



Day 2 – Technology Development, Business Development, and Proof-of-Concept

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Thanks to:

Boston University OTD



My mentor: Past president of AUTM
Ashley Stevens, D. Phil (Oxon), CLP, RTTP

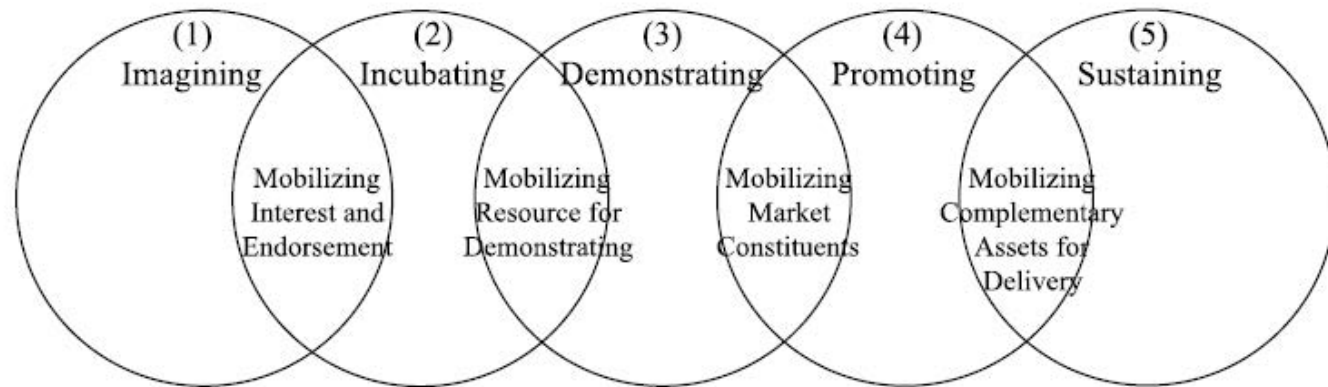
First Look Technology Assessment

1. Technology Description
2. Potential Benefits
3. Potential Markets and Market Interest
4. Development Status of the Technology
5. Technology Development Plan
6. Intellectual Property Status of the Technology
7. Competing Technologies and Competitors
8. Barriers to Market Entry



This lecture

Process of Technology Commercialization



	(1)Imagining	(2)Incubating	(3)Demonstrating	(4)Promoting	(5)Sustaining
Expected outcome	Exciting, preferably unique technology-based idea linked to a market need	Definition of idea's technical feasibility, commercial potential, and plan for taking it further	Incorporating technology in attractive, market-ready products and/ or process	Getting product or process rapidly accepted by various market constituents	Generating long-term value by entrenching and expanding use of technology and retaining a lead in it
Completion Points	Technical proof of principle, filing key patents, preliminary vision for technology	Preparing a business case and plan for commercialization, crafting technology or product platforms, testing with lead customers	Launch of commercial version of products or process	Capturing a profitable share of market quickly	Adequate return on investments made in technology and infrastructure for commercializing it
Main Stakeholders	Peers, colleagues, research partners, media	Providers of venture capital, development partners, potential users of technology	Potential customers, suppliers of complementary technologies, internal colleagues in other functions	Customers, end-urses, opinion leaders, and market constituents mobilized for delivery	Company management, changing customer segments, business partners

Jolly (1997)

Example of Proof-of-Concept/Prototyping

- ❑ Scale up experiment (e.g. “A New Epoxy Resin” case study)
- ❑ Undertake testing of a technology or material to obtain data on performance
- ❑ Develop a more user-friendly software interface
- ❑ Send a material out to independent third party for testing under industrial conditions
- ❑ Conduct *in vivo* or animal testing of a new compound

ref:

