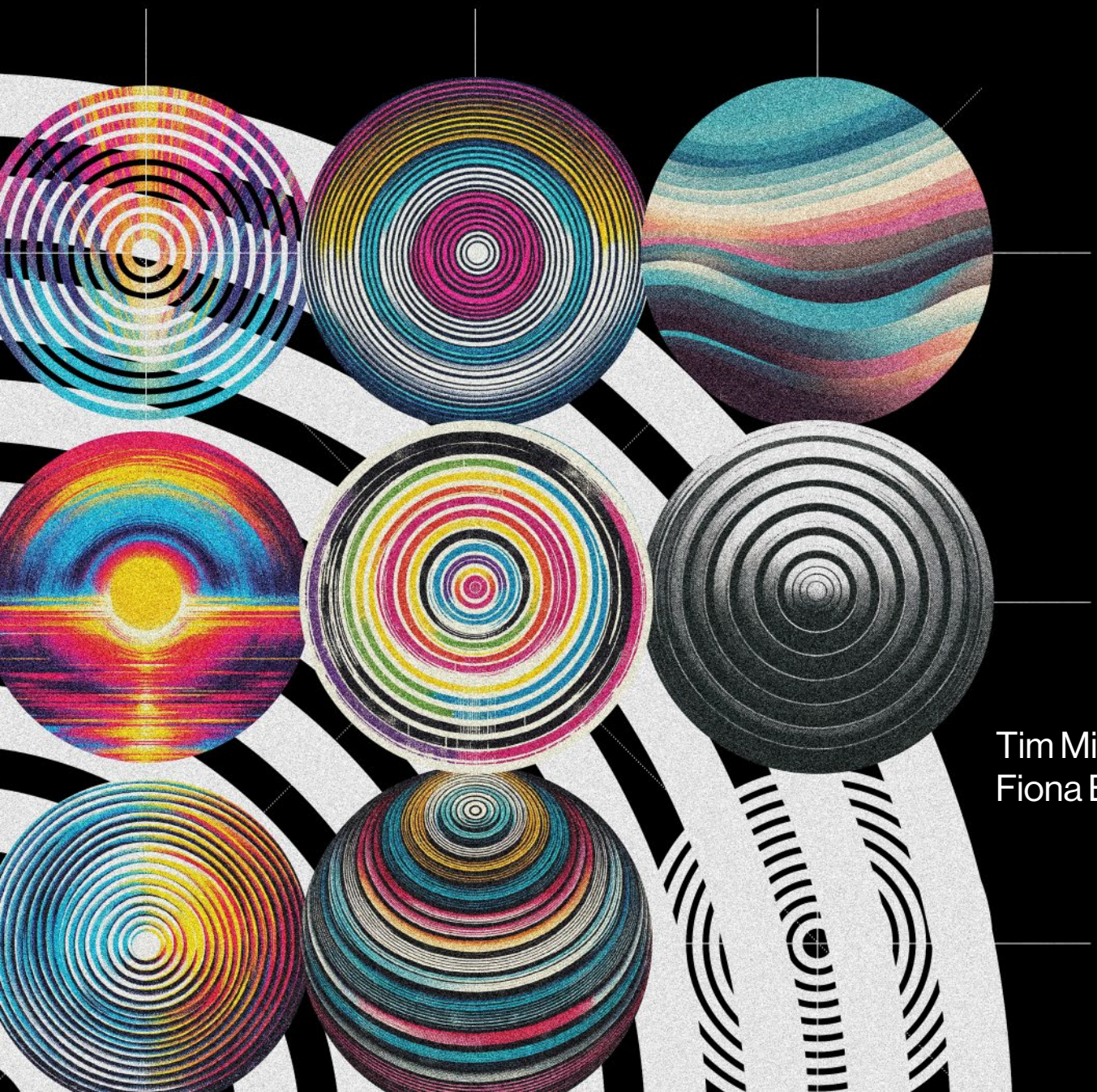
Innovation Systems
Blueprints and Lessons From MIT



Tim Miano
Fiona E. Murray


innovation-blueprints.com

A blueprint for MIT's expansive innovation system, guiding the next generation of innovators toward real-world impact.

Building MIT's Innovation System

Innovation has been a feature of university life for generations. A student team brainstorms in their dorm and launches a start-up. Breakthroughs in the lab spur faculty, their PhDs, and postdocs to spin-out a new venture. Vibrant communities of innovators form, then integrate into the wider innovation ecosystems surrounding the university. This virtuous cycle thrives on the confluence of passionate talent, resources supporting ambitious ideas, and a culture embracing problem-solving, experimentation, and impact.

Today, universities can no longer rely solely on organic innovation and entrepreneurship processes. As institutions supporting the next generation of innovators, they must provide systems of intentional, structured, and inclusive support. They can shape the direction of innovation by defining the problems with the greatest potential for impact, thereby guiding innovators towards things that matter. These expanded roles both nurture and emerge from wider regional innovation ecosystems where universities function as engines of innovation, in concert with startup ventures, risk capital providers, governments, and corporations.

Note our vocabulary choice: MIT is an innovation system because we make choices as to how to organize ourselves, and there are individuals who can take charge. In contrast, we refer to the wider region in and around MIT—Kendall Square and Greater Boston—as an innovation ecosystem precisely because it embodies organic complexity, inherent messiness, and a lack of centralized control.

As a leading university with over 160 years of experience creating the frontiers of knowledge in STEM fields, MIT excels at the early stage of the innovation journey. MIT is a large system that secures a research budget of over $1 billion a year, and spends around $50 million on innovation support activities. This is the work of hundreds of people at MIT—staff, faculty, students, and experienced volunteer (often alumni) mentors—and the effort is distributed across an array of centers, units, and programs.

As a community, we are increasingly seeking to go further and

faster along this path. We have already made progress putting interesting problems in front of our community of curious innovators and adding more structured resources. We are shaping educational opportunities to support innovators across all university departments and across all career stages—from undergraduates and masters students to PhDs, postdocs, and faculty. And we are restructuring the boundary with the outside ecosystem in more systematic ways to reduce frictions along the innovation journey.

The goal of this report is to provide a clear and systematic view of MIT's expansive and complex innovation system as a blueprint of a mature university innovation system. The language and structure we have chosen is our attempt to be clear about the important distinctions and nuances that sometimes cause confusion.

Our approach comes from a decade of data collection and interviews, having given hundreds of tours and talks on MIT's evolving innovation landscape, and from the privilege of driving the MIT Innovation Initiative (MITii) since its creation in 2013 by then-MIT President Rafael Reif, and its successor the MIT Office of Innovation, alongside many faculty and colleagues (including especially former MITii Faculty Co-Directors Professor Vladimir Bulović and then Professor Michael Cima, and Executive Directors Steve Haraguchi and then Gene Keselman).

Our hope is that this blueprint will be the start of discussion and debate. We continue to be inspired by what we see around the world from other institutions, empowering a new generation of innovators who seek to turn their good ideas into real world impact.

Fiona E. Murray
William Porter (1967) Professor of Entrepreneurship
MIT School of Management Associate Dean for Innovation

Tim Miano
Executive Director
MIT Office of Innovation

Innovation is the Process

Students, faculty, and staff are demanding that their universities make a demonstrable commitment to innovation, whether that is building makerspaces, teaching how to translate research into commercial ventures, or defining the most important challenges.

Universities that fail to respond will be left behind: they will not attract the most extraordinary talent, they will not support their regions and nations, and most importantly, they will slow down much needed progress on today's pressing problems.

# of Taking Ideas to Impact

SECTION 1

How To Define a University Innovation System

Why?

The next generation of innovators are motivated to have a big impact but at this early stage in their career don't necessarily know where to focus their attention.

Universities increasingly help define the problems with the greatest potential for impact. And they harness top talent by building an effective innovation system across their campuses.

How To Define Venture Pathways

Innovators select into startup pathways to learn to take ideas to impact. These pathways are often distinctive and require customized resources.

