

5 Emerging Megatrends & What to do About Them

PRESCOUTER

Agenda

- From hype to implementation
- Maximizing this Masterclass
- Portable energy
- Digital twins
- Third wave AI
- Smart materials
- 5G/IOT

About PreScouter

Advanced Degree Network

4000+ PhD Scientists across all disciplines as the foundation for research and analysis

Industrial Subject Matter Experts

2000+ Industrial SMEs across all industrial verticals that serve as experts for projects and ad-hoc consultations

Prototyping & Testing

Contract Research Organization Network designed to serve testing and prototyping needs for the next phase of product development



COVID-19 Worksite Testing

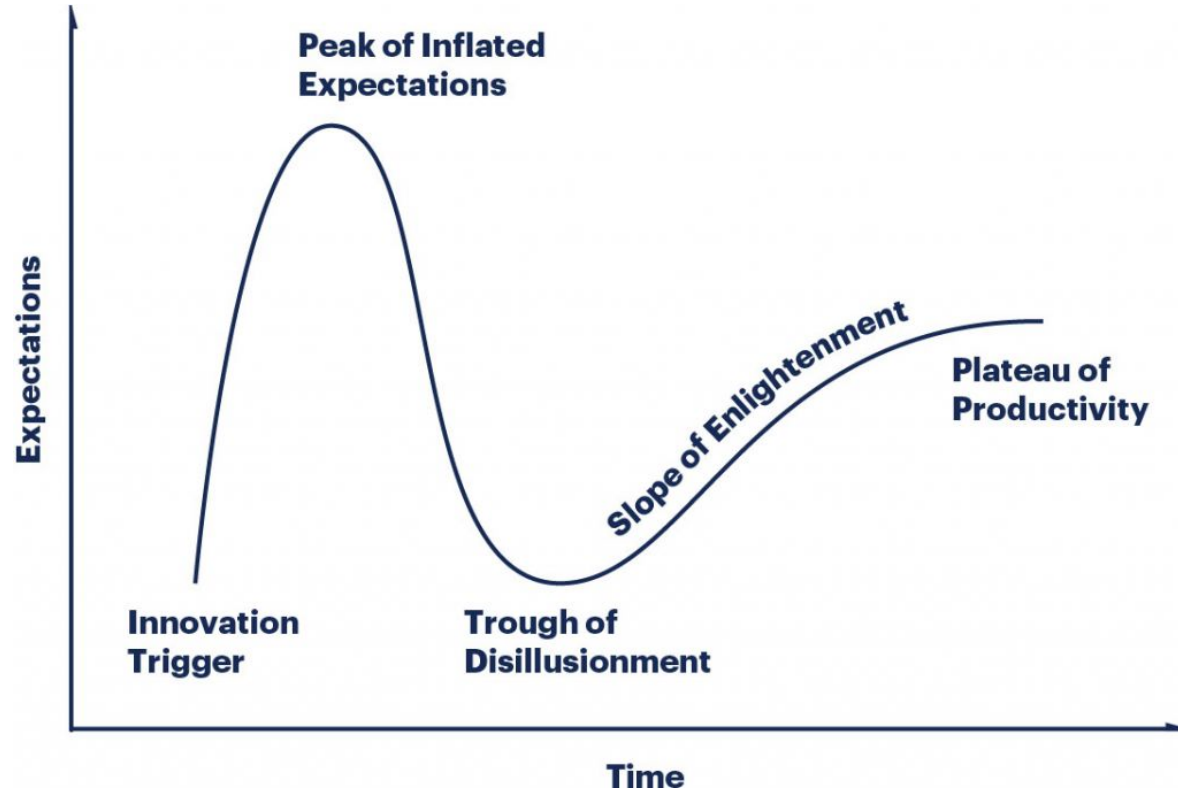
Onsite testing for COVID-19, results in less than 20 minutes, using cost-effective strategies

