

ConVergInce Advisers LLC

Visionary & Innovative solutions!



Industry in Transition: Global Overview Convergence of Renewable Products and Synthetic Biology

Canadian Bioeconomy Conference and Exhibition

June 7, 2018

Joel A. Stone

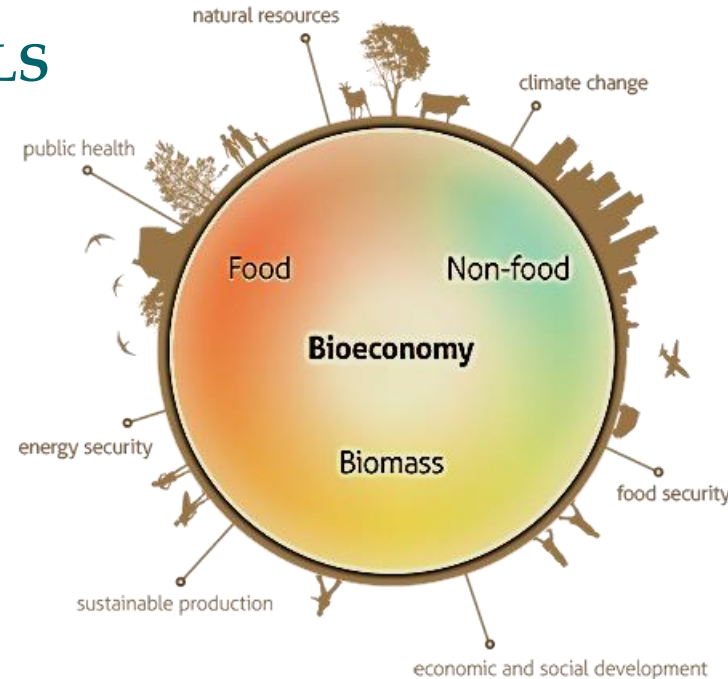
ConVergInce Advisers

Who we are

ConVergInce Advisers is a member of Lee Enterprises Consulting. Together we provide solutions from a network of experts passionate about the impact of bio-based and renewable processes. By staying abreast of developments in our respective fields and collaborating efficiently, we deliver the interdisciplinary advice, assessment, plans and solutions that best serve our clients.

