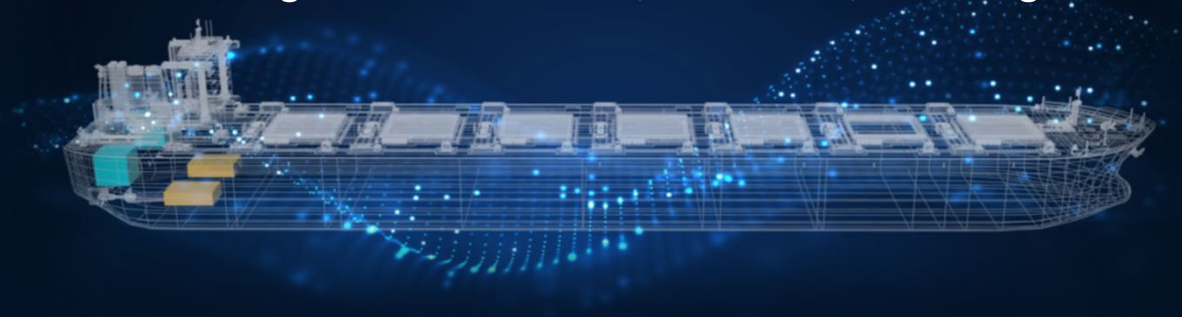
The Dual Transition of Digital & Circular Economies

Circular & Digital Transformation, Innovation, and Integration



Dr. Saman Sarbazvatan – The Dual Transition Intro – Sep 2022

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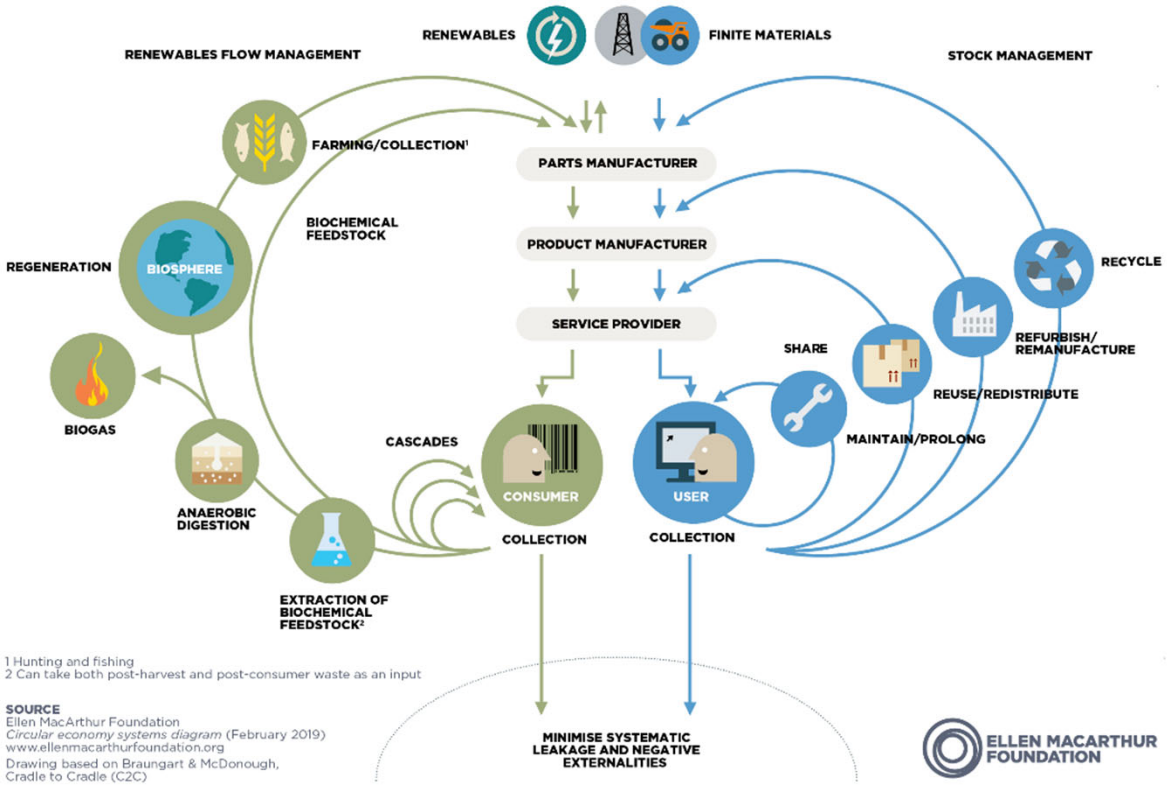
Linear vs. Circular



