Building an Innovative Ecosystem for Entrepreneurship

in a Developing Region

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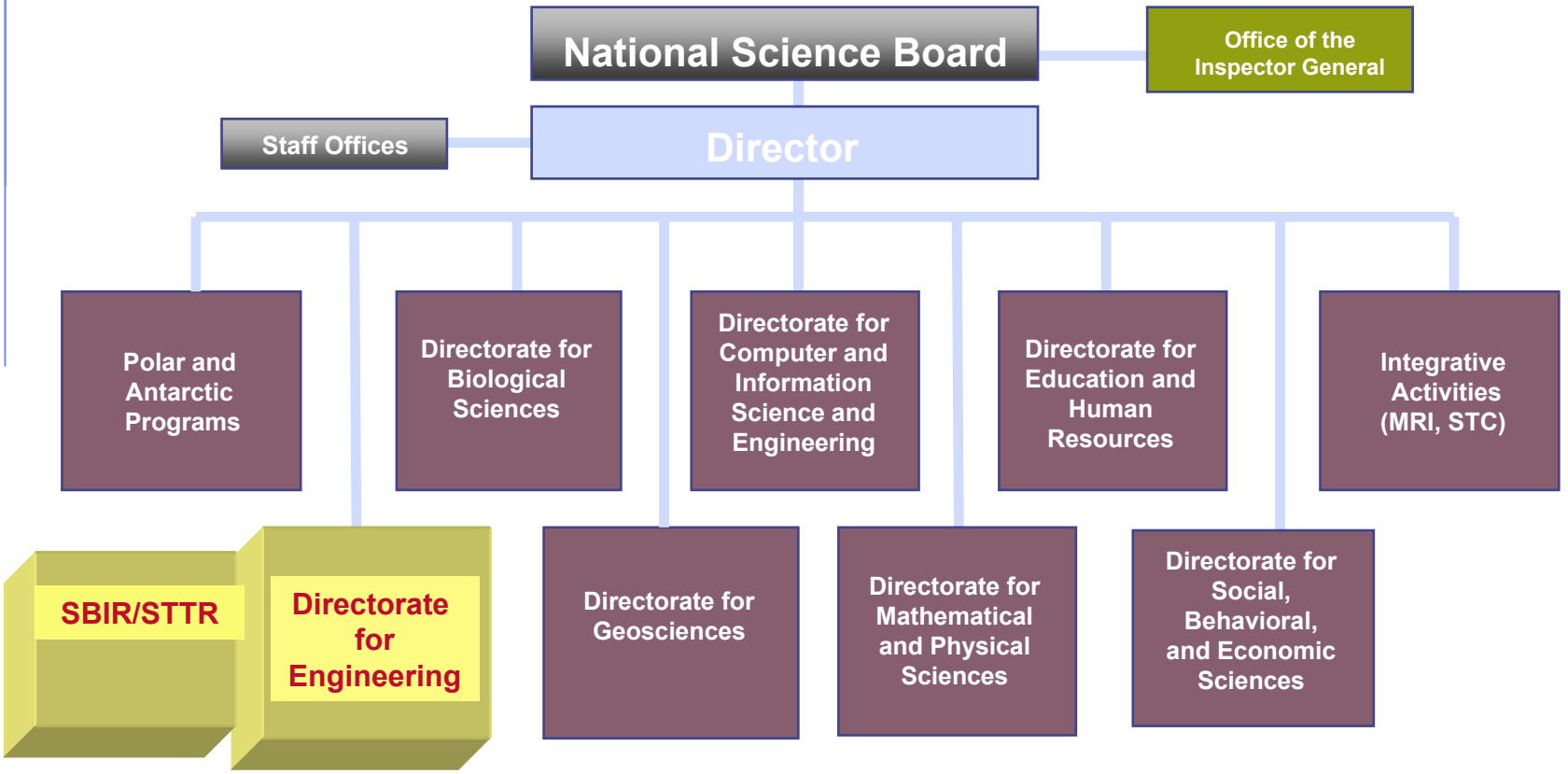
National Science Foundation

