The NSF I-Corps Program @ MIT

The Scientific Method applied to Entrepreneurship

Roman Lubynsky
MIT I-Corps – Director, PI
New England I-Corps – Director, co-PI
VMS - Mentor, Program Director

rml@mit.edu
WHAT IS I-CORPS?
I-Corps first program to apply lean startup principles to complex engineering, technology, and science based startups
I-Corps originally designed for federally funded academic researchers still in the lab.

10,000+ Researchers across US
1,700+ National Teams
400+ MIT Teams
An Act

To invest in innovation through research and development, and to improve the competitiveness of the United States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) Short Title.—This Act may be cited as the “American Innovation and Competitiveness Act”.

TITLE VI—INNOVATION AND TECHNOLOGY TRANSFER

SEC. 601. INNOVATION CORPS.

(a) Findings.—Congress makes the following findings:

(1) The National Science Foundation Innovation Corps (referred to in this section as the “I-Corps”) was established to foster a national innovation ecosystem by encouraging institutions, scientists, engineers, and entrepreneurs to identify and explore the innovation and commercial potential of National Science Foundation-funded research well beyond the laboratory.

(2) Through I-Corps, the Foundation invests in entrepreneurship and commercialization education, training, and mentoring that can ultimately lead to the practical deployment of technologies, products, processes, and services that improve the Nation’s competitiveness, promote economic growth, and benefit society.
Importance of Tech Transfer

- The NSF annual budget is over $8 Billion
- “To promote the progress of science; to advance the national health, prosperity, and welfare...”
- Technology is primary driver of the economy and societal well-being
- To achieve this impact, new inventions and discoveries in university labs must be put into practical use (commercialization)
- Many pathways for tech transfer:
  Licensing to large companies, new companies, and academic startups
What problem does it solve?

– Only a few new technologies make it
– The NSF found that the majority of their SBIR grant recipients never made it to commercialization
– The reason was not that the technology didn’t work
– And not that the thing they built wasn’t cool
– But that they built the wrong thing – something people didn’t need or want
– By this point, used up the grant $ / no do-overs, out of runway...
97% of all documented ideas fail
75% of all VC backed ideas fail
TOP 10 STARTUP MISTAKES

#1 Building something nobody wants
   Score: 300
   36% of Tot.

#2 Hiring Poorly
   Score: 153
   18% of Tot.

#3 Lack of Focus
   Score: 112
   13% of Tot.

#4 Fail to execute Sales & Marketing
   Score: 98
   12% of Tot.
I-Corps focuses on:
Customer Discovery

How NOT to build something nobody cares about
The Big Idea:

Customer Discovery
understanding who will buy and why
before building anything
Scientific Method applied to Entrepreneurship

- **WHAT PROBLEMS** do you think the technology solves
- **WHO** do you think has that problem (customers)
- **WHY** do you think it’s valuable to solve it

- Start with your best guesses (hypotheses)
- Conduct experiments: **Talk to customers**
- Not about creating a venture – about understanding
- And collecting evidence to inform your decision making
How can this help me?

– Explore the commercial possibilities of your research
– Identify best pathways – not just startups
– Influence your research direction
– Prepares you to engage with ecosystem
– Develop evidence for making informed decisions
– We’ll provide $1,500 to start
– You may qualify for up to $50K from NSF
– Increase odds of getting an SBIR/STTR in future
– Professional and career development
OTHER OUTCOMES:

I-Corps is more than just about creating startups
- Also about using entrepreneurial exploration for researchers to build new skills.
- Participants report the program has positively impacted their professional development as well as how they approach their research.

- 100% report learning new skills
- 100% report research direction influenced
- 100% would recommend program to others
- Built confidence in self and research
- Modified career thinking / Illuminated career path options
About customer discovery

You are going to run experiments

- Formulate and test hypotheses
- Update your understanding
- Re-formulate your understanding based on new data

I-CORPS PROCESS

HYPOTHESIS
TEST
ASSESS | ANALYZE
ADJUST OR PIVOT
About customer discovery

A Data-Centric Approach Applying the Scientific Method

• **Hypothesis:**  
  - Here’s What We Thought

• **Experiments:**  
  - Here’s What We Did

• **Results & Insights:**  
  - Here’s What We Learned

• **Action:**  
  - Here’s What We Are Going to Do Next
Wash, Rinse, Repeat…
Get out of the building!
What is this all based on?