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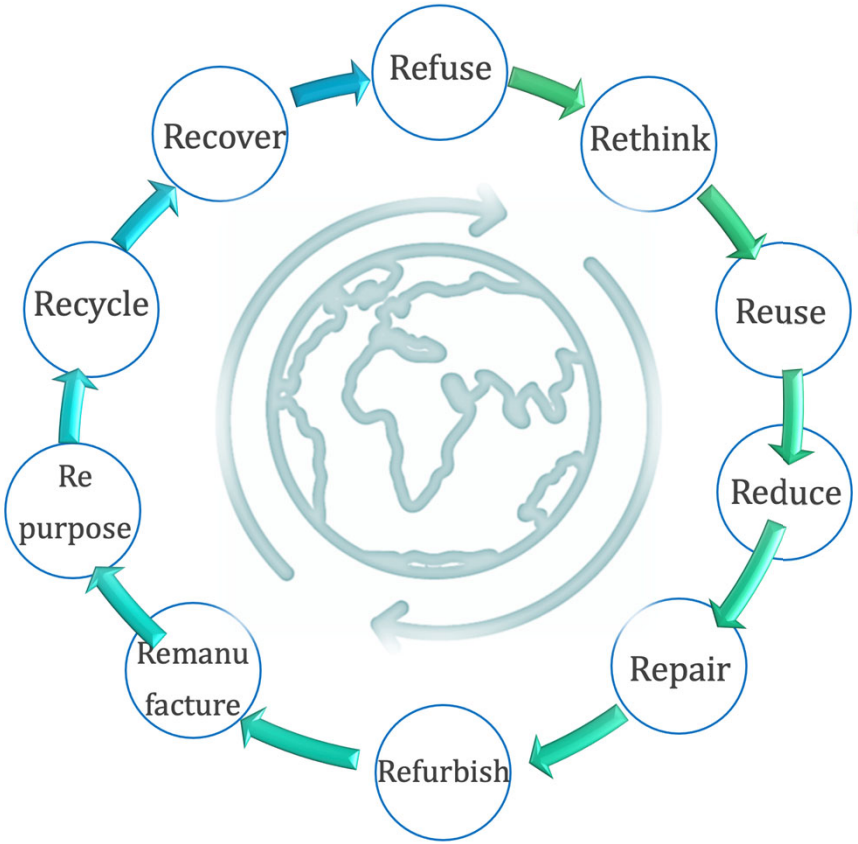
The Repercussions of the Linear Economy

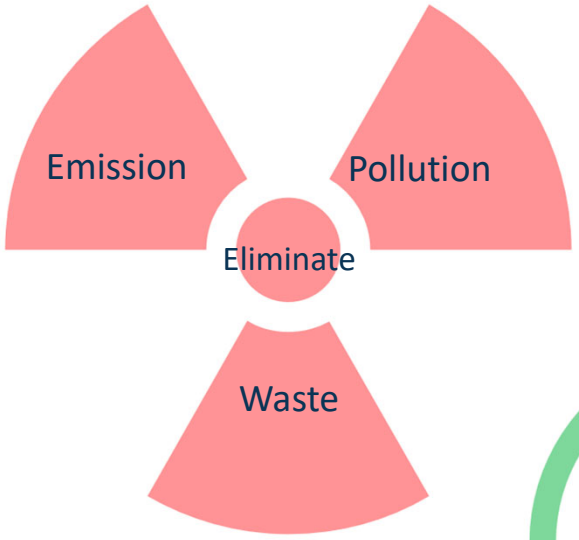
- **15% increase in GPC consumption since 1980**
- **50% loss of live coral cover of reefs since 1870s**
- **68% loss in biodiversity within the past 40 years**

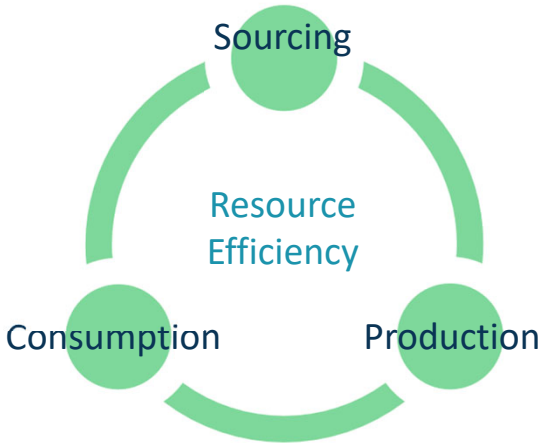
- Between COP21 and COP26 we consumed **70% more than what the Earth can safety replenish!**
- In the past 50 years the global use of materials has nearly **quadrupled, outpaced the population growth** by **200%** within the same time span.
- In 2020s the anthropogenic mass (human-made objects) is **surpassing the global living natural biomass** on Earth!

- **With a Circularity Gap of 91.4% we're moving toward 23% loss of natural habitat by 2100**

