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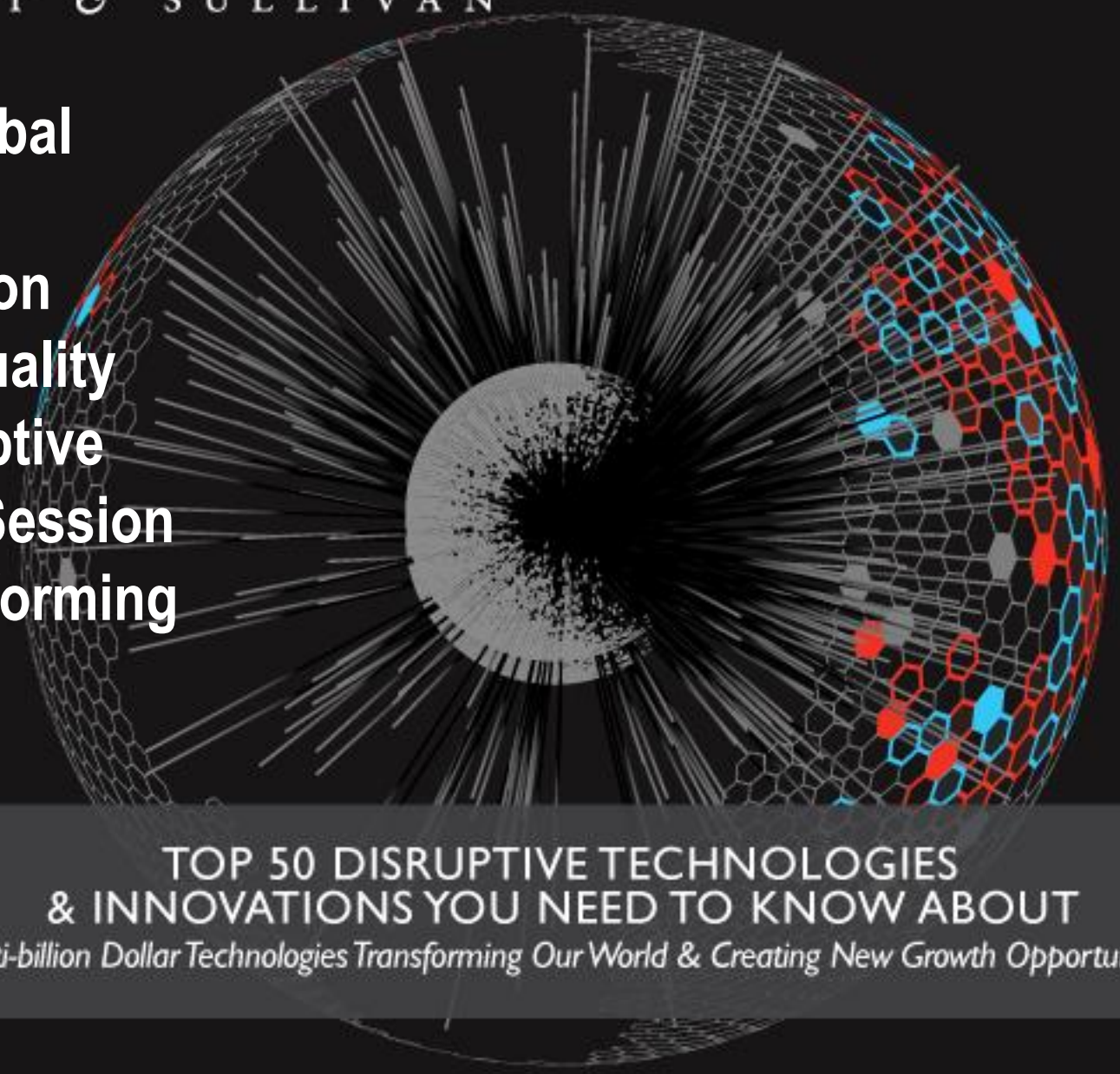
NIQR Global Quality Convention Digital Quality for Disruptive Future - Session on Transforming World



TOP 50 DISRUPTIVE TECHNOLOGIES
& INNOVATIONS YOU NEED TO KNOW ABOUT

Multi-billion Dollar Technologies Transforming Our World & Creating New Growth Opportunities

Today's Presenter

Anand Subramanian

Vice President, Frost & Sullivan

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Anand Subramanian is the Vice President with the TechVision business unit of Frost & Sullivan. Anand manages the groups consulting and is also responsible for providing the business unit's syndicated reports to clients. At Frost & Sullivan, Anand has focused on engagements and issues that deal with evaluation of emerging technologies and business models, their impact on market terrain and the firms that operate within it.

He has written multiple research reports, white papers and technology articles that have been published in global research journals and prominent business magazines. Anand has been quoted in several business dailies around the world. He has also been invited to speak at multiple conferences as the guest of honor, thought leader and as an expert on issues related to Business Strategy, and emerging technologies in the business domain.

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Top 50 Emerging Technologies and New Convergence Opportunities

THE FUTURE OF THE FUTURE

TechVision

Global Technology, Innovation, and Convergence Practice

Navigating an Innovation-driven World

Anand Subramanian
Vice President, sanand@frost.com

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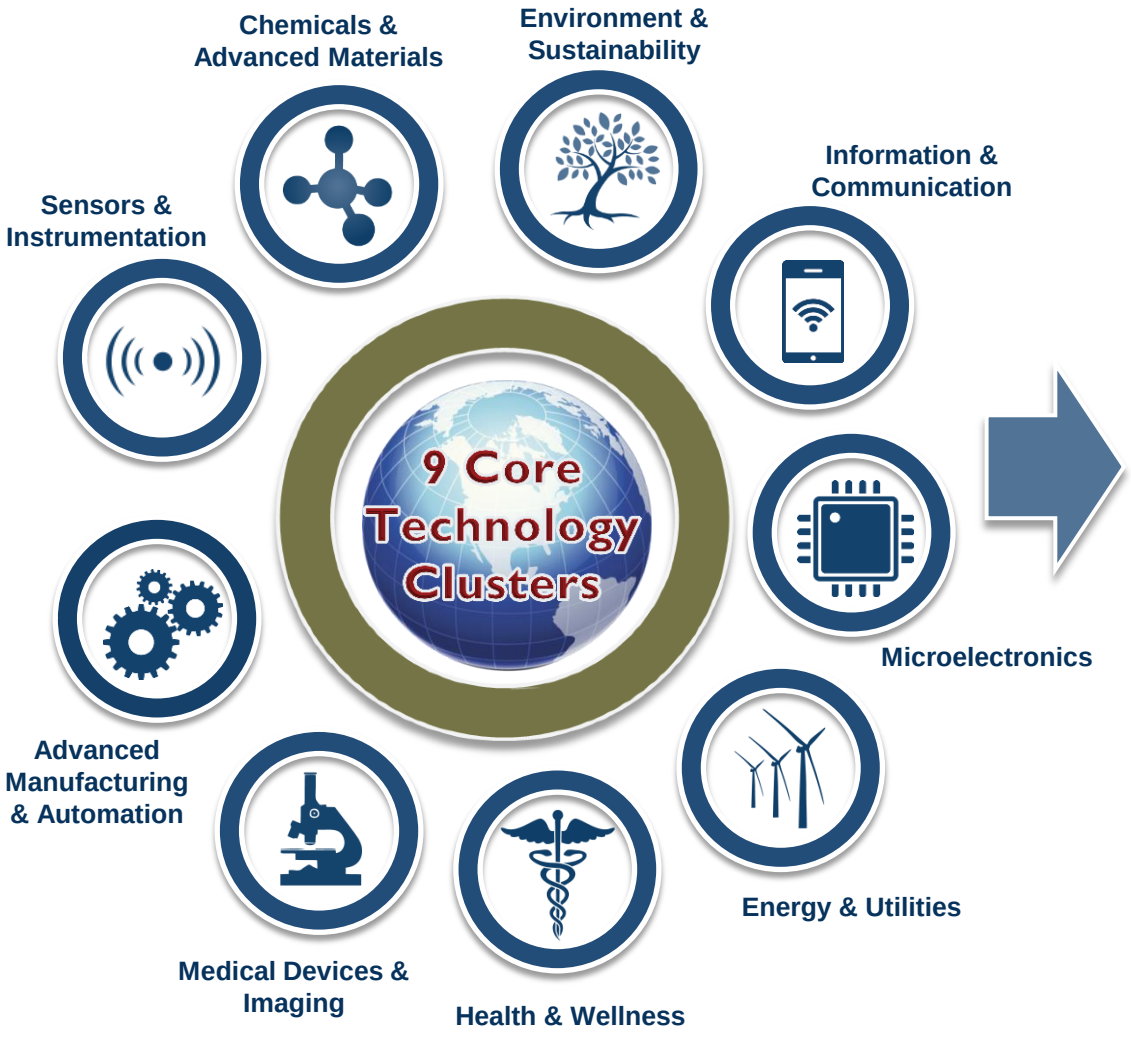
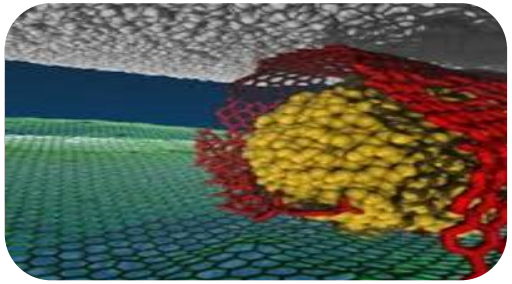
Horizontal technology clusters drive innovation across sectors



