



Turning R&D Into Economic Value

- What's Effective in Practice

Dennis Tsu

Nov. 2017

Agenda/Objectives

- Provide a Silicon Valley & a global perspective on how to turn R&D into economic value
- This is a manageable process
- That requires an Innovation Eco-system
- Biggest challenge for Estonia = critical mass

Personal Background



Global Perspective on Innovation

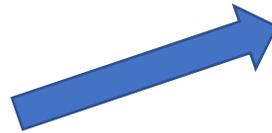


Two forms of R&D:

Academic & Corporate

- Academic R&D
 - At universities, research institutions
 - Two sources of funding:
 - Government, foundations – focused on “social impact”
 - Companies – focused on commercial impact
- Corporate R&D
 - Maybe done inside or outside of the company
 - Funded by the company’s profits
 - Focused on ROI

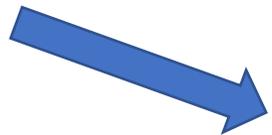
Three ways to commercial value:



License –
Typically to a
Medium-large
company



New Start-up
Company =>
New product
or service



Government
New program
or service

R&D has to get to the market to have economic
(commercial) value

The Challenge:

119

(11) EP 1 793 941 B1

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent: 02.05.2012 Bulletin 2012/19

(21) Application number: 0671725.8

(22) Date of filing: 21.07.2005

(51) Int. Cl.: B63C 2/00

(52) International application number: PCT/US2005/01664

(57) International publication number: WO 2006/014667 (26.02.2006 Gazette 2006/06)

(54) System and process for reducing number of steps on delivery route by identification of standard class mail

System und Verfahren zur Verringerung der Anzahl von Halteorten auf einer Lieferroute durch Erkennung von Post der Standardklasse

Système et procédé de réduction du nombre d'interceptions sur un parcours de distribution par identification de courrier de classe standard

(84) Designated Contracting States: CH DE FR GB IT LI

(85) Priority: 21.07.2004 US 89924 P

(43) Date of publication of application: 13.02.2007 Bulletin 2007/04

(73) Proprietor: Lockheed Martin Corporation Bethesda, Maryland 20817 (US)

(72) Inventor: STEMMLE, David, J. Shelton, CT 06814 (US)

(56) References cited: WO-A-2005/02864 DE-A1-102008 026 483 US-A-2 810 280 US-A-2 988 964 US-A-1 840 711 US-A-1 864 427 US-B1-4 377 319

• CADOP, Donald West Lafayette, IN 47906 (US)
• GINEK, Douglas, S. Bethel, CT 06801 (US)

(74) Representative: MCP/MANN ETLE Patent- und Rechtsanwälte Amalienstraße 4 81925 München (DE)

97%+



Worldwide – only 1 to 3% of patents ever get commercialized

WHY?

Commercialization is Hard Work

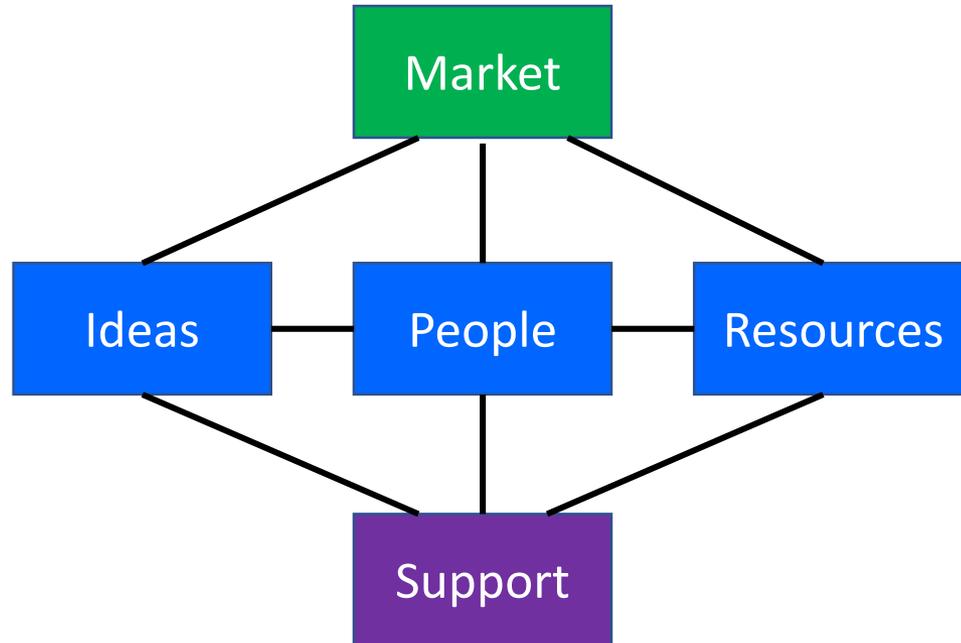
Repeatable success requires a process.

Commercialization requires a different set of skills and a mindset that most researchers/research institutions do not have.

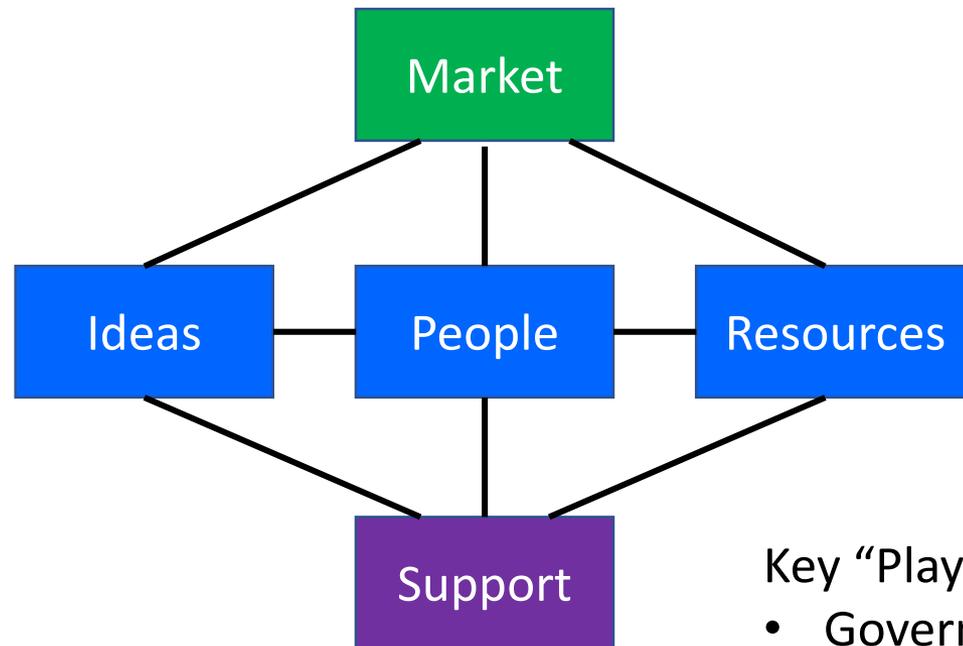
Many institutions (incubators, universities, governments) do not have the critical mass required to develop, sustain the required skills.

Everyone is in a global competition.

Key Elements of an Innovation Ecosystem



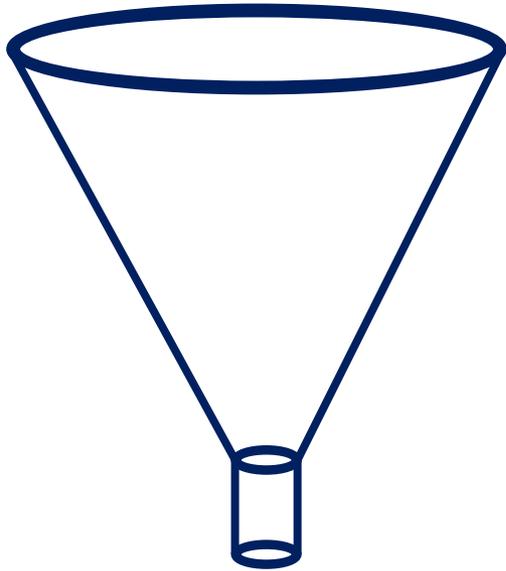
Key Elements of an Innovation Ecosystem



Key “Players” in the Ecosystem

- Government
- Universities/Research Labs
- Existing Large Companies
- Risk Capital
- Entrepreneurs