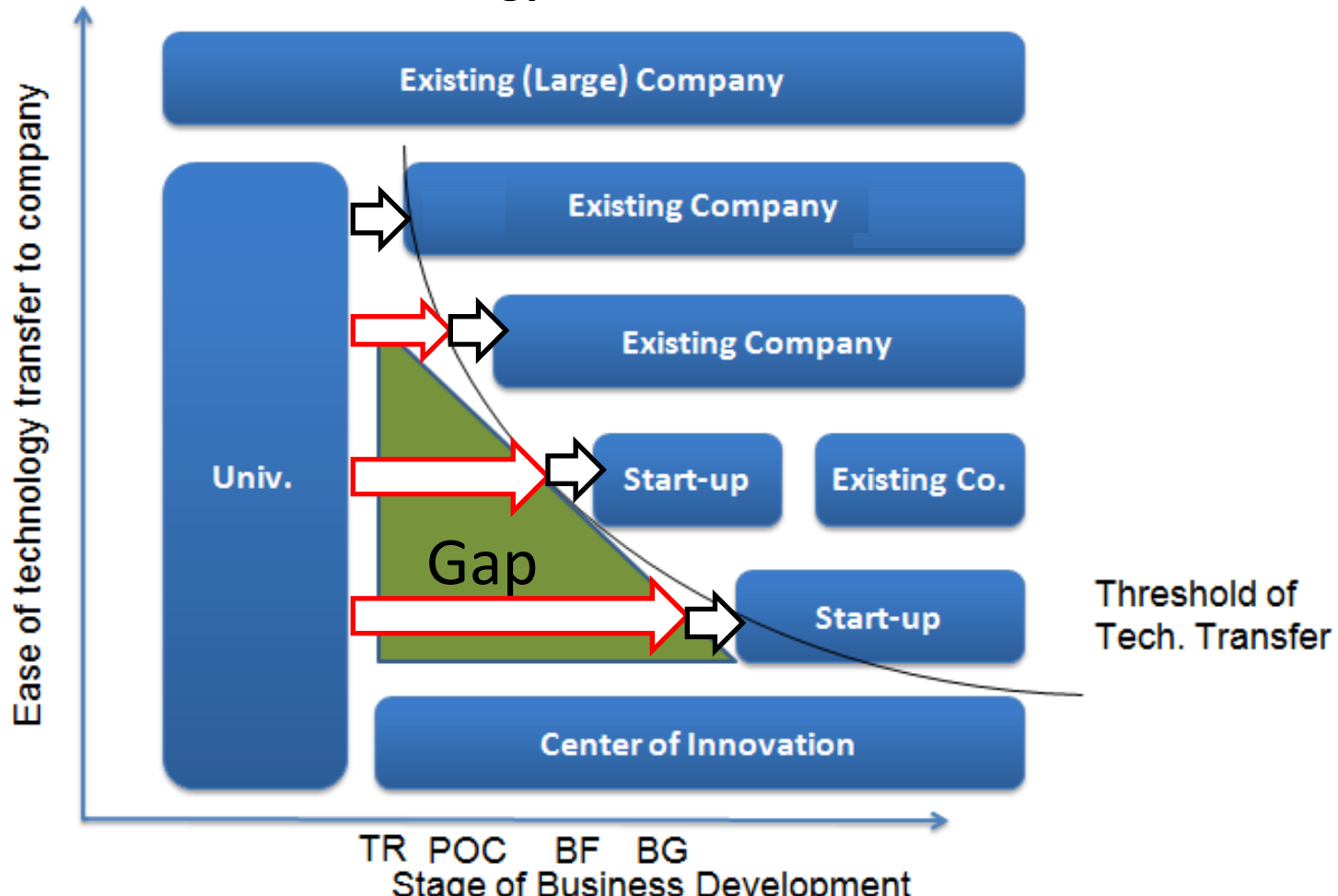
<http://www.bu.edu/otd/funding-opportunities/ignition/ignition-award-faq/>

Who will commercialize university technology?

- ❑ Existing Large Company
- ❑ Existing Small Company
- ❑ Startup Company

Bridge the Gaps in Technology Transfer

- How do we bridge the “Gap” in the process of technology transfer?
- This “Gap” extends from where the government funding of basic research ends to where **existing companies or investors are willing to accept the risk to commercialize the technology.**





Four (4) Steps to bridge the Gap in Technology Transfer

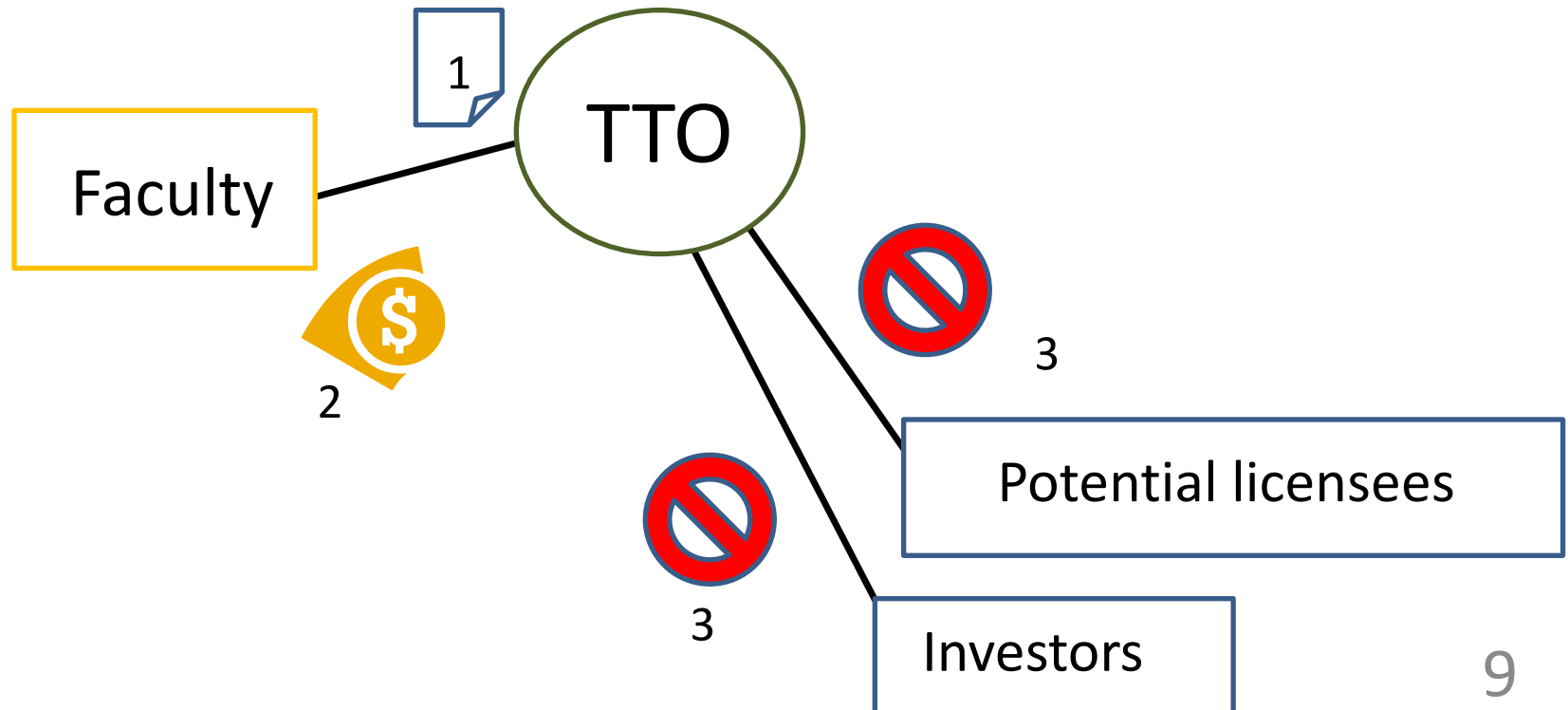
1. Assessment (Gap analysis / Stage Gating)
2. Funding
3. Project Management (Hands-on Support)
4. Assessment (Gap analysis / Stage Gating)