Verticals

- Aerospace
- Agriculture
- Business & Financial Services
- Chemicals & Materials
- Consumer Electronics
- Education
- Energy & Environment
- Food, Beverage & Nutrition
- Healthcare
- Information and Communications
- Manufacturing
- Measurement & Instrumentation
- Mobility
- Process Control
- Security & Defence

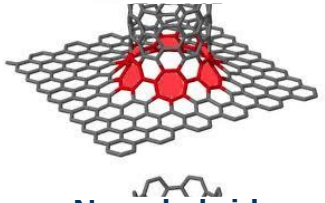
Core Focus of Technology Development Changing from Finding 'Killer Applications' to 'Disruptive Innovations and Convergence'



Zero Friction Surfaces

Smart water

nano TECHNOLOGY

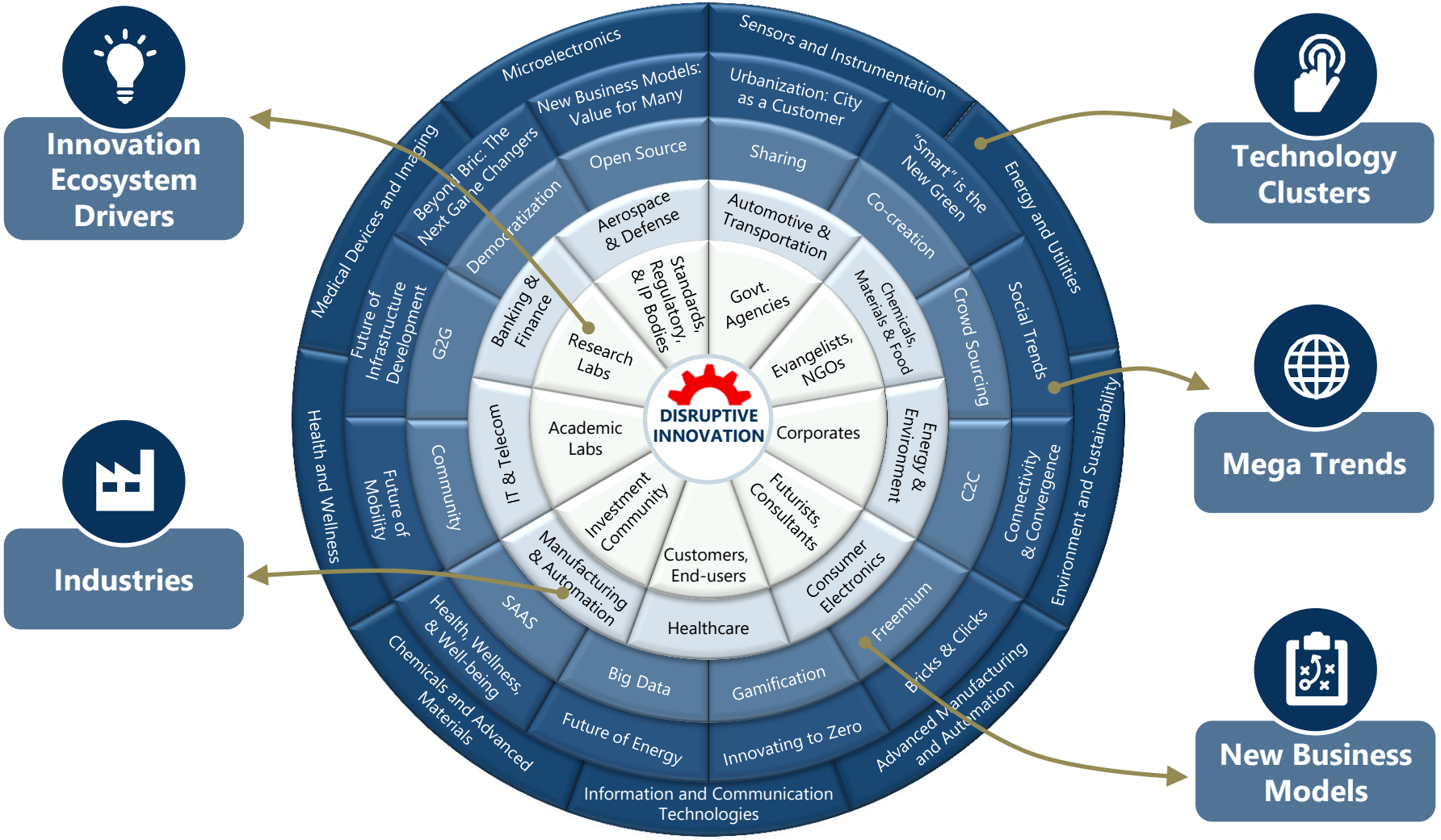


Nano hybrids

Self-Healing Materials

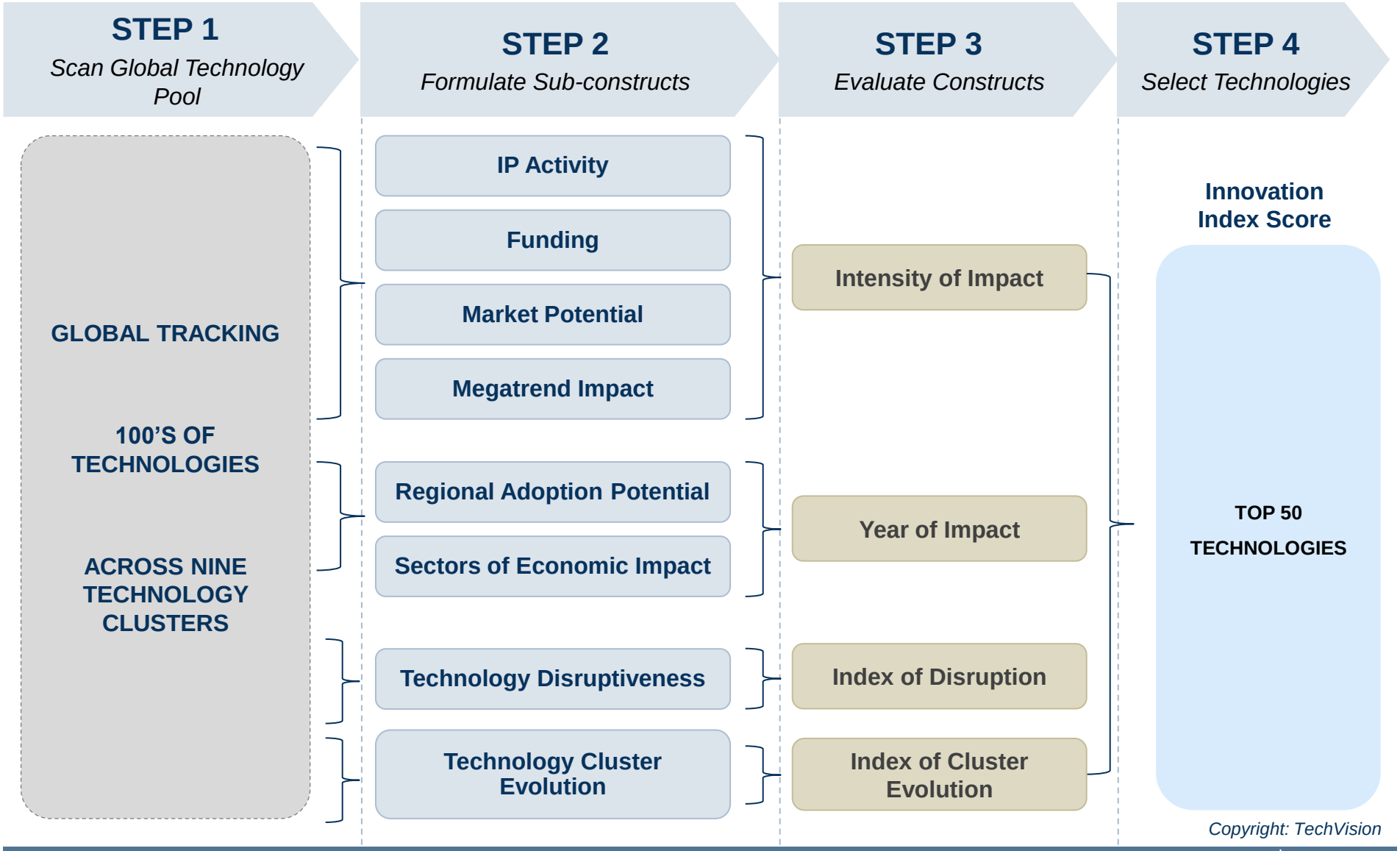
Innovation Engine Kaleidoscope

Constant churn of market dynamics leads to creation of new business models



Top 50 Technologies - Methodology

A comprehensive selection process to identify hottest technologies



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GLOBAL TOP 50 TECHNOLOGIES

Environment and Sustainability

- Agriculture 2.0
- CCUS
- Mobile Desalination
- Smart Water Grid

Information and Communication Technologies

- 5G
- Blockchain
- Cognitive Security
- Deep Learning
- Haptic Reality
- Hyperimaging Analytics
- Small Data

Health and Wellness

- Biobetters
- Biomarker Analytics
- Microbiomics
- Protein Therapeutics
- Regen Med
- Zika Control

Energy and Utilities

- Advanced Batteries
- Distributed Energy Generation
- Next Gen Smart Grids
- Super Fuel Cells
- Thermal Energy Storage

Medical Devices and Imaging

- Bioelectronic Therapeutics
- Myoelectric Prosthetics
- Personalized Orthopedics
- Smart Scalpel
- Stereotactic Surgery
- Synaptic Interface

Chemicals and Advanced Materials

- Advanced Encapsulation
- E-glass
- Intelligent Packaging
- Nanohybrids
- Self-healing Materials
- Super Engineered Polymers
- Ultra High Strength Metals

