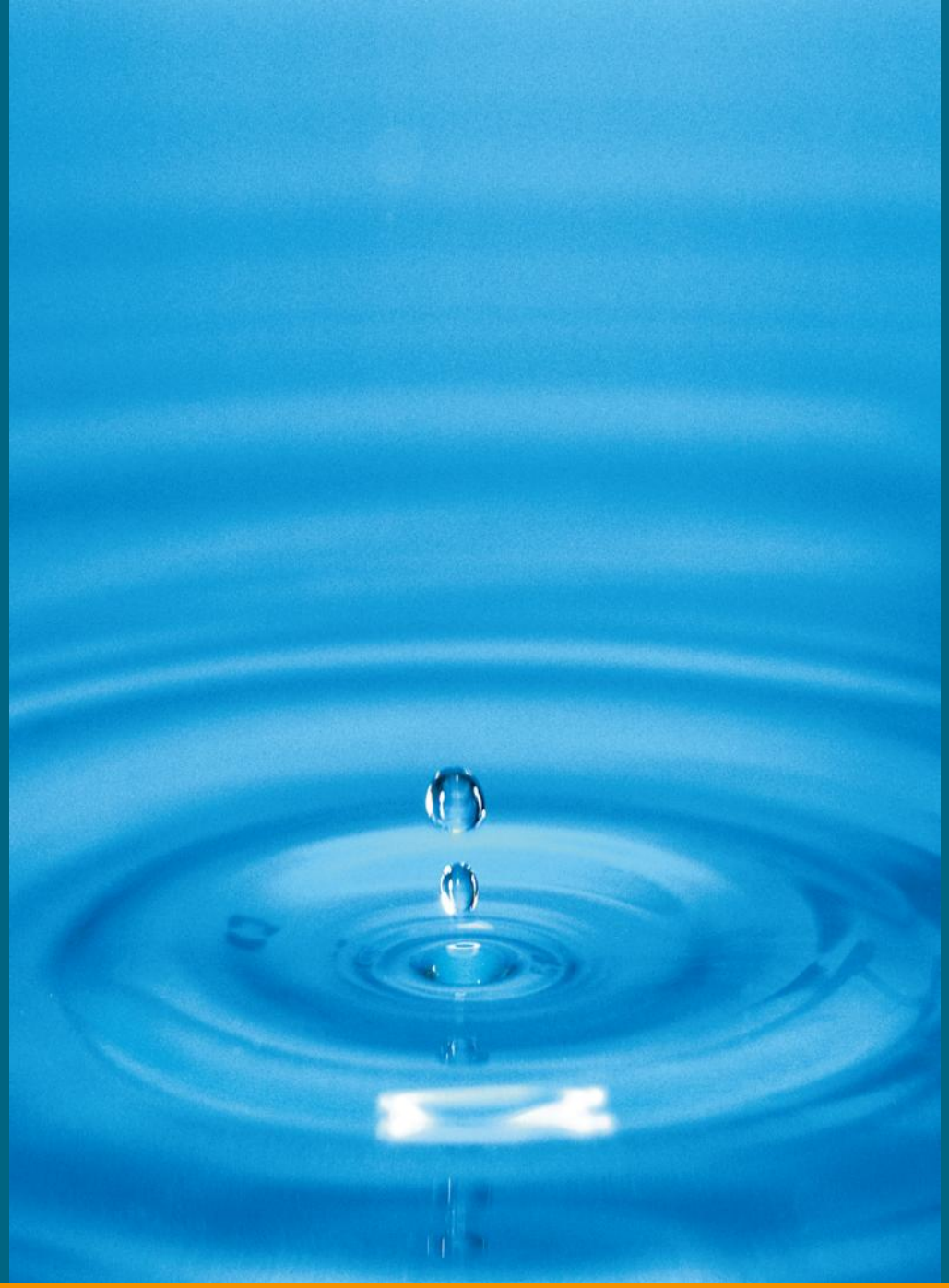


High-Tech Manufacturing for the Circular Economy

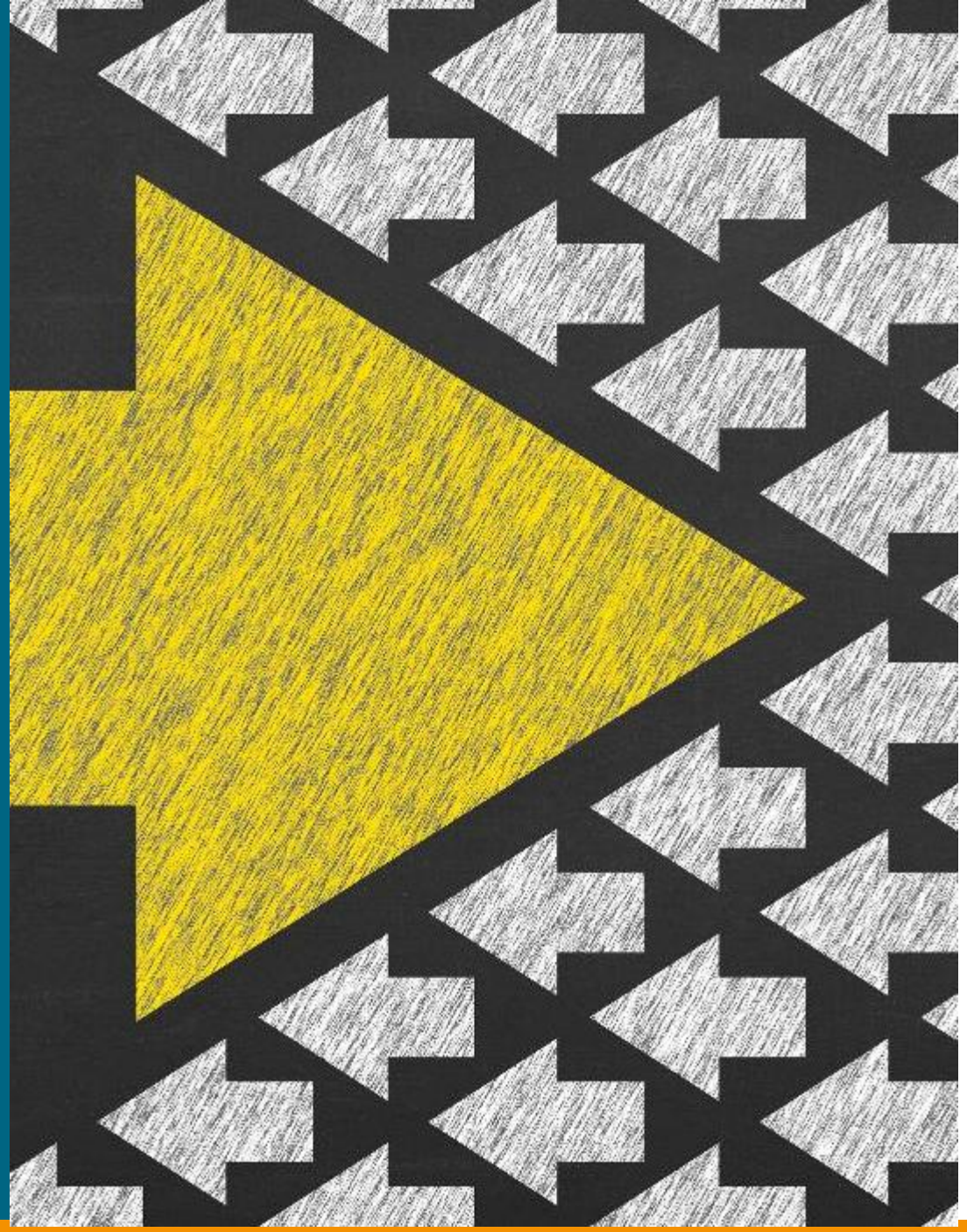

3rd May 2025

Just at the beginning

“But CBM (Circular Business Model) innovations remain limited in scale, depth, and speed of adoption.“

“Only 8.6% of global raw material use comes from recycled sources, while remanufactured products account for just 1.9% of the market”

World Bank, “Squaring the Circle”



