

From Lab Bench to Innovation: Critical Challenges to Nascent Academic Entrepreneurs

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MIT VMS

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- Reporting to the Provost, primary mission is educational across all schools
- VMS harnesses the knowledge and experience of volunteer business leaders to help innovators learn how to bring their ideas and inventions to market.
- VMS is part of the MIT entrepreneurial ecosystem
- Key info (as of 1/1/13):
 - Founded in 2000
 - >2,200 entrepreneurs in >1,300 venture ideas served
 - ~12 new monthly
 - >160 have launched as companies / raised over \$1.3B funding
 - 26 companies have had liquidity events totaling >\$1B
 - ~165 ventures currently working toward launch
 - 150+ active mentors







Inc. How to launch a COOL, PROFITABLE, WORTH-ALL-THE-RISK, KICK-ASS START-UP



ELIE OFEK
JILL AVERY

Nanda Home: Preparing for Life after Clocky

When you seek out a partner in life, you're looking for personality, intelligence, a sense of humor. Why should the objects we share our lives with be any different?

— Gauri Nanda, Founder of Nanda Home

As she was preparing to go to bed on a cold night in January 2011, Gauri Nanda reflected on the astonishing trajectory of the company she had founded, Nanda Home, and the source of its rapid growth, a quirky alarm clock named Clocky. Launched in late 2006, Clocky had been an instant success, selling more than 220,000 units in its first two years. During the four years since the launch, the 30-year-old Massachusetts Institute of Technology (M.I.T.) graduate had achieved a bit of a celebrity status herself, being featured on the cover of *Inc.* for an article entitled "How to Launch a Cool, Profitable, Worth-all-the-Risk, Kick-Ass Start-Up" and appearing on television programs and in magazines including *Good Morning America*, *The Today Show*, *Marie Claire*, *Esquire*, *Parents*, *Self*, *Better Homes and Gardens*, and *The New York Times*.



ELIE OFEK
ELIOT SHERMAN

Clocky: The Runaway Alarm Clock

Having the alarm clock hide from me was just the most obvious way I could think of to get out of bed.

— Gauri Nanda

Gauri Nanda paused to catch her breath. The 27-year-old Massachusetts Institute of Technology (M.I.T.) graduate student was in the midst of a P.R. blitz that was unlike anything she'd experienced in her life—articles, interviews, and television appearances that had culminated, most recently, with a spot on *Good Morning America*. ABC's erstwhile morning news show. And she wasn't finished: next scheduled was a guest appearance on the *Today Show*. *Good Morning America*'s NBC counterpart. October 2005, and the foreseeable future was looking busier by the day.

Source of all the attention, the result of years of hard work on Nanda's part at M.I.T.'s Media Lab, an innovative alarm clock named Clocky (see *Exhibit 1* for a picture). Clocky was designed by a graduate student who had difficulty getting out of bed in the morning. In addition to emitting a repetitive alarm, Clocky could jump off a nightstand and roll around the room like a normal alarm clock. Clocky could go in a random direction every morning, ensuring a successful wake-up. Owners could go in a random direction every morning, ensuring a successful wake-up. Owners could go in a random direction every morning, ensuring a successful wake-up.



Motivation for the research

Understand why science-based ventures seem different from other technology startups.

Observed:

1. Science based ventures appeared to take much longer
2. Confusing patterns resulted from help provided
3. Seemed to be struggling with their technology even though they thought it was ready
4. Faculty entrepreneurs aren't usually leading the startups.
5. Environmental hype about entrepreneurship and innovation (Entrepreneurial Cargo Cult)



My Message

1. Science-based startups are not just baby high technology ventures – they are different.
2. Students are important academic entrepreneurs.
3. How and why academic entrepreneurs start their ventures is different too.
4. Innovation has a long nose.

Research problem / background

- Universities are a significant source of new knowledge that leads to the innovations which are seen as important to economic and societal well-being.
- Changes in our innovation system are increasing the demand for research universities to generate new inventions and technologies.
- But invention alone is not innovation. Innovation requires being put into practical use (commercialization).
- One route for technology transfer is spinning out a new venture to take new knowledge to the market.
- A growing number of academics are becoming entrepreneurs and creating new ventures based on their discoveries.
- Evidence suggests that **Nascent Academic Entrepreneurs (NAEs)** face challenges beyond those of traditional technology startups.
- Limited research exists on how they emerge and the obstacles they encounter

Research purpose

The purpose of this inductive multicase study is to examine and understand the process and key challenges faced by NAEs at the Massachusetts Institute of Technology (MIT).