The Circular Economy Alternative







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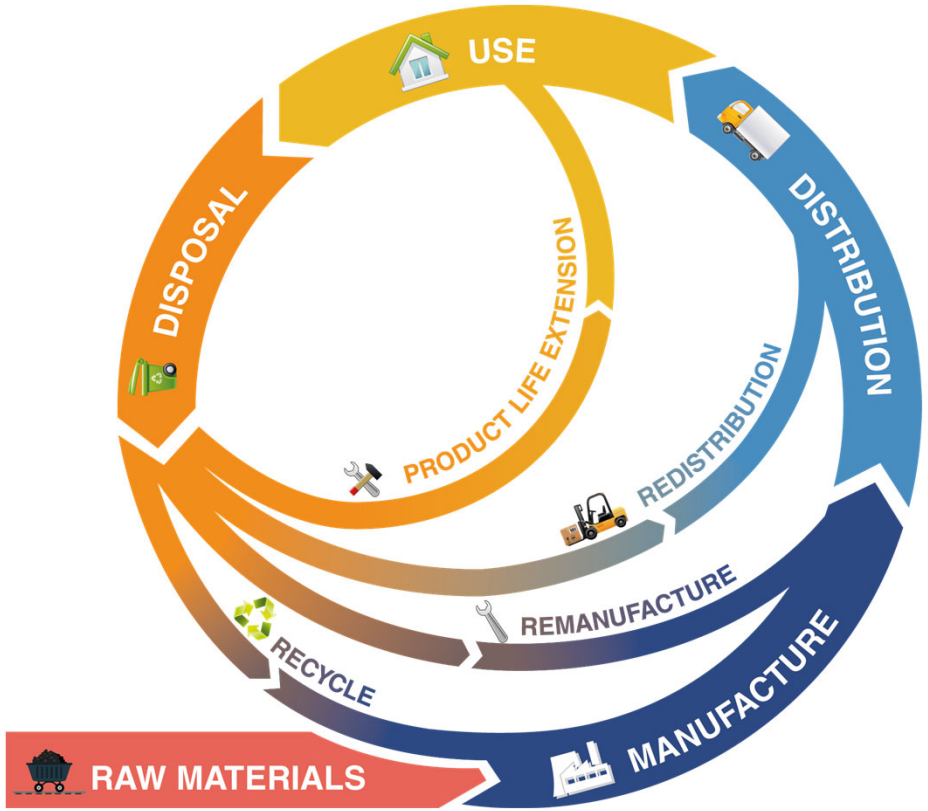
Five Commandments of CE

1. Narrow the Loops (Input)
2. Slow the Loops (life cycle)
3. Close the Loops (Flows)
4. Regenerate the Loops (Value Cycles)
5. Innovate in E&B Models (Generation)



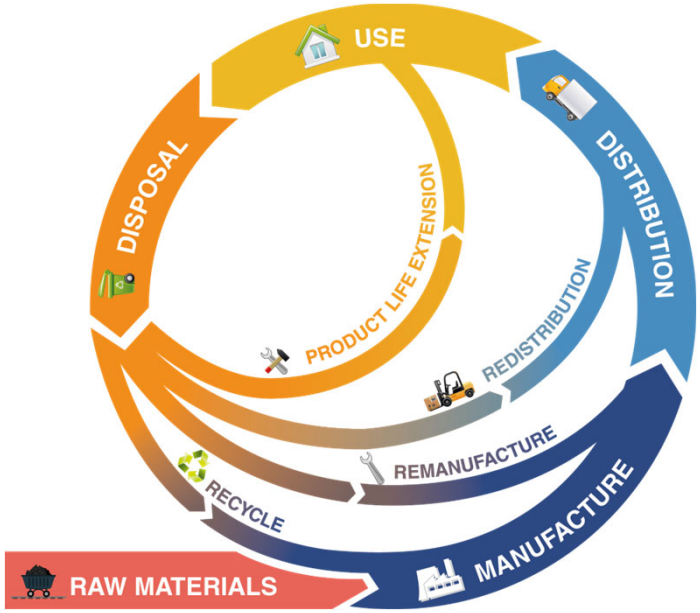
10 Rs:

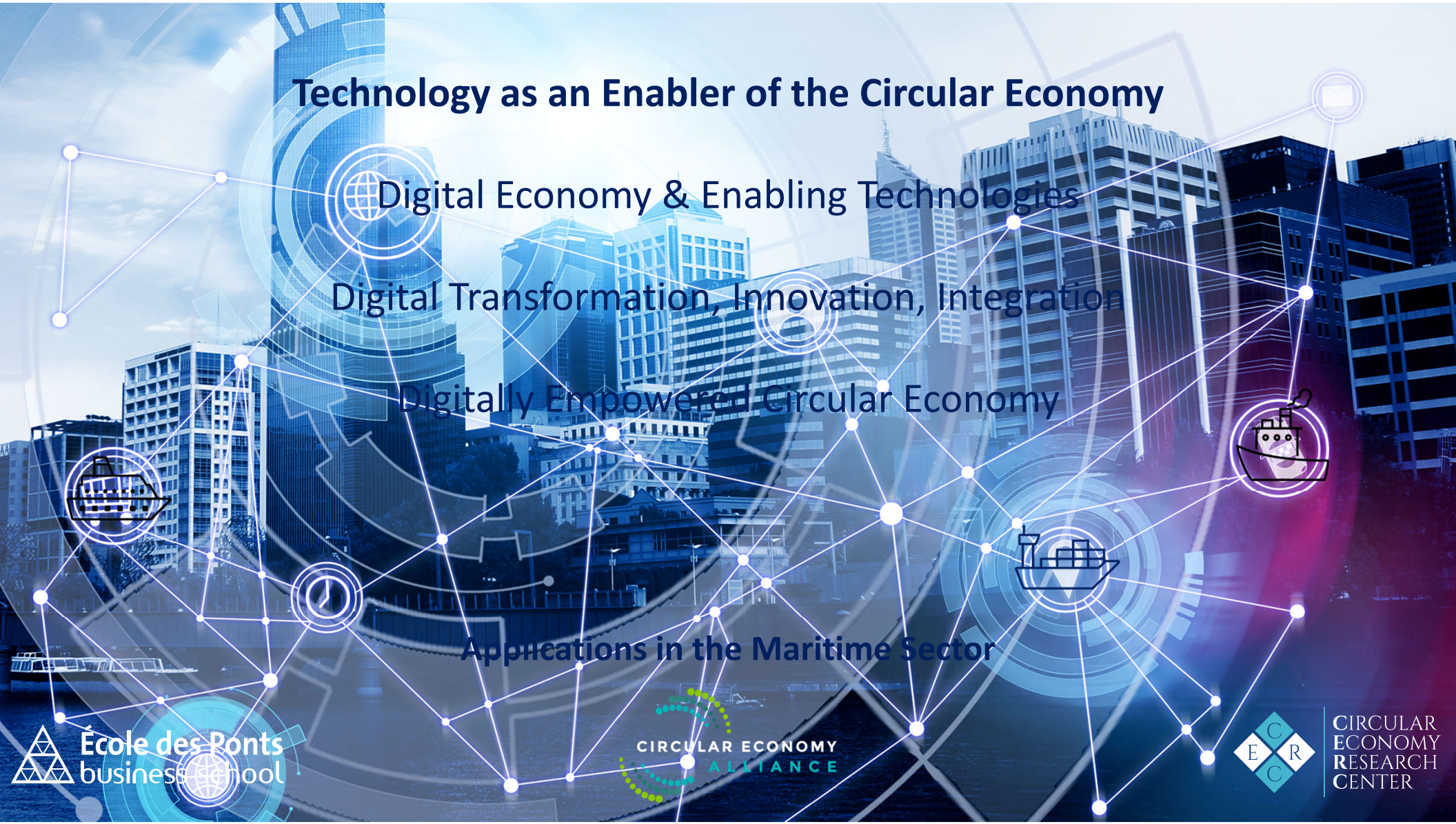
1. Refuse
2. Rethink
3. Reduce
4. Reuse
5. Reduce
6. Repair
7. Refurbish
8. Remanufacture
9. Repurpose
10. Recycle
11. Recover

The transition to the Circular Economy

Drivers, Enablers, Incentives

1. Sourcing, Manufacturing, Consumption, Product Afterlife (Problem)
2. Faster Product Replacement (Problem)
3. Mass Customization (Demand)
4. Instant Access and Support (Demand)
5. Awareness & Concerns (Driver)
6. Responsibility, Accountability, Transparency (Driver)
7. Sustainability (Agenda)
8. Digital Transformation, Innovation, Integration (Enabler)
9. Policy Initiatives and Strategies (Driver)
10. Competitiveness & Resilience (Incentive)




Technology as an Enabler of the Circular Economy
Digital Economy & Enabling Technologies
Digital Transformation, Innovation, Integration
Digitally Empowered Circular Economy
Applications in the Maritime Sector
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Digital Economy

Technologically Empowered Markets, Industries,

Business Models, Services, Products, and Solutions around them,

and their relationship with

Society, Environment, Economy, Policy, Diplomacy, Governance

and Political Economics, Geopolitics, Geoeconomics, Sociocultural, and Socioeconomics

via

Operational, Strategic, Structural,

Industrial, Economic, Social, Environmental, scientific, and Digital

Innovation, Transformation, and Integration

Digital Economy Enablers

Enabling & Disrupting Forces of Convergence of Technologies & Combinatorial Innovations

Impact Factors

- Society,
- Environment,
- Economy,
- Education,
- Market Dynamics,
- Governance,
- Geopolitics,
- Geoeconomics,
- Sociocultural,
- Socioeconomics,
- Political Economics,
- Cultural Economics,
- Science &Technology,
- Policy & Regulations
- Politics & Diplomacy,
- Etc.

Enabling Technologies

- Big Data, AI, Analytics,
- IoT, CPS, Robotics,
- Blockchain & Tokenization,
- Simulation & XR (AR, VR, MR),
- Telecommunication,
- Digital Twins,
- Quantum,
- Web3,
- Metaverse,
- Etc.

xTech

- FinTech, RegTech, EdTech,
- GameTech, HealthTech, MedTech,
- PharmaTech, InsurTech, AgriTech,
- SpaceTech, ClimateTech, ConTech,
- BioTech, Etc.

SmartX

- Wearables, Assets, Governance,
- Manufacturing, Shipping, Agriculture,
- Mobility & Transport Systems,
- Grids, Homes, Buildings, Cities, Etc.

XaaS

- Software, Product, Solution, Performance, Result, Light, Energy,
- Blockchain, Cybersecurity, Packaging, Analytics, Insight, Maintenance, Etc.

Digital Economy Dynamics, Implications, Potentials

1. Hyperconnectivity

1. Economic, Social, Cultural, Diplomatic,
2. Scientific, Institutional, Industrial, Regulatory,
3. Digital, Biological, and Physical Realms.