Microelectronics

- AI Chip
- GaNtronics
- Hybrid Cloud Storage
- Micro LED
- Non-Volatile Memory Express
- VCSE Laser

Advanced Manufacturing and Automation

- Cognitive Manufacturing
- Collaborative Robots
- Hybrid Manufacturing
- Metal 3D Printing
- Nanofabrication

Sensors and Instrumentation

- Biosensor
- LiDAR Sensor
- Sensor Fusion
- Smart Sensors

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Developing Intelligent Security Systems for Prevention against Cyber Attacks

Cognitive Security

- Cognitive security refers to the use of AI capabilities in cyber security and use of advanced threat detection techniques such as physiological factor- and behavioral-based threat detection to mitigate unknown and targeted attacks in the future.
- From using natural language processing (NLP) to sifting through unstructured data to gathering customer data from Surface Web, Deep Web, and Dark Web to analysis using sentiment-based model that discerns behavioral patterns, companies adopting cognitive security solutions are likely to use different approaches and proprietary tools to detect and protect enterprises from emerging threats.

Key Highlights

By 2017

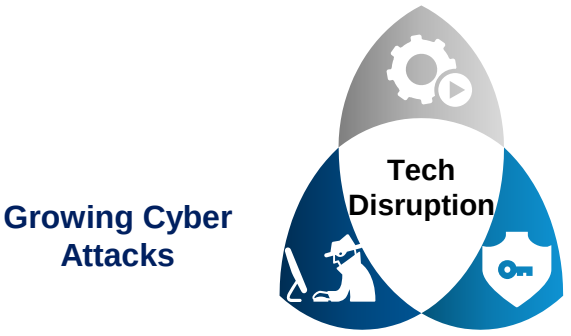
WEF has listed cybercrime as **the #1 global risk** for businesses

98% of companies have experienced malware-based threats

More than **200,000 computers were affected** globally by wannaCry ransomware attacks

2.5 quintillions bytes of data are produced globally and **80% of the produced data is unstructured.**

Factors Driving Tech Disruption



Analyst Viewpoint:

Cognitive security would definitely fill the intelligence and accuracy gaps that security leaders are facing currently. Rapid rise in need for analyzing huge volumes of data clearly depicts the growing interest in next generation cognitive security systems.

