

luxexecutivesummit 2018

Boston • April 9-11

# Supercharging Innovation with Data+Insight

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Kevin See, Ph.D.

VP, Digital Products



# Agenda

- 1 | The Stagnation of the Innovation Process
- 2 | Data + Insight to get at What, Who, and When
- 3 | Evolving for better results

# 2017 WORLD SERIES CHAMPIONS HO





## How big data won the 2017 World Series

Learn what the Houston Astros did to win the analytics arms race in Major League Baseball.

**The Boston Globe**

**Astros at leading edge of analytics and their success is proof positive**

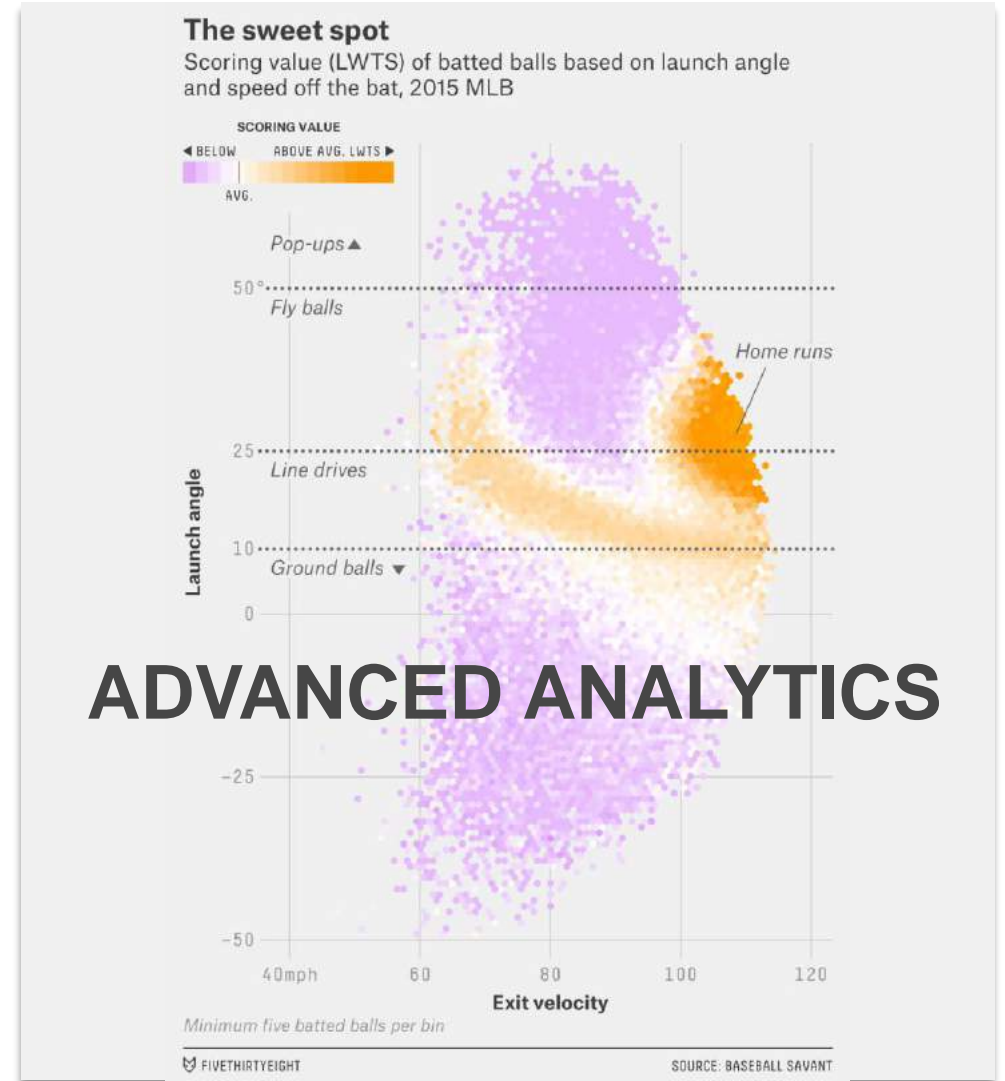


**Astros are winning at new, old numbers games**





TRADITIONAL



ADVANCED ANALYTICS



Analytics is about helping player development, managers and coaches to make better decisions; better decisions than what your competitors are making.



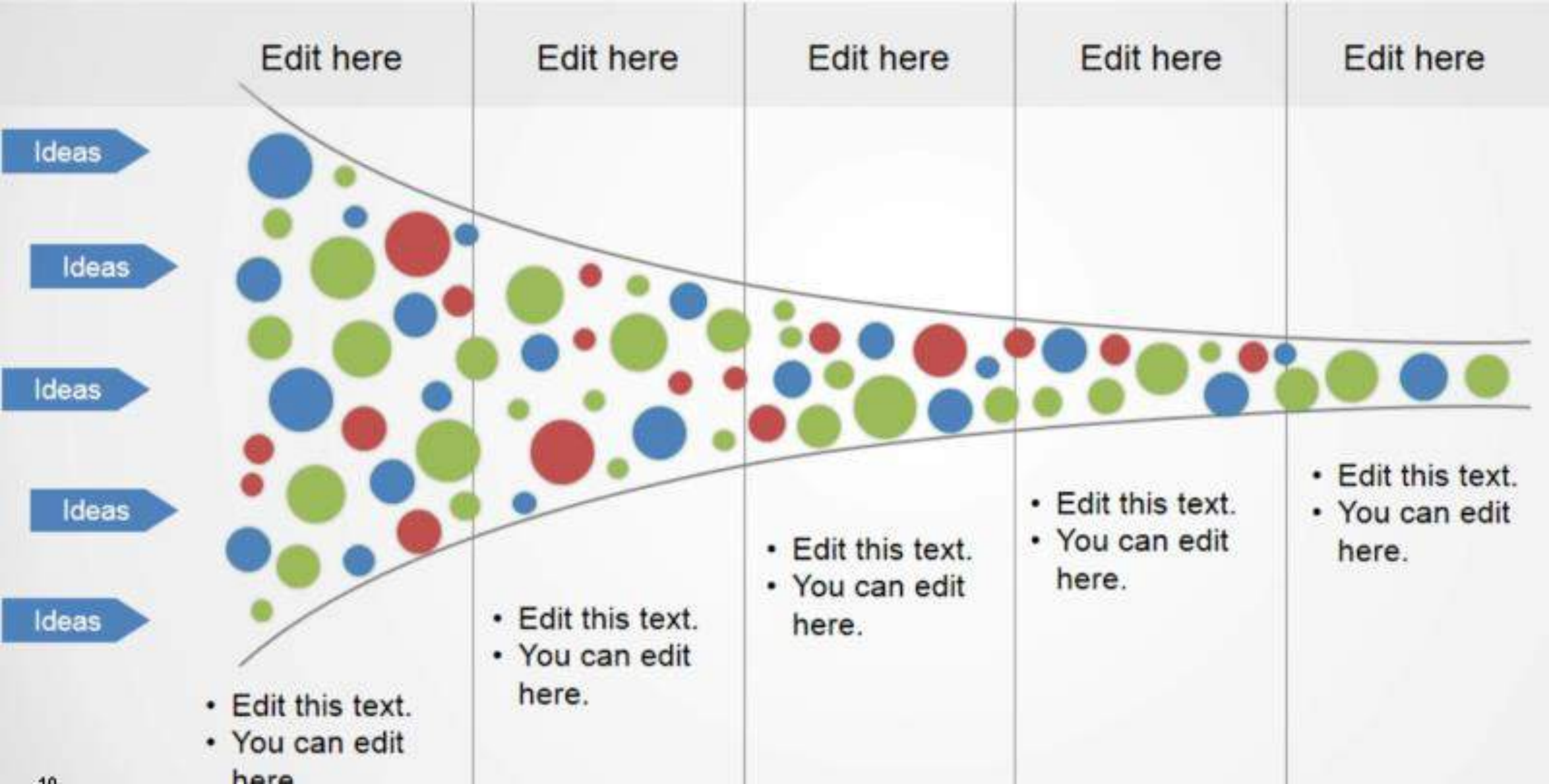


Luhnow recognized the incentives for losing baked into what was then a new collective bargaining agreement. The worst teams would have much more money to spend on amateur talent. **A few years of struggle could lead to many years of success.**



Year	Team	League	Wins	Losses	%
2017	Houston Astros	American League	101	61	.623
2016	Houston Astros	American League	84	78	.519
2015	Houston Astros	American League	86	76	.531
2014	Houston Astros	American League	70	92	.432
2013	Houston Astros	American League	51	111	.315
2012	Houston Astros	National League	55	107	.340





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Ideas

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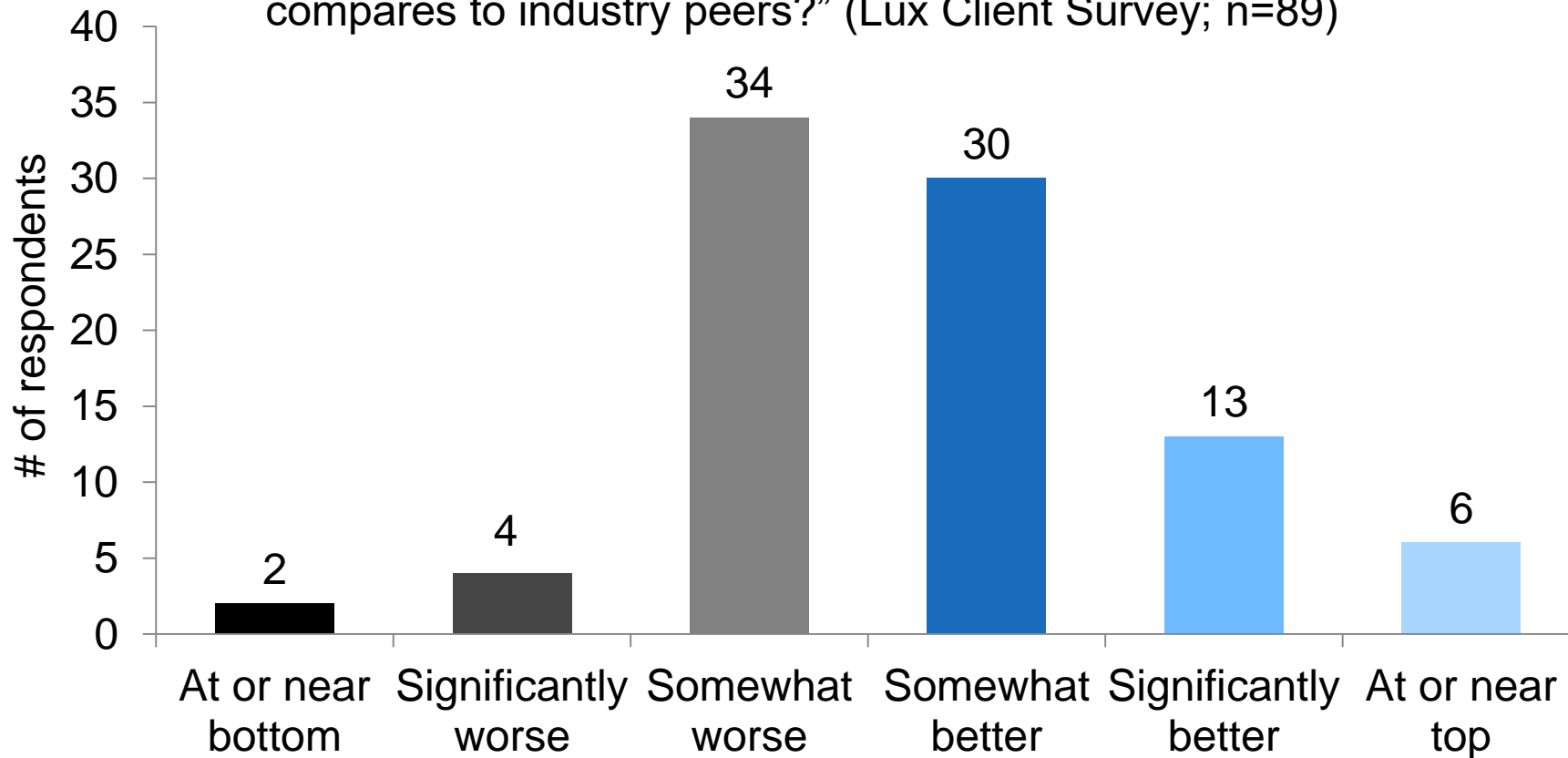
TRADITIONAL

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# 2013: Most see innovation results as modest

“Overall, how do you think the success of your program compares to industry peers?” (Lux Client Survey; n=89)



“I don’t have any home runs to talk about. Have quite a few singles and doubles – some that are still growing, could become a triple or a home run.”

“We find a lot of singles, haven’t found a home run. It’s not hard, over the course of year, to find a single or two.”

# 2018: The challenges remain the same



## TOP 10

INNOVATION ISSUES LEADERS  
ARE FOCUSED ON IN 2018

We asked our members: What issues are  
at the top of your agenda for 2018?

"Top issue is always getting buy-in. Execs want innovation to check a box that they're thinking about the future, but never act on pitches, results, insights produced by the team."

- Anonymous Respondent

- 1 Spotting emerging technologies & disruptive trends
- 2 How to spur cultural change / risk-taking
- 3 Building communities / networks of innovators
- 4 Rolling out successful projects into the business
- 5 Co-creation with customers
- 6 Metrics, reporting, dashboards
- 7 Governance & organizational structure for innovation
- 8 Co-creation with suppliers & business partners
- 9 Interacting with startups & entrepreneurs
- 10 How traditional R&D orgs need to change  
Reducing costs/streamlining operations (tie)



**Solution:  
Data + Insight**

# Approaches to spotting transformational technologies tend to fall into one of two camps

## TRADITIONAL FORESIGHT

### Characteristics

Examine broad themes (megatrends)  
Study markets and tech trends  
Get smart people to make judgments

### Challenges

Unreliable – vulnerable to bias  
Still easy to miss some key trends  
Often still a lagging indicator

# Approaches to spotting transformational technologies tend to fall into one of two camps

## TRADITIONAL FORESIGHT

## AUTOMATED DATA

### Characteristics

Examine broad themes (megatrends)  
Study markets and tech trends  
Get smart people to make judgments

Access to various data sources  
Look for trends and correlations  
Search interface and visualizations

### Challenges

Unreliable – vulnerable to bias  
Still easy to miss some key trends  
Often still a lagging indicator

Lacks context and insight  
Contributes to information overload  
Often still a lagging indicator

# Approaches to spotting transformational technologies tend to fall into one of two camps

## TRADITIONAL FORESIGHT

Examine broad themes (macro trends)  
Study markets and tech trends  
Get smart people to make predictions

Unreliable – vulnerable to bias  
Still easy to miss some key trends  
Often still a lagging indicator

## DATA-DRIVEN DATA

Use multiple data sources  
Identify patterns and correlations  
Use charts and visualizations

Can miss important context and insight  
Prone to information overload  
Often still a lagging indicator

**We need  
a way  
to synthesize  
the best of  
both**



## TRADITIONAL FORESIGHT CHALLENGES

# The perils of fallible insight

1999

The  
Economist

“In the early 1980s AT&T asked McKinsey to estimate how many cellular phones would be in use in the world at the turn of the century. The consultancy noted all the problems with the new devices—the handsets were absurdly heavy, the batteries kept running out, the coverage was patchy and the cost per minute was exorbitant—and concluded that the **total market would be about 900,000**. At the time this persuaded **AT&T to pull out of the market**, although it changed its mind later.

These days **900,000 new subscribers join the world's mobile-phone services every three days**”

## TRADITIONAL FORESIGHT CHALLENGES

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These days **900,000 new subscribers join the world's mobile-phone services every three days**”

2006

ZDNet

## Gartner: Apple should quit hardware business

The future success of Apple, Dell and Intel lies with a licensing deal between Steve Jobs' company and the PC maker according to analyst Gartner



By Andrew Donoghue | October 18, 2006 -- 15:55 GMT (08:55 PDT) | Topic: Innovation

# AUTOMATED DATA CHALLENGES

## The perils of automation

Google News

### EXAMPLE NEWS ALERT FOR TOYOTA



**I'm Turning A Salvage Toyota 86 From Hurricane Harvey For Charity**

Jalopnik · 3h ago



**Should Value Investors Pick Toyota Motor (TM) Stock?**

Zacks.com · 7h ago



**Driving the Toyota C-HR R-Tuned, a 600-HP Compact Crossover That Wants to Kill You**

The Drive · Mar 29, 2018

RELATED COVERAGE



**New Toyota RAV4 revealed with hybrid powertrain**

AutoExpress



**What to Expect at Richmond Raceway's 2018 Toyota Series NASCAR Event**

The Drive · Mar 31, 2018



**Toyota Launches Production Model "Sora" Fuel Cell Bus**

Composites Manufacturing Magazine · Apr 2, 2018

# Solution



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**Expert curation of data and advanced analytics**

**Domain knowledge sorts the significant from the spurious**

**Insight on what it means – and what to do about it**

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# Solution



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- Goals:**
- Improve our win rate
  - Make our wins bigger
  - Make our innovation efforts *indispensable* for growth
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# Agenda

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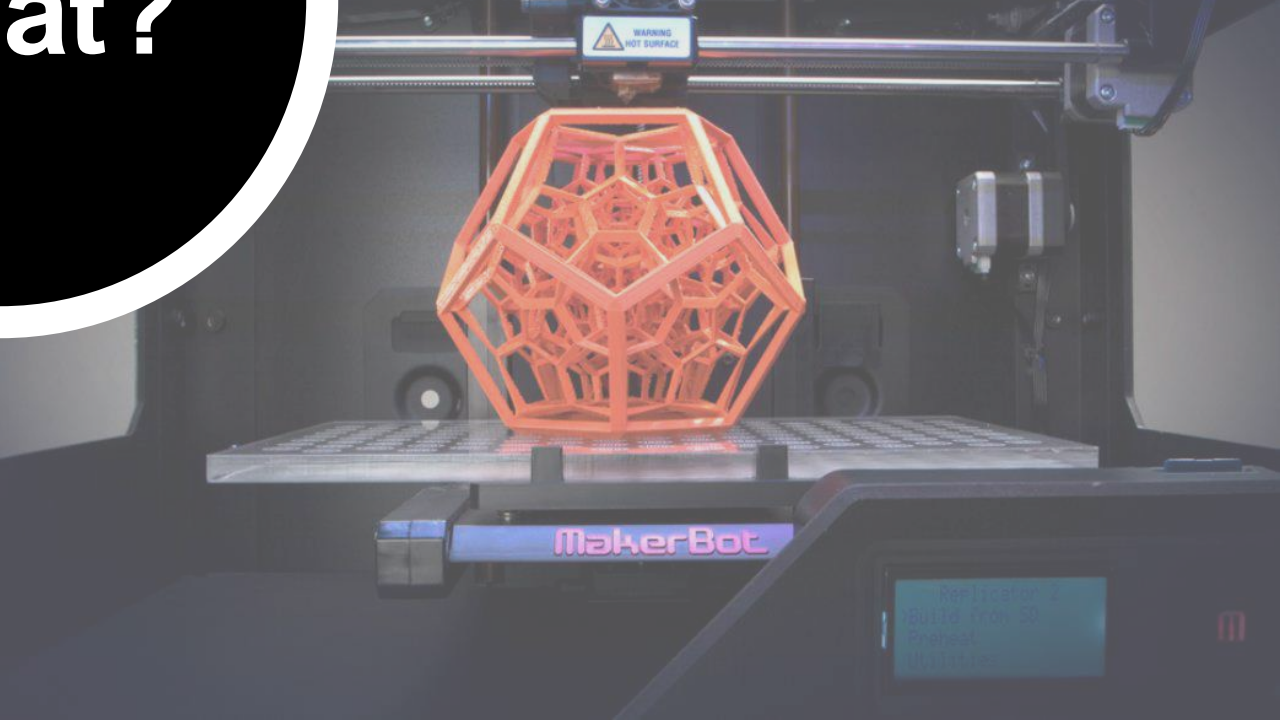
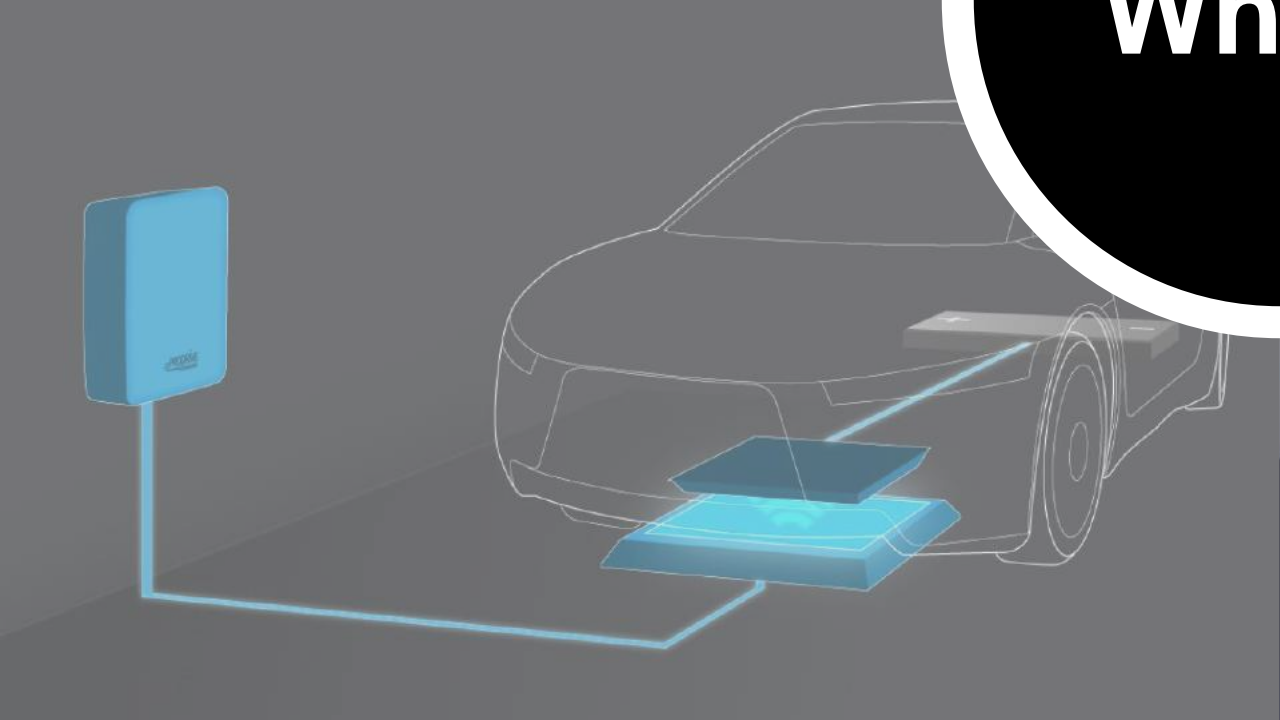
**What?**

