Commercializing and Building a Great Technology Product From Academic Research

Yingquan Li

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Outline of Topics For My Talk

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My Personal Experience Working at CEB

Experiences learned from working at a research-based company that achieved profitability.

02

Case Study #1: Moderna

How to build and commercialize a disruptive, data-centric technology product where the original research was done in an academic lab.

03

Case Study #2: Crimson Hexagon

How to commercialize a technology product and develop **product-market fit**.

04

Rules and Regulations Here at Penn

What rules and regulations exist here at UPenn if an academic lab develops research that's commercially viable. What does the university get in return.

05

Ethical Implications

The ethical dilemmas of an academic research lab trying to commercialize from the research that's produced.

01

My personal experience working at CEB/Gartner

My Story...

- Back in 2015, I worked for a company called **Corporate Executive Board (CEB)** located in Rosslyn/Arlington, Virginia.
- The company was a professional services company with a unique business model: it sold advisory services and technology solutions to executives on a subscription model.
- I was specifically in **Research and Development (R&D)** on the **Talent Management** side of the business. We would do research and put together webinars for our members.
- I was **23** years old on a team of **16** people with **6** Ph.D.-level Industrial/Organizational (**I/O**) Psychologists.
- The company values were: **1) Member Impact**, **2) Force of Ideas**, **3) Spirit of Generosity**, and **4) Stewardship of Exceptional Talent**.

CEB
WHAT THE BEST COMPANIES DO

What I Learned... 3 Lessons

1. Business is ultimately about service and true leadership is about serving your clients, your employees, your community, and society at large.

1. Building a great service or product and scaling it from an incumbent to a market leader takes vision + discipline. Specifically: the whole team worked from ~8:00 AM - ~5:00 PM every work day.

1. A team of talented, disciplined people who look out for each other and do their individual tasks with great care will naturally create a great product or service that delights customers.

02

Case Study #1:

“Academic science searches for knowledge; science done in business searches for solutions. It goes to where value is believed to exist imminently.”

— Noubar Afeyan, Moderna Co-Founder

Moderna: Turning Academic Research -> Technology Product

Moderna Co-Founders ##: Noubar Afeyan, Derrick Rossi, Robert Langer, Kenneth Chien

Moderna's Story ##:

- Co-founder **Noubar Afeyan** is an entrepreneur and venture capitalist who graduated from MIT with a Ph.D. in biochemical engineering in 1987.
- Afeyan founded **Flagship Pioneering** in 1999, a biotechnology venture capital firm.

- In 2010 Afeyan was directed to the work of Dr. **Derrick Rossi**, investigator at Boston Children's Hospital/Assistant Professor at Harvard Medical School by **Robert Langer**, David H. Koch Institute Professor at MIT. Rossi was working on novel mRNA research at the time.
- Afeyan brought Moderna into Flagship Pioneering as project **LS18** in 2010 to quickly prototype mRNA therapeutics.
- Rossi approached Dr. **Kenneth Chien** of The Harvard Stem Cell Institute as a fourth co-founder.