Source: Frost & Sullivan

Integration of Artificial Intelligence Helps New Security Providers to Compete Closely with Established Companies

IBM offers Watson cognitive computing services for SOCs

Sparkcognition provides cognitive endpoint security

Cisco delivers cloud-based cognitive threat analytics

XTN developed behavior-based security solutions

RSA security solutions designed to manage risk

BluVector offering intelligent solutions for IoT environment

Other Innovators

FORTSCALE™

JASK

BIOCATCH Less Friction. Less Fraud.

splunk>

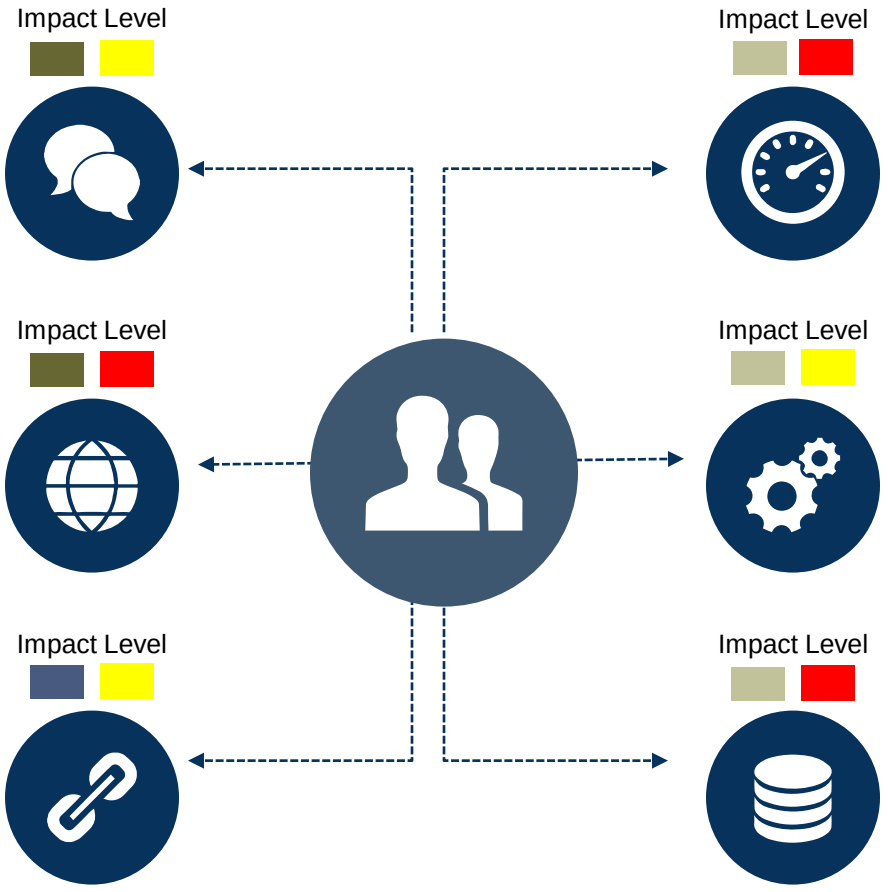
Source: Frost & Sullivan

Metal-ion and Metal-air Batteries are Alternatives for Li-ion

Lithium Sulphur Batteries
- Anode: Lithium metal
- Cathode active material: Sulphur
- Specific energy density: 2,566 Wh/kg.

Lithium Air Batteries
- Anode: Lithium metal
- Cathode active material: Air.
- Specific energy density: 5,200 Wh/kg

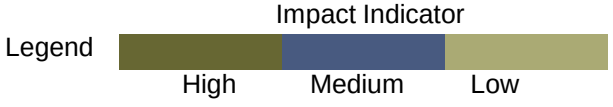
Sodium Ion Battery
- Anode active material: Sodium ion
- Cathode: Graphite.
- Specific energy density: 600 Wh/kg

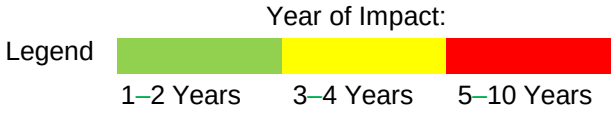


Sodium Air Batteries
- Anode: Sodium metal
- Cathode active material: Air.
- Specific energy density: 1,605 Wh/kg

Aluminum Ion Batteries
- Anode active material: Aluminum ion
- Cathode: Graphite.
- Specific energy density: 1,340 Wh/kg

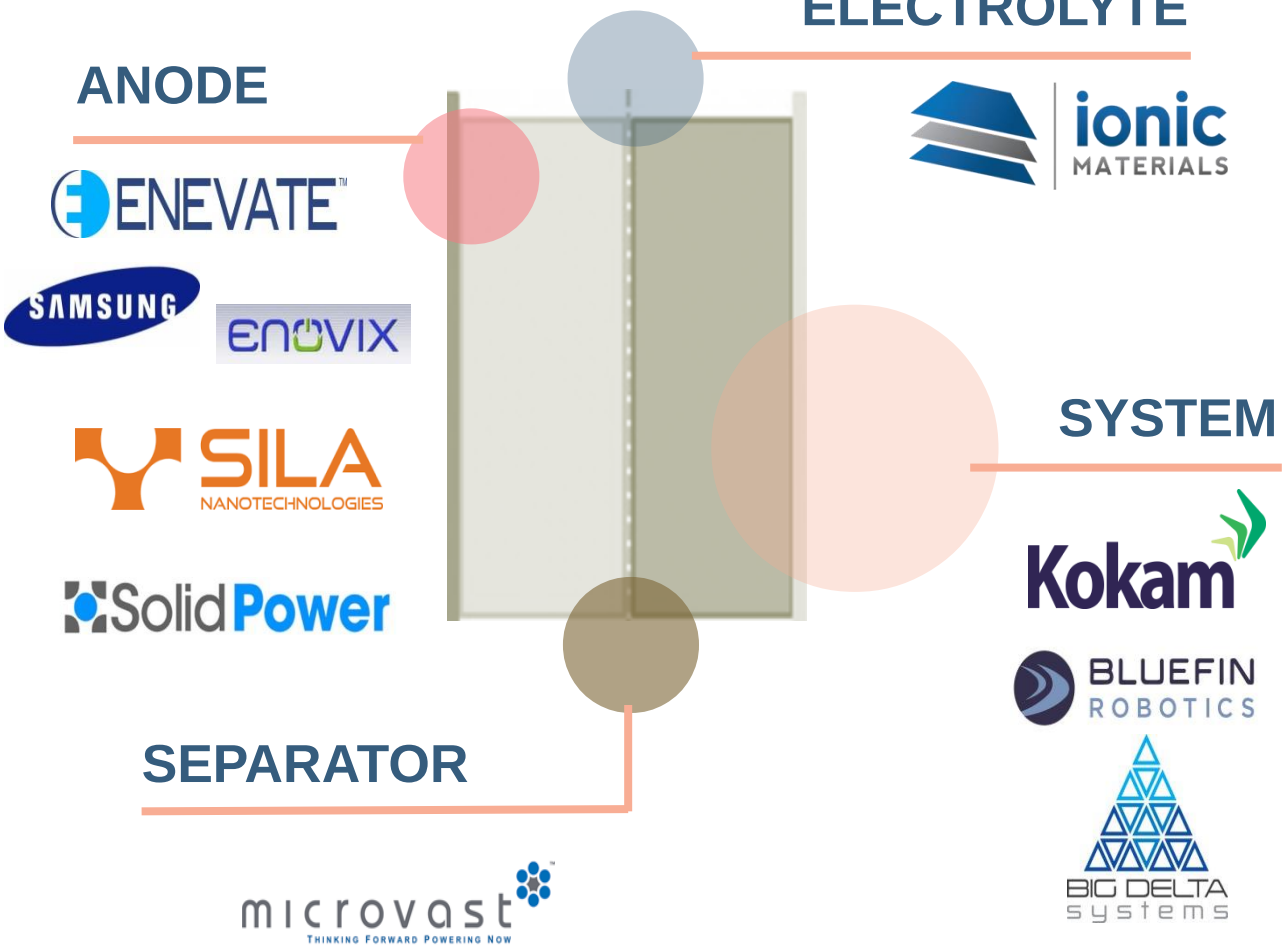
Aluminum Air Batteries
- Anode: Aluminum metal
- Cathode active material: Air.
- Specific energy density: 2,796 Wh/kg





Source: Frost & Sullivan

Innovator Ecosystem



Key Highlights

Enevate, USA

- Enevate has developed a high energy density battery by using its HD-Energy® Technology.
- This technology uses anodes that are based on silicon, which enables Lithium-ion (Li-ion) cells with upto 50% higher capacity than conventional graphite cells

Samsung, South Korea

- Samsung has produced lithium ion batteries that theoretically could reach 80% state of charge (SoC) within 12 minutes by coating the electrode with graphene.