Research question

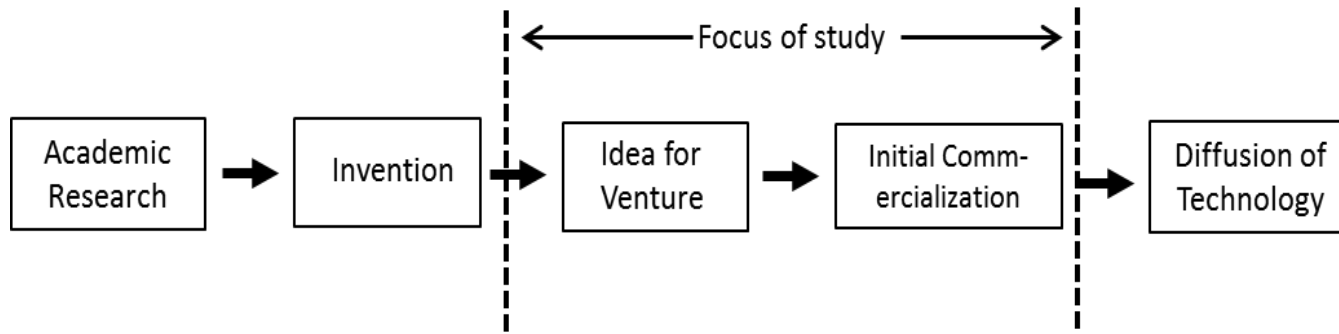
What are the critical challenges experienced by nascent academic entrepreneurs in their emergence process?

Definition of NAE

- A researcher at a university (faculty, staff, or student)
- Who has left the university, or intends to leave, to devote full-time attention to the development of a company
- Based upon basic research that originated at the university and in which they were significantly, if not principally, involved.
- First time entrepreneur (not serial)

Research Setting

- Site chosen because author has unique access to population of NAEs and robust, longitudinal archival data
- The invention as basis for the entrepreneurial effort was significant
- Focus is on NAEs at idea inception through initial commercialization



Comments on NAE definition

Prior literature and popular media tend to focus on faculty entrepreneurship

BUT – rare that they were the DRIVING entrepreneurs of ventures based on their university research

Many kinds of entrepreneurial roles, but being entrepreneurial is not the same as being the driving entrepreneur