BIOMATERIALS

TECHNOLOGIES



BIOFUELS

FEEDSTOCKS

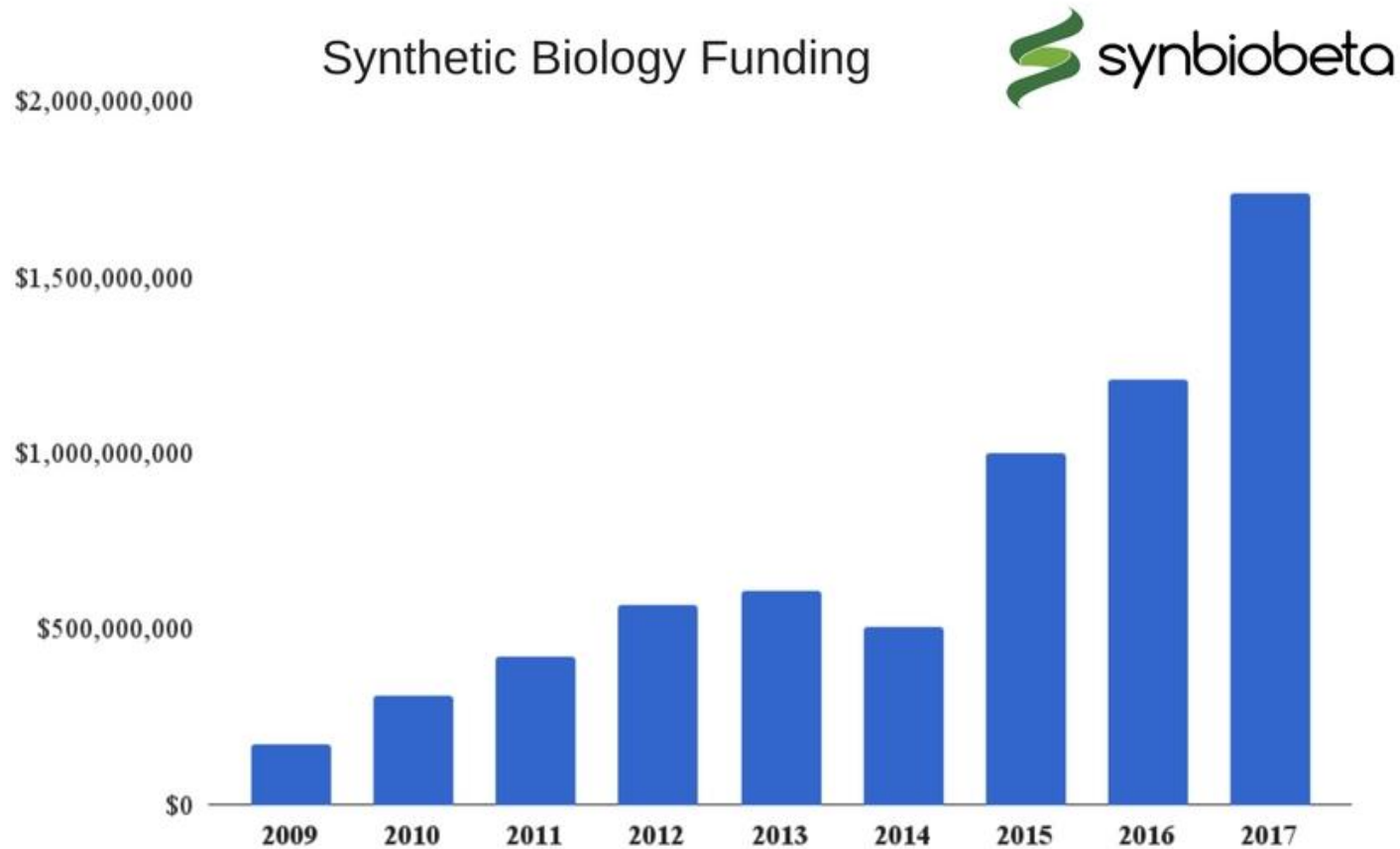
SPECIALTY SERVICES

Synthetic Biology: Disruptive innovation

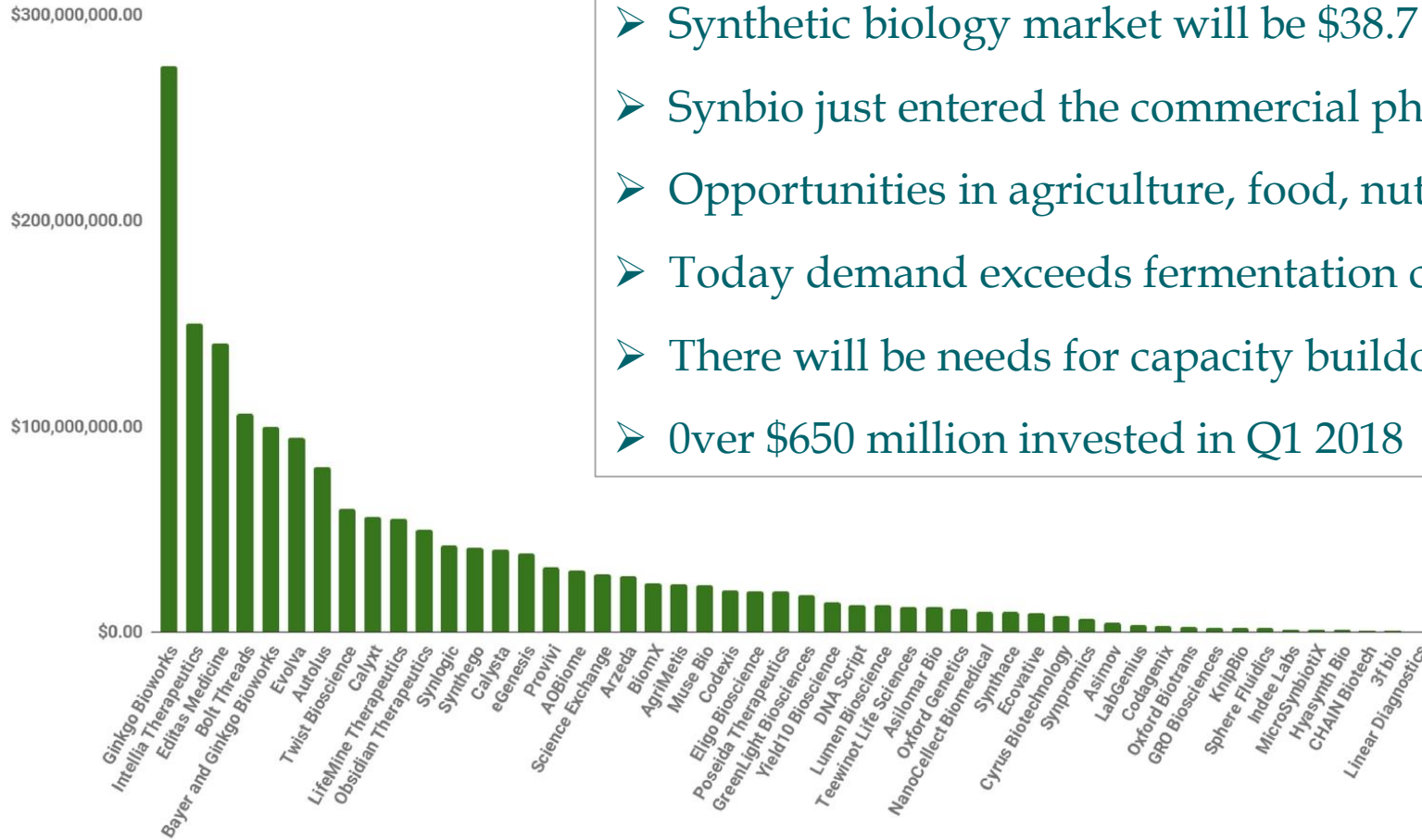
“When commercializing disruptive technologies, they found or developed new markets that valued the attributes of the disruptive products, rather than search for a technological breakthrough so that the disruptive product could compete as a sustaining technology in mainstream markets.”