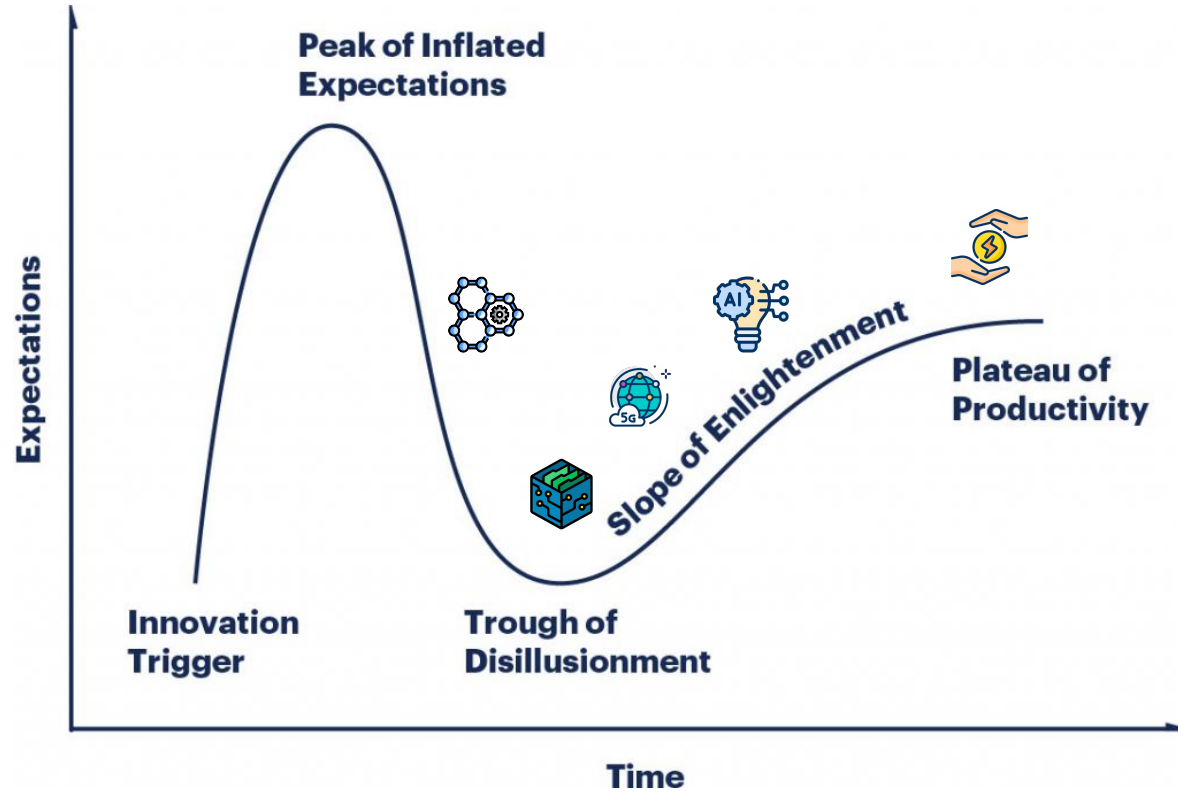
Sample Procurement

Designed to bring tangible concepts and prototypes to your organization. Fully anonymous, routed through PreScouter

Artificial Intelligence

Implementing Deep learning algorithms for a variety of industrial verticals to increase productivity and decrease cost







Pioneering companies proactively embrace change — not on a reactionary basis...but as an opportunity to challenge the status quo and achieve greater success.

Brian Kennell , former president and CEO, Tetra Pak Inc.

Maximizing this Masterclass

We will be discussing five (5) megatrend technologies.
During each of the megatrends:

Write down 3+ ideas how the technology could benefit your company

Generate 3+ questions you would need answered to move forward

The Energy Revolution



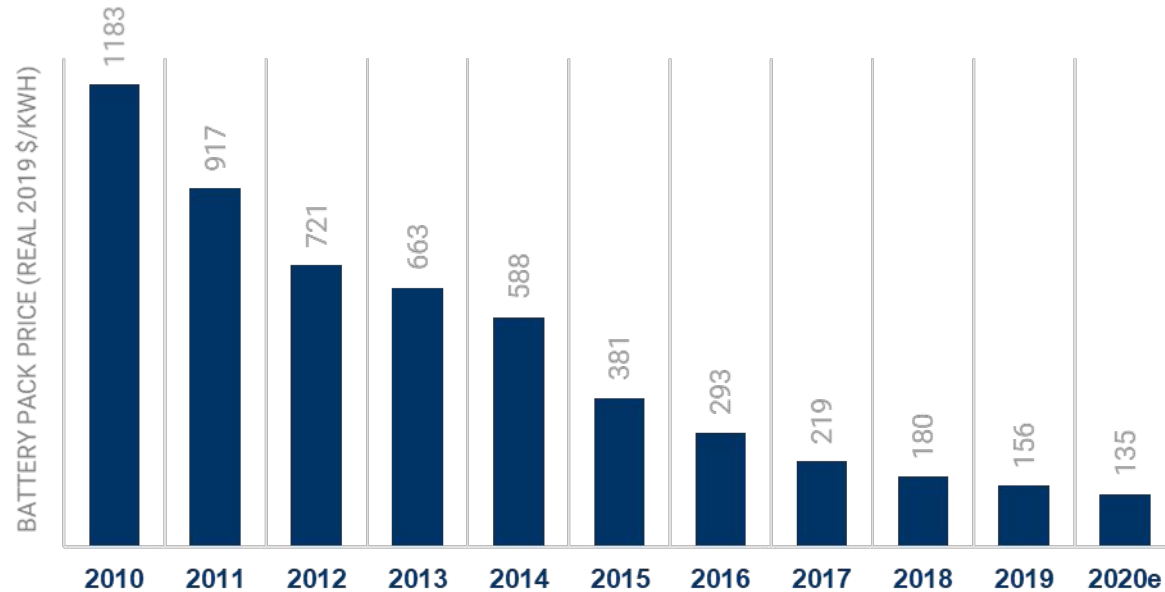
**Imagine what your organization could do if
portable energy was free?**