Process for Turning R&D into Value

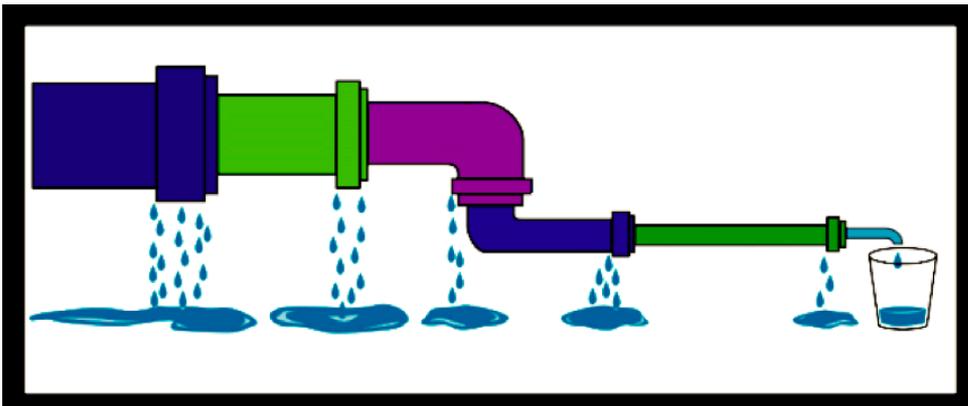


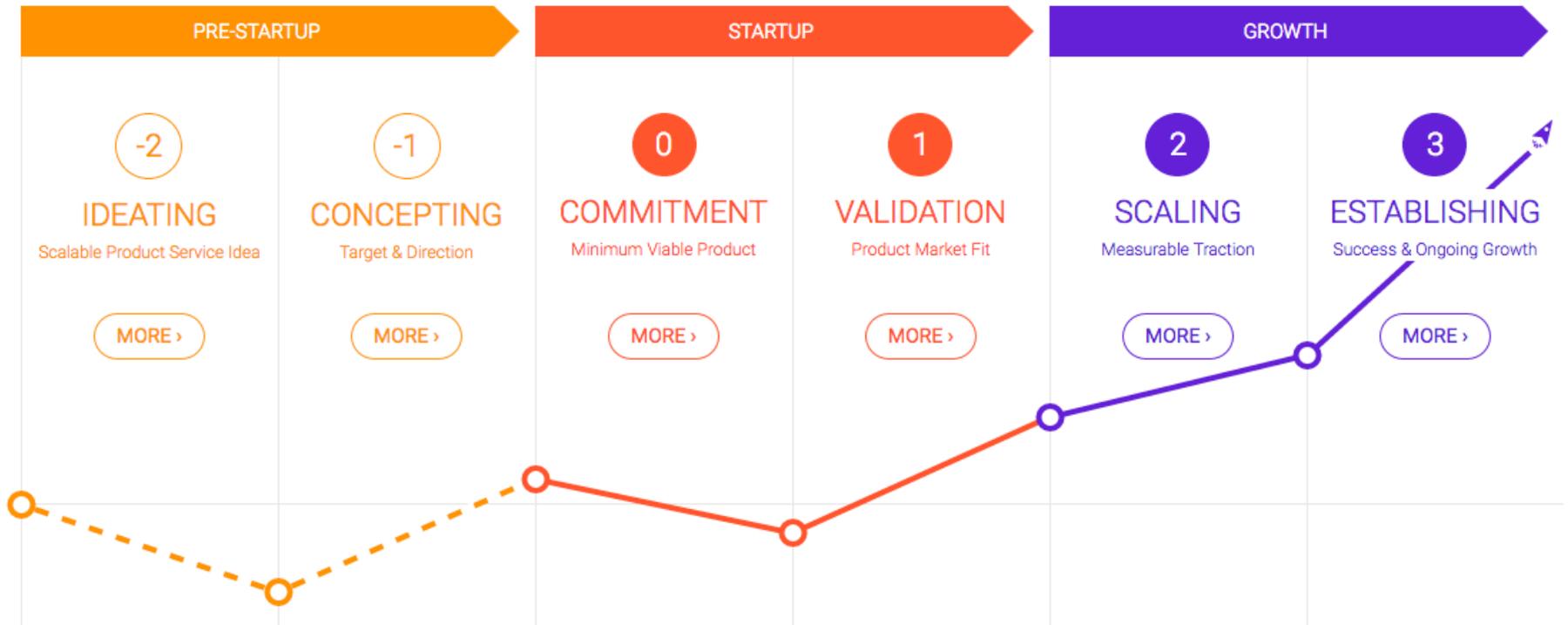
Two common descriptions:

- Funnel
- Leaky pipeline

Key concepts:

1. Filter/leaks – only a small % of ideas will succeed
2. Process/Steps/Progression
3. Time



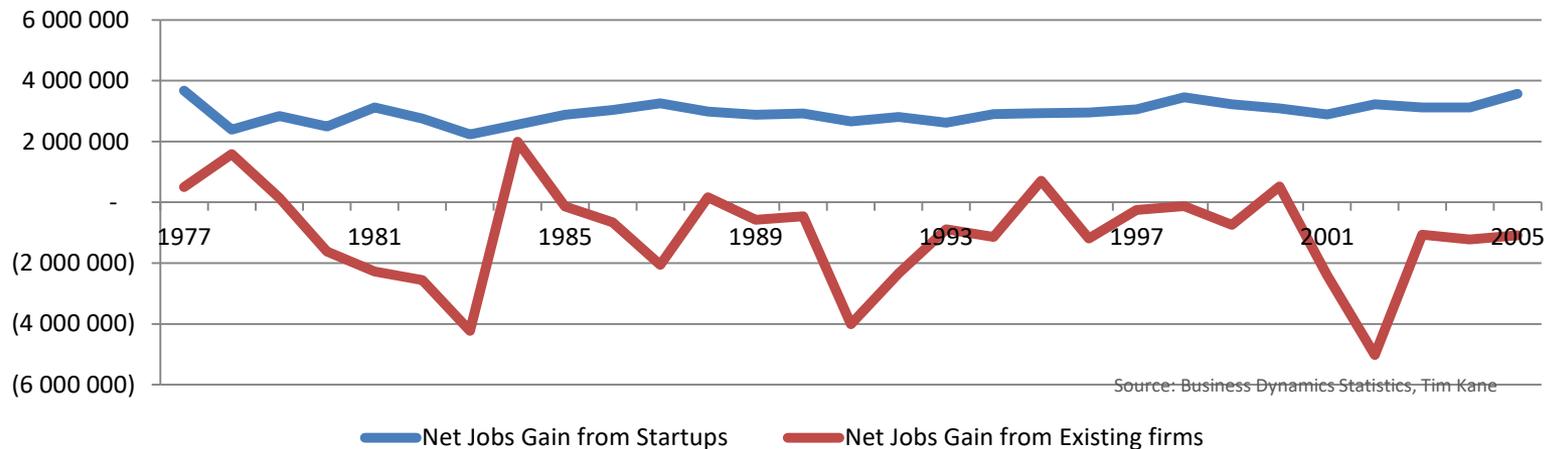


Motivation / Incentives

This is hard work – why bother?

Start-ups, Entrepreneurs Create Jobs

New USA Jobs by Source (1977-2005)



Net Jobs Gained by Source 1977-2005	
From Startups	+ 85,674,601
From Existing Firms	- 30,423,864

Key Issue – Motivating the Professor



Financial

Reputation

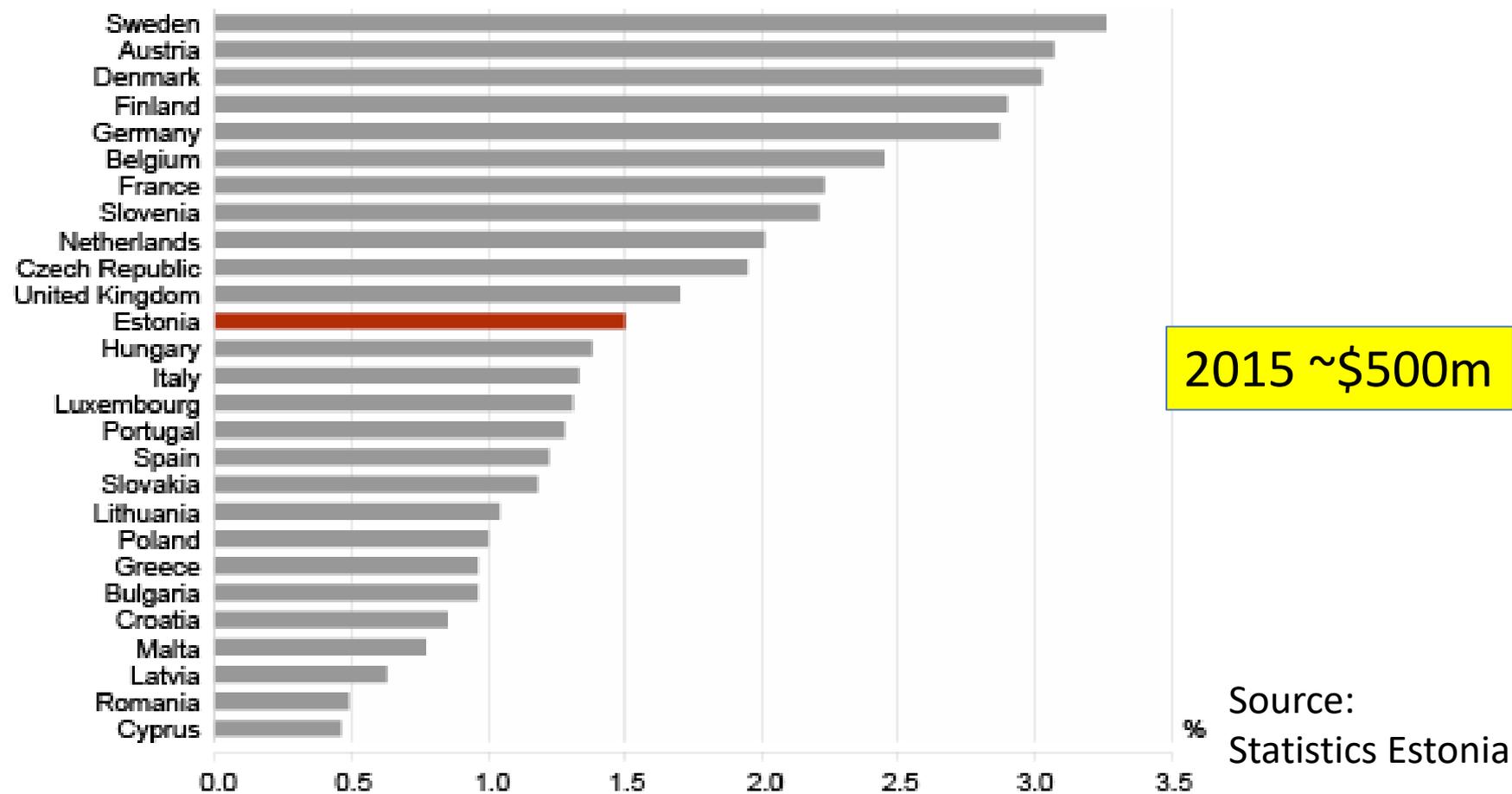
Tenure/Security

Attracting students



Starts With R&D

Ratio of R&D expenditure to GDP, 2015



ESTONIA – R&D Spending (GERD)