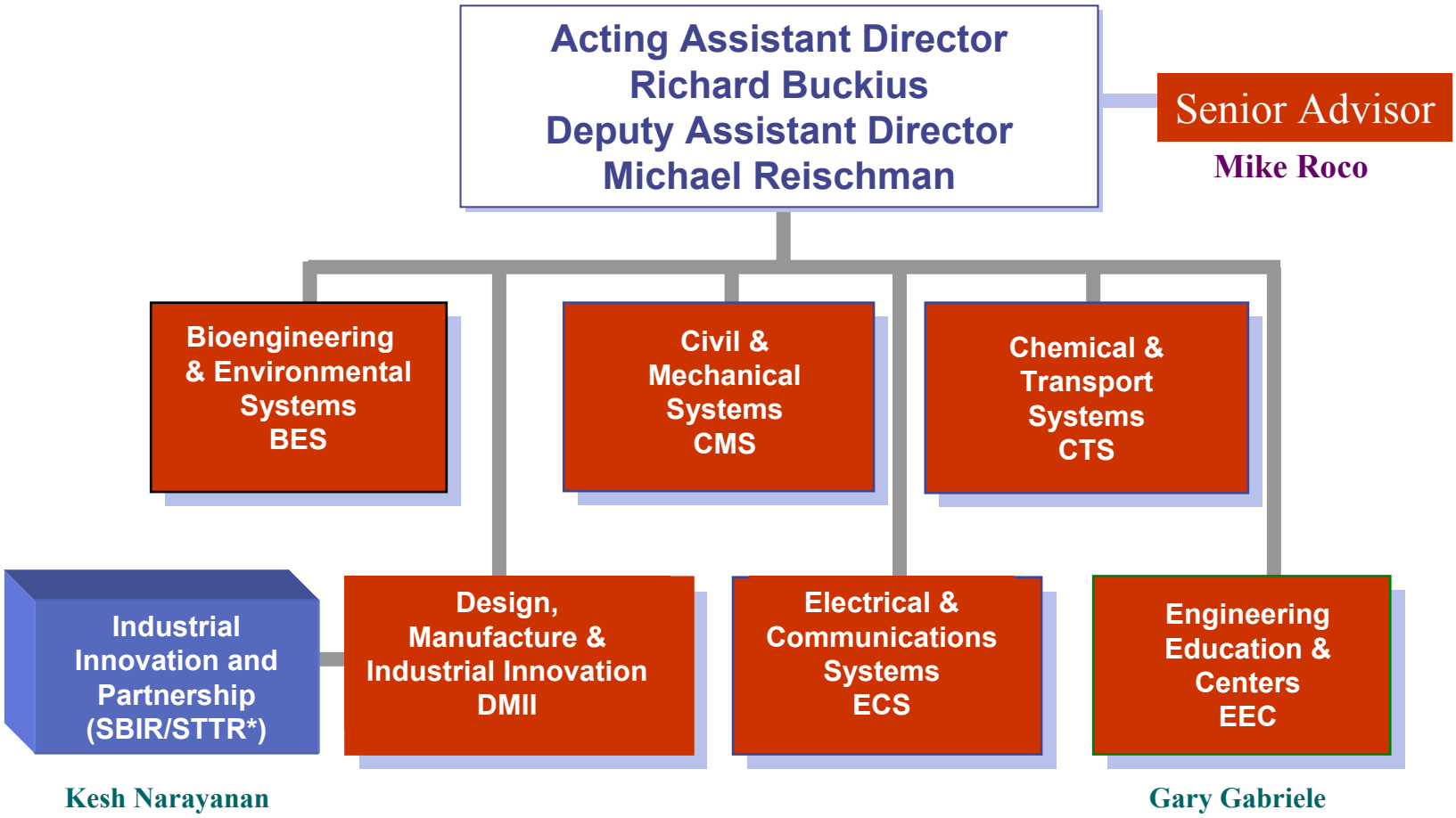
Agenda

- National Science Foundation Background
- Impact of Small Businesses
- Building small businesses and investment friendly environments
- Summary and Recommendations

National Science Foundation



NSF Engineering Directorate



NSF's Vision

To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense

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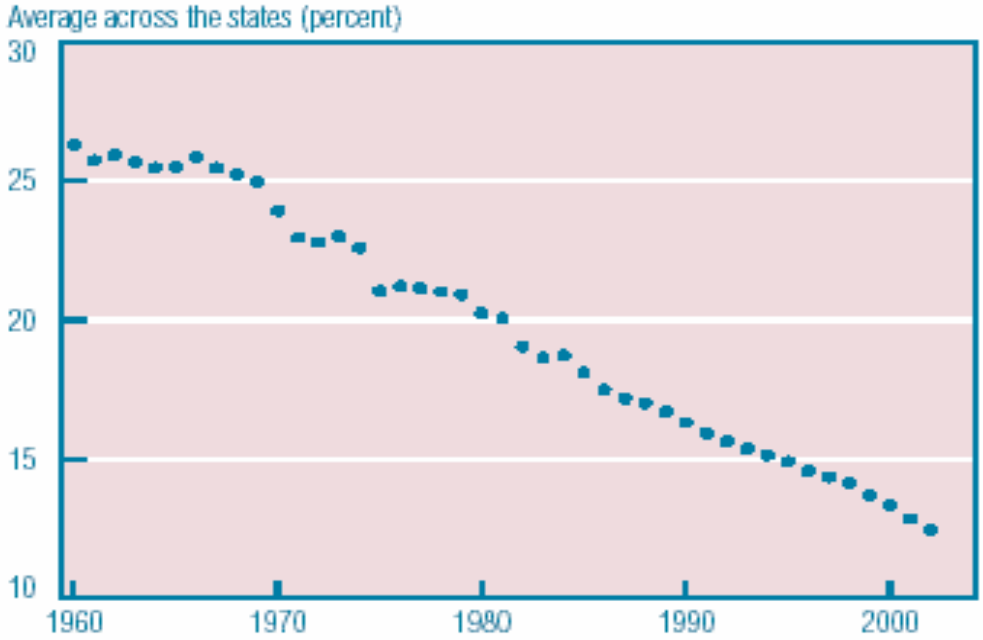
MANUFACTURING EMPLOYMENT SHARES IN US & ADVANCED COUNTRIES (PERCENT)

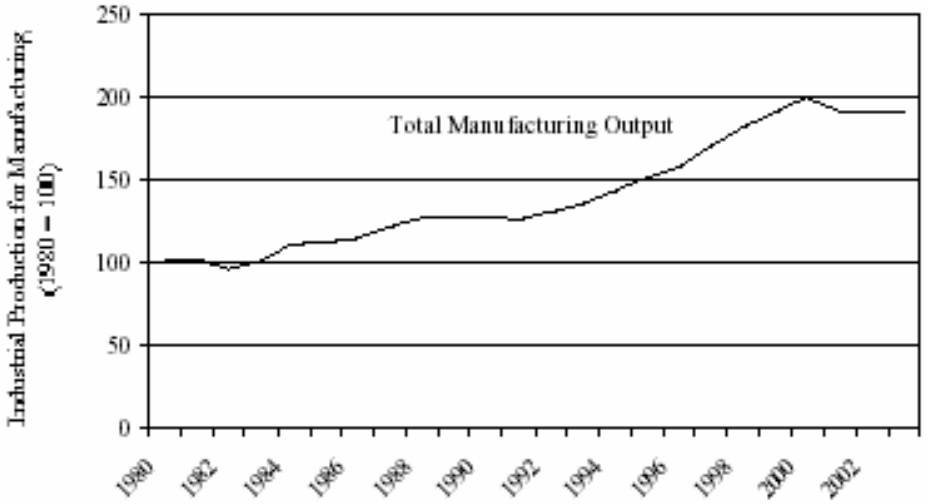
	1960	2002	Average annual growth rate
United States	26	13	2.1
Canada	25	15	1.7
Australia	26	12	1.9
Japan	22	19	2.2
France	28	21	1.5
Germany	34	24	1.8
Italy	24	23	1.7
Netherlands	29	14	1.9
Sweden	32	17	1.5
United Kingdom	36	16	2.1

SOURCES: U.S. Department of Labor and Penn World Table.