N. Afeyan

D. Rossi

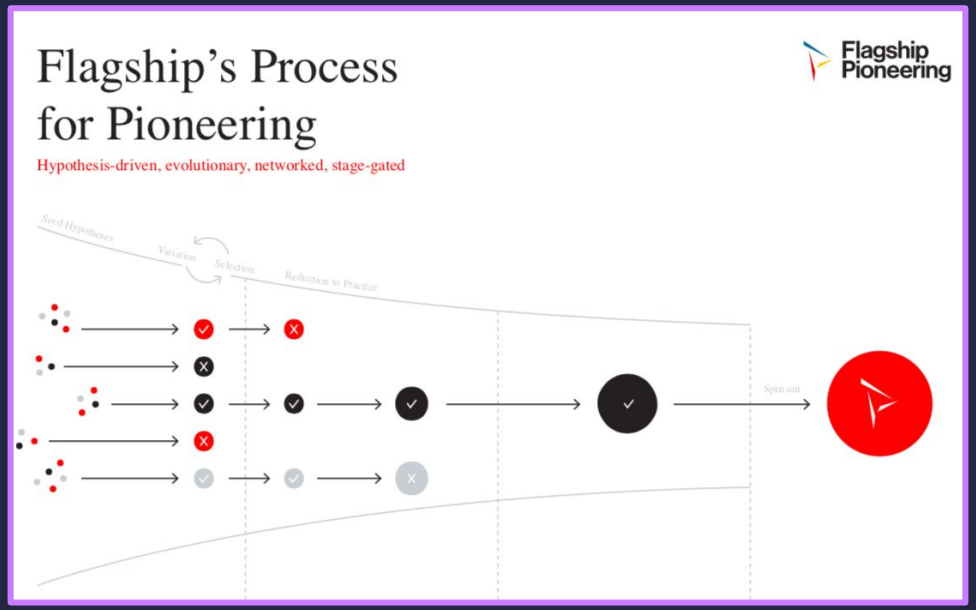
R. Langer

K. Chien

Flagship Pioneering Innovation Pipeline

Phase 1. Explorations
Hypothesis Generation
- White space seeded by multiple hypotheses
- Network engaged to iterate & refine

Phase 2. ProtoCo
Feasibility Testing
- Focused on **Proof of Concept (PoC)**
- IP creation
- Team formation
- Network engaged to critique & evolve



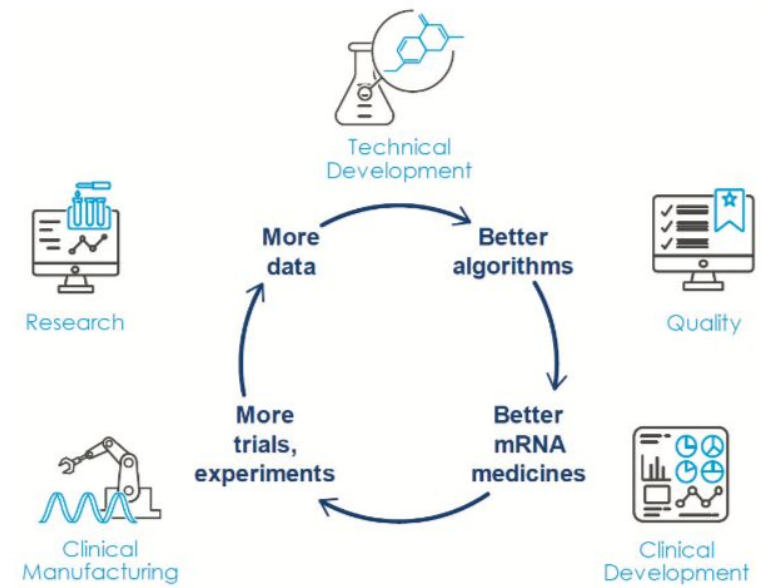
(1) (2) (3) (4)

Phase 3. NewCo
Internal Venture
- Execute product & platform development plan
- Assemble broader team & board
- Led by Flagship founding team

Phase 4. GrowthCo
Value Growth
- CEO recruited
- Board of directors governance
- Separate from Flagship resources
- Grow and thrive

Moderna's AI Factory

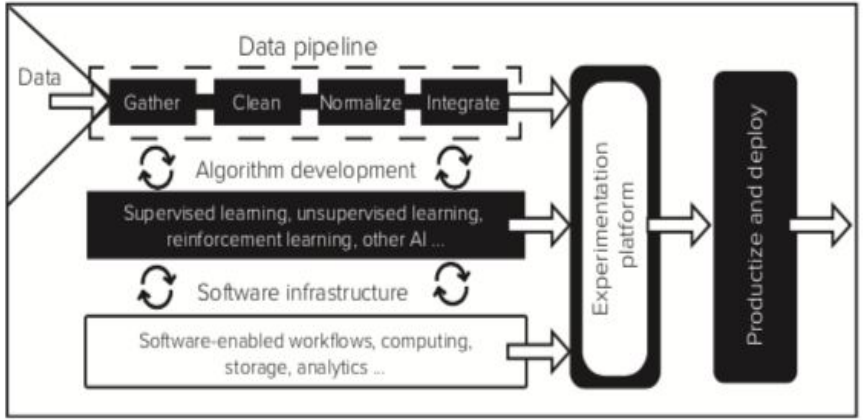
Exhibit 5 Digital Integration at Moderna



Source: Company documents.

FIGURE 3-2

AI factory components



Lessons CSS Lab can Learn from Moderna

1. CSS Lab can be thought of as a technology-based research lab that does social science. With technology, the systems must integrate together (pipelines, algorithms and software infrastructure). The key is to develop a **platform** in the long term if we want to have multiple collaborators.

1. Decision makers need to understand technology first principles to make strategic technology decisions that will have long-lasting effects. Everyone is a part-time engineer on this team and the team "**swarms**" to solve problems collectively together, not in siloes.

