

AWK'23

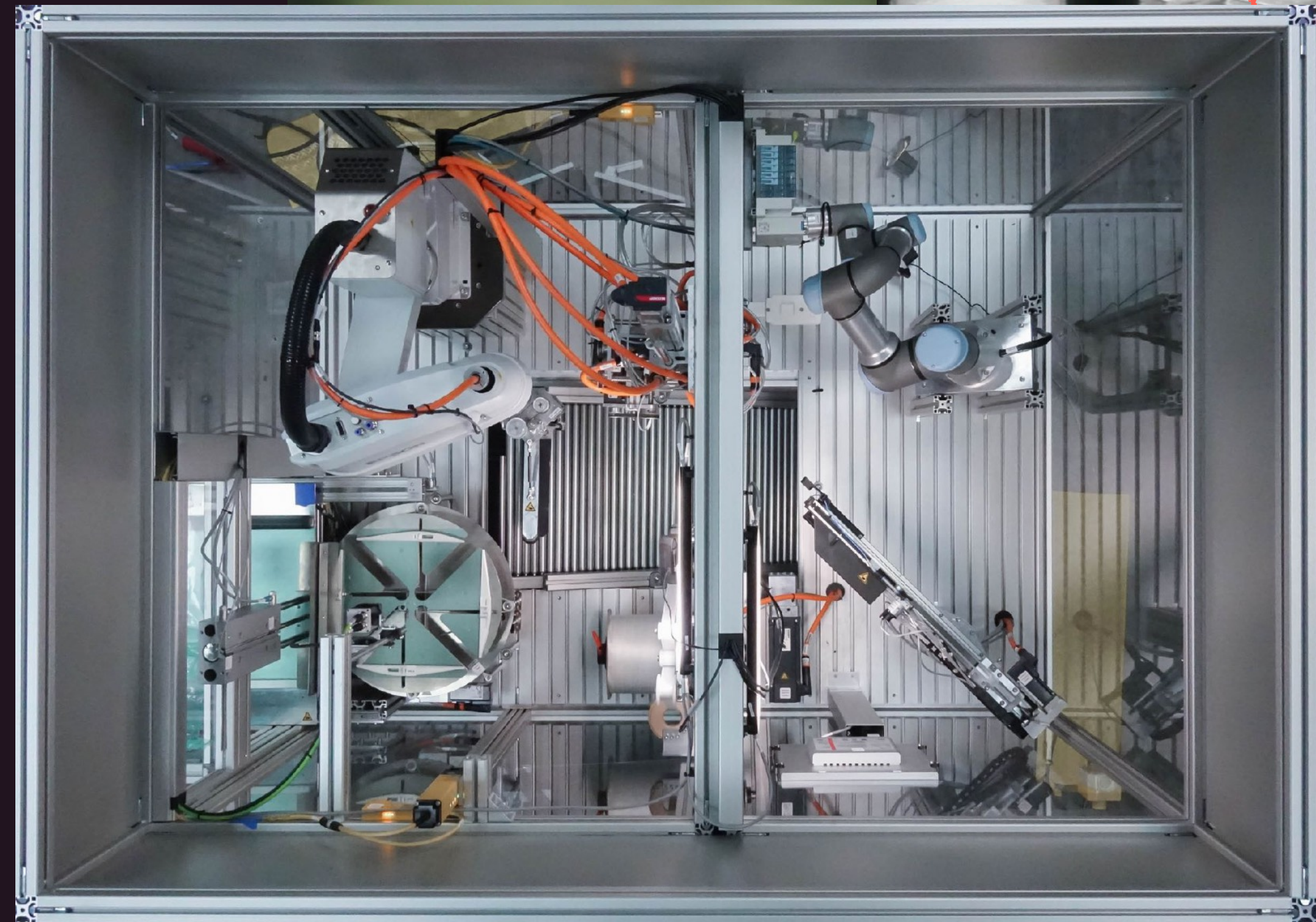
Industrial Biome

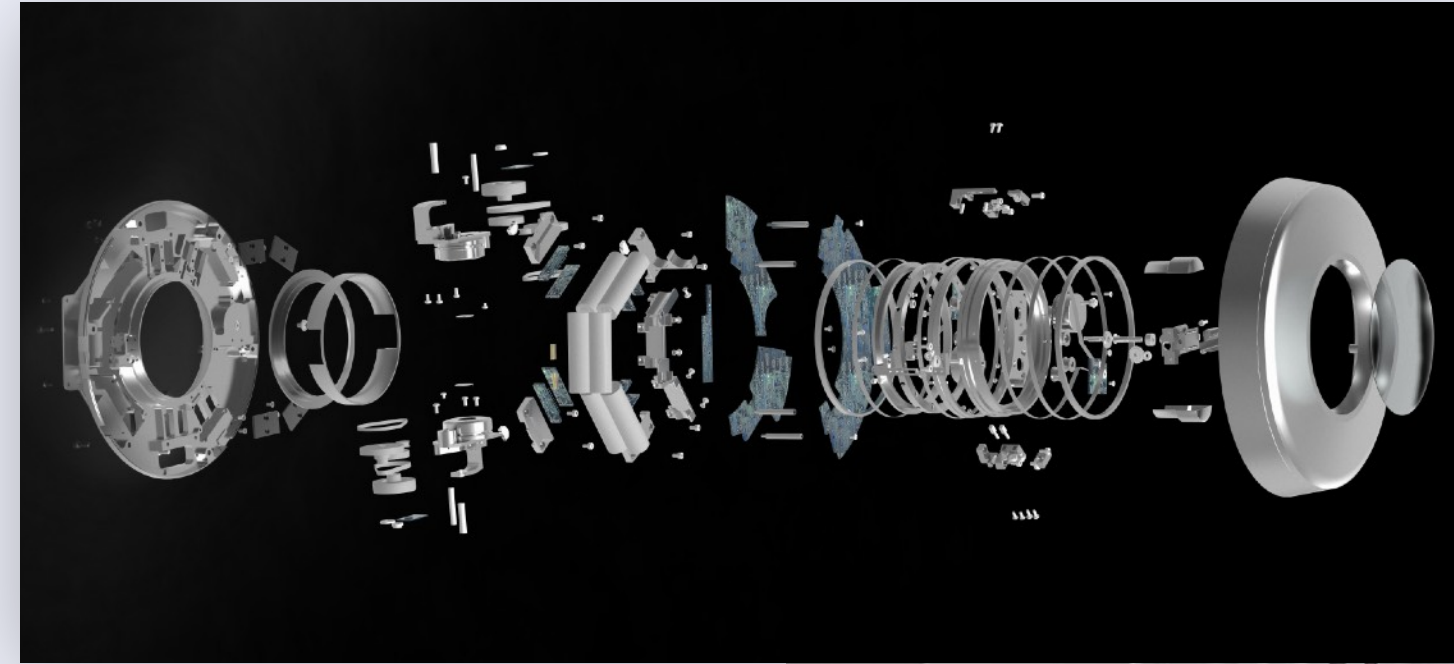
A holistic innovation framework to guide the next era of industrial imagination.

PCH
/INNOVATIONS

WZL

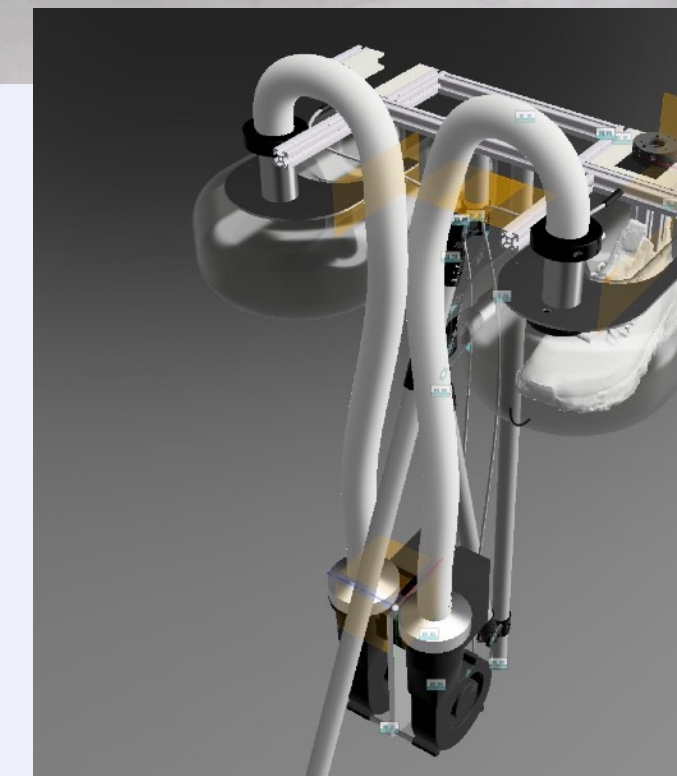
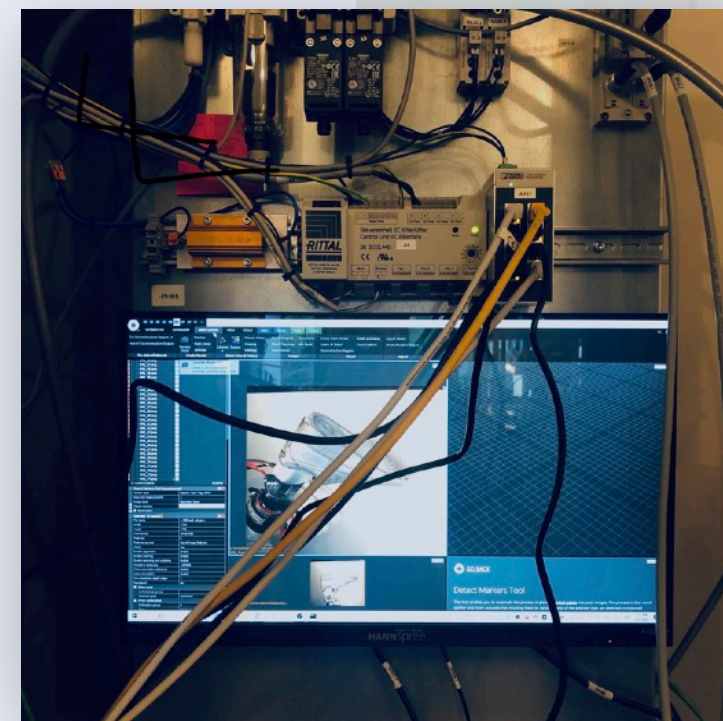
RWTHAACHEN
UNIVERSITY



