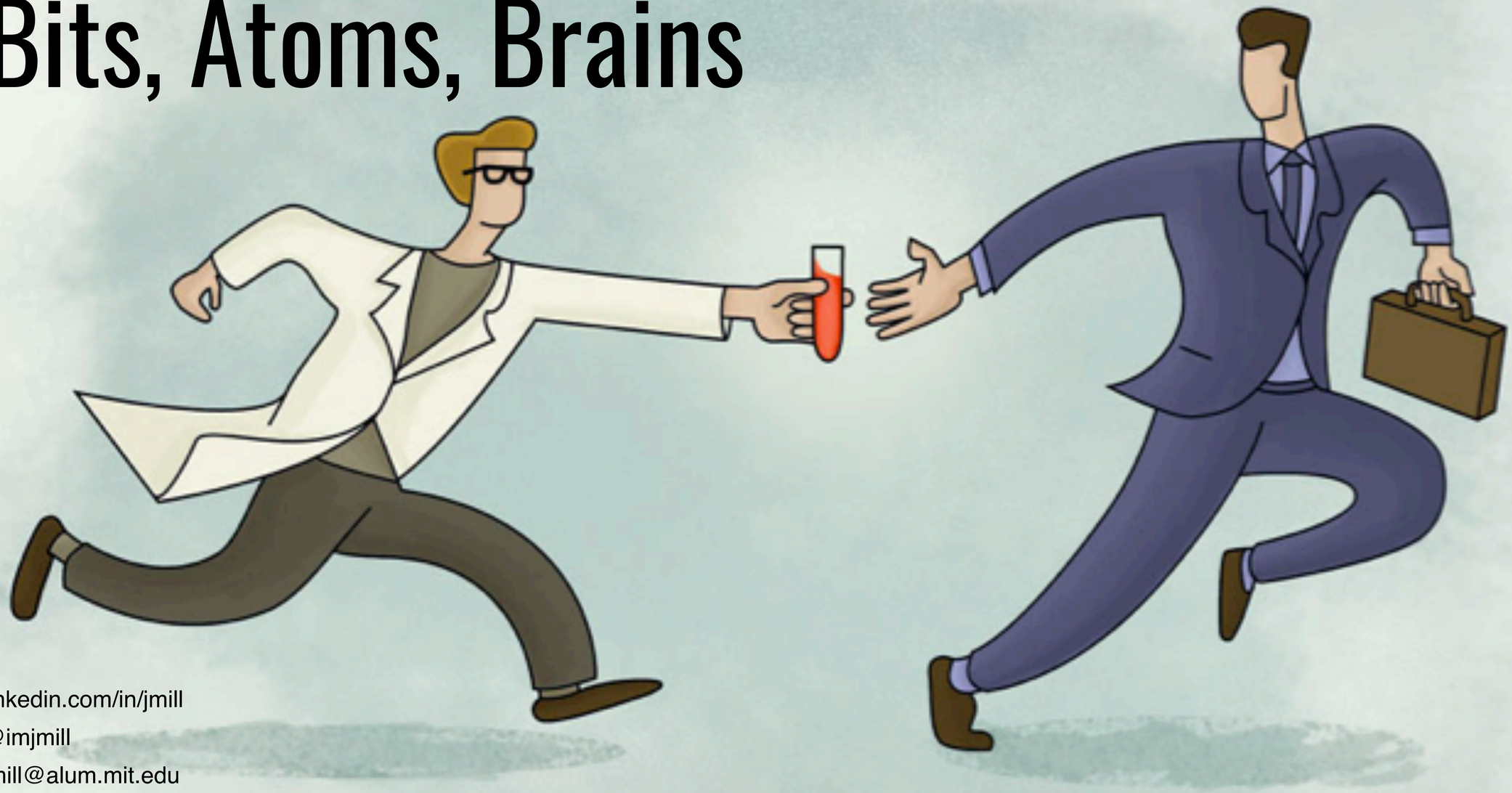
Lab-to-Market Commercialization

Bits, Atoms, Brains



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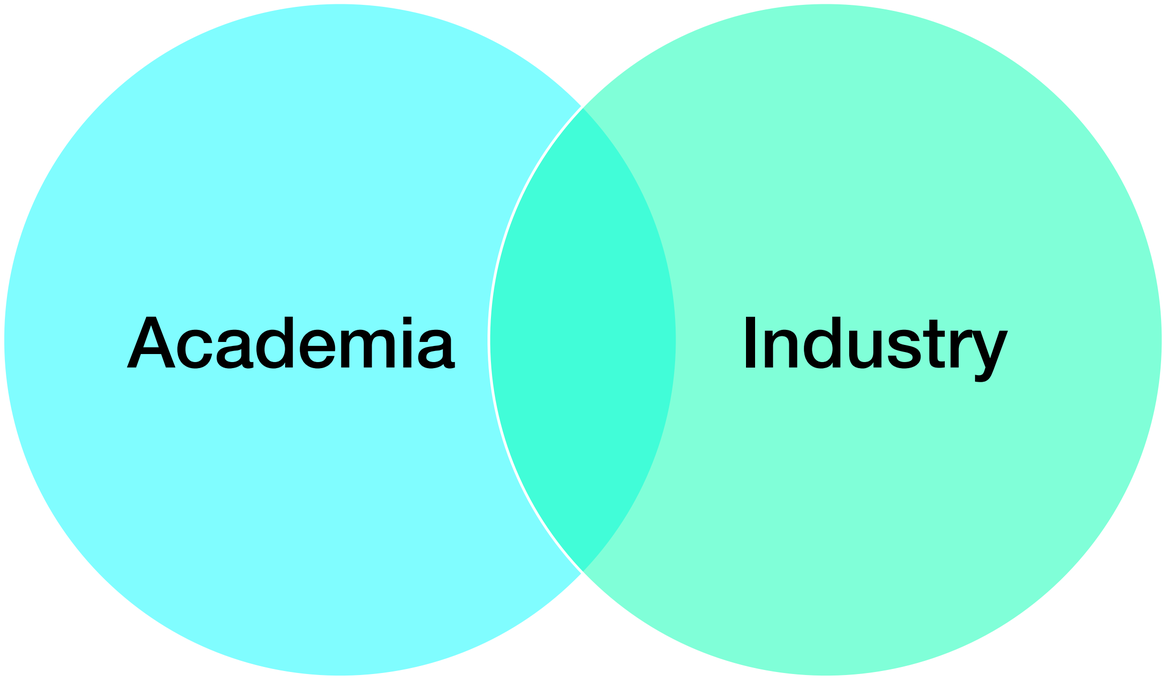

“Keep me honest”

→ ***The possibilities outside of traditional research roles in academia and industry***

Transitioning from being a chemistry student to being future you

Leveraging skills gained during education.
incl. do-it-yourself internships

Lessons learned from experiences in different projects and current responsibilities

Topics to cover

- STEM is great for *x*
- A view on what I do
- Spinning out of a lab
- Why commercialize science?
- Finding allies and resources

@imjmill

AFFILIATIONS (1/2)

Ventures founded...

dimples — it's like printing money
ink-saving software for bulk printing

Mad Dog Environmental Solutions
rig protection and waste stream control

Muddy Charles
fine home lifestyle items as functional art

ANGEL EYE — ROADWAY GUARDIAN
communications bridge for future-proof road safety

Pipeguard Robotics
Infrastructure leak detection and forecasting

P↑P Architexture
architectural 3D modeling

Lab-to-Market work...

CERMUSA
applied R&D in robotics and telehealth for emergency first response

modeling moonshot

NASA
lunar mission design and human systems

flex
autonomous vehicle infrastructure design, applied R&D

U.S. DEPT OF DEFENSE
innovation ecosystem development, tech transfer

White Feather Safari Ventures
venture architect lead, invent, incubate, deploy

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AFFILIATIONS (2/2)