2. Complex Interdependencies

- Social, Environmental, Economic, Diplomatic, and Policy, Regulatory, and Governance
- Political Economics, Geopolitics, Geoeconomics, Sociocultural, and Socioeconomics

=> Unprecedented Opportunities

- Efficiency
  - Governance of Political, Diplomatic, Social, Economic, Natural, and Intellectual Capitals
- Innovation
  - Scientific and Technological, Economic & Business Model, Cluster & Industrial
- Achievement
  - SDGs, CSR, ESG, DEI, Sustainable Competitiveness, and Circular Economy

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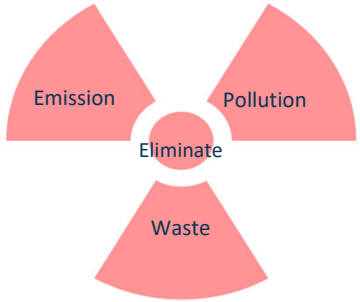
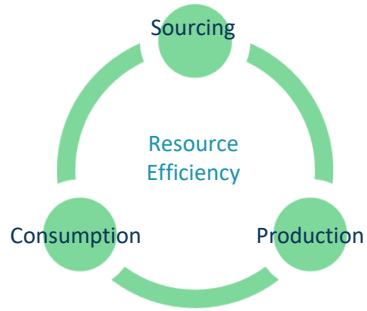
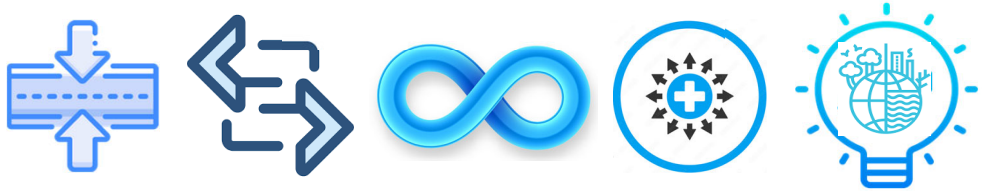
Digitally Empowered Circular Economy







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IoT, CPS, Intelligent Assets

- Connectivity & Feedback Loops
- Real Time Data via Sensors, Connected Devices, and Systems
- Bridging the Physical, Biological, and the Digital Realms
- Measures and Metrics for Security and Quality
- Condition, Availability, and Utilization of Assets
- Efficient Resource Management and Monitoring
- Preventive, Predictive, and Prescriptive Analysis
- Smart Maintenance From diagnosis to prognosis
- Empower BD, AI, AR, XR, Simulations, and Digital Twins

IoT, CPS, Intelligent Assets
Applications in the Maritime Sector

- Telematics, Monitoring, Management, Maintenance
- Cargo and Goods Flow Tracking
- Safety and Risk Management
- Energy Management
- Mobile Data Hubs
- Connected Fleet & Smart Ports
- Security & Regulatory Compliance
- Maritime Governance

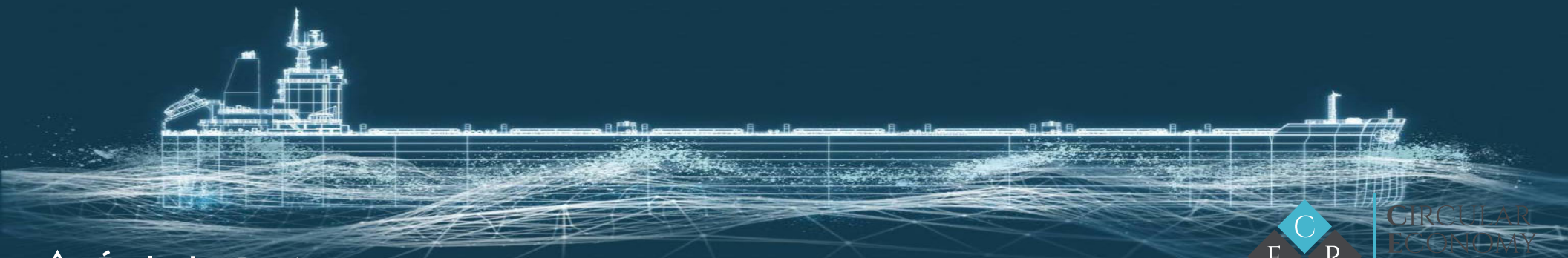
Artificial Intelligence

- Process, Product, and Service improvement
- Data Driven Decision Making
- Preventive, Predictive, and Prescriptive Analysis
- Smart Maintenance
- Forecast, Simulation, and Automation
- Risk Management
- Inventory Management
- Sustainable, Resilient, and Efficient materials, processes, Products
- Support and Assistance
- Asset Management

CIRCULAR ECONOMY ALLIANCE

Artificial Intelligence in the Maritime Sector

- Data Driven Decision Making, Forecast, Simulation, and Automation
- Smart Telematics, Monitoring, Management, Maintenance
- Autonomous Fleet & Smart Ports
- Preventive, Predictive, and Prescriptive Analysis
- Risk Management
- Smart Supply Chain, Inventory, and Asset Management
- Design & Development of new Sustainable, Resilient, and Efficient materials, and processes



Digital Economy Enablers

Enabling & Disrupting Forces of Convergence of Technologies & Combinatorial Innovations

Drivers

- Society,
- Environment,
- Economy,
- Education,
- Market Dynamics,
- Governance,
- Geopolitics,
- Geoeconomics,
- Sociocultural,
- Socioeconomics,
- Political Economics,
- Cultural Economics,
- Science &Technology,
- Policy & Regulations
- Politics & Diplomacy,
- Etc.

