# Commercializing UC Berkeley Technology via the University's Innovation Ecosystem

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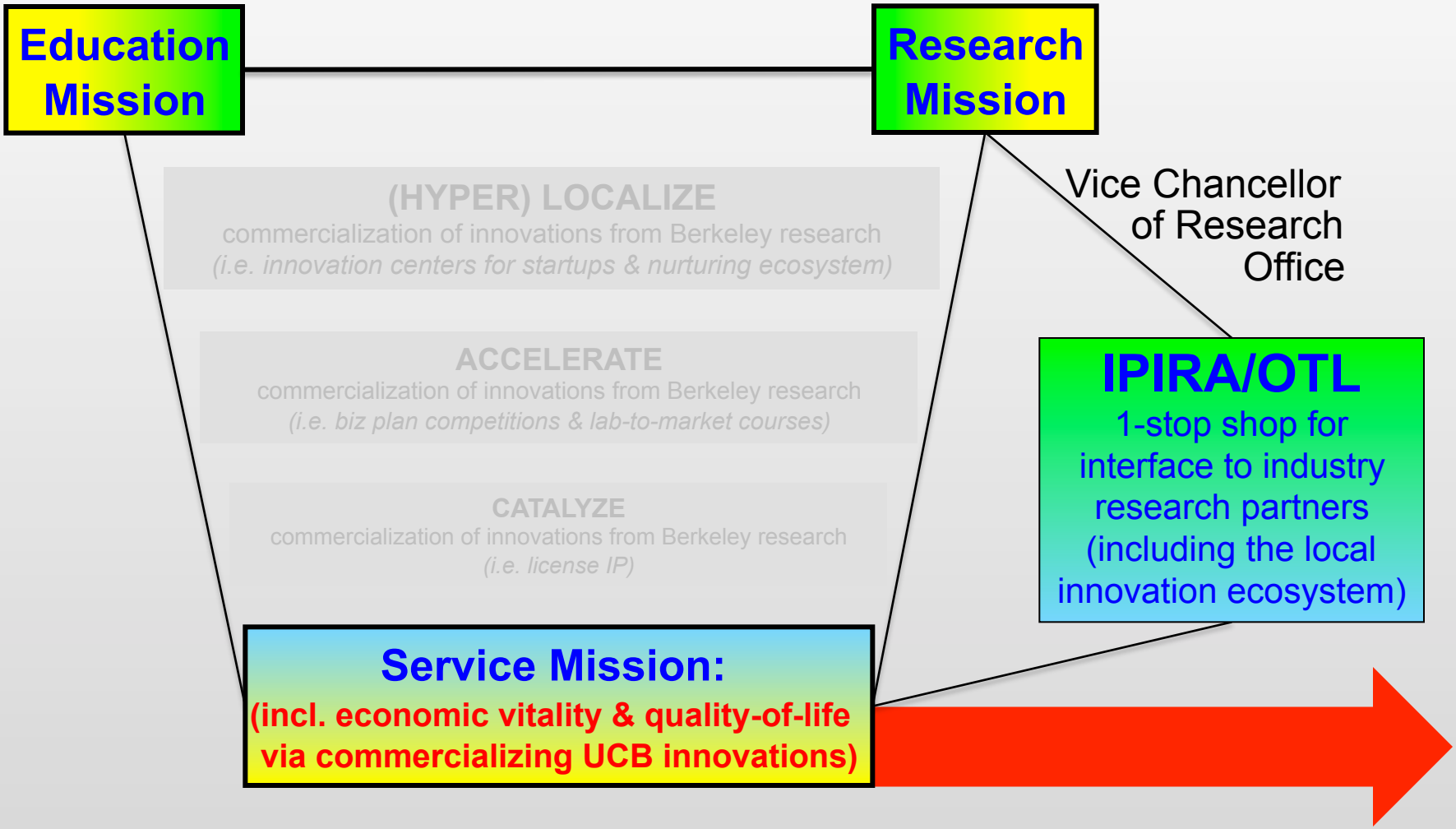
# Goals: *Big Picture Perspective (not factoids)*

1. Guide your transition from grad student to entrepreneur
2. Help you leverage Berkeley's innovation ecosystem
3. Familiarize you with licensing, patenting & disclosing IP

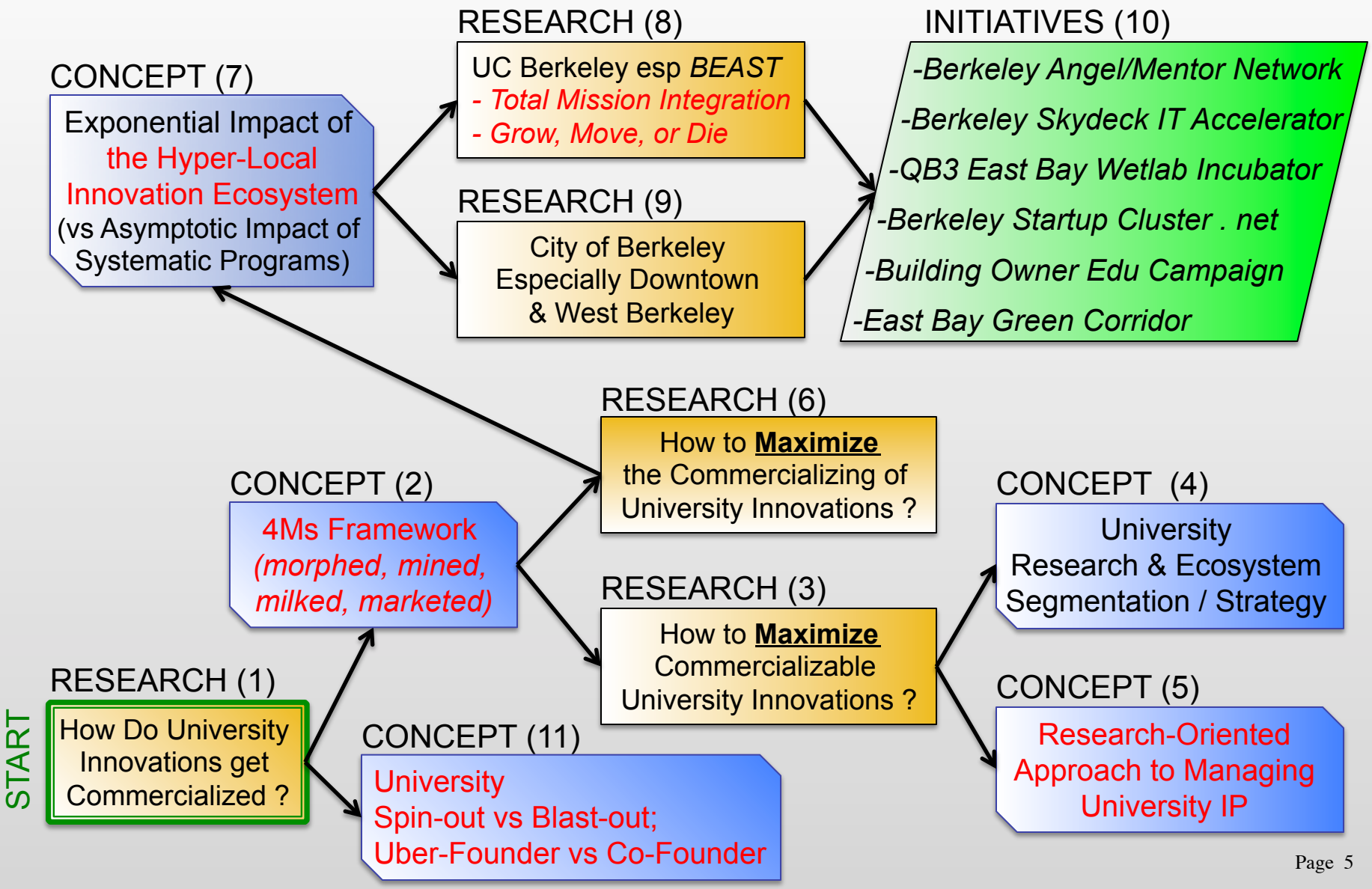
# Agenda: *Big Picture Perspective (not factoids)*

1. Brief Background: *HP, HBS, Sun, Mips, Silicon Graphics, Netpulse, PD, Cal*
2. How University People Start Companies
   - Commercialization pathways: *the 4Ms, spin-outs vs blast-outs*
   - Leveraging the ecosystem: *uber-founders, co-founders, early employees*
3. IP Licensing
   - Catalyzing the commercialization of innovations
   - Managing the risks associated with commercialization
4. Patentable Inventions & Copyrightable Software
   - Disclosing to UC Berkeley
   - Patenting
5. Q & A (but ask questions during the presentation!)

# Background: *Bio & IPIRA/OTL Role*



# Innovation Commercialization: *Research, Concepts & Initiatives*



# Research: *How Univ Innovations Get Commercialized?*

- **Questions**: How do university innovations get commercialized?
  - Conventional answer is linear (research=>invention=>license =>commercialize)
  - What and/or who catalyzed the commercialization?
  - How are universities involved in the process?
  - How can universities increase innovation commercialization?
- **Answers**:
  - Researched commercialization of >50 UCB & LBNL innovations
  - Research revealed 4 common patterns/pathways
  - Developed a useful framework based on 4 patterns
  - Developed strategies for optimizing the 4 pathways