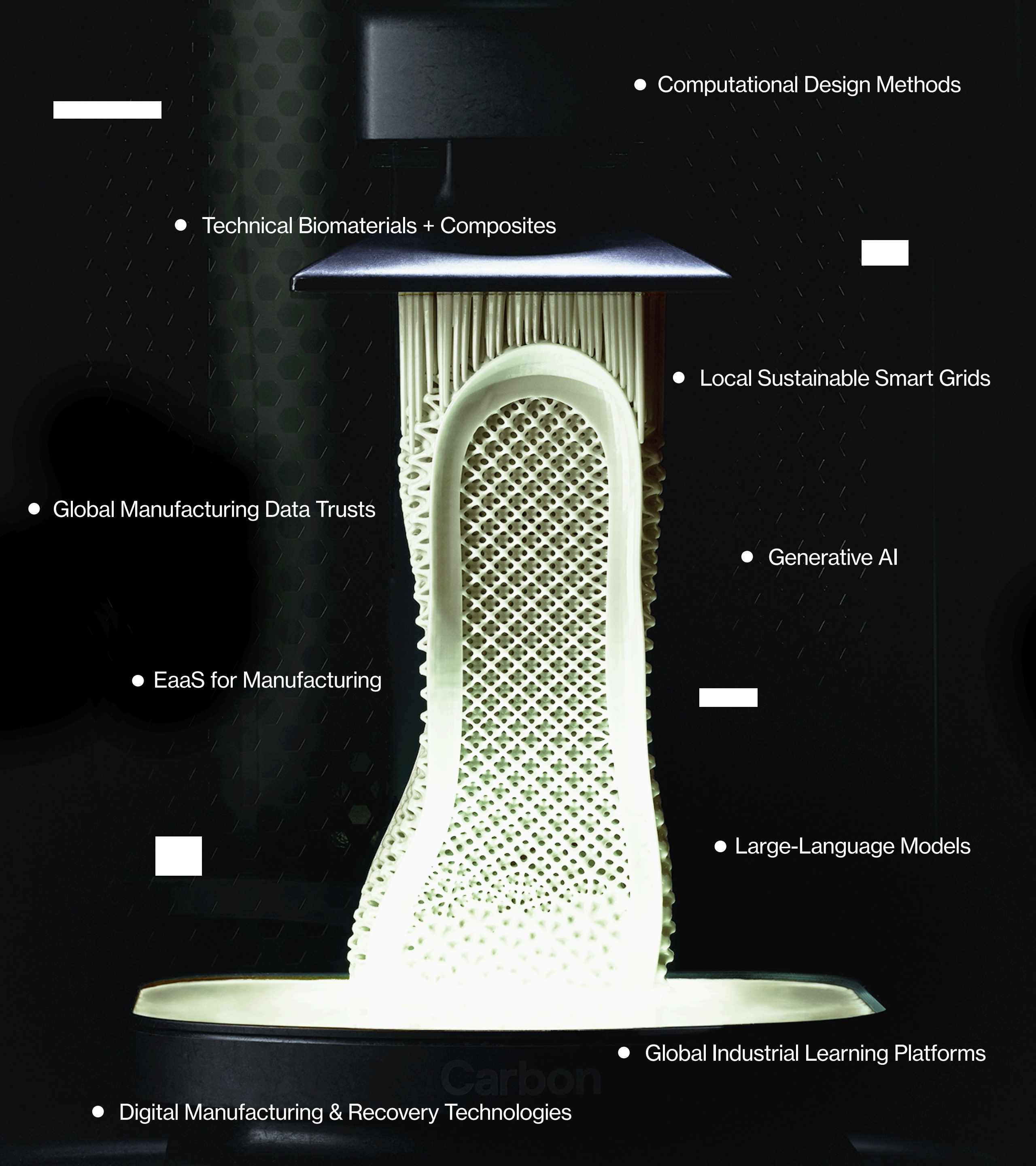


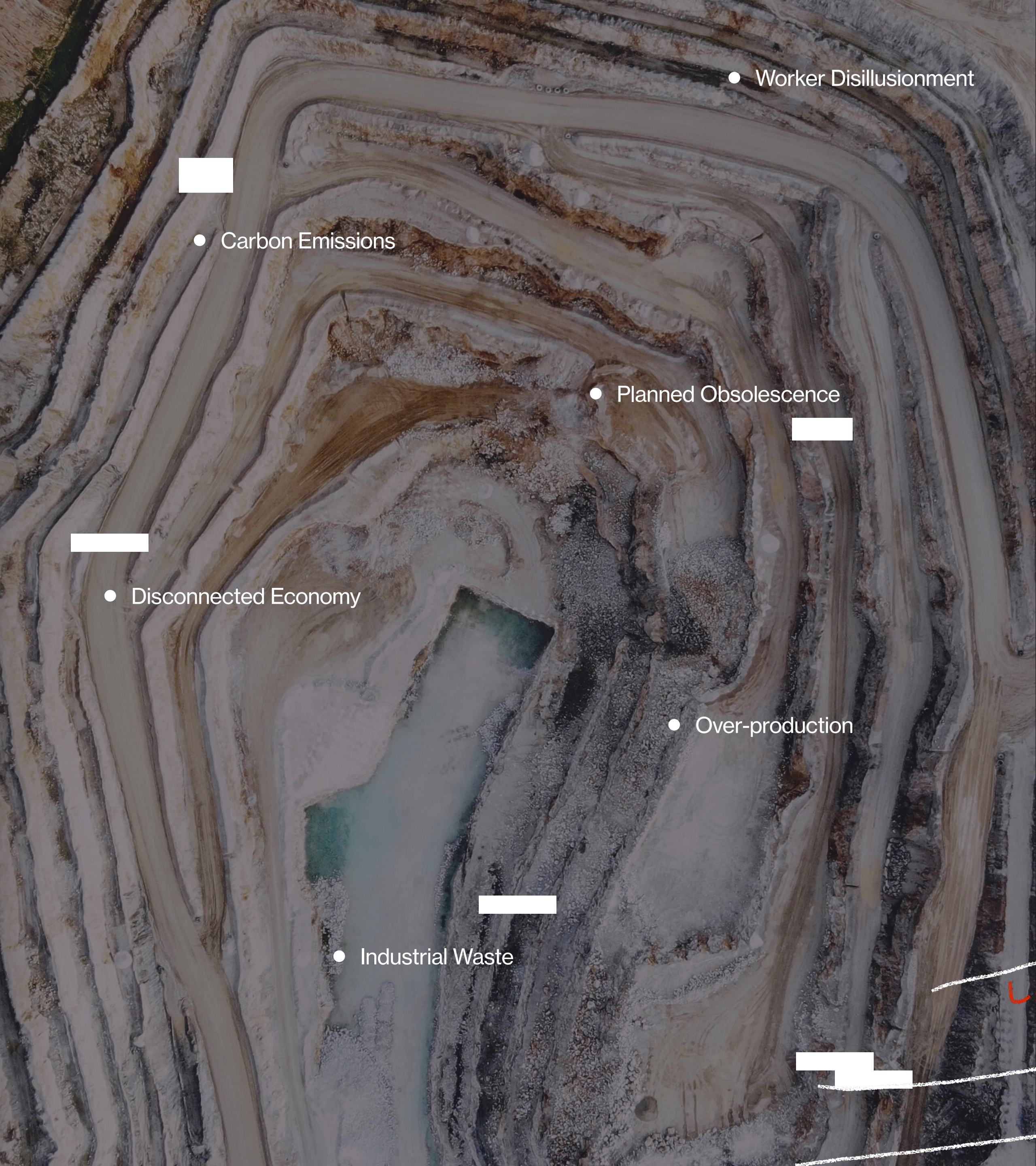
PCH is a creative engineering studio for exploratory technology.

Designers, engineers, technologists, coders, researchers and storytellers working towards a more regenerative future.

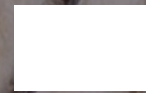


Industry is
doing great.



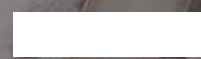
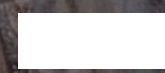


• Worker Disillusionment



• Carbon Emissions

• Planned Obsolescence



• Disconnected Economy

• Over-production

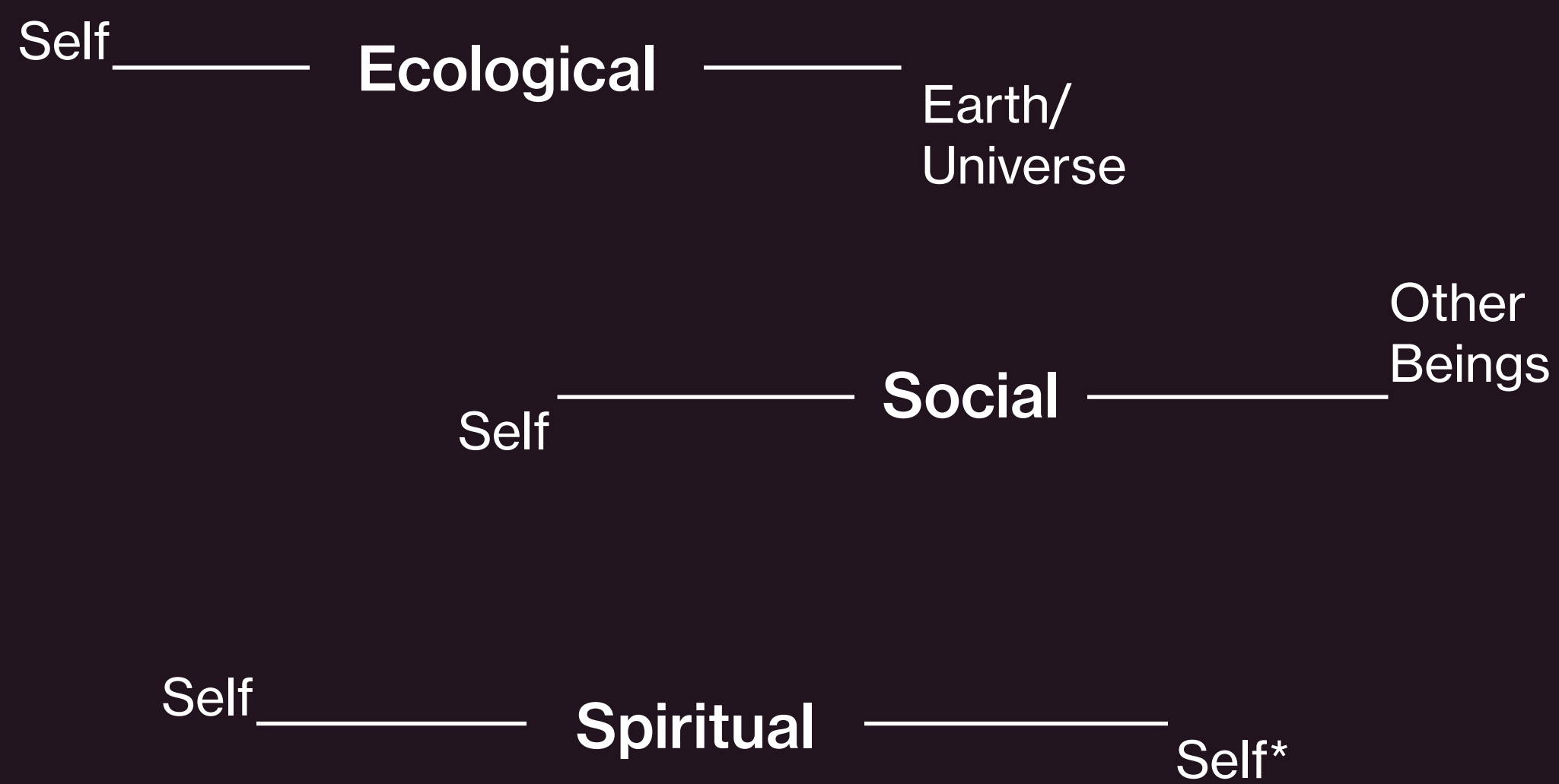
• Industrial Waste



Industry is doing great harm.



We are living within disconnected systems



*Disconnection between who I am today and who I might be tomorrow (my highest future potential).

Form follows consciousness

The output value of any system is dependent on the quality of awareness of the people operating within it.

The outer world is a reflection of the inner place from which we collectively operate.

Inner Void > Social Divide > Ecological Divide

The challenge of
our generation

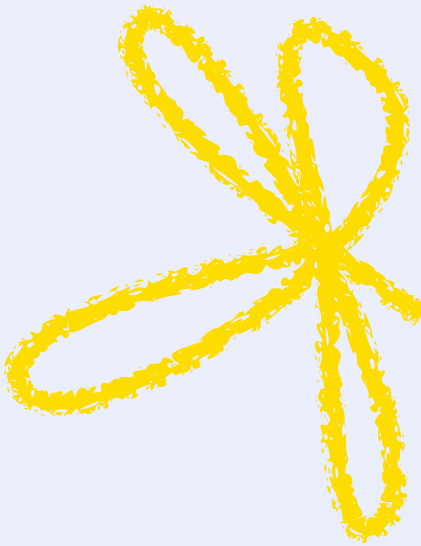
me

Our world is organized around groups
maximizing interests of the few rather
than maximizing the health of the
whole — an **ego-system**.



The opportunity
for our generation

(and those to come)

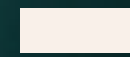


we



We need a new mode of business
+ society that includes the
interests and perspectives of all
stakeholders — an **eco-system**.





For industry, it's time to wake up.



The earth is showing the effects of our wasteful habits

3 Earths There is only one planet Earth, yet by 2050, the world will be consuming enough for three.

Resource extraction accounts for

90%

of biodiversity loss and water stress.

66% of species in Europe remain vulnerable.

2x
consumption
by 2060

Global consumption of materials such as biomass, fossil fuels, metals and minerals is expected to double in the next 40 years.