Tech Investment

AIRBUS VENTURES

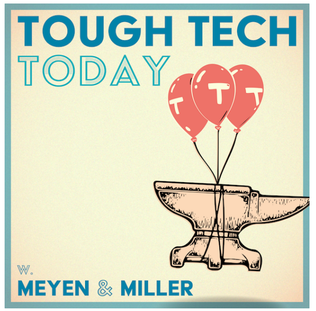
Education

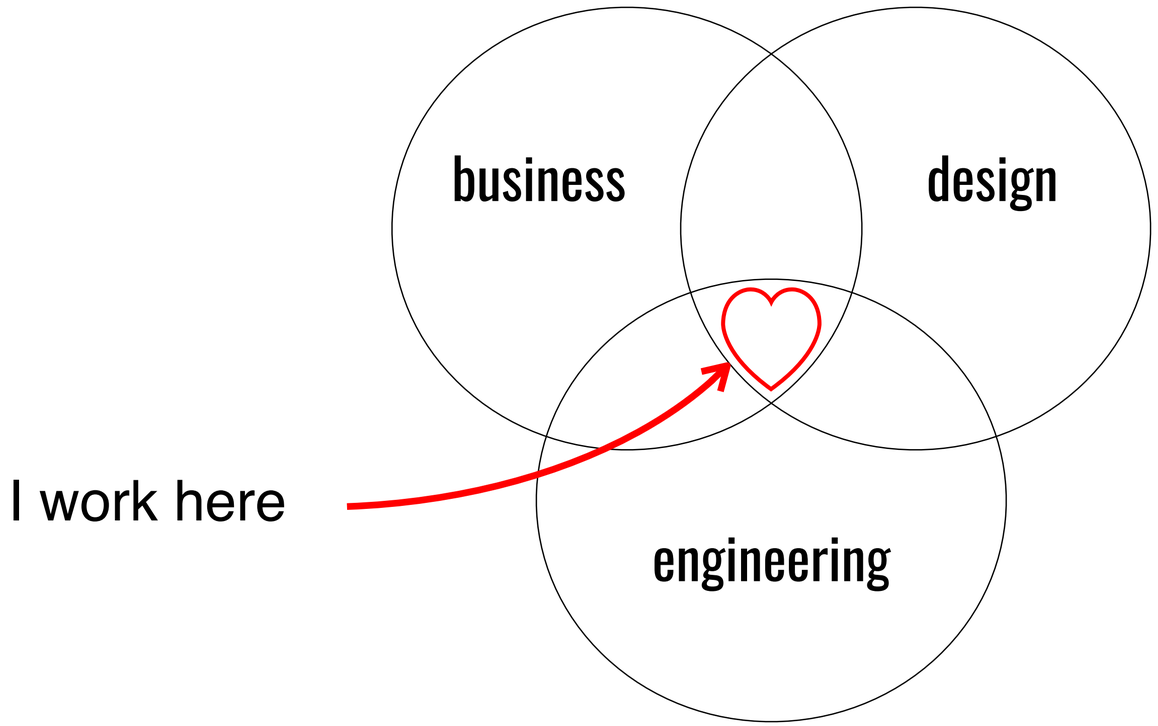
Massachusetts Institute of Technology

Research

MIT innovation initiative

Communications





Lab-to-market advancements from almost any industry can serve the public and private markets.

Some common industries are:

- Enterprise software
- HR
- IT
- Team management
- Analytics
- IoT
- Robotics
- Biotech
- Energy

Overview

1

Commercializing science

Lab-to-market flows

2

Tough tech

Decomposing frontier technologies and public-private partnerships

3

What you can do

Building better feedback loops

4

Where to go for more

Programs, readings, podcasts

1

Commercializing science

Lab-to-market flows

An approximation of the lab-to-market flow

At each stage: advocate for more resources

1. Research

Government-wide and DOD definitions of research[1]
(e.g., six-dot notation)

`OUTPUT:` publication(s)

2. Invention

Reduction to method… kind of. Super high-level sense of application areas.

`OUTPUT:` patent(s), secret sauce

3. Problem Area

Make sure it's a real problem – structure it.

What are the roadblocks in addressing the problem?

`OUTPUT:` problem specification, hunch

4. Prototype

Feasibility, Viability, Desirability

Downselect, test, find flaws and fix

`OUTPUT:` Janky, unoptimized, Macgyvered solution

5. Product-Service

Design, Develop, Refine

Achieve a crisp understanding of the product-service's 'value add'.

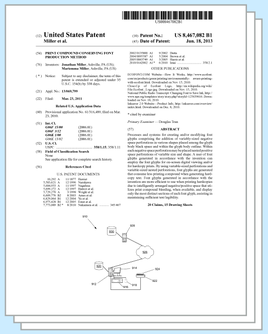
`OUTPUT:` You know who needs it, why, and how they are going to get it

6. Scaling Up

Optimize the organization.

Capture and carry-forward learnings for next product-service.

`OUTPUT:` More of the same, team turnover



1. https://www.rand.org/content/dam/rand/pubs/monograph_reports/MR1194/MR1194.appb.pdf

Decomposing Innovation

To introduce something new; make changes in anything established

OR

Creation of new things or processes intended to deliver benefits to its consumers

OR

Collective act of creating new things and processes intended to deliver some benefits to potential customers *and* improving each (things/processes, consumers, benefits) to maximize resultant value.[1]

1. Based on MIT's I-Teams

What is the biggest innovation in the past 50 years, in terms of value creation?

- Personal computer?
- Mobile devices?
- Internet?
- Synthetic biology?
- Search? Social networks?
- Hybrid cars?
- Satellites?