Creating a venture and leading it takes FT commitment by someone

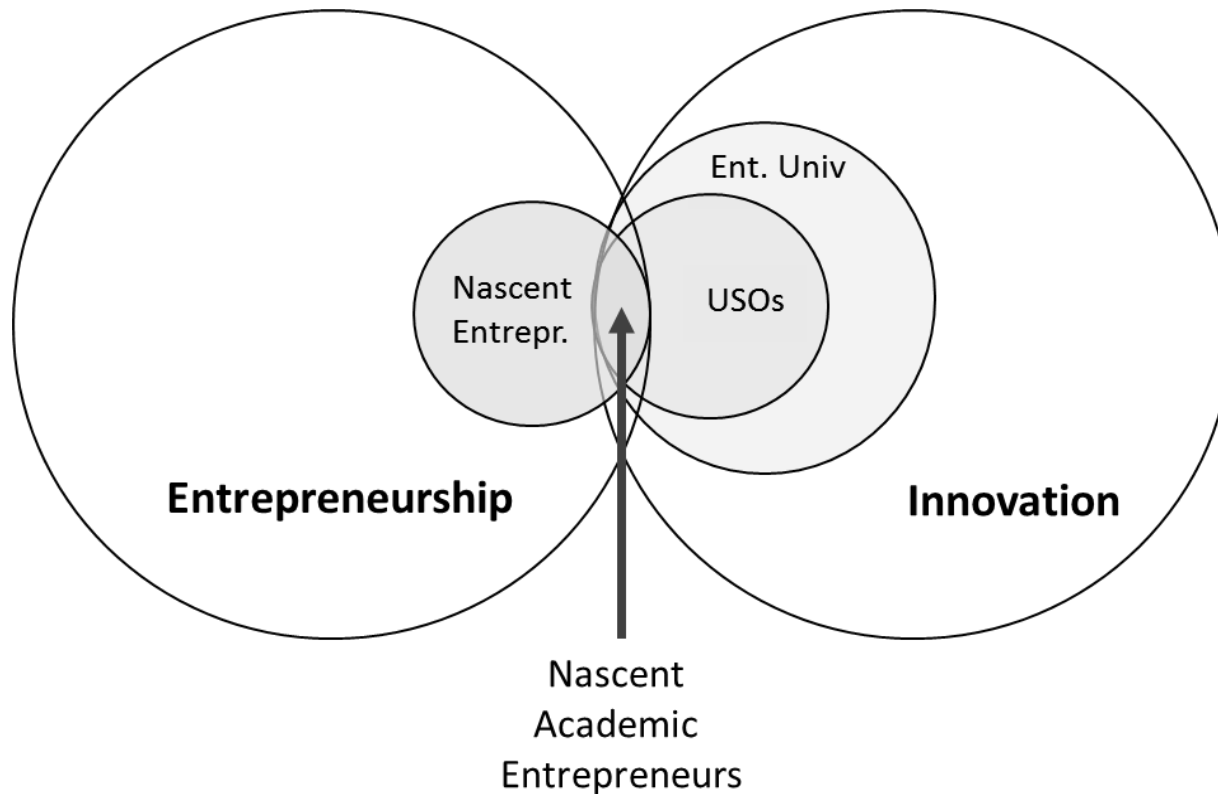
Faculty typically have a 3rd party to do this – often an experienced entrepreneur from industry

It's a perfectly fine way!

Intention is not to diminish importance of faculty entrepreneurship, but to reveal others who have previously been obscured

Adding 2 words – Full Time – reveals other academics that are actually the driving entrepreneurs. Expected to see PhD students.

This research is positioned at the intersection of two broad fields of study – innovation and entrepreneurship.