+70%
Waste by 2050

Annual waste generation is projected to increase by 70% by 2050.

2x
natural resources

Natural resources are currently being consumed at twice the rate they are produced. By 2050, this could be three times.



Thirty per cent

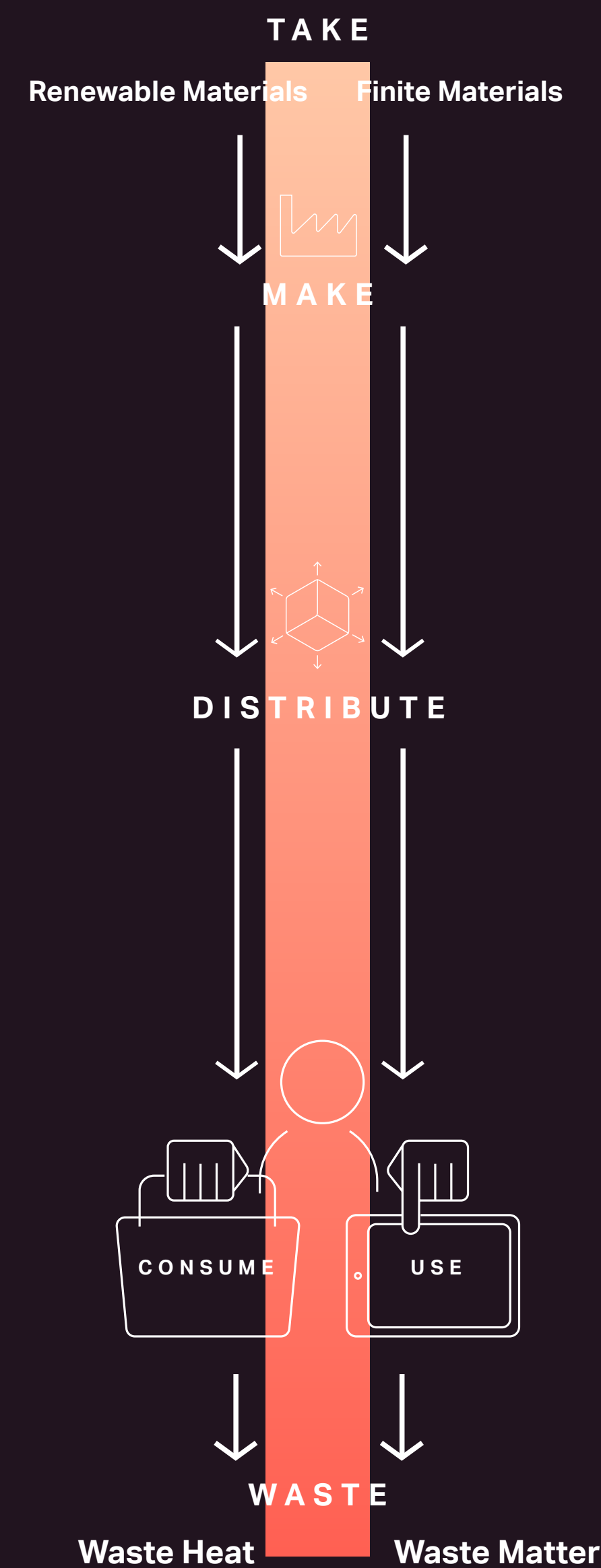
of food is wasted within the supply chain + consumption.

40%

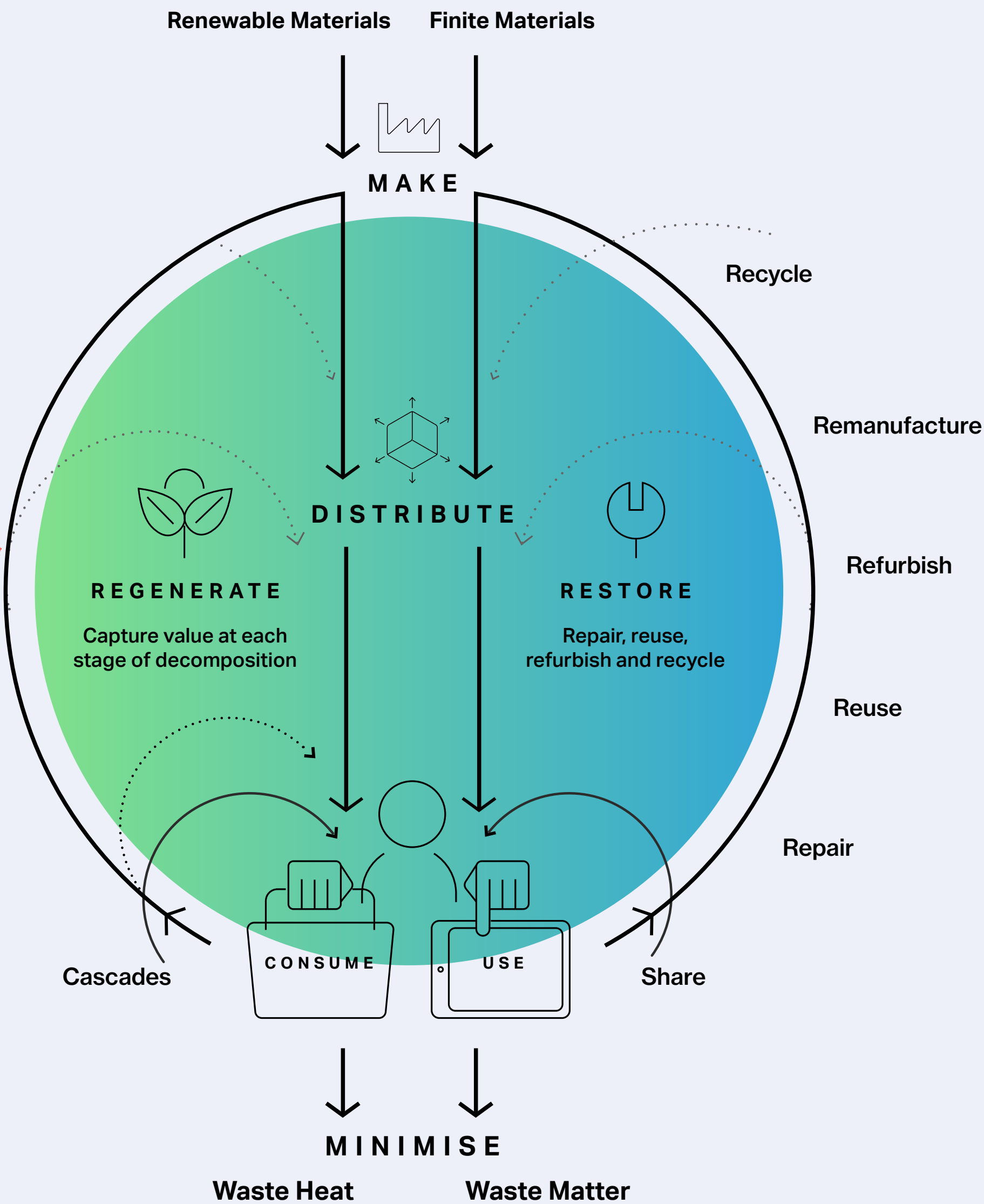
of plastic used is single-use plastic, and ends up in landfills.

One truck unloads plastic in the ocean every minute.





From linear to circular



How can we objectively define
MATERIAL VALUE?

How can we make products or
sub-components
RESELLABLE?

There is no consensus
on circularity.

What really is a **CIRCULAR
ECONOMY** in full effect?

What do we classify as
WASTE?

To what degree does **LIFE
EXTENSION** make sense?

Lack of END MARKETS...

New OWNERSHIP
MODELS are needed...

RECYCLING is
difficult...

What is preventing
circularity at scale?

Need for commonly agreed
STANDARDIZATION
MODELS...

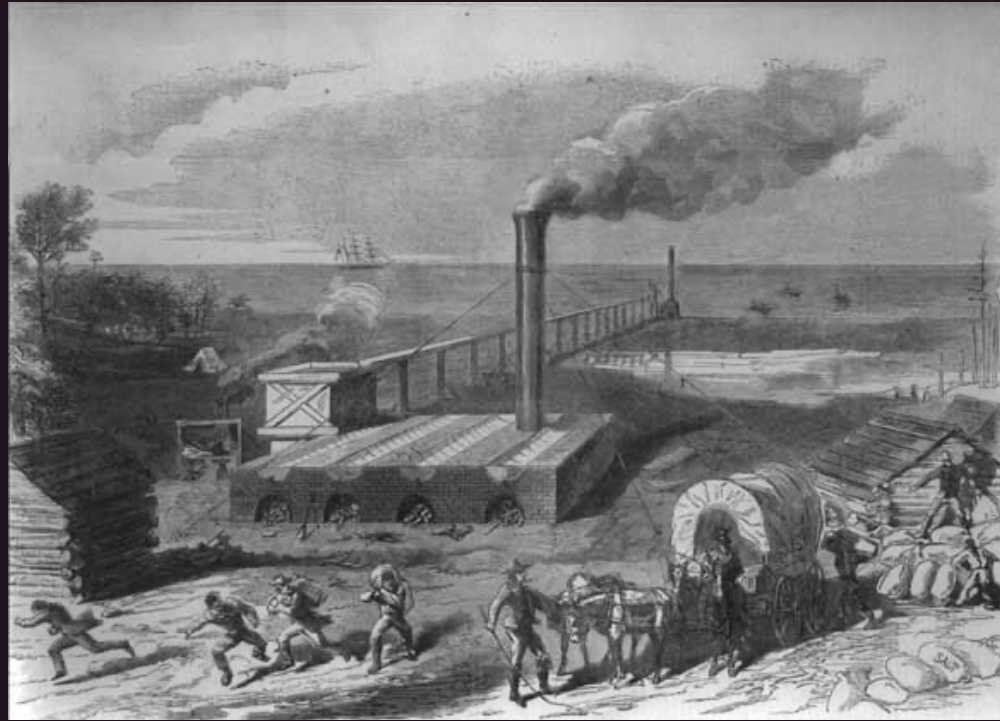
Lack of CIRCULAR
INFRASTRUCTURE...

Strategies to extend the
END-OF-LIFE...

Activating PASSIVE
CONSUMERS...



It's time for an Industrial Evolution.



Yesterday

A disconnected, static and sterile mechanism.

Extractive • Wasteful • Siloed

Harming

Healing

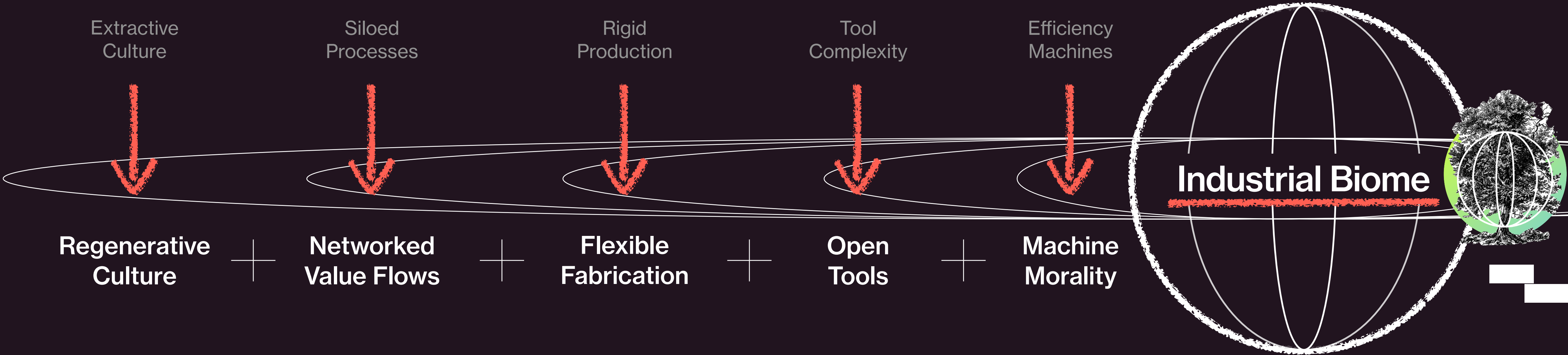


Tomorrow

A networked, dynamic and life-nurturing symbiote.