# Research: *Partial List of >100 Start-ups* *(with IP Rights)*

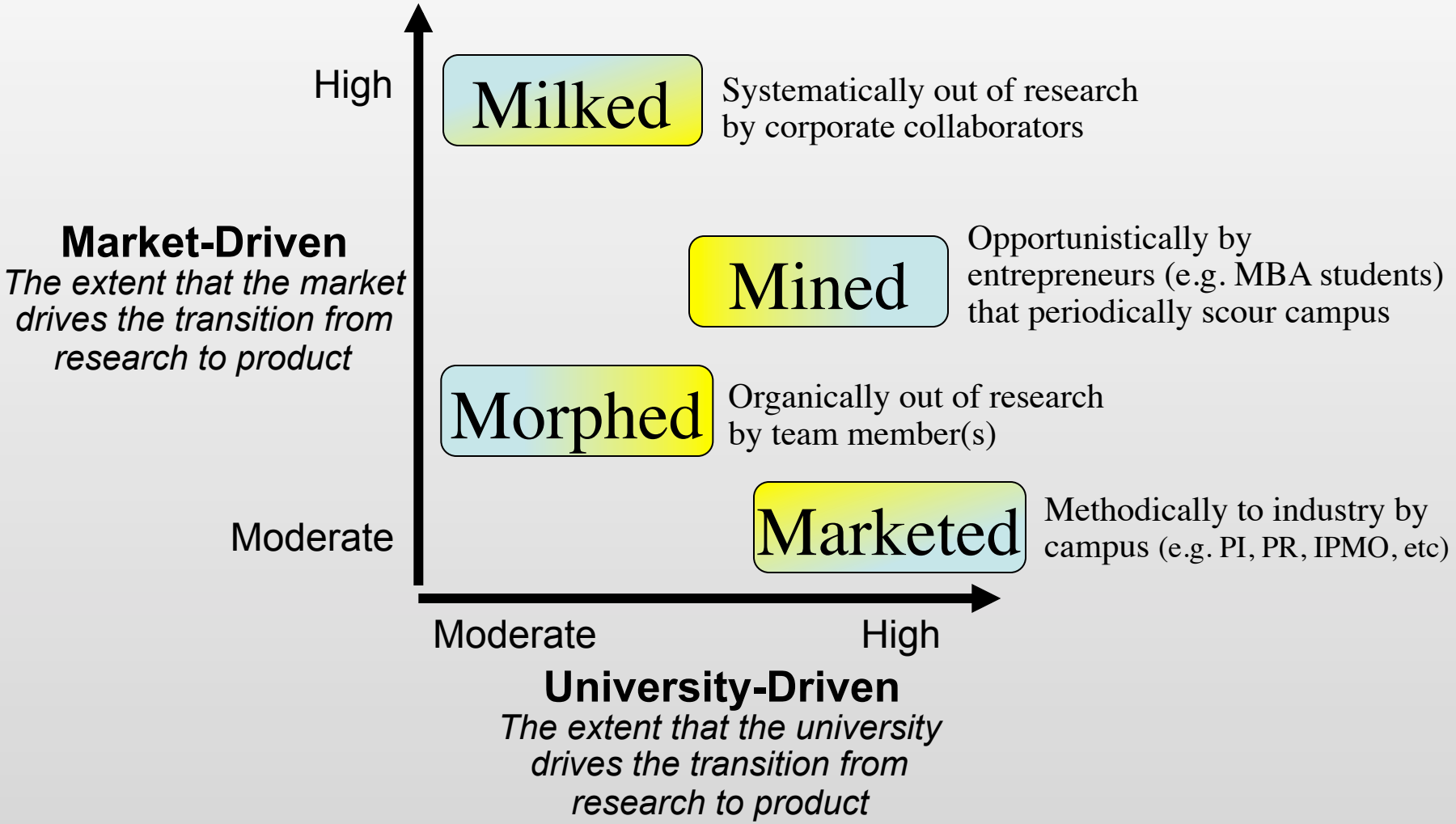
*This is a list of the over 100 start-ups that have leveraged UC Berkeley intellectual property rights (i.e. patentable inventions and copyrightable software) since about the mid 1990s.*

*These start-ups have used UC Berkeley's intellectual property (IP) rights to strengthen their business plans and thereby improve their prospects for obtaining the venture capital or other funding needed to pursue the commercialization of Berkeley innovations.*

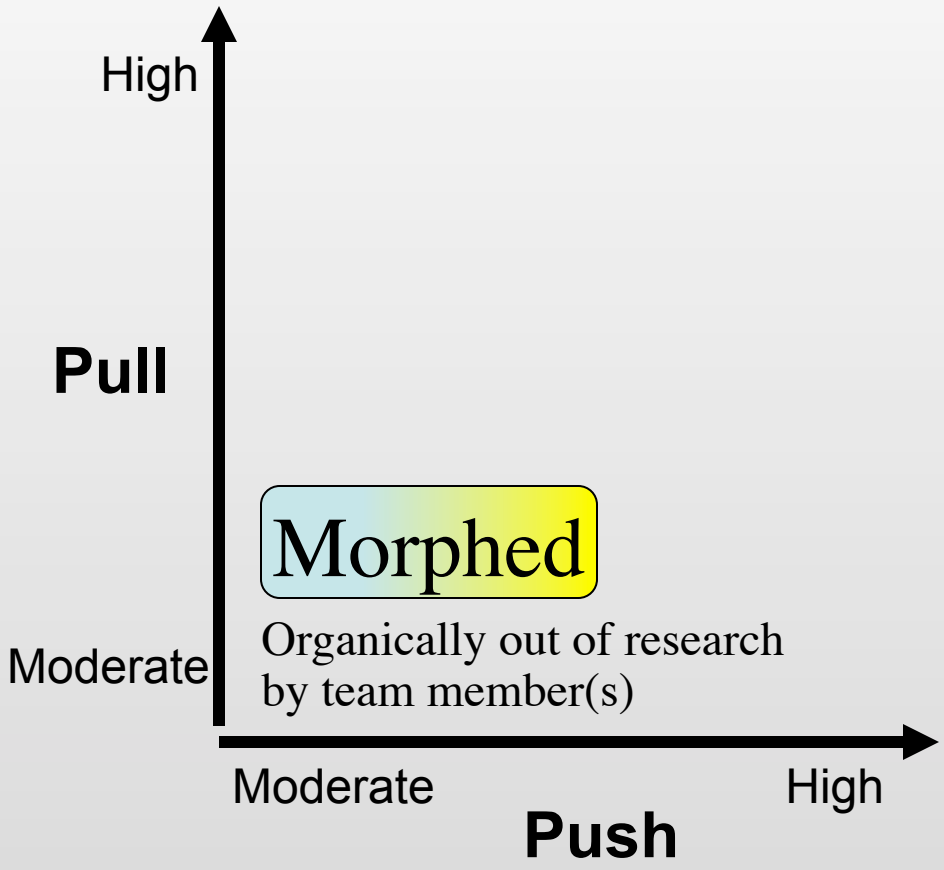
*Note that this list does not include the numerous start-ups that have commercialized UC Berkeley innovations but did not leverage any UC Berkeley IP rights (because the innovations don't have associated IP rights – such as UNIX, SPICE, RAID, etc).*

Acacia Biosciences
Adura Technologies
Alien Technologies
Ambrx
Amyris Biotechnologies
Arkal Medical
Aurora Biofuels
Bandwidth9
Berkeley Bionics
Berkeley Biosciences
Berkeley Madonna
Berkeley Microinstruments
BeThere
Biomanagement Group
Bioscale
BPS
Calimetrics
Calisolar
CellASIC
Ceres
Chiron
CNNSuperChip
Cognitive Wearable Technologies
Cooler
CommandCAD
Colusa Software
Cyberpac
Davis Allergy Research
Digital Mosaic Systems
Discera
DNA Sciences
Ecoprene
Euclid Media
EscharaX Medical
Excellin Life Sciences
Exelixis
Filgen Biosciences
FLX Micro
Fluxion Biosciences
Fuel FX
Genocea Biosciences
Gold Mountain Research
Goodguide
Harmonic Devices
Covarium/Heath Interactive
HFTA
iMedd
Inktomi
Integrated Diagnostics
IntelliOne
International Energy
InVino Sense
Iris Micromedical
Isatis
Joule Biotechnologies
Juvenon
Kaiwood Technologies
Kalinex
KineMed
Leucadia Technologies
Libraria
Light Stage
Lumiphore
Luminus Devices
Medifuel
Mendel Biotechnology
Mercator Medical
Microchip Biotechnology
Micro Climates / Aptility
MicroFab Biosystems
MicroReactor Systems
Mimesyn
Modulus Video
Molecular Dynamics
MOR Innovations
NanoGripTech
NanoNerve
NanoRay
NanoSys
NanoVasc
Neomorphic Software
nPrint
OmniOx
Oncobionic
ON Diagnostics
Onix Microsystems
OnWafer Technologies
Oswald Green
Photoswitch Biosciences
Preference Metrics
Protiveris
Q-Chem
Quadrant Imaging
Receptron
Redwood Biosciences
Renovis
RHA Technology
Rubicon Digital Mapping
Secured Streams
SenSys Networks
Silicon Basis
Silicon BioDevice
Silicon Clocks
Silicon Genesis
Similix
Solexel
Solidus Biosciences
SpectruMedix
Stressmarq Biosciences
Sunesis Pharmaceuticals
Symyx Technologies
Target Analytics
Thuris
TruVideo
Tularik
Two Blades (Foundation)
Urban Scan
Ventria Biosciences
Videnda
Vitapath Genetics
Wireless Industrial Tech
Xenometrix