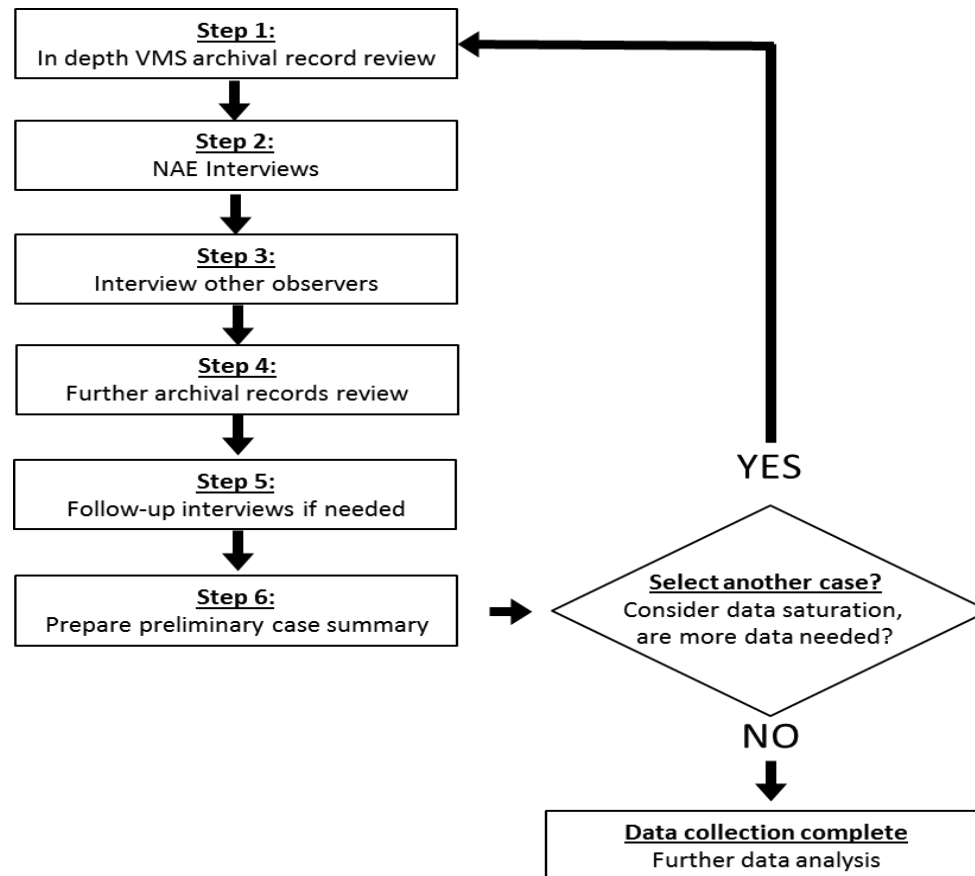


Entrepreneurship domain
Entrepreneurship
Nascent entrepreneurs

Innovation domain
Innovation
Entrepreneurial universities
USOs (university spinoffs)

Research approach – following Eisenhardt (1989)

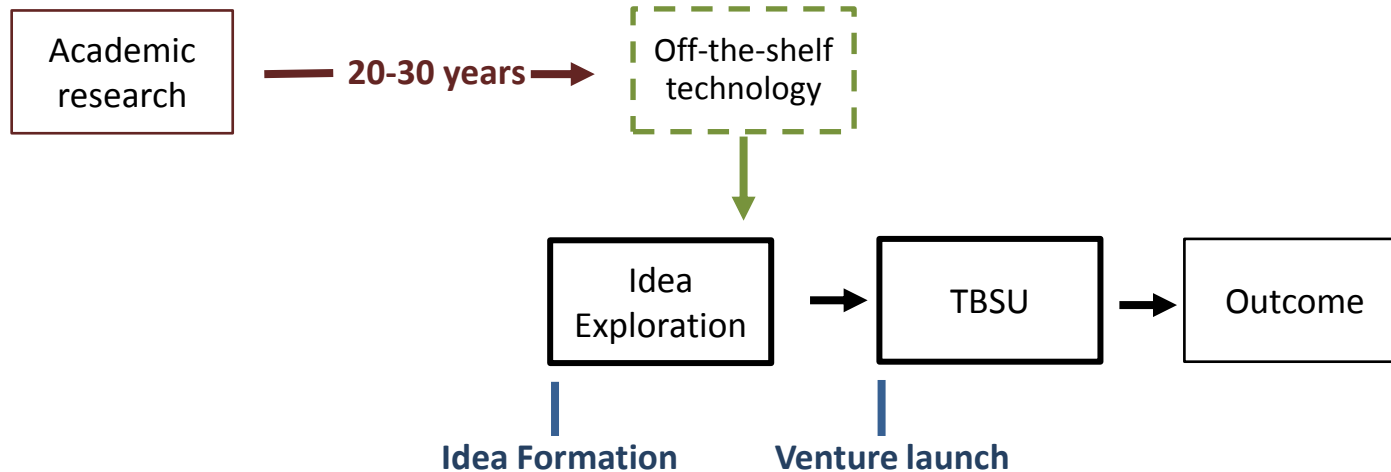
- Qualitative, inductive, multi-case study
- Multiple data sources: semi-structured open-ended interviews, longitudinal observations, archival data, participant review, audience review
- *Note: VMS archival data has thousands of documents for the ventures studied over life from inception.*



Key Findings

1. Evidence that NAEs undergo a unique process and spend most of their time in a research phase where they must first finish creating the technology before they can begin using it
2. The phases of the process differ in their objectives, views of opportunities, structure, resources needed, funding sources and role of the NAE.
3. Almost all the NAEs were PhD students pursuing ventures based on their research when they started their venture activities and the exploration phase was critical in launching.
4. NAEs face potentially serious conflicts, especially if they form a company before graduating.