**Who?**

**When?**



**What?**



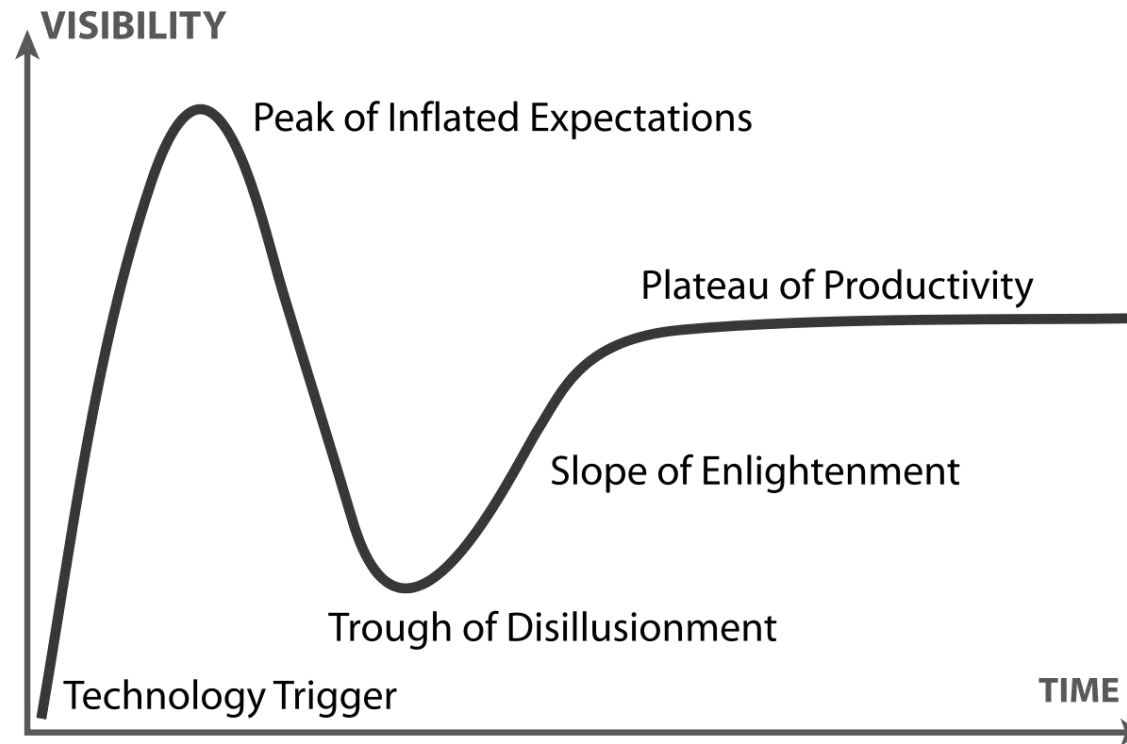


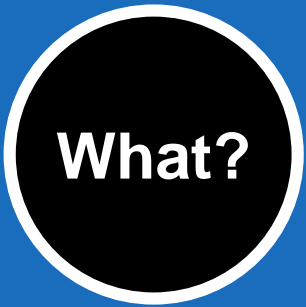


## TRADITIONAL FORESIGHT

# What technologies should you prioritize?

### QUALITATIVE FRAMEWORKS

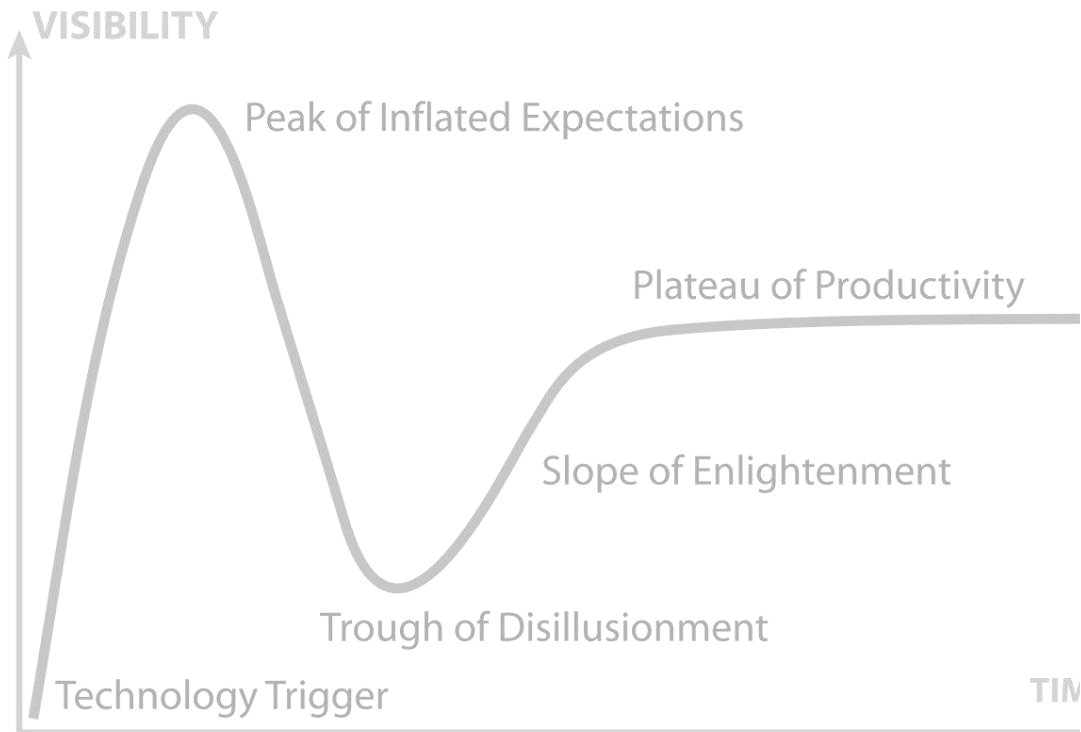




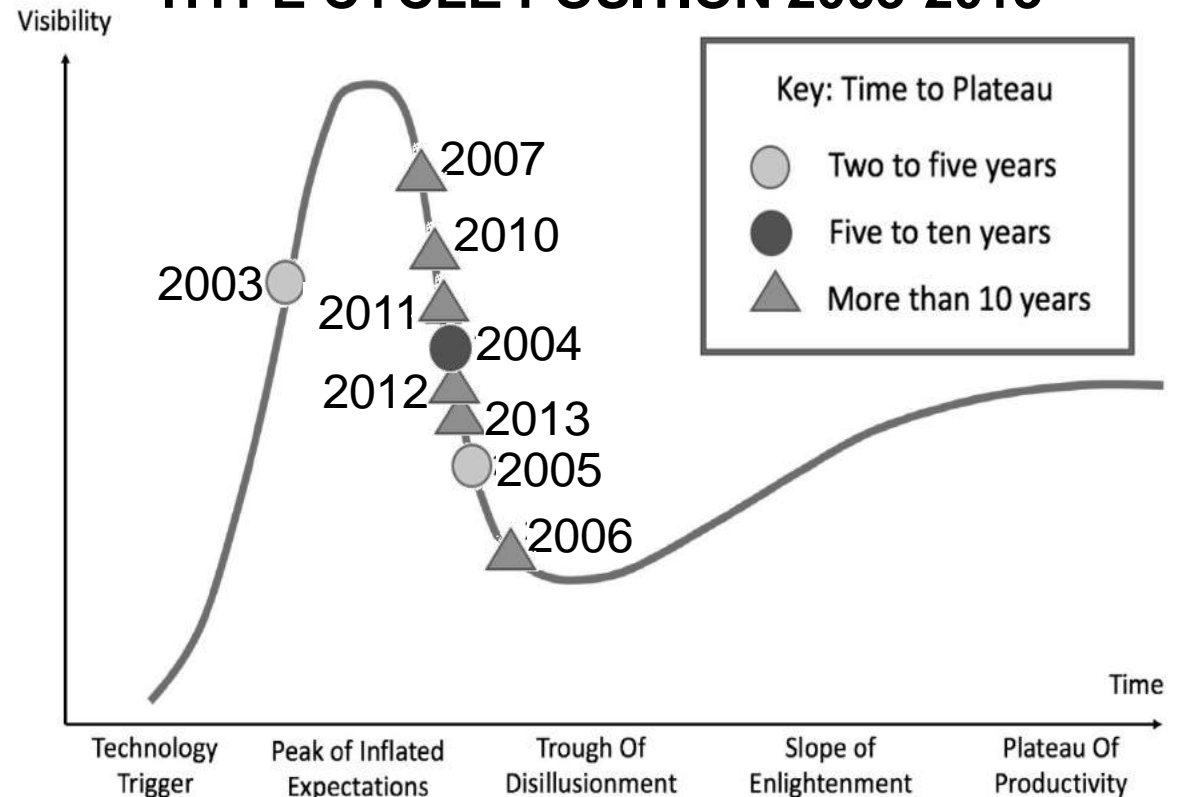
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### MESH NETWORKS HYPER CYCLE POSITION 2003-2013

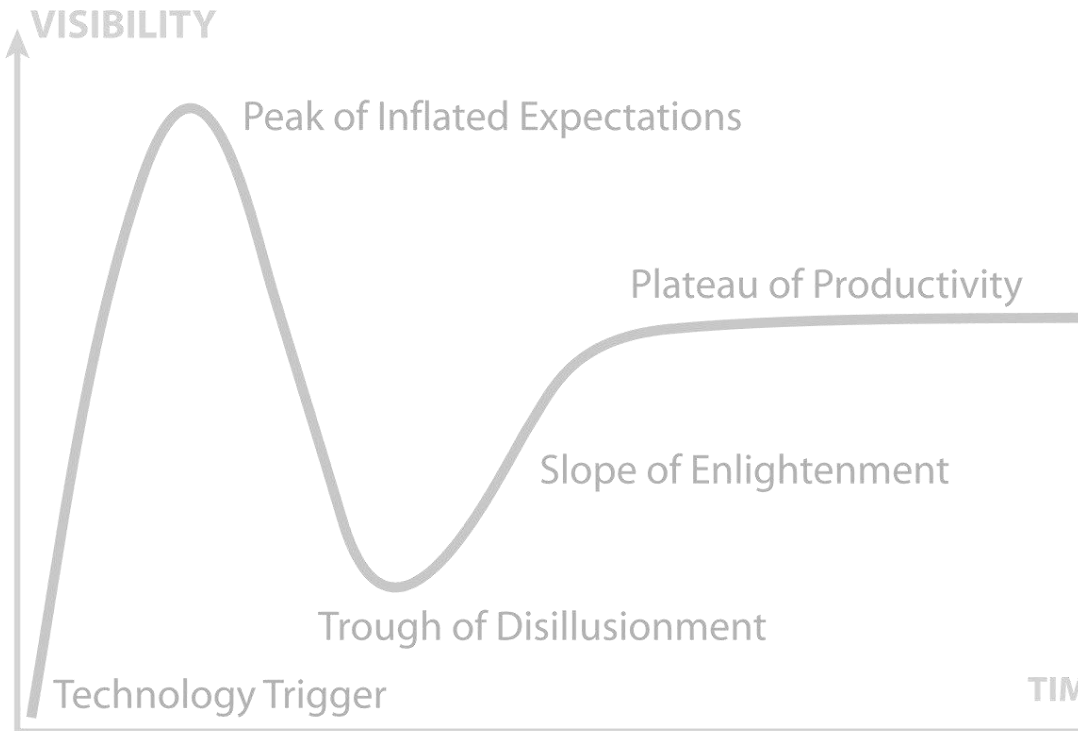




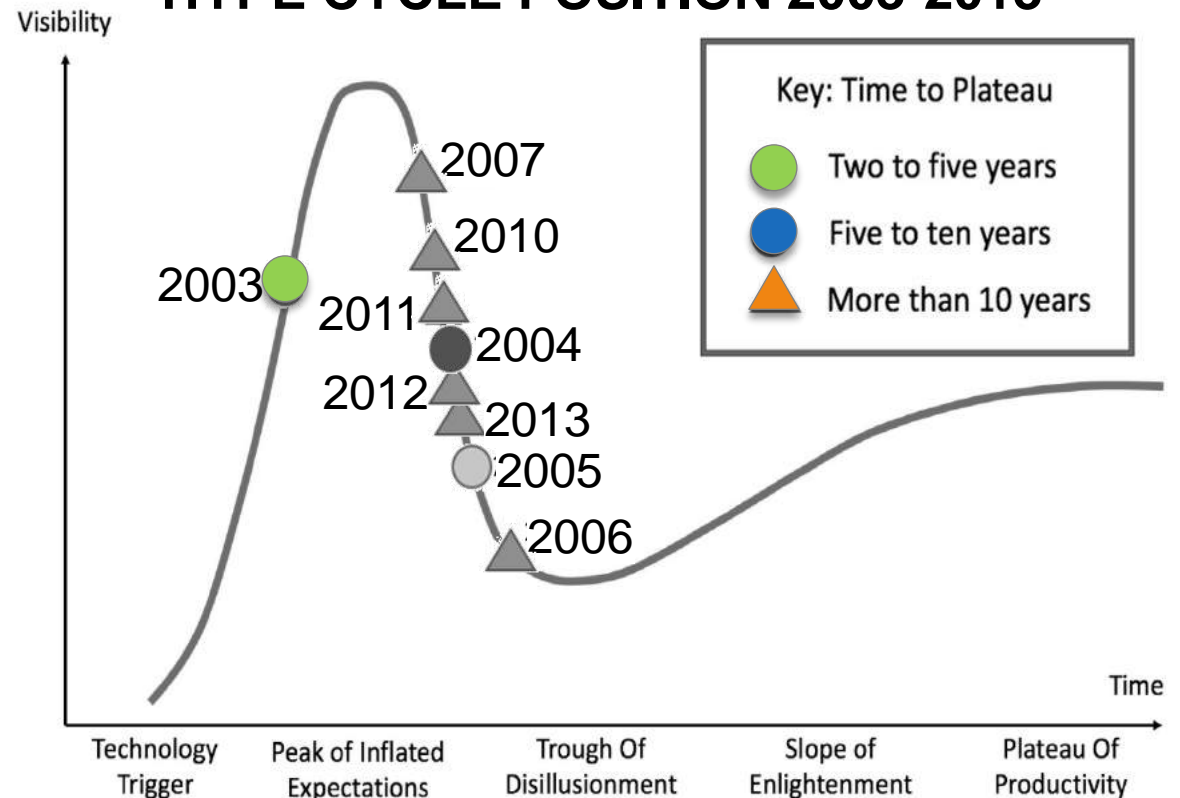
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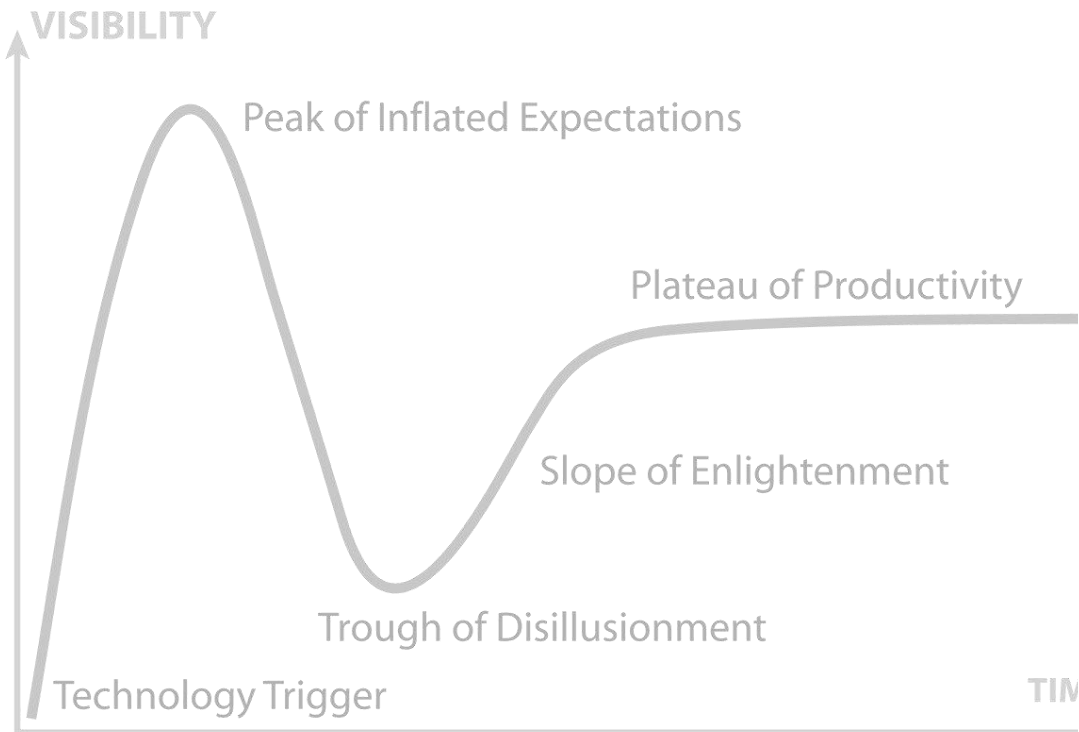