Drivers and Barriers

+ Regulation
+ Subsidies
+ Lead Markets
+ Scarcety of raw material
+ Awareness is raising

? Regulation
? Transparency / Willingness to buy
? Complexity
? Productivity & Costs
? Impact on Innovation & Competitivness
? Working conditions

Need for action

- **Framework / Single Market**
- **Metrics & KPIs**
- **Science, Technology, Education**

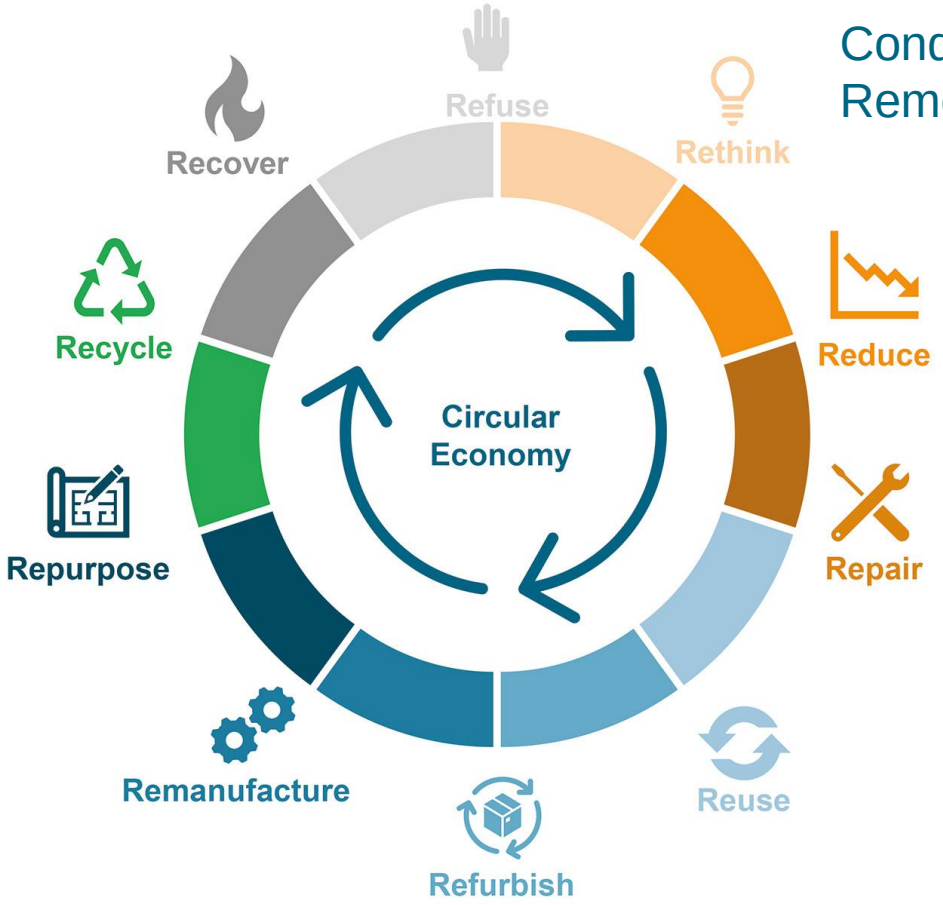
Circularity: „Manufacturing inside“