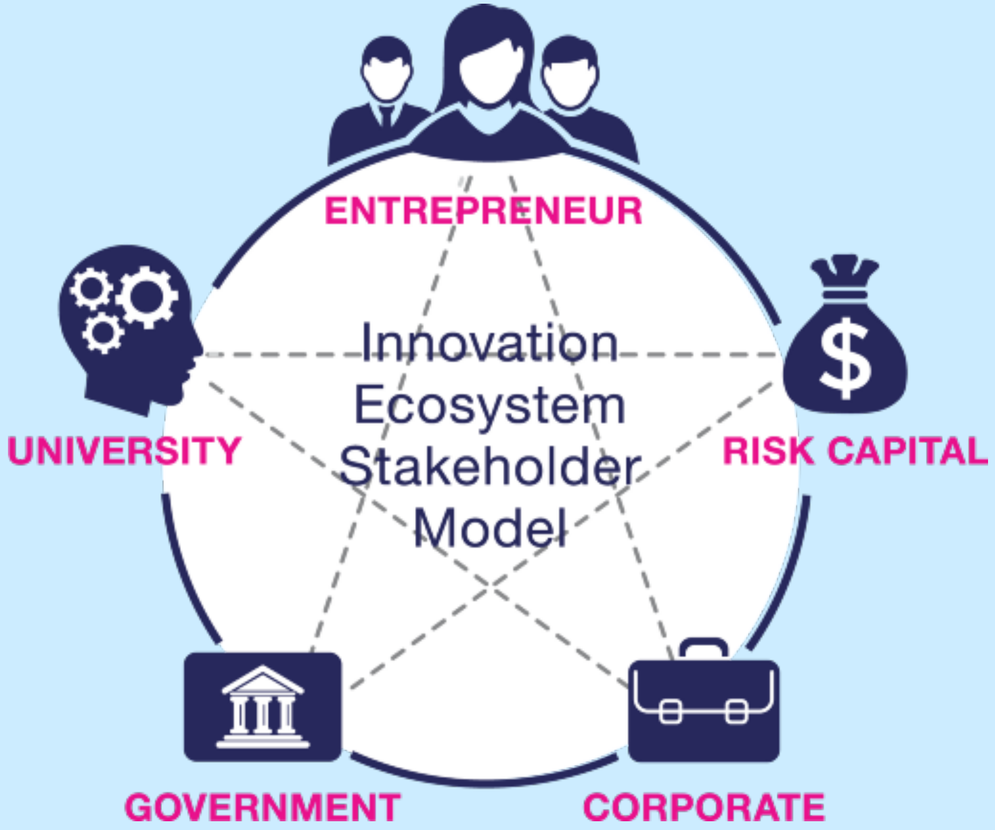
The biggest innovation is…

entrepreneurial innovation

Entrepreneurs, startups, capital, ecosystems, e.g.
- Apple, Amazon, Google, Microsoft
- Facebook, Twitter
- Genentech, Amgen
- 1,000s of others

Credit: Noubar Afeyan of MIT / Flagship Pioneering.

Stakeholders of an Innovation Ecosystem



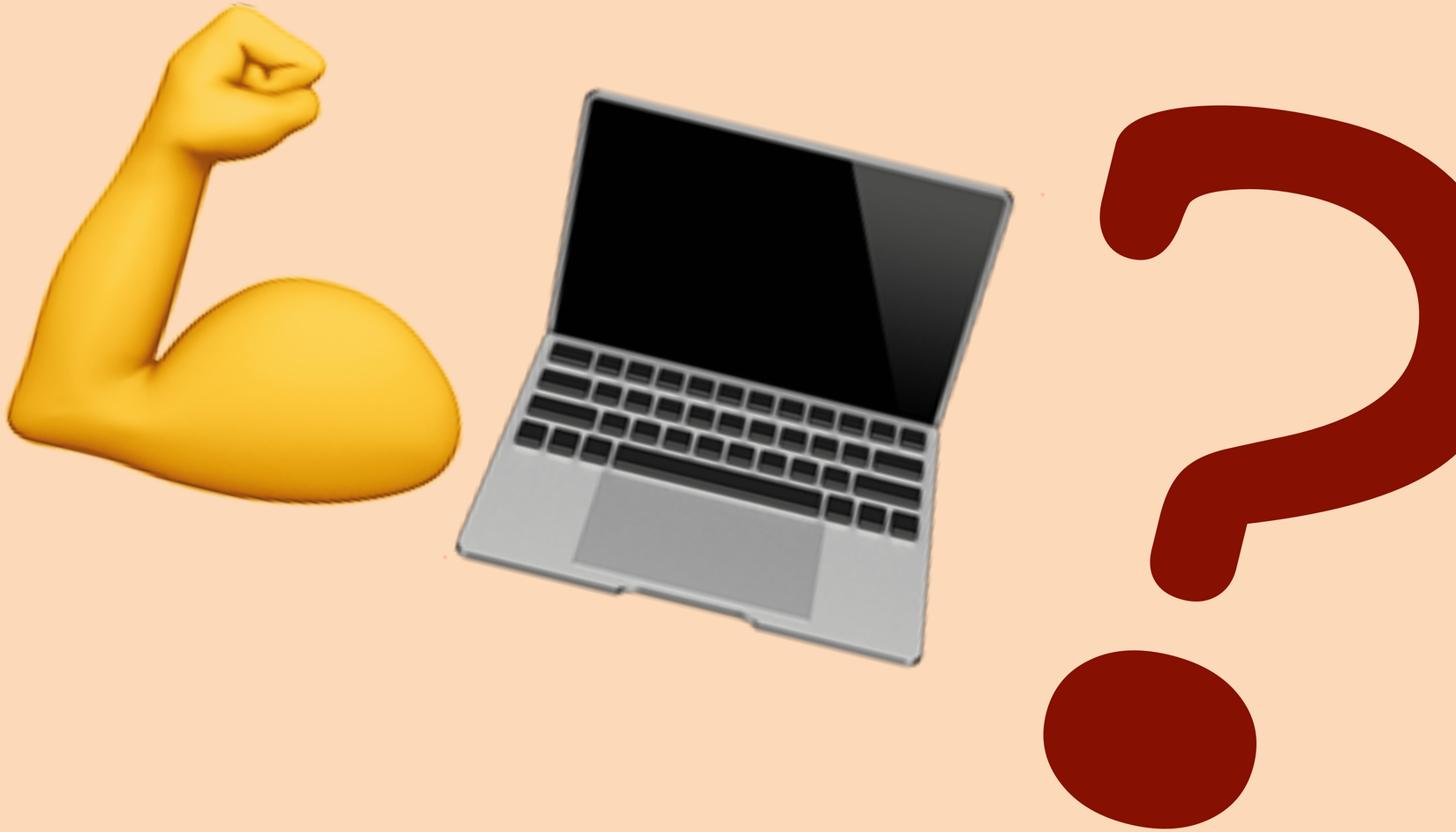
Stakeholder model image source: Fiona Murray et al, MIT Sloan.