Which step do you think is the most important?



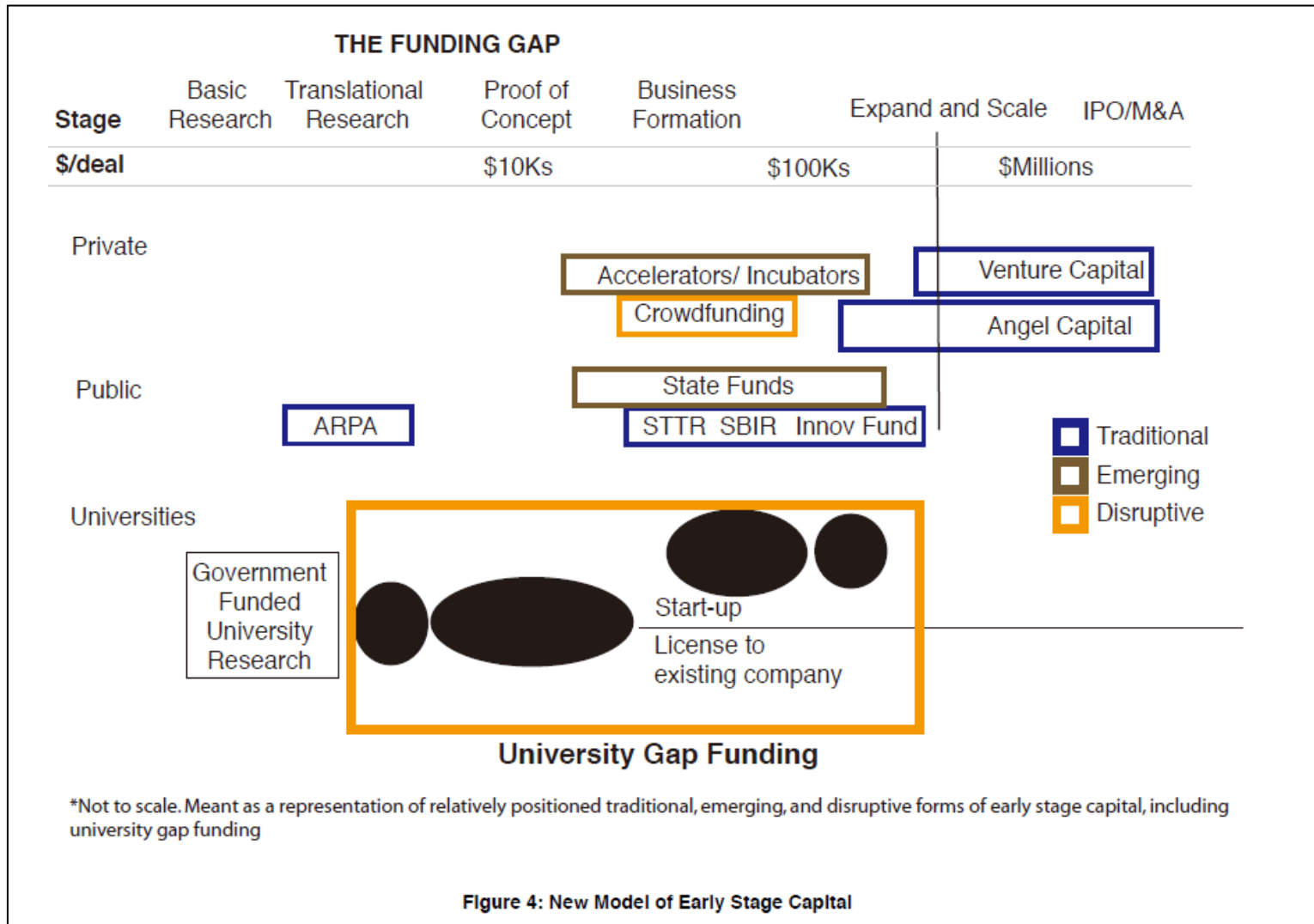
Importance of Assessment before Funding

1. Faculties wrote and submitted their proposals on the basis of their (unverified) assumption to attract potential licensees/investors.
2. TTO staffs evaluated the proposals and granted budgets to the winners.
3. Showing the collected data or developed prototype, TTO tried to motivate existing companies or investors to take the risks to commercialize the faculties' technology. **But, TTO staffs couldn't, unfortunately. Lost money!**



US Gap Funding Program

Depending on the stage and research field, the program structure (e.g. fund size and management) will be very different





Best Practices of PoC Funding at US Universities

Proof-of-Concept (“PoC”) Funding for Universities

- Aka “Translational Research”