Cost Reduction



Falling Price of Lithium-Ion Energy Density



The Indirect Cost of Li-Ion Batteries



Cobalt, Nickel



Rare / costly



Lithium



Pollutes water supplies

Lithium Disposal/Recycling



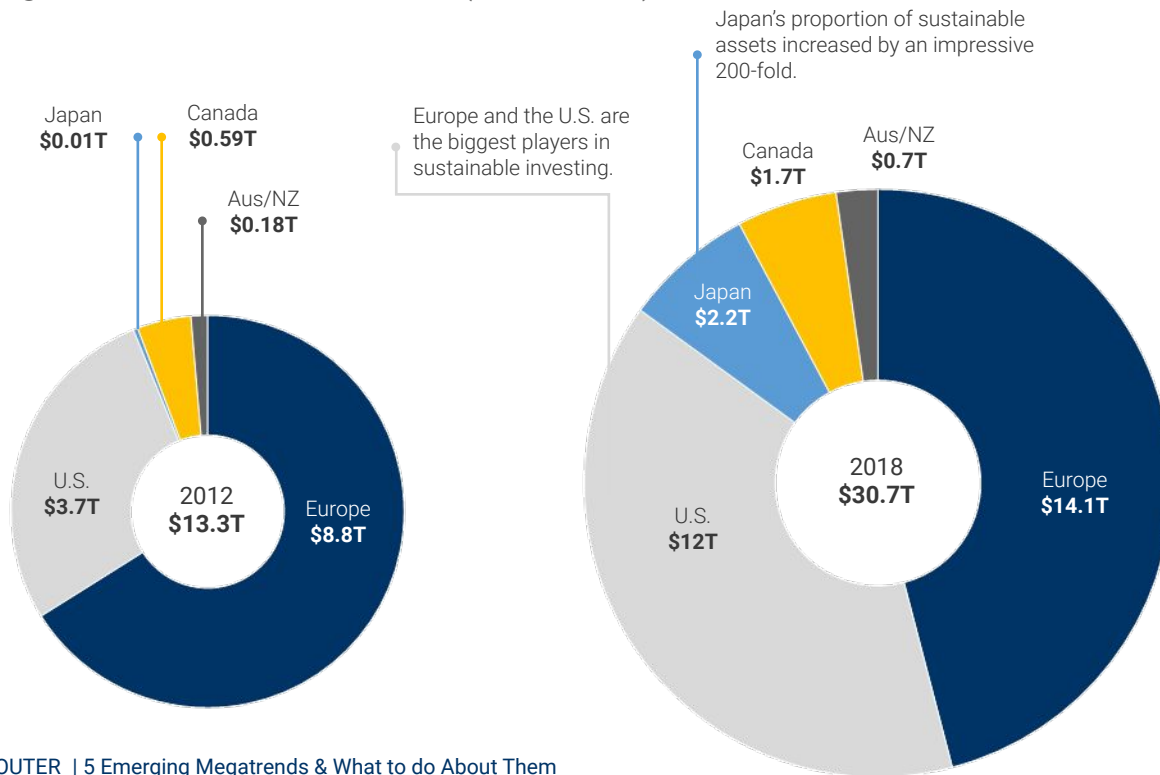
Dangerous / costly



Changing Investment Thesis



Global growth in sustainable investment (USD\$ Trillion)

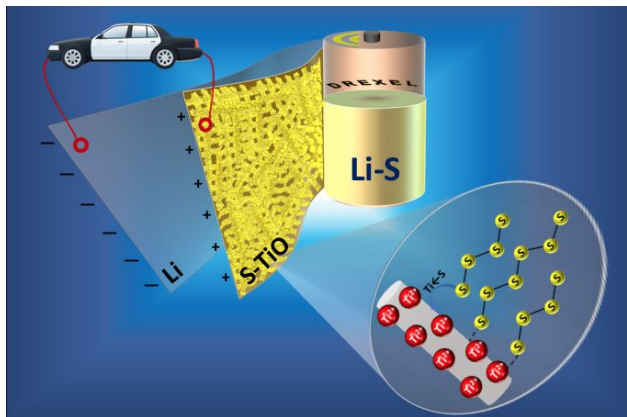


- ✓ Large Investors are withdrawing funds from non- sustainably oriented companies
- ✓ Assets doubling over past 7 years (2019)

Environmentally Focused

Lithium-sulfur batteries have been hailed as the next big step in battery technology, promising significantly longer use while being more environmentally sustainable.

These batteries don't last as long as their lithium-ion counterparts, degrading over time.



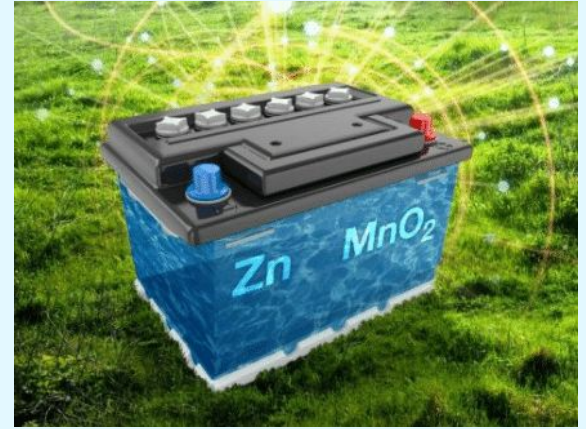
IBM's No Metal, "Sea Water" Battery components that can all be extracted from sea water.

Environmentally Focused

University of Adelaide's School of Chemical Engineering and Advanced Materials designed a new battery made of non-toxic zinc and manganese as well as incombustible aqueous electrolyte.

They partnered with a Chinese battery manufacturer, Zhuoyue Power New Energy to work on their patented technology.

The cost of this new battery will be less than \$10 per kWh compared with \$300 per kWh for many current lithium batteries.



THE UNIVERSITY
of ADELAIDE

Safety & Performance



Jenax developed a foldable battery is paper-like but tough. It can be folded over 200,000 times without losing performance

Power Japan Plus has a new battery technology called Ryden dual carbon. They claim will it last longer and charge faster than lithium and it can be made using the same factories where lithium batteries are built.

The batteries use carbon materials which mean they are more sustainable and environmentally friendly than current alternatives. They assert the batteries will charge 20x faster than lithium ion. They will also be more durable, with the ability to last up to 3,000 charge cycles, with lower chance of fire or explosion.



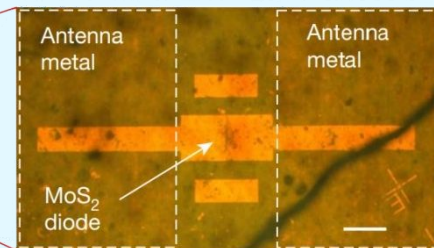
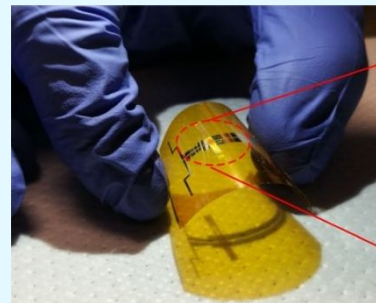
Energy from Wi-Fi

Proposed applications for the rectenna include:

- powering flexible and wearable electronics
- medical devices
- sensors for the internet of things (IoT)
- flexible smartphones

In experiments, the researchers' device has produced about 40 microwatts of power when exposed to the typical power levels of Wi-Fi signals. That is sufficient power to light up an LED or run silicon chips.