• Lean Startup framework from Steve Blank
  – Customer Discovery and Validation
  – Business Model Canvas
Plus ...

Disciplined Entrepreneurship

by Bill Aulet
What is a startup?

Temporary organization designed to search for a repeatable and scalable business model
What is a Business Model?

Companies are organized around a BUSINESS MODEL

How a company CREATES and DELIVERS value
Startups
Search

Customer Discovery
Customer Validation

Companies
Execute

Customer Creation
Company Building
Four key elements of a Business Model

PRODUCT-MARKET FIT
FINANCIAL MODEL
GO-TO-MARKET STRATEGY
OPERATIONAL EFFICIENCY
Product-Market Fit

- Key Partners
- Key Activities
- Value Propositions
- Customer Relationships
- Customer Segments
- Key Resources
- Channel Partners
- Cost Structure
- Revenue Streams

Product-Market Fit (Product-Market Fit):
- Key Partners
- Key Activities
- Value Propositions
- Customer Relationships
- Customer Segments
- Key Resources
- Channel Partners
- Cost Structure
- Revenue Streams
Financial Model

<table>
<thead>
<tr>
<th>KEY PARTNERS</th>
<th>KEY ACTIVITIES</th>
<th>VALUE PROPOSITIONS</th>
<th>CUSTOMER RELATIONSHIPS</th>
<th>CUSTOMER SEGMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY RESOURCES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COST STRUCTURE | REVENUE STREAMS
Go-To-Market Strategy

- Key Partners
- Key Resources
- Value Propositions
- Customer Relationships
- Channel Partners
- Customer Segments
- Cost Structure
- Revenue Streams
Using the BMC

- We begin with a blank canvas
- We are acknowledging that we **DO NOT KNOW** the answers. We are **GUESSING**.
- We’re on a **SEARCH** for the answers. Answers are “Outside of the Building”.

Using the BMC
Using the BMC

• We begin with a blank canvas
• We are acknowledging that we **DO NOT KNOW** the answers. We are **GUESSING**.
• We’re on a **SEARCH** for the answers. Answers are “Outside of the Building”.
• Our initial guesses may be wrong.
• So we may **ITERATE** and/or **PIVOT**.

**Using the BMC**
YOUR STARTUP NEEDS TO BE A SEARCH PARTY
How **NOT** to build something nobody cares about

Identify and validate a problem or need in the market that enough people care about.
To Accomplish This
Get OUT of the building
I-Corps Customer Discovery is Evidence-based Entrepreneurship
Talk *(listen)*

to customers...
Test the Problem first
Test the Solution second
All Done by talking and listening to customers...
1. Write **description of item** on top of page

2. Find a **Partner** and swap pages
1. **Create Interview Guide: ~3 Questions**
   
   Explain *what you bought and why?* (drill down on *WHY*)
   
   - What was the *problem/need* you were solving?
   - What was the *process* from *need/desire* to *acquisition*?
   - What other *options/alternatives* did you consider?
   - How did you decide to buy it? Who/What did you consult?

2. **2 minute interview… take notes**

3. **Switch**
Customer Discovery

**Process Steps**

- Identify the Customer
- Understand "Jobs-to-be-Done"
- Design Value Proposition
Identify the Key Individuals in the Purchase Decision
Typical roles include:

End Users
Decision Makers
Payer
Influencers
Identify the person not just the company or where they work
Customer Discovery

**Process Steps**

1. Identify the Customer
2. Understand “Jobs-to-be-Done”
3. Design Value Proposition
What is the progress that a customer desires to make in a particular circumstance?
Customers “hire” products / services to get jobs done...
..which means customers have to “fire” other solutions or overcome inertia of doing nothing
Customer Discovery

**Process Steps**

1. Identify the Customer
2. Understand “Jobs-to-be-Done”
3. Design Value Proposition
Design your Value Propositions to meet these needs
For Powerful VPs: Quantify Metrics for Success
Understand how the customer defines Better or Success
Different Roles may have different Value Propositions
How to ensure you’ll have a viable biz model?

Nail

Product / Market Fit
MIT I-Corps Focus: *Product Market Fit*

**The Business Model Canvas**

- **Key Partners**
  - Who are our Key Partners?
  - Who are our key customers?
  - Which are the most important customers?

