WORLD ECONOMIC FORUM

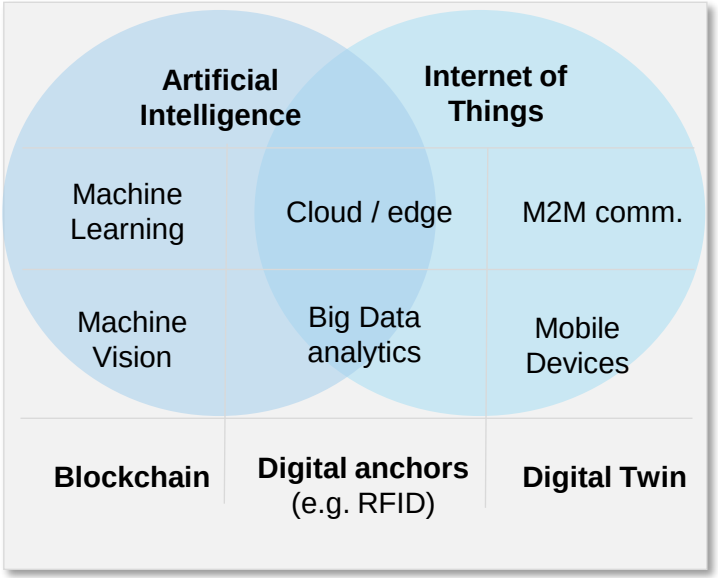
COMMITTED TO IMPROVING THE STATE OF THE WORLD

Role of 4IR technologies in achieving the Sustainable Development Goals (SDGs)

Characterized by a fusion of technologies blurring the lines between physical, digital and biological spheres, the 4IR is fundamentally reshaping the way we live and work

DIGITAL

Technologies based on computer sciences, electronics and communication which make use of increasing information intensity and connectedness of physical resources



PHYSICAL

Technologies based on basic property of materials, energy, forces of nature and their interaction

3D Printing	**Robotics**	**Energy Storage**
Energy Harvesting	**Nano-technology**	**Spectroscopy**
Physical markers	**AR/ VR**	**Carbon capture & utilization**
	Material science	

BIOLOGICAL

Technologies based on biology, aspects including but not limited to biological systems, living organisms, or derivatives thereof, to make products and processes for specific use

Bio-energy	**Bio-based Materials**	**Genetic Engineering**
DNA marking	**Cellular and Tissue Engineering**	**Hydroponics & aeroponics**

***Source**: World Economic Forum & Accenture Research (2018)*

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Harnessing the Fourth Industrial Revolution for Agriculture

Harnessing technologies to nourish the world without harming the planet

… to meet aspirational goals of efficiency, sustainability, inclusiveness, nutrition & health.

Inclusiveness

Link SHFs[1] & SMEs to finance & markets

Risk: Local bank lending meets only 3% of overall smallholder demand

Impact: Extending financial services to SHFs could help meet >$400B unmet demand

Empower women

Risk: Women make up 43% of agricultural workforce in developing countries but <20% of landowners globally are women

Impact: With more inclusive agricultural policies towards women, 100-150M people can be lifted out of poverty

Engage Youth

Risk: Avg. age of farmers exceeds 60 years in most geographies

Impact: Providing secure, well-paid jobs in agriculture could lift many of the 75M impoverished youth out of poverty

Sustainability

Build climate resilient systems

Risk: Weather extremes & climate change can cause up to 80% production variance

Impact: More resilient systems could help prevent $30B losses incurred in the past decade due to extreme weather

Improve land & forest management

Risk: 69% of agricultural land is degraded

Impact: Avoiding degradation could save $40B lost annually due to reduced productivity, damages to ecosystems and socio-economic effects

Improve water management

Risk: 2x as much water will be required for food production in 2050, but 28% of agriculture is in water stressed regions

Impact: Improved water management could increase access to safe water for 36% of the population

Sustainable consumption

Risk: Food production alone will reach or exceed total GHG targets for 2050

Impact: Halving meat & dairy consumption in Europe can reduce agricultural emissions by 25-40%

Efficiency

Reduce food loss & wastage

Risk: 1.3B tons of food is wasted or lost annually

Impact: $750B of economic loss caused by food loss and waste could be avoided

Build stable & transparent trade networks

Risk: 2008 food shocks pushed 130M-155M people into poverty

Impact: Managing systemic risk & ripple effect of shocks during market crises could avoid 14% decrease in crop supply in developing countries

Increase yields

Risk: Developing countries will need to increase agricultural production by 77%* to feed their populations by 2050

Impact: Closing current "yield gap" in Sub-Saharan Africa could increase productivity in the region by as much as 4x