Replenishing • Revitalizing • Connected

Thinking beyond machines.



Defining the Industrial Biome.

We see Industrial Biomes as distributed, modular, networked, intelligent R+D and production sites located in key material areas for materials not able to be procured locally.

These bio-technological innovation and fabrication centers are optimized to near zero marginal cost and are carbon negative.

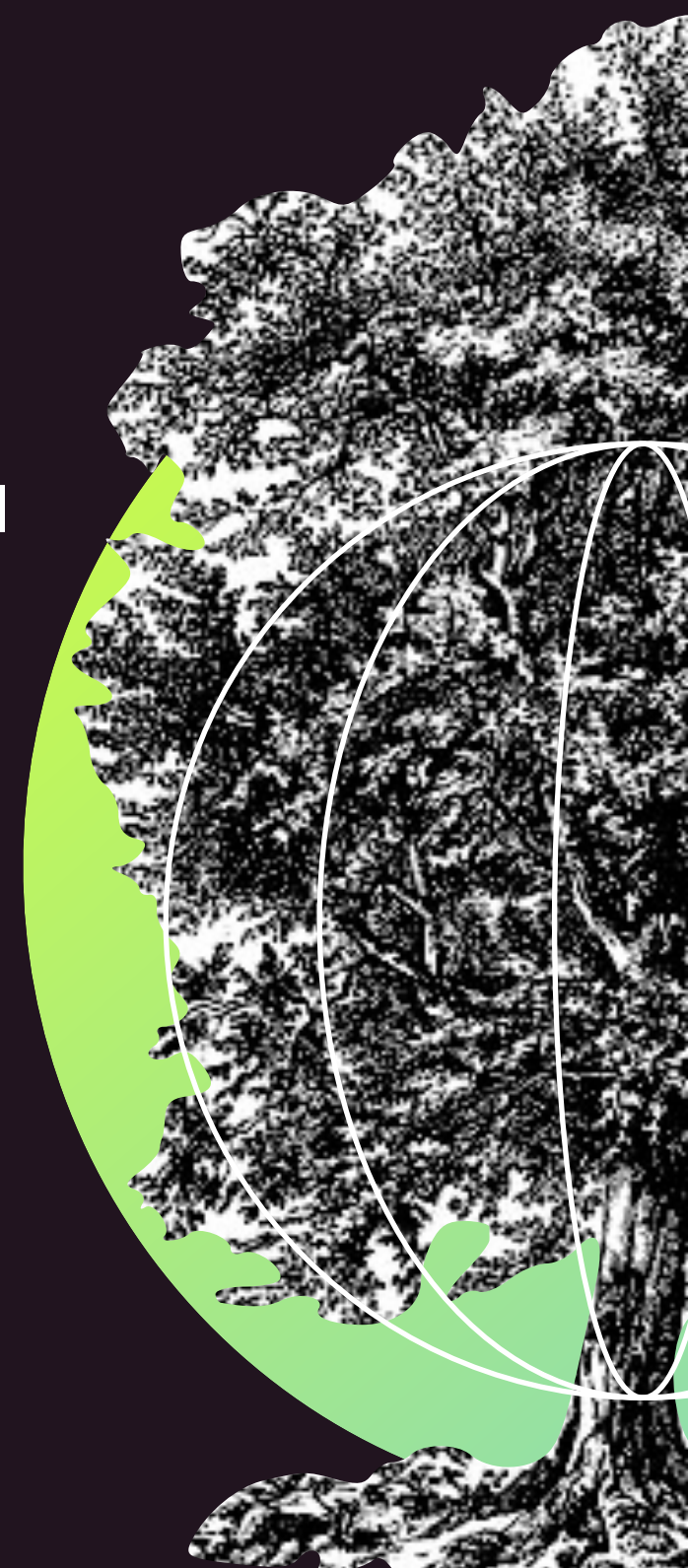
They also function as distributed village communities to host their R&D, material science and production teams.

Key Principles

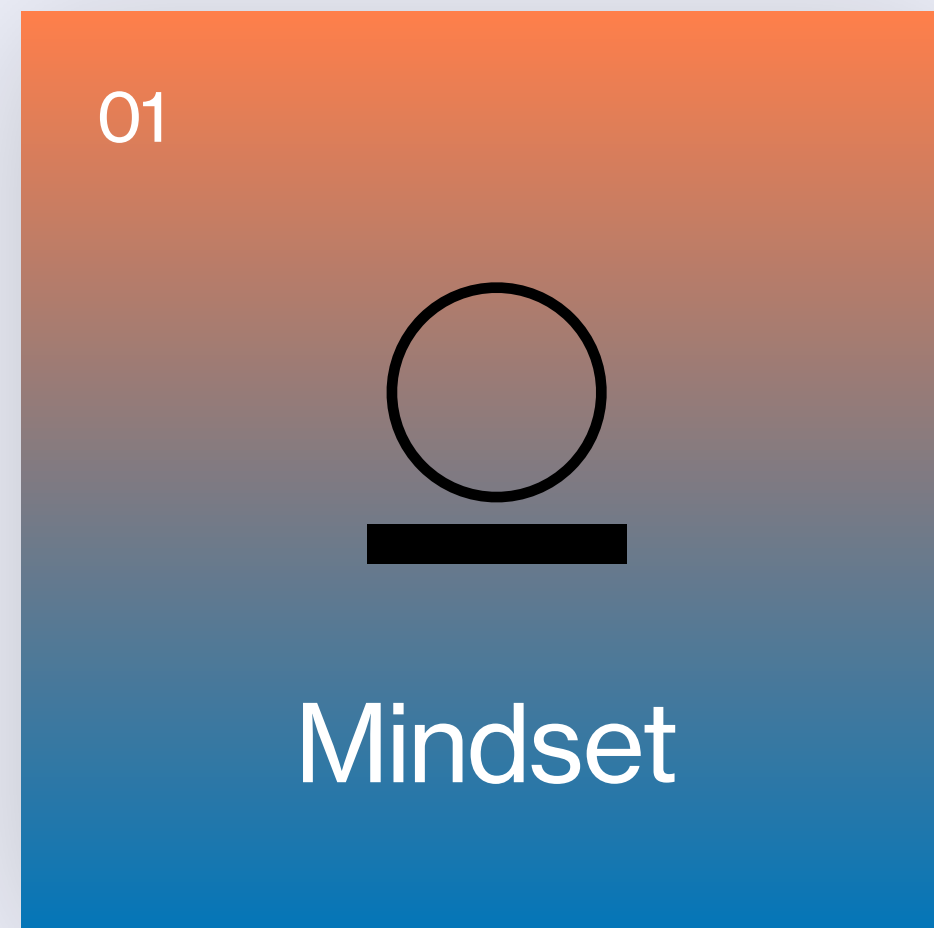
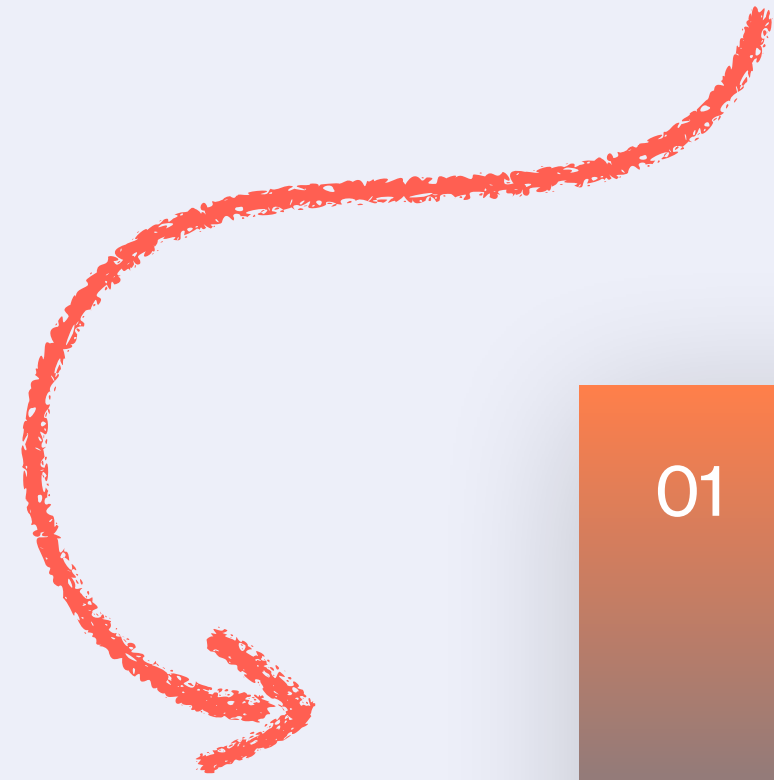
- / Focus process development and remediation on local/seasonal biome relevance – oceans, deserts, rainforest, taiga, grasslands, etc.
- / Use plants as feedstock for bio-based industrial processes
- / Lower resource intensity of production input (water, land, energy)
- / Contribute to local environmental, social + economic ecosystem

Key Output

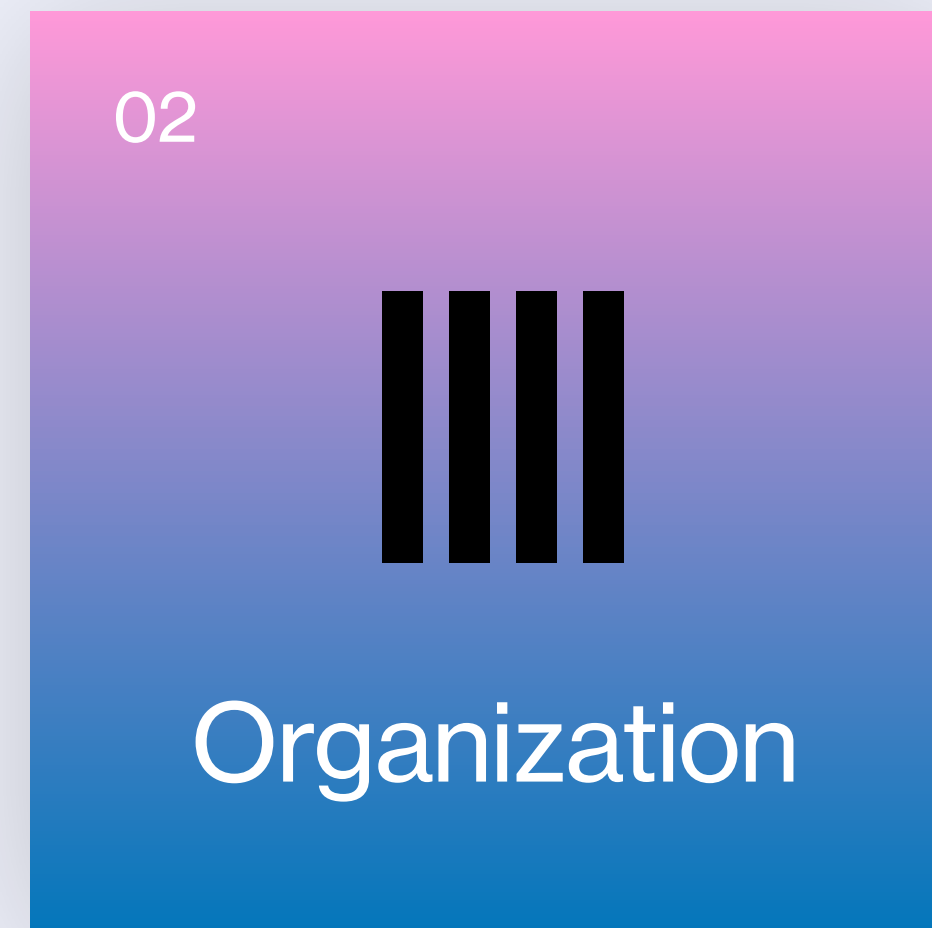
- / Carbon-negative feedstock materials + microbial manufactured materials
- / Materials from sequestering & biome-remediating, agricultural waste, or fungal sources (e.g. kelp, eucalyptus, mushrooms, etc.)
- / Bio-based chemical production competitive to petrochemicals (e.g. for adhesives, treatments + dyes)
- / Technical biomaterials (e.g. algae foams, cellulose nano-composites)
- / Bio-photopolymers generated from raw materials by metabolic engineered microbes
- / Material systems with self-repairing and self-replicating properties