Ionic Materials, USA

- Ionic Materials has developed a polymer electrolyte to create a safer lithium-ion battery.
- This electrolyte has 50% higher ionic conductivity than the usual polymer electrolytes

Technologies Poised to Transform the Global Healthcare Landscape

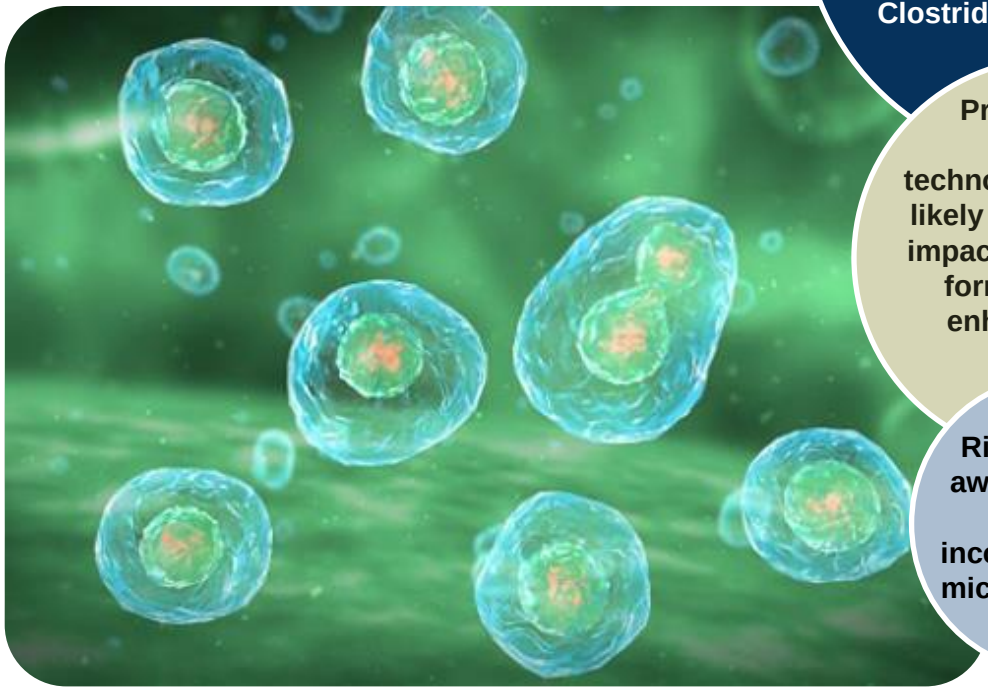
Microbiomics: Movers & Shakers

- Seres Therapeutics
- Chr. Hansen
- Rebiotix
- S-Biomedic
- Azitra
- Vedanta
- uBiome

★★★★★
★★★★★

10/10 **Disruptive Index**

Microbiome technologies are suitably poised to transform the healthcare, personal care, and food & beverage (F&B) sectors by enabling 'game changing' innovations, which have the potential to transform patient and consumer lives.



Microbiome therapeutics are likely to emerge as potential alternatives to conventional therapies, especially for the management of GI disorders such as Clostridium difficile (CDI).

Probiotic and prebiotic technologies are also likely to significantly impact personal care formulations by enhancing skin health.

Rising health awareness will drive the incorporation of microbiomics in F&B.

Source: Frost & Sullivan

Probiotic Innovations Lead the Global Microbiome Landscape

Application Diversity: Microbiome Technologies

Key Technology Segments by Application

Therapeutics
- Fecal microbial transplantation (FMT)-based treatments
- Over-the-counter (OTC) probiotic supplements
- Live biotherapeutics
- Genetically modified (GM) microbes

Personal Care
- Live probiotics
- Heat-inactivated probiotics
- Probiotic-derived ingredients, such as supernatant from bacterial cultures
- Prebiotics
- Targeted antimicrobials

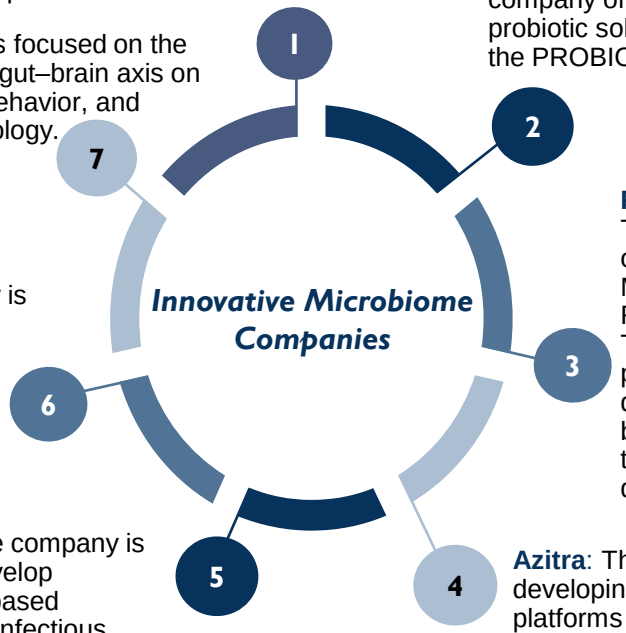
F&B
- Live Probiotics
- Non-live Probiotics
- Heat-stable Probiotics
- Prebiotics
- Synbiotics
- Targeted Antimicrobials

Microbiome Innovations: Companies to Action

Seres Therapeutics: The company is developing an FMT-based therapeutic platform for ulcerative colitis.

Chr. Hansen: The company offers custom probiotic solutions under the PROBIO-TEC® brand.

Kallyope: It is focused on the impact of the gut–brain axis on physiology, behavior, and disease pathology.



Rebiotix Inc: The company offers the Microbiota Restoration Therapy (MRT) platform for delivering live bacteria to treat intestinal diseases.

Evelo Biosciences: The company is looking to develop microbiome-based cancer therapies.

Vedanta: The company is looking to develop microbiome-based therapies for infectious and inflammatory diseases.

Azitra: The company is developing novel GM platforms for skin disease treatments.