	2011	2012	2013	2014	2015
EU (28 countries)	1.97	2.01	2.03	2.04	2.03 (p)
Euro area (19 countries)	2.04	2.1	2.11	2.14	2.12 (p)
Belgium	2.16	2.36	2.44	2.46 (e)	2.45 (p)
Bulgaria	0.53	0.6	0.63	0.79	0.96 (p)
Czech Republic	1.56	1.78	1.9	1.97	1.95 (p)
Denmark	2.97	3	3.01	3.02	3.03 (e)
Germany	2.8	2.87	2.82	2.89	2.87 (ep)
Estonia	2.31	2.12	1.73	1.45	1.5 (p)
Ireland	1.54 (e)	1.56 (e)	1.56 (e)	1.51 (e)	..
Greece	0.67	0.7	0.81	0.84	0.96 (p)
Spain	1.33	1.29	1.27	1.24	1.22
France	2.19	2.23	2.24	2.24	2.23 (p)
Croatia	0.75	0.75	0.82	0.79	0.85
Italy	1.21	1.27	1.31	1.38 (e)	1.33 (p)
Cyprus	0.45	0.43	0.46	0.48	0.46 (p)
Latvia	0.7	0.67	0.61	0.69	0.63 (p)
Lithuania	0.9	0.89	0.95	1.03	1.04 (p)

Gross R&D
Spending
as % of GDP

Source: EU

Research investment 'not a luxury, but a necessity,' Estonian leader tells other EU members

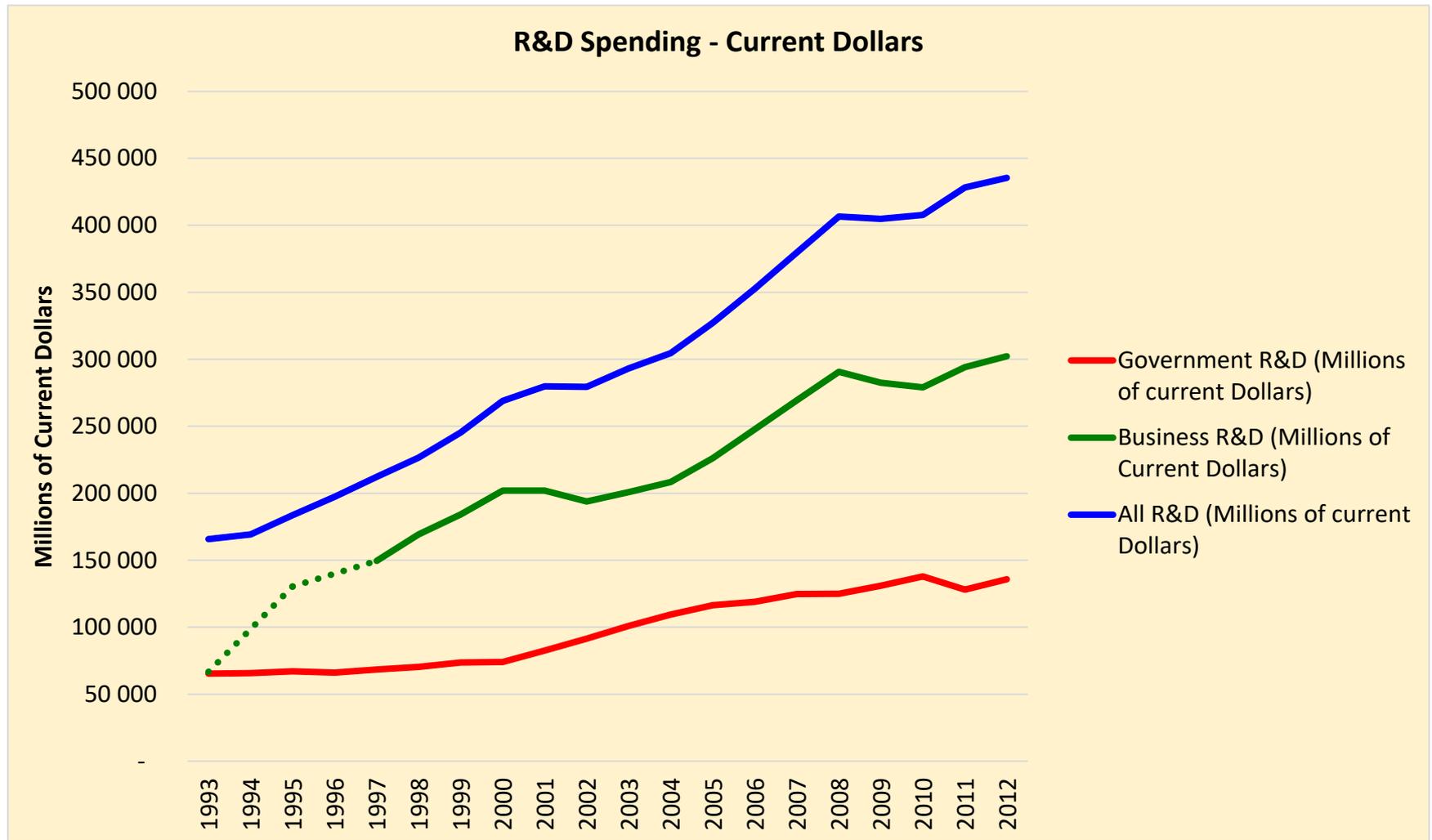
INSIGHTS 18/10/2017 08:50

[#eu2017ee](#)



Estonian Prime Minister Jüri Ratas at the European Research Excellence conference in Tallinn (photo: Science|Business)

US R&D Spending – last 20 years



SOURCES: National Science Foundation, National Center for Science and Engineering Statistics, Federal Funds for Research and Development (various years), National Patterns of R&D Resources (various years), Survey of Industrial Research and Development (various years) and Business R&D and Innovation Survey (various years);

How to Allocate Your R&D funding?

Spread thin – across many areas/ideas?



Focused on a few areas/ideas?



Open ERA

Both a positive
and a negative
Influence

Concern =
“Brain Drain”



The European Research Area (ERA)

A unified area open to the world, in which scientific knowledge, technology and researchers circulate freely.



MORE EFFECTIVE NATIONAL RESEARCH SYSTEMS

Boosting investment and promoting national competition.



OPTIMAL TRANSNATIONAL CO-OPERATION AND COMPETITION

On common research agendas on grand challenges and infrastructures.



AN OPEN LABOUR MARKET FOR RESEARCHERS

Facilitating mobility, supporting training and ensuring attractive careers.

LATEST NEWS

15.3.2017

Science4Refugees Workshop:
European Research with a view to integrating refugees

26.1.2017

Adoption of the **ERA Progress Report 2016**

17.2.2016

The **RESAVER** Website is now online

▶ ERA NEWSLETTER

KEY DOCUMENTS

ERA Communication

ERA Progress

ERA Documents

USEFUL LINKS

Horizon 2020

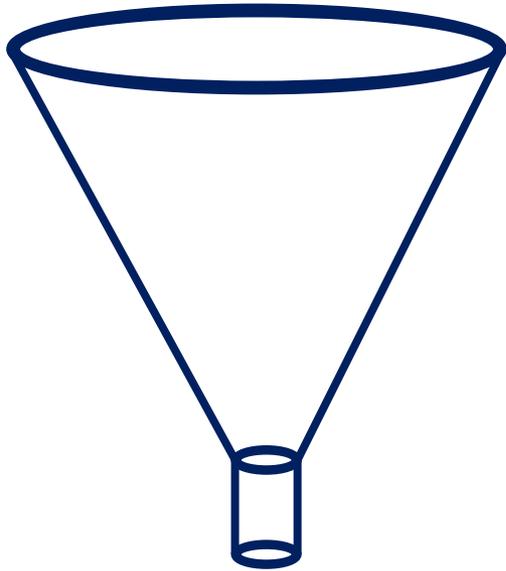
Research & Innovation website

Europe 2020

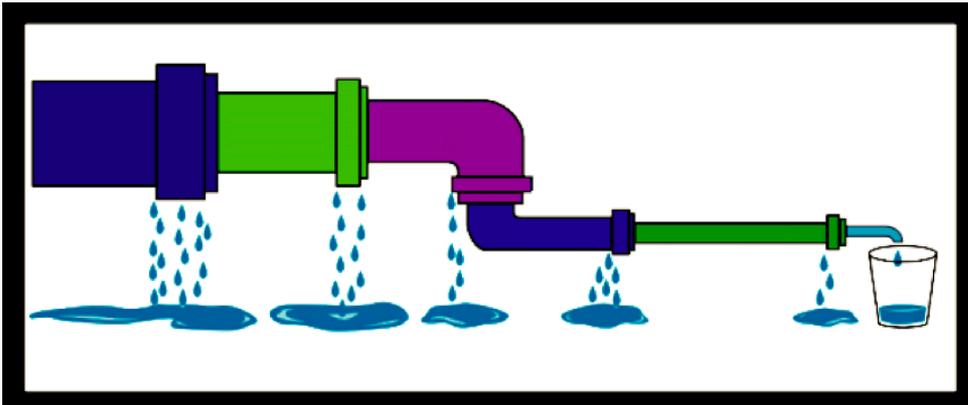
Innovation Union

Commissioner Carlos Moedas

Process for Turning R&D into Value



So what are the filters/
what are the steps?