NOTES: The data for Australia start in 1965, and the data for France stop in 1989. The growth rates are of chain-weighted GDP for the years 1980 through 2000 inclusive. The annual growth rate is the rate of real economic growth compounded annually.



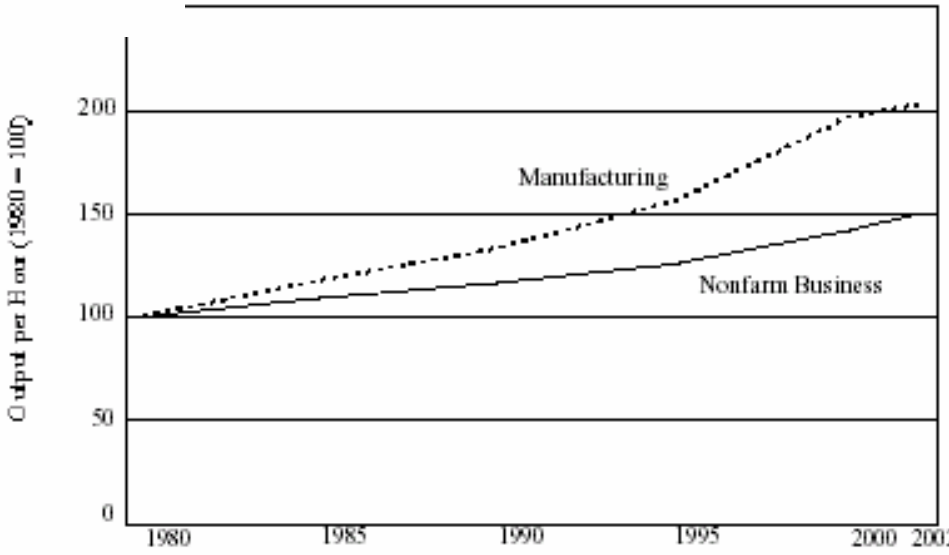
U.S. Manufacturing - Productivity



Source: *Economic Report of the President 2004.*

U.S. Manufacturing Output

U.S. Productivity Growth



Source: *Statistical Abstract of the United States: 2003.*

How Important Are Small Businesses to the U.S. Economy?

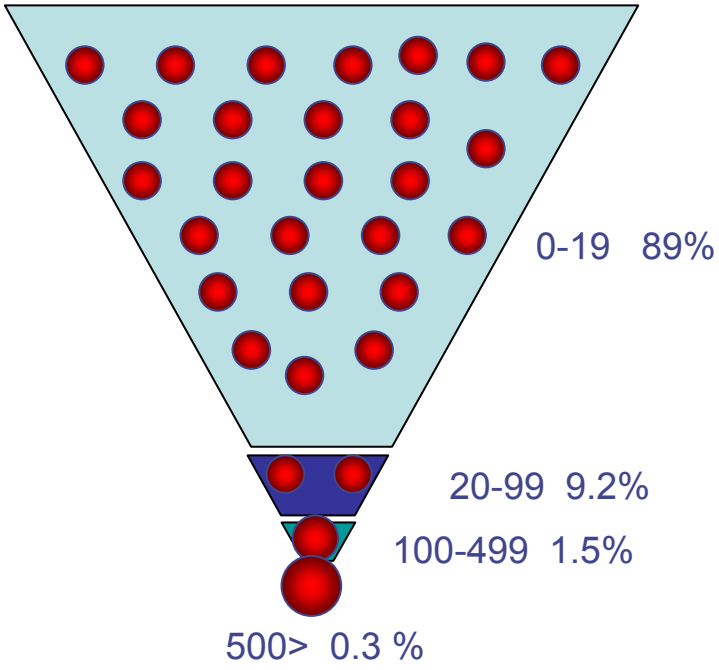
- Represent more than 99.7 percent of all employers.
- Employ more than half of all private sector employees.
- Pay 44.5 percent of total U.S. private payroll.
- Generate 60 to 80 percent of net new jobs annually.
- Create more than 50 percent of non-farm private gross domestic product (GDP).

How Important Are Small Businesses to the U.S. Economy?

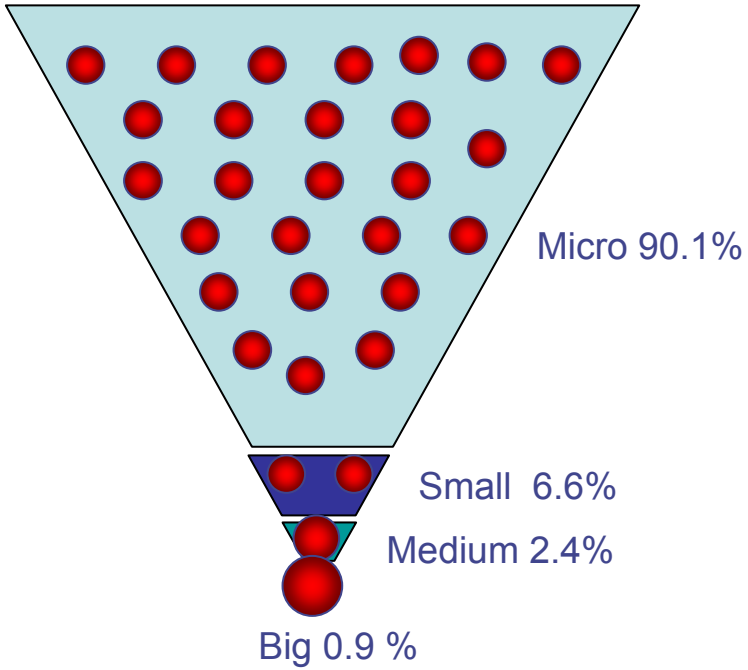
- Produce 13 to 14 times more patents per employee than large firms. These patents are twice as likely as large firm patents to be among the one percent most cited.
- Are employers of 39 percent of high tech workers (such as scientists, engineers, and computer workers).
- Made up 97 percent of all identified exporters and produced 29 percent of the known export value in FY 2001.