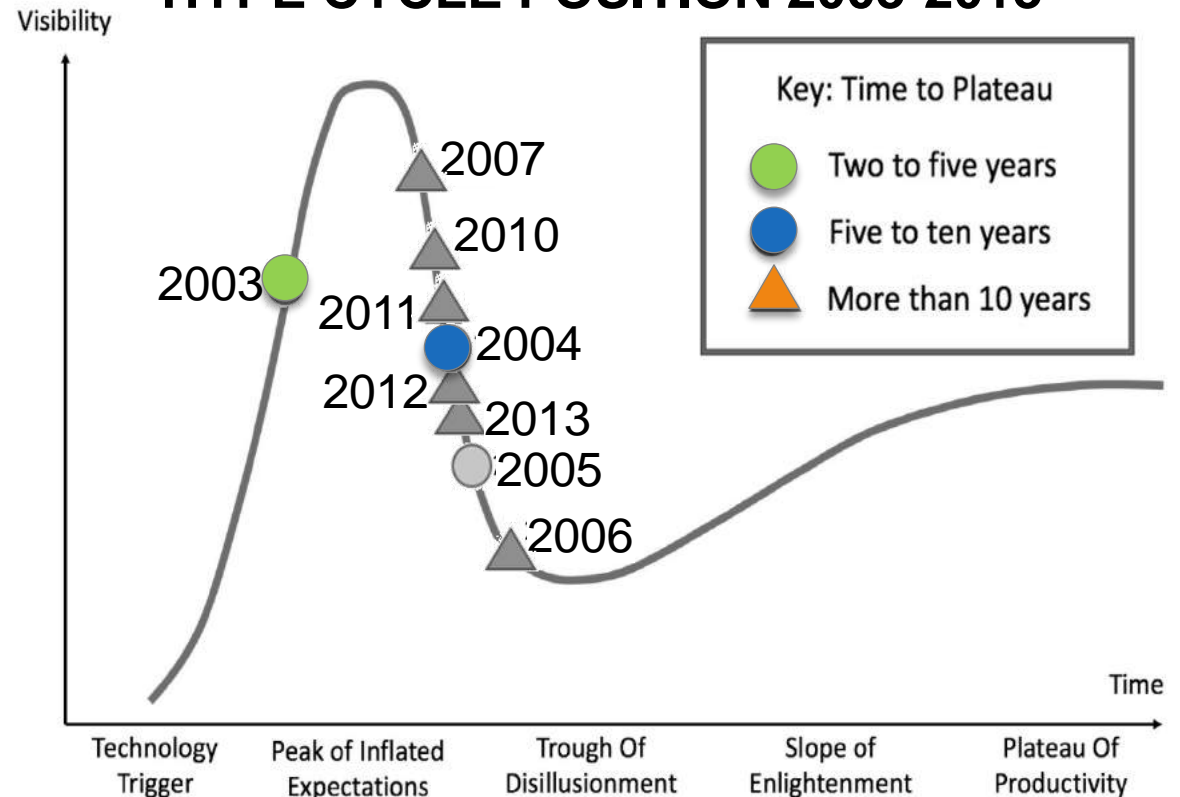
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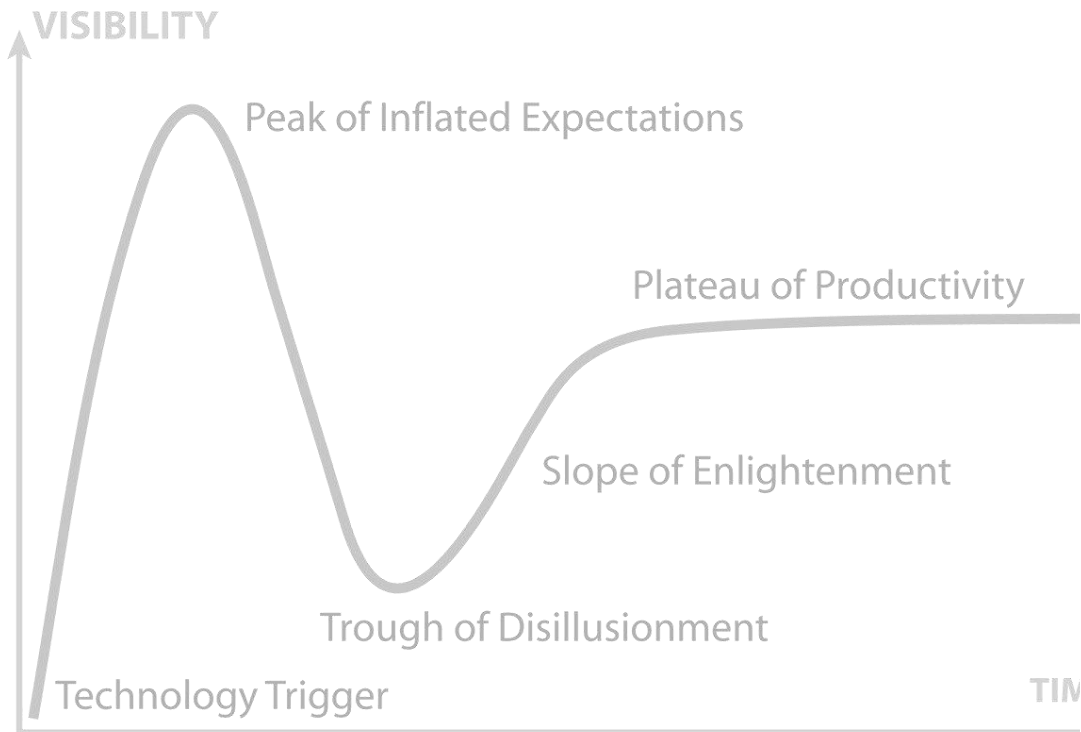




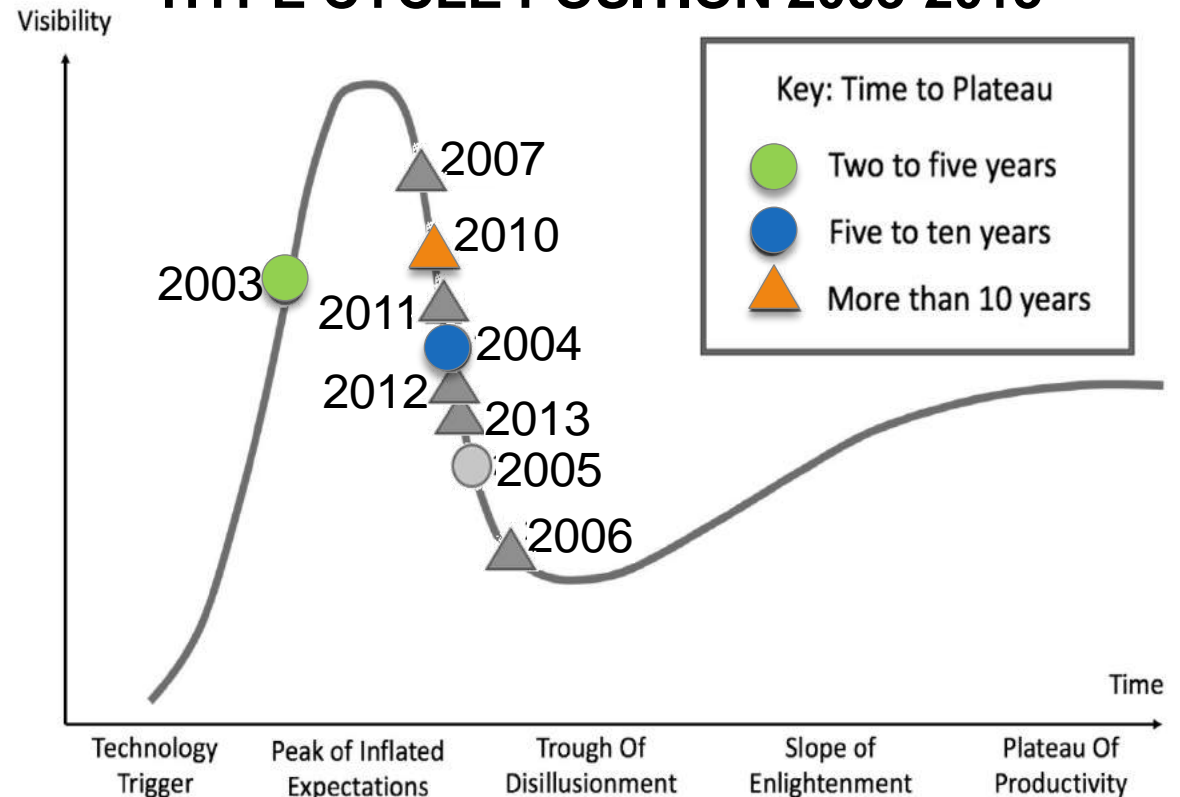
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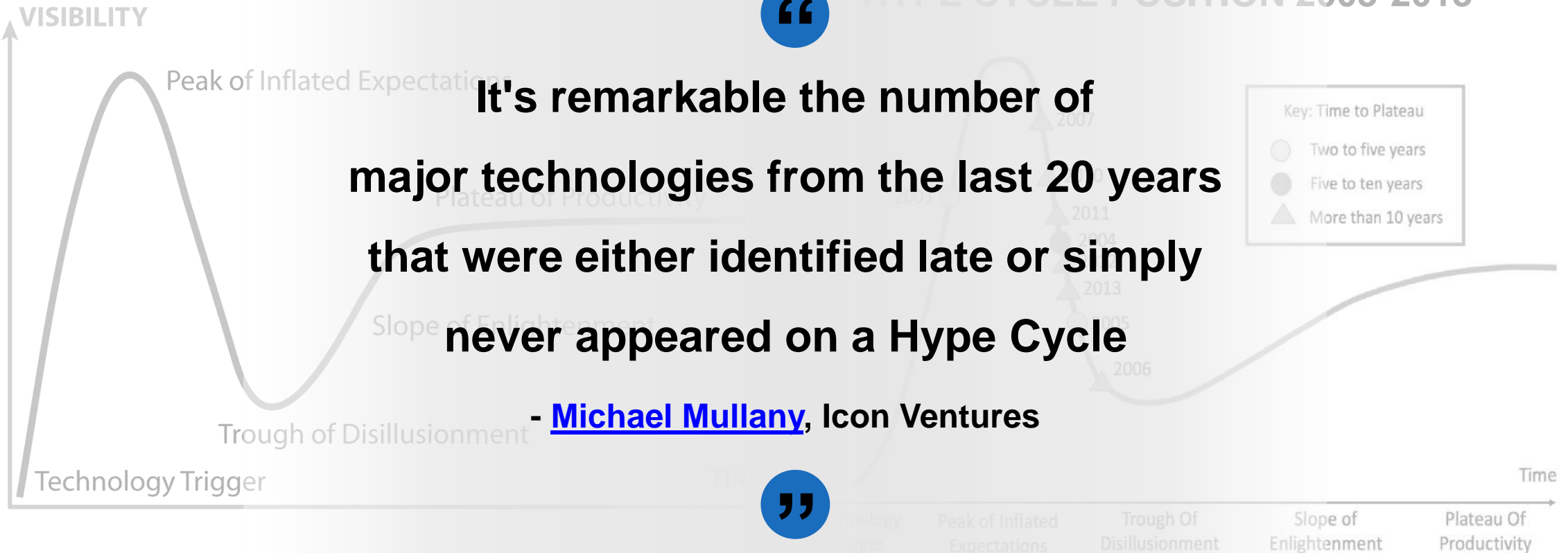
# TRADITIONAL FORESIGHT

## What technologies should you prioritize?

QUALITATIVE FRAMEWORKS

MESH NETWORKS

HYPE CYCLE POSITION 2003-2013



“ It's remarkable the number of major technologies from the last 20 years that were either identified late or simply never appeared on a Hype Cycle ”

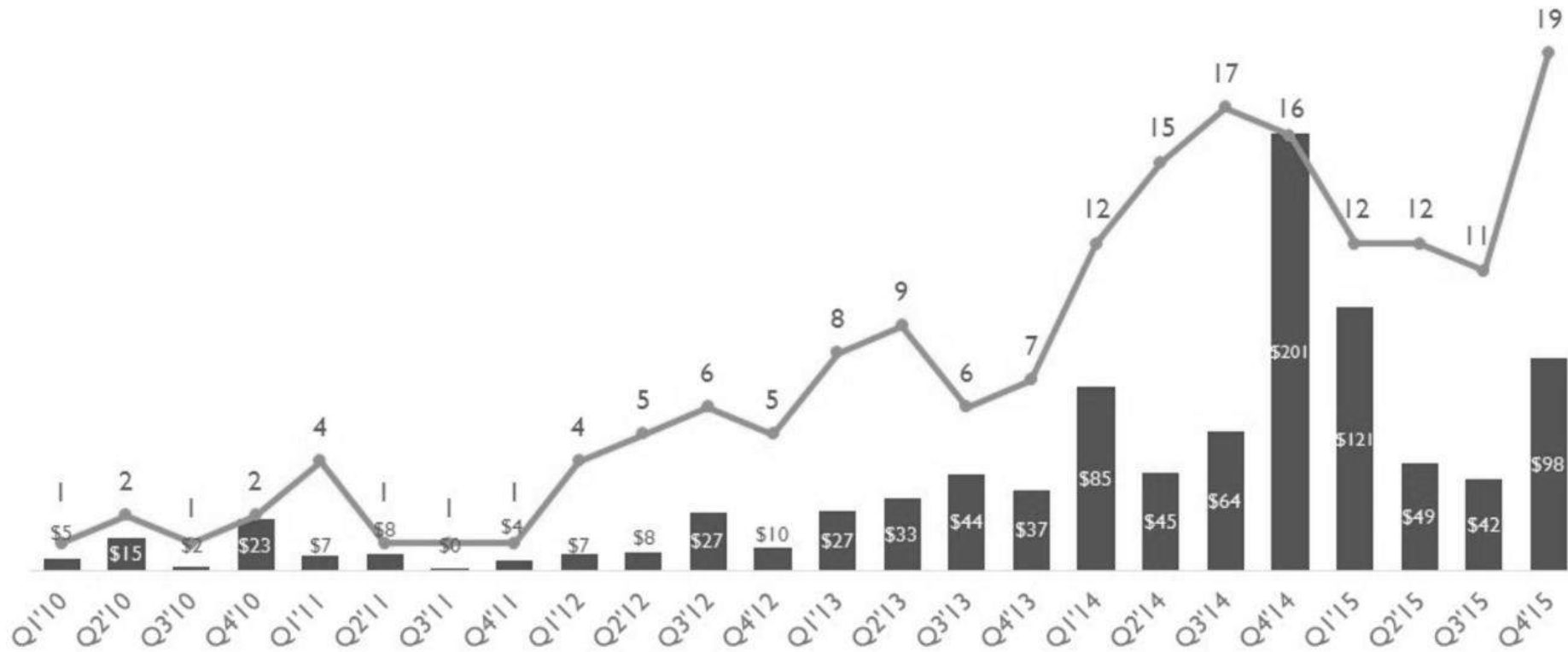
- [Michael Mullany](#), Icon Ventures



## AUTOMATED DATA

# What technologies should you prioritize?

### VC FUNDING





## AUTOMATED DATA

# What technologies should you prioritize?

### VC FUNDING





What?

AUTOMATED DATA

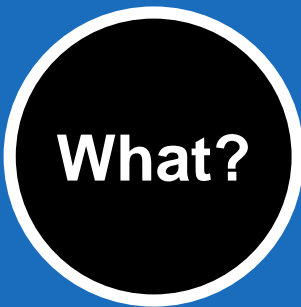
What technologies should you prioritize?

VCs struggle outside of software

**Venture Capital and Cleantech:**

The Wrong Model for  
Clean Energy Innovation





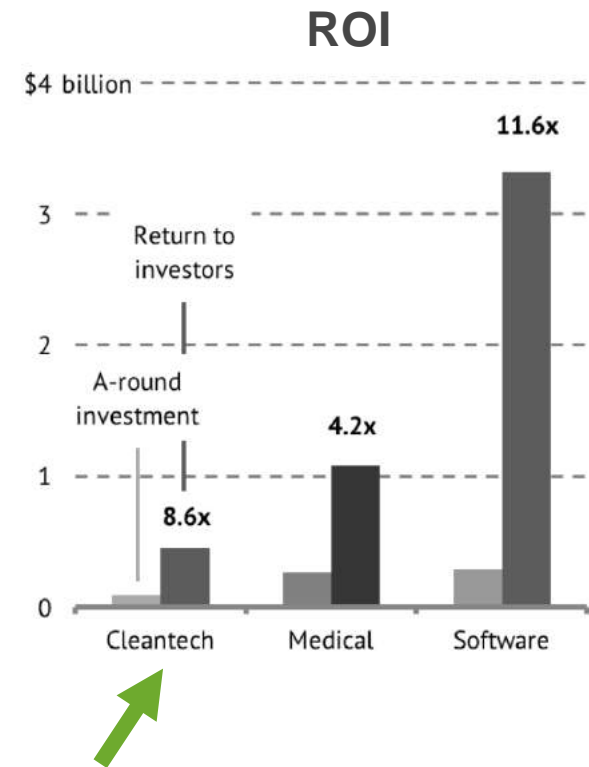
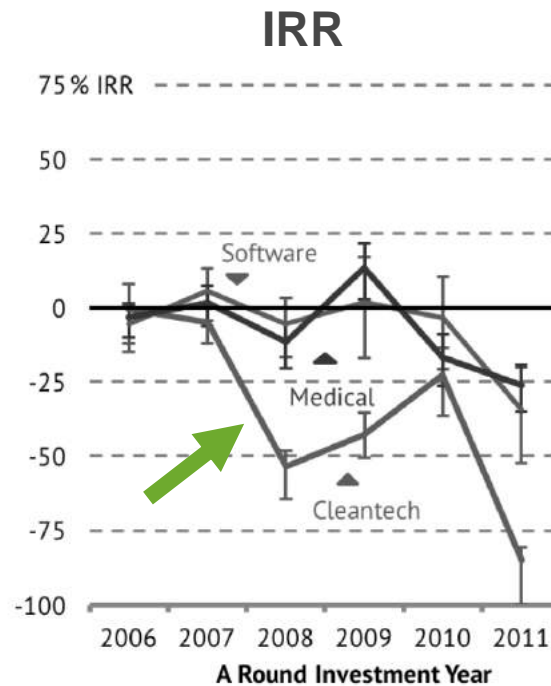
AUTOMATED DATA

# What technologies should you prioritize?

## VCs struggle outside of software

### Venture Capital and Cleantech:

The Wrong Model for  
Clean Energy Innovation



# Solution



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Introducing...  
**The Lux Tech Signal**

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# Lux Tech Signal (LTS) methodology

The Lux Tech Signal is based on our analysis of innovation data including:

- Patents
- Academic papers
- VC funding
- Government funding
- Lux proprietary data

The **Innovation Interest** score is calculated by analyzing multiple, diverse datasets weighted based on our evaluation of the role innovation sources play in each stage of commercial technology development; empirically tested and validated against real world historical data.

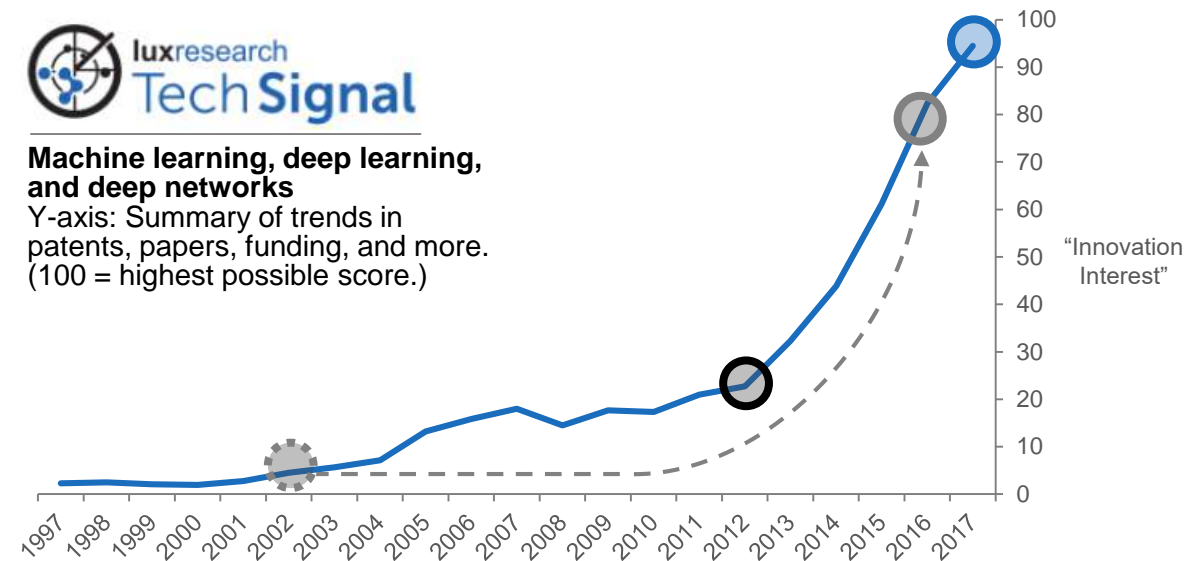
The maximum possible score is 100, indicating the highest observed rate of research, patenting, funding, etc.

## EXAMPLE:



### Machine learning, deep learning, and deep networks

Y-axis: Summary of trends in patents, papers, funding, and more. (100 = highest possible score.)

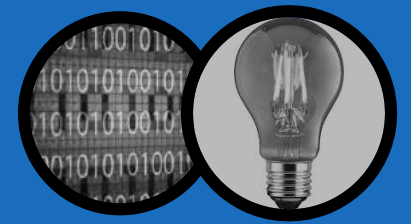


- **Changes over time** signal growing (or shrinking) innovation interest.
- **Inflection points** may point to commercial opportunities or challenges ahead.
- **Current value** indicates innovation maturity, distinguishing established technologies from those that are still emerging.

What?