# Framework: *4 Pathways for Commercialization*

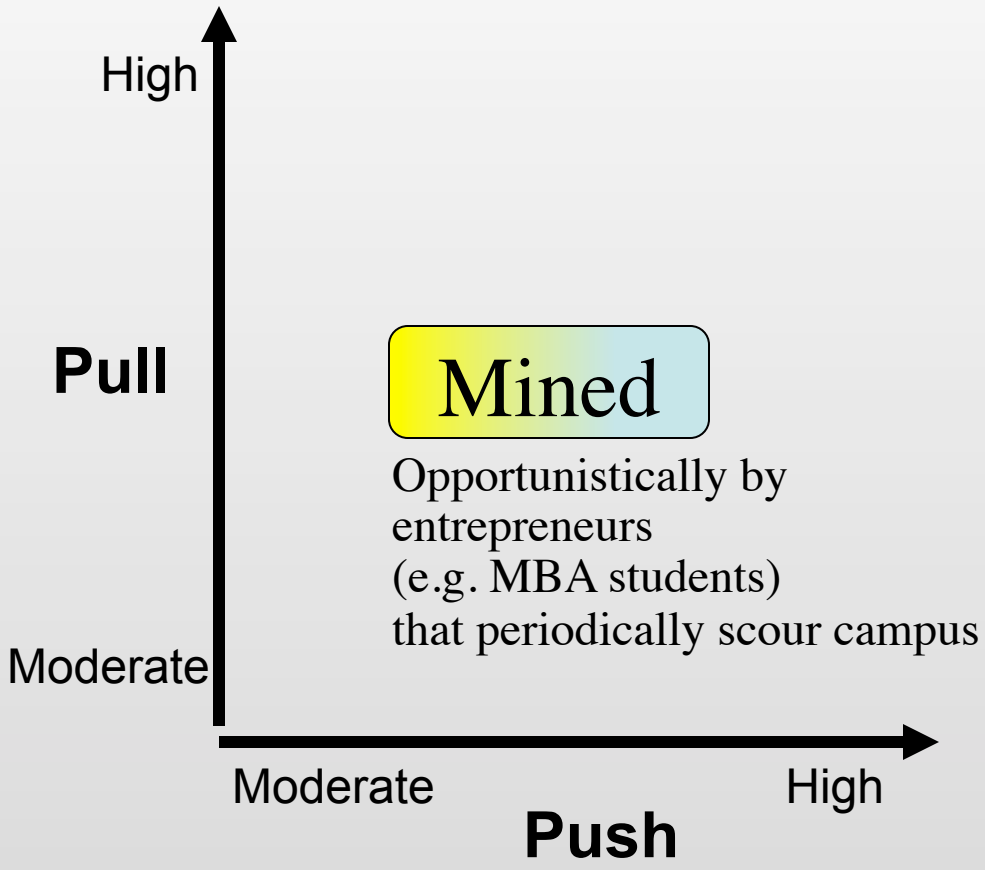


# Framework: 4Ms - ***Morphed***, *Mined, Milked, Marketed*



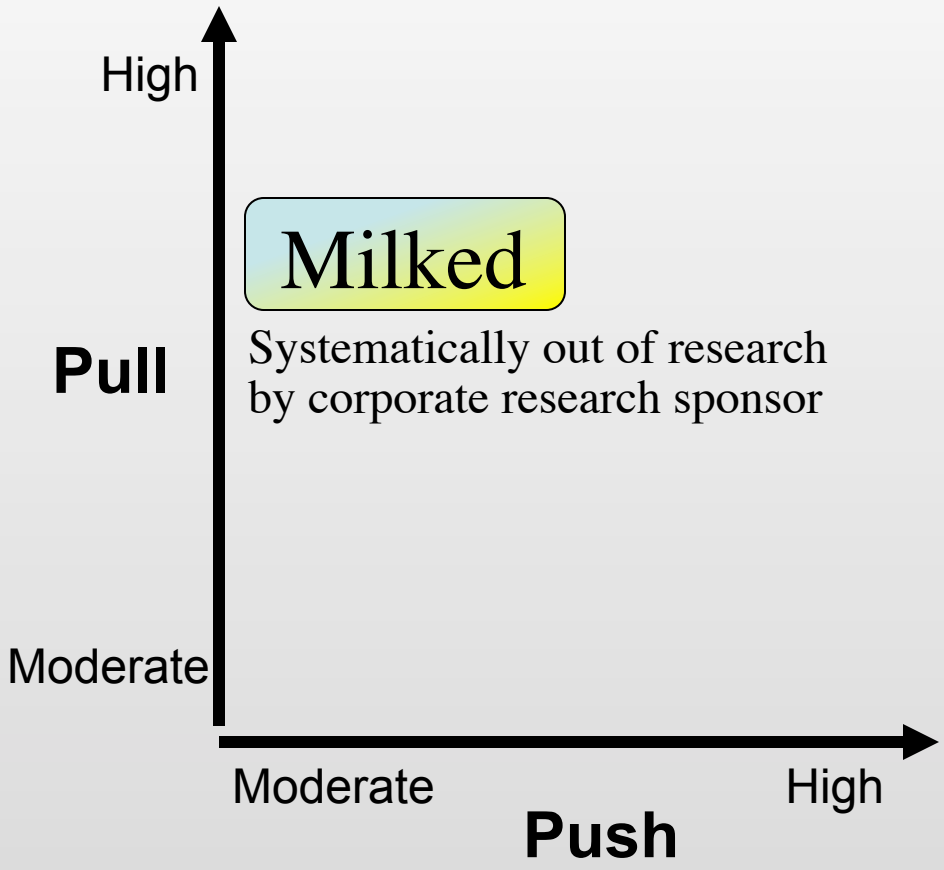

- Examples: Amyris, Calimetrics, CaliSolar, CellASIC, Chiron, Ensighta Security, Excellin, Fluxion Biosystems, GoodGuide, Harmonic Devices, Hybrid Wisdom Labs, Inktomi, Integrated Diag, IntelliOne, Kalinex, Lumiphore, Mercator Med, MicroClimates, MicroFluiDX, OnWafer, ON Diagnostics, PhotoSwitch Bioscience, Redwood Bioscience, Safely, SiClocks, TheraFuse, Urban Scan, Verimetra Med, Wireless Industrial Tech, Dust Networks, Iris AO, SiTime, NanoGripTech*
- Drivers:
  - Quantity & Quality of Research
  - Ecosystem: Spin-out vs Blast-out
- IP:
  - Some obtain exclusive license to improve biz plan & attract investors
  - Some ignore or abscond with IP

# Framework: 4Ms - *Morphed,* ***Mined****, Milked, Marketed*



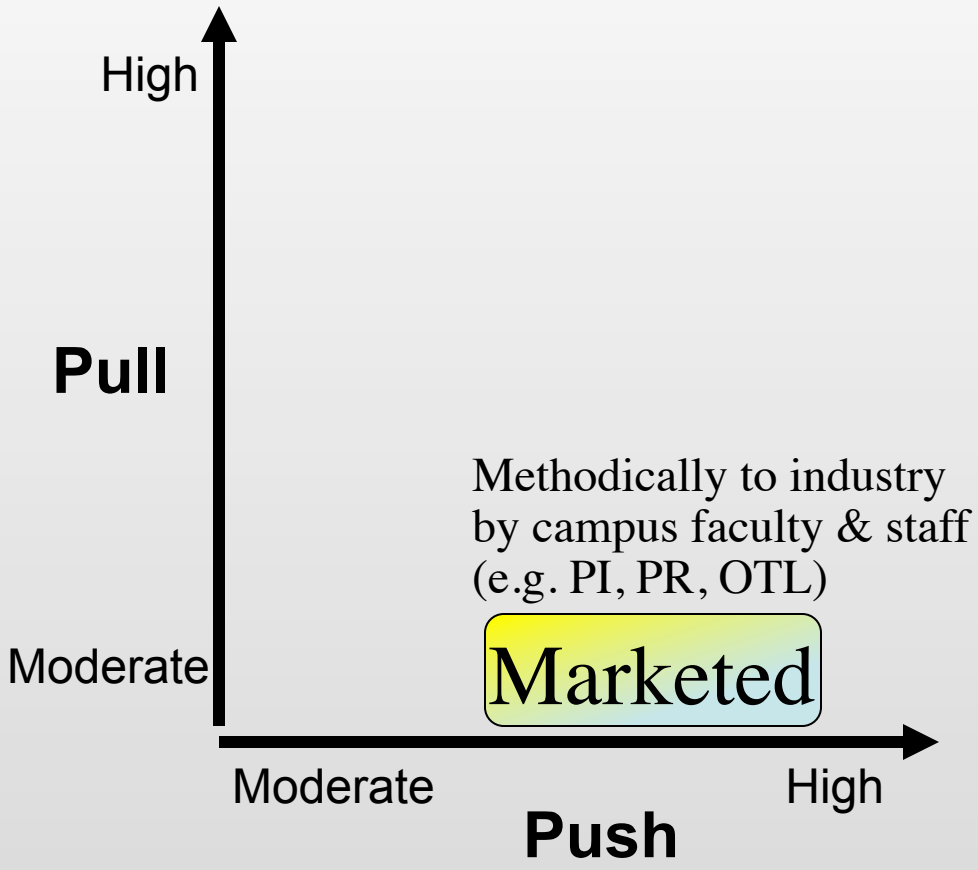

- Examples: Adura Tech, Aurora Biofuels, CommandCAD, Euclid Media, MediFuel, NanoRay, nanoPrint
- Drivers:
  - Quantity & Quality of Research
  - MBAs, Biz plan comp, OTL mrktg
- IP:
  - Many obtain exclusive license to improve biz plan & attract investors
  - Some ignore or abscond with IP
- Comments:
  - Pathway with highest growth rate
  - MBAs are the campus's EIRs

# Framework: 4Ms - *Morphed, Mined,* ***Milked****, Marketed*




- Examples (*that licensed IP*): Analog Devices, Nueprene (XL Tech), Google, Honeywell, Intel, Berkeley Bionics (first morphed then milked)
- Drivers:
  - Great sponsored research with optimized terms (i.e. 1st access, NERF, open source, etc)
  - Off-campus corporate labs (i.e. BWRC, Intel, Cadence, Yahoo, Starkey, etc)
- IP:
  - Some jointly own IP
  - Some obtain a license to legally use IP or thwart competitors
  - Some ignore or abscond with IP

# Framework: 4Ms - *Morphed, Mined, Milked,* ***Marketed***

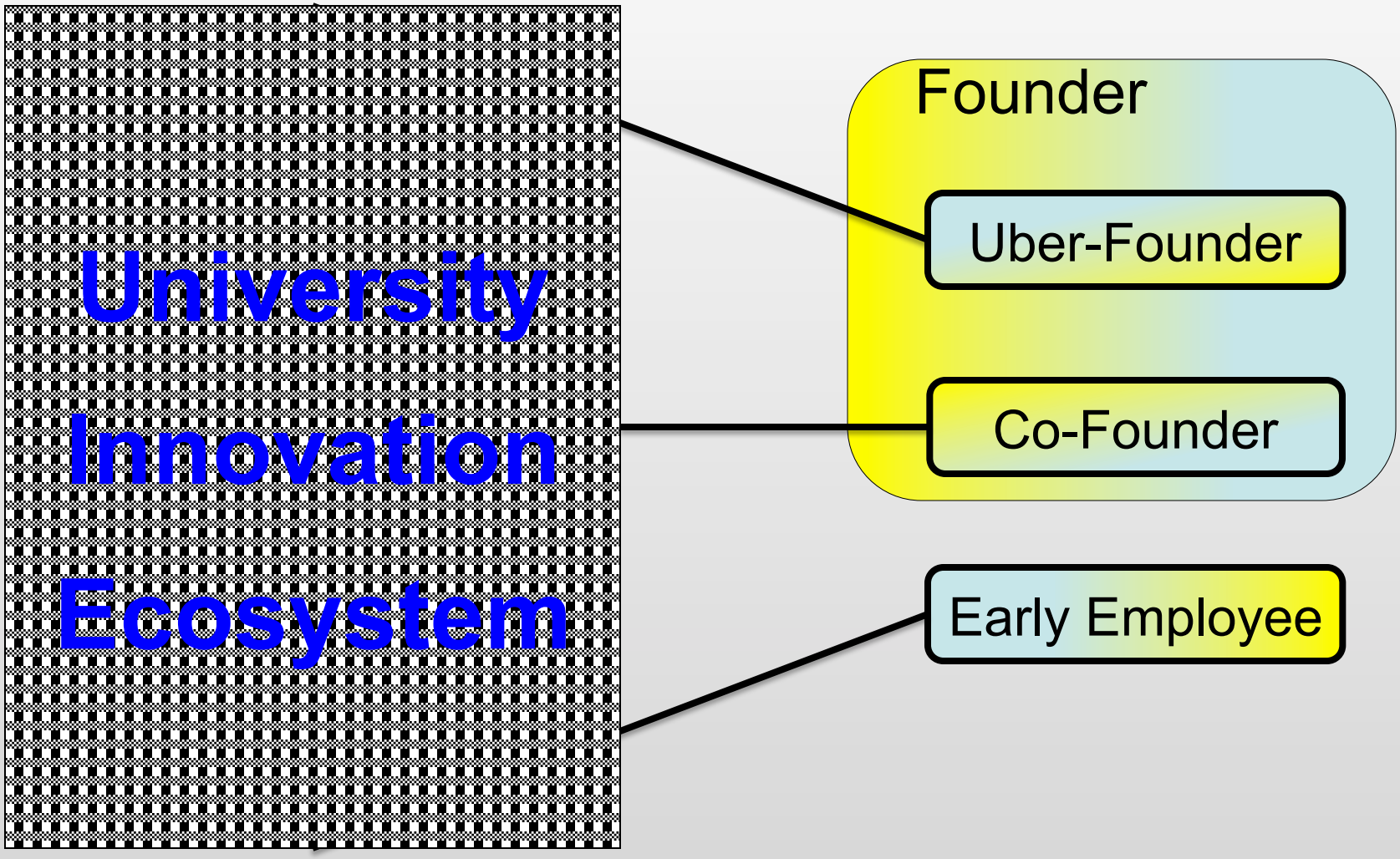



- Examples: Arkal Medical, Cisco, ClimateCooler, FuelFX, Luminus Devices, Honeywell, Microchip Biotech, Renovis, Sand9, Silicon Basis, Solexel, Vitesse, 3M
- Drivers:
  - Quantity & Quality of Research
  - Marketing (i.e. IP Licensing offices, University PR programs, Faculty pubs & ppts, Patent pubs, etc)
- IP:
  - Most obtain exclusive license to stay legal, improve BP, attract investment, or thwart competitors
  - Some ignore IP or abscond with IP
- Comments: Didn't get *morphed*, *milked* or *mined* because tech or market too nascent when invented