“Translational research is what we call product development in academia. We can’t call it “Product Development”, so we call it “Translational Research” and everyone’s happy”

*Paul Zavracky
Dean, School of Technological Entrepreneurship
Northeastern University
2008*

Purpose of PoC Funding

- ❑ Reduce technical risk
- ❑ Reduce market risk
- ❑ Help Technology Push find its Market Pull

Typical Uses of Funds

- ❑ Proof of Concept
 - ❑ Hiring of additional staff/grad students for specific experiments
 - ❑ Buying of specific testing equipment
 - ❑ Pivotal translational proof of concept experiments

- ❑ Prototype development
 - ❑ Testing in an industrial setting or by 3rd Parties
 - ❑ Clinical Development

- ❑ Marketing and Customer Development
 - ❑ Developing user friendly interfaces
 - ❑ Engaging end users to evaluate the technology

Disallowed Uses of Funds

- ❑ IP expenses (may be allowed if capped)
- ❑ Major equipment
- ❑ Laptops
- ❑ Travel to academic conferences

- ❑ Sector/Discipline/School Specific Funds

The Challenge

- ❑ Funding
 - ❑ US Government's primary investment in PoC funding is the SBIR and STTR programs
 - ❑ \$2.5 billion annually; **BUT**
 - ❑ SBIR must be led by a company; can involve a university
 - ❑ STTR must involve a company and a university; either can lead
 - ❑ i.e., The technology must already have been transferred
 - ❑ Some faculty start a company just to apply for SBIR or STTR grants

Proof of Concept Funding

- ❑ Majority of PoC funding to date has come from institutional, philanthropic or state sources
- ❑ Philanthropic
 - ❑ Individual institution
 - ❑ MIT/Deshpande, UCSD/von Liebig, USC/Stevens
 - ❑ National
 - ❑ Coulter, Kauffman Entrepreneurial postdoctoral fellowships
- ❑ State
 - ❑ Massachusetts Technology Transfer Center
 - ❑ Ben Franklin (Pennsylvania)
 - ❑ Edison (Ohio)

UCSD Von Liebig Center

- ❑ Seed grants
 - ❑ \$75,000 for proof of concept
- ❑ Advisory services:
 - ❑ Stimulate University/Industry exchange
 - ❑ Develop new alliances
 - ❑ Explore appropriate commercialization strategies for new technologies
- ❑ Analyze Commercial Potential
 - ❑ Protect Intellectual Property
 - ❑ Identify Potential Licensees
 - ❑ Market to Companies
 - ❑ Write Business Plan
 - ❑ Market to Investors

MIT Deshpande Center

- ❑ Grant Program
 - ❑ Ignition Grants – upto \$50,000
 - ❑ Innovation Grants – upto \$250,000
- ❑ Catalyst Program
 - ❑ Mentors
- ❑ i-Teams
 - ❑ For-credit courses
 - ❑ Fall and Spring semesters
 - ❑ Offered through MIT Entrepreneurship Center
- ❑ IdeaStream
 - ❑ Early stage investors' forum for Deshpande funded spin-outs

Coulter Foundation's Program

- ❑ Launched in 2006
- ❑ 5 year program;
- ❑ \$1 million per year
- ❑ Program Director
 - ❑ Senior level medical device industry
- ❑ Key elements
 - ❑ Co-PI's
 - ❑ Committee to select projects
 - ❑ University
 - ❑ Coulter Foundation
 - ❑ Local community
 - ❑ VC's
 - ❑ Entrepreneurs
 - ❑ Industry

Coulter Program -- Proposal Evaluation

- ❑ Opportunity for impact
 - ❑ Unmet clinical need
- ❑ Technology
 - ❑ Development stage
 - ❑ If any discovery remains to be done, it's too early
 - ❑ IP
- ❑ Team
 - ❑ Competency, commitment
- ❑ Plan
 - ❑ Commercial risk mitigated
 - ❑ Appropriate endpoint and years of funding
 - ❑ Milestones
 - ❑ Follow-on-funding sources identified

Coulter Program – Needs a rich innovation ecosystem

- ❑ Internal resources:
 - ❑ Tech Transfer Office
 - ❑ Research Administration – Management of Conflict of Interest
 - ❑ Prototype/Machine Shop
 - ❑ Business School
 - ❑ Animal Facilities
 - ❑ Clinical Research Services
 - ❑ SBIR/STTR Funding Office

Coulter Program -- Needs a rich innovation ecosystem

- ❑ Potential interactions externally:
 - ❑ Patent Consultants
 - ❑ Business Incubators
 - ❑ Regulatory Consultants
 - ❑ Market Research Firms
 - ❑ Clinical Research Organizations
 - ❑ Business Consultants
 - ❑ Industry experts, investors
 - ❑ NIH/DOD/NSF supplemental funding

Coulter Program -- Support for Awardees

- ❑ Business Skills
 - ❑ Marketing and business development support
 - ❑ Project/Sub-contractor management
 - ❑ Competitive analysis

- ❑ Mentoring
 - ❑ “Personal Commercialization Coach”
 - ❑ Managing consultants
 - ❑ Maintaining momentum
 - ❑ Networking

Measuring Outcomes

Comparison of UCSD and MIT

	UCSD	MIT
	<u>Von Liebig</u>	<u>Deshpande</u>
Annual Investment	\$1.2 mm	\$1.7 mm
Projects Funded	66	64
Average Investment	\$42k	\$109k
Licenses	4 (6%)	1 (2%)
Start-Ups	16 (24%)	10 (16%)
Total Capital Raised	\$71 mm	\$88.7 mm
Average per Start-Up	\$4.4mm	\$8.9mm
Leverage	105x	81x