Enabling Technologies

- Big Data, AI, Analytics,
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- Blockchain, Cybersecurity, Packaging, Analytics, Insight, Maintenance, Etc.

Blockchain

Decentralized, Distributed, and Tokenized
Governance, Economies, Business Models, Value Systems

- Trust
  - Hardcoded Behavior & Cryptography
  - Timestamped & Tamperproof Data
  - Data Source Legitimacy
  - Tamperproof History of Transactions
  - Compliance
- Transparency & Accountability
- Fractional Ownership, Stewardship, and Responsibility
- Incentive Systems & Ecosystems
- Hardcoded Automation & Decentralized Autonomous Organizations (DAOs)
- Multistakeholder Engagement & Governance

CIRCULAR ECONOMY ALLIANCE

Blockchain in the Maritime Sector

- Smart Contracts & Autonomous Operations
- Autonomous Fleet & Smart Ports
- Spillover of Innovation
- Cybersecurity
- Compliance

Digital Twins

A digital twin is a digital Live replica of a living or non-living Asset empowered by IoT, CPS, AI, BD, Analytics, Simulations, and XR, among other technologies.

- Performance & Efficiency
- Monitoring, Analysis, and Management of Asset
- time, cost, energy & material Saving,
- Elimination of Waste, Pollution, and Emission
- Enhanced Safety & Risk Assessment & Management
- Dynamic Updates & Upgrades
- Enabler for Smart Autonomous Systems
- Enabler for Sustainability & Circular Economy

CIRCULAR ECONOMY ALLIANCE

Digital Twins in the Maritime Sector

Innovation, Performance, Efficiency, Competitiveness, Resilience

Smart and Efficient Asset Maintenance & Management
Preventive, Predictive, Prescriptive Analysis
Precise Simulations

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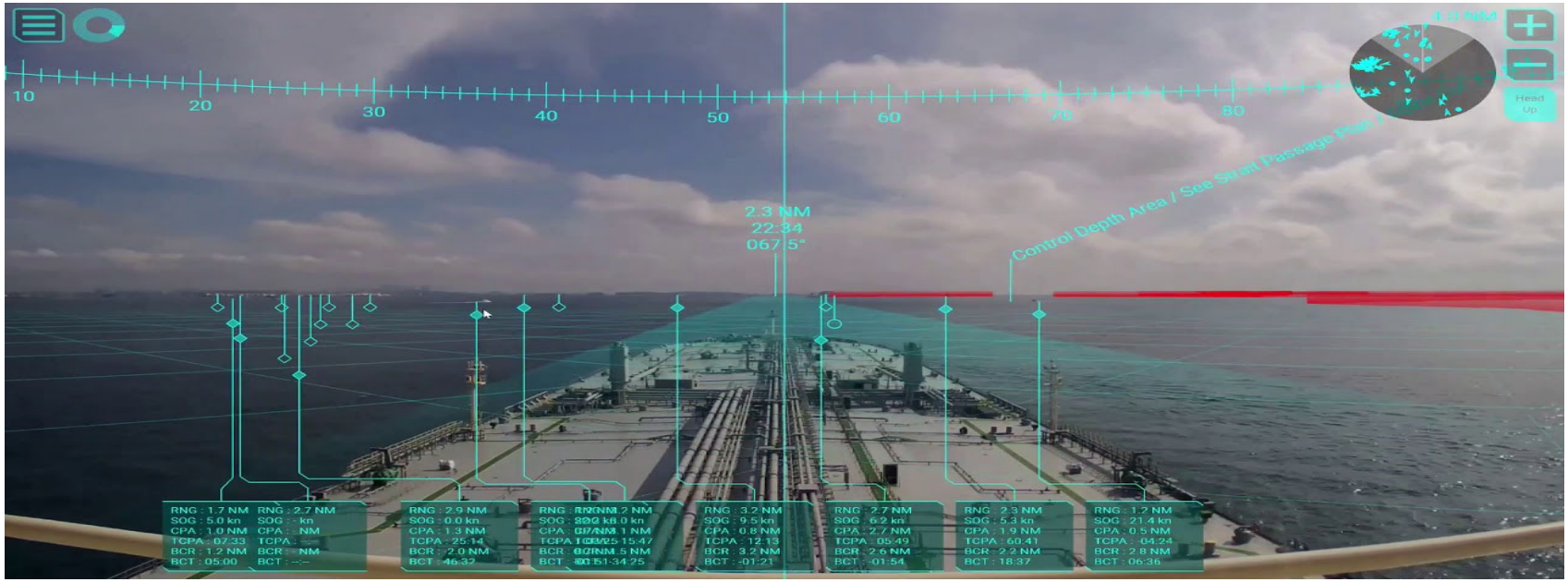
Extended Reality