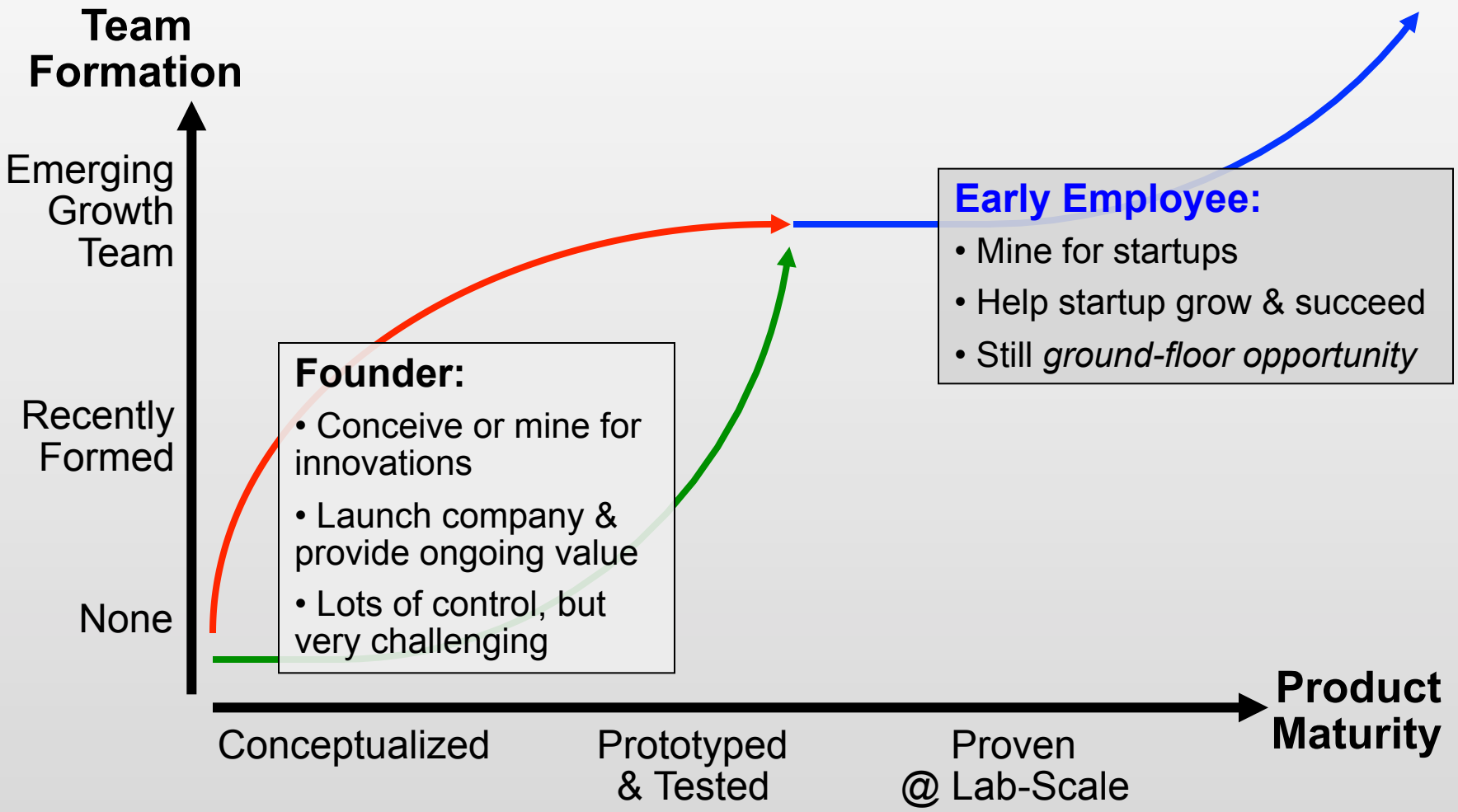
# 4Ms: *Ecosystem of Activities, Programs, Resources*

| Pathways (4Ms) | Activities, Catalysts, Programs, Initiatives | Recent Progressive Approaches | Offices | Ideas & Comments |
|---|---|---|---|---|
| Morphed | •Entrepreneurship classes<br>•On-campus Incubators<br>•Entrepreneurial Admissions<br>•Entrepreneurial Culture | •University startup<br>•Incubators & accelerators | •CET (CoE)<br>•Haas (Lester)<br>•OTL | •SBIR/STTR help center<br>•Berkeley Startup Cluster |
| Mined | •Entrepreneurial MBA Program (EIRs)<br>•Biz Plan & Tech Competitions<br>•Research-to-Market Courses (C2M)<br>•Seminars & Poster Sessions (YAPS)<br>•Haas Speaker Series & VC Office Hours | •Cleantech-2-Market Course | •Haas (Lester)<br>•OTL<br>•CoE<br>•CITRIS<br>•QB3<br>•Student Clubs (BERC) | •Berkeley Startup Cluster<br>•Berkeley Center for Growth Companies |
| Milked | •Institutional response to RFPs<br>•Opportunistic PIs<br>•Sponsored Research Agreements<br>•Visiting Industrial Fellows<br>•Faculty Consulting & Student Hiring | •Research-Oriented Approach to Managing IP rights (e.g. NERFs, BIP, SRA IP grants, etc) | •VCRO<br>•IPIRA (IAO & OTL)<br>•CoE<br>•CITRIS<br>•QB3 | •Adjacent R&D Office Parks/Buildings<br>•Research Enterprise Marketing |
| Marketed | •Newsletters & Press Releases<br>•Searchable Web Listings<br>•Serial Entrepreneur & VC Discussions<br>•Scholarly Publications & Presentations | • | •CoE<br>•VCRO<br>•OTL<br>•NewsCenter | •EBGC Customer Cred Program<br>•EBGC Cluster Clubs<br>•Email Mrktg |

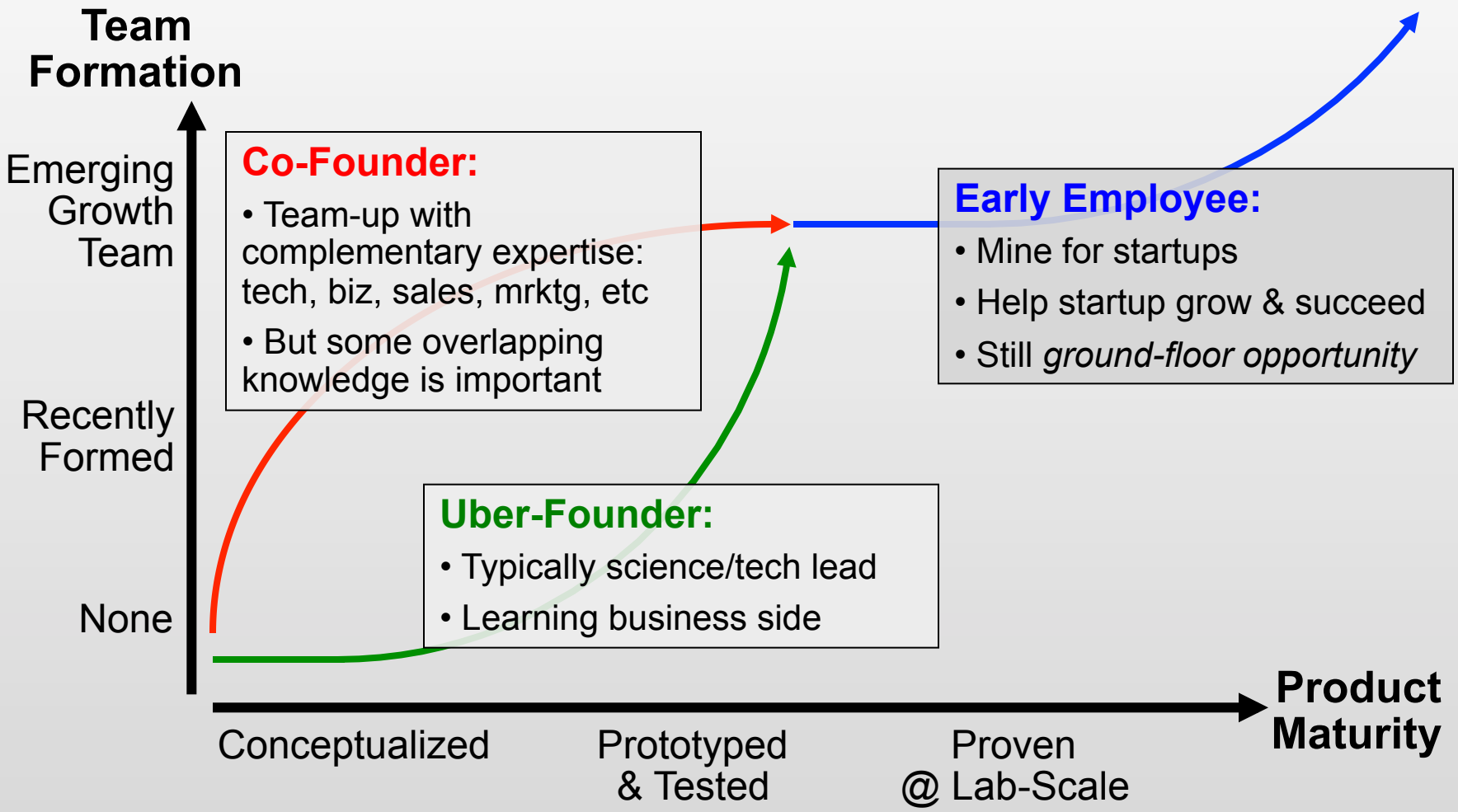
# Ecosystem Navigation: *3 Approaches*



# 3 Approaches: *Founder vs Early Employee*



# 3 Approaches: *Uber-Founder vs Co-Founder*



# Ecosystem*: *Entrepreneurship Training for Uber-Founders*

*Not a comprehensive list; just 1 page of examples

## ❑ Courses

- Haas: Cleantech-to-Market (C2M) ei.haas.berkeley.edu/c2m
- CoE: Center for Entrepreneurship & Technology cet.berkeley.edu
- Other: ChemE Product Development Program cheme.berkeley.edu/PDP