1. To commercialize our research, we have to think who's a potential customer for our research insights and identify a specific niche market to target first.

“We are a technology company that happens to do biology.”

— Stephane Bancel, Moderna CEO

Translation

“We are a technology startup that happens to do social science.”

— Yingquan Li, Engineer (2/28/22)

03

Case Study #2:

Crimson Hexagon

Crimson Hexagon: Quantitative Social Science -> Technology Product

Crimson Hexagon Co-Founders ##: Gary King and Candace Fleming

Crimson Hexagon's Story ##:

- Crimson Hexagon was founded by **Gary King** (Director of the Institute for Quantitative Social Science, Harvard) and business school graduate **Candace Fleming** in 2007.
- Crimson Hexagon was rooted in an algorithm published an academic paper titled: "A Method of Automated Nonparametric Content Analysis for Social Science" by King. The paper got published three years after Crimson Hexagon was formed in 2010.
- Crimson Hexagon's value proposition: **provides semantic search software to businesses, allowing clients to watch and track online conversations about their brands**.

- Crimson Hexagon raised a series A funding round of $2M in 2010.
- Crimson Hexagon raised a series B funding round of $5M in 2011 from business magnate Charles F. Dolan.
- The company kept growing and scaling it's users, customers and partners until it merged with British company **Brandwatch** in 2018.

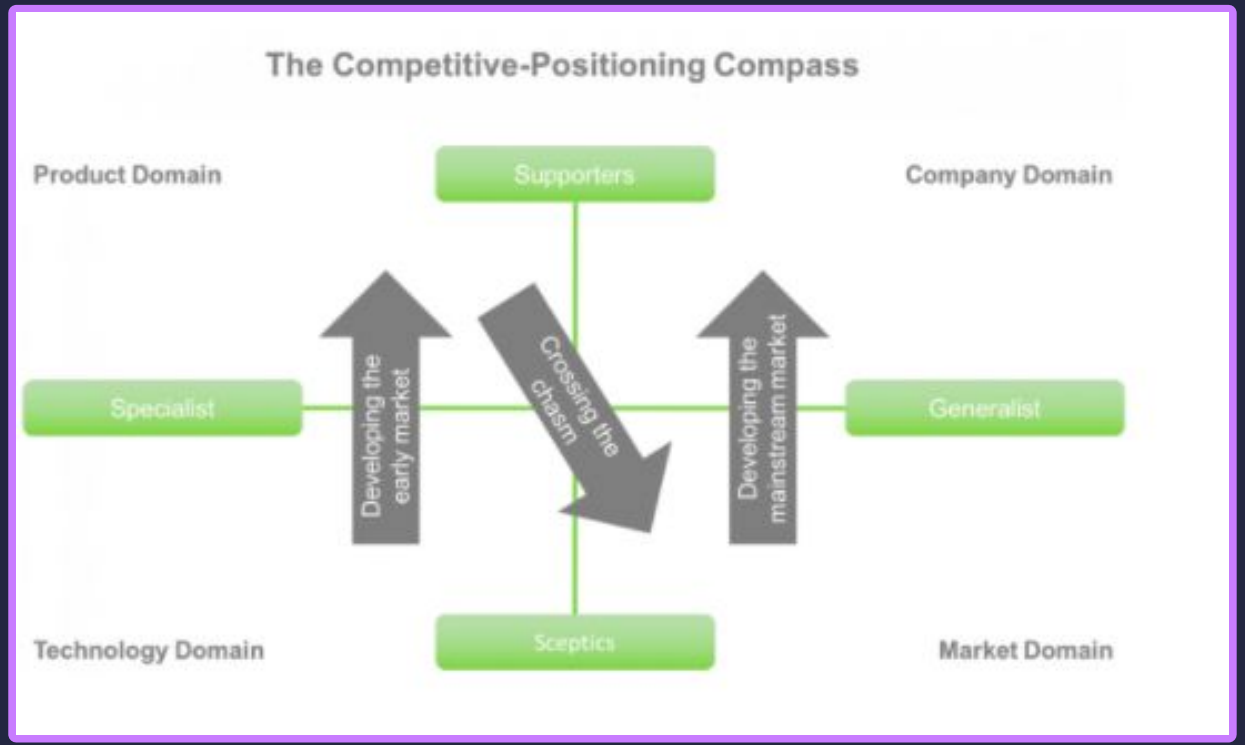
G. King

C. Fleming

"Identify repetitive use cases and then use technology to solve those issues. Technology is important in the beginning, but the whole product offering is more important as you scale."