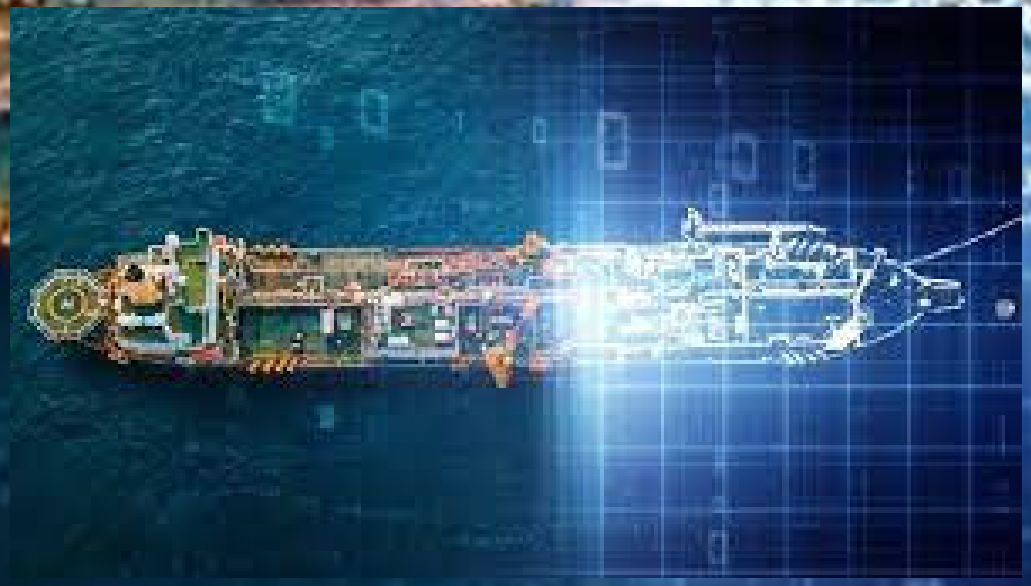
Enhanced Monitoring, Navigation, Operations, Maintenance, and Performance