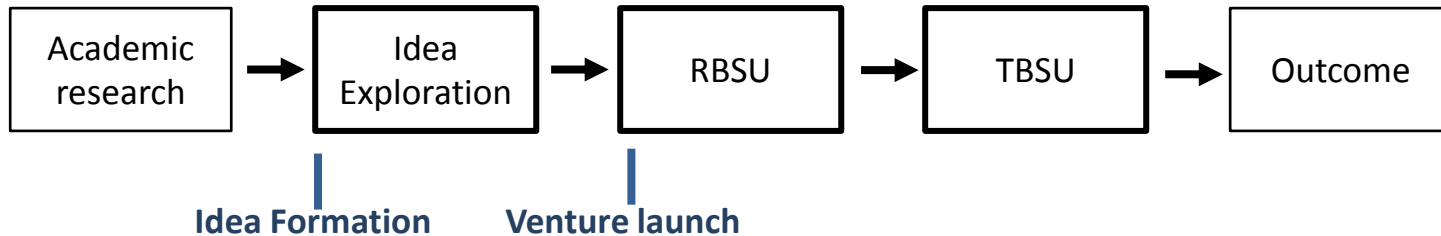
Typical high technology startup process



Technology Based Start Up (TBSU)

- Targeting a specific entrepreneurial opportunity – a product or service
- Use existing technologies that are already on the shelf and well understood
- They combine them in creative and novel ways
- They may push the engineering to new levels of performance / may be hard

Academic venture process (*from lab bench*)

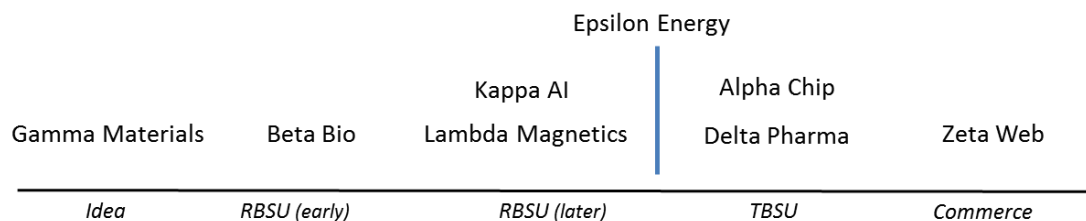


Academic ventures have to first finish creating the technology before they can begin using it

- Academic research creates knowledge
- But it is too embryonic to use
- This means someone has to do a bunch of science / research
(finding new questions / NOT predictable or plannable)
- They launch as a Research Based Start Up (RBSU)

Case description summary

| NAE Name | Venture Name | Industry / discipline | NAE | Current / Ending Status | Status/Outcome | Years in phase | | | | |
|-----------|------------------|---------------------------------|---------|-------------------------------|-----------------------------------|----------------|------|------|------|-------|
| | | | | | | Idea | RBSU | TBSU | Comm | total |
| Founder1 | Gamma Materials | materials / materials | student | Idea / early science | In progress / plan RBSU | 0.5 | – | – | – | 0.5 |
| Founder2 | Beta Bio | biotech / biology | student | RBSU early science | in progress / plan TBSU | 0.5 | 1 | – | – | 1.5 |
| Founder3 | Kappa AI | software / AI | student | RBSU / attempting TBSU | Failing | 4 | 6 | – | – | 10 |
| Founder4 | Lambda Magnetism | magentics / physics + materials | faculty | RBSU / pre commercialization | Failed | 1 | 10 | – | – | 11 |
| Founder5 | | magentics / physics + materials | student | | | | | | | |
| Founder6 | Epsilon Energy | energy / chemical eng | student | TBSU / pre commercialization | in progress / plan TBSU | 1 | 8 | 1 | – | 10 |
| Founder7 | Alpha Chips | computing / physics | student | TBSU / pre commercialization | intelligent outcome / acquisition | 2 | 7 | 1 | – | 10 |
| Founder8 | Delta Pharma | pharma / chem eng | student | TBSU / pre commercialization | intelligent outcome / acquisition | 2 | 5 | 1 | – | 8 |
| Founder9 | Zeta Web | software / signal analysis | student | TBSU / post commercialization | in progress / growth | 1 | 3 | 2 | 2 | 8 |
| Founder10 | | software / NLP | student | | | | | | | |



It takes a long time to go from idea to commercialization for these ventures.



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The RBSU phase takes the most time – much longer than they expected



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Challenges in RBSU phase

It's still science – can't be too surprised if things don't work...