Enterprise Sizes

Enterprise size in the USA Economy

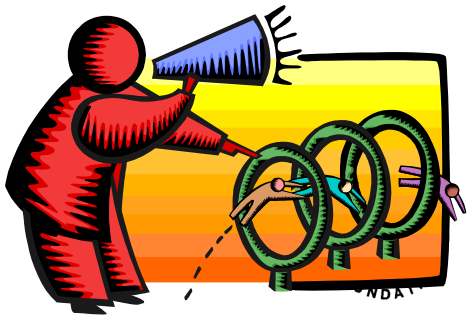


Enterprise size in the Mexican Economy

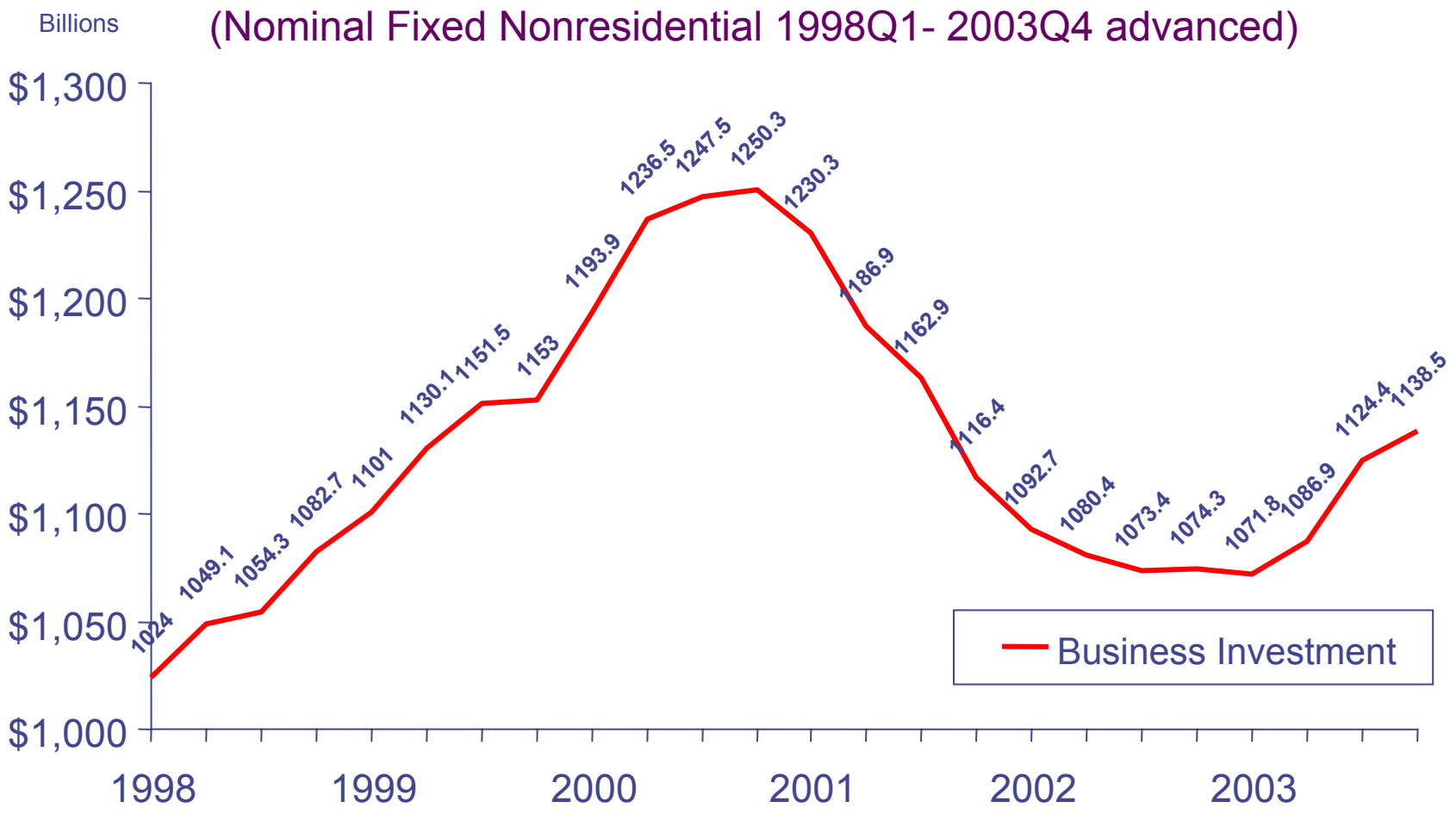


High Technology Differentiator

- Manufacturing jobs respond to politics, geopolitics and local politics, in short periods of time
- Small businesses and innovation are the main thrust of the economy
- Investment opportunities **may be there and we have to create/enhance it**
- High-Tech innovation is the differentiator
  - Partnership universities, small businesses, industry and goverment



U.S. Business Investment Over Six Years



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Stage of Company Development Determines Necessary Resources and Services

- Invention
- Company Creation
- Company Development
- High Growth
- Established Company