— Errol Apostolopoulous, SVP of Product

Crimson Hexagon Crossing the Chasm



* Geoffrey Moore, Organizational Theorist/Management Consultant/Author.

Crossing the Chasm in Detail

- The **Technology Adoption Life Cycle (TALC)** is segmented into 5 different adopter groups whenever there is a new technology product. The groups will react differently to your product as you move along the TALC and bring the product to market.
- Moving along the TALC is the hardest from the Early Adopters to the Early Majority, known as **Crossing the Chasm**. This is where most technology products fail and don't reach the mainstream market and a company falls into the abyss of the chasm.
- Once a product has penetrated the Early Majority market, the product will have truly achieved **product-market fit**, where the product starts selling itself by word-of-mouth.

* Geoffrey Moore, Organizational Theorist/Management Consultant/Author.

One BIG Lesson learned from Crimson Hexagon

If an academic research project is commercially viable, it's really important to **patent and protect the intellectual property** first before it's made public through an academic paper, a conference talk or a workshop to peers. Crimson Hexagon started in 2007 and only published their proprietary algorithm in three years later in 2010.

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Rules and Regulations Here at Penn

“Maximizing the ability of Penn researchers to effectively collaborate with the private sector is one of Penn’s highest goals as clearly articulated in Penn Compact 2020 (authored by former President Amy Gutmann).”

—Penn Center for Innovation (PCI)

Penn Center for Innovation (PCI)

- PCI helps to translate discoveries and ideas created at the University of Pennsylvania into new products and businesses for societal benefit.

- We actively facilitate a broad range of technology development connections between Penn and the private sector. Whether the end result is a technology license, an R&D alliance, or the formation of a new venture, PCI serves as a dedicated one-stop shop for commercial partnering with Penn.

- PCI's website is located here.

PENN CENTER FOR INNOVATION
Empowering Ideas

Important Facts about Intellectual Property

Taken from the Guide ##: PCI Commercialization Guide

- "Faculty founders generally may not take on fiduciary roles for the companies that they help to create (e.g. board seats, officer positions, full-time employment arrangements, etc.), but faculty founders do typically serve as advisors or consultants for the company often chairing or participating in the Scientific Advisory Board of the company, while also maintaining their position at Penn."

- "Penn owns the inventions created at Penn by Penn personnel (which includes faculty, post-docs, and grad students supported by research grants) and actively manages the licensing rights to the technology, while also taking direct responsibility for the protection and maintenance of patents."

- "Inventions made by students 1) in the course of employment at Penn; 2) resulting directly from work related to employment at Penn; 3) resulting from work under a grant or sponsorship requiring assignment to Penn; or 4) where the invention is co-created with another inventor who has a duty to assign the invention to Penn, will be considered the property of the University."

Commercialization Process End-To-End

PENN CENTER FOR INNOVATION

HOW DOES PCI COMMERCIALIZE FACULTY INVENTIONS?

INVENTION

Research paths to an invention can be supported by Penn, government grants, and corporate partnerships

DISCLOSURE

An inventor uses Inventor Portal to disclose, so PCI can protect the invention and create a plan for commercialization

PROGRAMS & ASSESSMENT

An assigned Technology Licensing Officer assesses commercial value and begins marketing efforts to industry partners

PROTECTION

Disclosures with commercial potential are protected through various channels (patents, copyright, trademarks, trade secrets, and/or know-how)

COMMERCIALIZATION

PCI and the inventor determine the best commercialization strategy, which may include licensing to industry, starting a company via PCI Ventures, or pursuing a corporate partnership via Corporate Alliances

MARKETING

PCI conducts a market analysis to identify potential clients and partners, creates marketing collateral, and lists the technology on our website. PCI may also market through programs and events, print and web media, and partnerships

BUSINESS RELATIONSHIPS

PCI works to generate agreements or relationships that may include an option and/or license to the technology, an MTA or SRA, or a new venture project

05

Ethical Implications

Some Questions for Debate

1. As an academic research lab, how does CSS Lab commercialize our research and is this even of interest to us as a lab?

1. Mark Whiting's Question: How does commercialization affect our sources of funding as an academic lab? Any objections?

1. As a social science lab if the goal is really to commercialize (which has been mentioned multiple times), should the team develop a product or a consulting/advisory service?