2

Tough tech

Decomposing frontier technologies and public-private partnerships

What is tough tech? or deep tech? or frontier tech?



1. Who's Your Ally? How Tech Startups Navigate Venture Capital and Federal Funding, by Jonathan B. Miller

What is tough tech? or deep tech? or frontier tech?

- It is a big bet that is carefully nurtured and de-risked over years
- Origins: labs (or dorms!)

> *Whether spinning out of a pristine laboratory or an unkempt dormitory, tough tech ventures and the entrepreneurs building them may be loosely defined by their work in an* ***emerging area where science meets engineering****, and may sometimes be referred to as working in "deep tech" or "frontier tech".*
>
> ***The markets which such companies could serve may not yet exist****, and the companies' development milestones may be measured in years rather than months.*[1]

1. Who's Your Ally? How Tech Startups Navigate Venture Capital and Federal Funding, by Jonathan B. Miller

What are dual-use ventures?

Deeply-technical startup companies that serve, or could serve, commercial and government clients.

> *Examples of commercial clients include enterprises and consumers. Examples of government clients include the US Department of Defense (DOD), National Science Foundation, or the Department of Health and Human Services. In practice, most observed US-based DuVs work with the US DOD, which has the largest Small Business Set Asides among US agencies.*[1]

Some dual-use examples:

COMPANIES Accion Systems [satellite propulsion], Pison [augmented reality], Catalog [DNA data storage]

MAGNETS The Engine, FedTech, Techstars, 500 Startups

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3 What you can do

Building better feedback loops

Stimulate your learning!
Seek diversity of experiences!

Loop image: https://i.pinimg.com/originals/3a/c7/cd/3ac7cd92f2d4cdf9019904ffd6a7630d.gif

A) **Invite**

B) **Embed**

C) **Engage**

Bring in lateral and external guests to give a talk, to have directed discussions.

Find groups where you're not the smartest person in the room – collaborate with engineers, designers, and other persons with diverse skillsets

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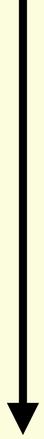


- ☑ *Collaborate with regional entrepreneurship communities*
- ☑ *Reduce time from pitch to contract for small businesses*
- ☑ *Contact the coolest person you can think of and suggest a 2-week collaboration sprint*
- ☑ *Write a short article about an emerging field of interest*
- ☑ *Make a video series about STEM subjects and recent interesting applications*
- ☑ *Sign up for industry newsletters; summarize and share key trends*

Loop image: https://i.pinimg.com/originals/3a/c7/cd/3ac7cd92f2d4cdf9019904ffd6a7630d.gif

4 Where to go for allies

People, programs, readings, podcasts

How to find allies

Alumni / Lab Networks

Ask professors for people with whom to have a ‘curiosity call’

Career Services

Programs

e.g., “Beyond Academia” conferences

‘DIY internships’