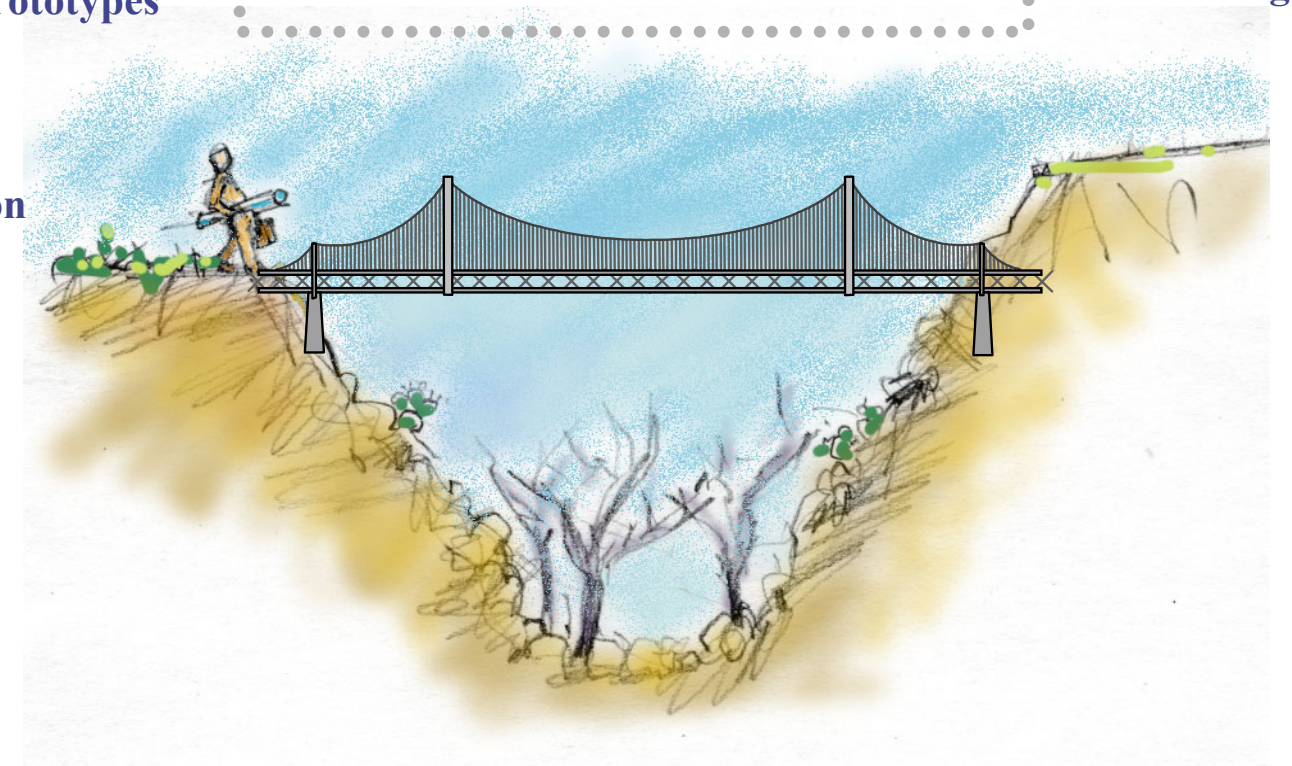
Bridging the "Valley of Death"