Source: Kauffman Foundation, 2008

Results of Coulter Program

(Audited data after year 5; \$ millions)

	<u>Number</u>	<u>Amount</u> (\$ mm)	<u>Average</u> (\$ mm)	<u>Leverage</u>
<u>Projects Funded</u>	200	\$46	\$0.23	
<u>Start-Ups</u>				
VC Funded	38	\$294	\$7.74	34.4x
Seed Stage	28	\$5	\$0.18	0.8x
Total Start-Ups	66	\$299	\$4.53	20.1x
<u>Licensed to Industry</u>	28			
<u>Gov't Follow-on Funding</u>		\$150		
Total	94	\$305	\$3.24	14.4x
LSR	47.0%			

Source: Caro Elias, Wallace H. Coulter Foundation, Personal Communication, February 2012

Conclusions on US Translational Research Programs

- ❑ Successful
- ❑ Can increase the overall licensing success rate
 - ❑ 25 - 47% success rate
- ❑ Are highly effective at generating start-ups
 - ❑ 6x the normal rate
- ❑ Are highly effective at leveraging the translational research funding into venture capital investment
 - ❑ 30-100x



Please read the case.

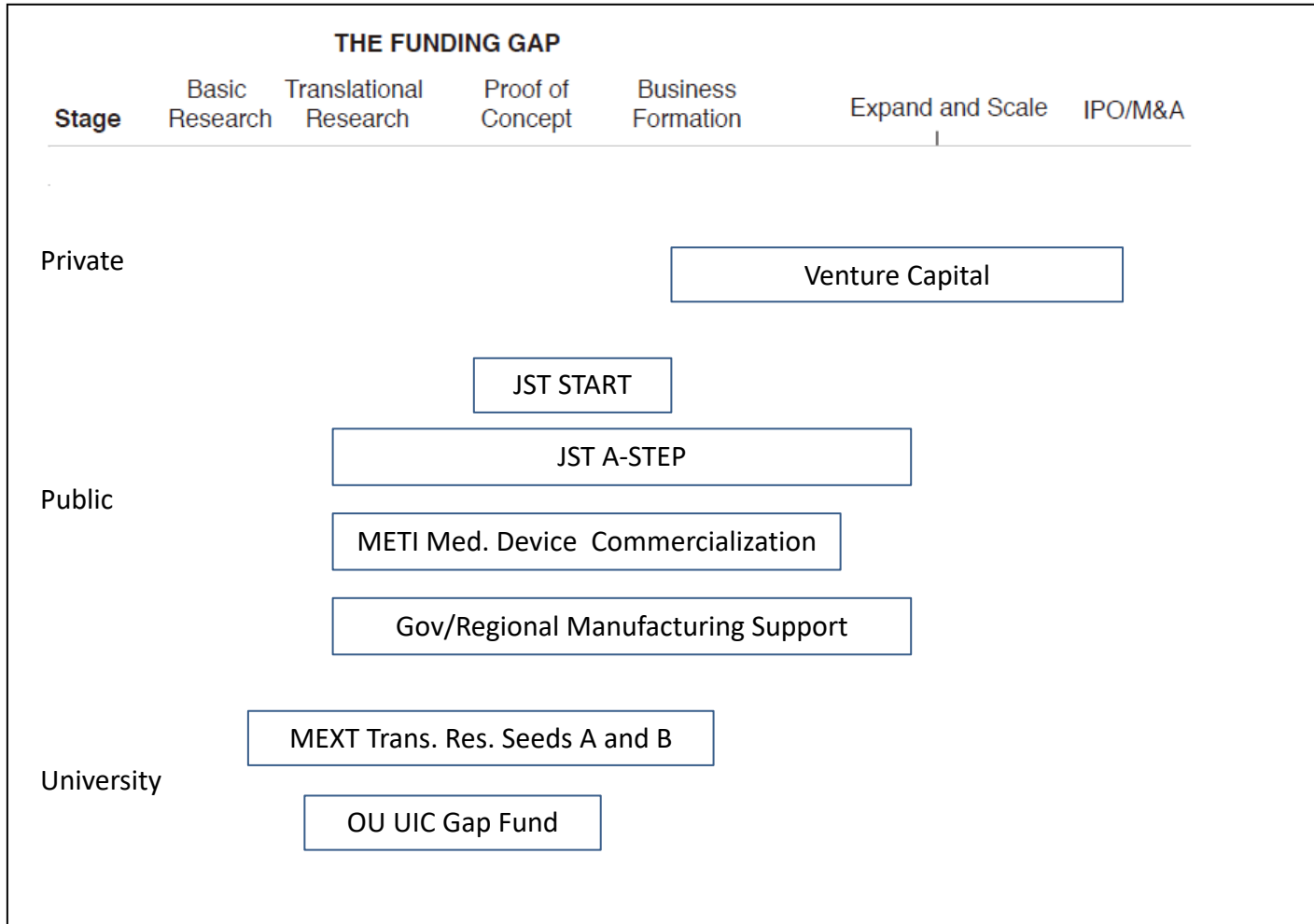


Japanese Gap Funding Program



Japanese Gap Funding Program

Depending on the stage and research field, the program structure (e.g. fund size and management) will be very different





Osaka University's Case



Target stage, research field, and fund : Osaka University's case

- Stage: Proof-of-concept/Prototyping, mainly
- Research field: All field
- Fund source(s):
 - Government: Strengthening research university project
 - Regional: Osaka prefecture manufacturing project
 - Osaka University: Rent by managing open laboratories
- Fund size: 10-30K US\$/project (Total: 150-200K US\$)
- Sustainability: Negotiation with each source every year
- Expected financial return: No

Selection criteria at Osaka Univ.