## ❑ Business Seminar Series

- Berkeley Entrepreneurs Forum entrepreneurship.berkeley.edu/BEF/index.html
- Best Practice Series entrepreneurship.berkeley.edu/resources/bestpractices.html
- QB3 Series qb3.org/startups/QED-QB3

## ❑ Workshops & Boot-camps

- Bench to Market: Idea Evaluation & Research Commercialization for Scientists
- See Skydeck website for events

# Ecosystem*: *Innovation Mining for Founders*

*Not a comprehensive list; just 1 page of examples

- Available IP: IPIRA.berkeley.edu "Available Technology"
- Faculty Research: VCresearch.berkeley.edu/faculty-expertise
- Information Technology: CITRIS-UC.org/initiative
- IdeaLabs: BigIdeas.berkeley.edu/idealabs
- Technology Seminar Series:
  - CITRIS Seminar Series CITRIS-UC.org/news/spring_2012_i4energy
  - QB3 Series QB3.org/startups/QED-QB3
  - LBNL EETD noon-time seminars EETD-Seminar@dante.lbl.gov
- Clubs:
  - Berkeley Postdoc Entrepreneurs Program QB3.org/startups/bpep
  - Nanotech club nano.berkeley.edu/people/berkeleyClub.html
  - Berkeley Energy & Resources Collaborative BERC.berkeley.edu

# Ecosystem*: *Startup Mining for Early Employees*

*Not a comprehensive list; just 1 page of examples

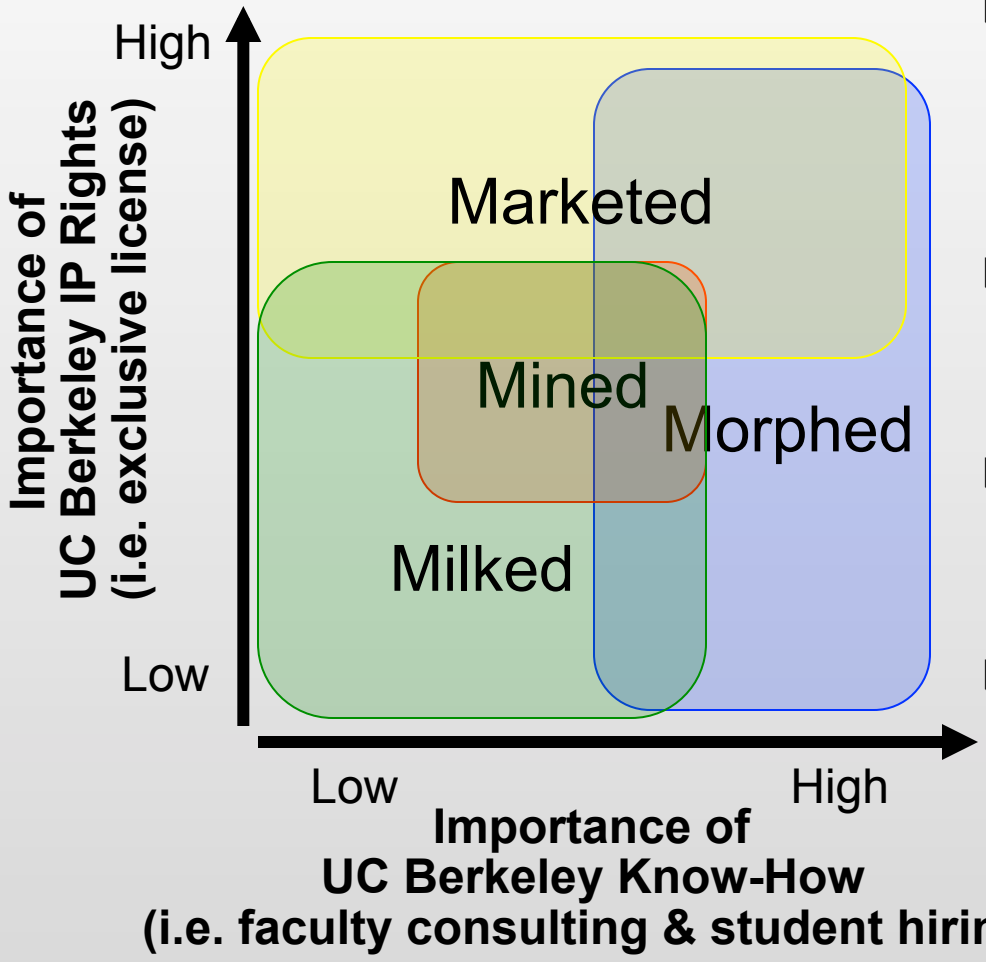
- Startup & Business Plan Competitions
  - Berkeley Startup Competition bplan.berkeley.edu/
  - Global Social Venture Competition entrepreneurship.berkeley.edu/business_competitions/gsvc.html
  - CET Venture Lab CET.berkeley.edu/vlab
  - Big Ideas BigIdeas.berkeley.edu/
  - Intel Global Challenge at Berkeley www.entrepreneurshipchallenge.org/
- Local Startup Cluster Organizations
  - Berkeley Startup Cluster: BerkeleyStartupCluster.net
  - East Bay Green Corridor: EBGreenCorridor.org

# Ecosystem*: *Resources for Startups*

*Not a comprehensive list; just 1 page of examples

- Startup Accelerators
  - Skydeck.berkeley.edu
  - QB3.org/startups/qb3-garage
  - CITRIS manufacturing accelerator (TBD)
- Mentor & Angel Investor Networks
  - Entrepreneurs Corner Office Hours entrepreneurship.berkeley.edu/students/mentoring.html
  - Berkeley Angel Network BerkeleyAngelNetwork.com
  - East Bay Green Corridor Mentor Program EBGreenCorridor.org
  - Berkeley Startup Cluster Advisory Committee BerkeleyStartupCluster.net
- QB3 Startup In a Box: QB3.org/startups/box
- Legal Resources: BerkeleyStartupCluster.net/Business-Resources

# Commercialization: *Pathways, IP & Know-How*




- **Morphed** commercialization, by definition, depends on UCB know-how, that is sometimes augmented with UCB IP
- **Marketed** commercialization usually involves UCB IP but frequently not UCB know-how
- **Milked** commercialization widely varies in how it involves UCB IP and know-how
- **Mined** commercialization usually involves a mix of UCB IP & know-how

# IP Licensing: *Top Generating IP (note variety)*

*This is a list of of 47 UC Berkeley patented inventions and copyrighted software that have generated the most IP licensing revenue for UC Berkeley.*

*This list doesn't include patentable inventions and copyrightable software developed at UC Berkeley that did not result in substantial licensing revenue but did create industries, market segments, and large companies – such as UNIX (scientific computing), SPICE (electronic design automation), and RAID (redundant disk storage).*

- Transfer primers for genetic analysis
- Spacers for primers in genetic analysis
- Laser confocal fluorescence microscanner
- Capillary confocal fluorescent microscanner
- Calcium primers for genetic analysis
- Search engine software
- Network router scheduling software algo
- Method of transforming barley genotypes
- Irreversible electroporation tissue abulation
- 3D modeling software
- Hydrodynamic transport for RFID mfg
- Gene reporter matrix for drug discovery
- Separation of thin film LEDs
- Monoclonal antibody mouse
- Microfabricated fluidic reactors
- Elimination of DNA artifacts
- Dehalogenation in toxic groundwater
- Improved fluorescence energy transfer
- E.coli detection in water DNA
- Recombination in eucaryotic cells
- Blockade of regulation from CTLA-4 signals
- resonant microstructure
- BMP antagonists / morphogenic proteins
- capillary array micro electronics
- Rotary confocal scanner
- Electrophoresis devices
- Mevalonate biochemical pathway
- Double-gate transistors
- Biosensor using filter & laser
- Tall microstructures
- Scanning micromirrors
- travel probe software algo
- Rejuvenating mitochondria
- Q-chem software
- hybridomas materials
- Identifying mutagenic changes
- Organocatalysis
- Heterologous proteins
- Pavement rehab analysis
- CA4PRS software
- Dectection in large doc sets software algo
- Methods for defining cell type
- Genetic markers breast/ovarian cancer
- TLA1 gene in algae for biofuels
- Intracellular delivery vehicles
- In-situ groundwater aquifer
- Treatment to reduce edema
- Capacitorless double-gate DRAM

# IP Licensing: *UC Berkeley Objectives*

Leverage the University's Intellectual Property (IP) rights to ***Catalyze*** (not just facilitate or "transfer technology"):

1)The Commercializing of UC Berkeley Innovations – quickly & broadly to:

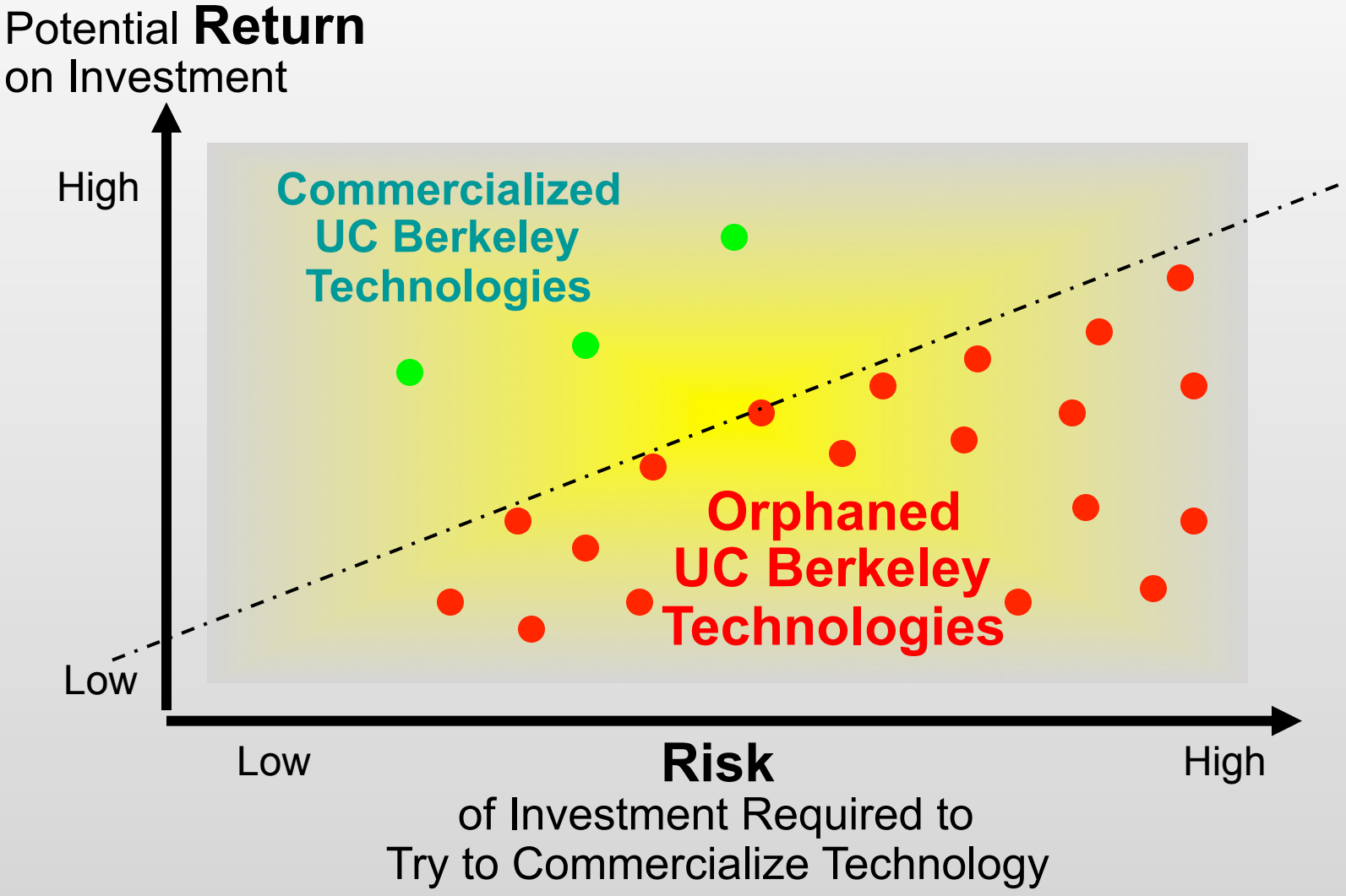
- Benefit the regional economy & society at large
- Fund research & education on campus
- Reward researchers for their ingenuity*

2)The Funding of UC Berkeley Research by –

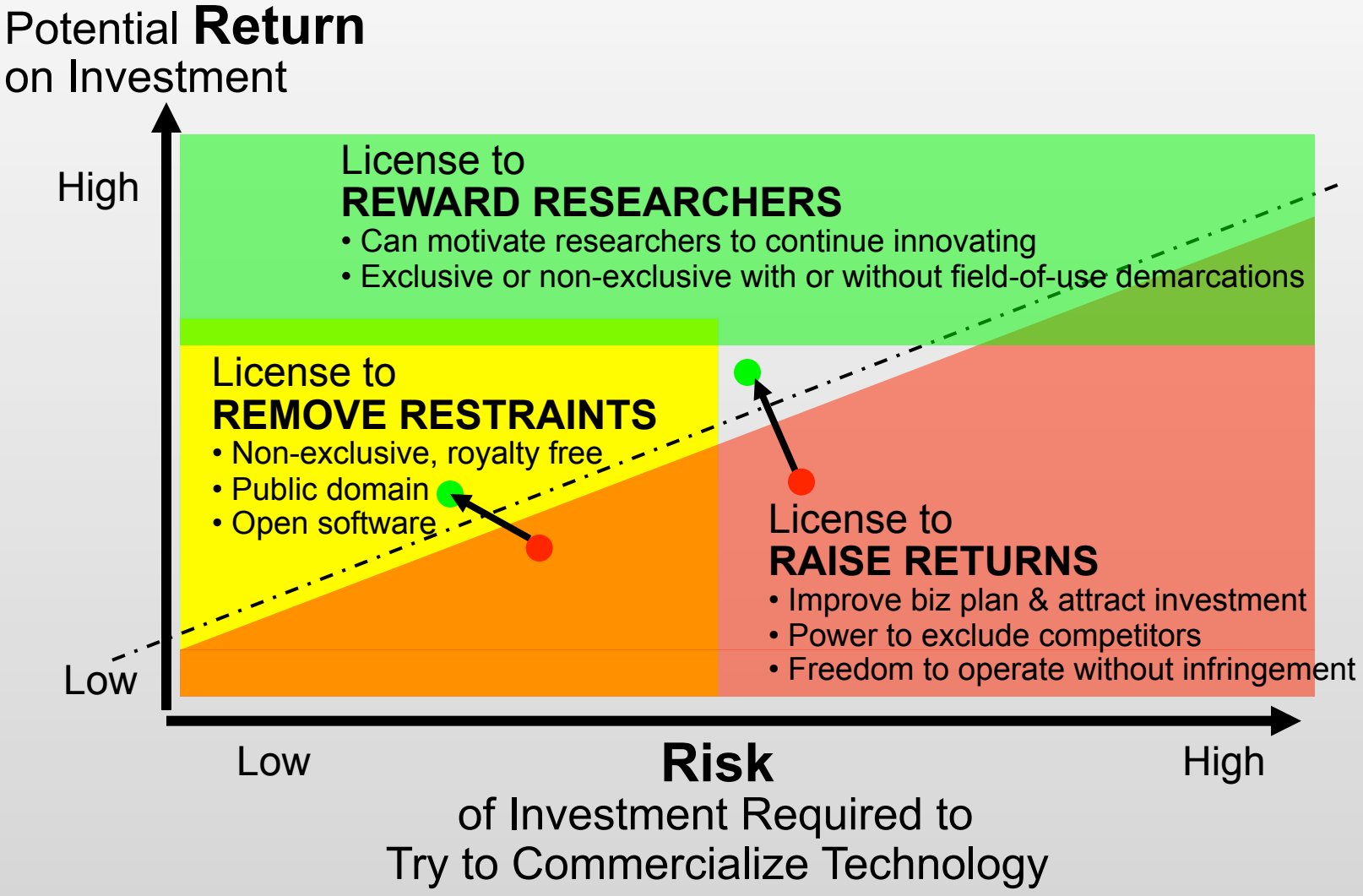
Reconciling the IP needs of sponsors with the IP policies of the University

* Depending on the circumstances, inventor rewards can vary and for example range from licensing income (typically 35%), to attribution and recognition, to the personal satisfaction of developing technology that has been successfully commercialized.

# IP Licensing: *Commercialization Challenges*



# IP Licensing: *Catalyzing Commercialization*



# IP Licensing: *Value to Companies*

**Exclusive License**

1. Used as **competitive barrier** & thereby **improves return on (risky) investment**
   - New feature, point-product, product-line, or multi-segment product family
   - Can be very helpful to startups, but often only marginally helpful to large companies
2. Used to **impress investors** & thereby **improve funding, acquisitions, valuation**
   - IP on which start-up is founded
   - Can be very helpful to startups, but often only marginally helpful to large companies
3. Used (with know-how, etc) to implement sublicense **solution** (fab-less IC corp)
4. Used (with other IP) to **cross-license** with competitors & gain freedom-to-operate
5. Used to **discourage infringement claims** & thereby lower company's legal costs
6. Used (with other IP) to **promote industry standard**
7. Used to prevent companies from **nefariously controlling technology's market**