	Examples
Dorm-to-Market (IP owned by innovator)	Match-making app, clothing made from recycled materials, b2b financial software
Lab-to-Market (IP owned by university)	CRISPR tech, superconducting magnets, AI, batteries, industrial processes

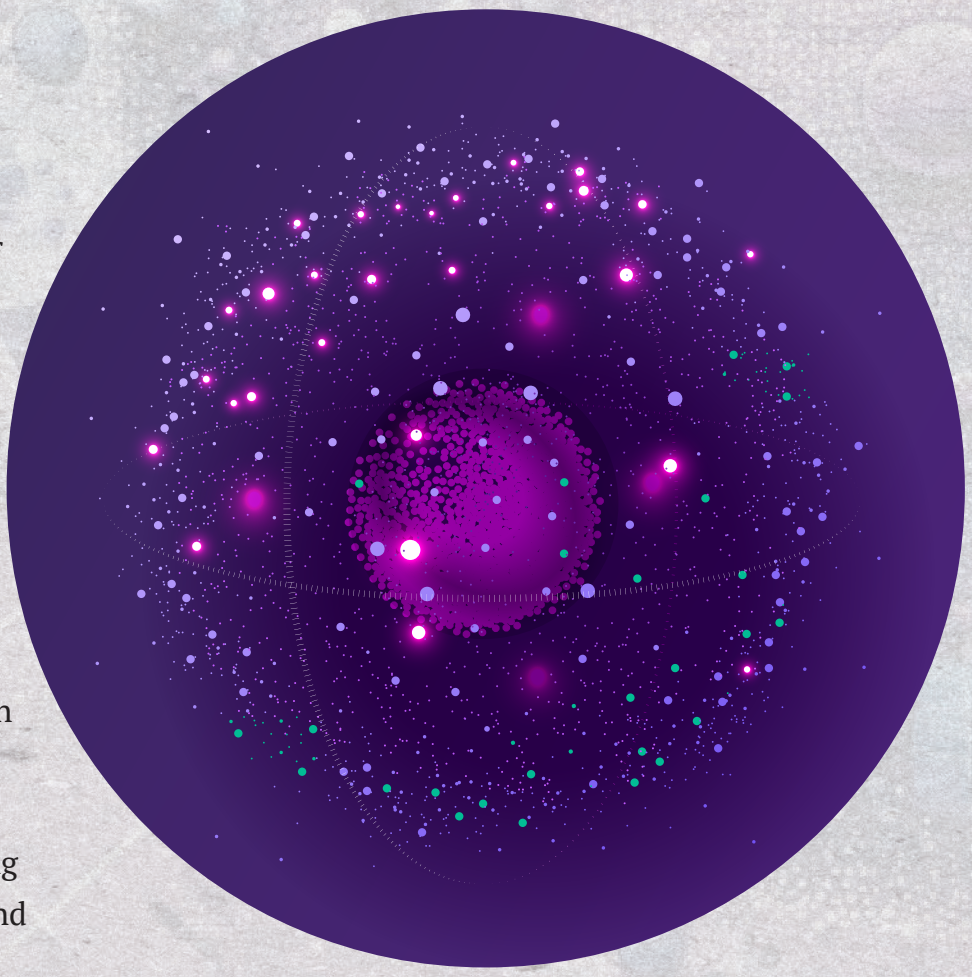
What	Who	How to Support it
Arising from student's own experiences and interests, without the use of university labs, these ventures are developed in classes, in competitions, and in conversations between peers. The IP fully belongs to the founders.	Typically undergraduates and MBAs who want to found startups.	Classic venture-building methods and skills, experiential learning, money, mentoring, programs, student clubs
Emerging from the university's research labs and based on work done by academics to generate university-owned intellectual property, and typically governed, in part, by the Bayh-Dole Act.	Graduate students, postdocs, and faculty who want to translate research into products and services through startups.	Training and methods for when and how to consider market opportunities from lab-based science and technology; expert mentorship; metrics of success beyond publications; funding for experimentation, materials, and scale up; and streamlined processes around IP and equity

How To Define a University Innovator

University innovation systems are improved by establishing the "innovator" as the base unit. This helps simplify goals and clarify metrics of success.

The community of university innovators includes many stakeholders:

- Current students
- Faculty and programmatic staff who support innovation
- Students from nearby institutions who form inter-university connections
- Recent entrepreneurial and expert alumni who maintain close ties to students and departments
- Volunteer mentors who assist in the early forming of teams and proto-startups
- Research staff/postdocs—among those with greatest expertise and ambition for high impact innovation



Mission-to-Impact

Who:	What:	Examples:	How to support:
Passionate community members driven to solve a problem they see as important.	Mission-driven ventures may be for-profit or non-profit, as success is tied to solving a mission-critical problem.	AI-first ed-tech, IP-driven biomaterials for plastics alternative, app to find clean water in a developing country.	Topic-specific classes, affinity groups, experts, and mentors to navigate mission-driven organizations.

Supporting Mission-Driven Innovators

Students increasingly want to ensure that their innovation efforts are focused on problems that matter to them. In many cases, mission-driven innovators bring a problem they are passionate about and want the university innovation system to support them as they build a solution. Universities have responded with classes and experiential learning opportunities that put students into problem-rich environments.

Another key distinction among mission-driven innovators is that use of a for-profit venture is not inevitable. Instead, they are willing to create a non-profit, partner with the government, or join a non-governmental organization if that leads to a more efficient solution. Accordingly, universities must provide more than traditional entrepreneurship training that focuses on how to launch a startup.

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Domain-Specific Training For Mission-Driven Innovators

Climate Action

MIT Climate and Energy Prize — Student-led competition in which teams compete for funding, get mentoring and other resources. Complemented by the long-running Climate and Energy Ventures course.

Social Innovation

IDEAS Social Innovation Challenge — Workshops, classes, and community-building activities for students who want to be social entrepreneurs, meaning launching a company that has a social purpose in addition to seeking commercial success.

Developing World

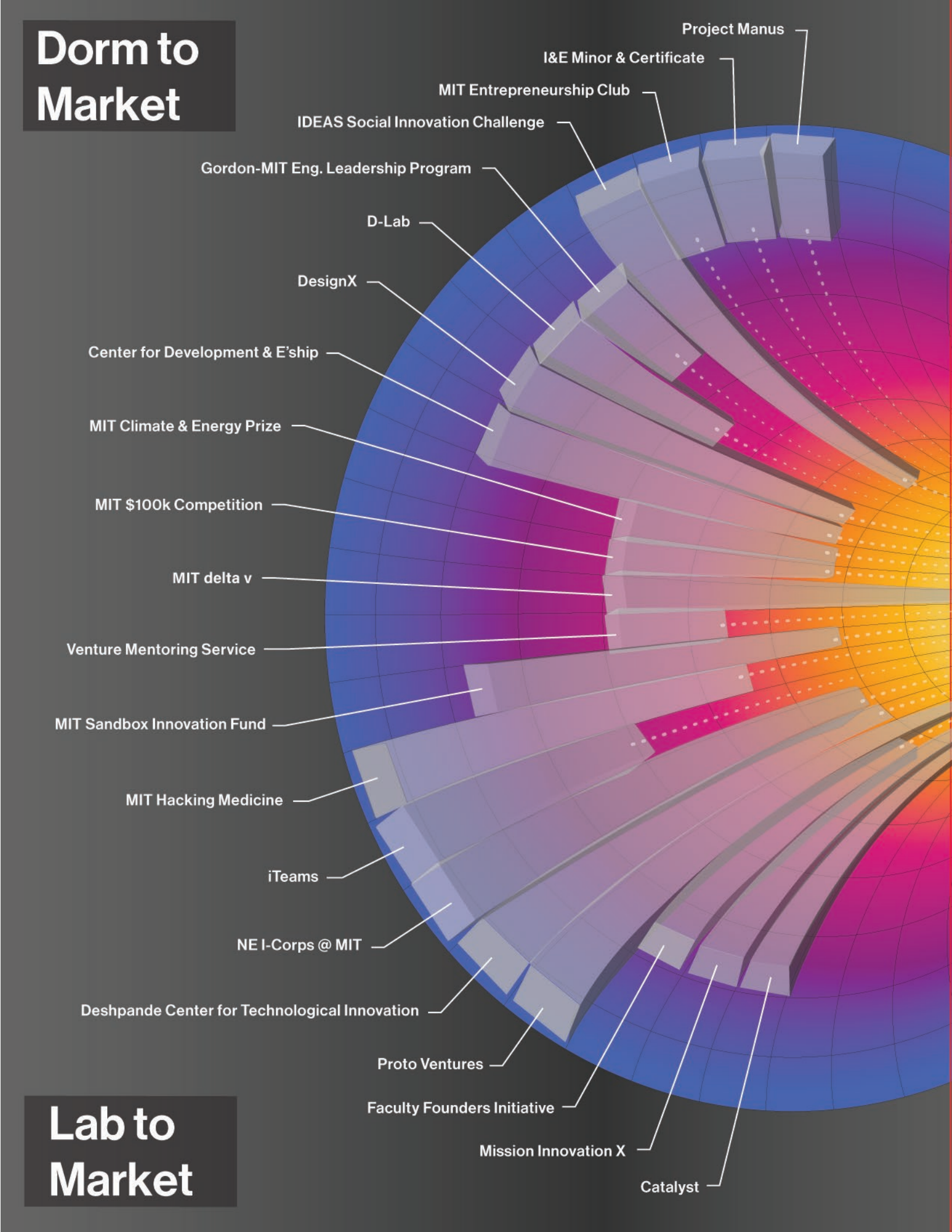
Center for Development and Entrepreneurship at MIT — Center and community for students launching ventures that solve challenges, create good jobs, transform systems, and change lives in global growth markets across developing countries.