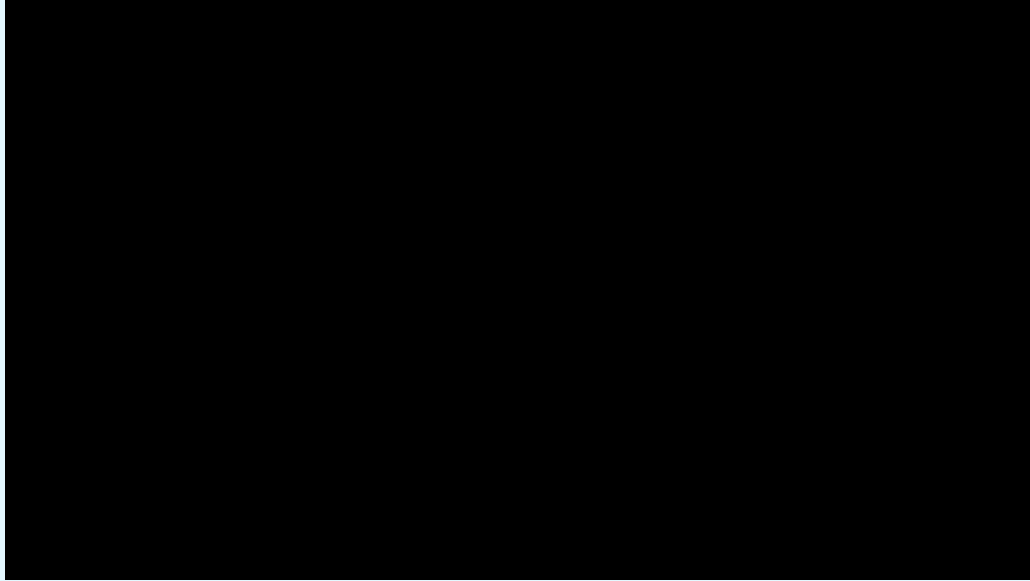
"Ideally you don't want to use batteries to power these systems, because if they leak lithium, the patient could die," Grajal says. ***"It is much better to harvest energy from the environment to power up these small labs inside the body and communicate data to external computers."***



**Massachusetts
Institute of
Technology**

Source: MIT Press Release, 2019

Portable Energy in Action: eVTOL Lilium



- ✓ 300 km/h top speed
- ✓ 60 min flying time
- ✓ Vertical take-off and landing
- ✓ 4 passengers and a pilot
- ✓ Low-noise
- ✓ Electric ducted fans
- ✓ The Lilium Jet is being certified by EASA in Europe and the FAA in the United States.

Source: Lilium, 2020

Energy



Healthcare

Novel wearable for
immune response



Manufacturing

Implement drone security
and plant inspection



CPG Food Beverage

Novel high-impact
packaging

Digital Twins



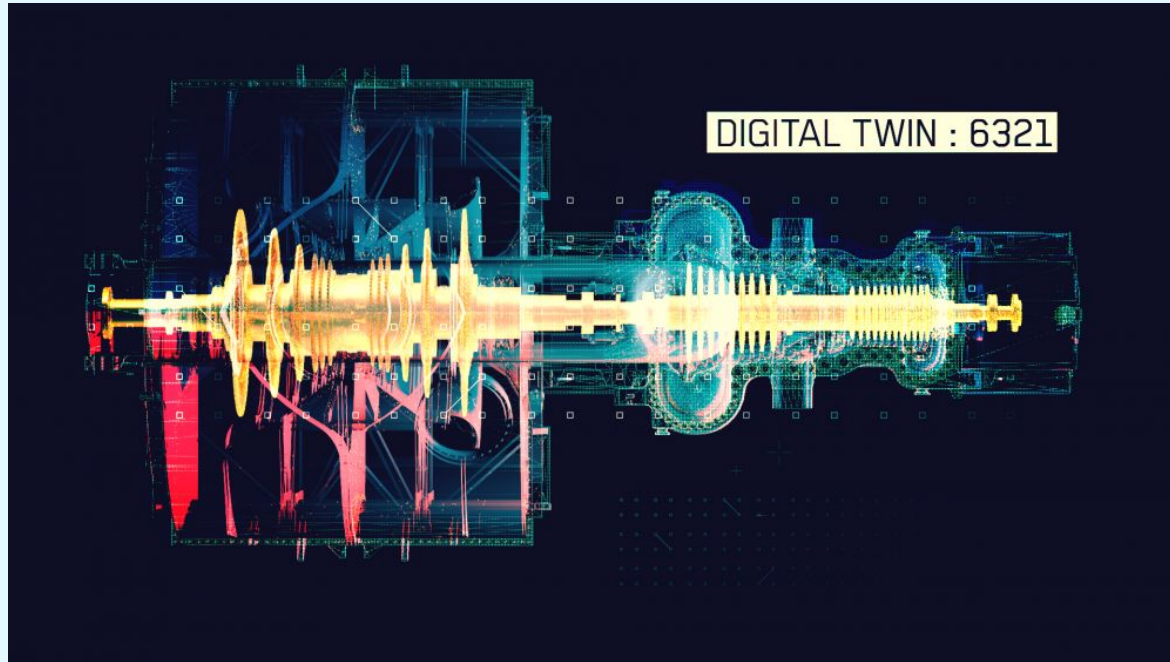


Unscheduled maintenance is an \$8 billion annual problem for passengers and the airline industry.

Digital Twins



“A ten-minute conversation with this Digital Twin saved \$12 million with a simple adjustment in how the turbine operates.”