— Clayton M. Christensen, The Innovator's Dilemma

Synthetic Biology is the future



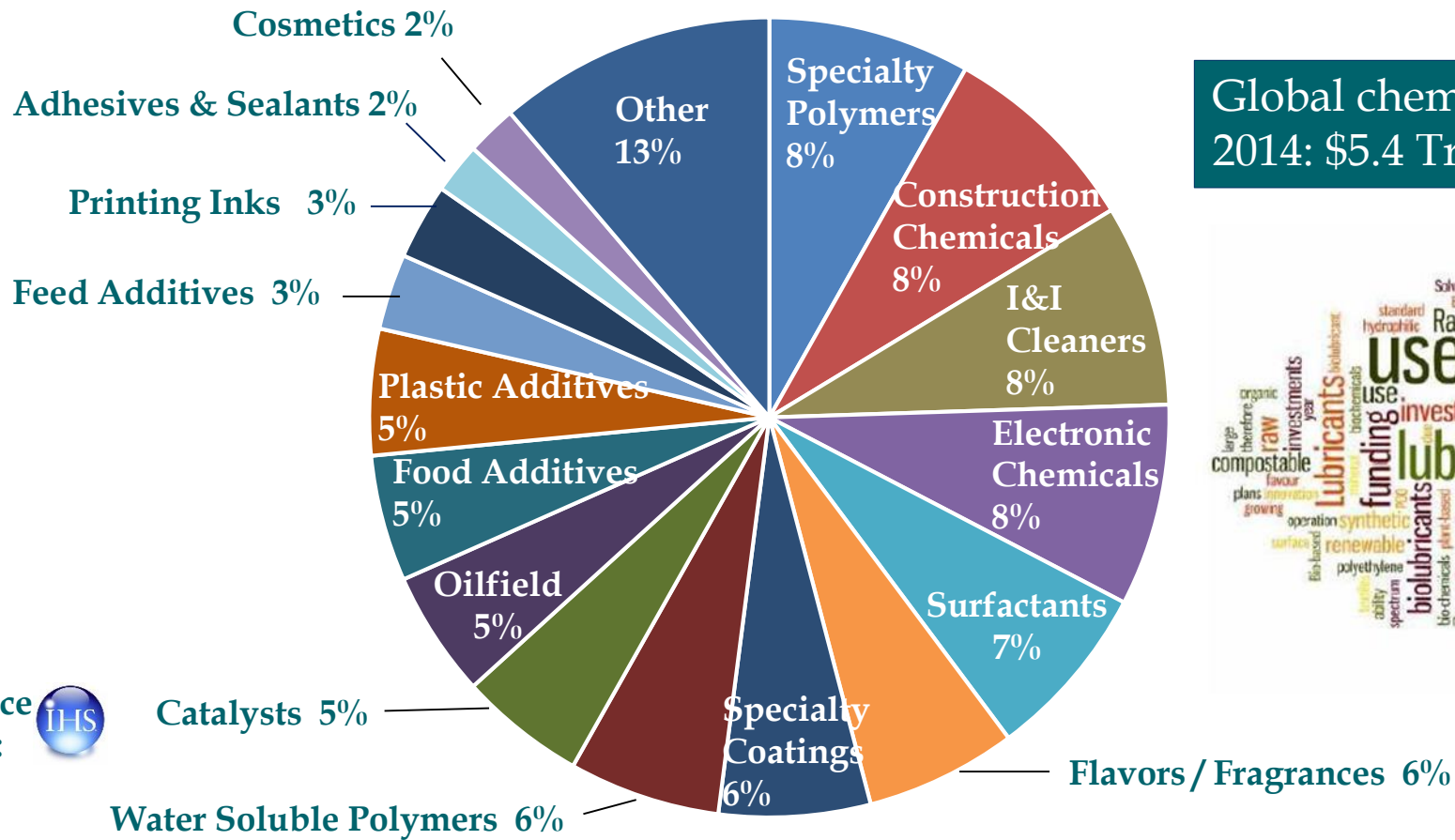
The Investment picture



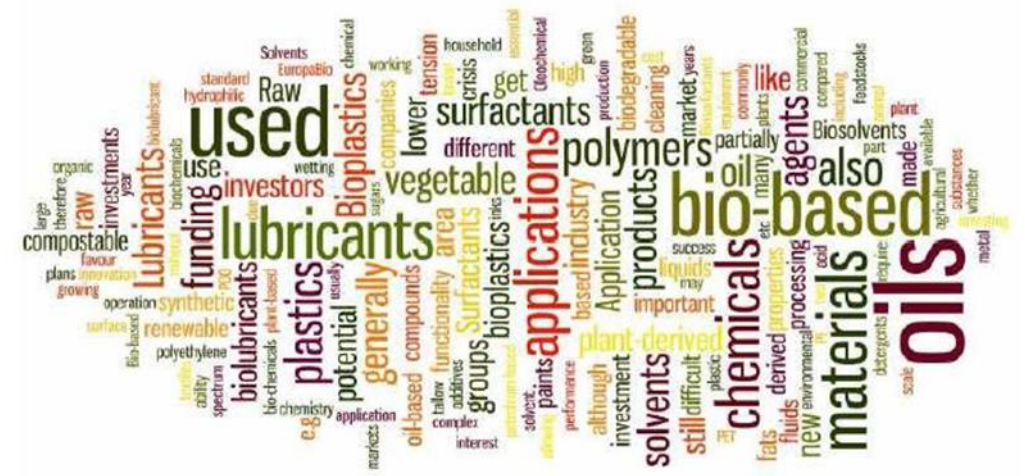
- Synthetic biology market will be \$38.7 billion in 2020
- Synbio just entered the commercial phase of development
- Opportunities in agriculture, food, nutrition, pharma, chemicals, energy
- Today demand exceeds fermentation capacity by 2.9 million liters
- There will be needs for capacity buildout
- Over \$650 million invested in Q1 2018



Renewable Chemicals: \$450 Billion Specialties



Global chemical market
2014: \$5.4 Trillion



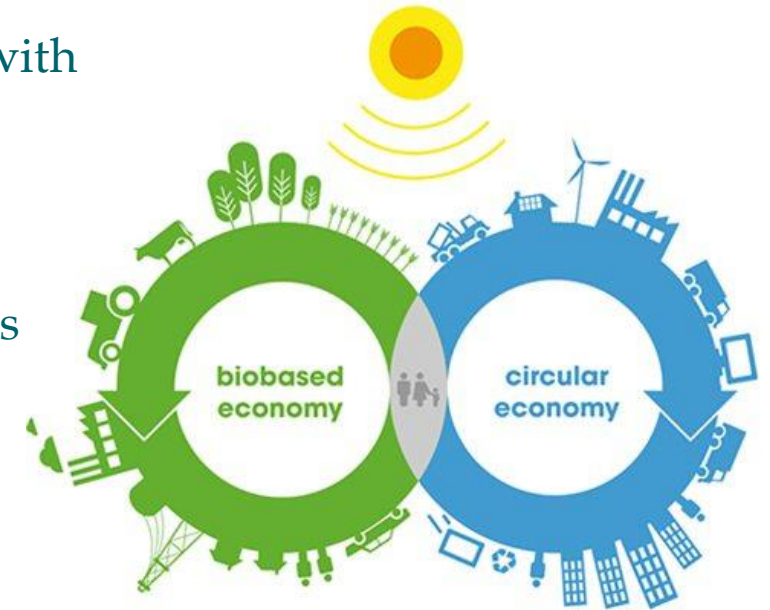
Source: IHS
2014:

Biomaterials is experiencing step changes

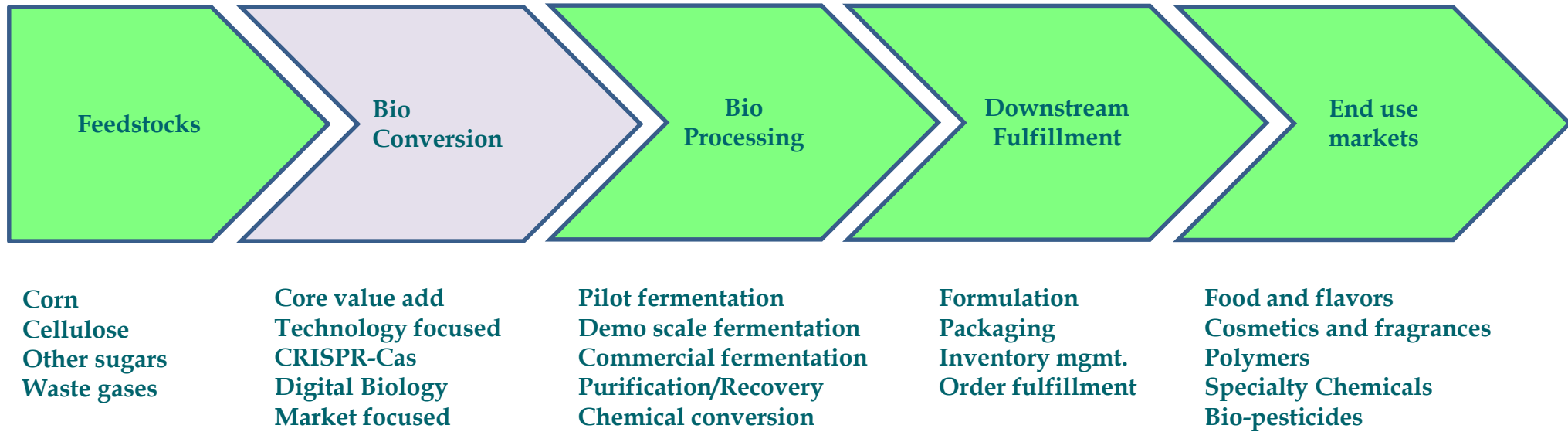
- **Animal Health**
- **Aquaculture Health**
- **Biochemicals**
- **Bio-fertilizers**
- **Bio-fibers**
- **Biomass to Sugars**
- **Bioplastics/Polymers**
- **Enzymes**
- **Biopesticides**
- **Food Proteins**
- **Food Ingredients / products**
- **Industrial chemicals**
- **Lubricants**
- **Nanocarbon/cellulose**
- **Nutraceuticals**
- **Organometallics**
- **Renewable Chemicals**
- **Solvents**
- **Microbiome**
- **Biostimulants**