Emerging Innovators in Microbiome Technologies

- uBiome
- Finch Therapeutics
- Janssen
- Clorox
- Enterome
- MicroBiome Therapeutics

Source: Frost & Sullivan

FUTURE 18

ADVANCED MANUFACTURING & AUTOMATION
4D Printing
Self-reconfigurable Modular Robots

INFORMATION & COMMUNICATION TECHNOLOGY
Pervasive Computing
Quantum Computing

MICROELECTRONICS
Neuromorphic Chips
Computational SSD

ENERGY & UTILITIES
Power-to-X
Proton Battery

SENSORS & INSTRUMENTATION
Biodegradable Sensors
SODAR

ENVIRONMENT & SUSTAINABILITY
Micro-climate Engineering
Rare Earth Recovery

MEDICAL DEVICES & IMAGING
Printed Organs
Ectogenesis

CHEMICALS & ADVANCED MATERIALS
Superamphiphobic Coatings
Zero Friction Coatings/Surfaces

HEALTH & WELLNESS
DNA Data Storage
Molecular Robots

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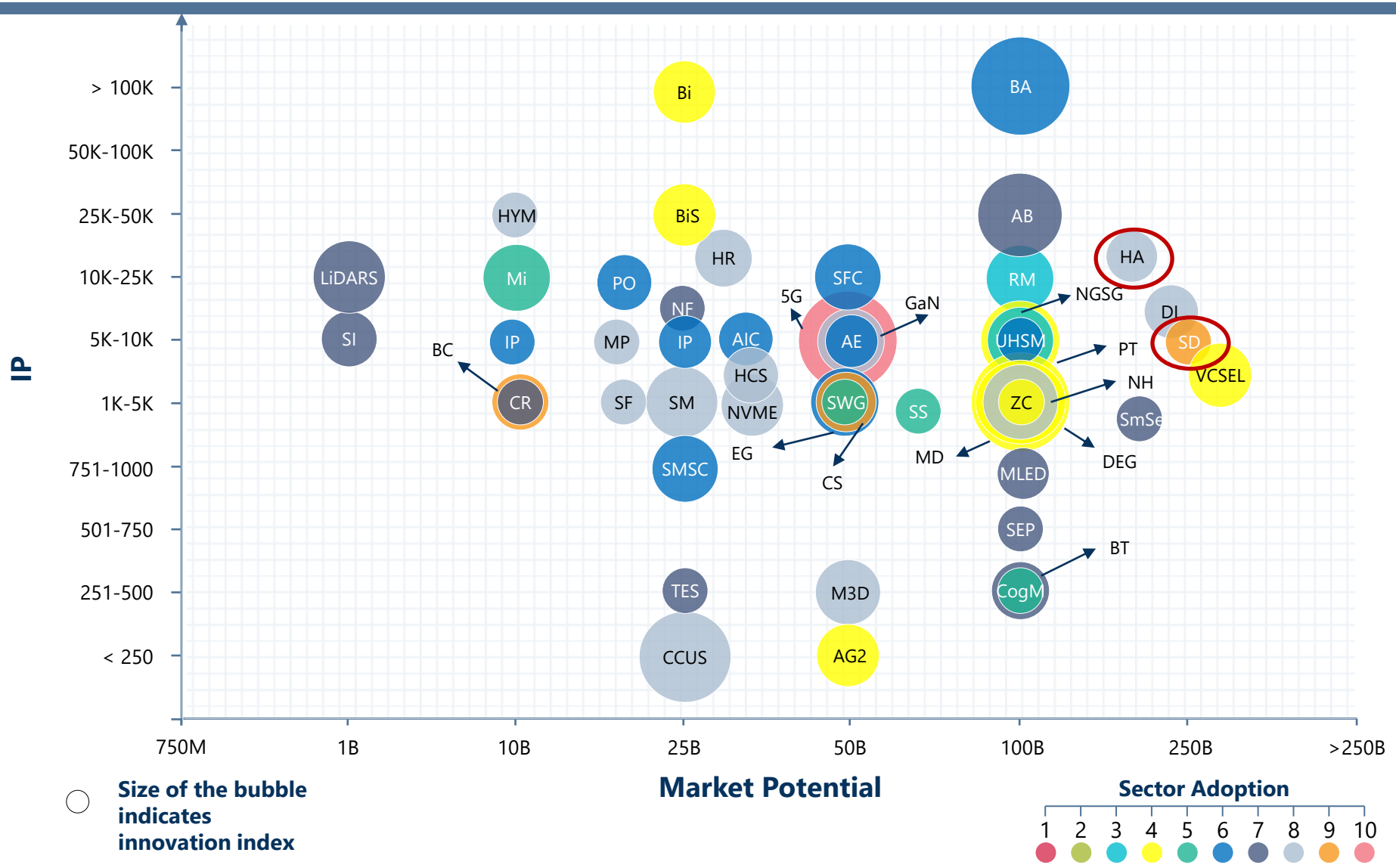
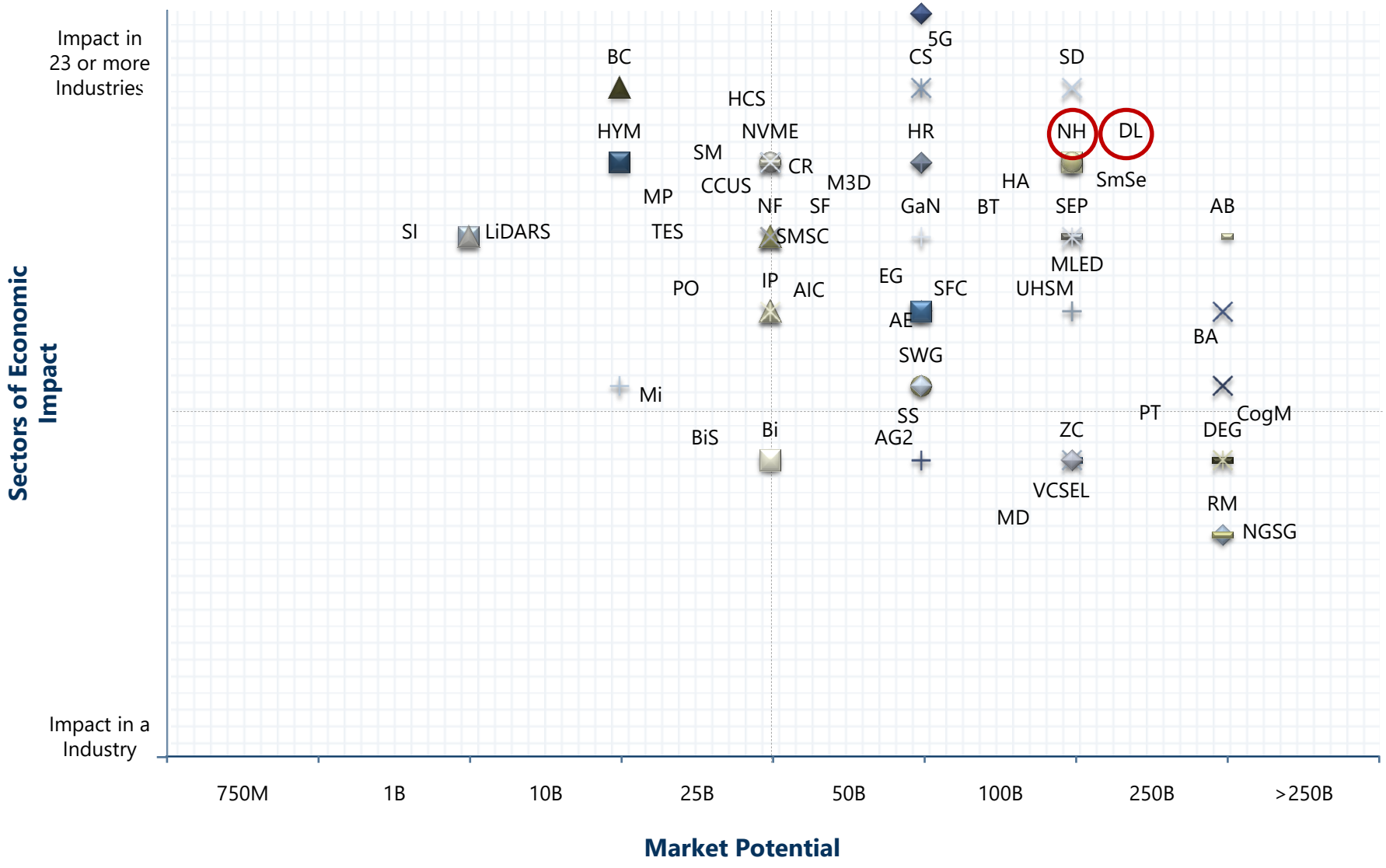
Strategic Opportunities Matrix