D-Lab — Working with people around the world to develop and advance collaborative approaches and practical solutions to global poverty challenges.

Dual-Use

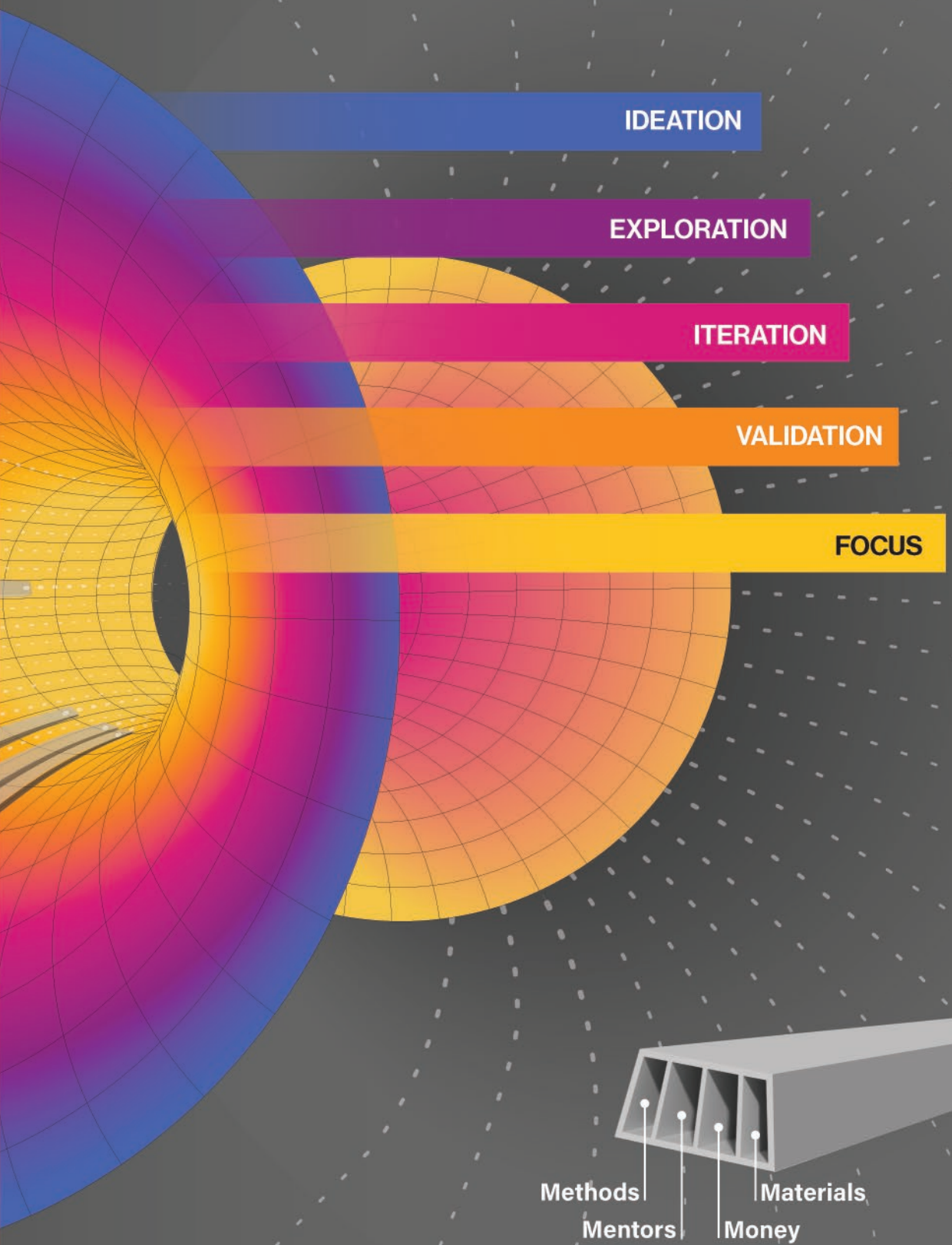
Mission Innovation X — Dual-use venture incubator to help MIT researchers learn how to form ventures that work with NASA, military contractors, or other government agencies as early customers.

Dorm to Market



Lab to Market

MIT Innovation System



SECTION 2

How To Support Innovators

Why?

Investing in innovation resources demonstrates a university's commitment to its innovation system, whether it is a mentoring service for students, a pitch competition with prize money, or a seven-story innovation headquarters.

Each university will decide on the right combination of resources, but all will contribute methods, mentors, money and materials.

methods

Methods are innovation activities through which innovators build skills and experiences.

Classes
Student Groups
Experiential Programs

Methods encompass the structured approaches universities employ to support learning goals, primarily through curriculum development, supporting student-led activities, and offering targeted experiential learning. Today, these methods support innovators at at each stage in their innovation journey.

The Many vs. The Few

A mistake some university innovation systems make is to focus only on building "startup unicorn" accelerators or other hyper-focused communities without allocating resources to the broad base of potential innovators and entrepreneurs. Highly focused programs that appeal to small subsets of innovators playing to a university's unique features can be valuable; but alone, they will not nurture a thriving and inclusive community.

- **Teach the tools and processes for innovation**
- **Cultivate human talent**
- **Create a community of peers**

How to Measure

Count: Units of time, # of innovators

Why: Universities use credit hours as a measurable unit of time in an academic context. Similarly, innovation methods are measured by the amount of time that a student spends learning skills or in experiential innovation opportunities.

Importantly, however, the structure of innovation activities are often shorter or longer than a semester.

Example: Evening workshop, weekend hackathon, summer accelerator, yearlong incubator.

Exploration Classes

Goal: These intro classes provide foundations of innovation and entrepreneurship.

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StartMIT — Entrepreneurship intro class offered in the shortened January term for undergraduates through the **Martin Trust Center for MIT Entrepreneurship**.

Innovation & Entrepreneurship Minor and Certificate — For undergraduates.

Entrepreneurship & Innovation Track — For MBA students, building on over 25 years of entrepreneurial education and led by the **Martin Trust Center for MIT Entrepreneurship**.

IDEA Week — For EMBA students, a week of project modules, panels, and speakers providing an integrated look at innovation and entrepreneurship from the perspective of both startups and large firms.

Student-Led Activities

Goal: Community-driven learning helps innovators develop peer relationships.

MIT Blueprint

Hacking Medicine — Student-run series of hackathons for MIT students who want to develop projects for health care. Each of the small hackathons involves a small amount of money, but its goal is to gather community members who share an interest in health care venture building.

PROD and **Momentum** — Self-organized, student-led, summer incubators for undergraduate and MBA students. Separate clubs with similar purpose.

MIT Entrepreneurship Club — MIT's community of founders. This is a traditional student entrepreneurship club.

$100K Entrepreneurship Competition — Pitch competition with a prize that is now well in excess of $100,000.

Student Projects

Goal: Provide real-world experiences to complement classroom learning.

MIT Blueprint

MIT Sandbox Innovation Fund — Provides seed funding, mentorship, and tailored entrepreneurship education for student innovators. Many teams spend 12 to 18 months working with MIT Sandbox mentors and evolving their ideas through market research, customer discovery, and prototyping.

MIT delta v — This is a classic student venture incubator. While the stated goal of the program is to incubate startups, it's part of the MIT academic curriculum because it is also a critical training ground for new startup founders.

DesignX — Startup incubator from the architecture school. Academic program design innovation and entreprenership, forward thinking.

Domain-Specific Experiences

Goal: Direct innovators to solve a specific world problem or challenge, for example poverty or climate change.

MIT Blueprint

MIT D-Lab — Hands-on, project-based classes to teach engineering and science students how to launch ventures that address global poverty.

Proto Ventures — MIT's venture studio hires a scientist with entrepreneurial experience to embed in MIT labs and build new ventures based on university research within specific problem areas like clean energy or AI-driven healthcare.

MIT IinQ Catalyst — Medical professionals learn process for venture building and seek out research to solve unmet needs in health care.

mentors

Connecting fledgling startup founders to experienced founders is critical to accelerate and smooth the path from idea to impact.

Mentors
Experts
Advisors
Coaches
Board Members
Near-peers

Keys to impactful mentoring:

Provide unbiased coaches, who have no financial interest in the company.

- New founders may have investors or experts who they admire and respect. However their business advice may be influenced by their financial interests in the future company, so having clear guard rails is important.

Match new founders with a proto-board of advisors that includes multiple experienced advisors in different areas.

- For example, mentors could include a startup founder and local investor. As a venture grows, subject-matter experts could be added who, for example, have experience in supply chain logistics.

How to Measure

Count: Mentors, mentees, time, interactions

Why: Start by counting number of mentors and hours of mentorship. Then, as programs mature, survey mentee satisfaction.

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Mentors are not the same as experts:

- Mentors provide entrepreneurial coaching and emotional support.
- Experts provide subject matter expertise and industry connections.