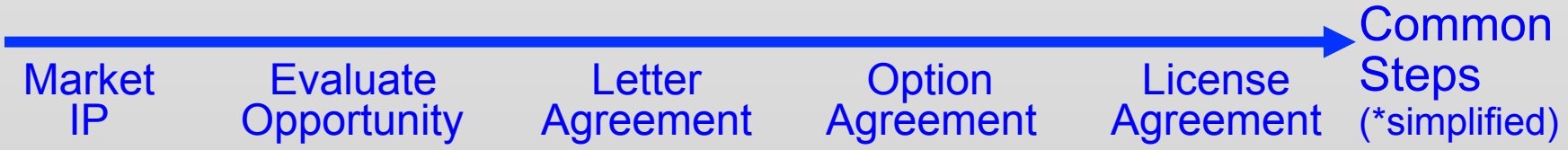
**Non-Exclusive License**

# IP Licensing: *Overview of IP Agreements*

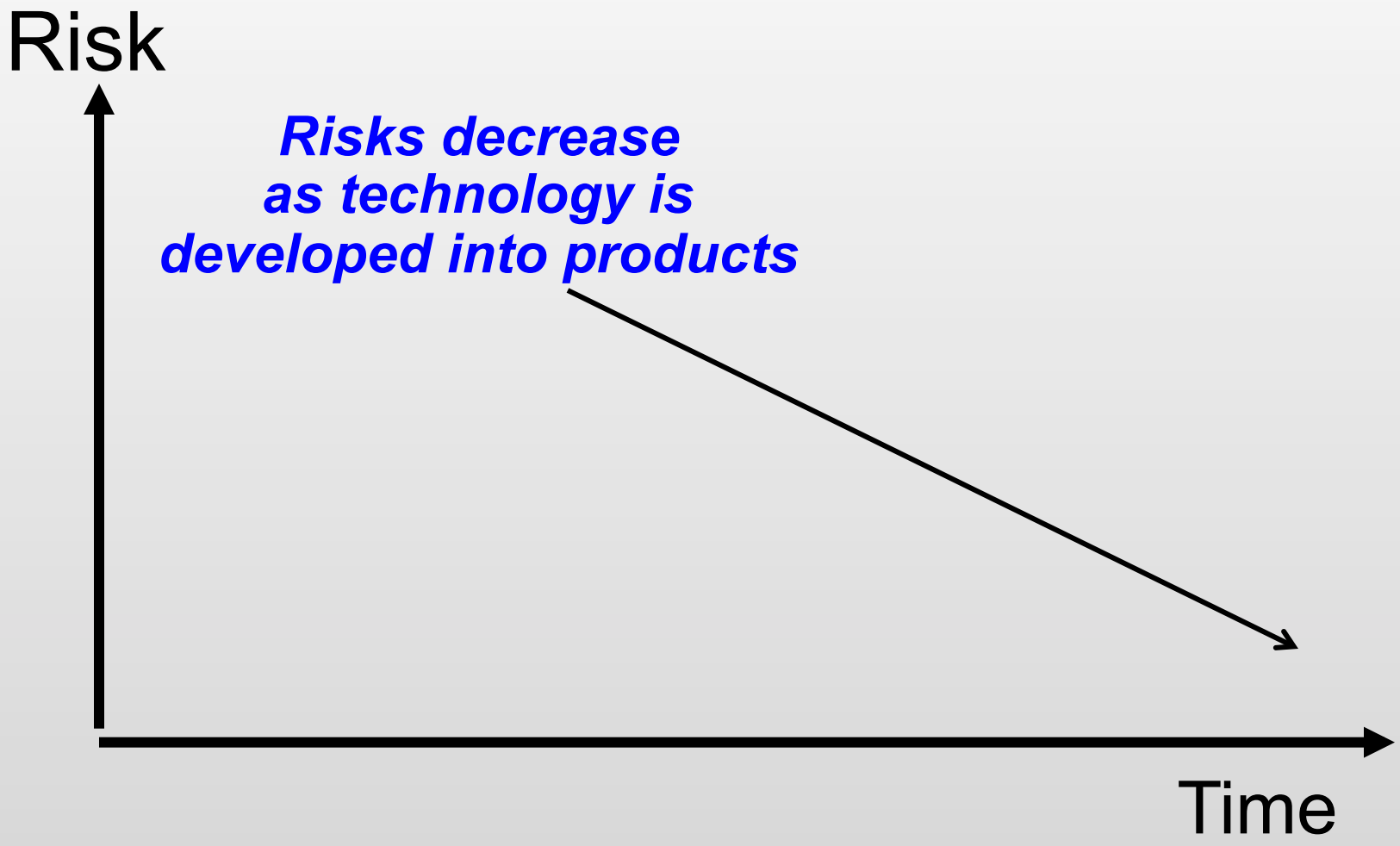
- Purpose: Legal agreement in which licensor gives licensee the right to use the licensor's patented technology or copyrightable software (note that IP is not sold)
- Types
  - License agreement (decades) vs option agreement (years) vs letter agreement (months)
  - Patent rights vs copyrights vs data rights licenses
  - Exclusive vs Non-exclusive
  - Field-of-use demarcation, sublicensing, etc
- Terms
  - Financial: royalties, license fees, patent costs, etc
  - Legal: Warranties, indemnification, confidentiality
  - Operational: Performance milestones (require progress or the license can be terminated)
- Price (royalty rate, fees, etc)
  - Nature of IP: revolutionary vs incremental / method vs device
  - Risks to commercialize IP: time, capital, regulatory, etc
  - Economics of IP's market: pharmaceuticals, semiconductors, software, energy

# IP Licensing: *Common Steps**

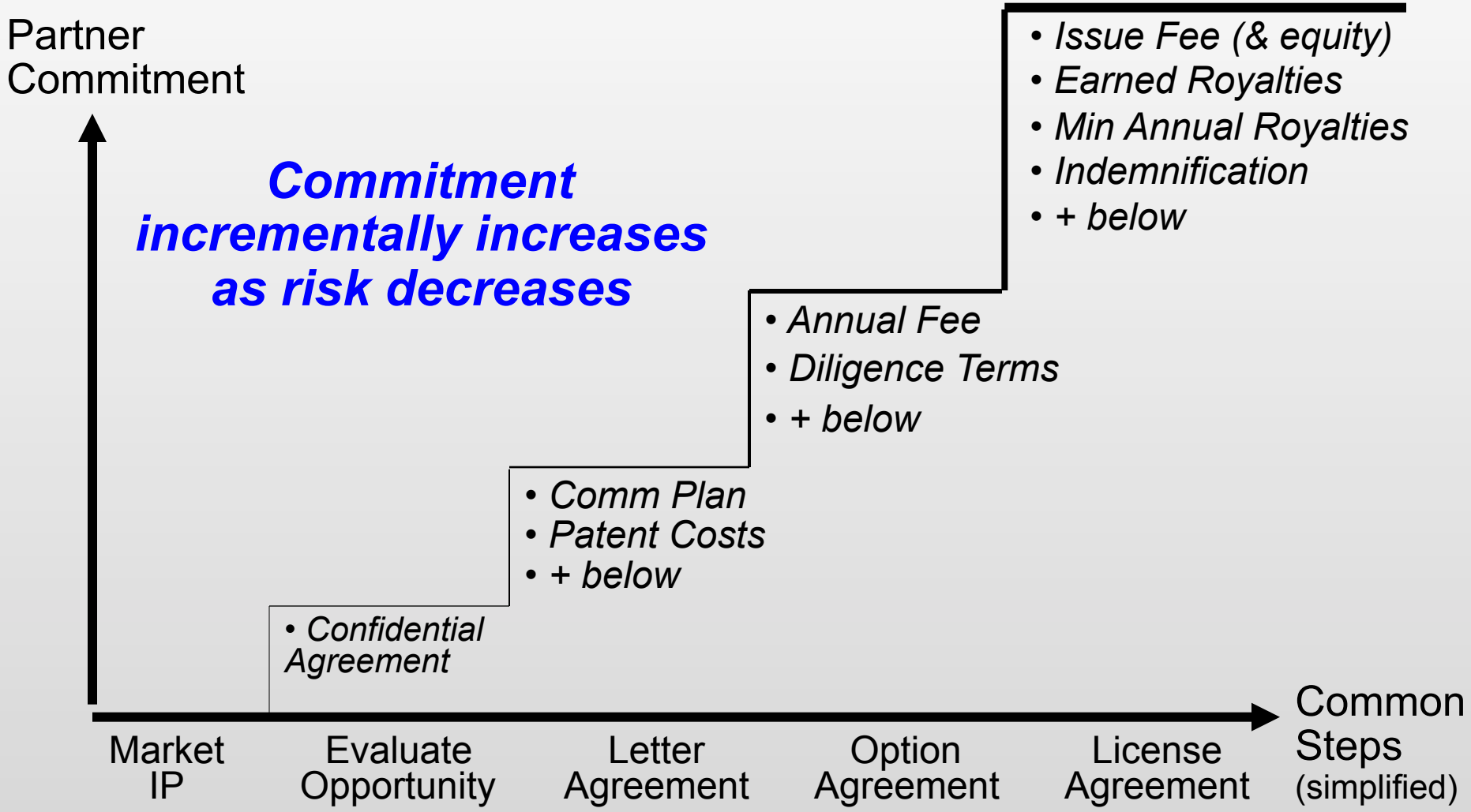
- Objectives: commercialize IP broadly, quickly, beneficially
- Challenges
  - Manage uncertainty & risk of commercial success
  - Understand & reconcile different perspectives (corps, inventors, univ)
- Approach
  - Entrepreneurial (flexible, creative)
  - Principled (win-win)
  - Transparent (no conflicts of interests)
- Process: **Incremental**



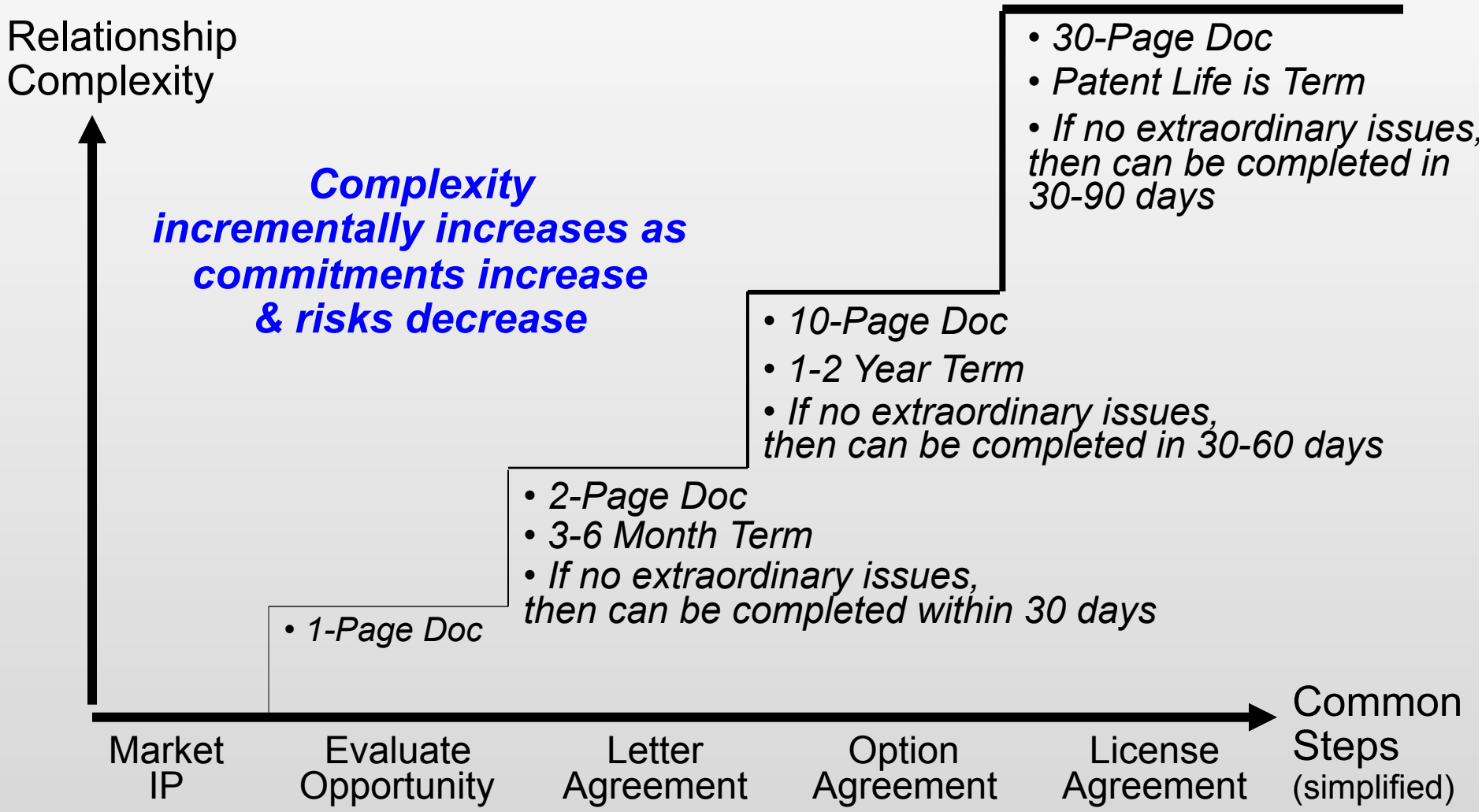
# IP Licensing: *Managing Risk*



# IP Licensing: *Commitment = f (Risk)*



# IP Licensing: *Complexity*



# Patents: *Overview of IP*

- Intellectual Property (IP): Includes patents, copyrights, trademarks, trade secrets
  - Patentable invention is a new & useful process, machine, article of manufacture, or composition of matter
  - Copyrightable work protects the expression of an original work of authorship (i.e. software)
  - UC Berkeley doesn't keep trade secrets
  - Researchers own their know-how
- Purpose: A patent is a legal monopoly that gives the patent owner the right to exclude others from making, using, or selling an invention for a limited time (20y)
- Creation: Patents & copyrights granted & enforced by governmental authorities in each country (in return for full disclosure of inventions to enrich public knowledge)
- Timing: A US patent must be filed within a year after the invention has been publicly disclosed; & most international patents must be filed before the invention is publicly disclosed; a patent *filing* is not a patent; it can take 1-3+ years for a patent to *issue*; once issued the patent term is 20 years from the *filing* date
- Costs: **Utility** US filing-only can cost > $15K, & international patent filings are even more expensive (translation charges, etc); **Provisional** US filing can cost ~$1K
- Value: It's not difficult to get a patent, but it's challenging to get a useful patent