US VC Rule – Market Size



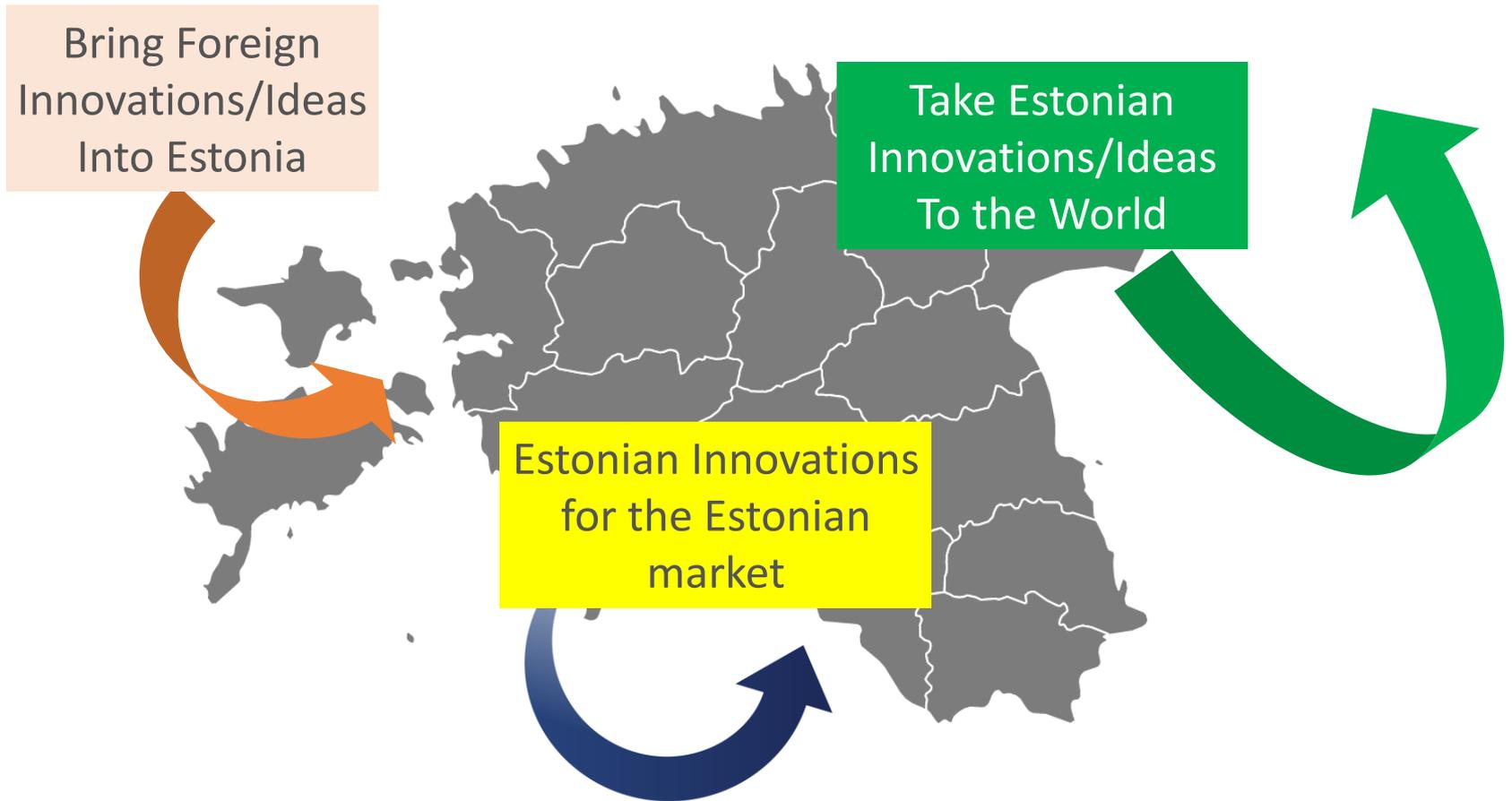
Russell Siegelman
Partner, Kleiner Perkins Caufield & Byers

The most important requirement is a large market opportunity in a fast-growing sector.

We like a company to have a \$100 million to \$300 million revenue stream within five years.

This means that the market potential has to be at least \$500 million—or more, eventually—and that the company needs to achieve at least a 25 percent market share.

Innovation Markets/Models in Estonia



Requires Customer Knowledge

Who is(are) the customer(s)?

- *influencer/decision maker/buyer/user*

How will they buy?

- *retail/distributor/on-line/other?*

What are their decision criteria?

- *price/capacity/capabilities/features/
service/reliability/brand/etc...*

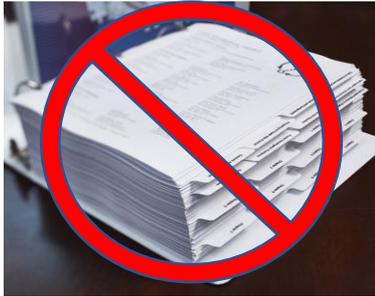
What are they using today?

- *What do they like?*
- *What do they not like? Why?*

Programs to increase customer/market understanding:

- Industry Associations
- University-Enterprise partnerships
- Student internships
- Overseas programs
- Coaches/mentors

Value Proposition



<60 seconds

- Easy to use format = NABC
 - **N**eed
 - what's the customer's need/problem?
 - **A**pproach
 - how are you solving it (your approach)
 - **B**enefits/Cost
 - what's the benefit to the user (vs. the cost)
 - **C**ompetition
 - why are you better than the competition

Competition



- Competition is good. It proves the market exists.
- Everybody has competition

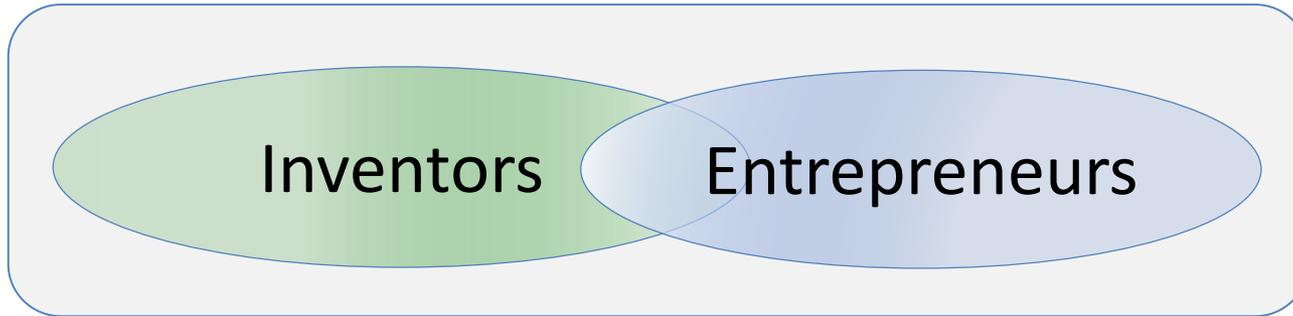


- **Why are you better? Why should I change?**

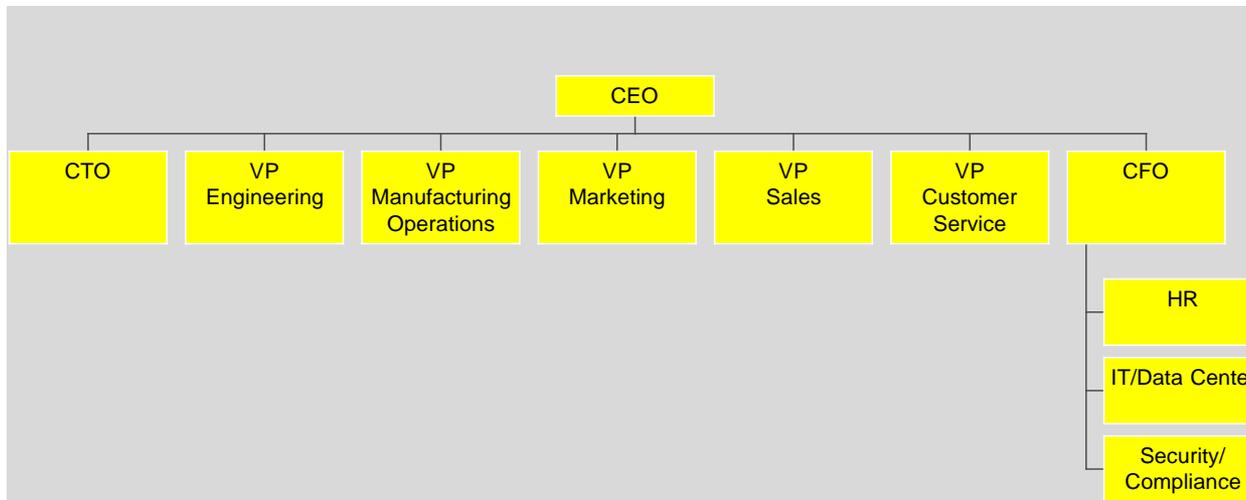


- Not just current – anticipate the future, reactions

Team



Starting
Point



Key Issues:
Timing of hires
Experience, background
Compensation

Business Model & Business Plan

Venture Pitch Outline:

1. Hook/describe problem (need) faced by customer
2. Discuss the market
3. Describe your solution (approach) and bring it to life
4. Show benefits and customer validation
5. Identify competition and positioning
6. Explain business model - how you will make money
7. Introduce the team, people involved
8. Discuss current status, milestones, roadmap
9. Give financial projections and major risks
10. Ask for what you need