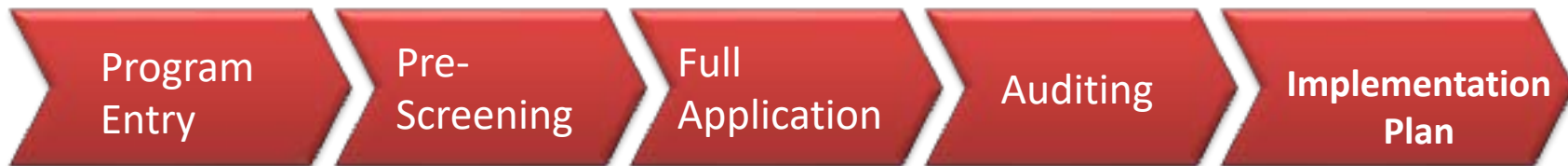
- Results of interview(s) to potential licensee and/or investors
 - If the specific data collection or prototyping is completed by the end of the fiscal year, can this project be succeeded in e.g.
 - Licensing to the potential licensee(s)?
 - Committed by the investor(s)?
- Market :needs, size, trend, and new vs. existing market.
- Social contribution
- Sustainability of competitive advantage.
- Intellectual property: e.g. freedom to operate.
- Barrier to market entry: e.g. regulatory path and custom.
- Stage of development and technology development plan
- Resource allocation
- Business formation

Large weight

On the basis of the Gap Analysis, the plans were mostly modified from the PI's initial proposal



Selection process at Osaka Univ.



Hands on Support

The three keys to success

Action	<ul style="list-style-type: none"> •PI (principal Investigator) fills in and submits a ca. 4 page application entry sheet to TTO 	<ul style="list-style-type: none"> •Advisors review the submitted entry sheet and advise on commercialization •TTO staff give feedback to PI and decide whether to write full application. •Consider application for other support programs 	<ul style="list-style-type: none"> •TTO staff investigate industry needs and opinions. •PI produces and submits full application (ca. 6-10 pages) •Review by external advisors 	<ul style="list-style-type: none"> •PI makes a presentation for external advisors on campus, and TTO decide whether to accept or reject on the basis of the advisors' evaluation. 	<ul style="list-style-type: none"> •PI and TTO staff meet and discuss the points made by the advisors at the screening, and based on this advice an implementation plan sheet is submitted. •Notice of Acceptance •Notice of Approved Budget •Hands -on Support
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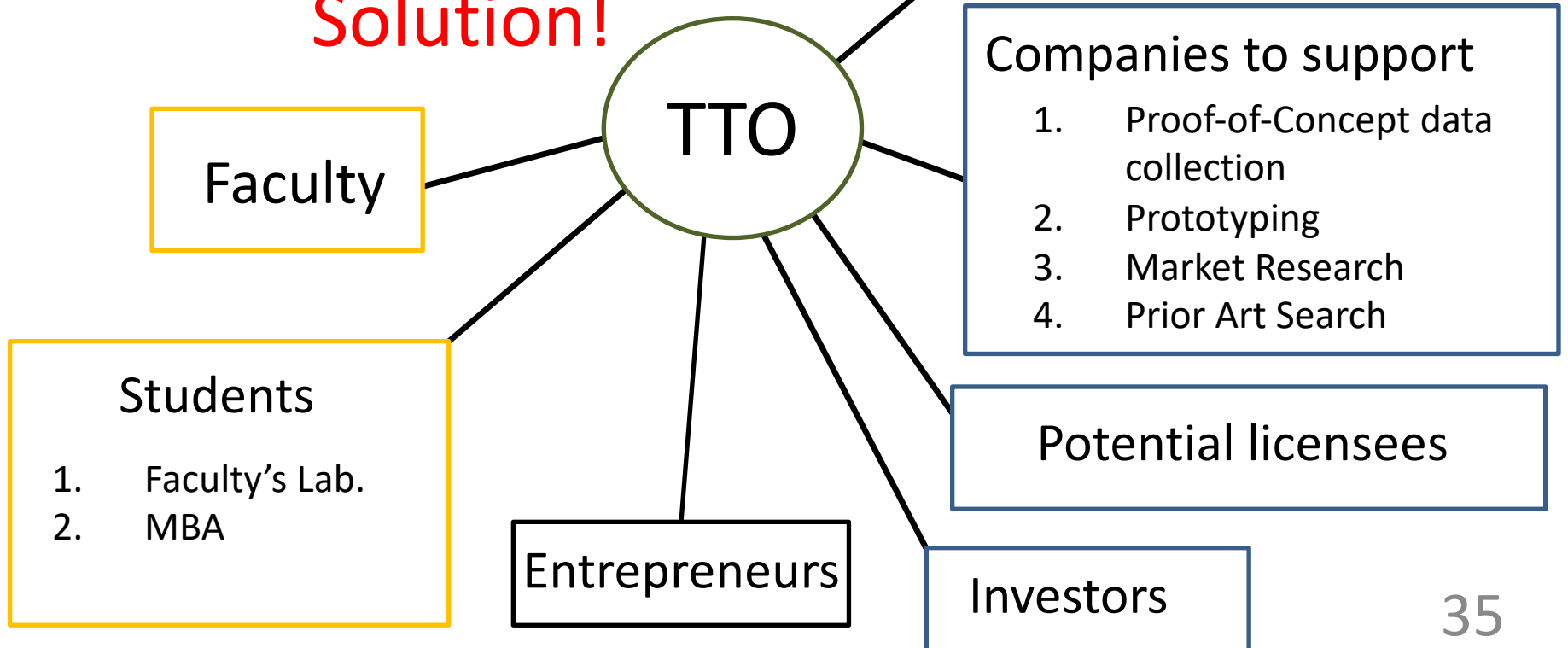