Venture Mentoring Service (VMS)

MIT launched its VMS in 2000 to provide more formal mentoring and support for emerging entrepreneurial ventures.

MIT alumni and faculty had been providing ***ad hoc*** mentoring to each other and students for years through alumni networking events. However, VMS established an official university-sanctioned mentoring service that was free to all MIT-affiliated individuals and ventures.

Teachers, Mentors, Colleagues, Co-Founders

Why is this complex? //

Professors and students who found new ventures may struggle in navigating their relationships. While faculty are typically the principal investigators on lab projects that could spin out multiple ventures, often it is their graduating students or postdocs who are most poised to serve as the CEO or CTO, and then spin out multiple ventures over the course of their careers. While the founding teams typically include the faculty, they are more often advisors or key board members to the venture, rather than the founding CEO or CTO.

The primary change agent in the venture building process of translating ideas from the lab is usually the PhD student or postdoc fellow who has deep knowledge of the specific technology underlying the IP. University mentorship programs can help students and faculty with guidance for how to navigate these evolving circumstances.

money

Money within a university is typically not flexible in how it can be used—a university must carefully track the ways in which different streams of financing are used for innovation projects.

Student-Founder Seed Money
Competitions & Prizes
Stipends
Fellowships
Grants

Why is this complex?//

- Conflicts of interest arise from many directions:
- Alumni and donors seeking to influence the university
- Funders requesting right of first refusal to license IP
- Balancing faculty and graduate student interests in IP creation
- Reconciling the need for research publication with potential future IP from research translation
- Available resources for current student startups vs. new alumni startups
- Dividing equity ownership between founders and the university

How to Measure

Count: Dollars, recipients, ventures

Examples: Largest competition prize, number of startup grant recipients, number of dollars raised by startups one year after launch

Why: This is the most direct measure of a university's innovation capacity and the best lever for a university to change its innovation capacity.

Using Money for Purpose

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Student-Founder Seed Money

MIT Sandbox Innovation Fund

WHAT: Provides small grants of seed funding to student startup founders.

WHY: Fills the critical role of providing a little funding to nearly all eligible student-led startups who ask. While not all of these startups will succeed, there's a higher chance that at least a few will succeed with so many germinated. MIT Sandbox also provides a crucial role in encouraging students to stay in school while launching their first enterprise.

MIT delta v

WHAT: A student accelerator providing mentorship and education to a small cohort of venture builders selected each summer. The accelerator also provides stipends and grants based on milestones.

Competition and Prizes

$100K Entrepreneurship Competition

WHAT: One of the largest prize competitions at MIT. This student-run competition offers up to $300,000 in prizes each year to startups of all kinds.

WHY: This kind of broad funding opportunity is important for universities seeking to build a wide base of startup founders.

MIT Climate & Energy Prize

WHAT: Offers $100,000 in prize money to startups with a climate change or energy industry purpose.

WHY: Purpose-driven competitions help create community among startup founders who have similar interests.

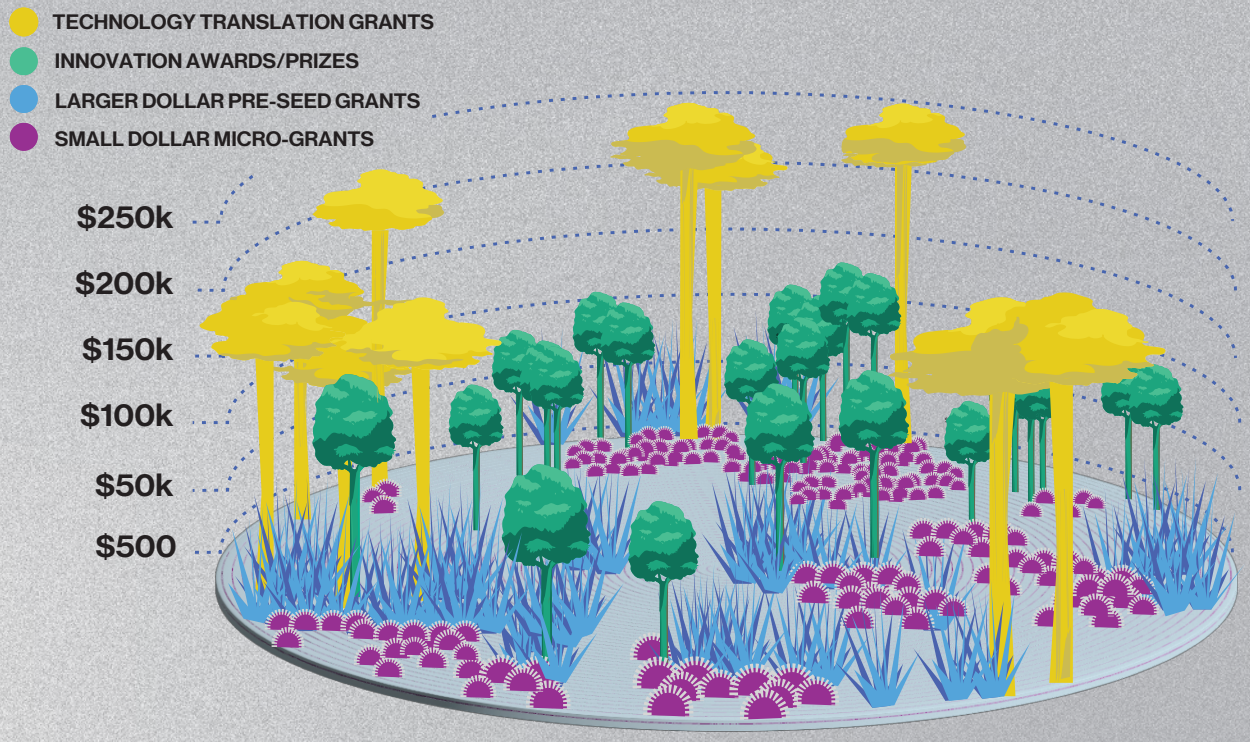
Stipends and Fellowships

Center for Development and Entrepreneurship at MIT

WHAT: Fellowships, seed grants, mentoring, and workshops for MIT students exploring a venture idea in a developing economy.

WHY: Unique in welcoming international students to learn innovation and business tools to take back to their home country, and also helps prepare purpose-driven students to launch ventures in growth markets.

Funding niche programs that appeal to subsets of innovators is only possible when there also are broad programs providing a foundation of training and community.



materials

Physical assets and resources dedicated to the exclusive use of university innovation activities.

Meeting Rooms
Labs
3D Printers
Whiteboards
Sticky Notes

Why?

- A university cannot have an innovation community without a place or places for it to gather.
- Establishing spaces for people from different disciplines to work together is a proven element in sparking innovation.
- Co-locating people at different phases of their career can help provide role models.
- Dedicated innovation space is a signal that innovation is important.

How to Measure

Count: Square feet, space utilization

Why: Like money, universities need to know what tangible resources have been allocated and whether and how they are being used.

Examples: Number of meeting rooms, number of meetings held in rooms, coffee cups served, whiteboard markers used.

Broad vs. Niche

A glassworks lab or bioengineering makerspace have specific uses for students and faculty seeking to hack in those niche areas. In contrast, the co-working space in an engineering school is open for all students to meet and brainstorm.

Why is this complex?

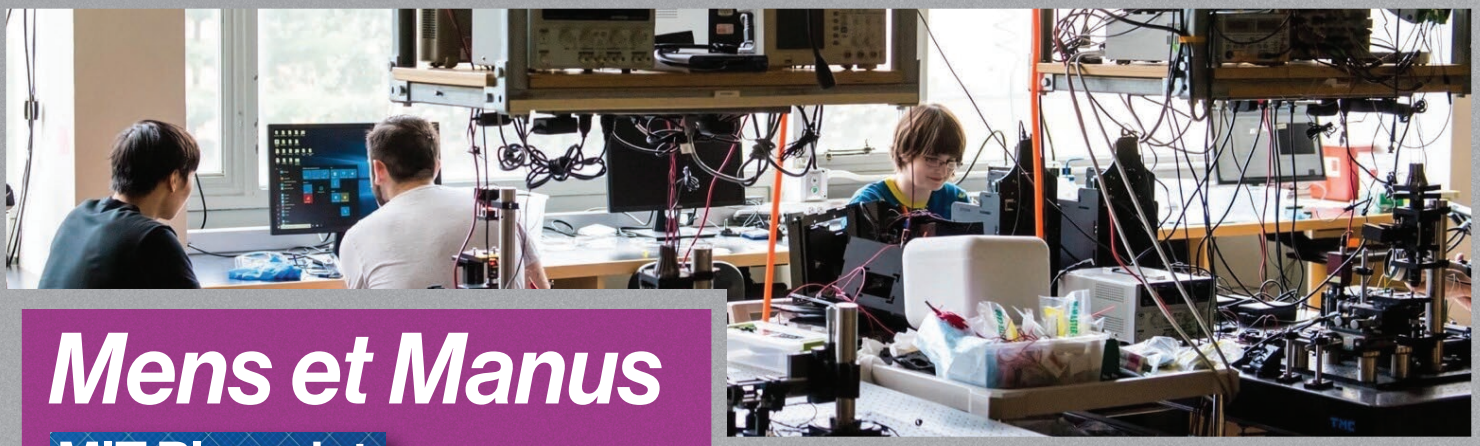
The use of campus facilities for non-university, IP-based startup development has given rise to the need to update official policies around "significant use of resources." For example, some co-working innovation hubs and maker spaces must be designated as "IP-pass through" zones that neither create nor destroy university ownership.