DATA + INSIGHT

# What technologies should you prioritize?



## 18 for 2018

Executive Summary: Top technologies Lux is following in 2018, using data from the Lux Intelligence Engine and analysts' insight

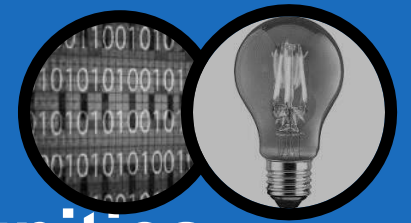
A ranking of the most important technologies to watch, given their potential to transform the world in the next decade

- 1 Machine Learning and Deep Neural Networks**  
30% annual increase in machine learning patents
- 2 3D Printing and Additive Manufacturing**  
Lux expects 3D printing to be a \$20 billion market by 2025
- 3 Genome Editing**  
\$1.2 billion in VC funding to impact industries from food to health care
- 4 5G Networks**  
Over 70,000 patents set the stage for 5G network launches in 2018
- 5 Microbiome**  
Harnessing the power of microbes for nutrition, agriculture, and more
- 6 Solid-state Batteries**  
Safer and better batteries, pursued by start-ups and giants like Toyota
- 7 Synthetic Biology**  
A recent \$275 million round for Ginkgo Bioworks highlights the potential
- 8 Augmented Reality (AR)**  
Enterprise applications are coming now, on heels of \$4.4 billion in funding
- 9 Smartwatches**  
Patents soar from near zero to over 23,000 in less than five years
- 10 Wireless Charging**  
Here now for consumer electronics, with R&D pushing for EV uses
- 11 Materials Informatics**  
Using IT and AI to break out of slow material development cycles
- 12 IoT Security**  
Patents are up 13x as connected devices proliferate
- 13 Edge Computing**  
When milliseconds matter, analytics can be local, not in the cloud
- 14 Energy Distribution System Monitoring**  
Growing demand and renewables require tech to balance the grid
- 15 Polyethylene Furanoate (PEF)**  
Innovation has grown at an 87% annual rate to improve on PET
- 16 Sugar Reduction**  
Over 162,000 patents to combat health ills from too much sugar
- 17 Neural Interfaces**  
Tech to read and stimulate the brain will see growing validation in 2018
- 18 Syngas and Power-to-Gas**  
Producing fuels from CO<sub>2</sub> to drive the energy transition



# DATA + INSIGHT FOR PRIORITIZING TECHNOLOGIES

## Segment mature areas from emerging opportunities

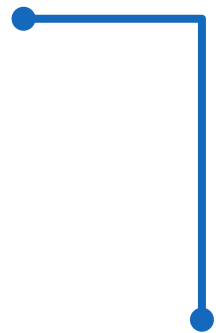


### Y-Axis: Innovation track record

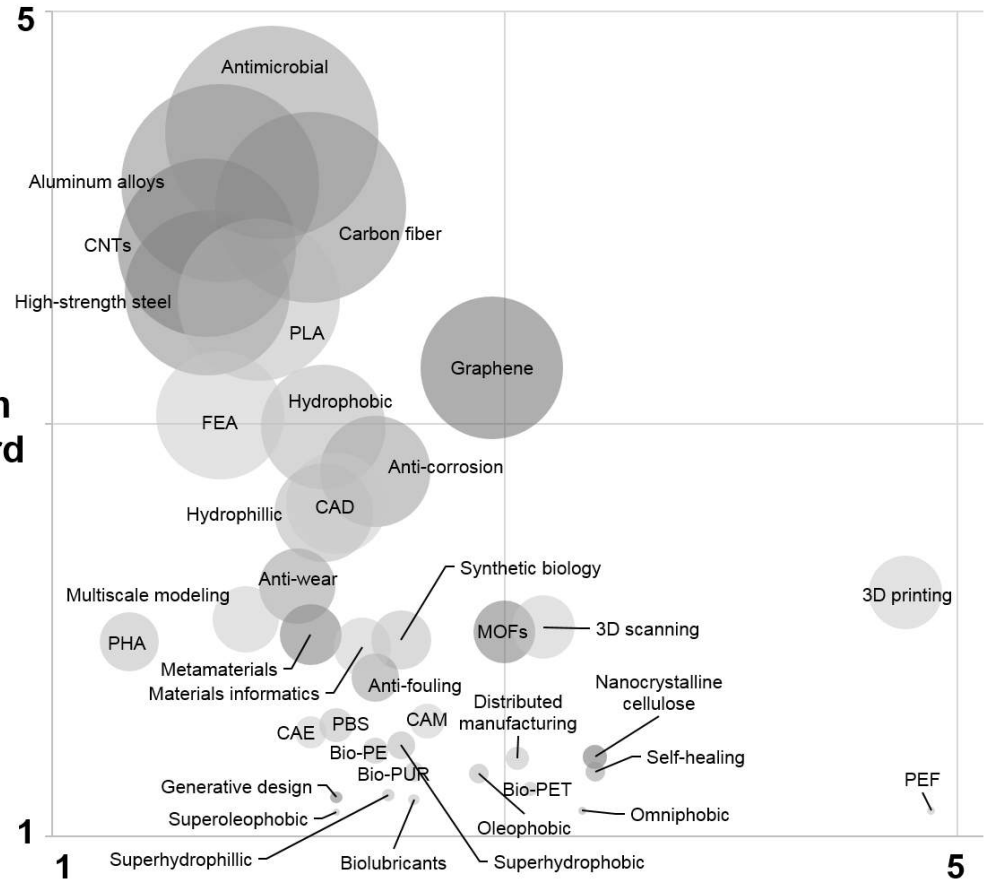
Cumulative number of papers and patents in the past 20 years.  
Determines dot size.

### X-Axis: Innovation interest today

What is receiving the most interest.  
Calculated based on rate of new patents, papers, and funding.



Innovation track record

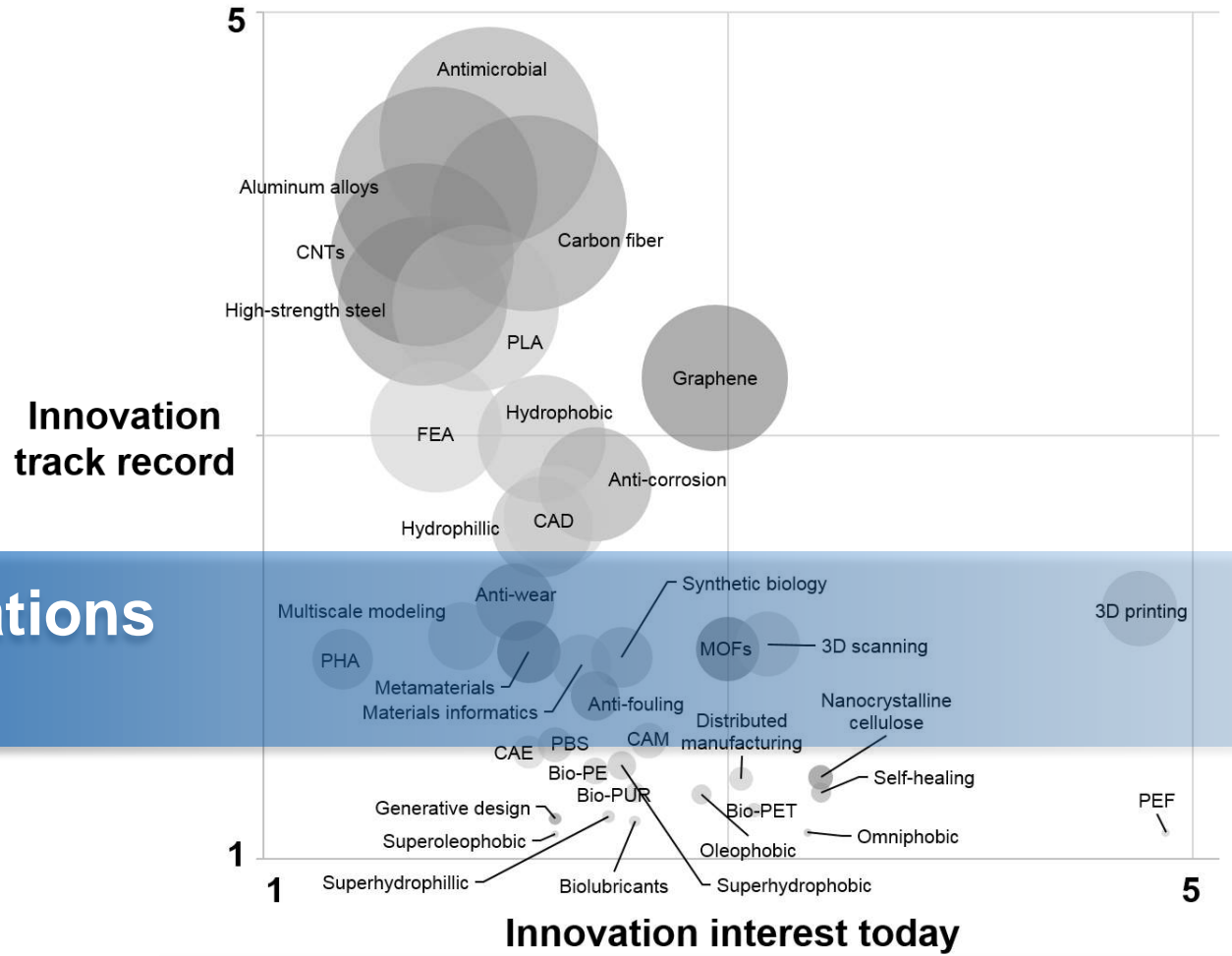
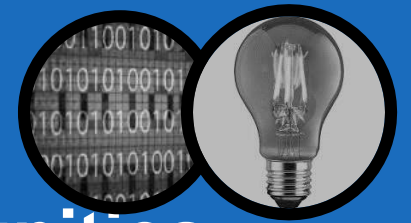


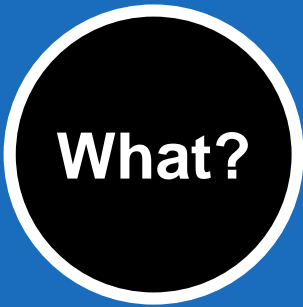
Innovation interest today



# DATA + INSIGHT FOR PRIORITIZING TECHNOLOGIES

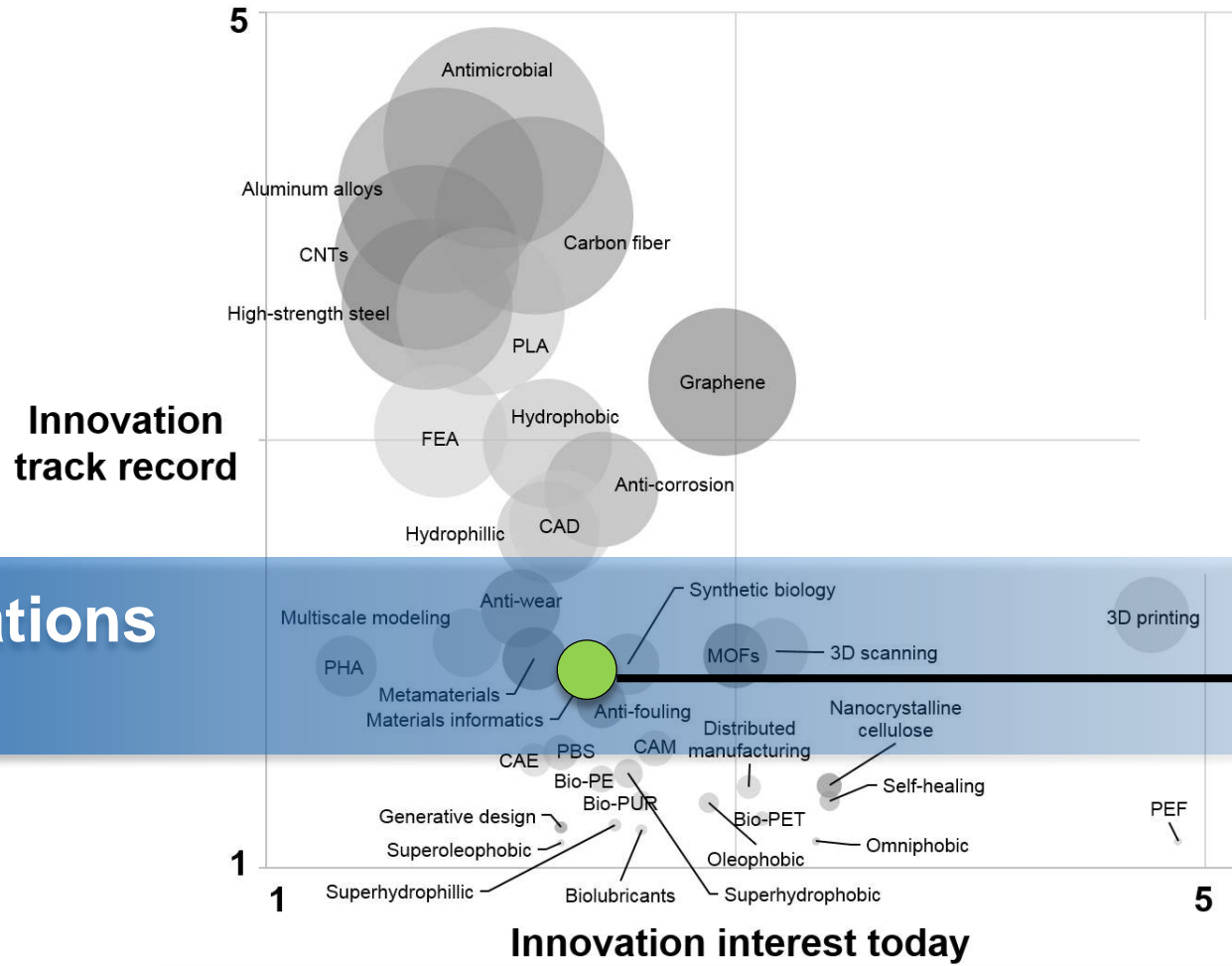
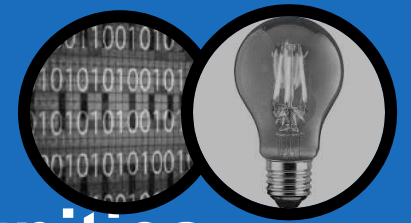
## Segment mature areas from emerging opportunities





# DATA + INSIGHT FOR PRIORITIZING TECHNOLOGIES

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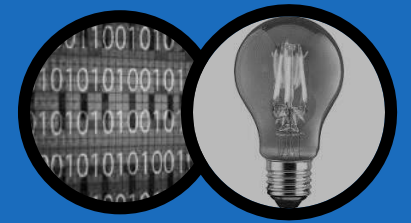






# DATA + INSIGHT FOR PRIORITIZING TECHNOLOGIES

## Materials Informatics



### DESCRIPTION

Use of data science and artificial intelligence methods to:

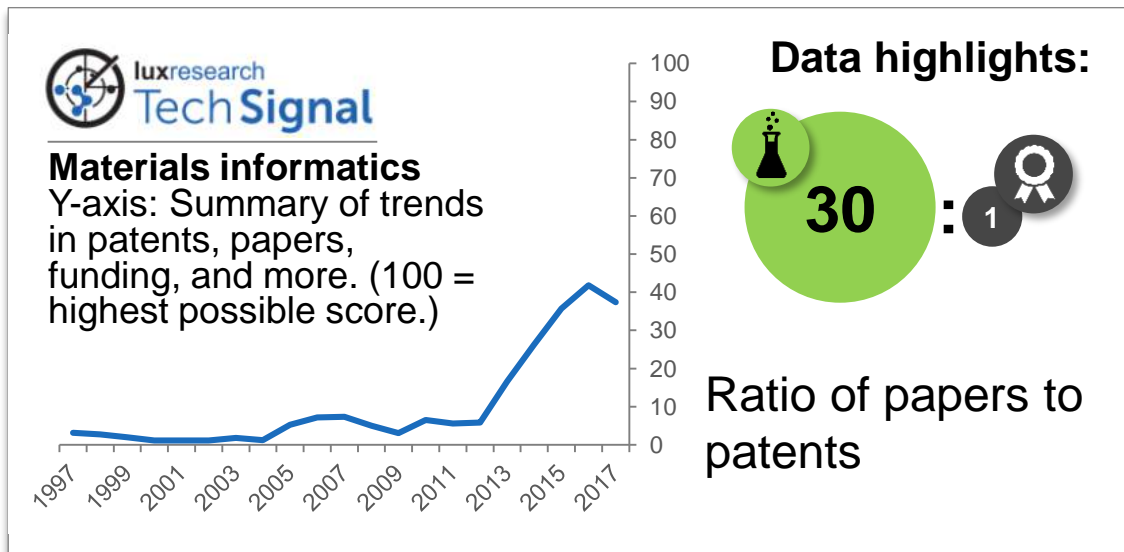
- extract insights from existing materials
- discover new materials matching desired property requirements

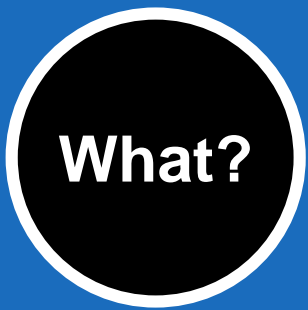
### KEY BENEFITS

Accelerates materials and chemicals research and product development timelines

Extracts additional value from existing experimental and computational data, leveraging past R&D spending

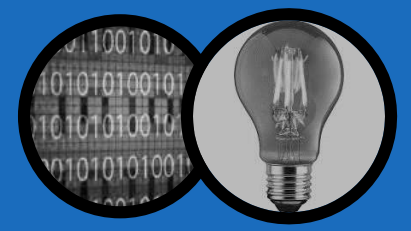
Optimizes experimental designs to attain the most valuable data per experiment





# DATA + INSIGHT FOR PRIORITIZING TECHNOLOGIES

## Materials Informatics



### LUX TAKE BY APPLICATION READINESS FOR MATERIALS INFORMATICS

Application	Data Availability	Experimental Data Cleanliness	Maturity for Machine Learning	Average	Lux Take
Small Molecules	4.7	4.7	4.7	4.7	Strong Positive
Alloys	3.3	3.9	4.5	3.9	Positive
Semiconductors	3.3	3.6	3.6	3.5	Positive
Polymers	2.4	2.9	4.0	3.1	Positive
Pharmaceuticals	3.0	3.0	3.0	3.0	Caution
Glass	2.6	3.0	3.1	2.9	Wait and See
Additive Manufacturing	2.0	2.2	3.8	2.7	Wait and See
Batteries	2.4	2.1	3.1	2.5	Caution
Heterogeneous Catalysis	2.3	1.9	2.1	2.1	Caution

Horizontal Solutions				
<b>Analytics</b> augur <b>BLOCKCHAIN INTELLIGENCE GROUP</b> CHAINALYSIS Skry	<b>Contracts</b> Counterparty ZEPPELIN <b>ETHERPARTY</b> RSK	<b>Sharing</b> slock.it La'Zooz BACKFEED S	<b>Dev Tools</b> blockstack <b>BLOCKFPPS</b> openchain FACTOM	<b>Identity</b> ShoCa KYC-CHA <b>SIGNICA</b> UNIQUID
Dominant Core Infrastructure Enablers		Enterprise Contributors		
<b>bitcoin</b> HYPERLEDGER ETHEREUM	Broadridge vmware CISCO	THE LINUX FOUNDATION pwc SAMSUNG Deloitte HITACHI	NTT DATA WELLS FARGO intel BNP PARIBAS JPMorganChase NE	intel BNY MELLON
Vertical Solutions				
<b>Finance</b> SETL.io	<b>Energy</b> LO3 ENERGY	<b>Supply Chain</b> CHRONICLED PROVENANCE	<b>IoT</b> oleo	



**Who?**



Who?

TRADITIONAL FORESIGHT

Few are immune to hype

2015

MIT  
Technology  
Review



magic  
leap

**10 Breakthrough  
Technologies**



Who?

TRADITIONAL FORESIGHT

Few are immune to hype

2015

MIT  
Technology  
Review



magic  
leap

# 10 Breakthrough Technologies

2017

luxresearch



magic  
leap

## Magic Leap's Mixed Reality

Magic Leap is a mixed reality company currently valued at \$6 billion that has raised \$1.5 billion in funding with no product to show. Rumors of wondrous technical feats followed by massive

Since then, the shiny veneer of this unicorn has started to crack, and its technology claims appear to be highly exaggerated.

and its technology claims appear to be highly exaggerated. In this report, we examine the company's history and patent portfolio to understand Magic Leap's mix of hype and reality.

Who?

TRADITIONAL FORESIGHT

Few are immune to hype

2015

**Inc.**

theranos

**How Elizabeth Holmes Became America's New Entrepreneurial Icon**

Who?