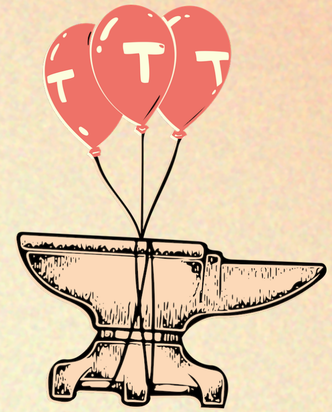
- Pursue orthogonal experiences
- Aim to get what you couldn’t get outside of school
- Doesn’t have to be a traditional, formal internship
- Make it useful for *you*
- The skills you gain are often more useful than where you gained them
- —> importance on framing experiences
- Nontraditional: winternship, collaboration, independent research, creating something new

Welcome

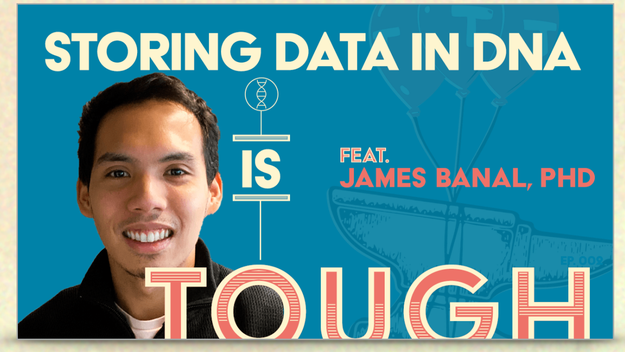
Malvika V. Miller

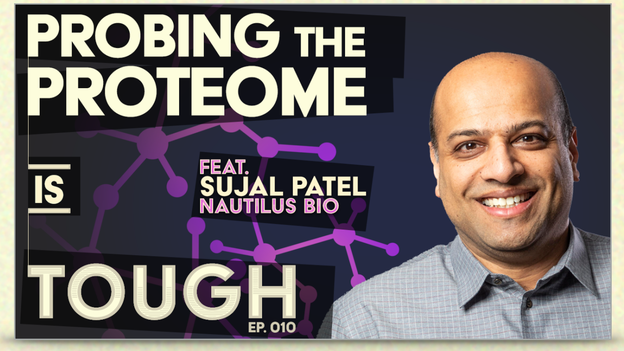
Tune in: **TOUGH TECH TODAY WITH MEYEN & MILLER**

@toughtechtoday



Podcast Episodes...





***Computing with the building blocks of life**, feat. James Banal*
https://toughtechtoday.com/computing-with-the-building-blocks-of-life-with-james-banal/

***Launching dual-use ventures**, feat. MIT's Katy Person*
https://toughtechtoday.com/venturing-into-federal-tech-featuring-will-dickson-and-trinity-torres-of-fedtech/

***Probing the proteome**, feat. Nautilus Biotechnology's Sujal Patel*
https://toughtechtoday.com/probing-the-proteome/

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Joe Lonsdale
@JTLonsdale

1st step to being an entrepreneur in any area -

Make plans that make people uncomfortable. Try to convince others, and defend your ideas.

(And iterate - learn as you get more information.)

Most people are afraid to have a different opinion.

Our society needs more courage!