- **Key Activities**
  - What key activities does Value Proposition require?
  - What is the most important activity?

- **Key Resources**
  - What key resources does Value Proposition require?
  - What are the most important resources?

- **Value Propositions**
  - What value do we deliver to the customer?
  - What bundle of products and services are we offering to each Customer Segment?
  - Which customer needs are we satisfying?
  - How do we make money?

- **Customer Relationships**
  - What type of relationships does each Customer Segment expect us to establish and maintain with them?
  - How many have we established?
  - How are they aligned with the rest of our business model?

- **Customer Segments**
  - For whom are we creating value?
  - Which are our most important customers?

- **Channels**
  - Through which channels do our Customer Segments view us?
  - How do we establish them?
  - How are they aligned with the rest of our business model?

- **Cost Structure**
  - What are the most important costs in our business model?
  - Which activities are most expensive?

- **Revenue Streams**
  - For what value do our customers pay us?
  - How much do they pay?
  - How much do they spend?

**www.businessmodelgeneration.com**
CUSTOMER SEGMENTS FRAMEWORK

- **Core Technology**: Starting Point
- **Applications**: What *Problems* can it solve?
- **Customer Segments**: What industries have these problems?
- **Customer Sub-Segments**: Within the industry, what kinds of customers are most likely?
- **Further Sub-Segments**: What specific subset has the most need?
- **Customer Type**: Who uses, decides, pays?
Customer Segments
Why do we group into Customer Segments?
Different Customer Segments often have...
Different Customer Segments often have... 

Different Business Models
Customer Segments often have Sub-Segments
Customer Segment

Hospitals
Group | Definition
--- | ---
University Teaching Hospitals | Those large hospitals with over 400 licensed beds, a scope of service index over 100, heavy teaching emphasis (over 700 intern hours per bed) and either are the primary-training site for a university which has a school of medicine or has over 1,000 intern hours per bed.
Major (Non-University) Teaching Hospitals | Those hospitals with over 500 intern hours per bed that do not qualify as a university teaching hospital.
Large Teaching Emphasis Hospitals | Those hospitals over 300 licensed beds and between 200 and 550 intern hours per bed.
Medium/Small Teaching Emphasis Hospitals | Those hospitals under 300 beds with between 200 and 550 intern hours per bed.
Extremely Large Sized Hospitals | Those urban hospitals with 500 or more licensed beds that do not qualify for any other group.
Large Sized Hospitals | Those urban hospitals with at least 380 but under 500 licensed beds that do not qualify for any other group.
Customer

Sub-Segments

Hospitals

University Teaching Hospitals

Major (Non-University) Teaching Hospitals
Not *Done*
Customer Segments also have Customer Types
Customers are not buildings

They are specific people
Customer Types
Customer Types Roles
Defining Customers*
The definition of “customer” is often quite complex...
Who is the “customer” for a new drug?
The person *taking or receiving* the drug?
The person administering the drug?
The person or group prescribing or recommending the drug?
What about regulators and reimbursement / payers?
Some of you have complex customer and stakeholder ecosystems.
Where do you start?
Find the **people!**

Customer Segments

University Teaching Hospitals

- Beneficiary (Patient)
Customer Roles

University Teaching Hospitals

- Beneficiary (Patient)
- End User
- Decision Maker
- Payer
- Influencer
- Recommender
- Saboteur
Depending on the Customer Segment, these roles may be filled by...

the same person, different individuals, or even a group of people (committee, board, etc.)
Identify Key Roles in *Purchase Decision*
For our course
the End User,
Decision Maker, and Payer
And Finally
Describe or show a typical purchase decision
Example *Purchase Decision*
Overall Ecosystem: Blood Bank

- **Food and Drug Administration**
  - Approves new tech
  - Sets pricing standards

- **Insurance**
  - Tells pricing standard

- **Medicare/Medicaid**
  - Purchases

- **Regulatory Bodies**
  - Certifying tests to determine accuracy

- **Blood Typing**
  - Purchasing decision

- **Lab Director**
  - Supervises

- **Blood Bank Administration**
  - Supervises

- **Med Tech Company/Distributor**
  - Reimbursement

- **Doctor**
  - Orders test

- **Medical Technician**
  - Performs test

- **Phlebotomist/Nurse**
  - Transfers sample to
  - Draws blood

- **Patient**
  - Sample performed on

171: Blood Microdevice
Value Propositions
Product-Market Fit

What Problem are you solving?