"We realized that there was a fundamental flaw... It needed to go back to the lab. And so we downsized the company back to basically me and 3 scientists... We had no idea what the outcome was going to be." (Founder8 – Delta Pharma)

Difference between academic and real-world research

"The biggest thing that I couldn't have anticipated was people. I figured it'll just be like MIT, like you get smart people who make stuff, like they'll be awesome, I'll be awesome. But then you've got to figure how to build them into a team..." (Founder7 - Alpha Chips)

Getting resources for critical mass

"You sort of need a critical mass to make real progress... I've now got a bigger team here now than any academic does in their lab... If we had more money we could be at least three years ahead of where we are today..." (Founder 6 – Epsilon Energy)

Many NAEs are students when they start the venture process



| | | | | | | Years in phase | | | | |
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Founder7 - Alpha Chips



They sent out an email around 5pm and “Free sandwiches!” was the title of the email.

And I’d been in the lab since earlier that day and hadn’t gotten lunch so I was really tired and hungry and was like, “Free sandwiches, alright I’m going to that!”



And then it was actually two or three HBS students who had crashed the party who came up to me and said kind of like, “Got technology?”

And I was like, “Well, you know, this is what I’m working on for my thesis,” and they said, “Well, you know, we want to write a business plan for this contest. We want to win and we think it’s going to take eight Saturdays to do that.”



So since I didn't have a girlfriend at the time
so I was like, "Okay, that's fine."

Serendipity



Evolution and challenges of NAEs – as academics

Started off with purely academic motivations

- Research originally curiosity driven
- Seeking research projects that are cool and have potential for impact
- Upon seeing promising results, begin to envision possible future applications
- They expect their career paths are to be professors and researchers
- They think they'll publish papers about it, that the university will file patents
- Initially believe someone else will license it and do something with the technology, not them

Evolution and challenges of NAEs – idea inception

But they have some curiosity and openness to entrepreneurship

- Use the technology as basis to explore – not really expecting to do it
- Use the ecosystem to explore
 - First stop: other student academic entrepreneurs
 - The recommendations:
 - enter a business plan competition,
 - enroll in VMS

Evolution and challenges of NAEs – exploration

Business plan competitions are a key trigger

- Provides structure with deadlines to push them to act upon the idea
- Fun and interesting way to explore their technology as a possible business
 - but mostly for “fun”, certainly not committed to start a venture
 - business / startup world is unknown to them – somewhat mysterious
 - often team up with B-school students to supply the business knowledge

Evolution and challenges of NAEs – exploration

- During course of the competition
 - find there's really no “magic” to business once they learn the language
 - find that business school students are typically pretty “green”
 - gain confidence in their own abilities to make business decisions
 - get “pressure tested” evidence that future business opportunities exist
- By the end, they realize two key things
 - that the plan submitted to the competition is not real-world
 - that the technology is not ready yet – too early to license effectively

Evolution and challenges of NAEs – decision to launch

- Their motivations and expectations are different from the conventional wisdom of exploiting an entrepreneurial opportunity for economic gain
- The driving factor for these academic entrepreneurs is technological gain
 - Believe that their technology is important and can make an impact
 - but that it is too early and embryonic to be licensed effectively
 - and that without them starting a company to develop the technology further, it will languish and never see the light of day.

Evolution and challenges of NAEs – decision to launch

- They see it as their responsibility – a mission – to make it real
 - watching the technology unfold further is a big kick
 - economic gain is farther down the list as a driver
 - and they view their oppty cost as low since they're students and believe they can move on if it doesn't work out
- When they actually launch, it's without the B-school students

Conflicts – faculty

If they launch while still students – can run into conflicts with faculty

- Policies against (faculty can't be involved financially in businesses of students)
- Mis-calibrated expectations

Conflicts – faculty

For example:

“I was still finishing up my PhD and we’re kind of haggling on how to split up this company” - *Delta Pharma*

“He believed I was trying to deceive him, or somehow rob him of his rightful share of equity by being reluctant to discuss equity while I was his student.” - *Beta Bio*

“I would love to stay and get my PhD... But there are just so many things that wouldn’t work out... I need to withdraw... I’m not going to finish this last year I don’t think.” - *Gamma Materials*

Those that formed a company and launched after graduating – no problems.