Nutrition & Health

Improve consumer diets

Risk: 795M people go hungry everyday, 2B suffer from nutrient deficiencies, & 1.4B people are overweight or obese

Impact: Addressing malnutrition in developing countries can increase GDPs by as much as 5%

Enhance food quality & safety

Risk: There are 582M cases if food borne diseases annually

Impact: Eliminating unsafe food could avoid 350K deaths from foodborne disease and ~$16B in lost wages for consumers in the US alone

Transformative technologies impacting Agriculture

Sowing, Precision Agriculture and Crop health

Soil health monitoring

- Govt. of India's comprehensive soil health card database: macro, secondary and micro nutrient contents, pH, EC, OC (ratio of $N:P_2O_5:K_2O$)
- Sensors and crop imagery

Precision agriculture for input and water use optimization

- Granular weather data, climate variability, seasonal & short-term weather forecasts, crop imagery, monsoon patterns/ rain per unit of crop planted, soil profile and pattern of soil degradation, humidity
- Reduce agriculture's impact on water use by **2-5%**

Crop health monitoring

Annotated datasets with images that help diagnose plant diseases pests, nutrient deficiencies, crop damages for specific crop-types depending on soil and irrigation profiles

Promoting value-chain linkages

Mobile service delivery

Increase farmer income by **3-6%** and reduce food loss by **2-5%**

Farm Mechanization Efficiency

Digital twins of tractors, power tillers, combine harvesters, diesel engines, electric pump-sets

Blockchain-enabled traceability

Reduce food loss by **1-2%**

Creating effective production systems

Agri credit and Insurance-AI and Big Data

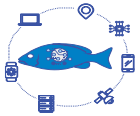
- Digital land records, risk based on past cropping patterns, acreage , yield estimates, periodic evaluation of farm-plot performance to reduce NPA-risk (crop growth, crop stage analysis), Smart sampling points for crop-cutting experiments
- Credit history, demographic and financial data

Farmer income could increase by up to **2%**

Food sensing technologies for safety, quality, and traceability

Reliable assaying and grading based on quality will help drive pan-India participation

Reduce food waste by **5-7%**



IOT for real-time supply chain transparency and traceability

Reduce food loss by **1-4%**

***"estimated impact by 2030**

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Harnessing the Fourth Industrial Revolution for a Circular Economy

Scale360° aims to establish conditions for scaling circular innovation around the world.

VISION

To scale Fourth Industrial Revolution technologies' impact on the circular economy transition.

MISSION

To mobilize action among innovators, governments and private sector stakeholders to grow the ecosystem for circular 4IR technology innovation.

In doing so, support the achievement of the sustainable development goals.

How can we...

.. DESIGN FOR BEST POSSIBLE AFTER-USE IN A GIVEN MARKET?

Durable design tool

AI-based application supporting design choices by impact modeling and connecting data on alternatives to hazardous or hard-to-recycle material given the product's target market recycling infrastructure. Product modularity and overall durability is evaluated and results are communicated though an overall circularity index for the designed product.