10 slides
20 minutes

*You need
coaches/mentors
who have done
this*

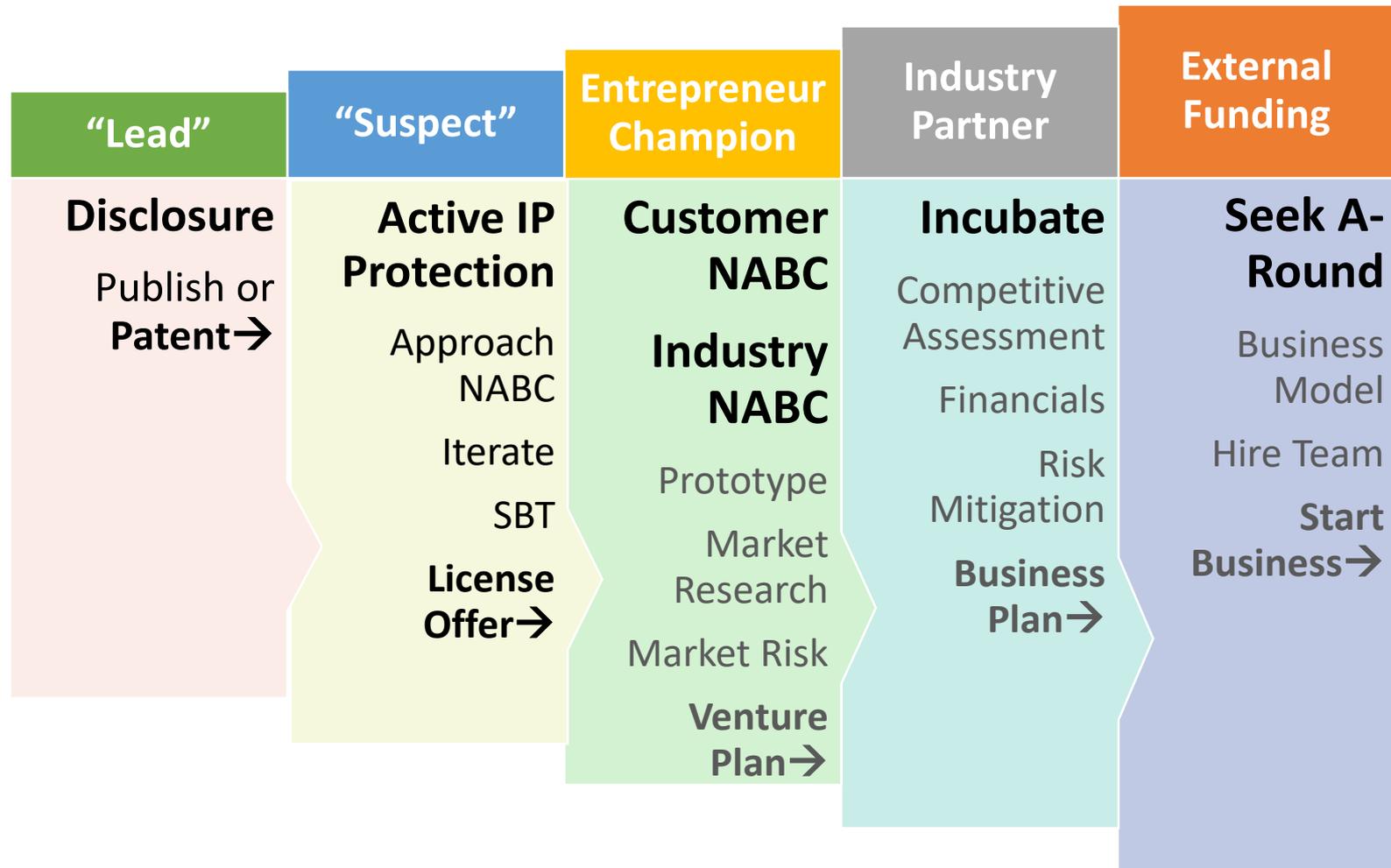
Financing

- Starting a company requires money/funding
- By definition – a risky, unproven venture
- Who is going to provide the funding?

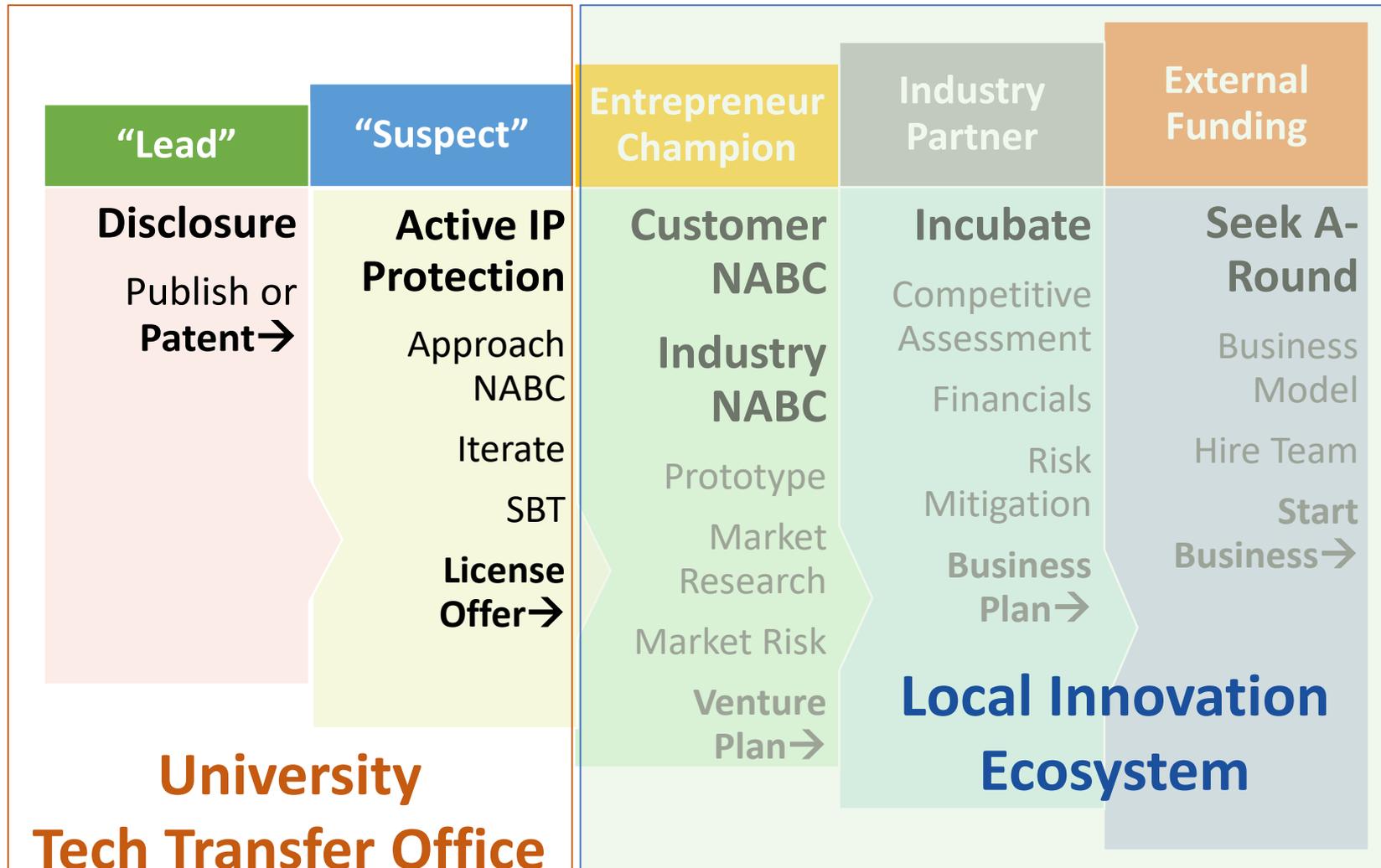
- “Risk Capital”
 - Friends and family
 - Seed/angel investors
 - Family offices
 - Venture Capital
 - Government?



Process Requires Multiple Skills



How It Works at Stanford, MIT & Others

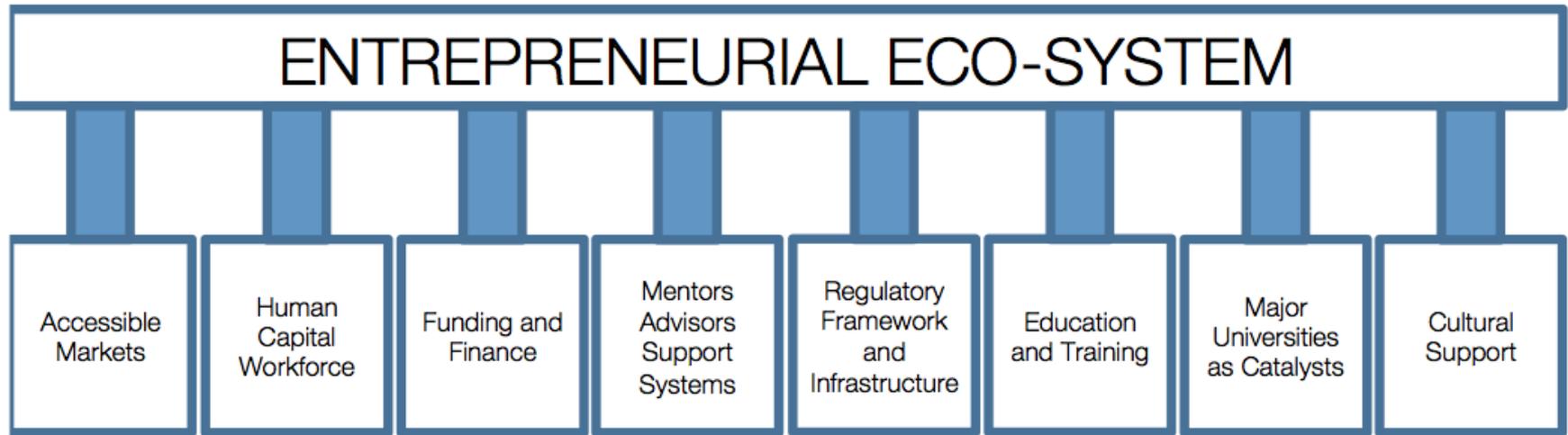


Critical Mass Requirements

- A Silicon Valley VC will receive over 300 business plans per year
- And invest in about 5 start-ups
- It takes practice and experience to know when/how to invest

How to achieve that critical mass in Estonia?

8 Pillars - Successful Entrepreneurial Ecosystems



Source: Entrepreneurial Ecosystems around the Globe and Company Growth Dynamics
World Economic Forum

World Economic Forum – Entrepreneurial Ecosystems Around the Globe

Exhibit 2-1: Entrepreneurial Ecosystem Heat Map by Continent/Region: Pillars Readily Available in Your Region

Pillar	US - Silicon Valley	US - Other Cities	North America	Europe	Aus/NZ	Asia	MEA	South/Central America and Mexico
Accessible Markets	92%	83%	85%	72%	69%	68%	68%	62%
Human Capital Workforce	93%	87%	90%	81%	81%	73%	50%	71%
Funding and Finance	91%	76%	82%	57%	69%	44%	55%	45%
Mentors/Advisers/Support Systems	91%	72%	78%	52%	58%	38%	36%	35%
Regulatory Framework/Infrastructure	67%	57%	62%	54%	54%	39%	55%	42%
Education and Training	80%	62%	70%	60%	38%	34%	32%	27%
Major Universities as Catalysts	88%	67%	75%	52%	42%	30%	23%	27%
Cultural Support	90%	64%	75%	33%	35%	26%	45%	16%
Average Score	86%	71%	77%	58%	56%	44%	45%	41%

Universities



Three “products” from the universities:

- Research/Ideas/Technology
- Entrepreneurial students
- Culture

Talent Pool

The Google logo, featuring the word "Google" in its characteristic multi-colored font.The Facebook logo, featuring the word "facebook" in white lowercase letters on a dark blue rectangular background.The Microsoft logo, featuring the word "Microsoft" in a bold, black, sans-serif font.The Yahoo! logo, featuring the word "YAHOO!" in a purple, serif font.