Makerspaces

Why?

Makerspaces respond to the population of budding engineers, scientists, and innovators.

Makerspaces are central to the undergraduate learning experience. They range from labs and technology equipment to 3D printers, glassmaking studios, and even sewing machines. Students may use a makerspace to build a prototype for a startup, get hands-on experience working with different substances, or design a new musical instrument.



Mens et Manus

MIT Blueprint

Supporting Makerspaces @MIT

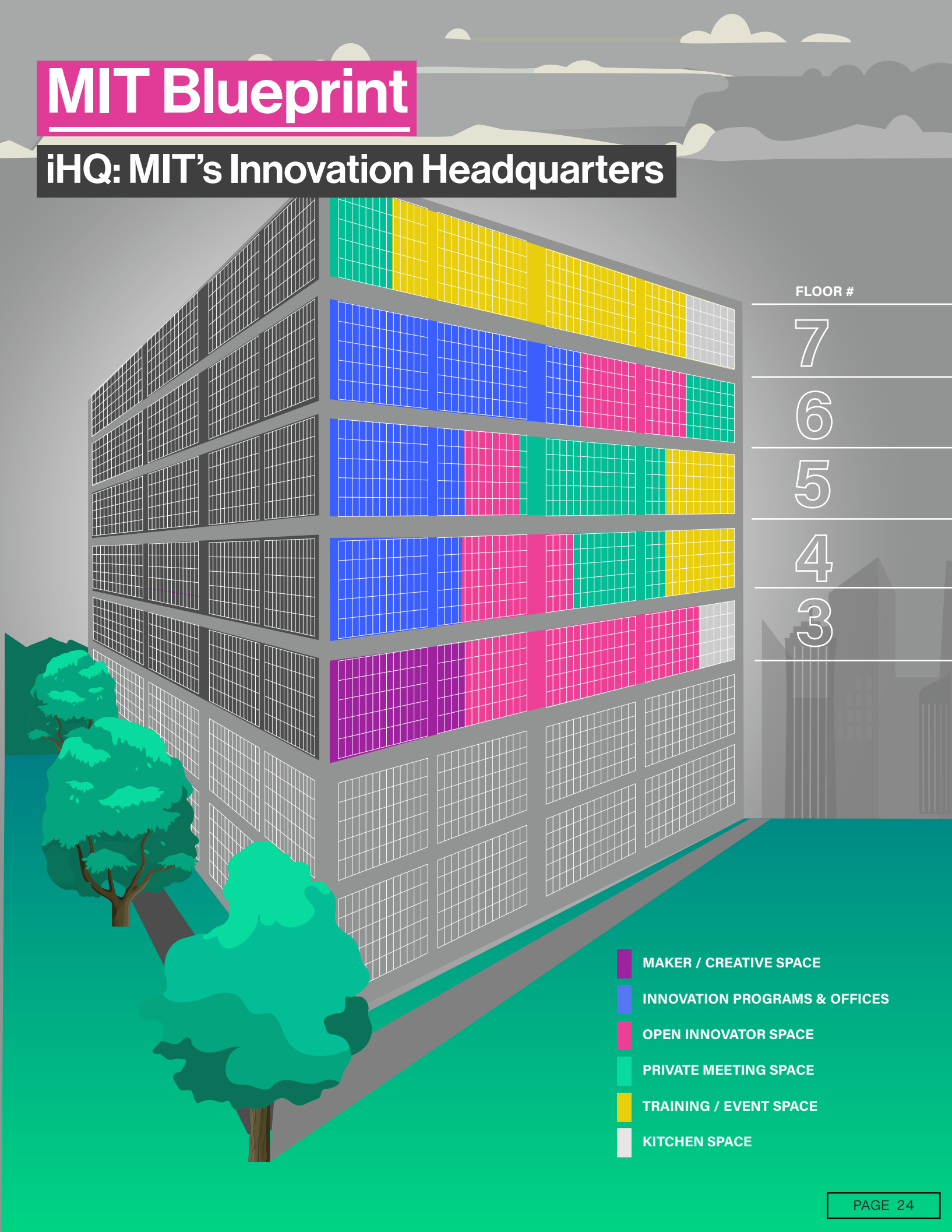
Project Manus is MIT's initiative to establish, update, and integrate makerspaces at MIT. Launched in 2015, the program has the important role as champion and steward of MIT's makerspaces, which otherwise have no single department supervision or office. MIT's innovation community has greatly benefited from having a single team overseeing the tools, co-working spaces, and supplies that make up the variety of campus makerspaces. By prioritizing makerspaces, MIT is fulfilling its motto of "mens et manus," or "mind and hand," signifying the fusion of academic knowledge with practical purpose.

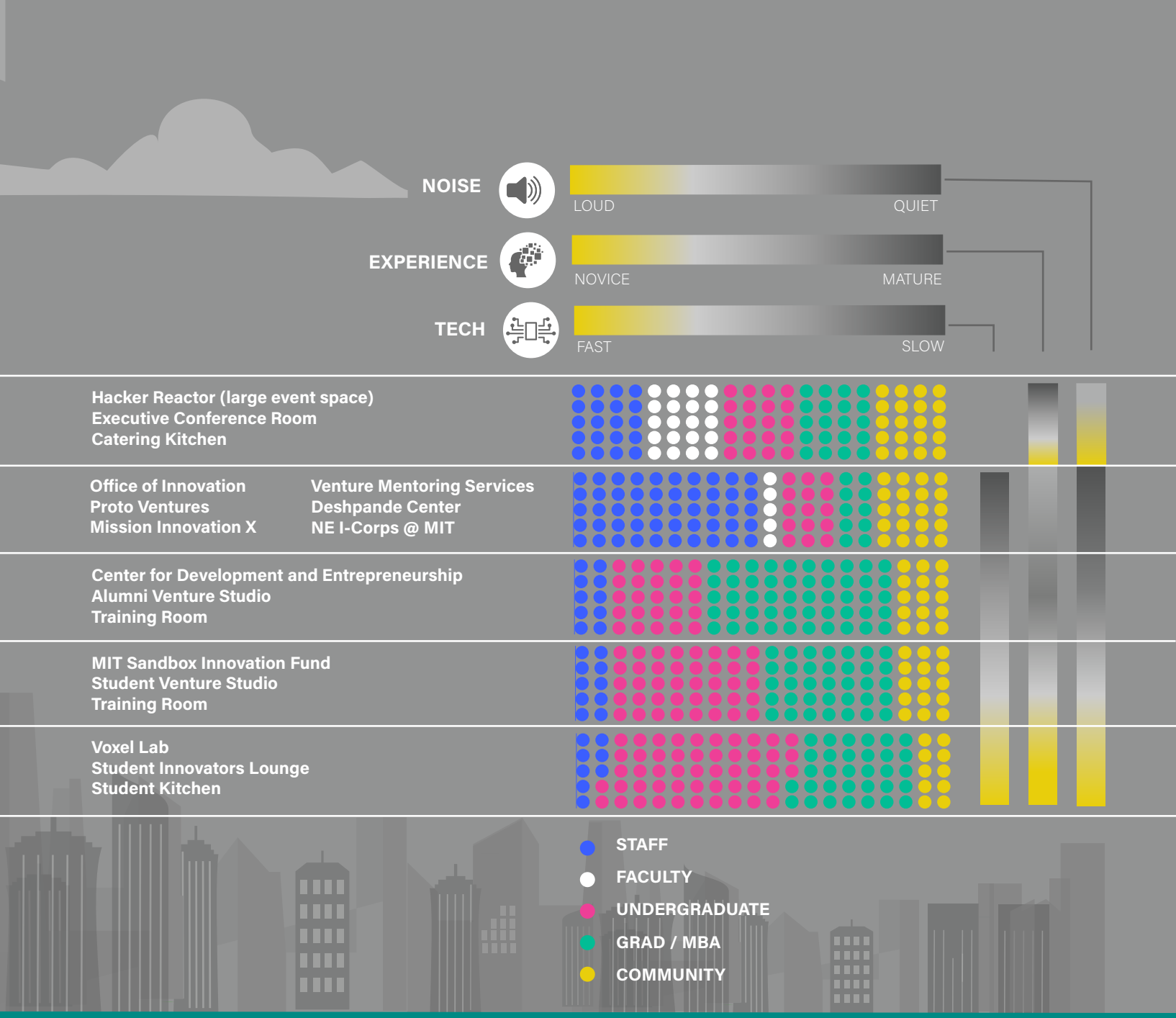
Key initiatives launched by **Project Manus**:

- **Mobius** — An app to link 130,000 square feet of MIT labs, co-working spaces, and toolshops dedicated as makerspaces.
- **MakerBucks** — A program to provided every first-year MIT student who undergoes introductory training with $50 for materials to use in a makerspace.
- **MakerLodge** — First-year maker training program. All incoming MIT students build something—a wood-crafted iPhone speaker, or laser-cut puzzle of MIT campus—that serves as a training class on using and navigating MIT's makerspaces. The classes are 2-6 hours each.