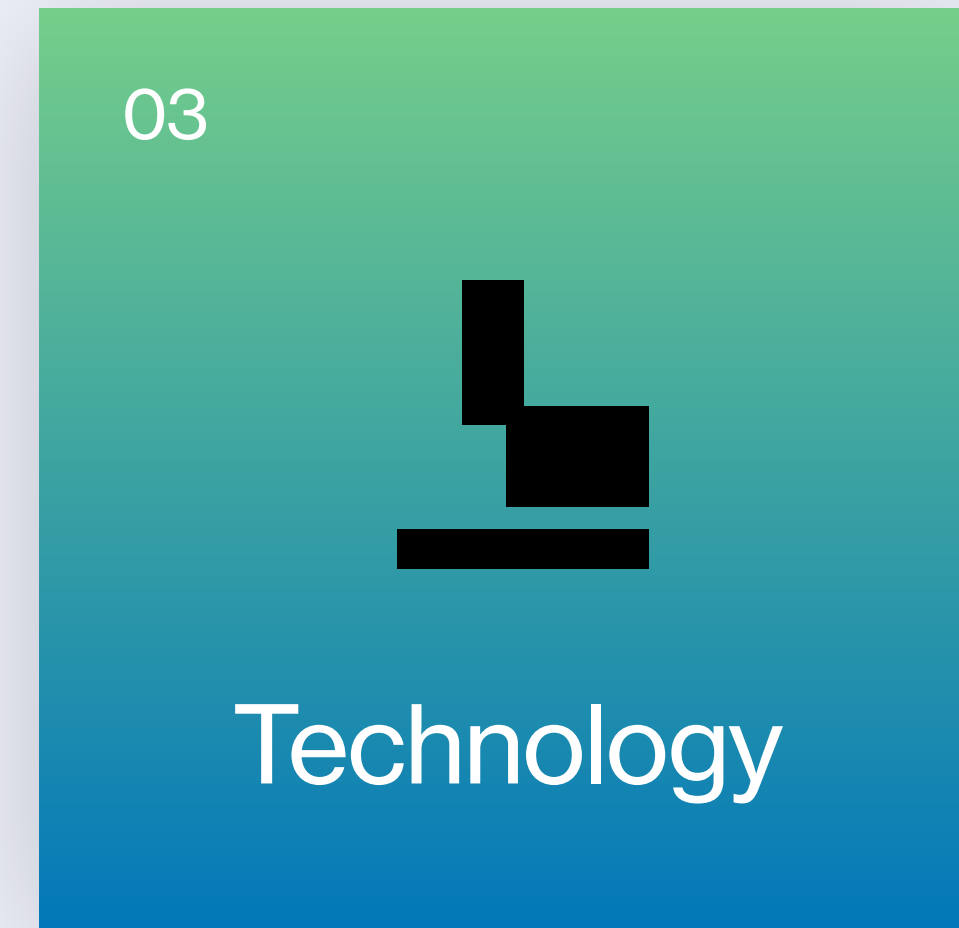
An Industrial Biome Innovation Framework.



Practices to shift industrial culture to nurture collective consciousness.



Infrastructures required to shift from transactional to regenerative flows.



Tools that enable the symbiotic interplay of human, machine, and environment.



Mindset

Practices that create the conditions for organizational consciousness transformation.



De-Conditioning Practices

Challenge unquestioned, sedimented or ‘common sense’ discourses of future, to broaden the field of possibilities.

Actualization Practices

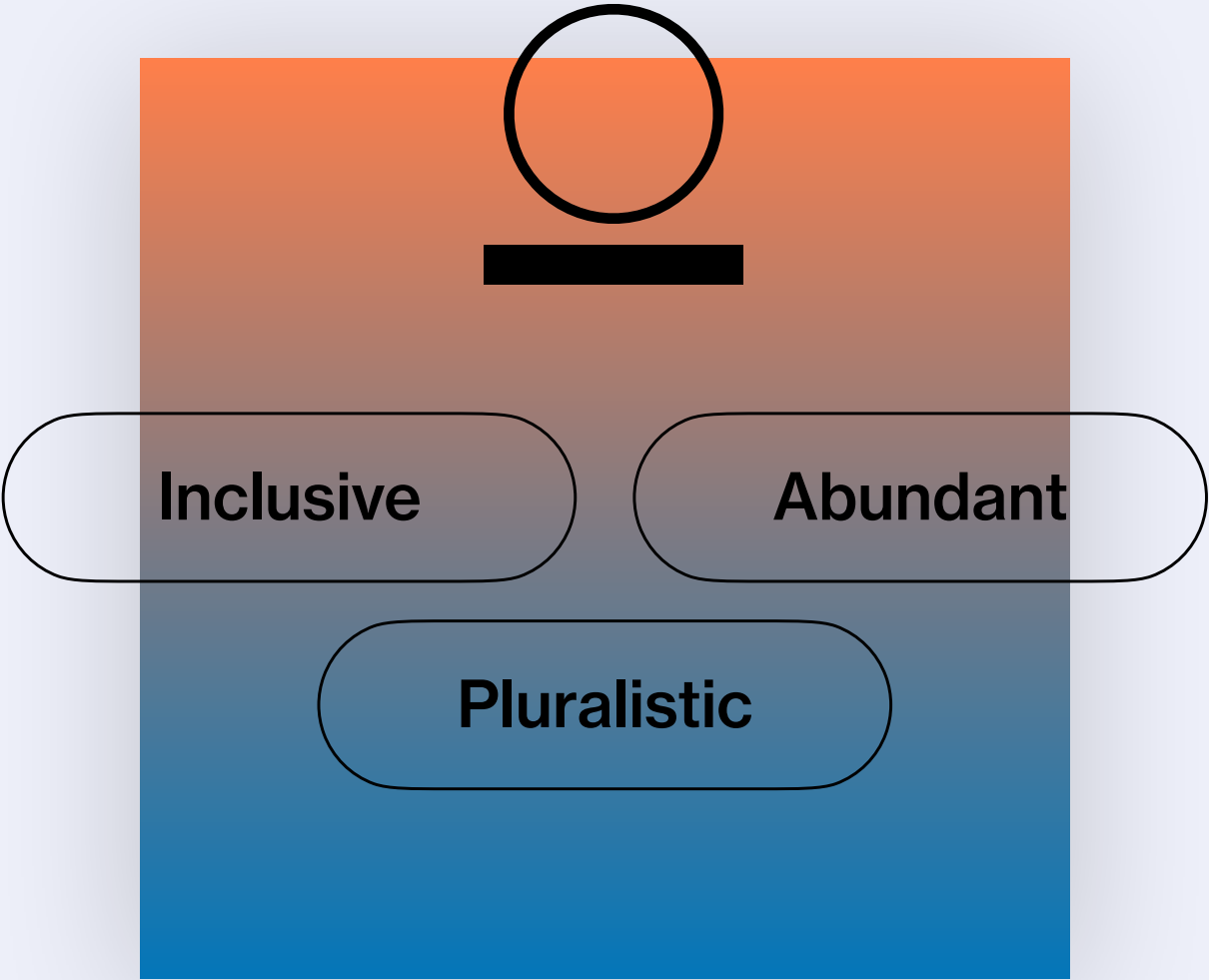
Give space, time and tools to leverage unrealized personal and collective potential and empower new creativity.

Healing Practices

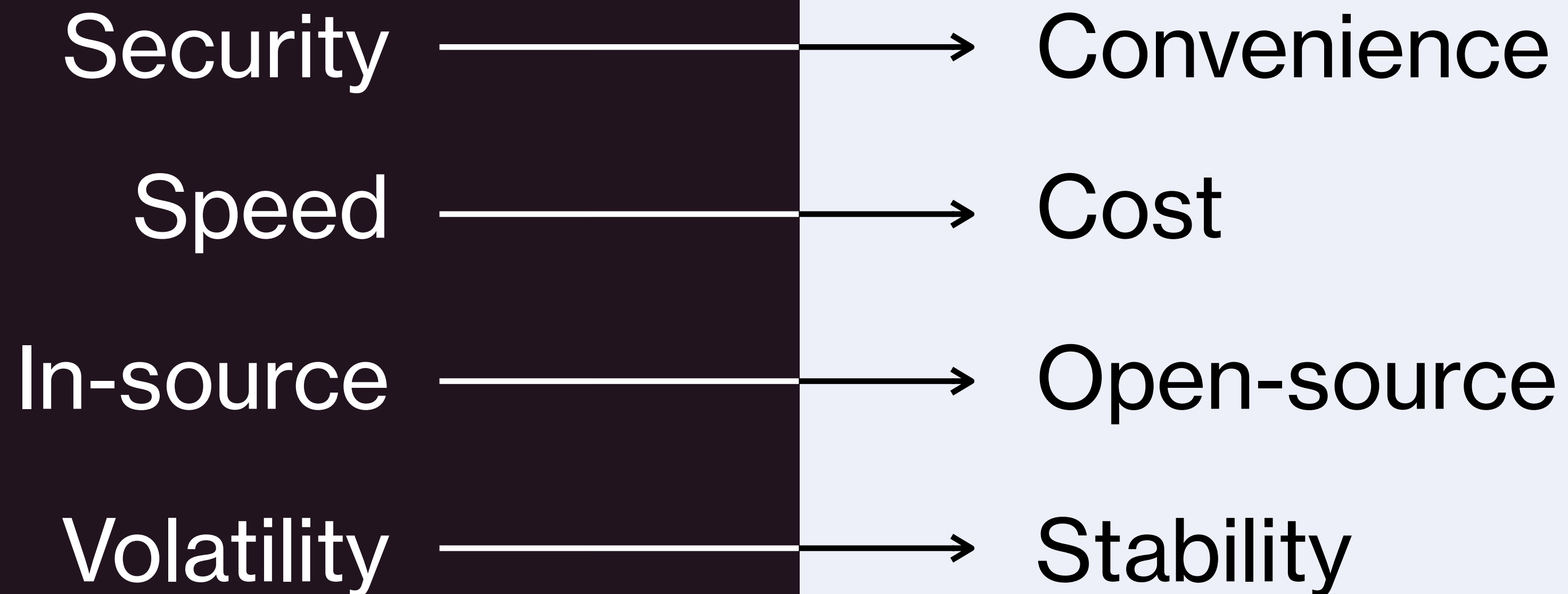
Create conditions to develop unrestricted concepts to heal people, planet, product and processes.

Alignment Practices

Create mechanisms that foster the safe exchange and alignment between people, organization and environment.