Hands-on Support 1: Team formation and deal making

- Business formation and deal makings are the keys to success

Team formation and Deal makings

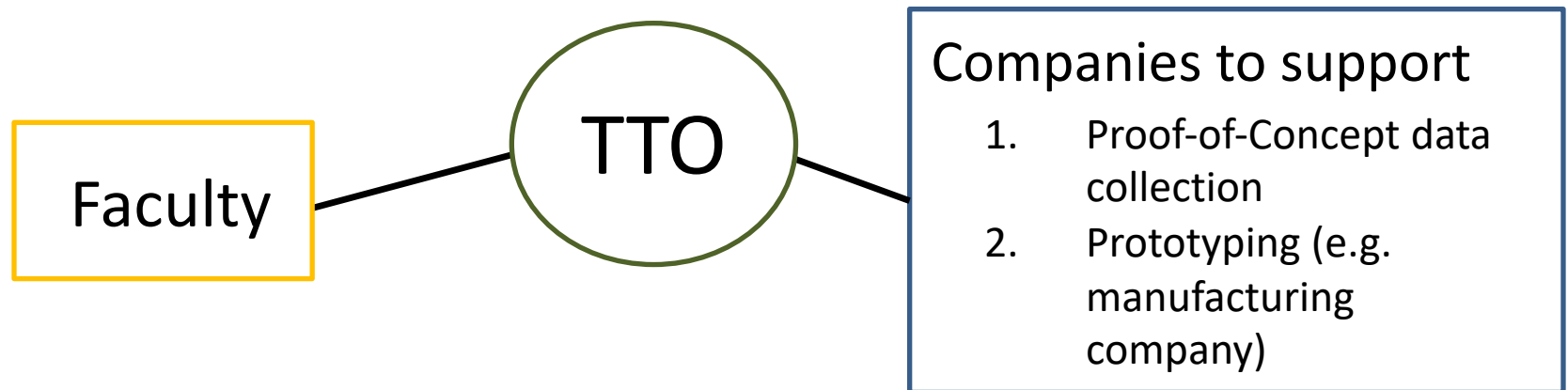
Solution!