Functional Integration

Waste treatment technologies

Logistics

Automation, robotics & AI for collection, disassembly, sorting



Condition Monitoring / Remote maintenance

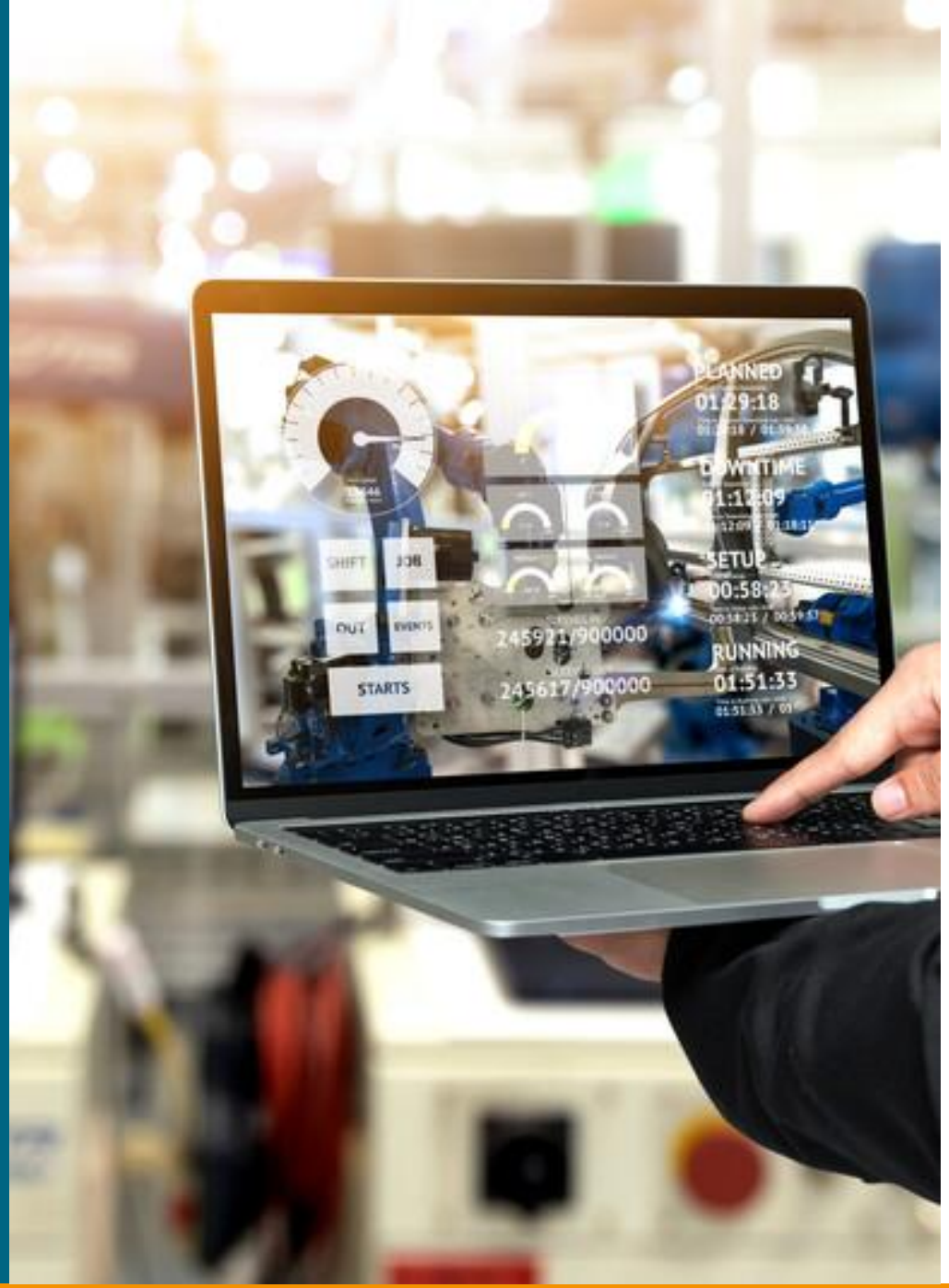
Quality Management

Miniaturisation
reducing material needs / efficiency
use of secondary materials

„repair“ technologies (e.g. Additive Manufacturing)

Intelligent Digital Twins **„as a service“ (XaaS)** **„upstream“ enabler** **„Re-stream“ enabler**