Government Innovation Promotion Agency

Small Business Tech Development → Business Development → Seed Funding

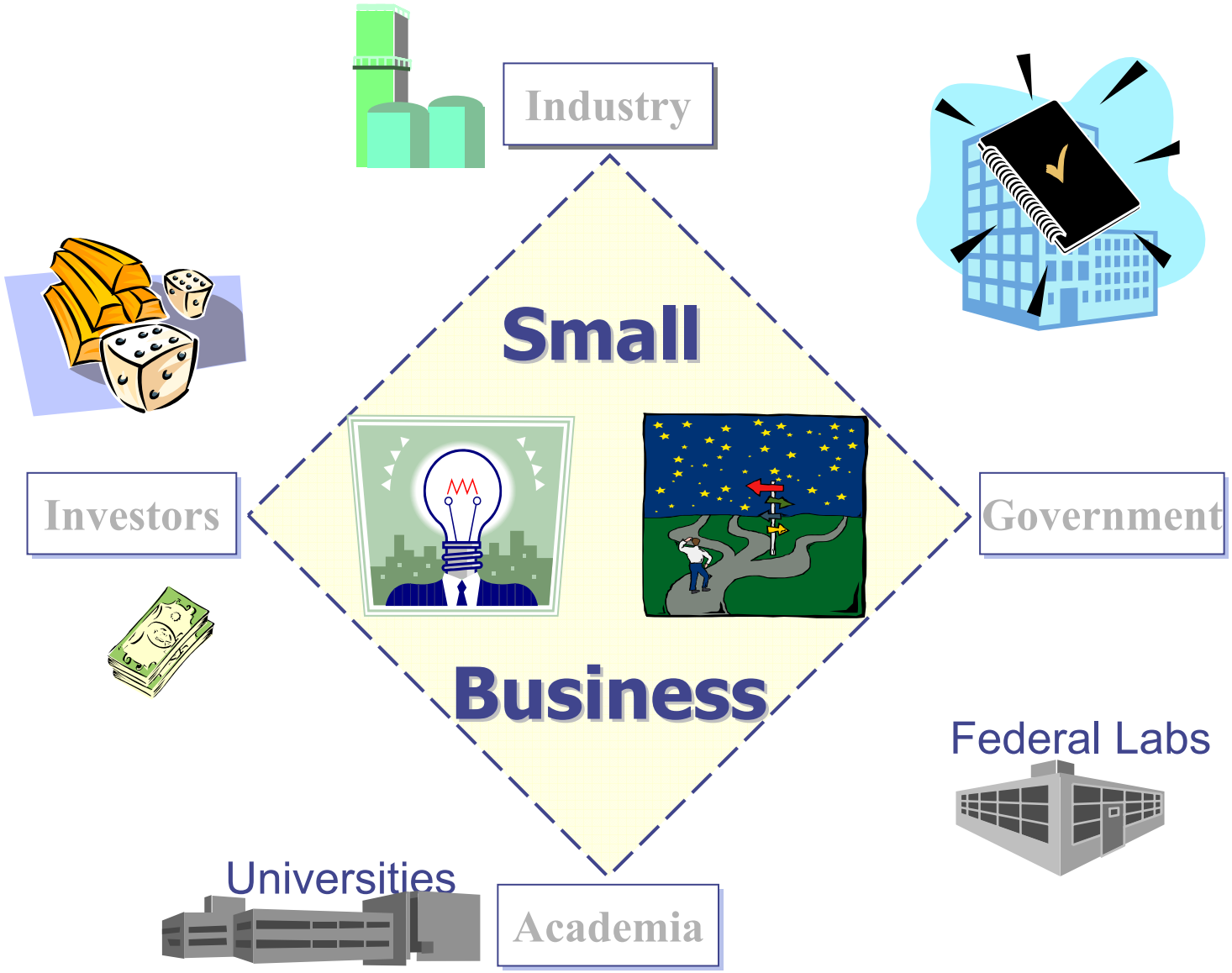
Prototypes

Research and Education
-Univ.
-R&D Labs



Business Startups; Expansions

Key Elements for Birth and Survival of Small Businesses



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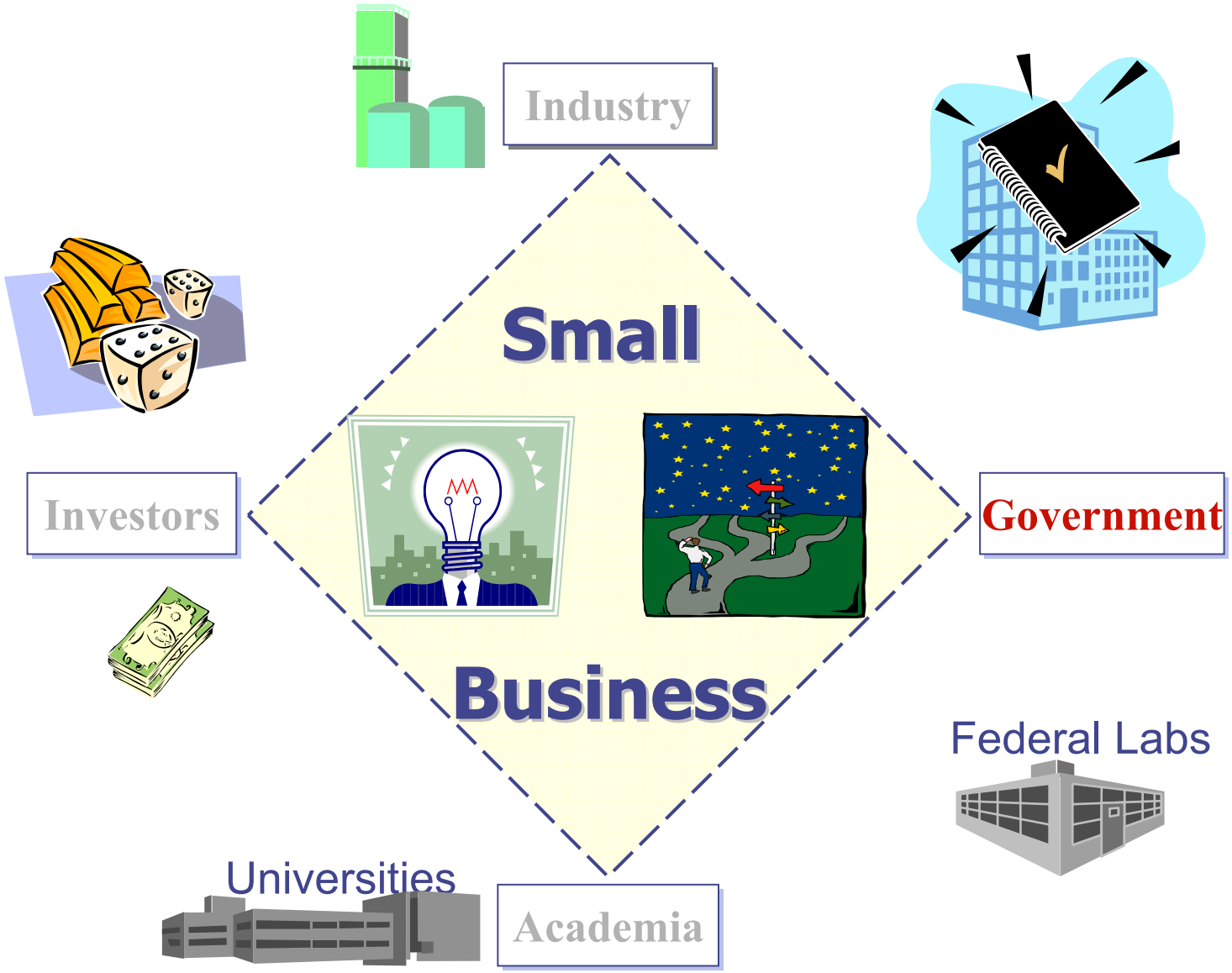


Expansion of Public Sector Programs to Catalyze Investments

- Implement public policies that support Venture Capital development through activities designed to build a culture that fosters venture capital and entrepreneurship
  - Funding basic science and R&D activities
  - Providing political leadership and aid for venture “catalyst” and technology commercialization agencies
  - Funding research parks and business incubator buildings
  - Promoting entrepreneurial education
  - Creating venture funds
  - Redirecting workforce education programs toward the needs of a competitive economy
  - Reforming intellectual property policies
  - Advancing public education.

Program Descriptions

- SBIR: Set-aside program for small business concerns to engage in federal R&D -- with potential for commercialization.

- STTR: Set-aside program to facilitate cooperative R&D between small business concerns and U.S. research institutions -- with potential for commercialization.