MIT Blueprint

iHQ: MIT's Innovation Headquarters





MIT Blueprint

MIT's Innovation Headquarters (iHQ) offers a blueprint of how universities can create a physical nexus for innovation. Located in the heart of Kendall Square, often called "the most innovative square mile on the planet," iHQ represents a critical "material" resource in MIT's broader innovation system. By providing a centralized hub for innovation activities that co-locate programs and groups housed under many different schools and offices, iHQ exemplifies how universities can create environments that nurture creativity, collaboration, and entrepreneurship.

SECTION 3

How To Expand Lab-to-Market Pathways

Why? //

Lab-to-market innovation amplifies the impact of a university's R&D investments. While the lessons learned from MIT have unique features connected to our underlying comparative advantages—deep tech R&D and IP development—any university can use this framework as a blueprint to enhance their own innovation system. This is especially relevant when considering the relationship between an institution's lab-to-market pipeline and its surrounding regional ecosystem, as exemplified by MIT's connection to Greater Boston.

How to *Cultivate* Translational Researchers

> At MIT, we are really great problem solvers, and yes we know how to adapt technology to achieve a goal. But it's as important to figure out the right problems to solve. I think if you marry finding the right problem with a spectacular ability to solve them, then you really can change the world.

Martha L. Gray
Whitaker Professor in Biomedical Engineering
Director of MIT IinQ

Methods

One of the key features of successful innovation systems is exposing students, post-docs, and faculty to translating ideas and research into commercial applications and real-world impact. When universities prioritize showcasing successful lab-to-market research projects, they create a self-reinforcing cycle of innovation as this exposure both inspires new ideas and also provides practical models for future innovators.

MIT Blueprint

For Students

Innovation Teams (iTeams)

Goal: Train students in the lifecycle of innovation from idea to impact.

What: One of the first opportunities for students to explore the pathways to impact for research-based ideas.

How It Works: Solution-first project class in which mixed-teams of business and technical students develop commercialization plans for existing MIT faculty-led research projects or university-owned IP.

For Researchers

NSF NE I-Corps @ MIT

Goal: Teach academic-minded scientists to focus on practical applications of their research and accelerate the process of moving ideas to impact.

What: Scientists and engineers learn how to do customer discovery for their own research, helping researchers to reduce the time to translate promising ideas from the laboratory to widespread implementation.

Why: This training is especially valuable for researchers developing IP-driven deep tech, which can take years or even decades to develop.

For Professionals

MIT IinQ Catalyst

Goal: Train early-career medical professionals to create ventures targeted at solving unmet health care needs.

What: Teams of multiple disciplinary professionals learn a clinical needs-driven approach to venture building. Participants do not bring their own research or IP, but instead scour MIT research to solve unmet health care needs.

Why: By focusing on unmet health care needs, Catalyst seeks to increase potential impact of biomedical research.

How to *Support* Translational Researchers

Faculty as Founders

A common mistake is to focus on faculty as the only "human agent" in the journey to translate research from the lab to market. They are essential but others are important—the PhD students and post-doctoral researchers as well as research staff. Indeed, at MIT and other research universities, principal investigators who develop patents and spin-out startups also educate many of their PhD students to patent and spin-out startups.

That said, faculty matter, and with an emphasis on lab-to-impact comes a need for universities to consider their tenure review processes to take into account IP generation and not simply publication, and perhaps even commercialization activities. Universities have rewarded publishing for so long that researchers and their peers have difficulty learning a new definition of success. But for research to have an impact, it has to get out of the lab. This begins with innovation-minded faculty serving as principal investigators.

MIT Blueprint

The Postdoc Gap

Recruiting and training translational researchers remains a challenge for nearly all universities: there are not enough academic positions for all PhD students, while those with translational expertise are highly sought after in the private sector.

Programs that fund and encourage translational research—such as the MIT Deshpande Center for Technological Innovation and I-Corps—help build strong translational skills and drive more translational outcomes.

MIT has also had some success with postdoc fellowship programs, such as The Venture Exploration Program that facilitated funding for post-docs to continue lab-to-market work after graduation.

MIT Faculty Founder Initiative

Goal: Increase the number of MIT female faculty members who start biotech companies.

What: A year-long mentorship and skills-building program for MIT female faculty that culminates in a pitch competition with prizes of $250,000 and $100,000 to the winner and two runners-up, respectively.

> "Innovation happens at this interface between different disciplines, you'll read this again and again. I think it also happens by just looking at problems in new ways."

Sangeeta N. Bhatia
John and Dorothy Wilson Professor of Health Sciences and Technology and of Electrical Engineering and Computer Science
Co-Founder, MIT Faculty Founder Initiative

How to Use Funding to Spur Translation and Venture Building

Why?

Universities can use translational funding to accelerate research from idea to impact.

Money

Most lab research will have impact through a number of different pathways. When funding is provided for researchers to understand the value of their research outside the lab (i.e.,to determine if it can be taken to higher levels of readiness to solve a real-world problem), then those resources for translation can be a source of leverage. That funding is even more valuable when it comes with guidance as to which direction, the milestones that matter, and the nature of more commercially relevant experiments and evidence. For example, knowledge of which diseases are most expensive to treat or which natural materials have the highest extraction and environmental costs may help direct the next steps in lab research of mRNA vaccines or which rare materials might be grown in a new bio-reactor.

> **MIT's long history of generating and translating great ideas into impact is well known. Less known is how many ideas are left on the table. MIT's new Proto Ventures Program aims to create a culture of new scientist/engineers dedicated to building ideas that can translate.**

Michael J. Cima
Executive Director of MIT Innovation Initiative
David H. Koch (1962) Professor of Engineering

Niche v. Broad

Why? //

The typical university deep-tech model provides a broad pool of money for sponsored research toward any lab with IP that shows translational promise. The MIT Deshpande Center for Technological Innovation provides that type of funding, plus entrepreneurship training and mentors. By contrast, Proto Ventures inverts that model through a venture building program where MIT has comparative expertise around a niche area of nascent technology with high commercial potential. Past areas include AI & healthcare and clean energy.

MIT Blueprint

Proto Ventures
MIT's venture studio

WHAT: A venture studio inside a university to proactively build and launch new ventures from MIT labs and tech.

HOW: Recruit a scientist with expertise in translating research into practical applications to work within MIT labs, concentrating on addressing challenges within a specific area such as clean energy.

MIT Blueprint

MIT Deshpande
Center for Technological Innovation

WHAT: Research grants and training for faculty-led deep-tech research that has potential to make a big impact.

WHY IT WORKS: Offers initial funding to researchers, allowing them the time and resources to contemplate the direction of their research. Additionally, through guidance from entrepreneurship training and mentors, there is an increased likelihood that the research will achieve tangible real-world impact.

How to *Allow* Equipment Sharing

Materials

A piece of university equipment can be more valuable than money to a deep tech venture or protoventure. Furthermore, equipment sharing is often the key bottleneck for getting translational research out of the lab.

And yet, offering equipment and space to outside ventures creates real and perceived conflicts of interest for universities.

Though still early, recent best practices create flexible and supportive innovation systems that maintain academic integrity and manage potential conflicts of interest.

Why this is complex?//

The most common conflict arises between startups coming out of university labs whose founders want to continue to use university equipment and facilities after launch. This can be especially divisive between researchers who remained at the university and newly launched venture founders. This may be critical for the viability of deep tech research that requires large and expensive equipment.

Other Conflicts:

- Maintaining research integrity while fostering integration
- Charging user fees for consumables and maintenance; offering subsidies for certain user groups
- Faculty-driven research (university-owned IP) vs. student-driven research and IP

Photo Credit: Anton Grassl
MIT.nano Labs in Cambridge MA

MIT Blueprint

MIT allows startups and external companies to use its ultra-small, advanced facility called MIT.nano. Launched in 2018, MIT.nano serves more than 1,200 researchers from more than 50 MIT departments, labs, and centers. Importantly, however, the facility also serves external users from industry, other academic institutions, and more than 130 startup and multinational companies. For example, MIT hard-tech accelerator START.nano provides participants use of MIT.nano's facilities at a discounted rate and access to MIT's startup ecosystem. This program–which is still in development–seeks to reconcile conflict-of-interest policies while also protecting underlying IP that continues to grow.