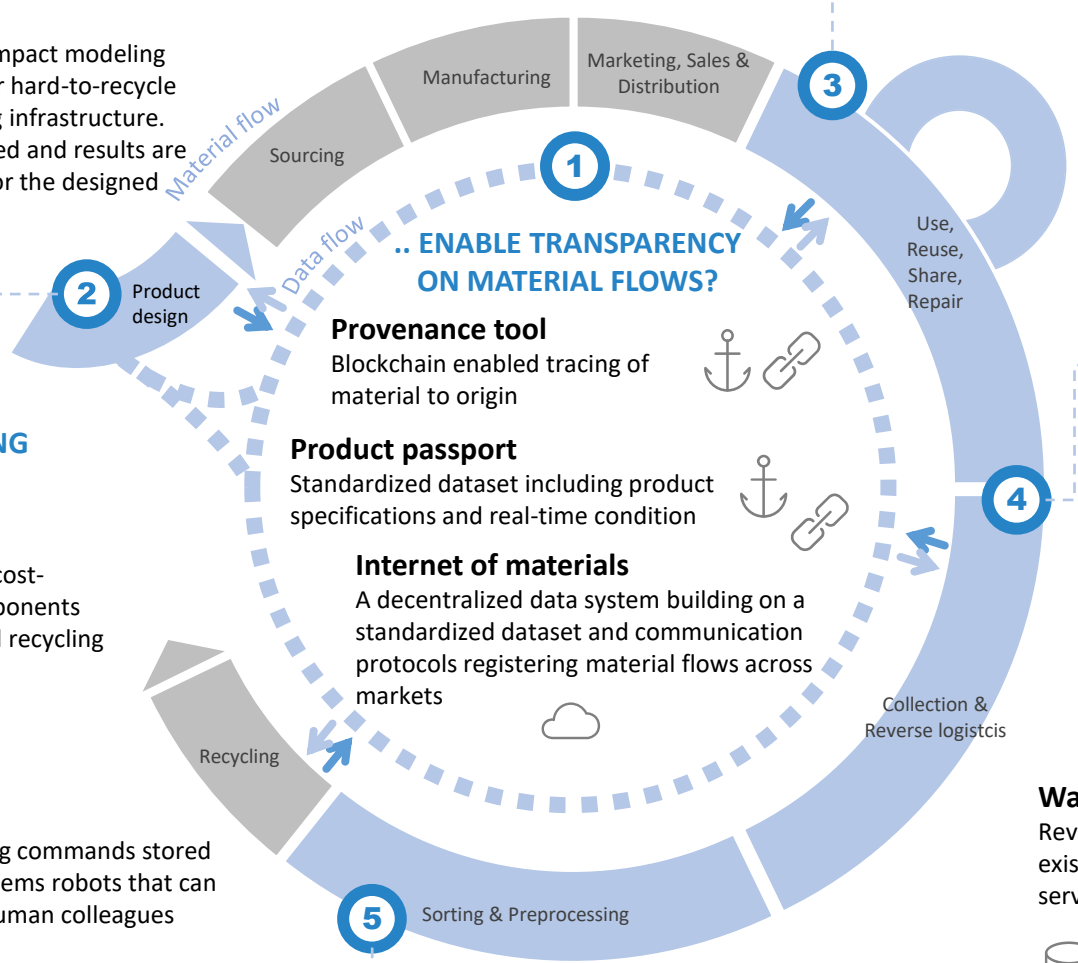
.. OPTIMIZE SORTING AND PRE-PROCESSING PROCESSES?

Hyper-intelligent sorting systems

Machine vision and robotic-based sorting enabling cost-efficient and accurate sorting across products, components and brand owners, allowing for closed loop material recycling models.

Learning disassembly robots

Disassembly processes with robots using dismantling commands stored in product passport, or in the case of open loop systems robots that can adapt their dismantling routines by learning from human colleagues working hand in hand



.. ENABLE EFFICIENT REUSE OF PRODUCTS?

Service-based models

Sensor-based tracking of condition throughout the use phase by device manufacturer to offer customer targeted repair and upgrade services/solutions.

Value assessment tool for used products

Tool allowing consumers/resellers to read a product's condition, certify its value and assess most appropriate after-use pathway to increase trust and efficiency in second hand markets.

.. OPTIMIZE COLLECTION & REVERSE LOGISTICS?

Value-based return incentives

Collection stations equipped with product identification and value assessment capability offering incentives (e.g. tokens, discounts, donation) through a blockchain-based remuneration scheme.

Waste taxi

Reversed logistics for high-value products leveraging existing infrastructure of customer-facing delivery services (e.g. taxis, parcel delivery)

***Source**: World Economic Forum & Accenture Research (2018)*

To scale up such promising 4IR innovations, **five enabling conditions** are required

1 STANDARDS AND REGULATION

- **Standardize materials and design** to reduce technical challenges and enable economies of scale
- **Align processes**, e.g. for repair, maintenance, sorting, treatment to increase efficiency
- **Facilitate data interchange** on product information and material flow to increase transparency
- **Ensure data security** to lay foundation of a trustworthy digital twin of the circular economy

2 CHANGE DRIVERS

- **Push through policies and taxation** harmonized across jurisdictions
- **Provide targeted rewards**, e.g. return incentives, differentiated EPR schemes to promote circular routines
- **Leverage social movement** harnessing the power of the people to speed up the transformation

3 DATA-ENABLED INFRASTRUCTURE

- **Ensure open-source interoperability** of individual innovations tailored to local markets by drawing on standards to allow for transferability and scaling
- **Establish a globally distributed architecture** for data sharing in global supply chains

4 INVESTMENT

- **Drive for-profit investment from banks** to support business, also SMEs to adapt their business models and develop infrastructure
- **Provide public investment** to ensure inclusive development of technologies and equal distribution of their benefits
- **Harness stakeholder funding**, e.g. donations from return systems to tap into new funding streams

5 INNOVATION AND ENTREPRENEURSHIP

- **Nurture collaboration** with a range of organizations to incorporate new perspectives
- **Embrace disruption** to move from incremental improvements of products and processes to completely rethinking the way value is created
- **Build right skills and capabilities** at the intersection of sustainable innovation, technology, data science and supply chain management to develop circular innovations

***Source**: World Economic Forum & Accenture Research (2018)*