Conflicts – business plan competition

Problems with business plan competition team members

- Especially business school students
- who want to launch venture according to plan and believe they are part of a company
- Mismatched expectations and unclear agreements

Conflicts – business plan competition

“It’s the constable delivering a notice I’m being sued... if I don’t show up in court... it shuts down the whole thing... I had no money in the company, I had not even gotten my PhD yet, I had no prospects of money... ” - *Delta Pharma*

“We did have an issue with some of the business guys on the team. There were some threats made... we worked it out. I’ve heard a lot of stories and ours wasn’t really all that bad... But I’ve heard of some total horror stories from competition.” – *Epsilon Energy*

“They tell you to make a founder’s agreement in the competition. We learned it’s not a good idea... You know nothing at that point and... all that does is set expectations that should’ve never been set. We’re fixing it, but... no matter what we’re going to end up destroying friendships and relationships.” - *Gamma Materials*

Key Conclusions

1. Science-based ventures are different from high tech ventures

- Start as RBSU, a distinct and unique phase that distinguishes them, takes a long time.
- Challenges increase if treated as if regular high tech ventures.

2. Students are important pathways for university tech transfer

- Almost all NAEs in study were students when idea formed.
- Biz plan competitions are very important, though not in ways expected.
- May be more serendipitous than deliberate / exploration period is journey of discovery.
- As academic and research career options become more limited, more student NAEs are likely.

Key Conclusions

3. Technological opportunity is driver of RBSU launch

- In contrast to views of entrepreneurial opportunities
- Shifts to EO at TBSU

4. Using technology lens, process points to distinct phases

- The NAV is different in configuration and focus at each phase, transitions are key challenges
- Most critical is from RBSU to TBSU, can get stuck in RBSU

5. NAEs who form companies and launch as students encounter conflicts

- Some dissonance in messaging to students and policies / programs/ stakeholders
- Mis-matched expectations
- Conflicts are likely to increase unless resolved

Different configurations and issues at each phase

| | | Phases | | | |
|-----------------|-------------------------------|---|---|--|--|
| | | Academic Research | Idea Exploration | RBSU | TBSU |
| Characteristics | Technology maturity | Create knowledge | Too embryonic for use or licensing | Finish creating the technology | Begin using the technology |
| | Entrepreneurial Opportunities | Scientific discoveries create possibility of future opportunities | Evidence for belief some opportunities are possible and valuable | Monitor for changes in possible opportunities | Identify a specific initial commercialization opportunity |
| | Technological Opportunities | Discover, publish, patent | Understand technology requirements to satisfy entrepreneurial opportunity | Continue research to satisfy requirements of entrepreneurial opportunity | Adapt and embody technology in initial commercialization opportunity |
| | Organization | Academic lab | Ad-hoc / temporary project | R&D Lab | Product Company |
| | People | Academics | Part-time, ad-hoc / ecosystem | Mostly scientists and researchers | Mix of researchers and business / customer facing people |
| | Funding | Sponsored research | Personal, friends and family | Grants, investment from non-strangers | Investment from strangers |
| | NAE role | Researcher | Researcher and project leader | R&D Leader | Decide on role, business or technical leader |

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Implications – management practice

NAEs – current and prospective

- Use mechanisms in the local entrepreneurial ecosystem to explore and learn.
- Especially about the technological requirements you need as a target.
- Understand the phase they are in and the configuration / issues to focus on – will conserve resources and extend runway.
- Be aware of potential conflicts and be proactive to prevent – if student, try to wait to graduate before forming a company.

Implications – management practice

Institutions and policymakers

- Recognize that academic ventures are increasing and students as NAEs likely to rise
- Support programs should not treat NAEs and typical entrepreneurs the same
- Mixed and unclear messages – single set of principles for all stakeholders
- Find ways for students to explore and progress without forming a company until after graduation.

Implications – management theory

- Reconceptualized process technology maturity – simplifies, fewer stages, eliminates much of the iteration in prior models.
- New knowledge about duration of emergence process and within phases, especially the RBSU. New knowledge about duration of emergence process and within phases.
- Adds to knowledge in terms of entrepreneurial opportunities with insights into the genesis of technology-based opportunities
- Also that NAEs are initially motivated by technological opportunity, in contrast to common view of economic gain.
- In contrast to prior literature, students are also significant actors as NAEs.
- Results reveal serious conflicts which have limited research, adds to conversation about entrepreneurial universities and academic capitalism.