Source: VDMA

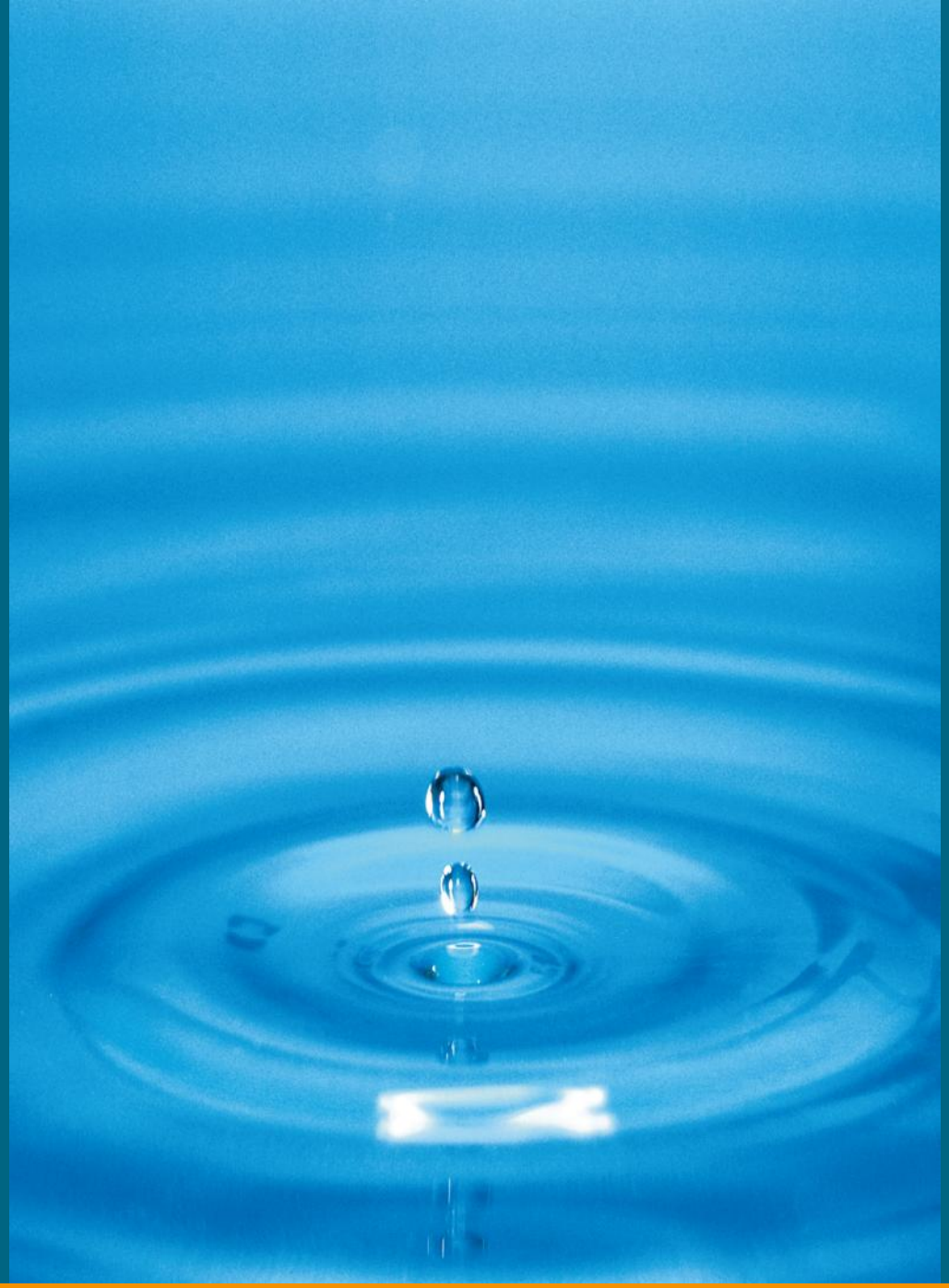


The „10-R-Factory“

- Making intelligent decisions, optimizing foot-prints along the life-cycle and across supply chains
- Enabling long-lasting, material-efficient, light-weight, easy-to-repair/remanufacture products
- Proving good jobs and attractive working conditions
- Repair, Refurbish, Remanufacture, Recycle with the same productivity, quality & working conditions as „new“ manufacturing

Conclusion: What is needed

- Develop a Manufacturing R&I - Vision for the Circular Economy
- Gather data, improve metrics
- Skills and education
- Collaboration is key: Teaming-up of science, industry, policy makers and disciplines



Thank You!