What do these companies all have in common?

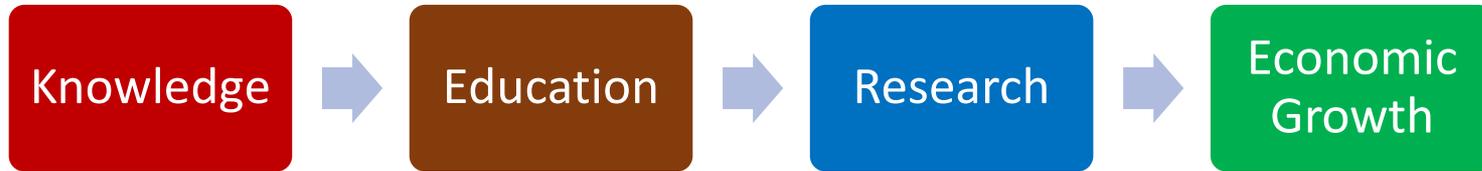
Talent Pool

The Google logo, featuring the word "Google" in its characteristic multi-colored font.The Facebook logo, featuring the word "facebook" in white lowercase letters on a dark blue rectangular background.The Microsoft logo, featuring the word "Microsoft" in a bold, black, sans-serif font.The Yahoo! logo, featuring the word "YAHOO!" in a purple, serif font.

What do these companies all have in common?

Founded by STUDENTS

Evolving Role of the University



“Knowledge is replacing other resources as the main driver of economic growth...”. *Harvard President - Drew Faust*



“Universities now play that fundamental research role that Bell Labs and Xerox Park and IBM research used to play in earlier times.” *Stanford President - John Hennessy*



University Support of Entrepreneurship

The screenshot shows the TTU MEKTORY website. At the top, there is a navigation bar with links for Studying, Research, Innovation, MEKTORY, Student guide, International cooperation, and University. The main header features the TTU logo and the text 'TALLINN UNIVERSITY OF TECHNOLOGY'. Below this, the word 'MEKTORY' is prominently displayed in large, bold letters, followed by the tagline 'MODERN ESTONIAN KNOWLEDGE TRANSFER ORGANIZATION FOR YOU'. A secondary navigation bar includes links for Home, For company, For student or for faculty, TTU Mektory Startup, and Mektory School of Technology. A third navigation bar lists EducationUSA, Advising Center, Satellite Programme, Visit us: rooms and activities, Partners, and Contact. At the bottom, a breadcrumb trail reads: 'You are here: Main Page of TTU > MEKTORY > TTU Mektory Startup'.

TTU Mektory start-up programs

Share

Startup pre-incubation program "STARTERtech"

The advertisement features the TTU MEKTORY logo and a photograph of a group of people in a meeting. Text on the ad includes: 'TTU Mektory STARTERtech', 'Free business idea development program in TTU', 'LAUNCH EVENT "Casting the Startup Fortune" 18th of September 2017 18:00 @Mektory', and a large blue 'JOIN NOW!' button. It also mentions 'REGISTRATION BEGINS until 16.09.2017' and 'www.ttu.ee/mektory'.

Startup pre-incubation program "STARTERtech" was launched again on the 18th of September, 2017!

The screenshot shows the University of Tartu website page for 'Spin-off Companies of University of Tartu'. The top navigation bar includes 'Welcome Web', 'Admissions', 'Current Students', 'Research', 'Business', and 'International'. The page title is 'Spin-off Companies of University of Tartu'. The main content area begins with the text: 'According to the principles for creating spin-off companies of the University of Tartu (UT) and the university's cooperation with such spin-off companies:'. This is followed by a bulleted list of criteria for spin-off companies. Below the list, a paragraph states: 'In 1999, the Spin-off Program of UT was launched with 9 projects/companies formed. After that, 2-3 new companies per year have been created. Between 2010 and 2013 into the list of spin-off companies was added 3-4 companies per year on average. 2014 into the list of university spin-off companies was added more 6 companies. 2015 into the list was added more 9 companies. 2016 there are three new spin-off companies: Villeman Biotech OÜ; Sporditeraapia Keskus OÜ and Captain Corrosion OÜ added into list.' The final paragraph reads: 'However, UT has no ownership in companies, the ownership of university member (academician) is considered to be sufficient. It could be said that UT expects indirect returns and socio-economical impact for society.' The page concludes with the statement: 'The total number of spin-offs as on 01/12/16 is 59.'

People

How do you feel about Innovation?

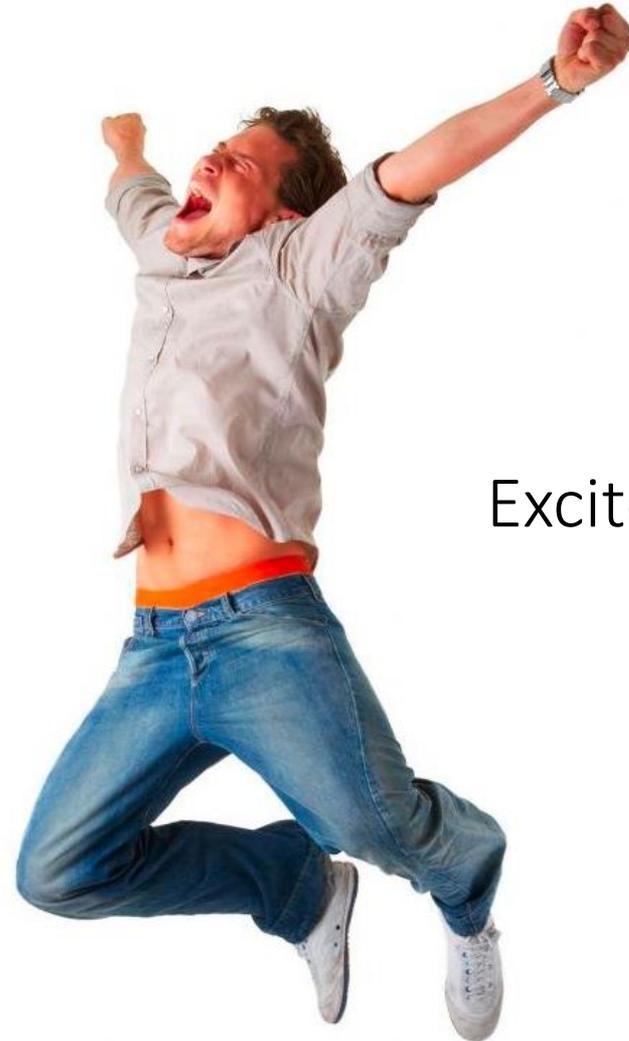


Anxious?

People



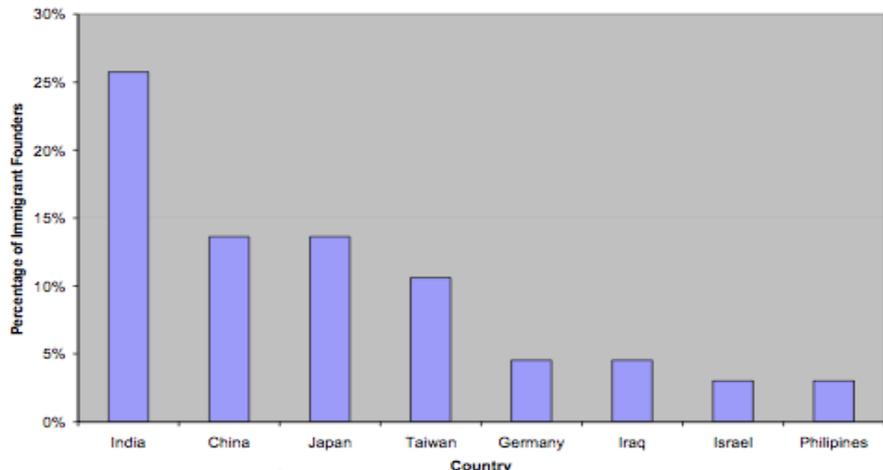
Anxious!



Excited!