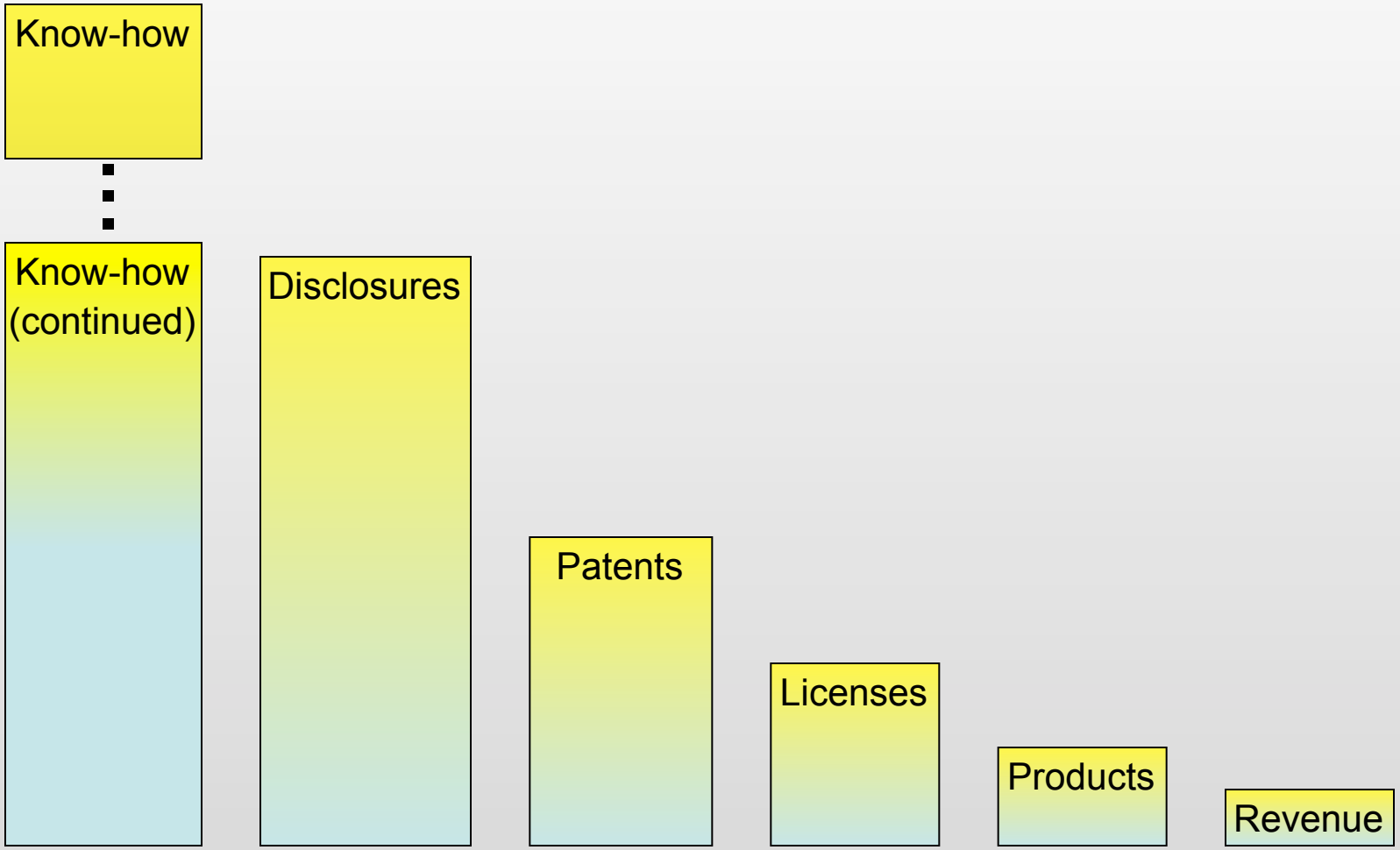
# Invention & SW Disclosures: *Responsibilities*

- Disclosures Required By
  - Many funding agreements -- especially US Government funding
  - UC Employment agreement (Patent Policy and associated Patent Acknowledgement)
  - Note that UC employees own their own "know-how"
- Disclosure Forms Purpose (not a useless bureaucratic exercise)
  - Describe specific invention to clarify novelty & value (i.e. patentability)
  - List funding source(s) to check for encumbrances & obligations related to patent rights
  - List public enabling disclosure(s) to determine patent deadlines (bar dates)
  - List inventorship to determine ownership, distribution of proceeds, patenting help, etc
- Inventorship on Disclosure Form
  - If contributed to 1 claim, then co-inventor on patent (this is law not UC policy)
  - Can change from disclosure to patent depending in claims in actual patent issued
  - If co-inventor from another university or company, then IP jointly owned
    - Each owner has rights to the entire patent rights
    - Often joint owners establish an agreement on how to collaboratively manage IP

# Invention & SW Disclosures: *Opportunities*

- UCB inventors (hired after 1997)
  - Get 35% of licensing proceeds (after costs)
  - Proceeds split evenly among co-inventors unless another split is agreed to in writing
- UCB researchers that spin-out companies can license patent rights
  - Inventors have the most know-how to commercialize inventions
  - Therefore inventor start-ups are best candidates to meet objectives of exclusive license
- Ownership of IP
  - Invention disclosure doesn't automatically give title to UC
  - UC owns if (a) use UC resources, (b) fund via UC, or (c) scope of employment with UC
  - Inventors can request UC DISCLAIM or WAIVE ownership of invention
  - If in doubt about ownership, then it's better to disclose invention to UCB OTL
- If UCB doesn't want to pursue patent for an invention, then
  - Funding agency can pursue the patent
  - If funding agency doesn't want to pursue patent, then inventors can pursue patent

# Invention Disclosures: *Statistics (not to scale)*

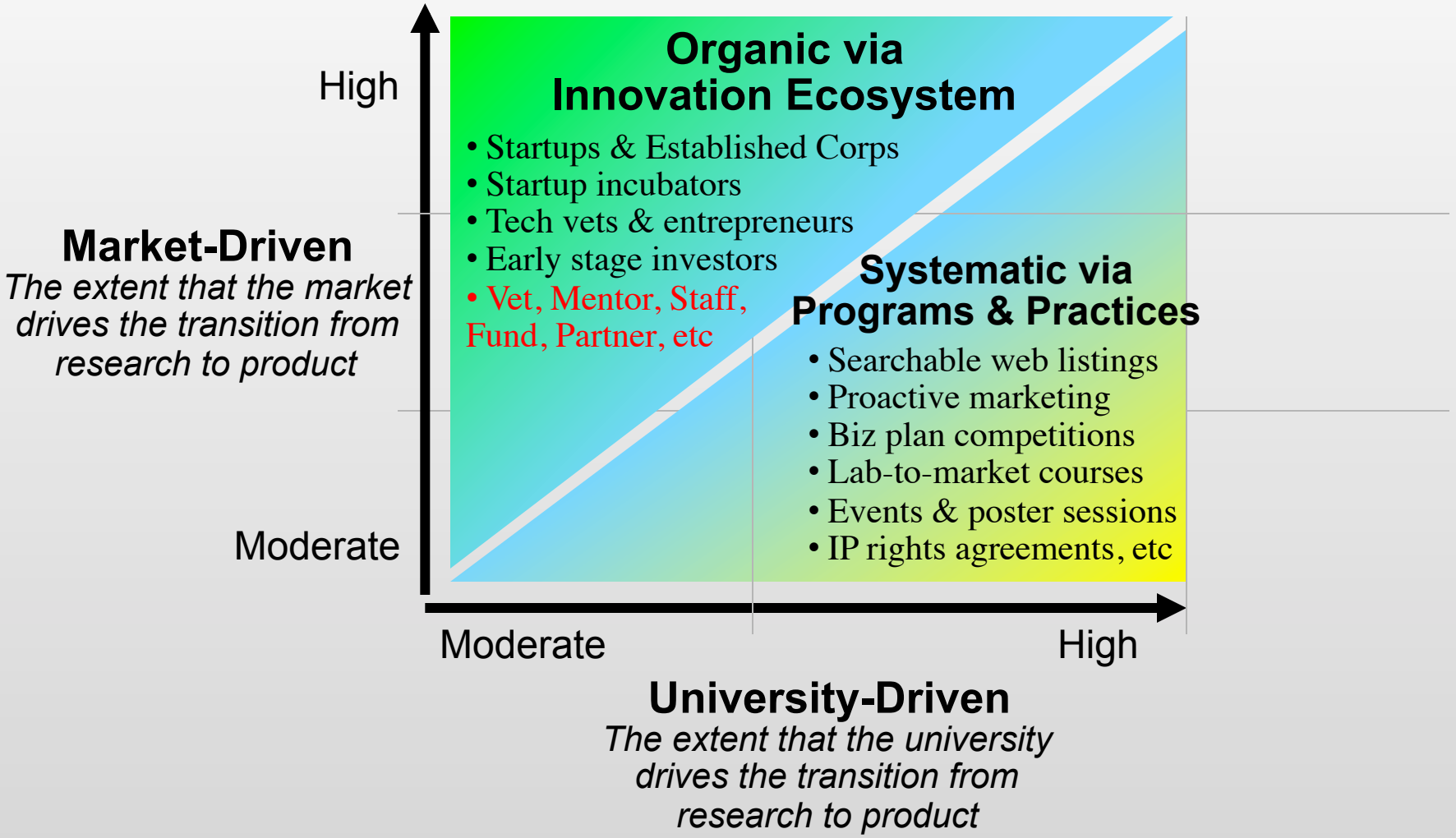


# Summary & Questions

- Key points
  - Commercialization pathways: *morphed, mined, milked, marketed*
  - Leverage ecosystem: *uber-founder, co-founder, early employee*
  - Leverage IP rights to catalyze commercialization

- Follow up
  - http://IPIRA.berkeley.edu
  - Mike Cohen; mike.c@berkeley.edu

# Research: *4Ms Activity & Program - Segmentation*



# Research: *Systematic + Organic / Asymptotic v Exponential*