TRADITIONAL FORESIGHT

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**Inc.**

theranos

**How Elizabeth Holmes Became America's New Entrepreneurial Icon**

2018

*The Washington Post*

theranos

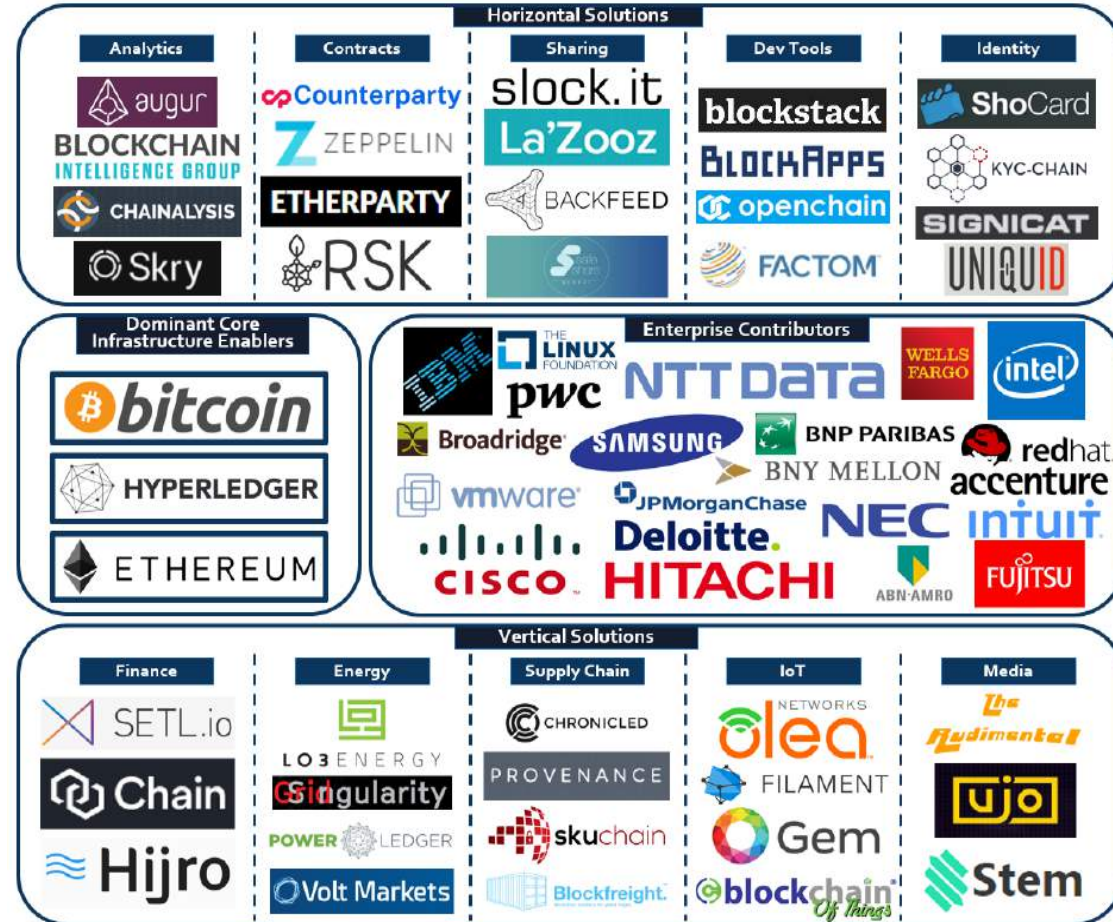
**Theranos chief executive Elizabeth Holmes charged with massive fraud**



AUTOMATED DATA

# Cherry-picking logos gets you only part of the way

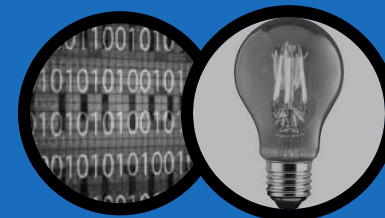
Example:  
**LUX BLOCKCHAIN LANDSCAPE  
2016**





# Who?

## DATA + INSIGHT FOR WHO TO WORK WITH Key player analysis (for Deep Learning)



### Use data

Patents, investment, academic publications – to surface leading players

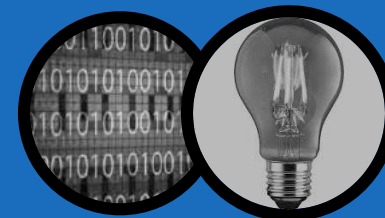
### Using data science, segment into:

- 1) large players
- 2) start-ups
- 3) research centers

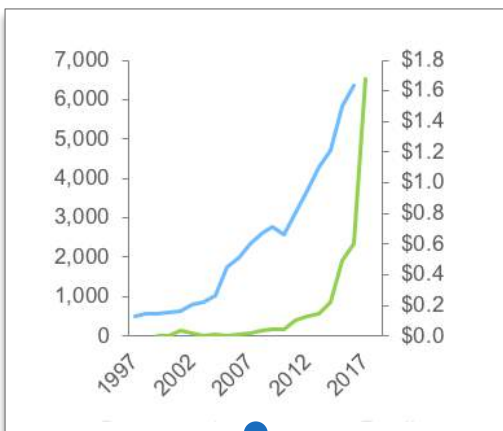
 <b>Lux Take: Strong Positive →</b>	 <b>Lux Take: Positive →</b>	 <b>Lux Take: Positive →</b>	 <b>Lux Take: Positive →</b>
 <b>Lux Take: Positive →</b>	 <b>Lux Take: Wait and See →</b>	 <b>Lux Take: Wait and See →</b>	 <b>Lux Take: Wait and See →</b>

# Who?

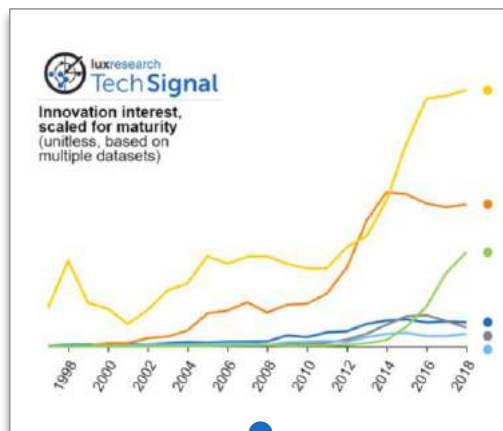
## DATA + INSIGHT FOR WHO TO WORK WITH Bolster the data with Insight



### PATENTS, PAPERS, FUNDING DATA



### LUX TECH SIGNAL LEADING INDICATOR



### NEWS & CURRENT EVENTS

SoftBank

**Softbank led a 2017 \$159 million Series B investment in Nauto**

### LUX ANALYST EXPERTISE



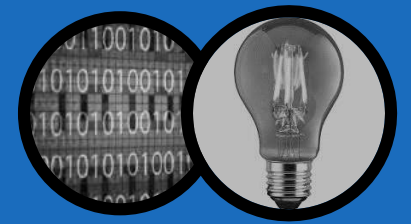
COMPANY PROFILE

# Nauto

Connected hardware for vehicle fleet management

Who?

# DATA + INSIGHT FOR WHO TO WORK WITH Bolster the data with Insight



## Nauto Company Profile Summary

Connected hardware for vehicle fleet management

### TECHNOLOGY AND DIFFERENTIATORS:

- Develops deep learning enabled retrofit dashboard camera system for occupant and environmental monitoring purposes
- Provides fleet managers with reports on individual driver performance as well as scenarios that could affect the entire fleet

### STRATEGY AND MARKETS:

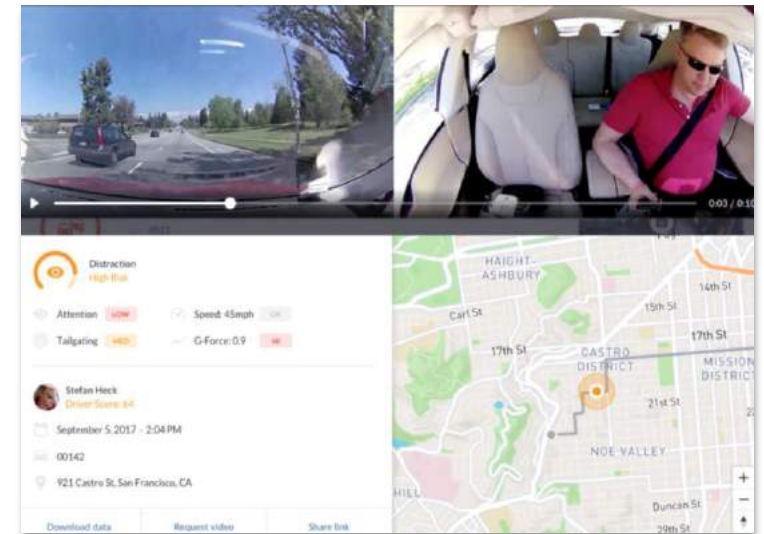
- Sells its cameras at an initial price of \$399 and then offers a SaaS model to access Nauto's cloud processing and reporting services

### LUX TAKE:

- *Positive* – Pursuing a cloud platform that would focus on autonomous vehicles, instead of connected car services; **Unique solution leverages deep learning for insight in and out of the car**

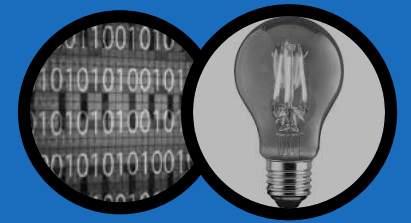
Lux Take

*Positive*

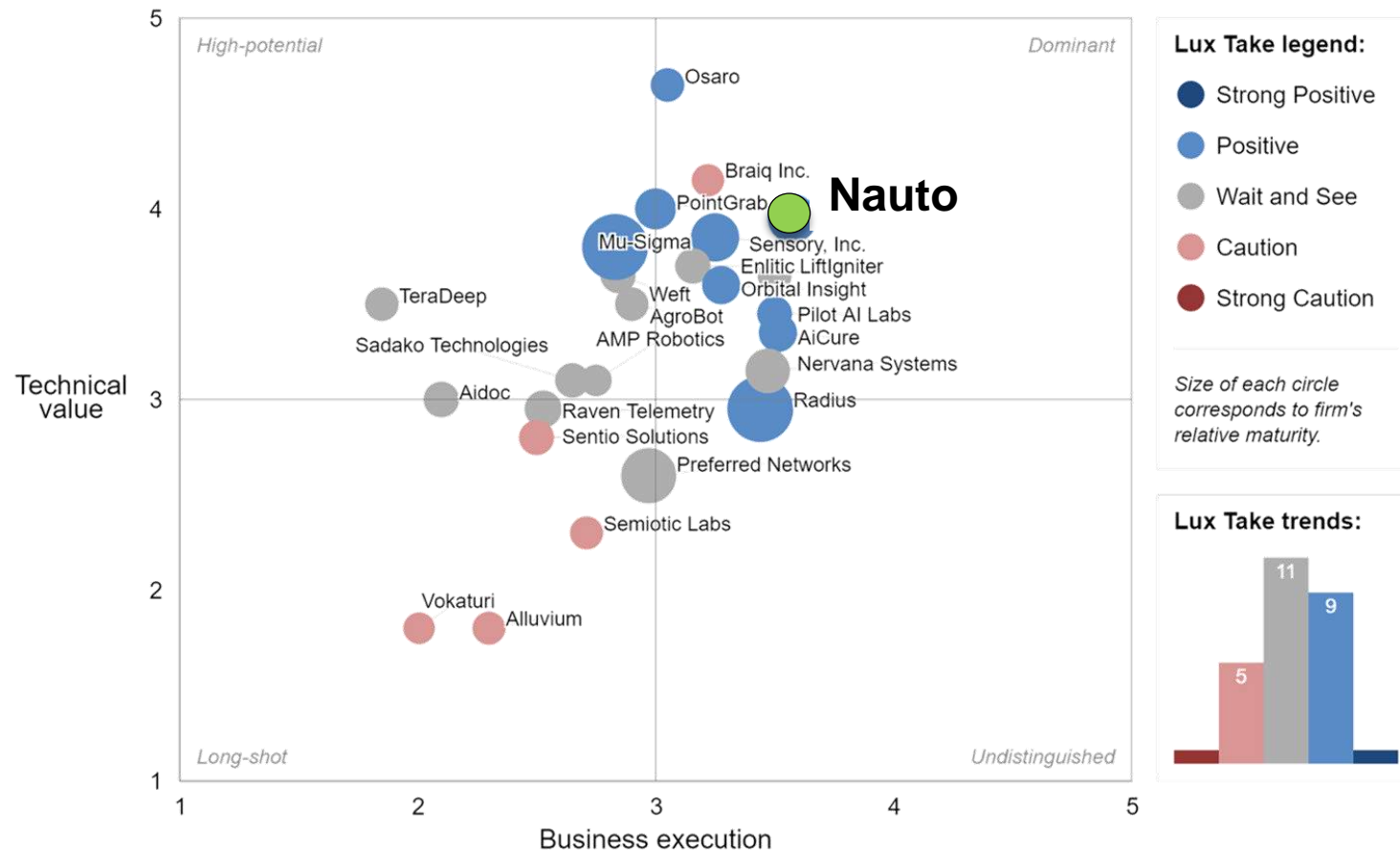




# DATA + INSIGHT FOR WHO TO WORK WITH Bolster the data with Insight



## Lux Innovation Grid (LIG) for Deep Learning





**When?**



# EVs vs. Fuel Cells



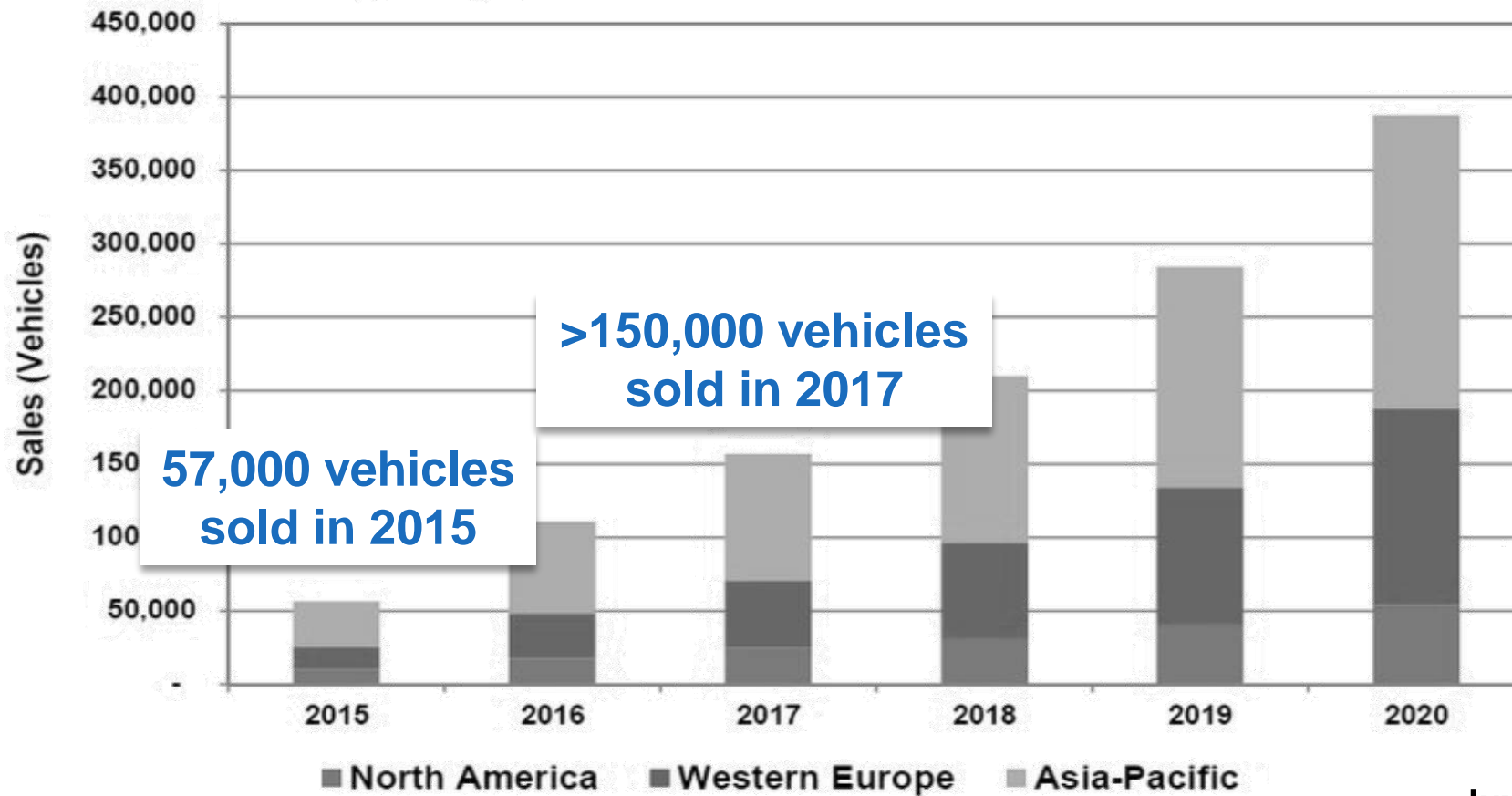


When?

TRADITIONAL FORESIGHT

# Fuel cell vehicle adoption – what they said in 2011

## 2011 Forecast



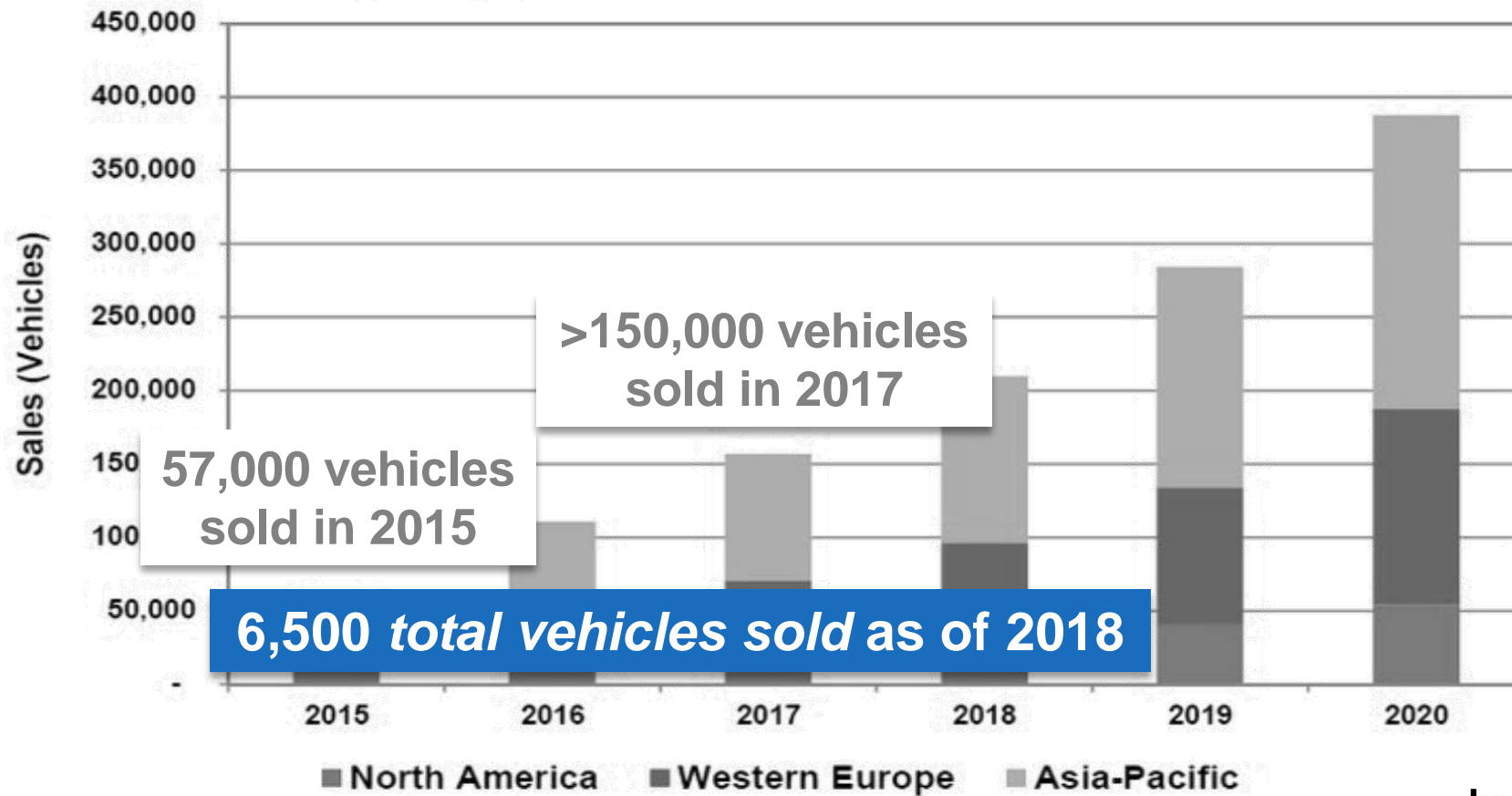


When?