What Need are you Fulfilling?

Who cares and why?
Strong *Value Propositions* enable and inform *everything* in your business model!

*It’s essential to get them right!*
Product Features ≠ Value Propositions
Product Benefits

= 

Value Propositions
Moving from...

Feature → Benefit

What (is it)? → So what (for a particular customer)?
Two General Types

Pain Killers

Gain Creators
Pain Killers - Hypotheses

• Ends difficulties or challenges for customers?
  - Makes things easier, eliminates resistance

• Fix underperforming solutions?
  - new features, better performance, better quality

• Reduce losses / inefficiencies?
  - time, money, or efforts

• Make your customers feel better?
  – kills frustrations, annoyances, things that give them a headache

• Wipe out negative social consequences?
  – loss of face, power, trust, or status,

• Eliminate risks
  – financial, social, technical risks, or what could go awfully wrong
Gain Creators - Hypotheses

• Create savings that make your customer happy?
  – in terms of time, money and effort

• Produce expected or better than expected outcomes?
  – better quality level, more of something, less of something

• Copy or outperform current solutions that delight customer?
  – regarding specific features, performance, quality

• Make your customer’s job or life easier?
  – flatter learning curve, usability, accessibility, more services, lower cost of ownership

• Create positive consequences that customer desires?
  – makes them look good, produces an increase in power, status
You are testing your Customer not your product!
So where does my technology come in?

Customers don’t care about technology
They are trying to solve a problem or satisfy a need

Customer discovery is about identifying these and exploring how you provide solutions
One way of crafting VPs

Create statement with 3 elements:

“Minimize time required to diagnose diseases”

Verb - tends to be directional: increase, decrease

Unit of measure – probe for metric that matters

Object – identify need

Often initial VPs bundle multiple concepts / separate

Keep asking why?
One way of crafting VPs

Create statement with 3 elements:

“Reduce time by 3 days to diagnose (a specific disease)”

Verb - tends to be directional: increase, decrease

Unit of measure – probe for metric that matters

Object – identify need

Often initial VPs bundle multiple concepts / separate

Keep asking why?
Value Propositions should be **Q R S T**

- **Quantitative** / quantified – You must be able to measure the value being provided

- **Relevant** – Can your product reasonably / possibly create the gains or relieve the pains

- **Specific** – Drill down to the details. *Exactly* what is the value that the customer is receiving?

- **Testable** – The customer segment must be able to say no to the value proposition.
Magnitude Matters! – timing + severity

Mosquito Bite?

Pinched Finger?

Shark Bite?
A few more points...

- **Different Customer Segments** may have different Value Propositions.
- Within a Segment, **Different Customer Roles** may have different Value Propositions.
- The **importance (mosquito to shark bite)** of a Value Proposition may vary by segment or by customer type.
Via Separations

Nanofiltration membranes for industrial process separations

- MIT PhD students and PI
- MIT I-Corps 2016
- NSF National I-Corps 2016
- Seed Investment - 2017
- Received SBIR Phase I – 2017
- Received SBIR Phase II – 2018
- Raised $4.8M – 2019

Created 10 jobs

- See MIT News and Joule paper:  
Kytopen

Paulo Garcia and Cullen Buie

Microfluidic device enabling a new wave of genetic engineering

- MIT postdoc and PI
- MIT I-Corps 2015
- NSF National I-Corps 2015
- Received NSF $200K AIR-TT grant (qualified by I-Corps) - 2016
- Pre-seed Investment – 2017
- Received SBIR Phase I – 2018
- Received SBIR Phase II – 2019
- Raised $3.8M – 2019

Created 8 jobs
Mesodyne

Photonic Crystal Enabled Thermo-photovoltaic Portable Power Generator

- MIT PhD students / then postdocs
- MIT I-Corps - 2017
- MIT Summer Accelerator - 2017
- NSF National I-Corps - 2018
- Argonne CRI Fellowship - 2018
- Received SBIR Phase I – 2019
- Submitting SBIR Phase II – 2019

Created 4 jobs
Escher Reality

Augmented Reality backend platform for developers
- MIT PhD student
- MIT I-Corps – Winter 2017
- NSF National I-Corps – Spring 2017
- Y-Combinator – Summer 2017
- Raised $3M – Fall 2017
- Commercialization – late 2017
- Acquired – Jan 2018

Created 6 jobs then 40 more after acquisition
Key tech in commercial application with millions of users
Other Outcomes

I-Corps is more than just about creating startups

- Also about using entrepreneurial exploration for researchers to build new skills.
- Participants report the program has positively impacted their professional development as well as how they approach their research.