SBIR / STTR Participating Agencies

TOTAL ~ $2.2 B
FY 2006

- **DOD** SBIR/STTR
- **HHS** SBIR/STTR
- **NASA** SBIR/STTR
- **DOE** SBIR/STTR
- **NSF** SBIR/STTR
  - **~$104M**
- **DHS** SBIR
- **USDA** SBIR
- **DOC** SBIR
- **ED** SBIR
- **EPA** SBIR
- **DOT** SBIR

Origins of Federal SBIR/STTR Programs

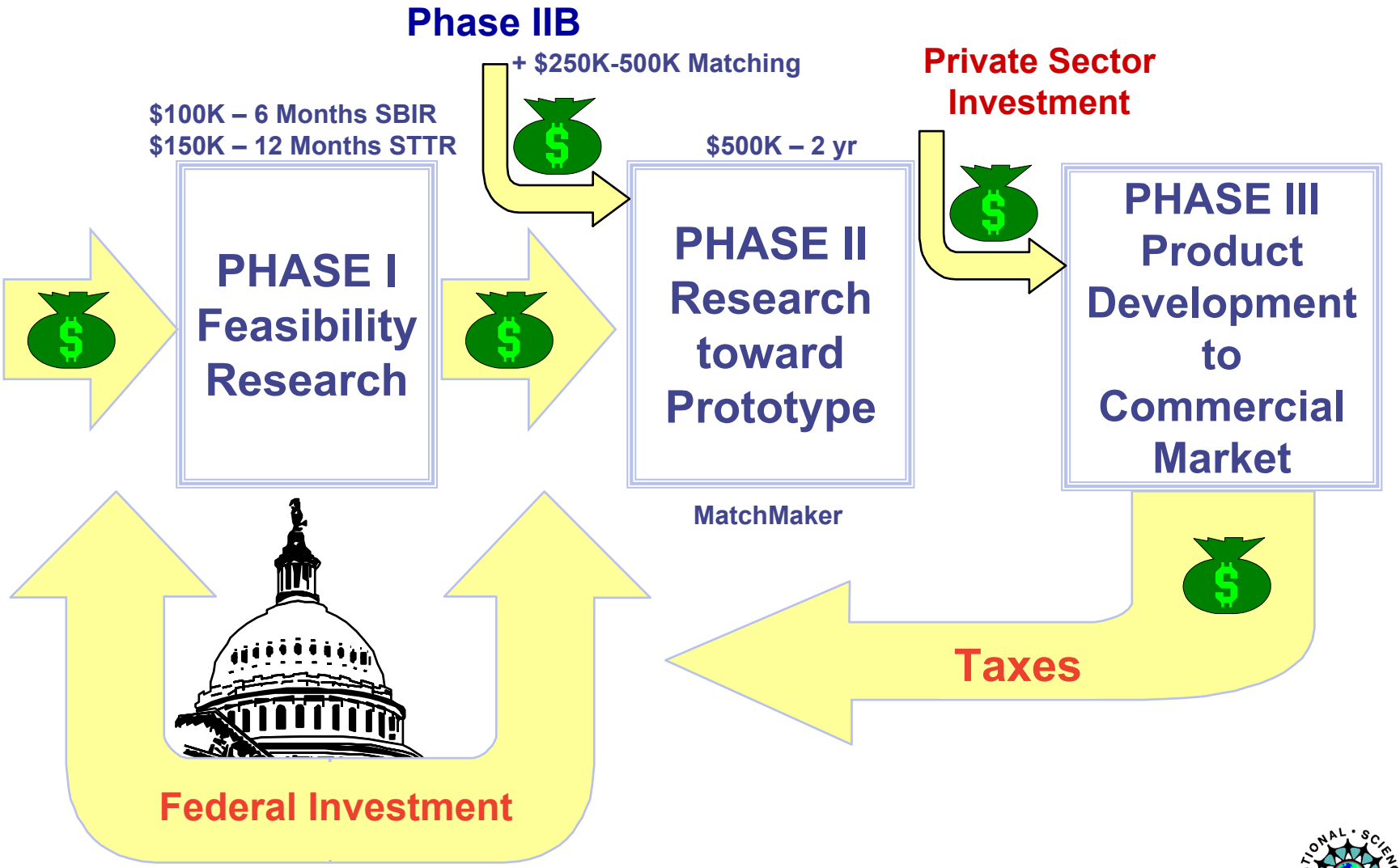
- Federal Research & Development Needs can be met by:
  - Small Business
  - Academia, Federal Labs
  - Large Business
- Small Business is a key contributor to the Economy of the Nation
  - **Job Creation**
  - **Wealth Creation**

NSF originated SBIR (Roland Tibbetts)

SBIR Program Eligibility Checkpoints

- ✓ Organized for- profit U.S. business
- ✓ At least 51% U.S.-owned and independently operated
- ✓ Small Business located in the U.S.
- ✓ P.I.'s primary employment with small business during project
- ✓ 500 or fewer employees

SBIR "Innovation" Model



Doing Business with NSF

- NSF is not the Final Customer
- NSF has broad market driven technology topics:
  - **you identify the opportunity**
  - **pose the research problem**
  - **propose novel/unique solution**
- NSF wants to see you successfully **commercialize** your high-tech research
- You need investment dollars beyond NSF SBIR/STTR

Market Driven Investment Focused Solicitation Topics

- **Solicitation Released every 6 Months**
- **Topics rotate 12-18 months**
- **Match innovation research ideas with current open solicitation**
  - **Manufacturing Innovation (MI)**
  - **Electronics**
  - **Biotech**
  - **Advanced Materials (AM)**
  - **Information Technology (IT)**
  - **Emerging Opportunities (EO)**

Opportunities to Explore

- Cyberinfrastructure
- Nanotechnologies
- Biotech
- High value-added production specialization
- Collaboration – Beyond networking
- Wireless
- Complex systems modeling
  - Social/cultural
  - Economics
- Not your standard security issues