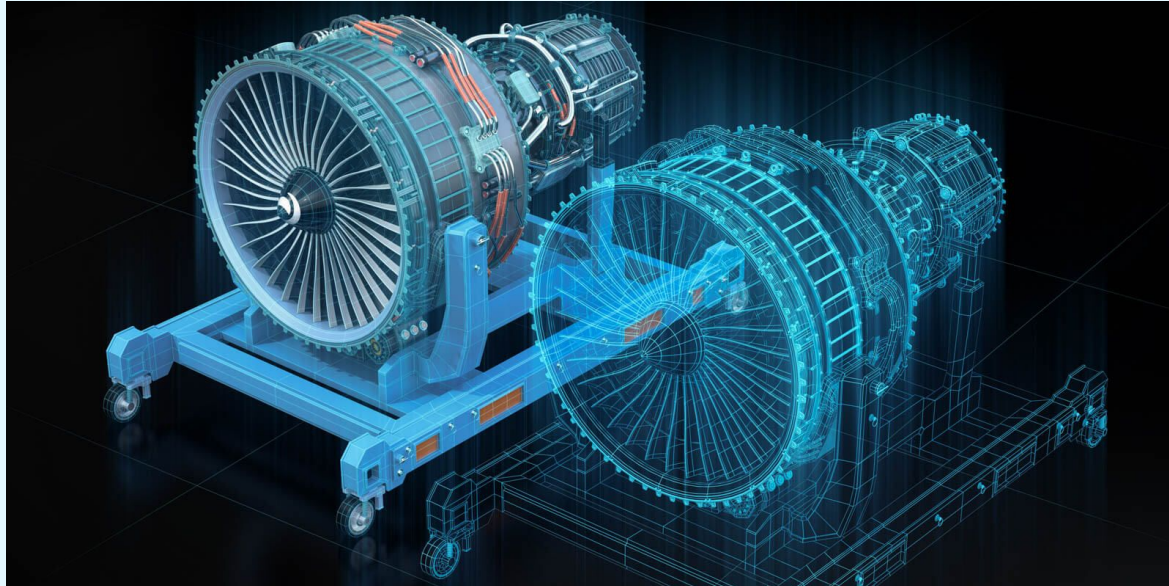


Source: GE, Digital Twins 2017








What are Digital Twins?

A digital twin is a virtual model of a process, product or service.

They can integrate IoT, artificial intelligence, machine learning and software analytics to create living digital simulation models that update and change as their physical counterparts change.



Start Simple

	Software only				Software and Hardware		
	1. Digitize	2. Visualize	3. Simulate	4. Emulate	5. Extract	6. Orchestrate	7. Predict
Digital Twin description	Any digitized information	Basic digital representation of a physical object	Simulation model of a physical system in its environment	Emulation model of the physical system with real software	Extraction model of real-time data streams, physical to virtual system	Orchestration model for virtual control/updating of physical devices	Prediction model to predict future behavior of the physical system
Digital Twin Example	Documentation, object properties, 10 sketches, 2D blueprints in digital format e.g., digital soft copies of Help manuals	Skeuomorphic models designed in a digital environment e.g., CAD design replacing manual drafting	Computer-aided simulation of how the object performs in the real world e.g., Simulink	Machine level assembly language emulators are provided by device manufacturers for I/O debugging e.g., Solidworks	Extract system readings/sensor data from the physical device and send to the digital representation e.g., IoT device data	Changing parameter values in the virtual space orchestrating updates to the relevant physical systems e.g., device mgmt. platform	Running exploratory tests in virtual space using real data to enhance physical system performance e.g., ML algorithms calculating asset lifetime
							

Source: IoT Analytics Research 2020

Digital Twins



Healthcare

Digitize, and simulate
immunological
mechanisms



Manufacturing

Decrease downtime,
increase efficiency



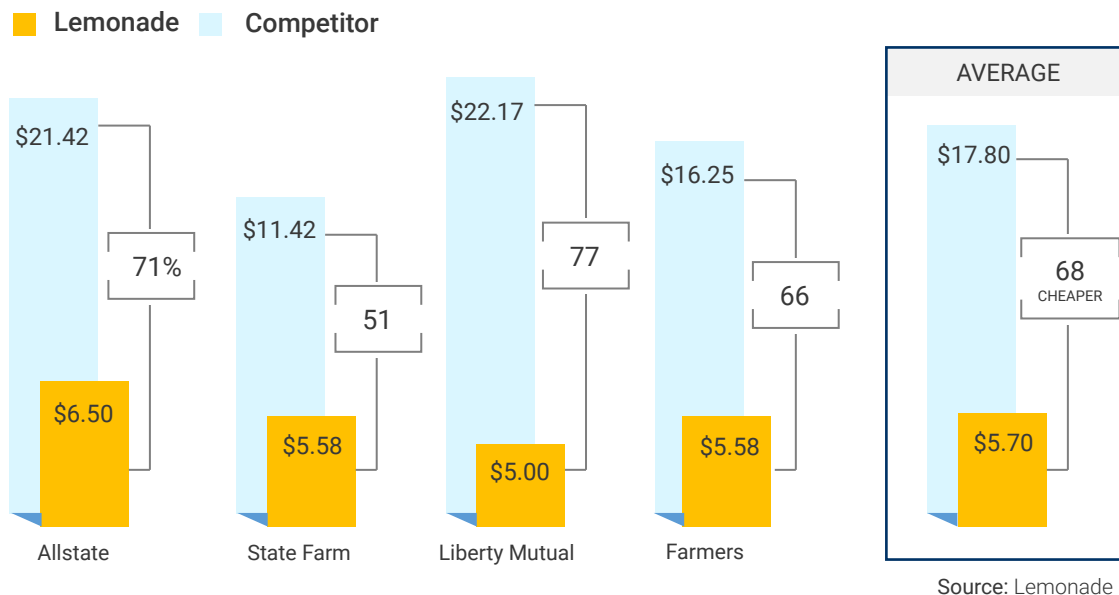
CPG Food Beverage

Simulate packaging,
handling, strength



3rd Wave AI

AI is killing a generation of businesses, while those making AI investments are seeing a 5x return



The Four Waves of AI



First Wave

c. 1970s – 1990s

Good at reasoning, but no ability to learn or generalize.