- 100% report learning new skills
- 100% report research direction influenced
- 100% would recommend program to others
- Built confidence in self and research
- Modified career thinking / Illuminated career path options
MIT I-Corps Focus: **Product Market Fit**

**The Business Model Canvas**

- **Key Partners**
  - Who are our key partners?
  - Why are they important?

- **Key Activities**
  - What key activities does our value proposition require?
  - How can we improve these activities?

- **Key Resources**
  - What key resources does our value proposition require?
  - How can we optimize these resources?

- **Value Propositions**
  - What value do we deliver to the customer?
  - How can we quantify the value?

- **Customer Relationships**
  - What types of relationships do we need to establish and maintain with our customers?
  - How can we improve these relationships?

- **Customer Segments**
  - Who are our most important customers?
  - What do they value most?

- **Channels**
  - Through what channels do we reach our target customers?
  - How can we optimize these channels?

- **Revenue Streams**
  - For what value are our customers really willing to pay?
  - How can we maximize our revenue?

- **Cost Structure**
  - What are our most important costs in our business model?
  - How can we reduce these costs?
FREE
Training + Experience + Funding
for researchers considering or undertaking commercialization and startup efforts
ANY Student, Postdoc or Faculty member considering a “Tough Tech” startup.
Short Courses @ MIT

MIT Spark
3 weeks long
2 evening workshops
2 Office Hours; coaching with experienced entrepreneurs
Talk to a minimum of 12 potential users, buyers and decision makers

Fusion
Talk to an additional 12 potential users and customers
$1500 microgrant for further customer discovery (travel, conference registration costs, etc.)
Upcoming Spark Courses @ MIT

**JAN 22 – FEB 12** - *Filled*

**FEB 6 – FEB 27**

**FEB 20 – MAR 12**

**MAR 4 – MAR 25**

To Engage:

email: icorps@mit.edu
web: icorps.mit.edu
• Gather Evidence about **product-market fit** for your idea

• Completion qualifies you for **$1,500** for additional discovery

• Then apply for **$50,000 NSF** grant for even deeper discovery

• **Increases** your chance of an **SBIR / STTR** by 3-4x
WHY DO THIS? WHAT'S THE CARROT?

➤ More evidence to support your decision making
- should you continue? Is there a business there?

➤ Increases your ability to articulate a compelling story
- who will use your product and why

➤ Increase chances for further support

All Carrot, No Stick
How to engage

Email:

icorps @ mit.edu

Next Spark Programs begin:

February 6
February 20
March 4
Sherwin Greenblatt, Director

120 Massachusetts Ave., W31, 3rd floor

vms@mit.edu

vms.mit.edu
Through our group of experienced volunteer mentors working in teams, we focus on helping future entrepreneurs in the MIT community.

We help them develop skills, judgment, self-confidence and networks of contacts. As a consequence, we help create companies.
REQUIREMENTS TO PARTICIPATE

➤ Be a member of the MIT community
➤ Have an idea
➤ Be passionate about commercializing the idea
➤ Be committed to spending the time and effort to build a successful venture
➤ Idea must not violate the laws of physics or the laws or ethics of the USA
VMS APPROACH

• A process to develop entrepreneurs
• Services are free - no strings attached
• Utilize experienced volunteer mentors – they have been there, done that
• Set strict guidelines for mentors – unbiased advice in the best interest of the individual
• Mentor in teams
• Coach – give guidance, not direction
• Learn by doing – you do the work
WHAT VMS PROVIDES

➤ Sound advice (practical, actionable, timely)
➤ Targeted advice (tailored to your status, your product or service, your team, your resources)
➤ In-depth advice (guidance no matter the topic)
➤ Hands-on education (not just what to do but why, when and what are your choices)
➤ Trusted mentors (unbiased, confidential, in your personal interest)
➤ Available when you need them (anytime, forever)
➤ Network of contacts
WHAT VMS DOES NOT PROVIDE

➤ Funding or funders
➤ Working space or equipment
➤ Legal or accounting services
vms.mit.edu
Click on “Apply Now”