TRADITIONAL FORESIGHT

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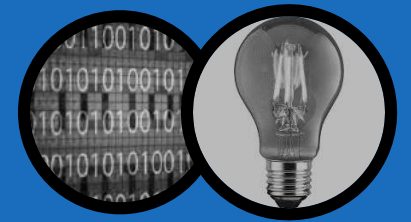




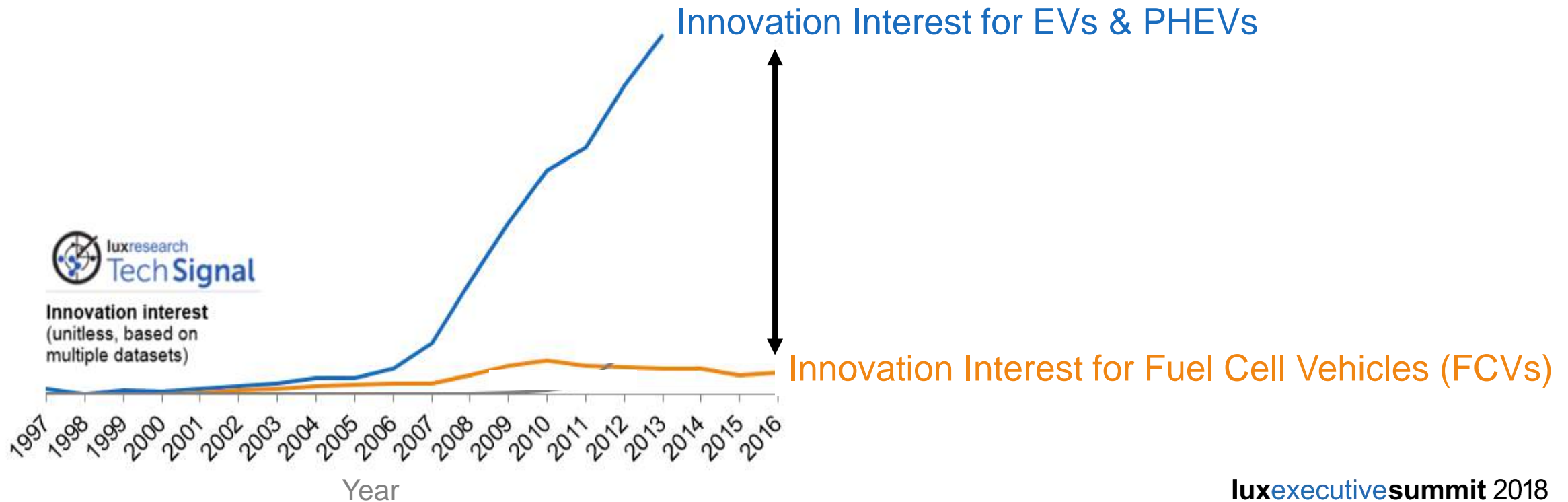


# DATA + INSIGHT FOR WHEN TO ACT

## The value of leading indicators



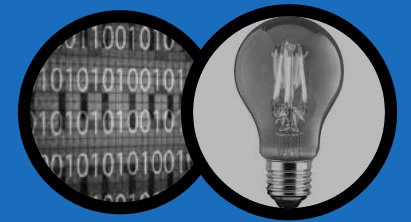
### How Lux Tech Signal anticipated the rise of plug-in vehicles and failure of fuel cell vehicles





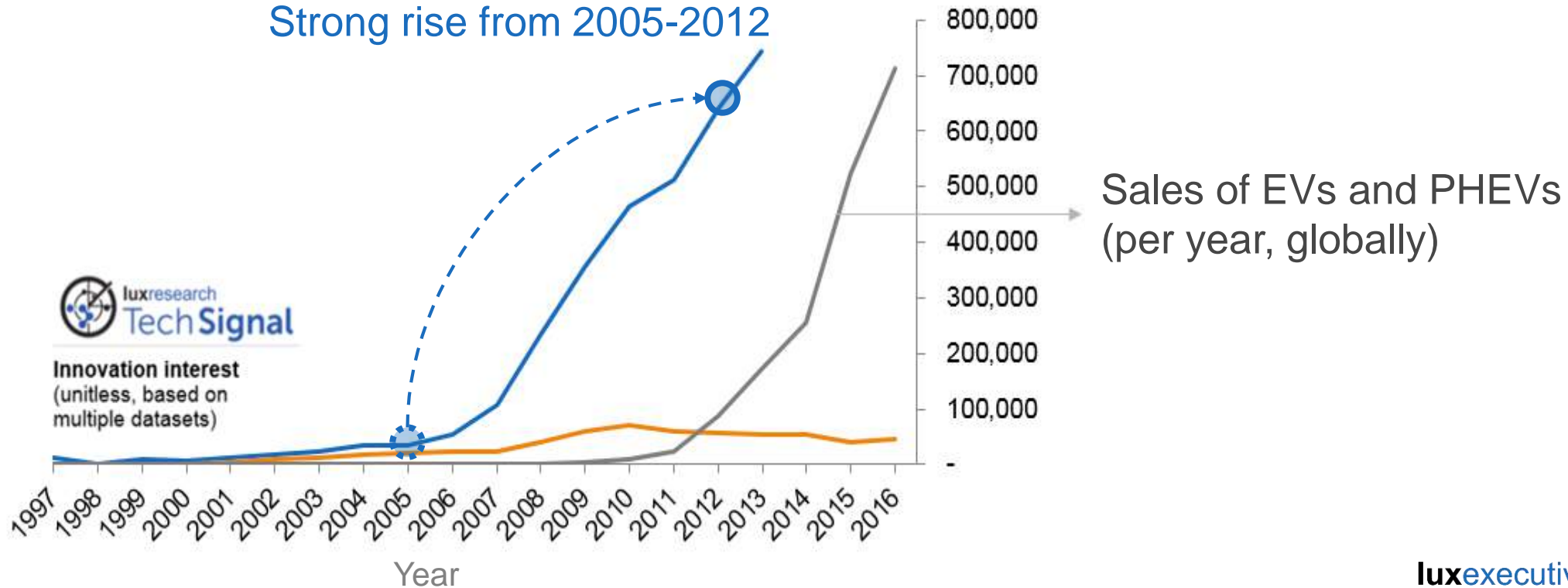
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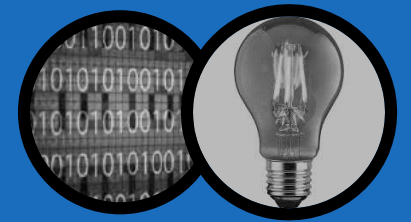
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Innovation Interest for EVs & PHEVs  
Strong rise from 2005-2012



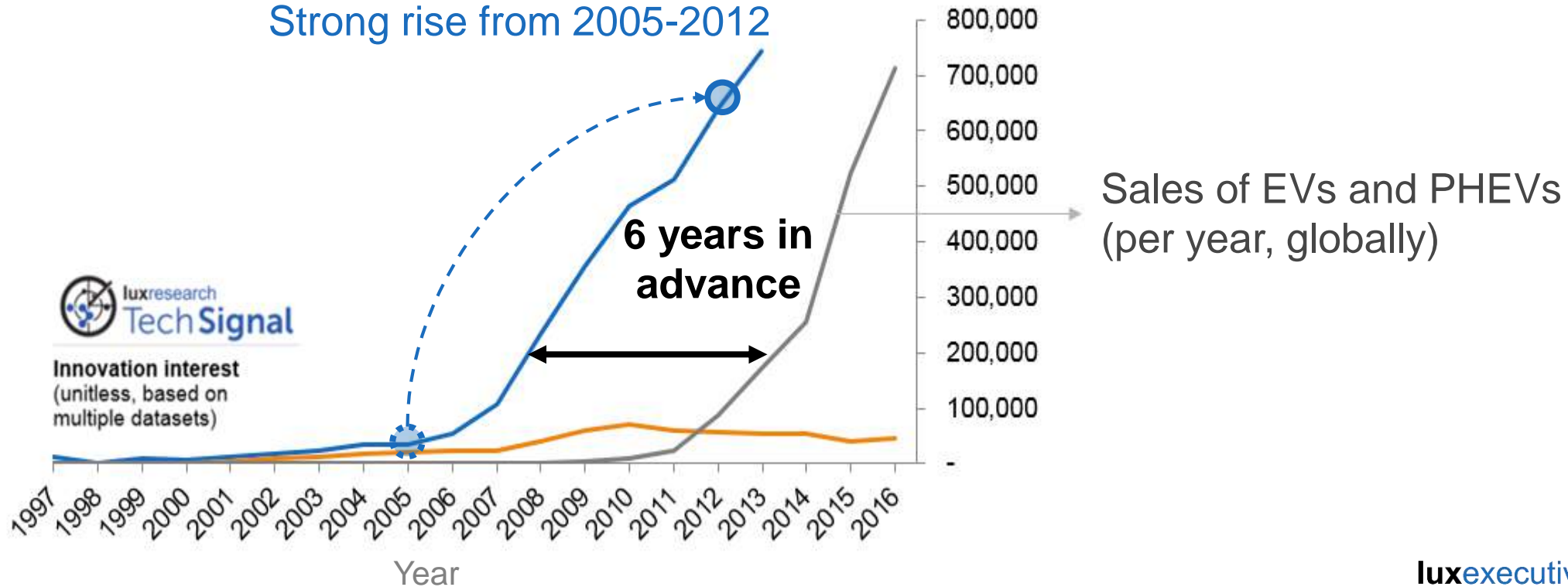


# DATA + INSIGHT FOR WHEN TO ACT The value of leading indicators



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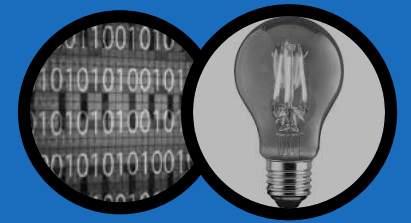
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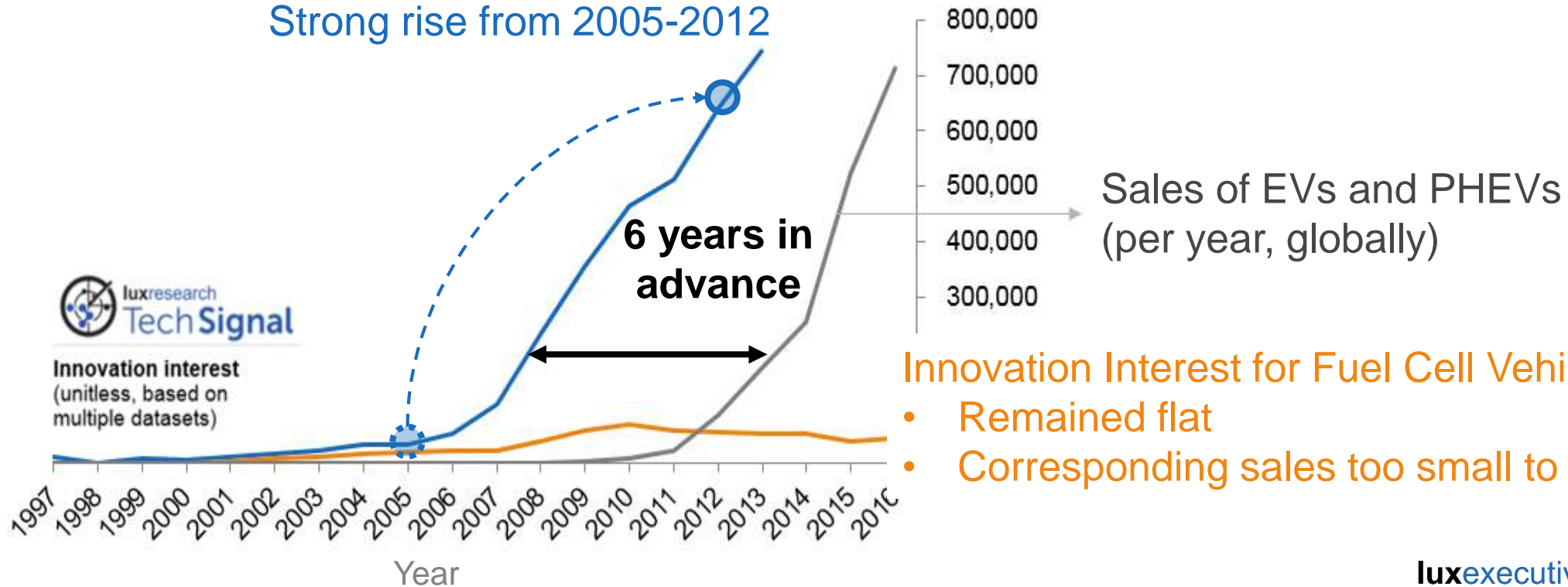
# DATA + INSIGHT FOR WHEN TO ACT

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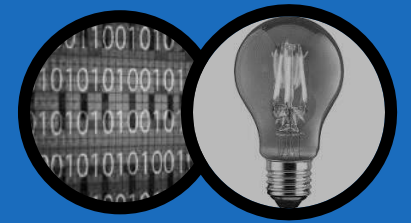
Innovation Interest for Fuel Cell Vehicles (FCVs)

- Remained flat
- Corresponding sales too small to register

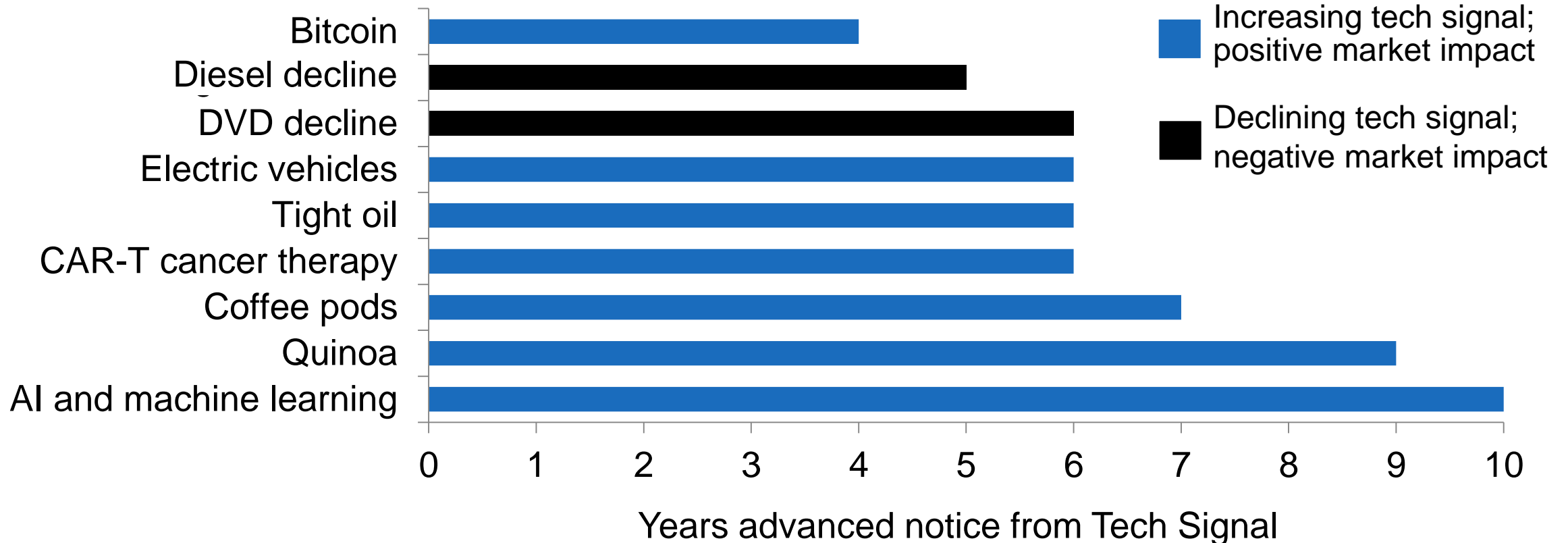


DATA + INSIGHT FOR WHEN TO ACT

# The Lux Tech Signal as a leading indicator



## Years advanced notice of technology market impact from Tech Signal



# The microbiome

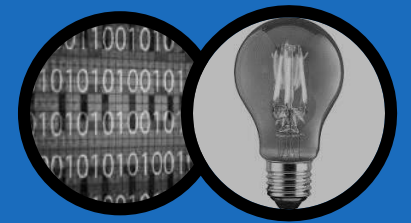


**Impacts of microbes in different environments to aid development of ingredients, therapeutics, and diagnostics**



DATA + INSIGHT

# What technologies should you prioritize?



## 18 for 2018

Executive Summary: Top technologies Lux is following in 2018, using data from the Lux Intelligence Engine and analysts' insight

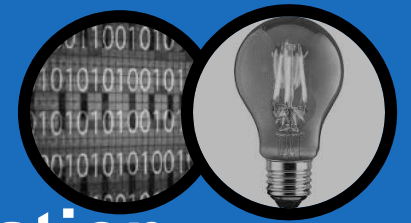
A ranking of the most important technologies to watch, given their potential to transform the world in the next decade

- 1 Machine Learning and Deep Neural Networks**  
30% annual increase in machine learning patents
- 2 3D Printing and Additive Manufacturing**  
Lux expects 3D printing to be a \$20 billion market by 2025
- 3 Genome Editing**  
\$1.2 billion in VC funding to impact industries from food to health care
- 4 5G Networks**  
Over 70,000 patents set the stage for 5G network launches in 2018
- 5 Microbiome**  
Harnessing the power of microbes for nutrition, agriculture, and more
- 6 Solid-state Batteries**  
Safer and better batteries, pursued by start-ups and giants like Toyota
- 7 Synthetic Biology**  
A recent \$275 million round for Ginkgo Bioworks highlights the potential
- 8 Augmented Reality (AR)**  
Enterprise applications are coming now, on heels of \$4.4 billion in funding
- 9 Smartwatches**  
Patents soar from near zero to over 23,000 in less than five years
- 10 Wireless Charging**  
Here now for consumer electronics, with R&D pushing for EV uses
- 11 Materials Informatics**  
Using IT and AI to break out of slow material development cycles
- 12 IoT Security**  
Patents are up 13x as connected devices proliferate
- 13 Edge Computing**  
When milliseconds matter, analytics can be local, not in the cloud
- 14 Energy Distribution System Monitoring**  
Growing demand and renewables require tech to balance the grid
- 15 Polyethylene Furanoate (PEF)**  
Innovation has grown at an 87% annual rate to improve on PET
- 16 Sugar Reduction**  
Over 162,000 patents to combat health ills from too much sugar
- 17 Neural Interfaces**  
Tech to read and stimulate the brain will see growing validation in 2018
- 18 Syngas and Power-to-Gas**  
Producing fuels from CO<sub>2</sub> to drive the energy transition

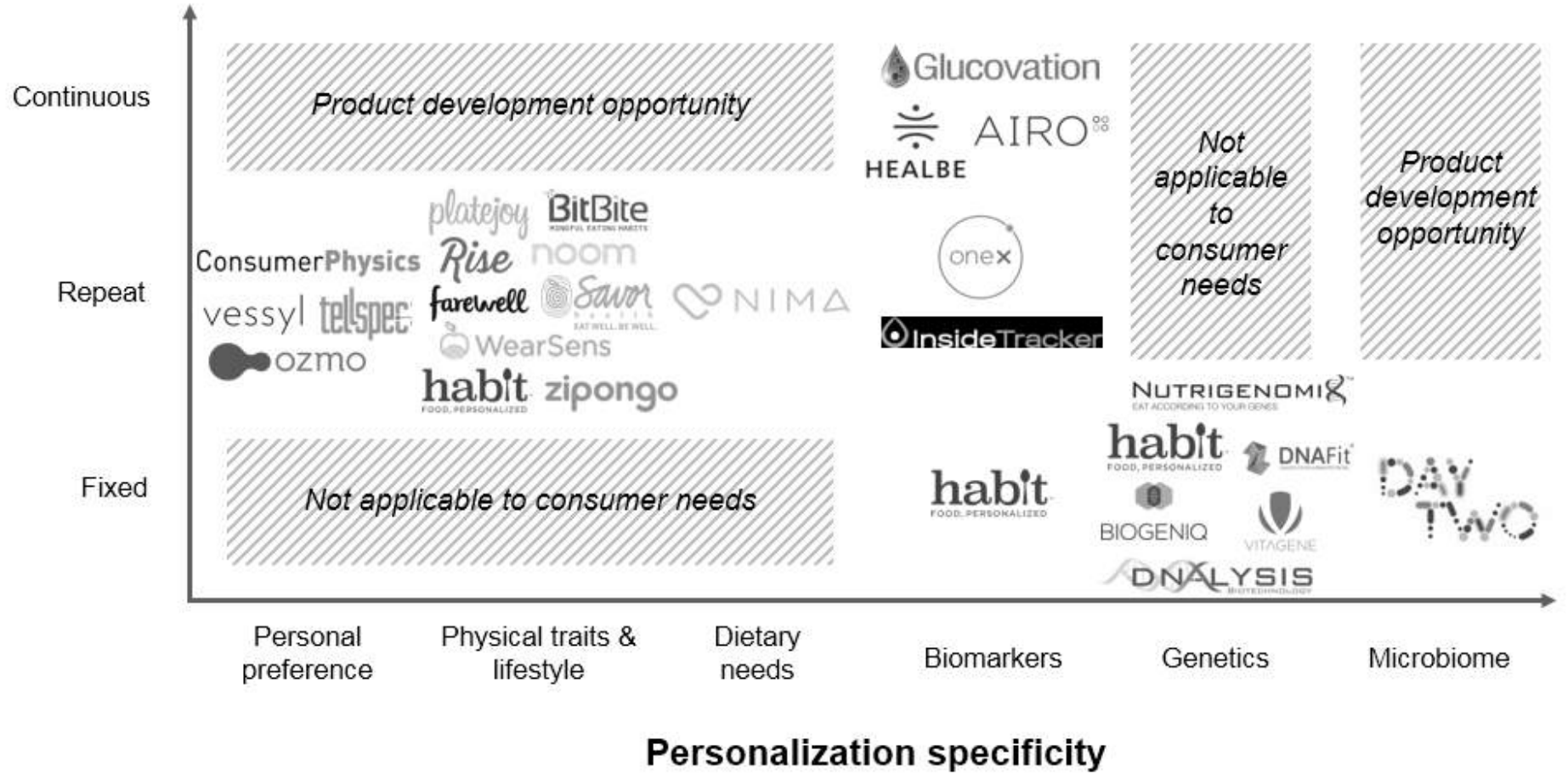
# What?