Second Wave

c. 2000s - present

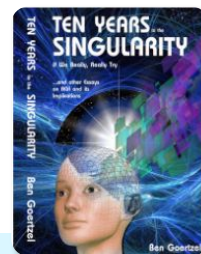
Good at learning and perceiving, but minimal ability to reason or generalize.



Third Wave

est. 2020s – 2030s

Excellent at perceiving, learning and reasoning, and able to generalize.



Fourth Wave

est. 2030s □

Able to perform any intellectual task that a human can.

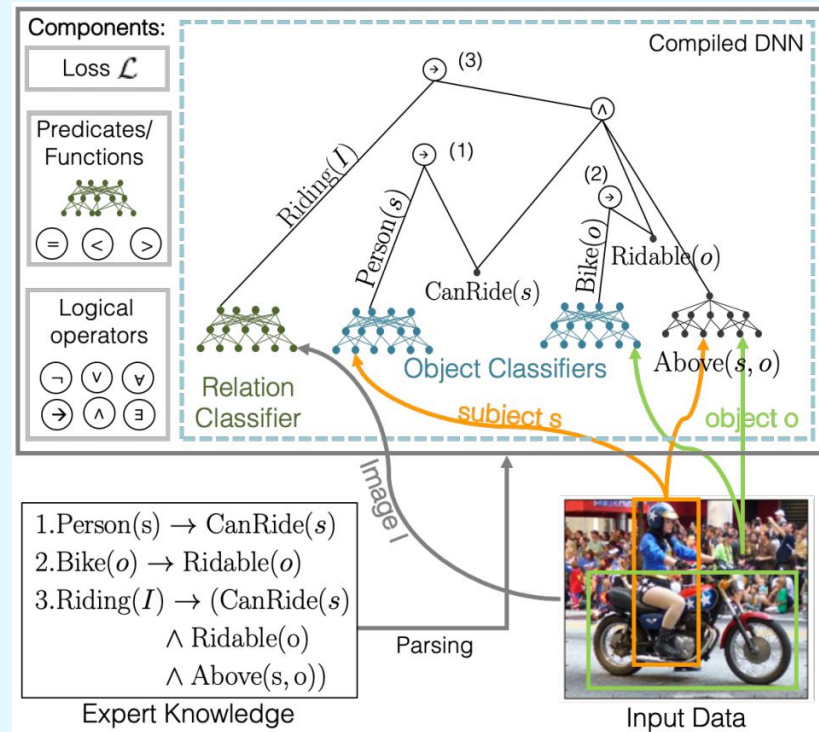
A new Third Wave of AI technology is dramatically improving quality and reducing barriers to entry

Third Wave AI mitigates the need for extensive training data by relying on expert knowledge

Earlier generations of AI learned through trial-and-error. Training these models required users to create massive datasets - finding thousands or millions of relevant data points and labeling them accordingly.

Third Wave AI includes expert decision making and intelligent frameworks so that systems can be established and trained in a fraction of the time of older algorithms. Relying on this expert knowledge also makes them more accurate and robust.

For example, Third Wave AI will not only recognize the man riding a motorcycle, but will be able to explain why and how it arrived at that conclusion.



Third Wave AI is being put to use in almost every industry.



Pending.ai and other **chemical products** companies are able to predict the properties of novel compounds without physical synthesis.



Advanced manufacturers including **Siemens** are reducing lost time incidents by detecting safety hazards before they cause accidents.



Food and beverage producers, such as **Benson Hill**, use AI can detect out of spec products, even in highly variable meat and produce products.



Highmark Inc.'s Financial Investigations and Provider Review (FIPR) department used AI to generate over \$260 million in savings associated with **fraud, waste, and abuse** in 2019.



HS2 and **similar Infrastructure** providers are drawing conclusions automatically from hours of drone inspection data.



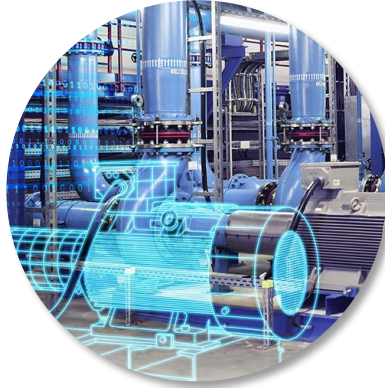
IBM estimates that it has realized “almost \$1 billion in savings” since 2011 by integrating AI and other modernization efforts in its **HR** department