12:13 AM · Dec 2, 2020 · Twitter Web App

https://twitter.com/JTLonsdale/status/1334002765165715456

Lab-to-Market Commercialization

Bits, Atoms, Brains

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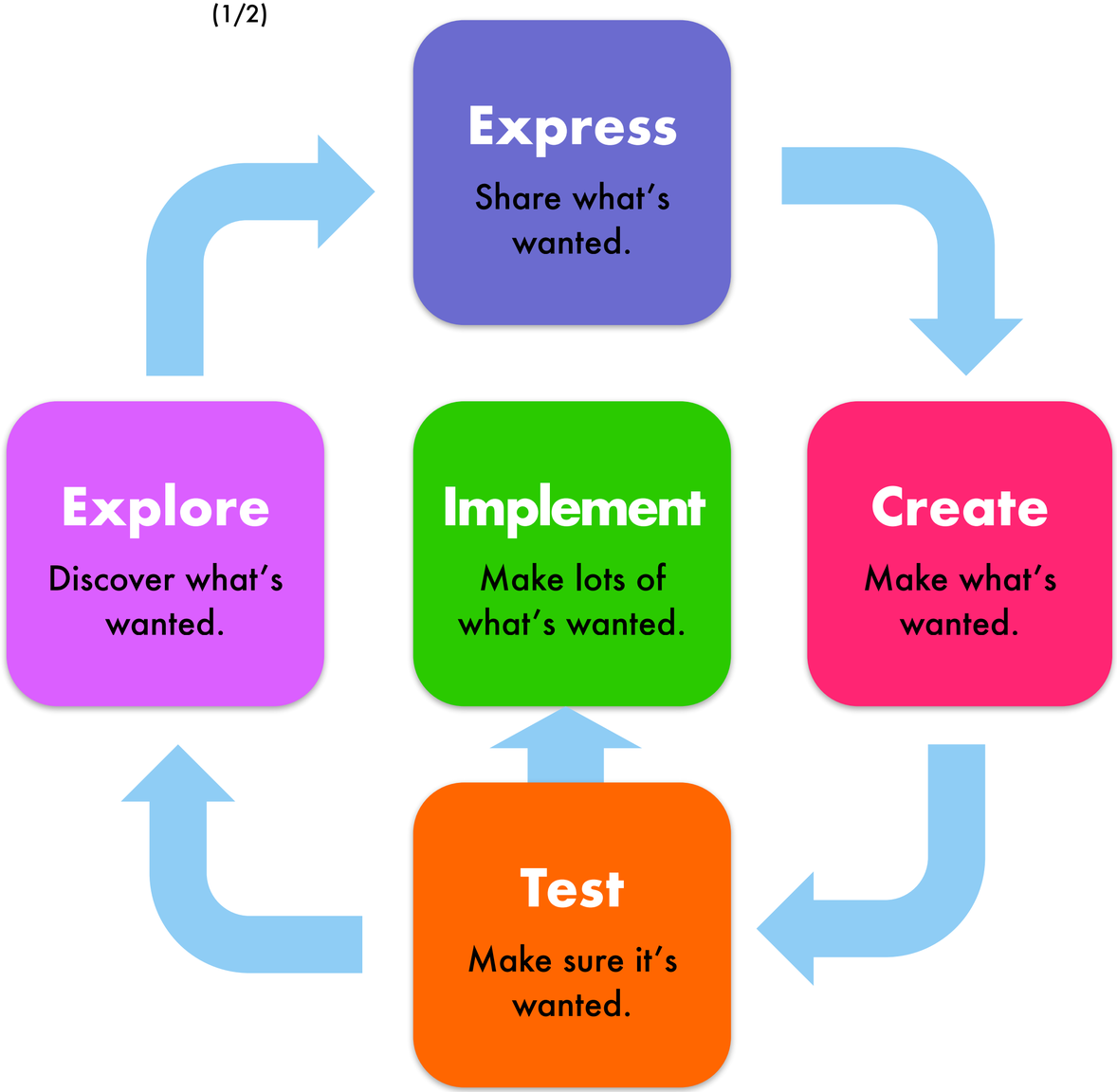
Opportunity Methodology

(1/2)

Driven by *empathy* for the user, my *technology research* and *design process* ensures *stakeholder needs* are discovered, shared, and intrinsic to the end product.



Opportunity Methodology

(2/2)

This process provides structure to abstract concepts, facilitating *design critique* and the *scientific method*.

Methodologies have enabled me to have *impact* in multiple industries.

This sounds qualitative. How do I make it feel less ‘subjective’?

Interviews → Needs List → Product Specs → Selection Criteria

Needs List

Tie product-service specifications to observables

- Captures the problem in spirit and technically
- Informs the Product Specifications and Selection matrices

Need #	User Needs	User Statements	Imp (1-5)
1	The EFNDS is easy to use.	U-3,9,13,18,21/JK-6	5
2	The EFNDS is durable.	U-1,2,14,22/LM-4,5,6,7,8/JK-1	5
3	The EFNDS taste good.	U-6,4,16,20,21/SM-1	5
4	The EFNDS has good tactile feedback.	U-3,9,14,15,21	4
5	The EFNDS can easily modulate concentration.	U-3,21	3
6	The EFNDS stays clean.	U-1,2,13,22,18	4
7	The EFNDS pouch fastens properly with repeated use.	U-7	4

M. Kressy, MIT IDM 2016

D.F.V. METHOD

Convert soft qualities into numerical parameters

		Concept A	Concept B	Concept C
Parameter	Desirability	2	4	3
	Feasibility	3	3	3
	Viability	1	2	4
		8	9	10