Please debate these points right now! Thank you for your attention.

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Slides that will not be presented.

My Story Part 2

- On **January 5th, 2017** CEB was acquired by **Gartner Inc**.
- **Gartner (Stamford, CT)** is the world's leading technology and research company that invented the following market research frameworks: The Magic Quadrant, The Hype Cycle, Unique Vendor Ratings, etc.
- Gartner's recommendation and research is highly respected by technology companies and it's opinion has a lot of sway on decision makers (CTOs, CIOs, VPs, etc.).
- Gartner decided to rebranded **Talent Management** as **SHL** and sold the business in summer, 2017.
- Sadly, because of this acquisition my team disintegrated in October, 2017. I think about my former team a lot and the lessons I learned.

Gartner®

03

How Does a Scrappy Team Attack Entrenched Incumbents

Point #1: Commercialization/Competition

4 Commercialization Strategies Depending on Market Forces

- **Attacker's Advantage**:
- Incumbent has no complementary assets, but incumbent could also exploit the novel idea. Better to attack the incumbent.

- **Greenfield Competition**:
- Incumbent has no complementary assets, and it would be hard for an incumbent to develop the technology. Therefore, competition is between the innovators on who achieves a competitive advantage first. The market is still being defined.

- **Reputation-Based Ideas Trading**:
- Need incumbent for their complementary assets, but can't prevent incumbent from commercializing the novel idea. Better to be acquired by incumbent.

- **Ideas Factories**:
- Need incumbent for their complementary assets, and incumbent can't develop the technology by itself. Better to cooperate and potentially do a licensing agreement with the incumbent.

* Pai-Ling Ying, Associate Professor of Entrepreneurship; USC Marshall School of Business.

Crossing the Chasm in Detail

The **Technology Adoption Life Cycle (TALC)** is segmented into 5 different adopter groups whenever there is a new technology product. The groups will react differently to your product as you move along the TALC and bring the product to market.

- Innovators: The Technology Enthusiasts love new technology for its own sake.
- Early Adopters: The Visionaries are rare individuals who can match an emerging technology to a strategic opportunity.
- Early Majority: The Pragmatists (the majority of the market) want proven technology at a competitive price.
- Late Majority: The Conservatives are stuck in their ways and don't like discontinuous technology, but will eventually adopt new technology and go with the crowd.
- Laggards: The Skeptics hate technology and it's not worth your time to sell them new technology.

Moving along the TALC is the hardest from the Early Adopters to the Early Majority, known as **Crossing the Chasm**. This is where most technology products fail and don't reach the mainstream market and a company falls into the abyss of the chasm.

Once a product has penetrated the Early Majority market, the product will have truly achieved **product-market fit**, where the product starts selling itself by word-of-mouth.

* Geoffrey Moore, Organizational Theorist/Management Consultant/Author.

Point #3: Achieving Digital Scale, Scope, Learning

Digital Scale: Managing scale, simply put is about designing an operating model to deliver as much value to as many clients at the lowest possible cost. A company scales when it starts thinking about and building automation into operational workflows from the beginning.

Digital Scope: A company's scope is defined as the range of activities it performs - the variety of products and services it offers to clients. When a company archives **economies of scale** and a **network effect**, it's naturally going to increase the scope of what it offer in terms of products or services.

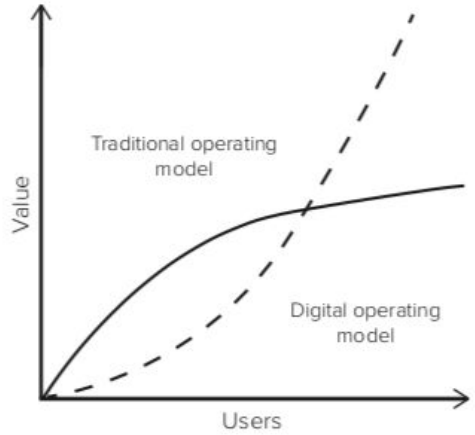
Digital Learning: The learning function of an operation is essential to drive continuous improvement, increase operating performance over time and develop new products and services.

Bottomline:

Human labor is analog in nature and does not scale. Digital technology and algorithms when developed with thought and care (not quick hacks) will scale exponentially. This applies analogously to CSS Lab work.

FIGURE 1-2

The collision between traditional and digital operating models



Marco Iansiti & Karim R. Lakhani, Professors of Business Administration; Harvard Business School (HBS).