3rd Wave AI



Healthcare

Predict immunological response



Manufacturing

Develop a predictive maintenance schedule



CPG Food Beverage

Identify customer needs and predict high ROI market opportunities



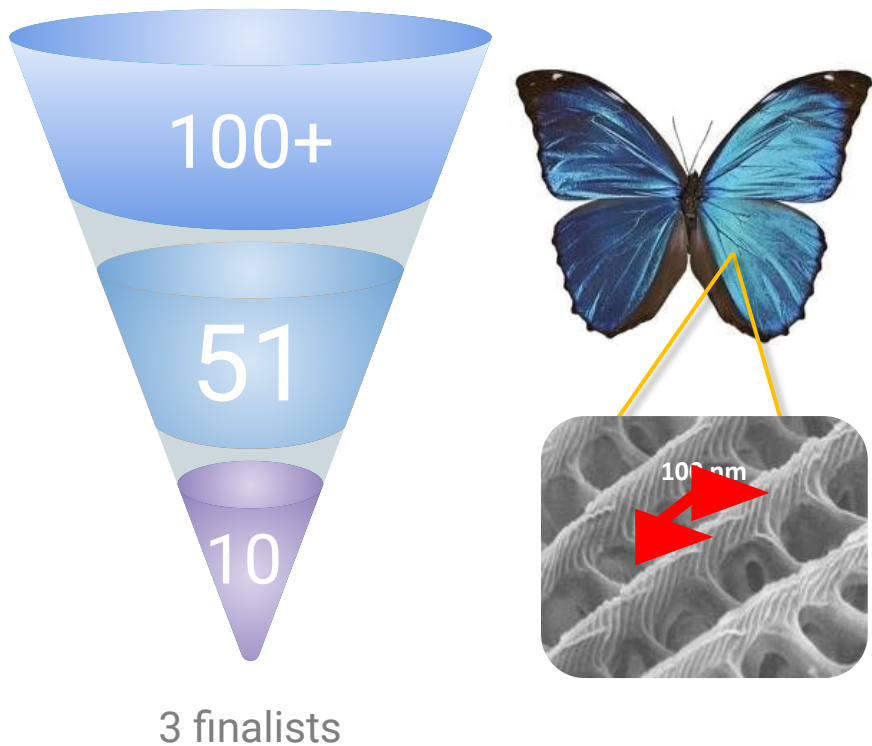
Smart Materials



**Counterfeiting costs US businesses between
\$200 – 700 Billion annually**

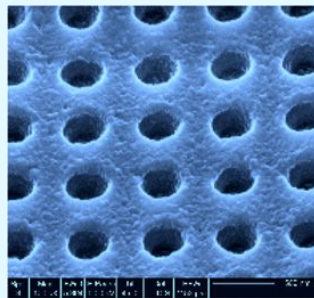


Problem to production

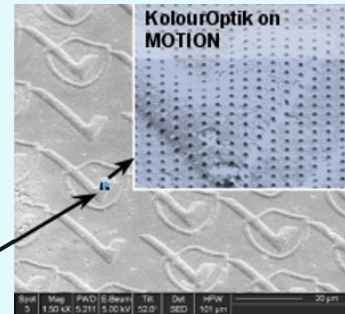


3 finalists

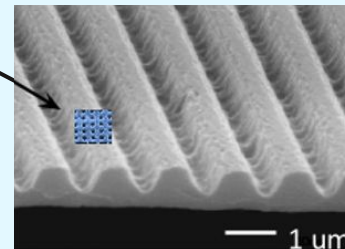
Nanotech Differentiator: Nano-Structure



KolourOptik™ nanohole array compared other OVD micro-structures

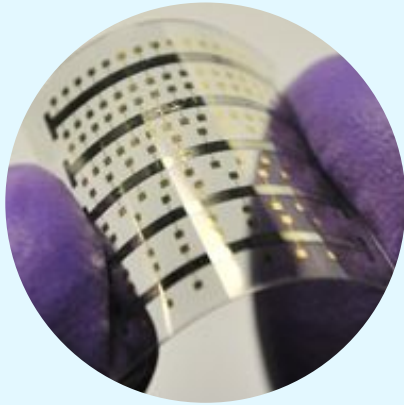


Crane MOTION™ Micro-optics



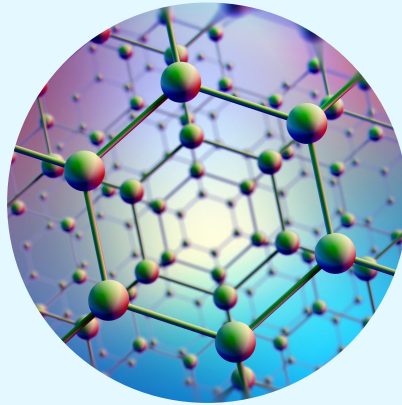
Hologram Diffraction Grafting

Smart materials are designed materials that have one or more properties that can be significantly changed in a controlled fashion.



Sensors

- Light
- Heat
- Pressure
- pH
- Chemicals
- Moisture



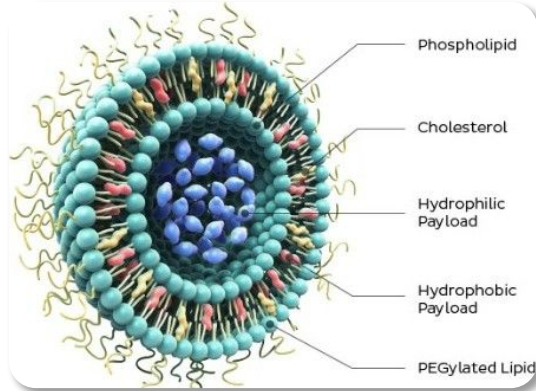
Smart Materials



Novel materials

- Self healing
- Ceramics
- Graphene
- Aerogels
- Metallic foams
- Biocomposites

Smart Materials



Healthcare

Develop immunosuppressant drug delivery using biocomposite materials



Manufacturing

Utilize metal foam for lightweighting while strengthening components



CPG Food Beverage

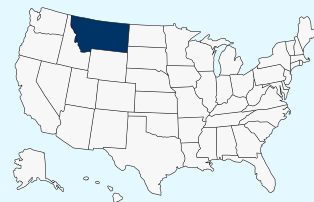
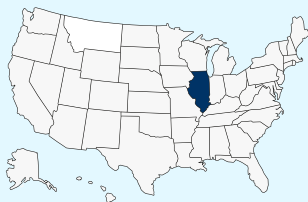
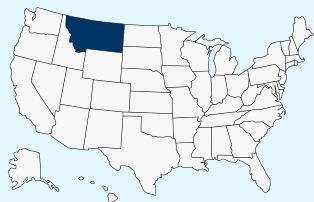
Prevent spoilage with embedded pH sensors for soft cheeses



5G / IOT



Single digit (ms)
latency



5G increases performance across the board



10x

Decrease in latency:

Delivering latency as low as 1 ms.



10x

Connection density:

Enabling more efficient signaling for IoT connectivity.



10x

Experienced throughput:

Bringing more uniform, multi-Gbps peak rates.