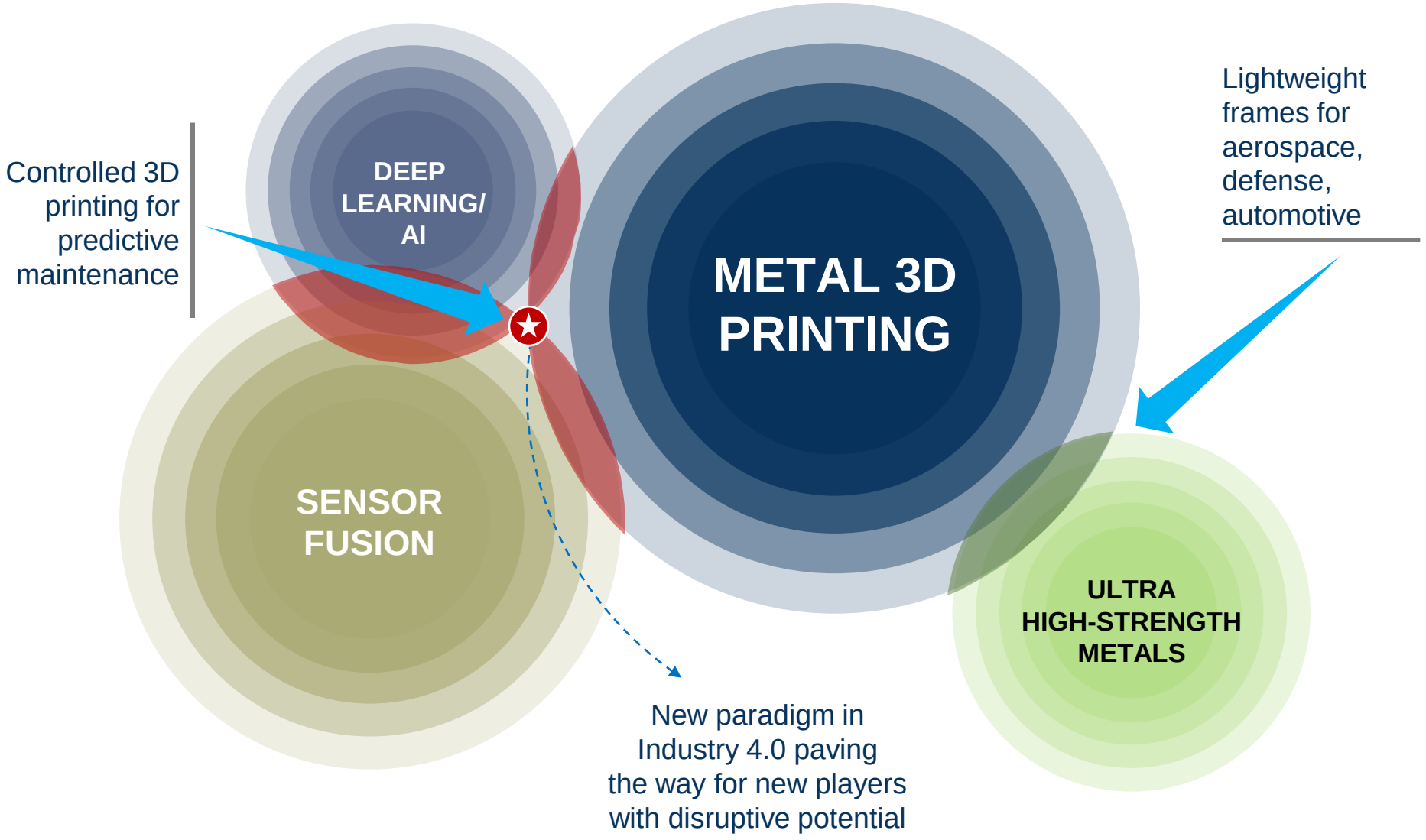


Market Attractiveness Matrix



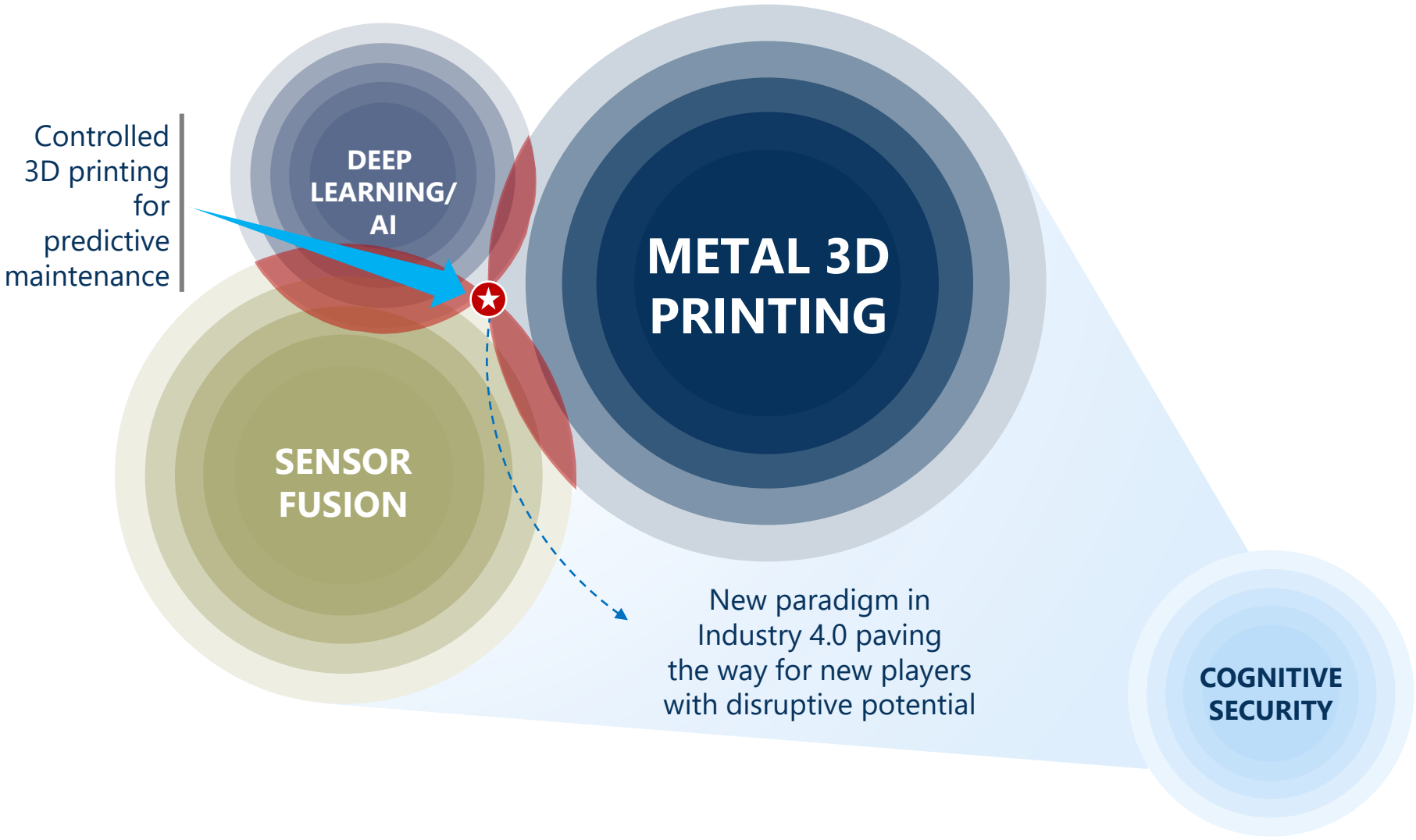
Waves of Innovation

Leveraging points of convergence



Waves of Innovation
Leveraging points of convergence

Option 2



MAGA – Make Agriculture Great Again

Make Agriculture Great Again!

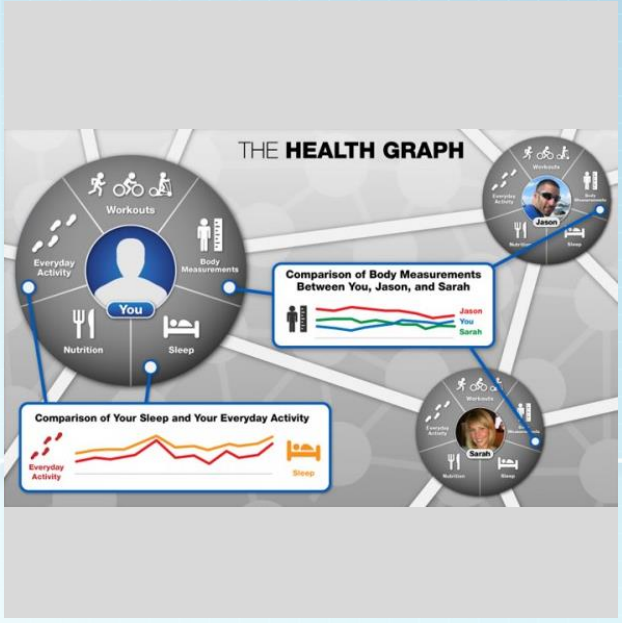
This convergence scenario is mainly suitable for geographies where agriculture is affected by scarcity of water. By making use of mobile desalination, advanced encapsulation and agriculture 2.0 technology solutions like mapping, targeted delivery of water, insecticides, and fertilizers can be ensured. Mobile desalination is supported by renewable and advanced battery solutions.