The Long Nose of Innovation

New Technology

Lab Bench
Idea



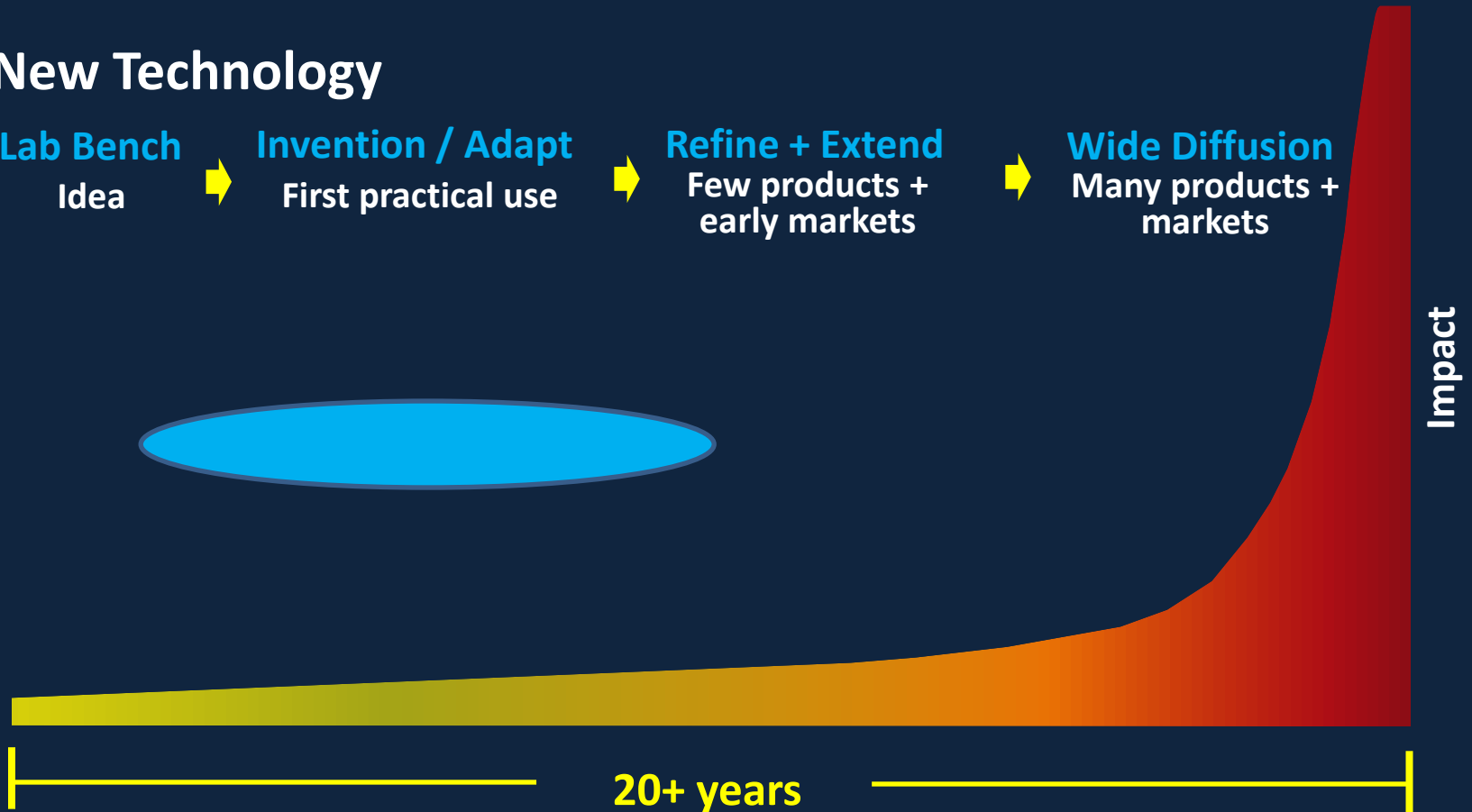
Invention / Adapt
First practical use



Refine + Extend
Few products +
early markets



Wide Diffusion
Many products +
markets



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Questions?

Roman M. Lubynsky

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