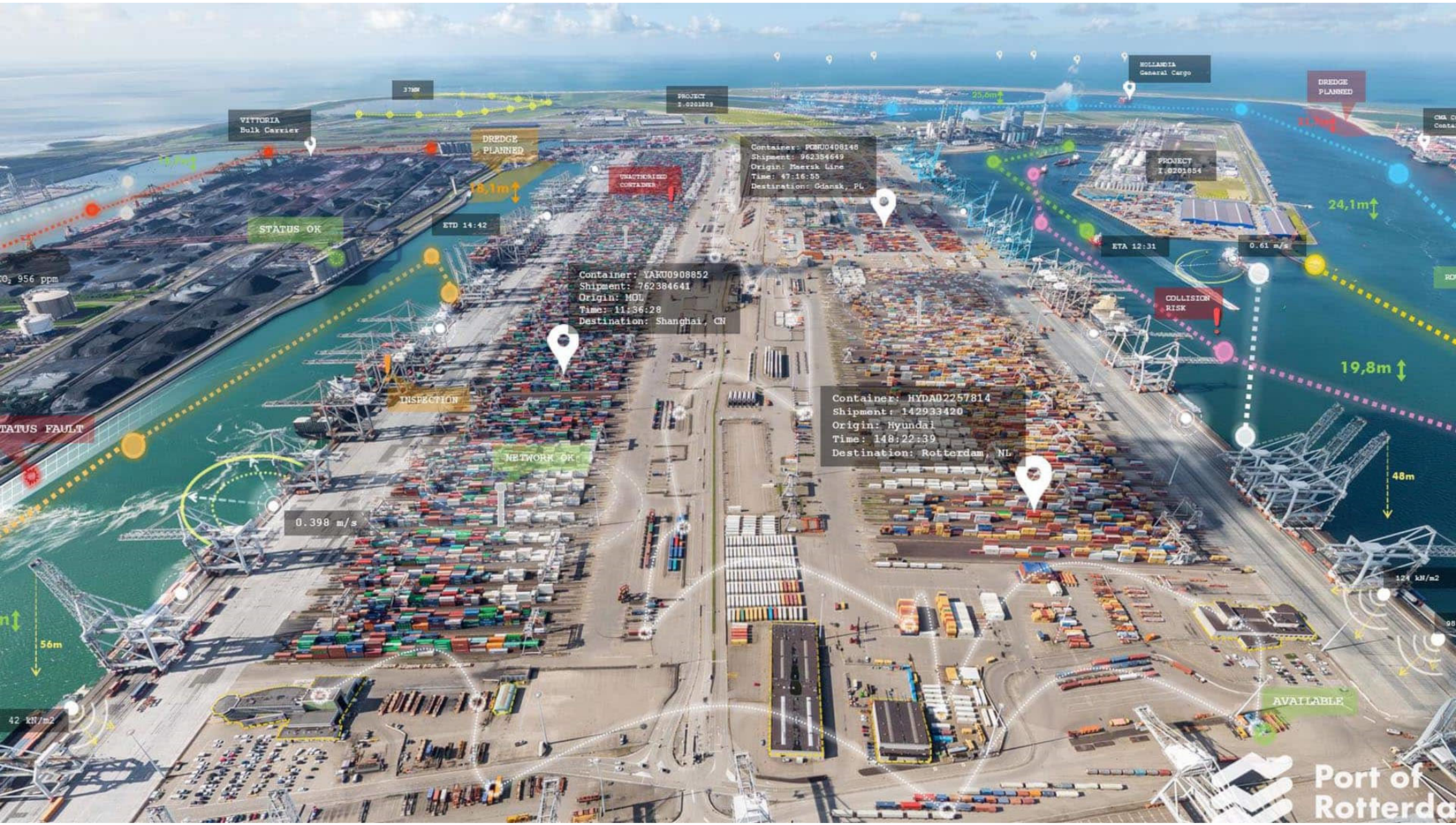


CIRCULAR ECONOMY ALLIANCE

Robotics, Drones, UUVs

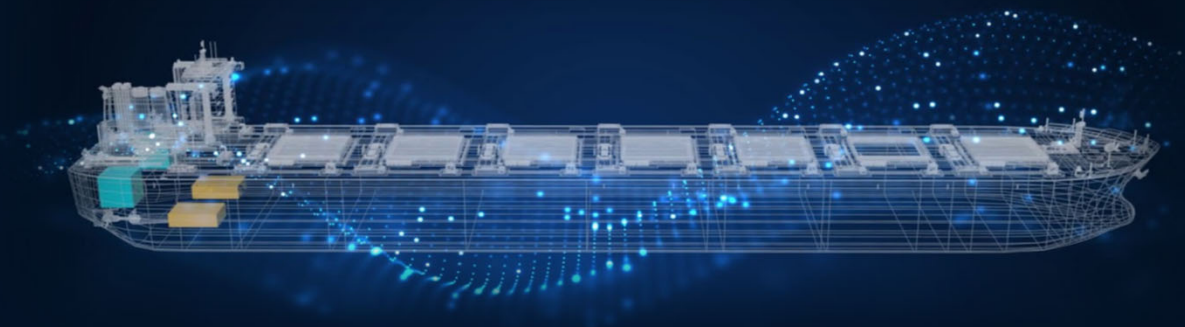
- Maintenance, Operations, Cargo Management
- Dynamic Modular Infrastructure and Support Systems
- Advanced Recon, Repair, Rescue, and Monitoring
- Ship-To-Ship (STS) transfer & Replenishment at sea (RAS)




VITTORIA
Bulk Carrier
DREDGE
PLANNED
18,1m
STATUS OK
ETD 14:42
UNAUTHORIZED
CONTAINER
PROJECT
I.0201803
Container: PGMU0408148
Shipment: 962354649
Origin: Maersk Line
Time: 47:16:55
Destination: Gdansk, PL
HOLLANDIA
General Cargo
DREDGE
PLANNED
PROJECT
I.0201854
24,1m
ETA 12:31
0.61 m/s
COLLISION
RISK
19,8m
Container: YAKU0908852
Shipment: 762384641
Origin: MOL
Time: 11:36:28
Destination: Shanghai, CN
INSPECTION
NETWORK OK
0.398 m/s
Container: HYDA02257814
Shipment: 142933420
Origin: Hyundai
Time: 148:22:39
Destination: Rotterdam, NL
48m
124 kN/m2
56m
42 kN/m2
AVAILABLE
Port of
Rotterda

The Dual Transition of Digital & Circular Economies

- See Through Supply Chains
  - Efficiency, intelligence
  - Transparency, Accountability,
  - Resilience, Security, Compliance.
- Autonomous & Sustainable
  - Operations & Management
  - Fleet & Smart Ports
  - Marine Ecosystem



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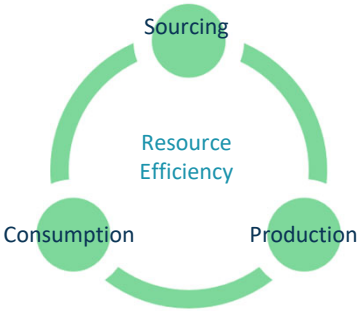
Digitally Empowered Circular Economy

Connectivity, Visibility, Intelligence, Insight, Feedback Loops, Enhancement, Accessibility, Trust
Ecosystems, Engagement, Impact, Collaboration, Innovation, Competitiveness, Resilience

Eliminate Emissions, Waste, Pollution

Promote Resource Efficiency & Smart Utilization of Assets



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The Dual Transition of Digital & Circular Economies

Circular Economy

- Eliminating Waste, Emission, Pollution
- Maximizing Resource Efficiency
- Smart Utilization of Assets
- Sustainable Competitiveness
- Ecosystems and Support Systems
- Multistakeholder Engagement
- Narrow, Slow, and Close the Loops
- SDGs, ESG, CSR, DEI

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The Dual Transition of Digital & Circular Economies

Questions, Ideas, Discussion Points