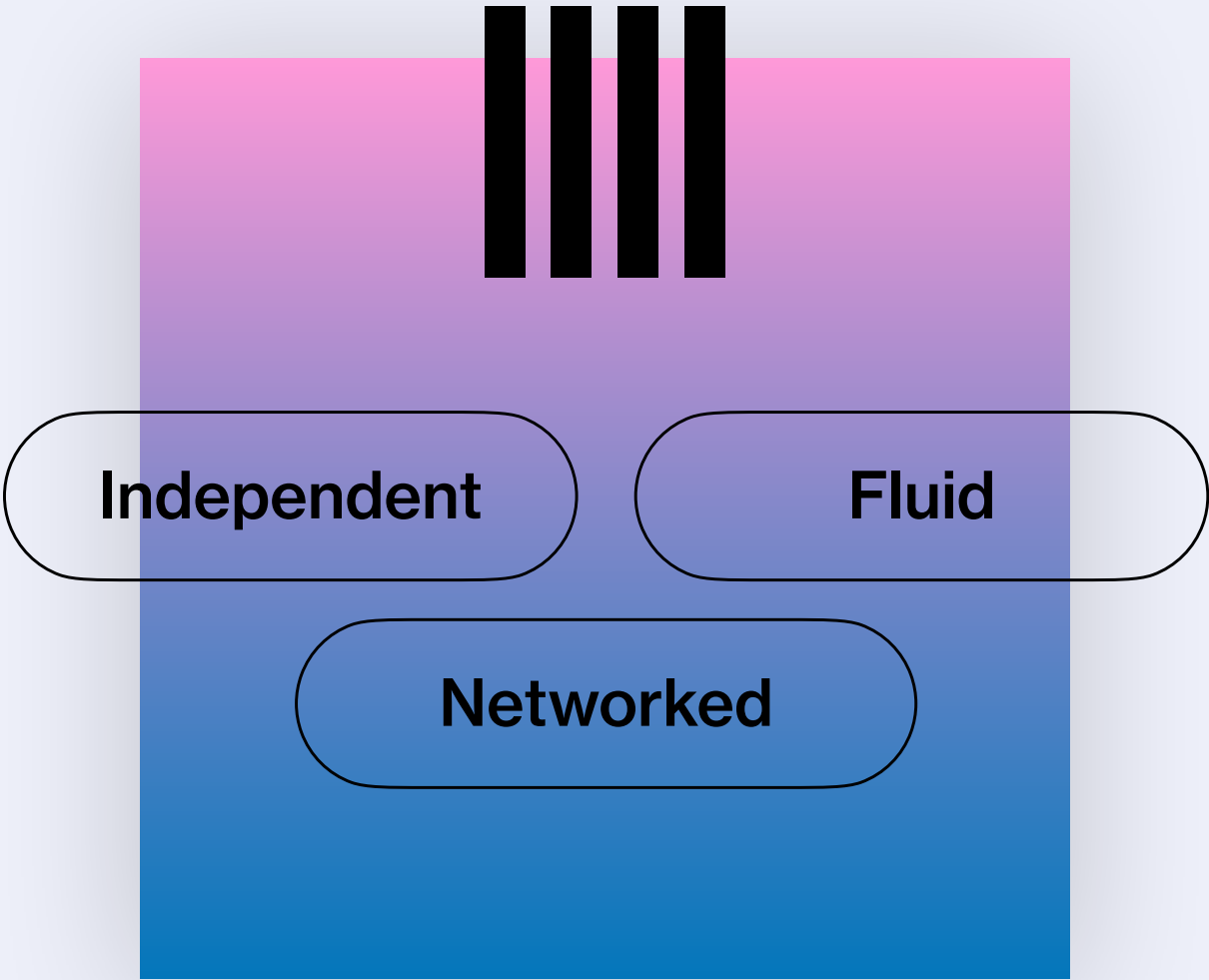
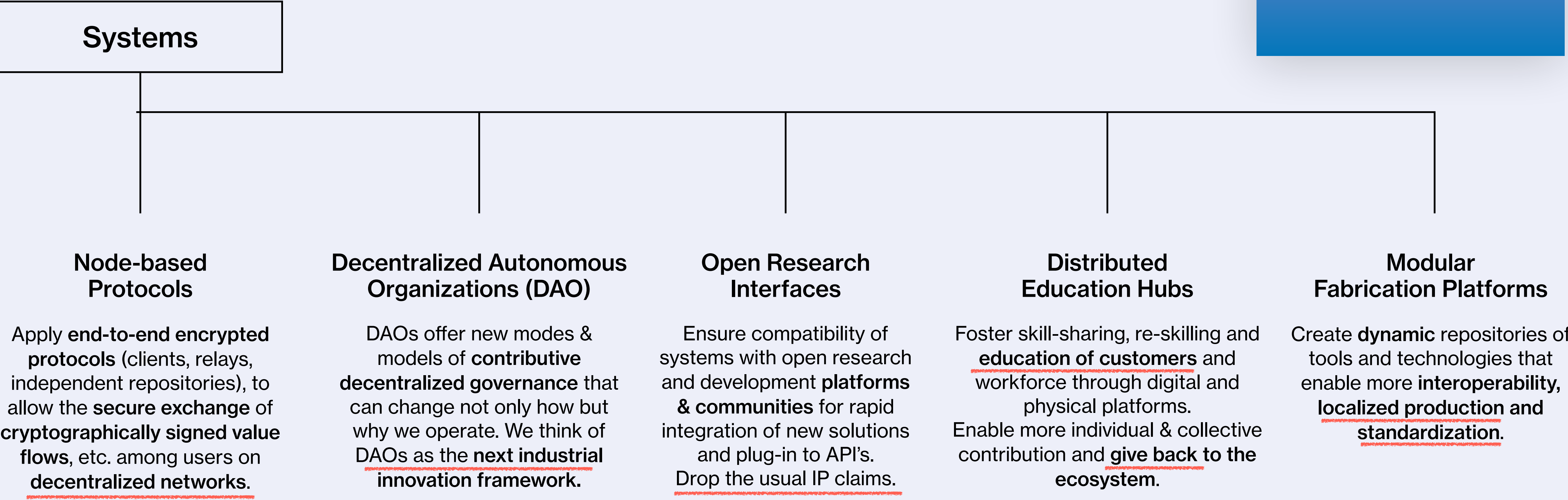


Organizations have to make trade-offs.



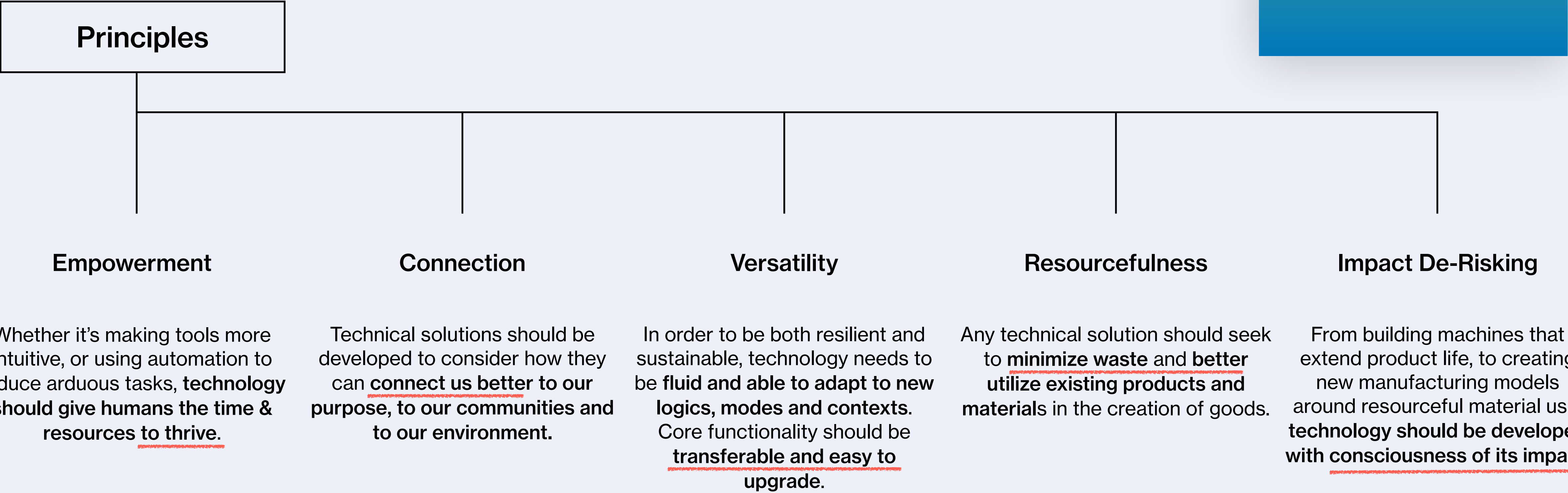
Organization

Systems that enable more heterogenous and contributive innovation.



Technology

Principles to guide the development of meaningful tools and machines.

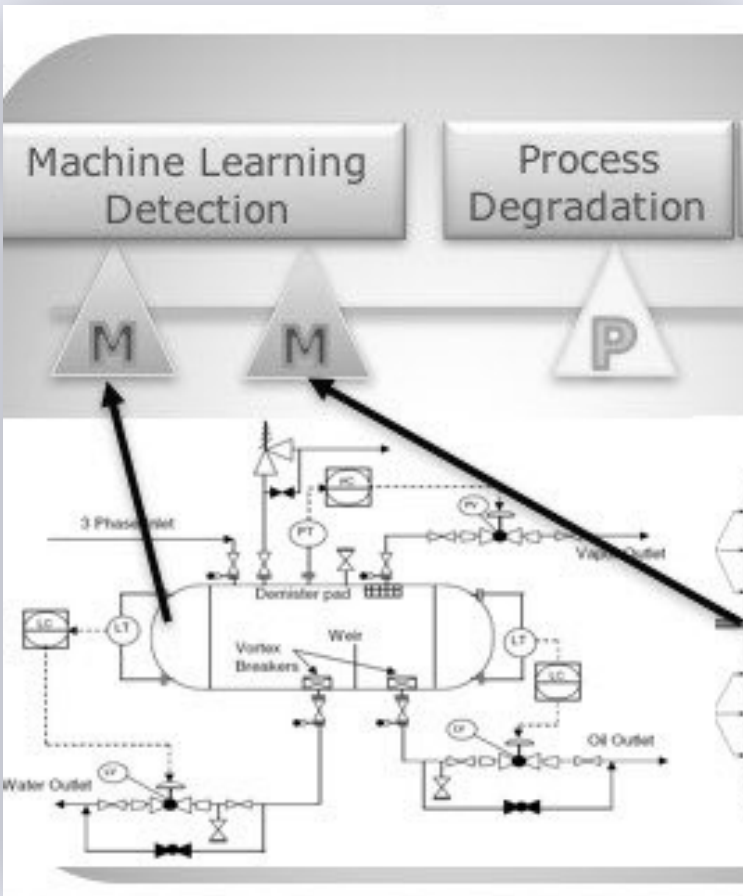


Enabling Tools

Leveraging state-of-the-art technologies and datasets to facilitate innovation.



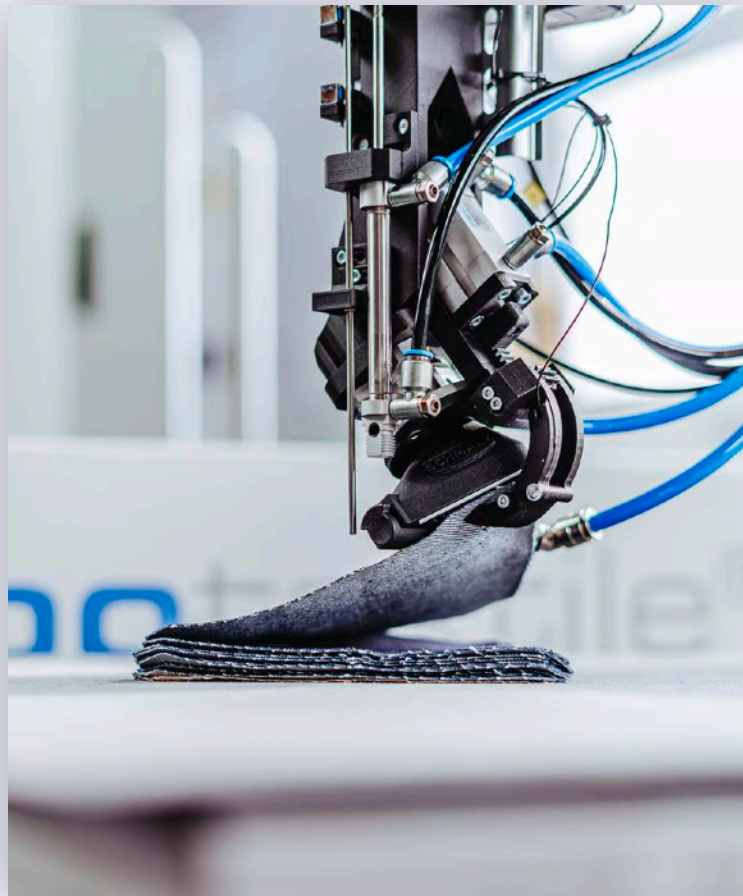
Biome-like manufacturing system setups



Machine Learning based lifetime & failure determination



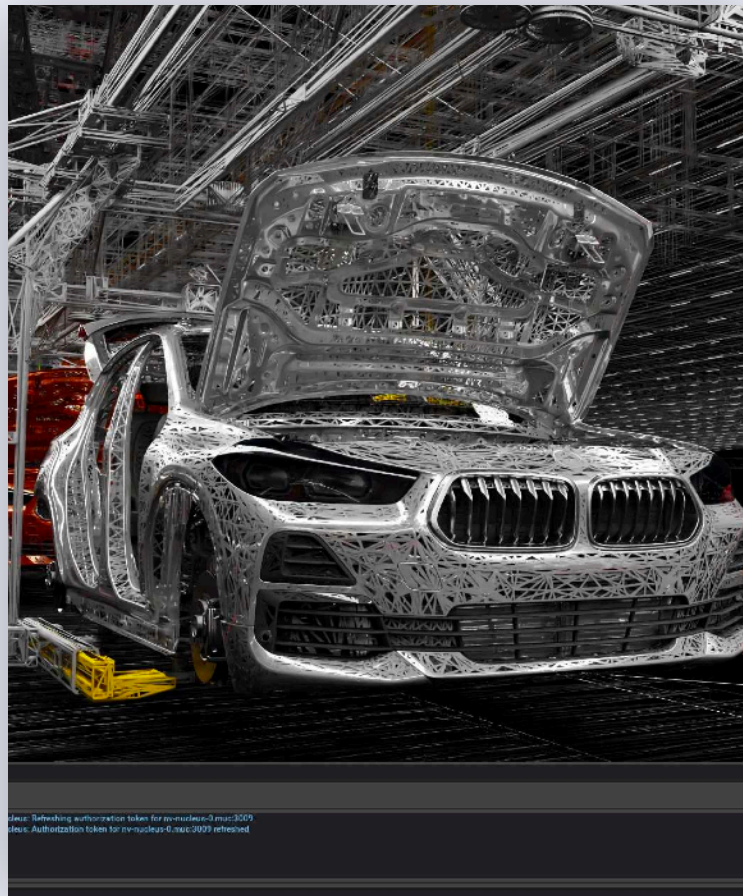
System-product compatibility via Plug & Play HW/SW