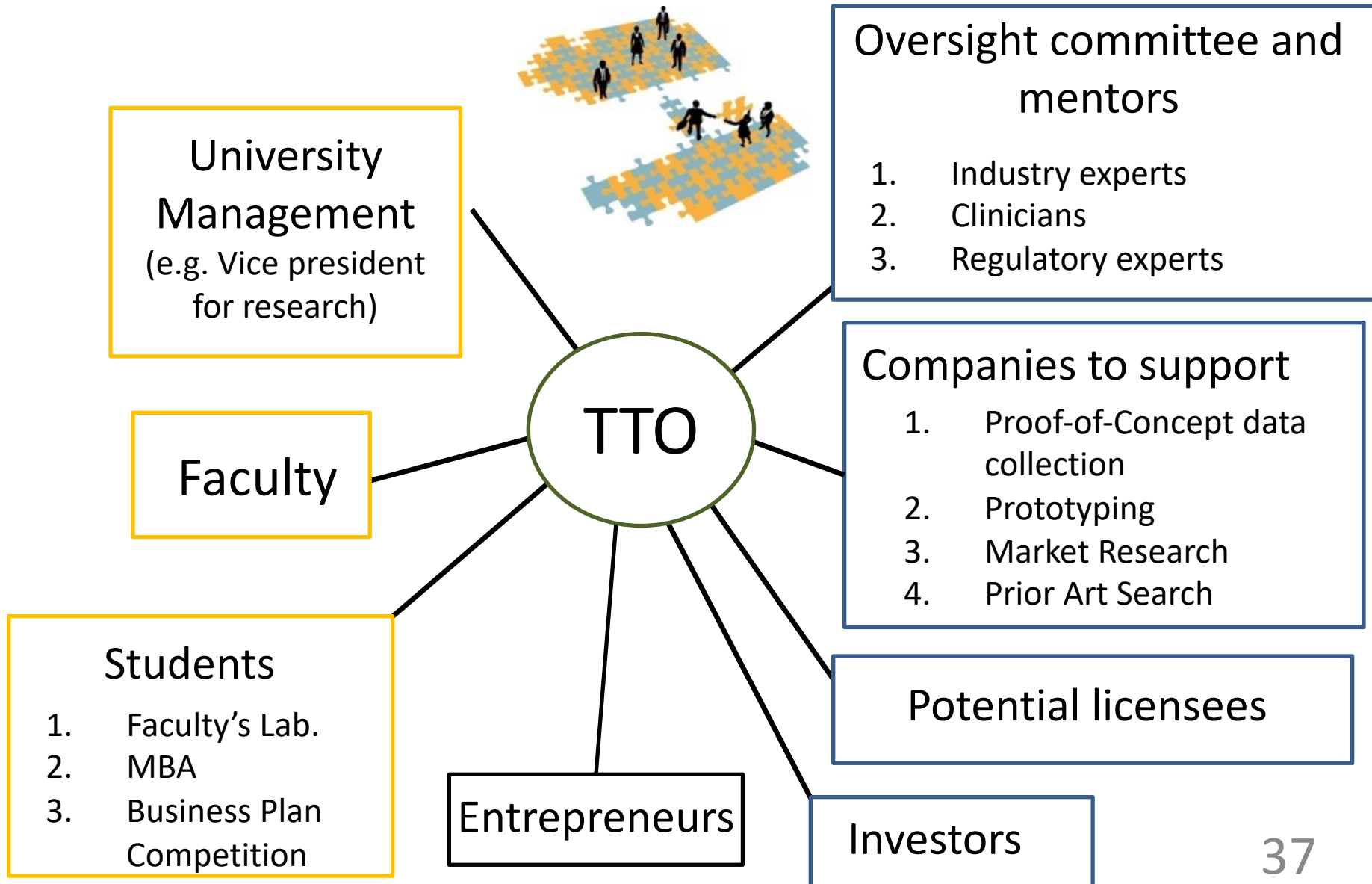
Hands-on support 2: Out source

- **Problem:** Faculty is generally not highly motivated to the data collection or prototyping which are NOT lead to the publication of academic papers.



Out source **Solution!**

Role of TTO: Build and effectively use own innovation ecosystem





Evaluation of OU Gap Bridging Program e.g. FY2011's case

- Short-term
 - 21 proposals received
 - 11 proposals selected
 - 3 follow-on funding
 - 5 Joint research agreements
 - 2 Licensing agreements
 - 1 MTA (Material transfer agreements)
 - 1 Investment (A bank decided to invest: FY2013)
- Long-term
 - Building an ecosystem to bridge the Gap:
 - ca. 20 external advisors from industry, VCs, and regulatory department
 - Subscription of Market Research Databank
 - Business formation: 1 startup company launched in FY2012.



Let's discuss the case.

Case study: A new epoxy resin

1. What type of funding is needed to launch the product in the market?
2. Which type of company is likely to want to produce and sell the product?
3. What type of company will be an appropriate collaborator for this purpose in the future?
4. What incentives/terms should be offered to induce a collaborator to commit to future development activity?
5. What are the essential requirements for launching the product in the market?
6. What should be the target/desired results of the PoC project in order for a collaborator to be interested in the technology?
7. Who should carry out the PoC project?
8. What is the likely cost of the PoC project?



Q1. What type of funding is needed to launch the product in the market?

1. Purpose

1. Basic Research
2. Translational Research
3. Proof-of-Concept/Prototyping
4. Business Formation
5. Business Growth

2. Target area: Manufacturing, Green Innovation

3. Source

1. Private
2. Public
3. Institutional



Q2 Which type of company is likely to want to produce and sell the product?

1. Raw material manufacturer: e.g. Manufacturer of Non-halite
2. Reaction apparatus manufacturer
3. Epoxy resin maker
4. Electronic parts maker
5. Electrical products (e.g. PC) maker



Q3 What type of company will be an appropriate collaborator for this purpose in the future?

1. Raw material manufacturer: e.g. Manufacturer of Non-halite
2. Reaction apparatus manufacturer
3. Epoxy resin maker
4. Electronic parts maker
5. Electrical products (e.g. PC) maker



Q4: Incentive/Terms

1. Get funds
 1. Grant
 2. Matching fund
2. Joint research agreement
 1. Borrow reaction apparatus from the reaction apparatus manufacturer
 2. Scale up experiment at Osaka Univ. or reaction apparatus manufacturer
3. Licensing agreement
 1. Exclusive/non-exclusive



Q5: Essential Requirements

1. Value Proposition
2. Confirmation of the needs of the companies in downstream of value chain
3. Set a proper milestone
4. Leadership



Q6: What should be the target/desired results of the PoC project in order for a collaborator to be interested in the technology?

1. 5 litter scale up experiment



Q7: Who should carry out the PoC project?

1. Osaka University (PI's lab)
 1. PI
 2. Student
 3. Hiring technicians
2. Manufacturers of powder reaction reactors
3. Others?



Q8: What is the likely cost of the PoC project?

1. Materials
2. Equipment / Devices
3. Human Resources
4. Traveling fee

Real story of the case study.



Technology prior to Gap bridging program

- Dr. Junko Ichihara in Osaka University – methods to enable chemical powder reaction **without solvent (liquid)** under a laboratory scale.
→ important applications in epoxies



Gap bridging project (ca. 30,000 US\$): Scale-up experiment

- **Gap analysis:** Dr. Ichihara was originally planned to use a large-size glass reactor. However, external advisory board conditioned Dr. Ichihara's group that the group should negotiate with a company to rent a larger scale chemical reactor to meet industry's needs.
- **Deal making:** TTO staff negotiated a potential licensee to rent a five liter chemical reactor by free of charge under a joint research agreement.
- **Outsource:** The scale-up experiment itself has no value for publishing academic paper. Therefore, a external technician was hired.

Outcome

- **Deal making:** Potential licensee launched an incubation laboratory inside Osaka University under a joint research agreement (FY2012)
- **Deal Making:** Licensing agreement with the potential licensee (FY2013)

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This lecture is
the basis for
chapters 4 and 5



Thank you for listening.
Questions?

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