"This extraordinary potential for game-changing innovation is why MIT placed a big bet on the very small with the construction of MIT.nano, MIT's nano-fabrication, nano-characterization, and prototyping facility, which after 5 years of operation now supports over 1,500 users and engages over 100 companies. Its shared-tool-space design enables convergence of disciplines. It brings together physicists, chemists, material scientists, biologists, engineers—electrical, mechanical, civil, nuclear—all in the same place where they can go ahead and build the 21st century. We are extremely cognizant that we only have two products as a university: knowledge and people. Through MIT.nano, we propel them both.."

Vladimir Bulović
Founding Director of MIT.nano at the Lisa T. Su Building
Fariborz Maseeh Professor of Emerging Technology
Professor of Electrical Engineering

How to Integrate Lab-to-Market With the Ecosystem

Community & Alumni

> **At a time when the world is beset by crises, your mission is nothing less than to salvage what seems lost, reverse what seems inevitable, and save the planet ... With the right mindsets, "Mission Impossible" can become "Mission Improbable"–as you overcome obstacles and seemingly long odds by imagining and innovating your way to novel solutions.**
>
> **Noubar Afeyan PhD '87**
> MIT Commencement Address 2024
> CEO and Founder, Flagship Pioneering

One of the key characteristics of MIT is that it is embedded within the Greater Boston ecosystem. In many instances, this means that rather than having to establish later-stage venture programs on campus, MIT's ambitious alumni simply move just outside the university into the robust ecosystem of accelerators, co-working spaces, funds and venture studios—many built by MIT alumni. Over the past several decades, MIT alumni and others have built a wider set of ecosystem support structures.

Materials

LabCentral — 0.5 miles from iHQ

WHAT: A specialized co-working space that offers month-to-month, fully functional lab and office spaces, shared equipment, and community support for biotech and life science innovators.

Cambridge Innovation Center — 0.2 miles from iHQ

WHAT: A co-working space of over 1.5 million square feet that supports all entreprenuers and builds a community with its weekly meetups

Methods & Mentors

MassChallenge

3 miles from iHQ

WHAT: Not-for-profit accelerator that operates at significant scale to link startups to experts and corporations through a variety of programs and through community building.

Greentown Labs

2.0 miles from iHQ

WHAT: The largest clean technology incubator in North America, with a community of entrepreneurs solving climate, energy, and environmental challenges.

Nucleate

4.1 miles from iHQ

WHAT: Fosters a unified global bioentrepreneur community, with chapters across the world.

The Engine Accelerator

0.6 miles from iHQ

WHAT: Supports tough tech teams who are working at the convergence of science and engineering though comprehensive programs and specialized infrastructure.

Money

The Engine Ventures

0.6 miles from iHQ

WHAT: Invests in tough tech founders: providing capital, operational expertise, and a powerful academic, commercial, and governmental network.

E14 Fund

0.2 miles from iHQ

WHAT: Invests in MIT startups that tackle challenges through differentiated science or engineering and enterprise-focused business models.

Flagship Pioneering

1.1 miles from iHQ

WHAT: Large-scale life science venture studio that builds and invests in companies that change the world

SECTION 4

How To Build a University Innovation System

Why?

We have three recommendations for how a university can quickly improve its innovation system, derived from insights at MIT. While a mature system and ecosystem takes years to develop, we've observed that any university can enhance its innovation activities by implementing these recommendations. Importantly, this can be achieved without fully centralizing all innovation and entrepreneurship activities—a key insight from MIT's experience.

What to Measure?

Recommendation #1

First, Count Innovators

Why? //

Universities have always anticipated that they are educating students for a lifetime of success, not just one challenging action immediately post graduation. Today, they are training their students for a lifetime of impact. For innovators they must train them for a lifetime of real-world problem solving. For innovators they must train them for a lifetime of real-world entrepreneurial

INSIDE THE UNIVERSITY

Goal is to develop innovators & innovations

OUTSIDE THE UNIVERSITY

Goal is to develop startups

Why this is complex?//

Universities are often conflicted about how to measure innovation.

Should universities count startups? Yes, but not first. Tracking startups and, more importantly, startup outcomes requires looking down a longer time horizon than counting innovators within a university. Traditional university students are not expected to win Nobel prizes or cure cancer within the year after they graduate. Likewise, universities should not expect to launch unicorn startups in the year after students exit the system.

Metrics: Broad Volume vs. Niche Impact

In venture capital, success is driven by a high volume of investments, where only a select few yield outsized returns. This principle is equally crucial for a university's innovation system.

To maximize impact, a university must engage a large number of student innovators, as this high volume is not merely beneficial—it is essential. It sets in motion a flywheel effect, fostering a vibrant culture of entrepreneurship and significantly increasing the likelihood of developing ventures that can achieve substantial impact.

At the same time, niche innovator communities also play a vital role. While it's important to provide specialized resources, such as accelerators and targeted mentorship, to boost a few high-potential startups, this focus should never come at the expense of maintaining scale.

What To Count?

Universities must measure volume first, then impact after:

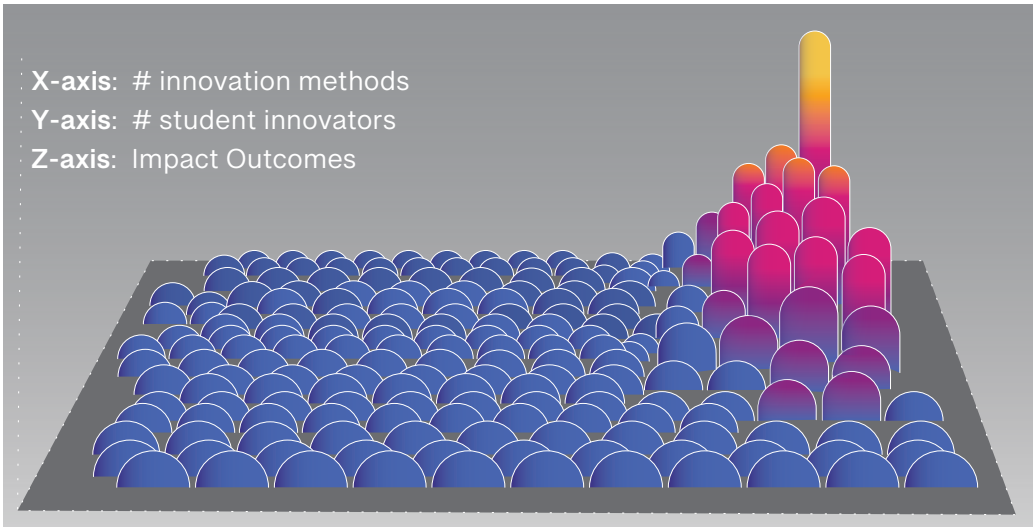
In year 1, what's important to measure:

- # **Students attending an event**
- # **Coffee cups served**
- # **Co-working spaces**

In year 10, what's important to measure:

- # **Ventures launched**
- # **Funding for new ventures**
- # **PhD grads that license IP on which they are an inventor**

Just like VC portfolios, the diversity and breadth of participation at universities are what drive the most transformative outcomes. By effectively balancing these elements, a university can establish itself as a leader in innovation.



How to Prioritize Innovation Resources?

Recommendation #2

Focus on Your Comparative Advantages

Why?

Universities that focus on their unique, comparative advantages can more easily attract talent and organically build innovation systems that are synergistic with embedded resources.

How to Find Your Comparative Advantage:

University leaders should thoroughly explore which parts of the university and the local or regional ecosystem provide anchors or platforms and could be harnessed in an innovation context.

- Why do students choose your university?
- What are the unique strengths of your regional economy?
- In what areas are your faculty and researchers producing the most intellectual property?
- What are the special physical resources already present on your campus?
- Are there unique features of the local geography?
- What partnerships with regional, national, or global governments or corporate entities would provide unique opportunities?

> **Universities play a critical and often underappreciated role in regional development … and the norms and governance of universities as well as their particular research strengths make a unique contribution to promoting the sort of growth entrepreneurship [that is] conducive to long-term economic growth.**

Scott Stern
David Sarnoff Professor of Management
Co-Founder MIT Regional Entrepreneurship Acceleration Program

MIT Blueprint

MIT Regional Entrepreneurship Acceleration Program (REAP)

What: Since 2012, MIT REAP has engaged with communities around the world to strengthen innovation-driven entrepreneurial ecosystems and help train ecosystem stakeholders on how to transform economies.

How is this different: Teams of stakeholders that include leaders from university, government, business, risk capital, and entrepreneurs join together to assess, design, and create programs to accelerate innovation-driven entrepreneurship and thus drive collective prosperity.

Why is this complex?