Intelligent haptics for human-robot operation in unstructured environments



Conversational UIs & conversational automation agents



Democratized end-to-end simulation environments

Case Study

Applying the framework to
materialize a new company
logic for Nike.



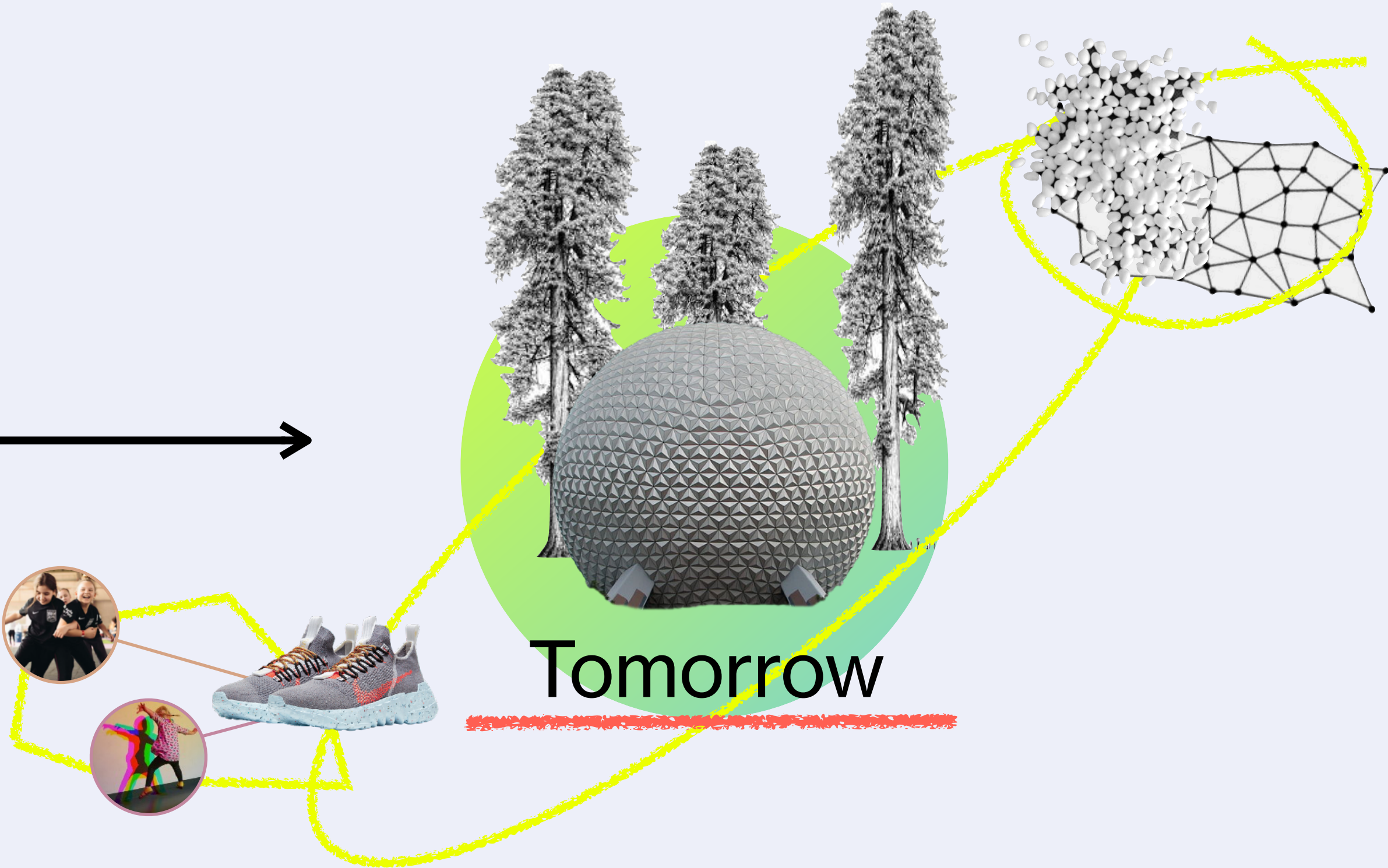
PCH
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Yesterday

400+ sweatshops
Siloed + limited material research
Exorbitant Athlete Endorsements

Siloed R&D • Damaging Growth • Push Marketplaces • Top Down Governance • Extractive Production



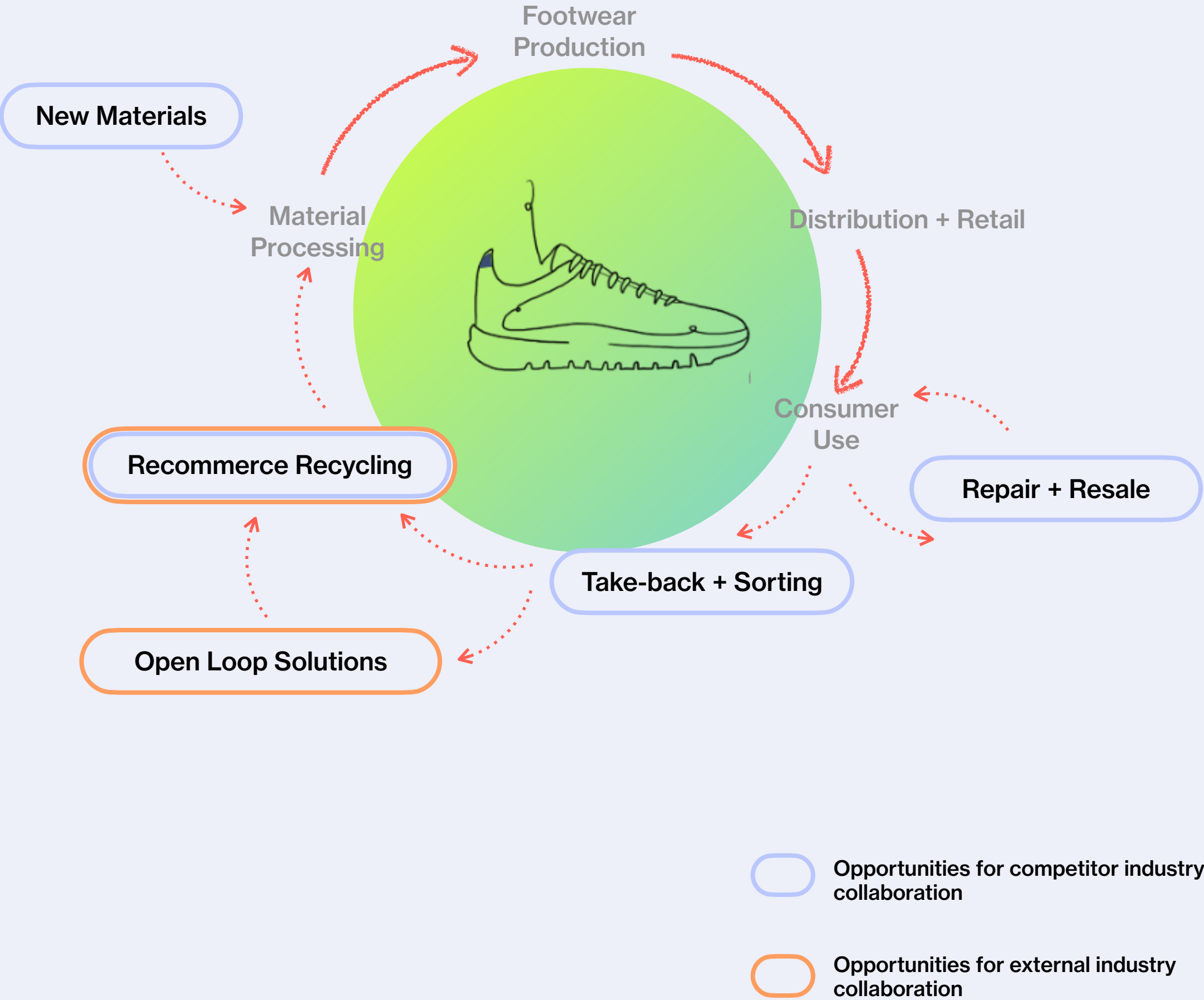
Digital Mediation Platforms
Biomaterials Research Networks
Biome R&D + Manufacturing Ranches

Co-development • Balanced Demand Creation • Nurturing Governance • Pull Marketplaces • Bio-production