Biobased Products market

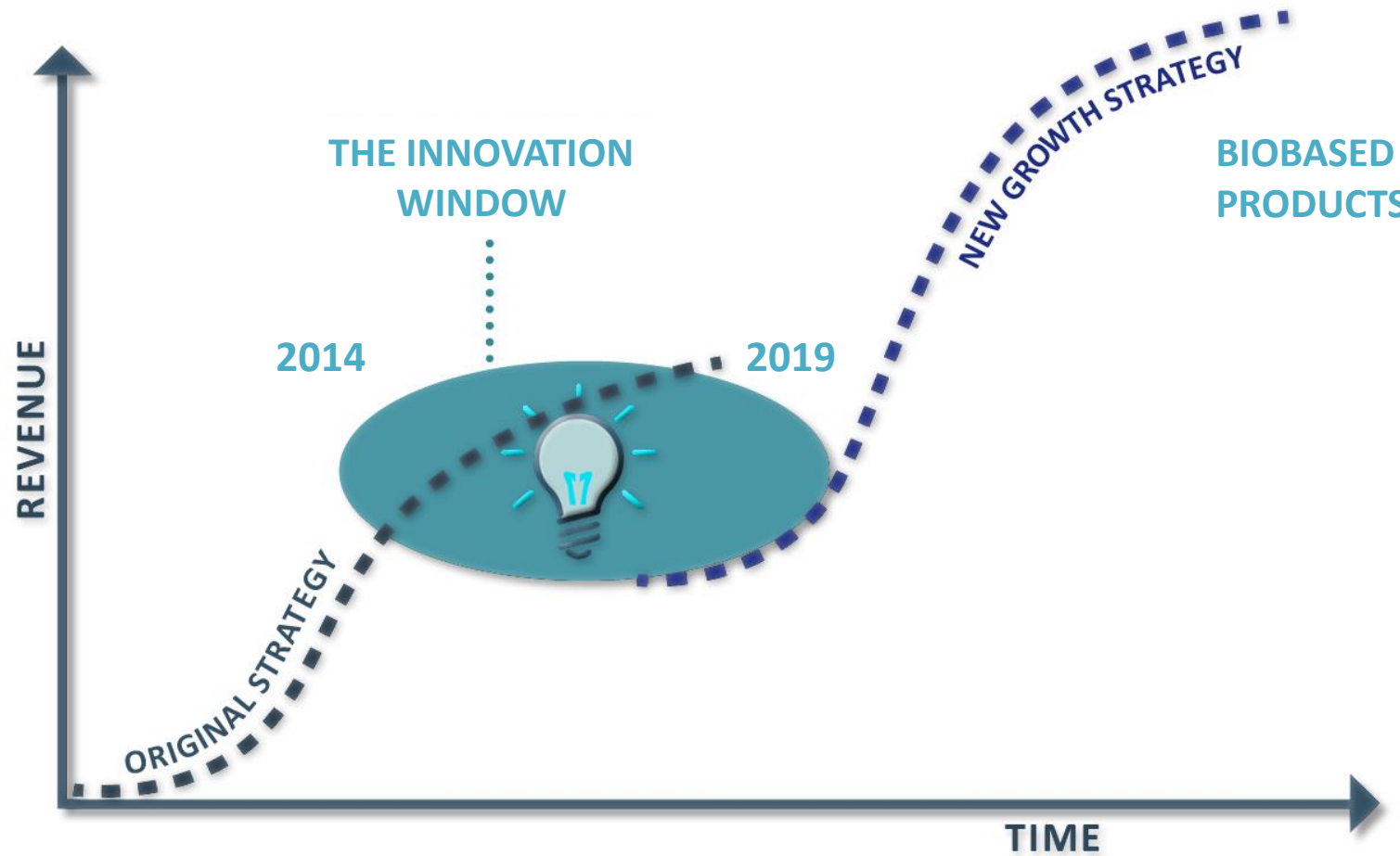
- The circular economy replaces extractive models that consume capital with regenerative models that seek to rebuild and recycle inputs and capital
- Driven by both consumer demand and increasing access to scalable technologies
- Dependent on biology, biotechnology, recycling and restorative sciences
- The new material science = **Biology + Chemistry**
- Efficiently provide manufacturing scale to the industrial biotechnology industry
- The USDA BioPreferred® program has grown by over 61% from 2014 to 2017 with strong growth trends in food, cosmetics, polymers and chemicals



Bioproducts value chain



Increasing investments & disruptive innovation



Strategies for growth: Experience matters

- **Strategies for de-risking, commercialization & growth require:**
 - Solid laboratory and bench chemistry development including pilot developments and pilot replication testing.
 - Demonstration plant operation at 1/25th to 1/50th commercial scale.
 - A planned Engineering, Procurement and Construction program including risk management focus and capital budgeting including an FEL3.
 - A clear commissioning and startup plan.
- **Lessons learned: Why have there been many failures?**
 - Skipping proper time allotments or short cutting lab, pilot, and demo plans.
 - Shortcutting the capital budget with unrealistic FEL3 designs.
 - Inability to be fully funded to reach the objective.
 - Understand importance of product quality and differentiation versus predecessor products.
 - Understand the customer needs and priorities.

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Thank you

Collaborative Expert Advice
Outcome: Success Stories

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