Talent Pool – Competition for Talent

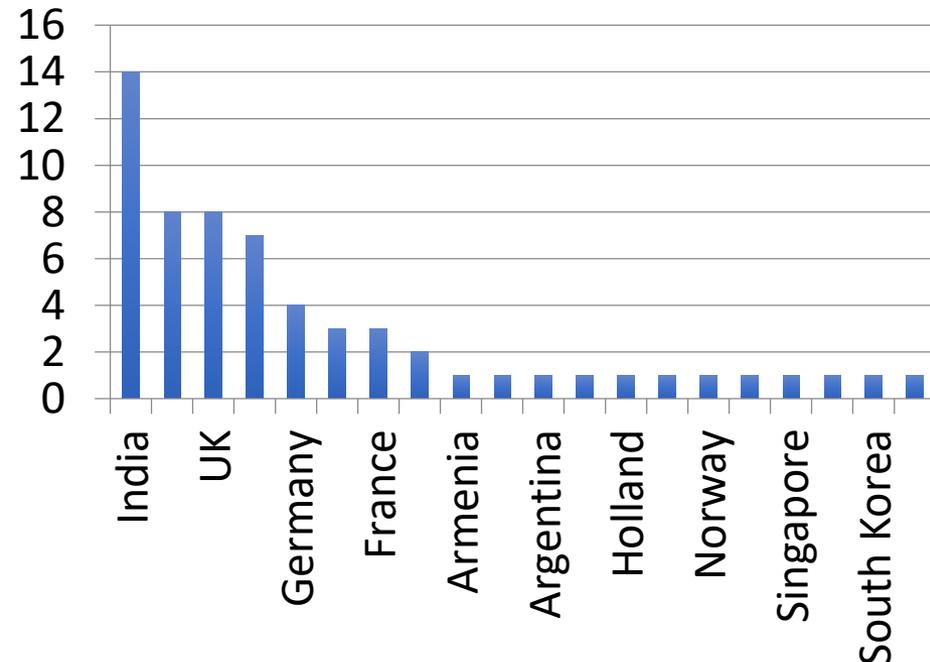
2007 - **52.4%** of start-ups in Silicon Valley have immigrants as key founders



Origins of Tech Company Founders in Silicon Valley

Source: Duke & UC Berkeley Study - 2007

2016 - **51%** of US Billion Dollar Startups have immigrants as key founders



70% of key management or product development positions are held by immigrants

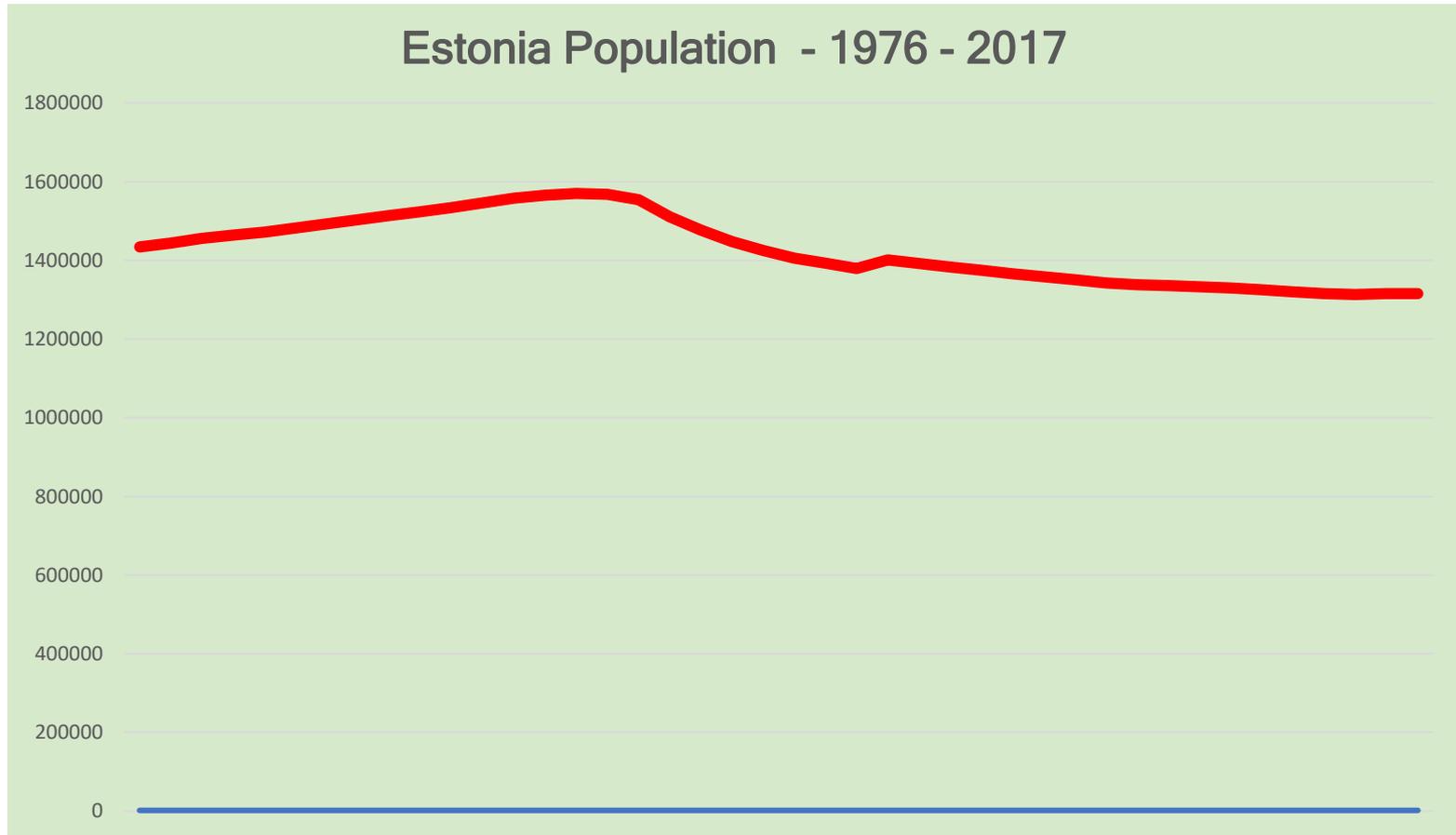
Source: National Foundation for American Policy, March 2016



- Anyone, anywhere in the world can submit a business plan to the Chilean government
- If they like it, they send you 2 visas and invite you to move to Chile and start your company
- When you land, you get US\$40,000 to get started
 - No equity to the Chilean government
- Expectation that 75+% will fail
 - And that they will stay in Chile and try again

Building the talent pool of Chilean-based entrepreneurs

Biggest challenge = scale



Alternative Models ?

	1976	2016
Estonia	1.4m	1.3m
Singapore	2.3m	5.6m
Israel	3.6m	8.5m

Tolerance of Failure

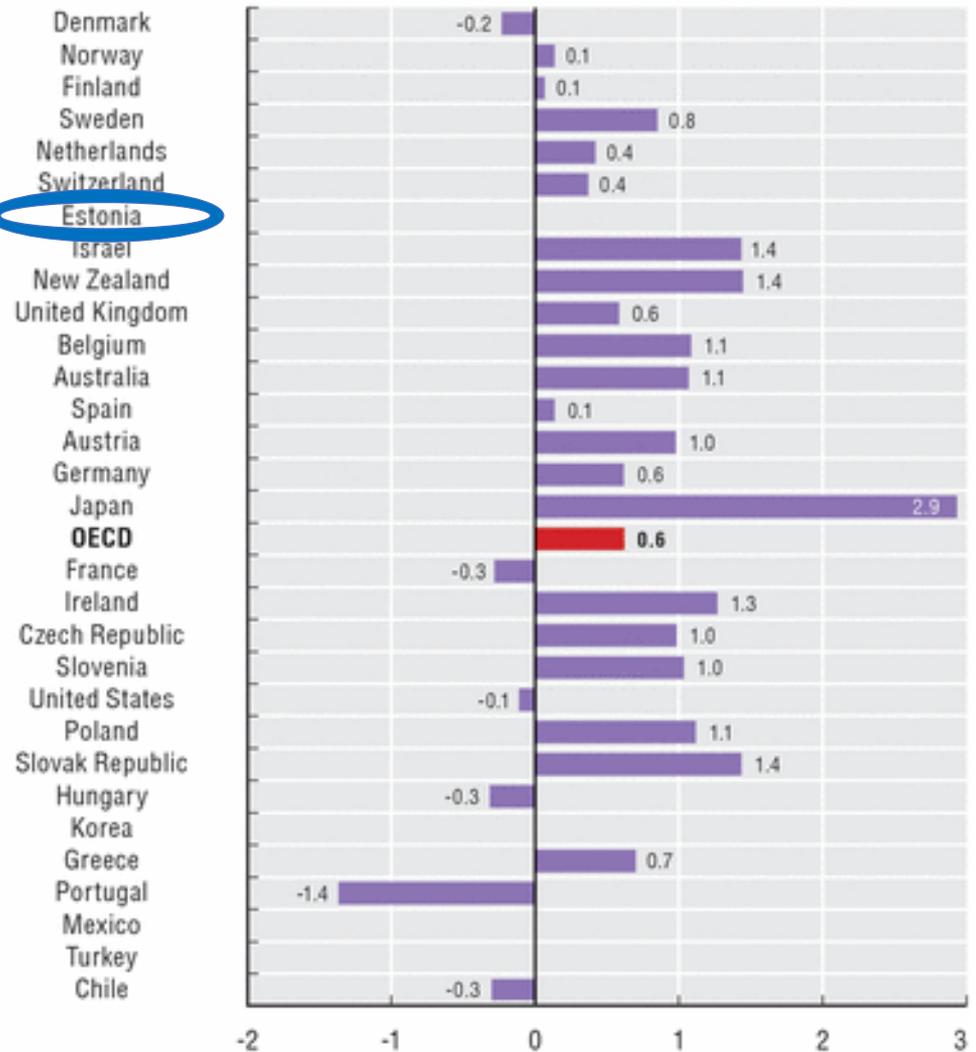
- "I have not failed, I've just found ten thousand ways that won't work." – Thomas Edison
- "It's fine to celebrate success but it is more important to heed the lessons of failure." – Bill Gates
- "Failure is success if we learn from it." – Malcolm Forbes
- "Success is going from failure to failure without loss of enthusiasm." – Winston Churchill
- "Failure happens all the time. It happens every day in practice. What makes you better is how you react to it." – Mia Hamm

Social Trust Index

Panel A. Percentage of people expressing high level of trust in others, 2008 (↘)



Panel B. Average annual percentage point change (1998-2007 or 2002-08)