Yesterday

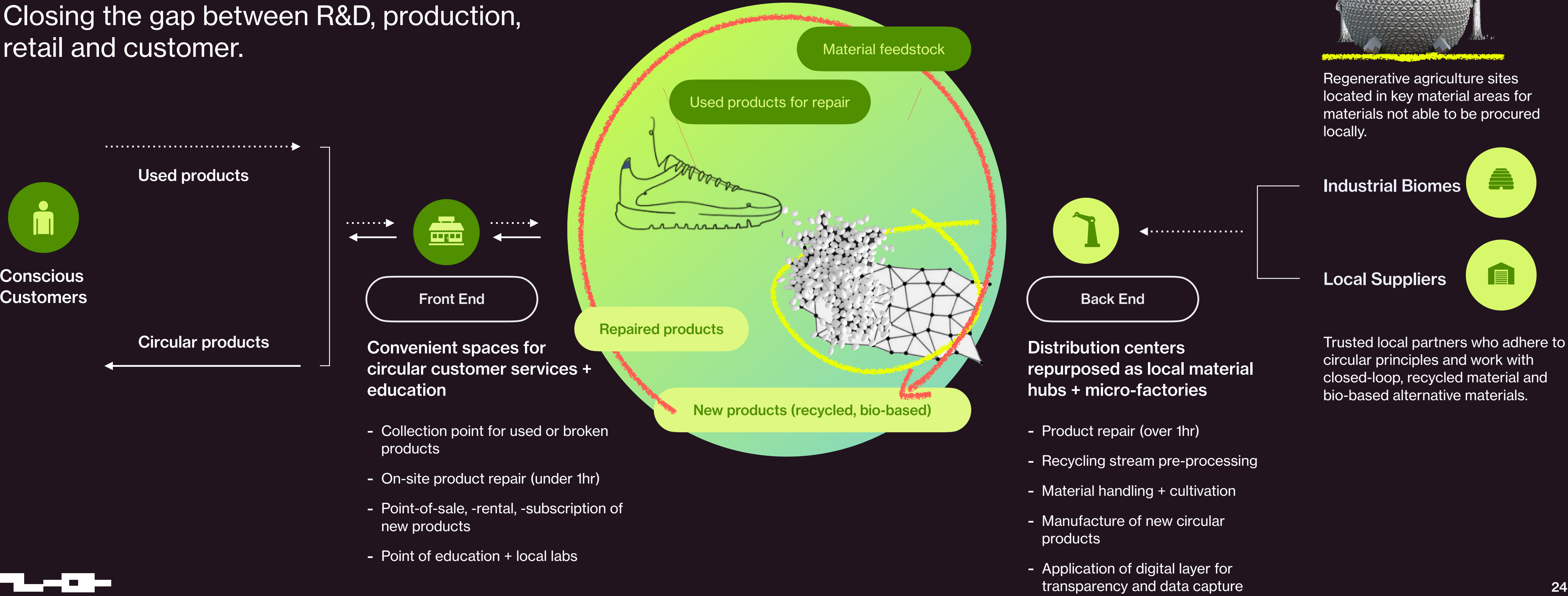


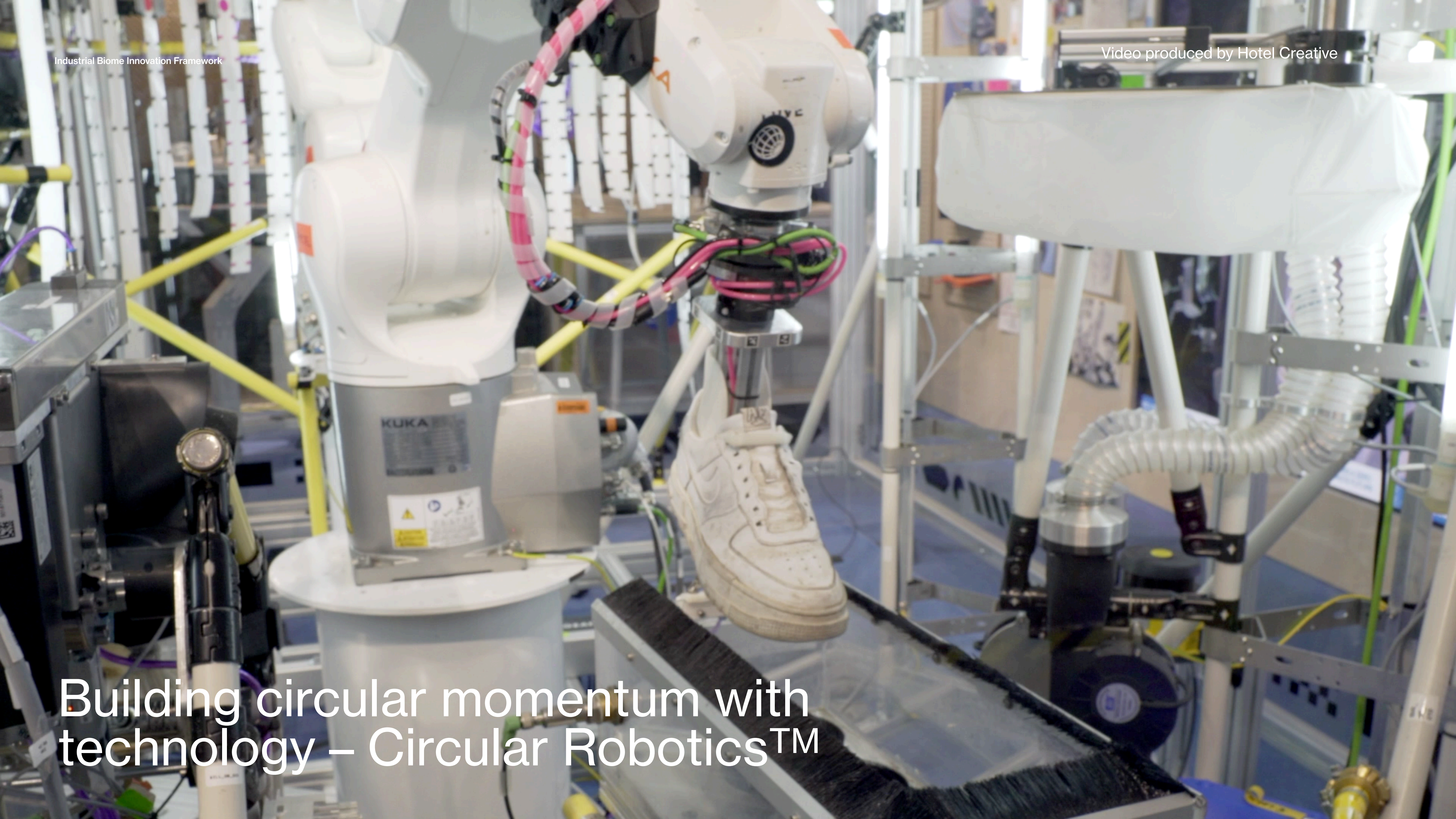
Tomorrow



Creating a symbiotic production eco-system

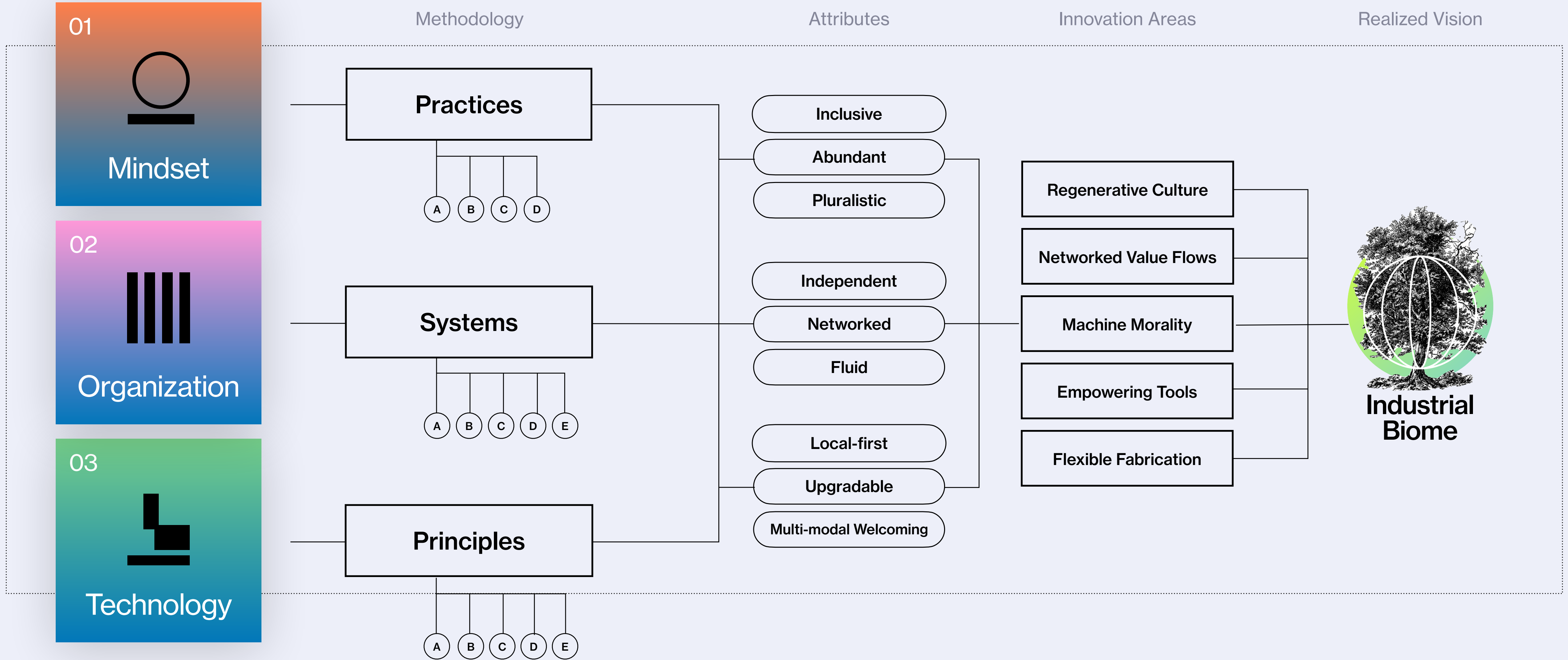
Closing the gap between R&D, production, retail and customer.



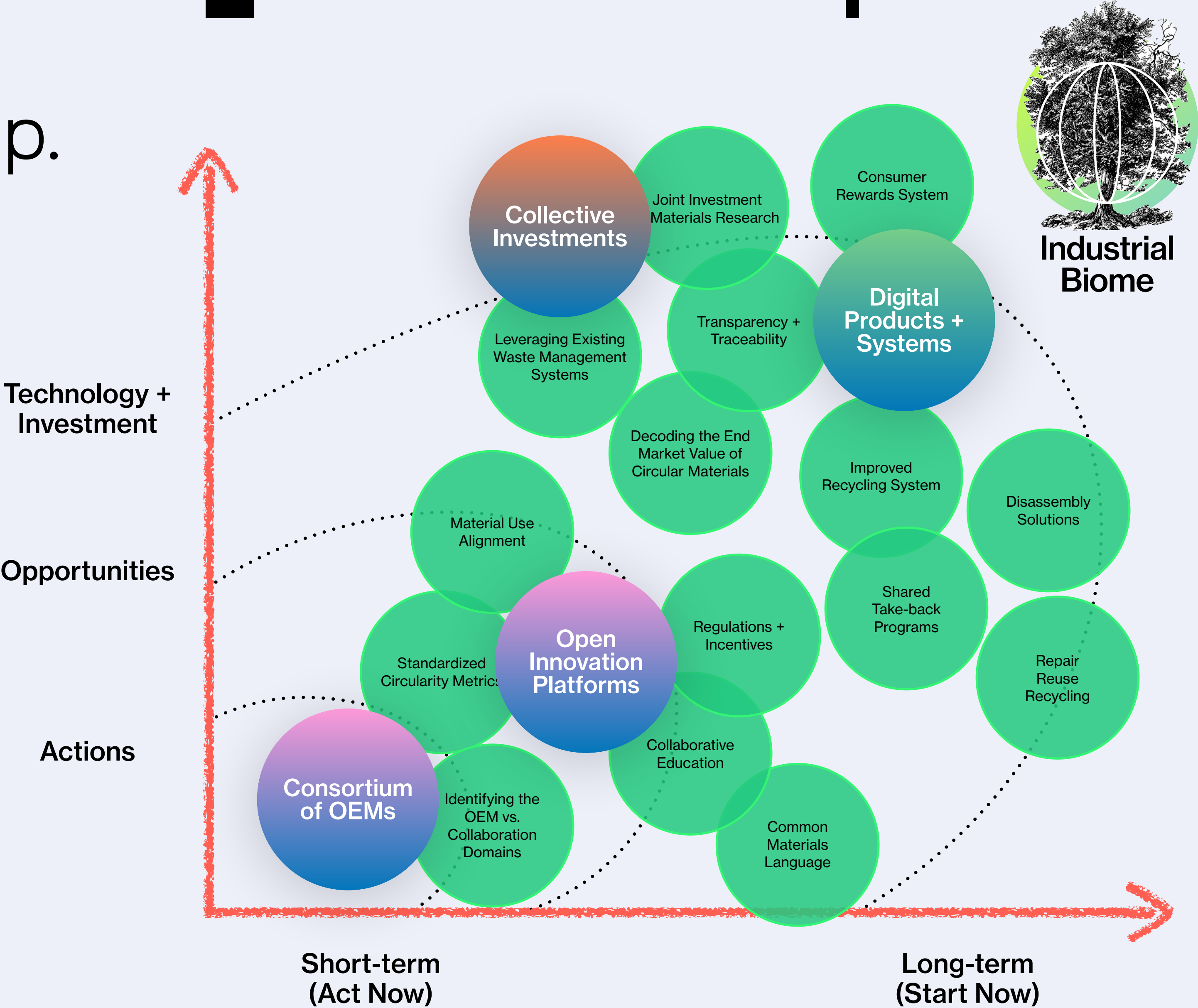


Building circular momentum with
technology – Circular Robotics™

Recap.



Roadmap.



If trust is established amongst OEMs, infrastructure and consumers, we can imagine new value chains across all core industries that enable both circularity and profitability.

Sustainability at SCALE can only be achieved through pre-competitive collaboration.



BLOOM OVER DOOM

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Part of the
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