DATA + INSIGHT

The microbiome is the holy grail of personalization



Frequency of recommendations

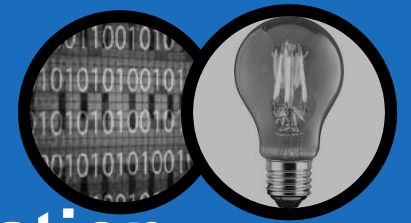




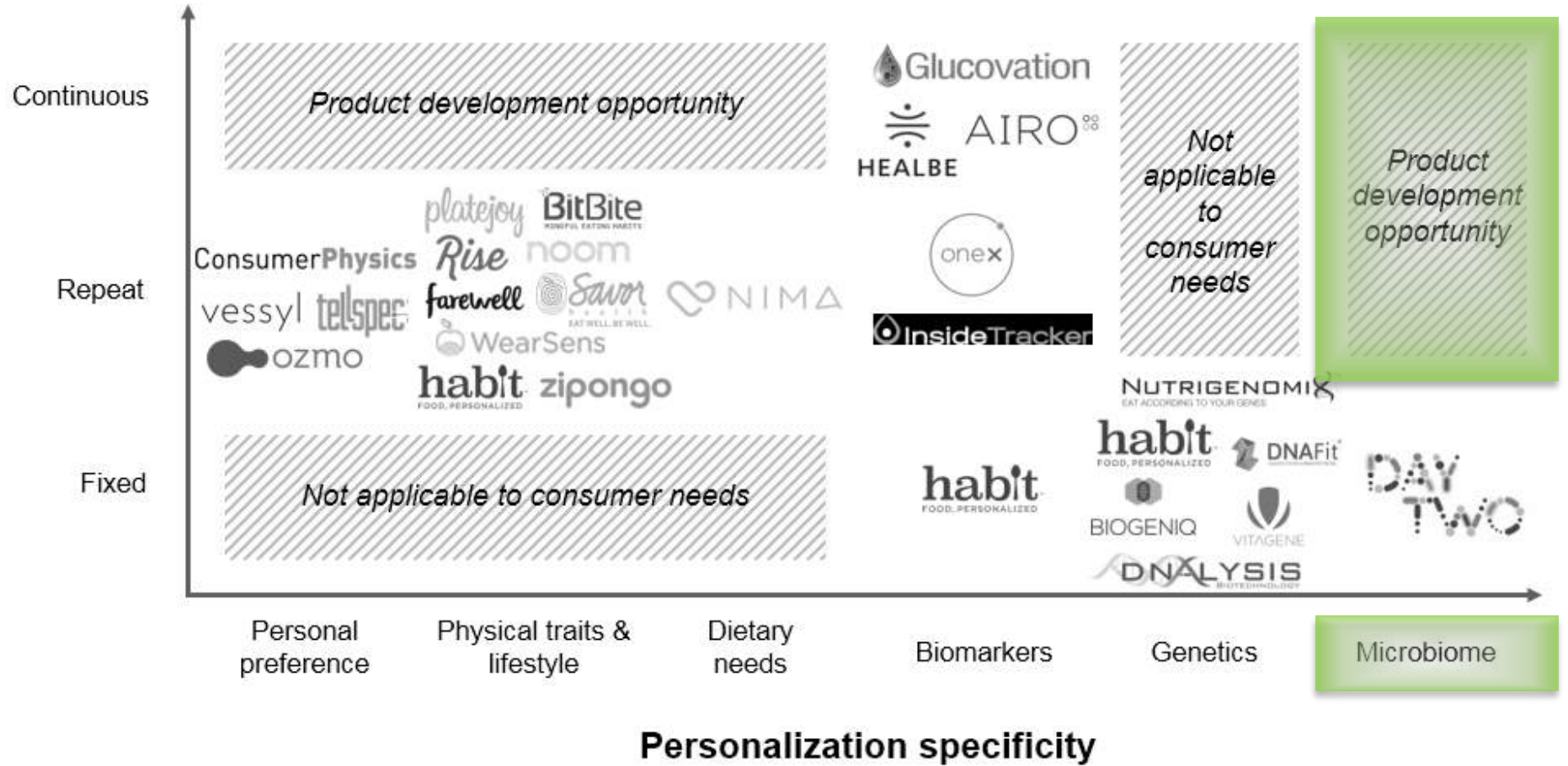
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DATA + INSIGHT

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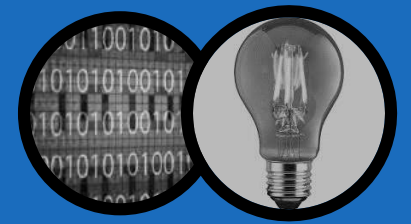
Frequency of recommendations



Who?

DATA + INSIGHT

# Development of ingestible sensors capable of measuring gases in the gut



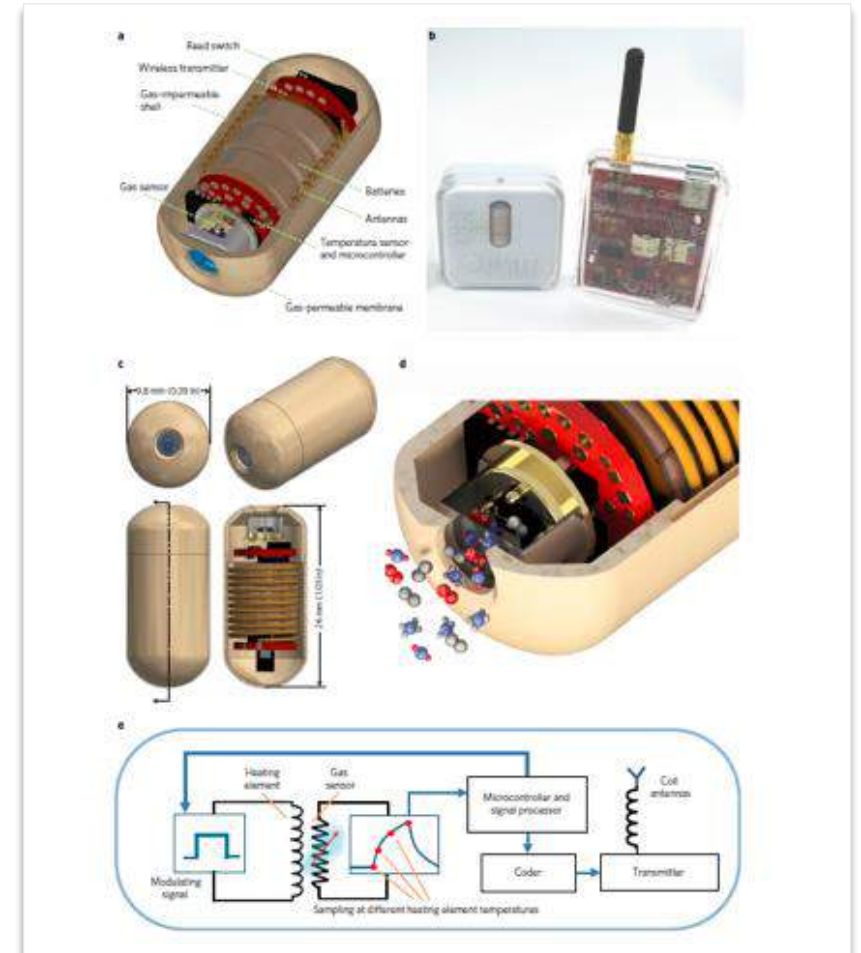
RMIT is **developing an ingestible sensor to measure gases (oxygen, hydrogen, carbon dioxide) in the gut and recently conducted a human pilot trial**

Version 2: add hydrogen sulfide sensing

Version 3: add short-chain fatty acids

Looks to include analytics to convert raw data to actionable insight.

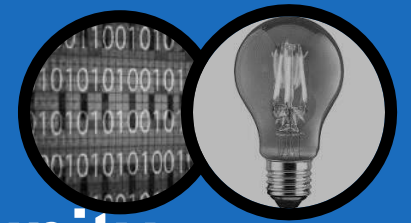
Unique in providing localized, high frequency measurements of the microbiome.





DATA + INSIGHT

# Ingestible gas sensor plays into a previously-open product development opportunity

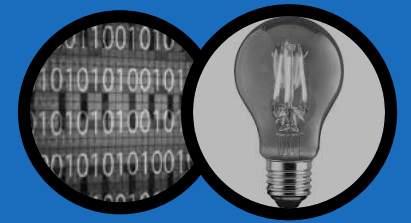


Frequency of recommendations

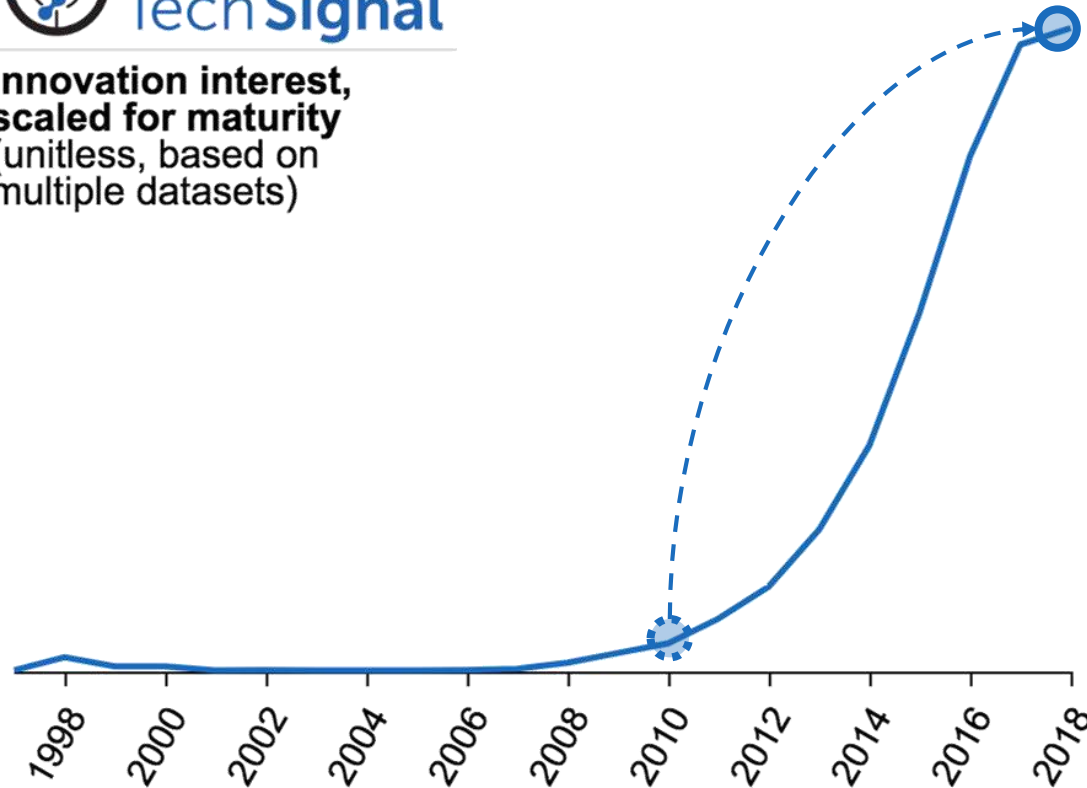


# When?

## DATA + INSIGHT FOR WHEN TO ACT Microbiome innovation is rising fast



**Innovation interest, scaled for maturity**  
(unitless, based on multiple datasets)

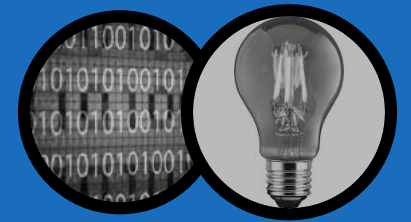


Microbiome innovation interest

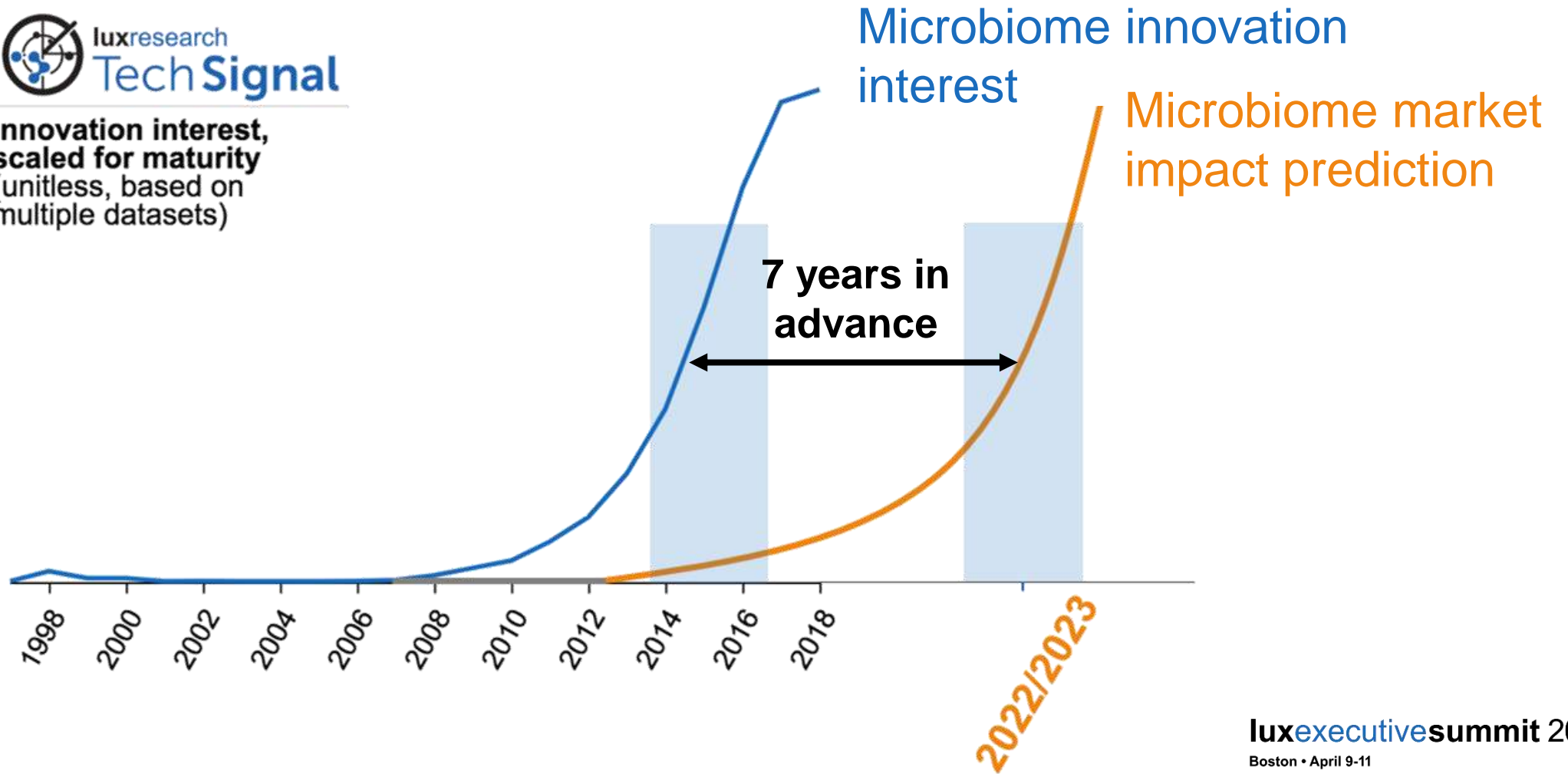
# When?

DATA + INSIGHT FOR WHEN TO ACT

## Making a call – predicting market impact



Innovation interest, scaled for maturity (unitless, based on multiple datasets)

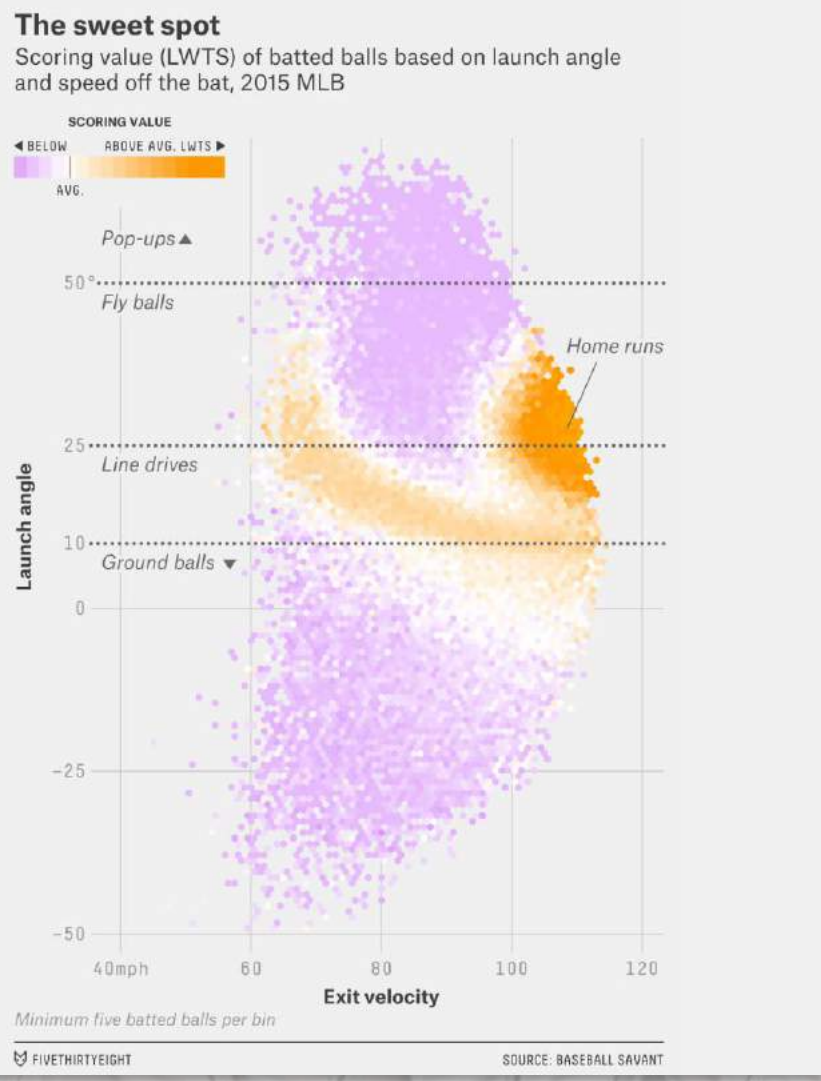


# Agenda

- 1 | The Stagnation of the Innovation Process
- 2 | Data + Insight to get at What, Who, and When
- 3 | Evolving for better results

# 2017 WORLD SERIES CHAMPIONS HO





Year	Team	League	Wins	Losses	%
2017	Houston Astros	American League	101	61	.623
2016	Houston Astros	American League	84	78	.519
2015	Houston Astros	American League	86	76	.531
2014	Houston Astros	American League	70	92	.432
2013	Houston Astros	American League	51	111	.315
2012	Houston Astros	National League	55	107	.340



...A few years of struggle could lead to many years of success.





# Solution



+



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Coming soon...

**Tech Pages**

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# Tech Pages

Analyst-curated Lux Take on key technology innovations, paired with ongoing updates from multiple data sources

**luxresearch** COMPANIES TECH MARKETS CHARTS NEWS

Saved Searches Ask An Analyst Hi, Pete

Follow Technology Download a PDF

## Deep Learning

Advanced machine learning techniques making use of neural networks, for much improved computer vision, speech recognition, filtering, and more.

**LUX TAKE**  
One of the most important technologies for the future of artificial intelligence. For details on our take, [click here](#) to read more.

**Last Updated:** October 6, 2017  
**Content Programs:** Digital Transformation  
**Key Coverage Areas:** Industrial Big Data and Analytics  
Industrial Internet of Things  
Digital Health and Wellness

## What's New in Deep Learning

During the past four weeks, Lux Research analysts and the Lux Intelligence Engine have added the following about recent Deep Learning developments.

3 News Commentaries	54 New Patents	31 New Academic Papers	2 New Investment Rounds
<p>Google's Deep Mind branch opens up Montreal outpost to tap local talent</p> <p>A path forward for AI to evolve deep learning's next steps</p> <p><a href="#">View All</a></p>	<p><b>Siemens Healthcare:</b> Method and system for cross-domain synthesis of medical images using contextual deep network</p> <p><a href="#">View All</a></p>	<p><b>Microsoft:</b> Face alignment with deep regression</p> <p><a href="#">View All</a></p>	<p><b>Paige.AI</b> has raised a \$25 million Series A</p> <p><b>DeepBlue Technology</b> has raised a \$16 million Series A</p> <p><a href="#">View All</a></p>

# Tech Pages

Analyst-curated Lux Take on key technology innovations, paired with ongoing updates from multiple data sources

The screenshot shows a Lux Research article page. At the top, there is a navigation bar with the Lux Research logo, a search bar, and links for 'COMPANIES', 'TECH', 'MARKETS', 'CHARTS', and 'NEWS'. On the right side of the navigation bar, there are links for 'Saved Searches', 'Ask An Analyst', and 'Hi, Pete'. Below the navigation bar, there are two buttons: 'Follow Technology' and 'Download a PDF'. The main content area features the article title 'Deep Learning' in a large font. Below the title is a short introductory paragraph: 'Advanced machine learning techniques making use of neural networks, for much improved computer vision, speech recognition, filtering, and more.' To the right of this paragraph, there is a 'Last Updated' date of 'October 6, 2017', a 'Content Programs' list including 'Digital Transformation', and 'Key Coverage Areas' including 'Industrial Big Data and Analytics', 'Industrial Internet of Things', and 'Digital Health and Wellness'. Below the introductory paragraph is a 'LUX TAKE' section, which is a blue-bordered box containing a small icon and the text: 'One of the most important technologies for the future of artificial intelligence. For details on our take, click here to read more.' Below the 'LUX TAKE' box is a section titled 'What You Need to Know' with a horizontal line underneath. This section contains another 'LUX TAKE' box, which is a blue-bordered box with a small icon and the text: 'Deep learning will have a transformative effect on the future of AI, and on digital transformation as a whole. Clients should believe the hype, although keep expectations in check—the high talent requirements and ongoing need for R&D means deep learning will take a while to impact most applications.' Below this box are four sub-sections, each with a blue header: 'WHY DEEP LEARNING MATTERS' (text: 'It is rapid progress on applications that have traditionally stumped artificial intelligence (AI), including accurate image recognition, language processing, and other growing opportunities.'), 'HOW IT WORKS' (text: 'Analogously to the human brain, deep learning uses multiple layers of neuron-like computing units that together make up complex neural networks.'), 'KEY PLAYERS TO BE AWARE OF' (text: 'Software powerhouses Google and Microsoft are doing leading work and already productizing deep learning; electronics stakeholders, especially Samsung Electronics, IBM, and Qualcomm, are also active; within healthcare, Siemens is off to early start.'), and 'CHALLENGES TO OVERCOME' (text: 'Deep learning remains difficult to use by many, due to its complexity, lack of available talent, and opacity. Moreover, its use cases are still being refined and expanded.'). At the bottom right of the page, there is a footer with the text 'luxexecutivesummit 2018' and 'Boston • April 9-11'.