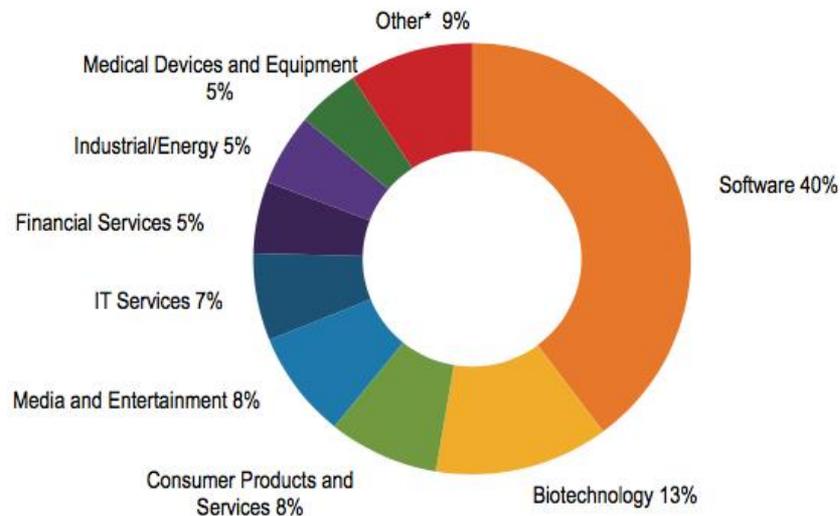
Risk Capital

Key Requirements:

- Deal Flow
- Constructive/supportive regulatory environment
- Opportunities to Exit/Liquidity

2015 VC Investments – by Sector

Figure 3.04
Venture Capital Investments in 2015 By Industry Sector
(% of Dollars Invested)



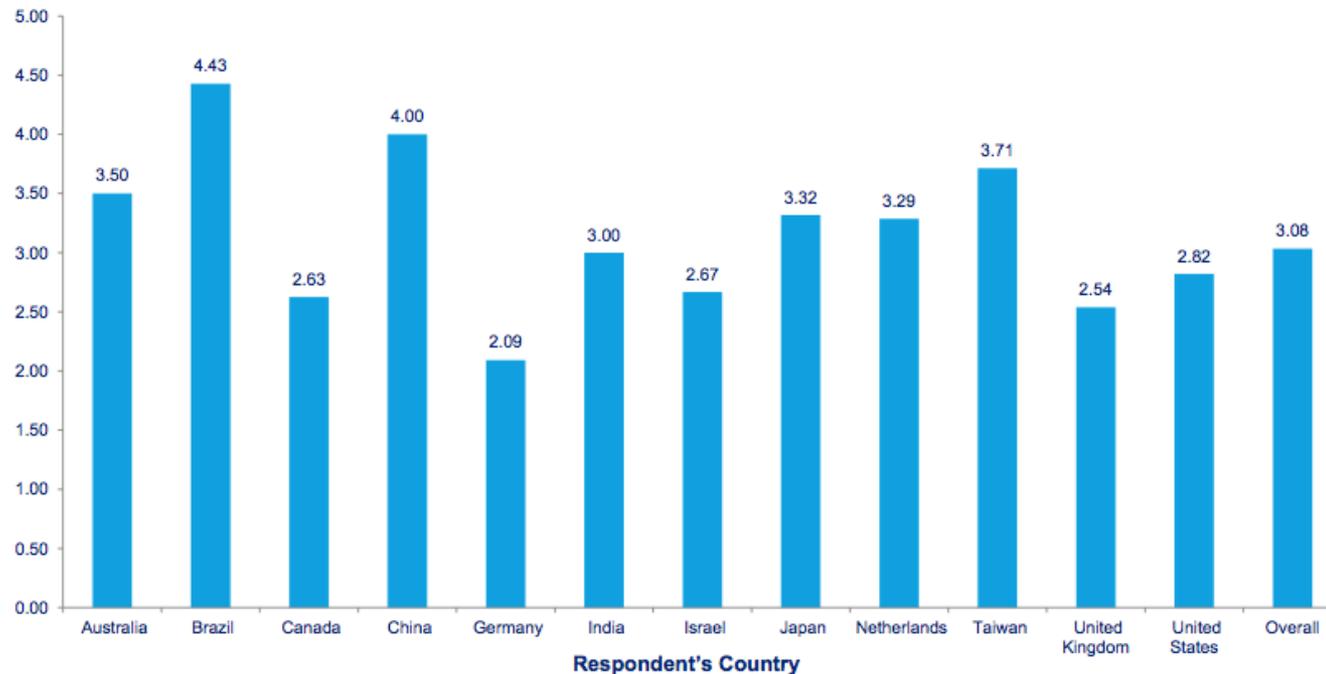
*Includes: Retailing/Distribution 2%, Healthcare Services 1%, Semiconductors 1%, Computers and Peripherals 1%, Telecommunications 1%, Business Products and Services 1%, Electronics/Instrumentation 1%, and Networking and Equipment 1%

Source: NVCA

VC Interest – varies by geography

Industry Investing

Overall confidence in VC investing in the Biopharmaceuticals sector

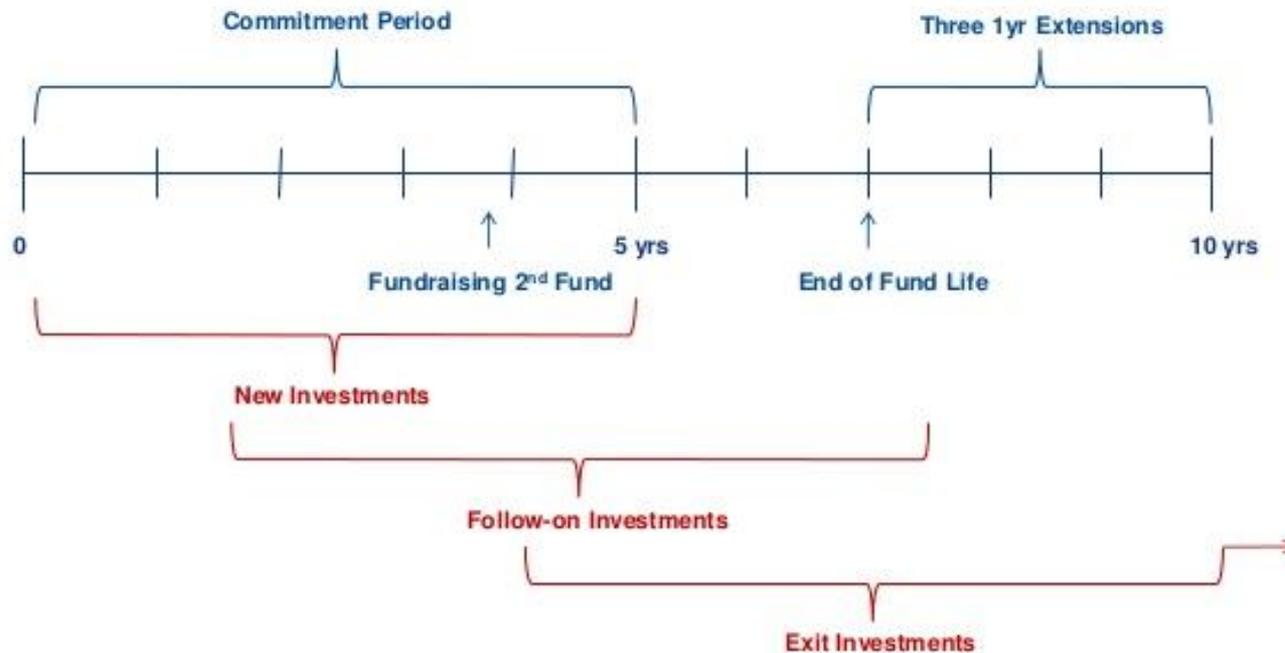


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Time horizon – VC fund

TYPICAL LIFE OF A VENTURE FUND

Example of VC Timeline



Government



REPUBLIC OF ESTONIA
GOVERNMENT



Processes to set-up, shut-down a company

Investing in Education

Investing in R&D

Supporting Entrepreneurship, Risk-taking

Supporting Risk Capital

Government

Time to Set Up a Company (Days)

Country	2003	2016
Argentina	66	25
Australia	3	3
Austria	25	21
Belarus	80	5
Belgium	56	4
Bolivia	59	45
Brazil	156	80
Bulgaria	39	23
Canada	4	2
Chile	42	6
China	48	29
Colombia	43	9
Costa Rica	90	23
Czech Republic	40	9
Denmark	7	3
Dominican Republic	79	15
Ecuador	92	49
Egypt, Arab Rep.	39	7
El Salvador	115	16
Estonia	72	4
Finland	31	14
France	41	4
Germany	45	11
Greece	38	13
Guatemala	39	20
Haiti	260	97
Honduras	61	13
Hong Kong SAR, China	11	2
Hungary	54	7
India	123	26
Ireland	18	5

Country	2003	2016
Israel	19	12
Italy	23	7
Jamaica	31	10
Japan	31	11
Malaysia	38	19
Mexico	32	8
Netherlands	9	4
New Zealand	12	1
Nicaragua	47	13
Norway	18	4
Panama	18	6
Paraguay	72	35
Peru	100	26
Poland	63	37
Puerto Rico	7	6
Russian Federation	43	10
Saudi Arabia	78	16
Singapore	8	3
South Africa	56	43
Spain	138	13
Sweden	16	7
Switzerland	20	10
Turkey	39	7
Ukraine	40	5
United Arab Emirates	19	8
United Kingdom	13	5
United States	6	6
Uruguay	45	7
Venezuela, RB	143	230
World	52	21

Summary / Closing thoughts

This is hard work.

It can/should be managed, there are processes.

And it requires a certain critical mass.

Estonia Knows the Challenges



**Estonian Research and Development and
Innovation Strategy 2014-2020**

“Knowledge-based Estonia”

Swedish National Incubator Initiative



- Data from 42 Incubators – over 7 years (2005-2011)
- Project/Idea Volume
 - 25k+ ideas submitted
 - 2419 projects accepted (9.5%)
- Average 27 months in Incubator
- 1031 companies still active in 2011 (42.6%)
 - Average # Employees = 3
 - Average Revenue = \$294k/year
- Incomplete data on M&A, IPOs, other exits

Norwegian Perspective



“We have no raw materials,
and we have a 67% higher cost of people,

So the only way we will survive is through:

- Competence,
- People,
- And a way of working”

Sverre Narvesen - President

Knowledge \neq Action

What are you going to do differently next week?

Thank you!

Aitäh!

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