3x

Spectrum efficiency:

Achieving even more bits per Hz with advanced antenna techniques.



100x

Traffic capacity:

Driving network hyper-densification with more small cells everywhere.



100x

Network efficiency:

Optimizing network energy consumption with more efficient processing.

Source: ITN Spotlight, 2019

Tactile Internet



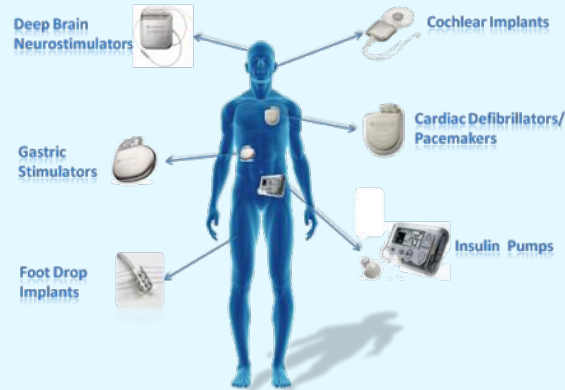
True AR/VR/MR



Telesurgery



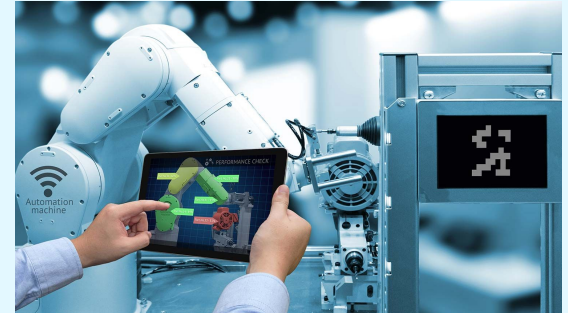
WIRELESS IMPLANTABLE MEDICAL DEVICES



Enhanced Connectivity



Autonomous travel



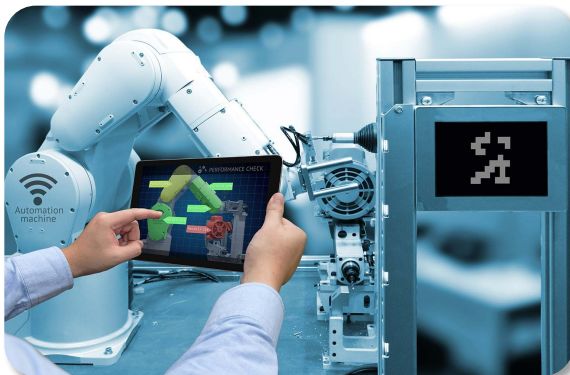
Smart Manufacturing

5G/IOT



Healthcare

Immunosuppressant dosing
wearable with real time data
feedback and tunability



Manufacturing

Fully automated assembly and
inspections with real time
predictive maintenance
schedules



CPG Food Beverage

Embedded sensors inform
consumer in real-time when
spoilage is about to occur

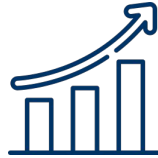
Next Steps

1



Develop a strategic
technology
roadmap

2



Ideate both
incremental and
disruptive concepts

3



Explore and
understand limitations
and timelines

4



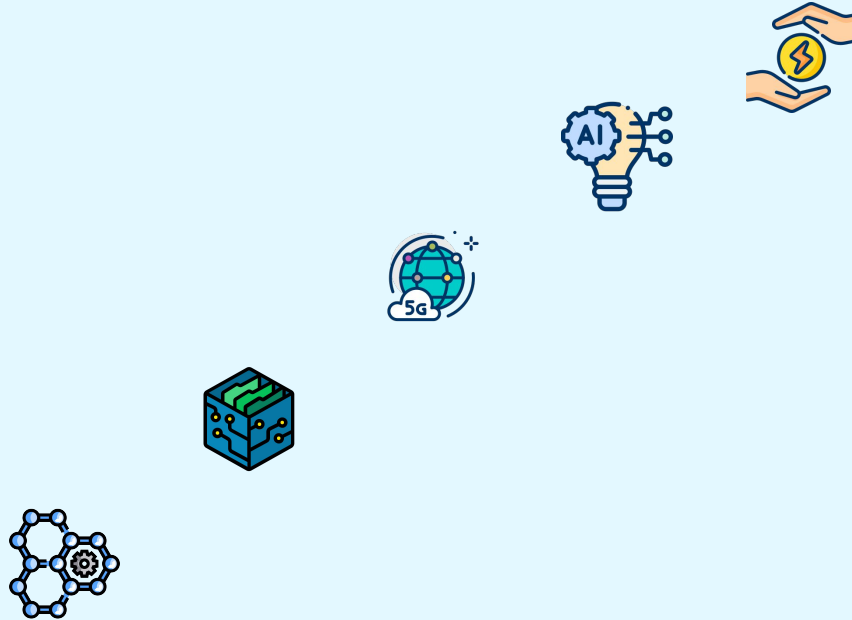
Ask for help

5



Experiment

Questions?



Thank you!

About PreScouter

PRESCOUTER PROVIDES CUSTOMIZED RESEARCH AND ANALYSIS

PreScouter helps clients gain competitive advantage by providing customized global research. We act as an extension to your in-house research and business data teams in order to provide you with a holistic view of trends, technologies, and markets.

Our model leverages a network of 3,000+ advanced degree researchers at tier 1 institutions across the globe to tap into information from small businesses, national labs, markets, universities, patents, startups, and entrepreneurs.

CLIENTS RELY ON US FOR:



Innovation Discovery: PreScouter provides clients with a constant flow of high-value opportunities and ideas by keeping you up to date on new and emerging technologies and businesses.



Privileged Information: PreScouter interviews innovators to uncover emerging trends and non-public information.



Customized Insights: PreScouter finds and makes sense of technology and market information in order to help you make informed decisions.