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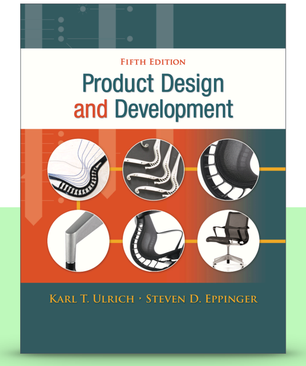
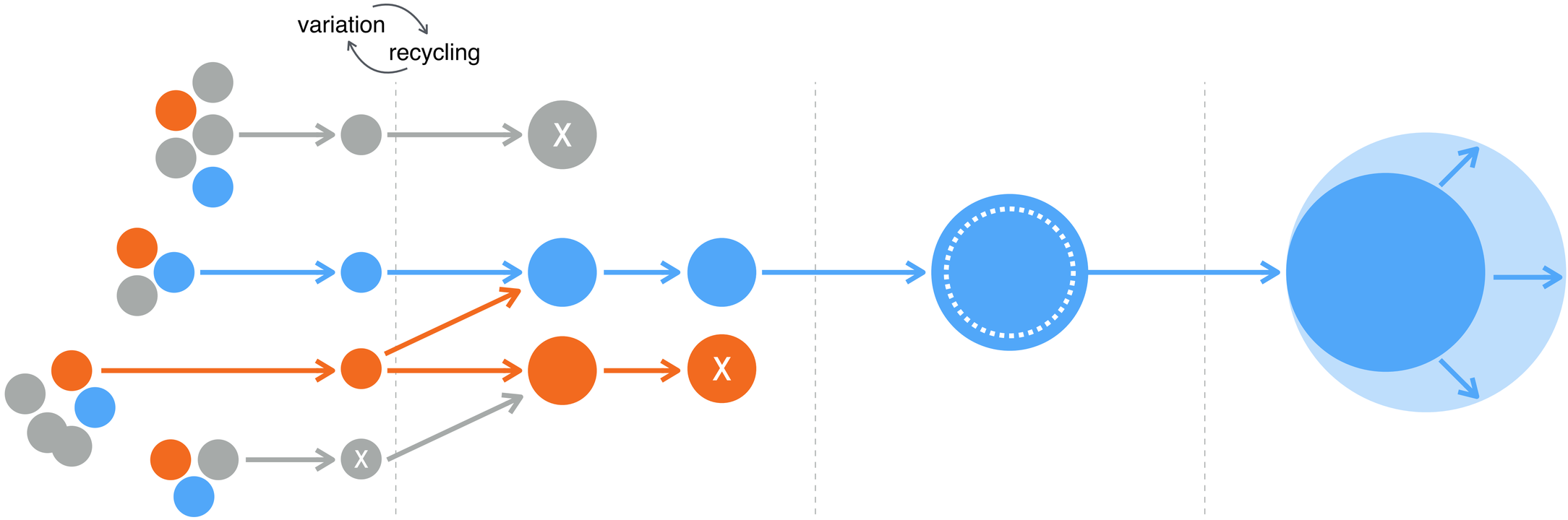


Want even more structure around these ideas? Check out *Product Design and Development* by Ulrich and Eppinger

My process for venture creation starts with seeding hypotheses, evolves to generating IP, then executes on the product platform development plan

VENTURE METHODOLOGY



PHASE 1: Exploration

Hypothesis Generation

PHASE 2: ProtoCo

Feasibility Testing

PHASE 3: NewCo

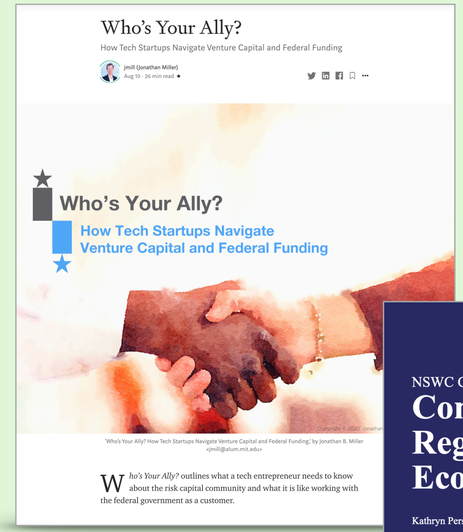
Internal Venture

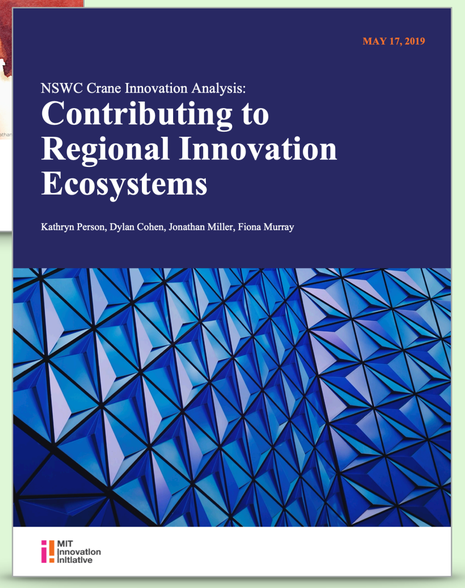
PHASE 4: Venture

External Venture

@imjmill's work on DUVs and tough tech

Writings...





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https://medium.com/@iamjmill/whos-your-ally-e2ff6068cd3a

NSWC Crane Innovation Analysis: Contributing to Regional Innovation Ecosystems

https://innovation.mit.edu/document/nswc-crane-innovation-analysis-contributing-to-regional-innovation-ecosystems/attachment/nswc-crane-report_/