Automated TheraNostics

Personalized error-free medicine

Connected Healthcare

- Wearables/ AI Chip
- Biosensors
- Self-healing Materials
- AI/NLI
- Targeted Drug Delivery



Future Utility

Self-sustaining neighbourhoods through localized energy production and management

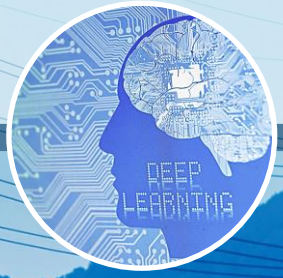
Advanced Batteries

Blockchain

Smart Grids

Smart Localized Power Generation and Management

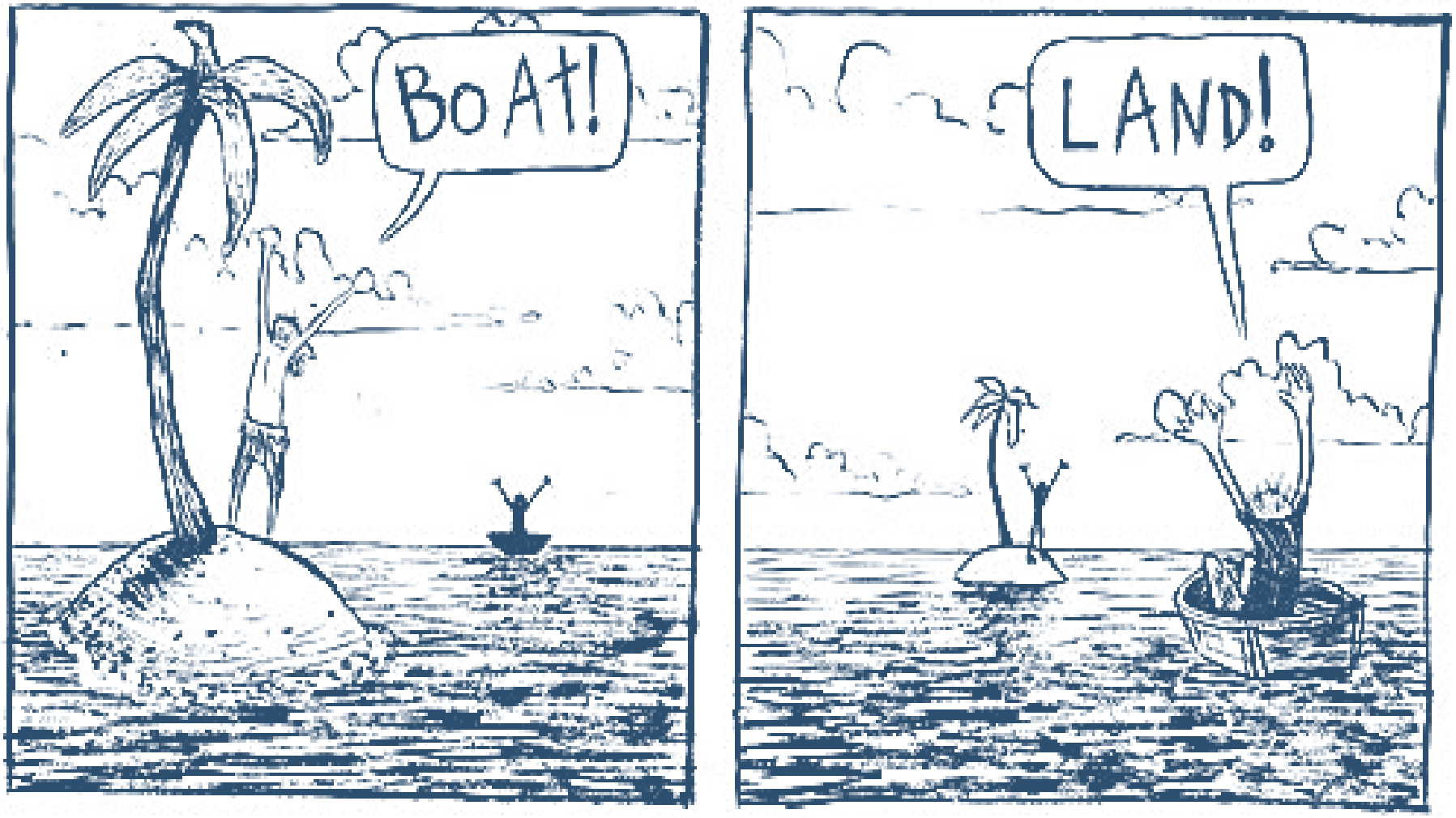
Sensor Fusion



Deep Learning/AI

Waste-to-Energy

‘Innovative Convergence’ Drives Solutions!



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