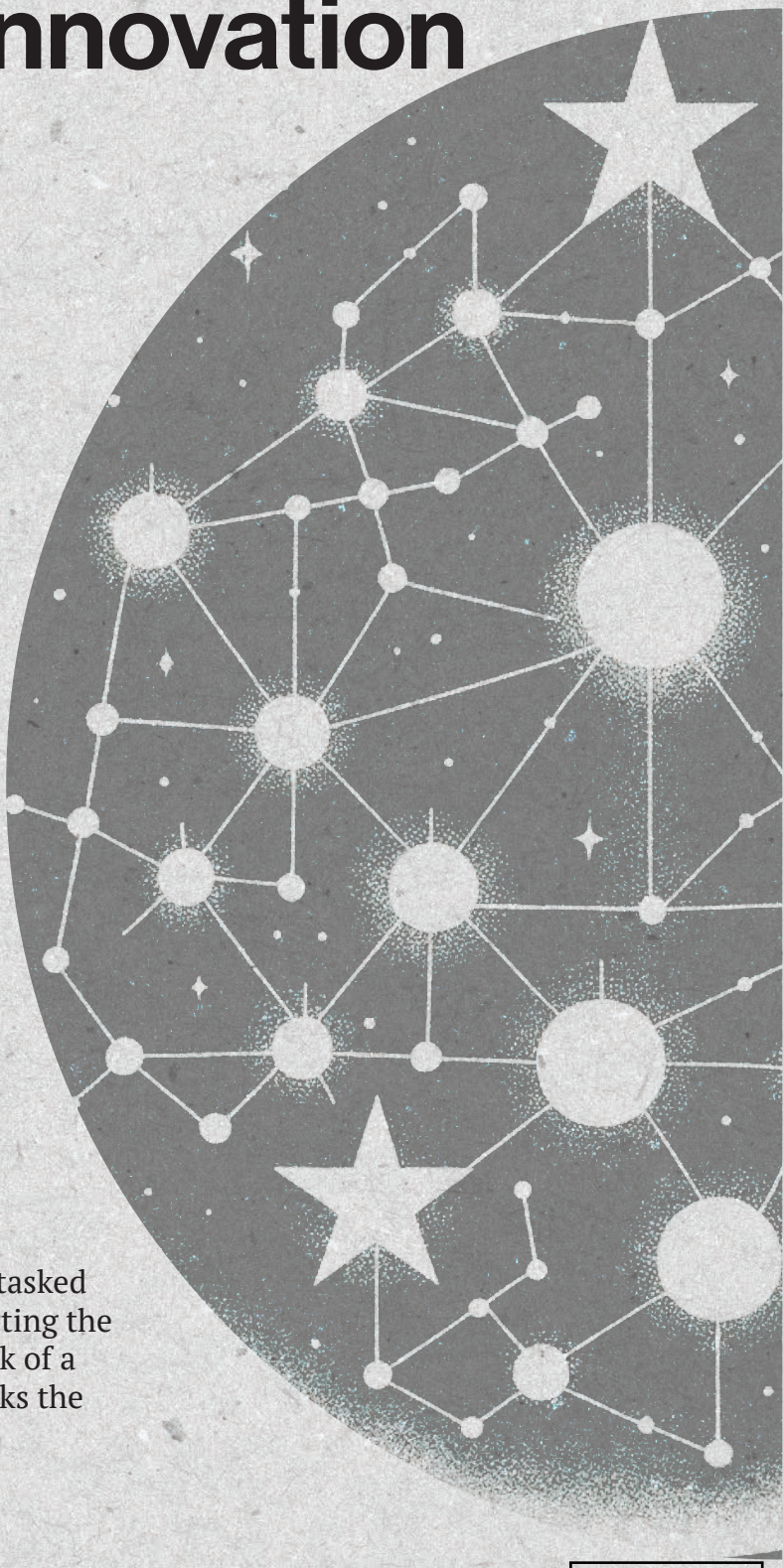
Whereas Recommendation #1 encourages focusing on volume, Recommendation #2 seeks to offer insight on how to focus on key areas of innovation. Yet, in both cases it is necessary to create a physically dense cluster of innovators no matter their focus area.

The job of a university leader involves focusing inward. Yet, exploring and building strong ties with local, regional, or even global corporations, governments, investors, and communities is necessary to to identify and amplify a university's comparative advantages.

Recommendation #3

Whose Job Is This?

Create Stewards and Champions of Innovation



Why?

Innovation happens at the intersection of different disciplines. Therefore, there is no department head who is charged with thinking about innovation across the classes, student groups, and programs. Those faculty- and student-led programs are focused on delivering the training and experiences for which they have been charged.

Therefore, university systems benefit from the presence of actors with a mandate from university leadership who take on the role of bottom-up stewards and champions of the innovation system, across all silos.

Why is this complex?

Innovation might be taking place in any silo. Cross-department programs are critical to innovation but also antithetical to how most universities are structured. Without a steward and without strong social ties across silos, innovation can be invisible to university leadership. Universities need strong teams who are measuring, enabling, amplifying, and inspiring innovation across all silos and disciplines.

How to implement this?

The highest levels of leadership must support a team tasked with championing innovation university wide, connecting the dots, filling the gaps, and providing pathways. The lack of a champion will limit the success of this activity and risks the whole being less than the sum of the parts.

Predictions: The Future University Innovation Systems

1 // Innovation as an Academic Discipline

As innovating and entrepreneuring are increasingly recognized as professional activities that need to be undertaken by those with a wide array of other skills from engineering and science to music and the arts, so the pressure to formalize the educational content of innovation and entrepreneurship (I&E) will grow across university campuses. The shift will emphasize the importance of skills and knowledge, rather than simply instinct, luck, or personality. At MIT, we have seen this balance being most effectively struck when classrooms are shared by faculty with scholarly expertise in innovation and practitioners with deep practical experience. We predict that many universities will attempt this balance but find it fraught with creative tension. The rise of more systematic knowledge about startup venture building, experimentation, and strategy will support the changing structure of education, and meet the growing demand for cross-disciplinary majors that include innovation. Eventually, this will even give rise to some universities founding Schools of Innovation.

2 // Dorms as Innovation Hubs

As housing trends in the broader economy continue to impose cost of living constraints, and universities seek to attract top talent interested in innovation, we predict that many institutions will blend dormitory living with innovation co-working spaces. We envision dormitories housing student founders while concurrently providing dedicated innovation spaces on the lower floors, as exemplified by Lassonde Studios at the University of Utah. Simultaneously, we expect campus spaces to continue blurring the boundaries between education, research, and the wider startup community. This integration allows stakeholders to collaboratively build startup ventures while preserving the vital space for learning and experimentation that is a precious part of the university experience.

3 // New Norms for University IP

As university innovation systems expand and improve, competition will increase between universities to attract faculty, staff, and students based on the sophistication and resources of these systems. We predict the emergence of significantly improved best practices around university education for I&E—especially in the relatively uncharted territory of lab-to-market education for PhDs and postdocs. At the same time, we expect to see competitive pressure to improve the depth and effectiveness of support for translation. This may include structured

Continued on next page

funding awards that emphasize milestones (akin to the work being undertaken at Imperial College's new Institute for Deep Tech Entrepreneurship), streamlined intellectual property management and licensing with simple licensing agreements that allow for rapid licensing contracts with valuations subject to future look-back provisions, and increased homogenization of licensing norms across universities, especially in Europe.

4// Leadership and Governance of Innovation on Campus

We observe that many research universities already view innovation as an essential part of their mission, yet many of their proactive efforts remain part of a highly fragmented innovation system. We predict the continued rise of positions in university leadership that will corral everything from technology transfer and sponsored research with industrial partners to entrepreneurship support for researchers. MIT has created the new position of Chief Innovation and Strategy Officer, and Washington University has created a new Vice Chancellor for Innovation and Chief Commercialization Officer. Other universities have seen a rise in the role of an Office of Innovation and Entrepreneurship (or similar), often under the Provost or VP of Research. At the same time, we predict the establishment of more thorough governance of innovation, as growing a university innovation pipeline necessarily leads to various ethical and conflict-of-interest issues: funding/equity of spinout ventures, relationships between mentors/experts and student founders, co-founder relationships between faculty and students, relationships between outside venture funding and university IP, etc. Rather than ignore these issues, we hope and predict that universities will tackle them openly and establish dedicated review boards for their innovation systems.

5// Cross-University Innovation Networks

We frequently observe that smaller academic institutions with limited resources, expertise, and density of innovators face similar challenges to building self-contained innovation systems. We predict more consortia of universities that share innovation resources and expertise at the programmatic level. In Greater Boston, we have already seen this happening across over a dozen universities through Cross University Student Innovator activities. In Iceland, seven universities connected to the MIT Regional Entrepreneurship Accelerator Program community facilitated creating a shared technology transfer office and other shared interactions. In the UK, eight universities in the Midlands have collaborated to build Midlands Mindforge—a fund to support investments in lab-to-market spinout ventures.

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