# Tech Pages

Understand the landscape of key players, start-ups, and academia...

## Key Player Analysis

Curated by Mark Bunger, VP of Research  
Questions? [Submit an inquiry.](#)  
Last updated on January 16, 2018



In this section, we analyze key players of different types, using our curated data science approach that analyzes patents, papers, investments, and more to identify the leaders in deep learning.

### LUX TAKE

As the likes of Google and Microsoft continue to build up strength in deep learning, start-ups offer an enticing way to catch up.

Developing successful products that make use of deep learning requires some very specific and rare skill sets, and not enough of these specialists exist in the world. With many of these working at the likes of Google and Microsoft, the war for talent is intensifying.

That problem makes start-ups especially attractive in this space, as they can offer a rapid—albeit expensive—way to catch up in the war for talent and IP. However, hype runs rampant even within deep learning, so extra due diligence is crucial.

LARGE PLAYERS		START-UPS		RESEARCH CENTERS	
✔ Data last updated two days ago					
	<a href="#">See Our Case Study</a>				

# Tech Pages

Understand the landscape of key players, start-ups, and academia...

...along with case studies on successful deployments

## Key Player Analysis

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## Case Studies: How Firms use Deep Learning

Curated by Shriram Ramanathan, Senior Analyst  
Questions? [Submit an inquiry.](#)  
Last updated on January 16, 2018



GE HEALTHCARE

GOOGLE

BASF

TOYOTA

### LUX TAKE

Clinical decision support using AI is already off to a strong start (see the report "The Future of Artificial Intelligence in Health"), and this bolsters GE's position there further. Solid partnerships between two leaders in the space make for a strong strategy for applied deep learning.



GE Healthcare

LUX CASE STUDIES: DEEP LEARNING IN HEALTHCARE APPLICATIONS

**GE Healthcare brings Nvidia's deep learning platform to imaging devices, aiming for faster scans and lower radiation doses**

#### INTRODUCTION

GE and Nvidia have worked together on healthcare for years, and this latest radiology-focused announcement focuses on Nvidia's offerings around deep learning and edge computing.

#### WHAT THE TECHNOLOGY IS USED FOR

Deep learning is particularly well-suited for image analysis, and GE aims to improve image quality, speed up scan times, and lower radiation dosage. Some 500,000 existing GE Healthcare imaging devices will benefit from Nvidia's AL platform, and GE plans to develop future products using the technology.



## Tech Pages

Track trends and updates in key innovation areas like patents, academic papers,

### LUX TAKE

**IP opportunities remain for application-specific work. Convolutional neural networks are of high interest within deep learning, and nearly all leaders are actively pursuing it.**

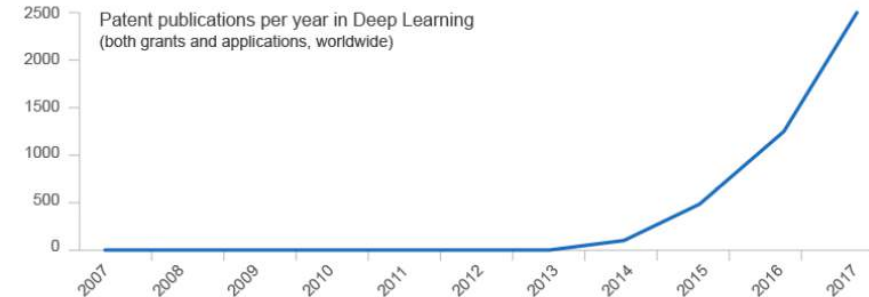
The patent landscape shows how extremely nascent deep learning is—activity was practically zero even just 10 years ago. Since then, software and hardware developers have jumped in, but plenty of room remains for more specialized developers, especially in the application side. For example, Ford Motor is beginning to shore up IP here, but few other OEMs are.

While some like Google and Samsung electronics have investigated both convolutional neural networks and recurrent neural networks for deep learning, most are focusing their attention on the former. Qualcomm in particular is betting heavily on it. The other

### OVERALL TRENDS

FIG. Data last updated two days ago

Patent publications in Deep Learning have been growing at a rapid pace since 2013—with a CAGR of 139% during the past five years—reaching more than 2,000 per year.



# Tech Pages

Track trends and updates in key innovation areas like patents, academic papers, and venture capital investment

## Patent Analysis



### LUX TAKE

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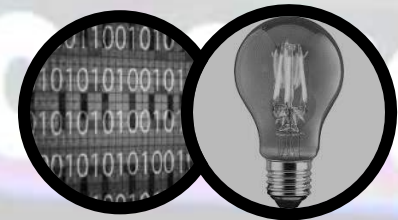
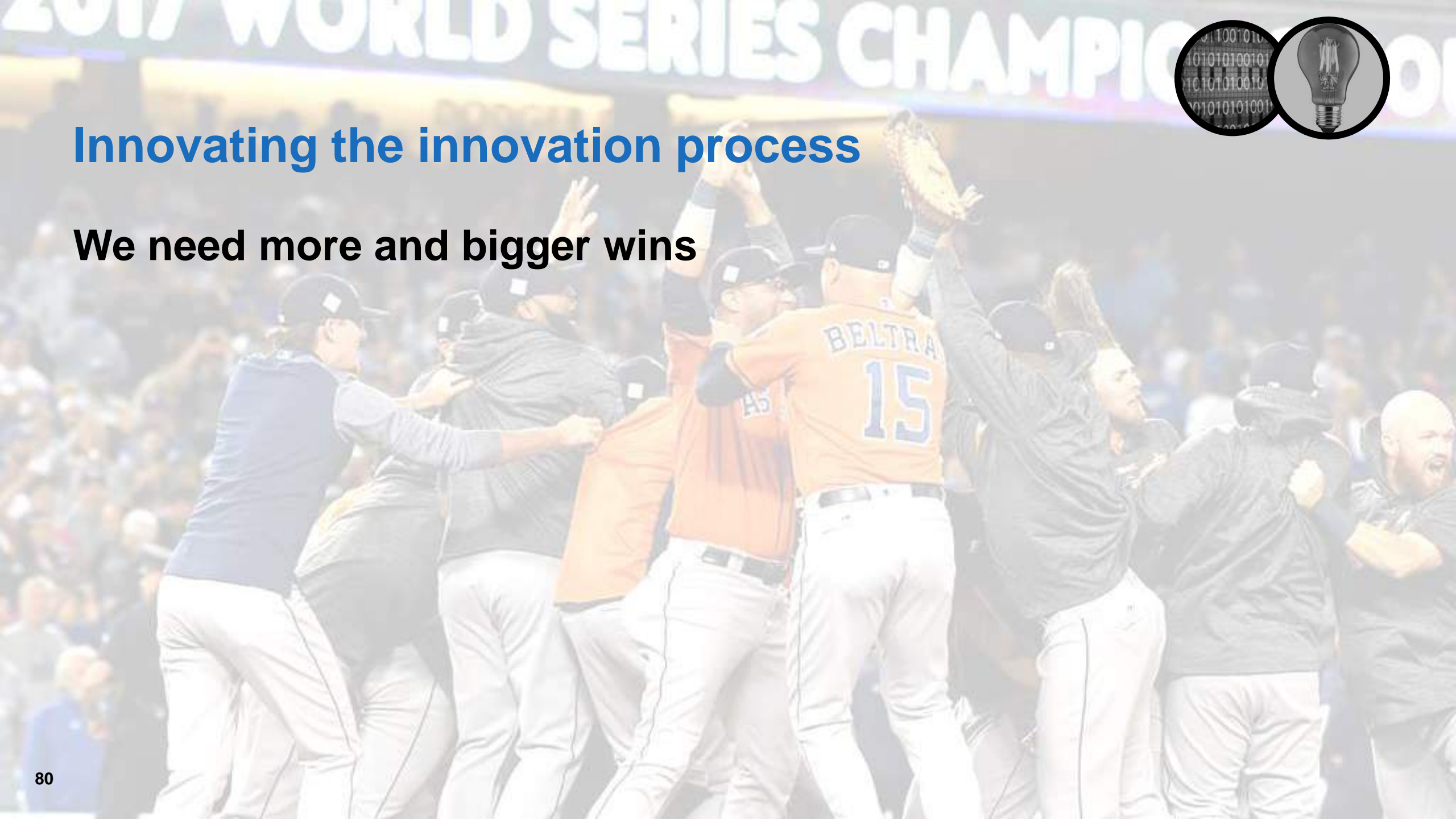
FIG. Data last updated two days ago

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2500

### HIGHLIGHTED RECENT INVESTMENTS

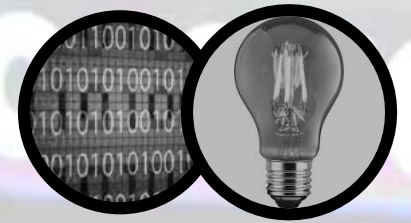
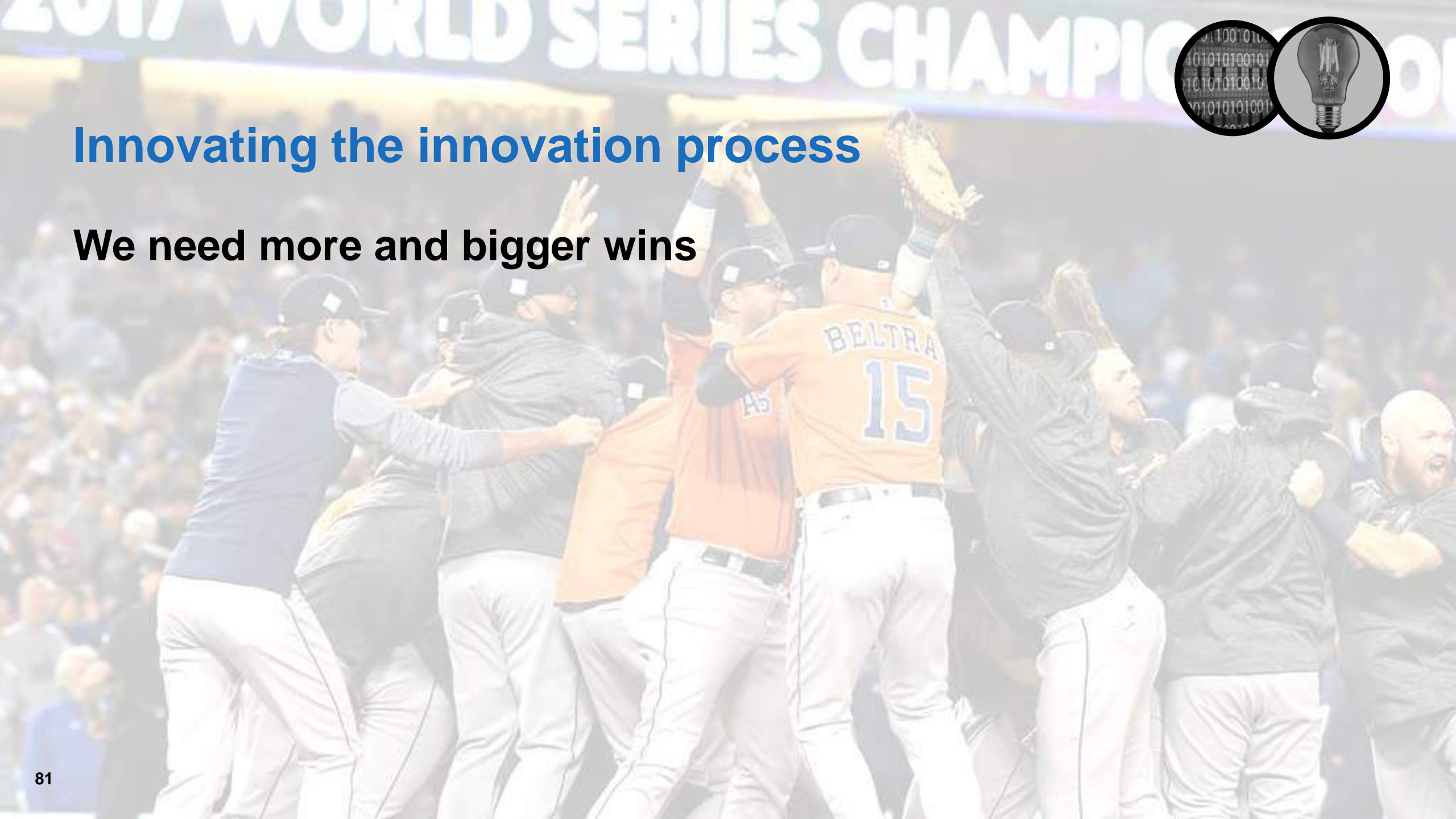
		Toyota Motor was a lead investor in Preferred Networks' \$95 million fund raise in August 2017.
		Nvidia was an investor in Deep Instinct's \$32 million Series B fund raise in July 2017.
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# Innovating the innovation process

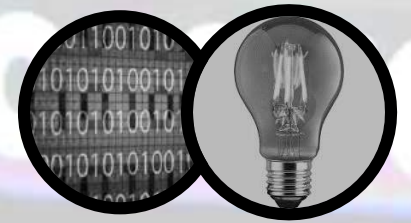
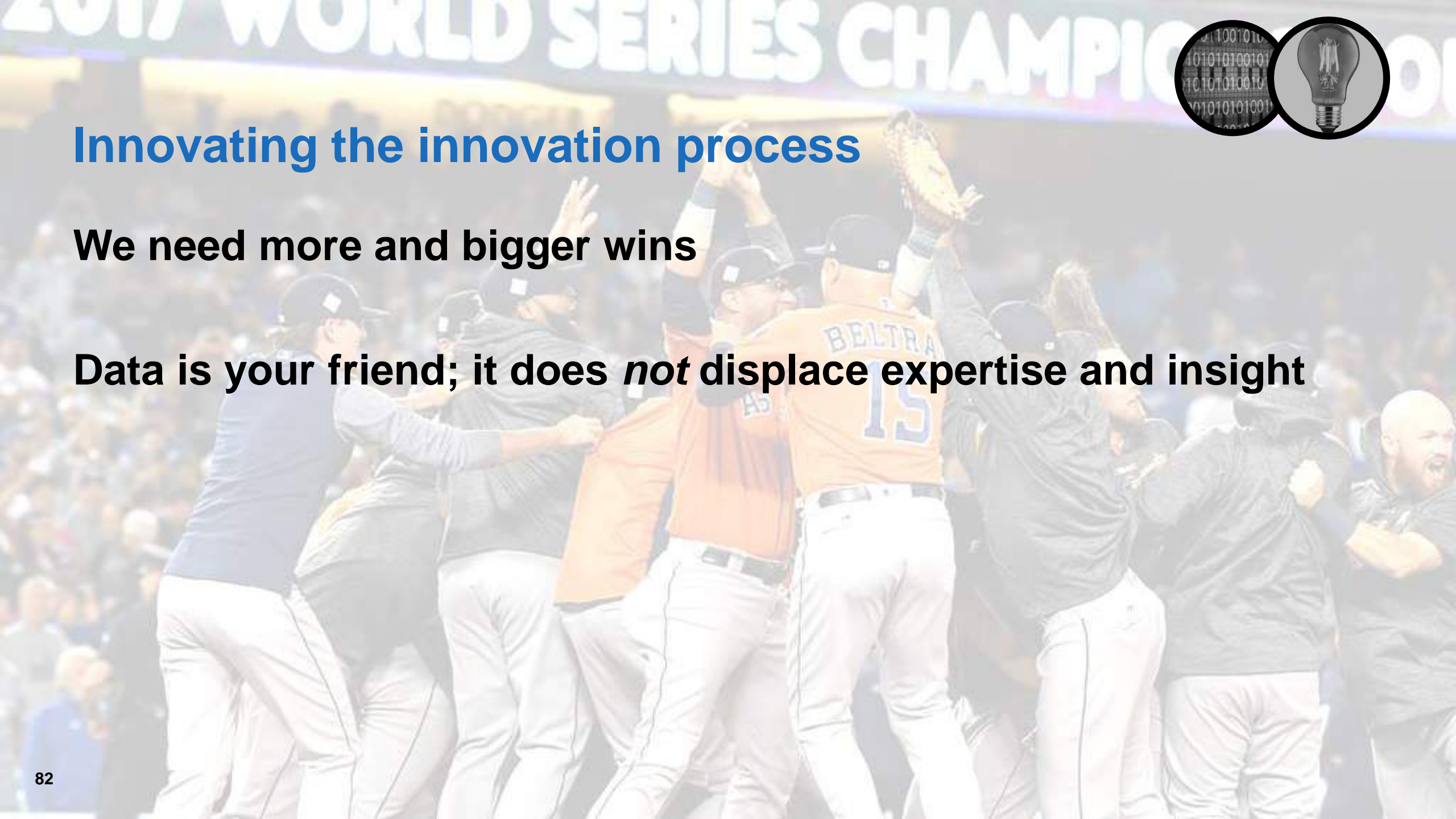
**We need more and bigger wins**





# Innovating the innovation process

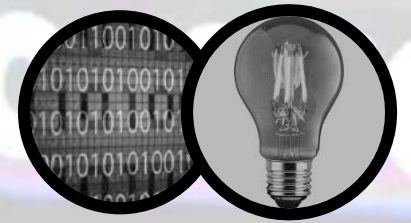
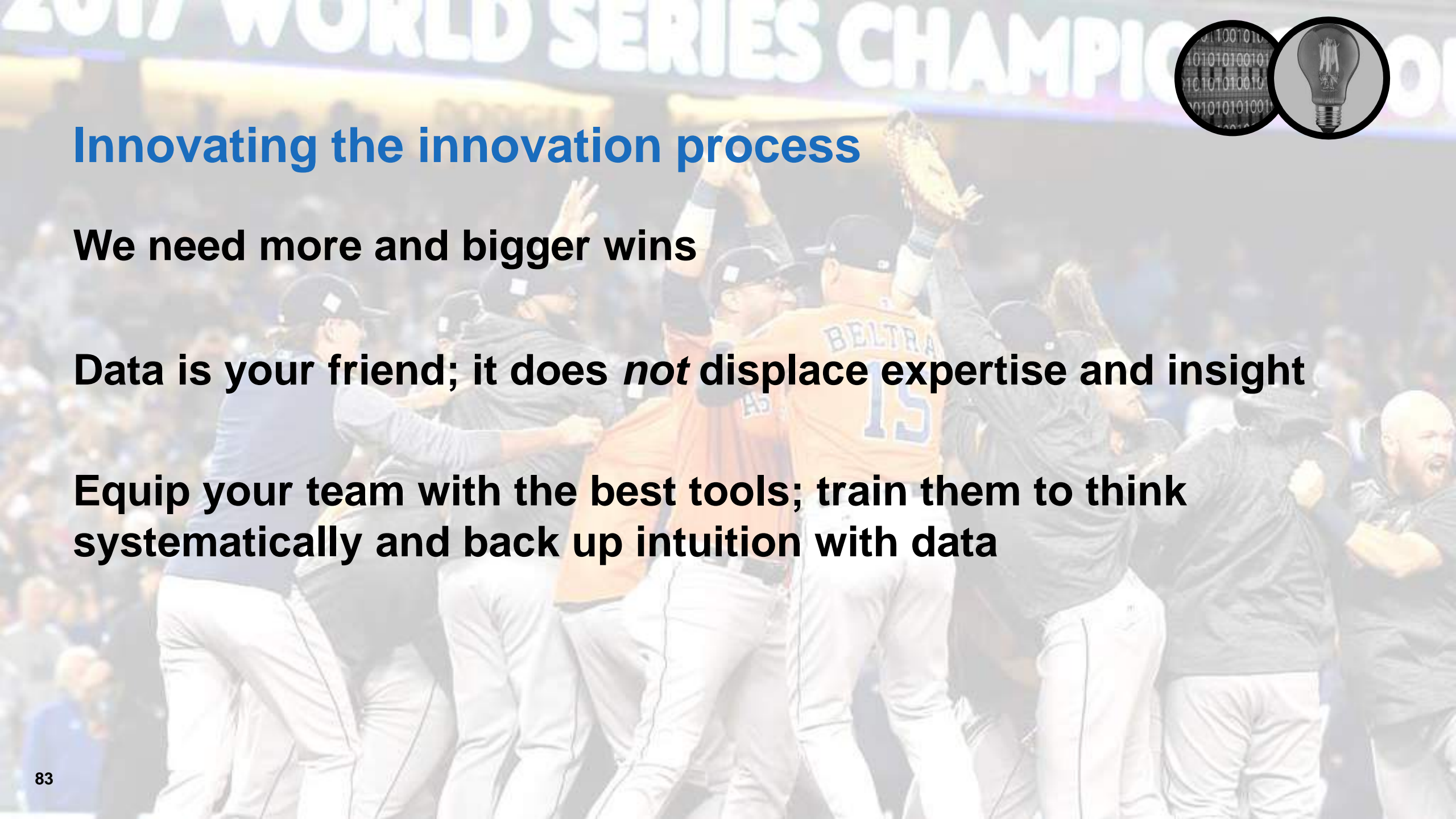
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## Innovating the innovation process

**We need more and bigger wins**

**Data is your friend; it does *not* displace expertise and insight**



## Innovating the innovation process

**We need more and bigger wins**

**Data is your friend; it does *not* displace expertise and insight**

**Equip your team with the best tools; train them to think systematically and back up intuition with data**



# 2018 luxexecutivesummit

Boston • April 9-11

*Thank you for joining us.*





**Kevin See Ph.D.**

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