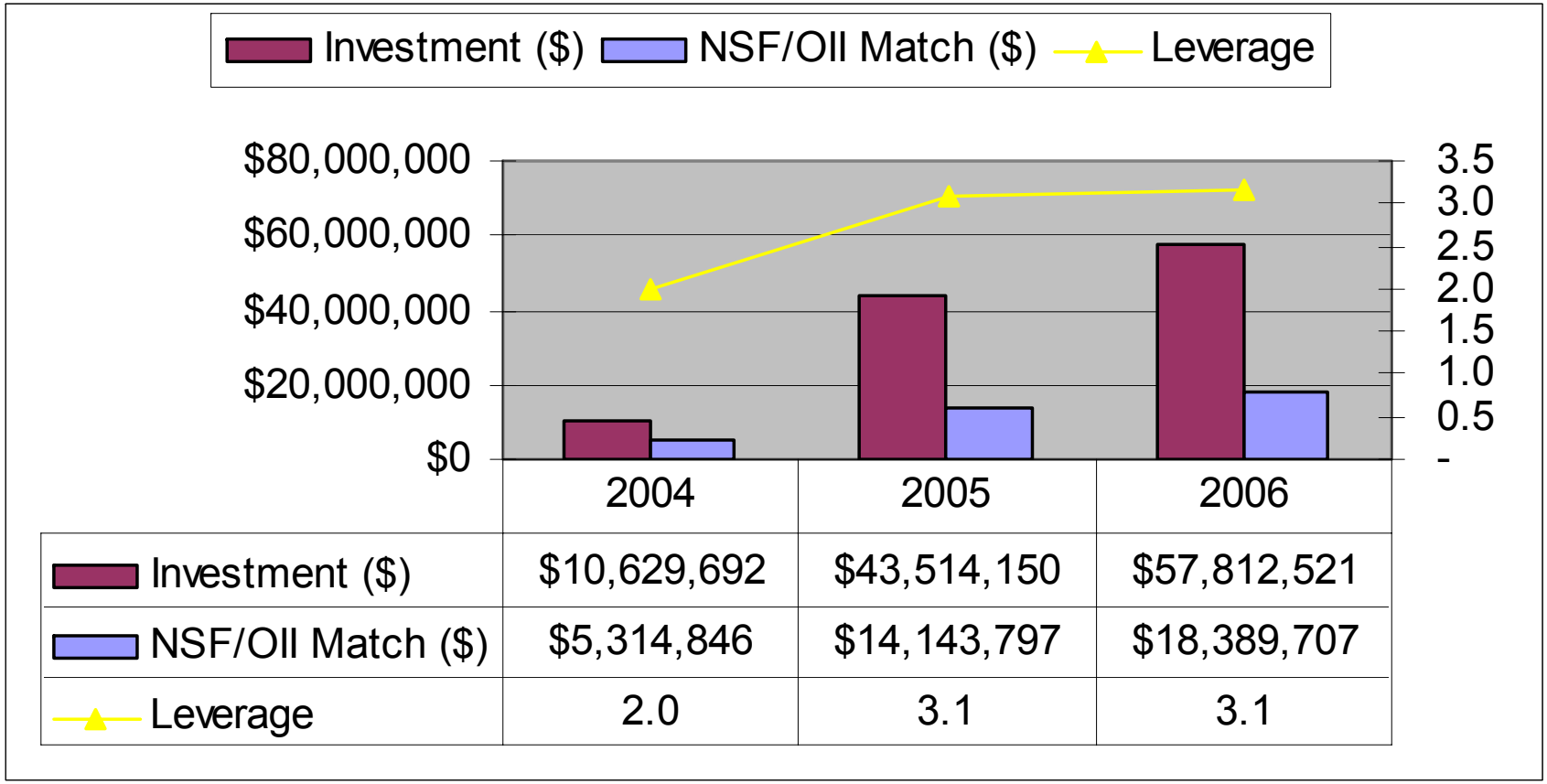
Commercialization Survey, March 2006

- Project success rate is 44% over 240 past projects reviewed.
- Success criteria ranges from
  - Any product sales for 1 year post-completion projects
  - To $1M sales for 6 year old projects.
  - No "credit" was given for the impact of the technology on other projects, although this factor was often cited.
- Companies with 10 or less personnel at time of award constitute about 40% of the awardees
  - Appear to have success rates at least as high as their larger counterparts.
  - Smaller companies make very frequent use of collaborations with industry leaders.
- Success rates per topic
  - IT projects have the highest success rates (56%)
  - Biotech the lowest (31%)
  - Electronics (46%)
  - Advanced Materials and Manufacturing (40%).
- IT products appear to have smaller sales and shorter lifetimes than the other products.

Commercialization Survey, March 2006

- Among the unsuccessful projects, marketing failures (57%) predominates.
  - The most commonly cited reason, " the market disappeared as the project was ending".
  - Failure to achieve certain cost or product performance goals are frequently cited for technical failures.
- The successful projects are heavily patented (56%) except in the IT area where copyright and trade secrets predominate.
- In the other three fields the strong patent positions are well above the overall 56% figure.
- Almost 60% of the successful projects are "in-bed" with an industry leader
- About one-third have close ties with academic groups.

NSF Phase IIB Matching Funds Trends

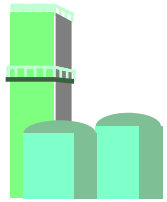


	2004	2005	2006
Investment ($)	$10,629,692	$43,514,150	$57,812,521
NSF/OII Match ($)	$5,314,846	$14,143,797	$18,389,707
Leverage	2.0	3.1	3.1

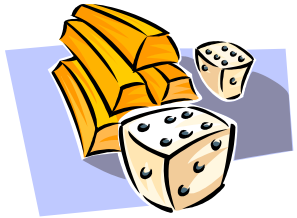
Types of Third-Party Funding Arrangements

- Cash
  - Venture Capitals
  - Angels
- Date-Certain
  - Purchase Orders
  - Licensing Agreements
  - Contracts

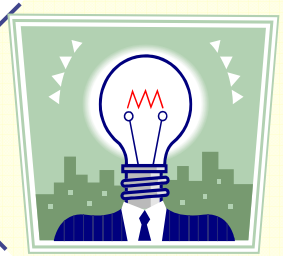
Key Elements for Birth and Survival of Small Businesses



Industry



Small

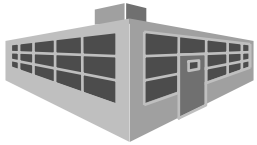


Investors

Government

Business

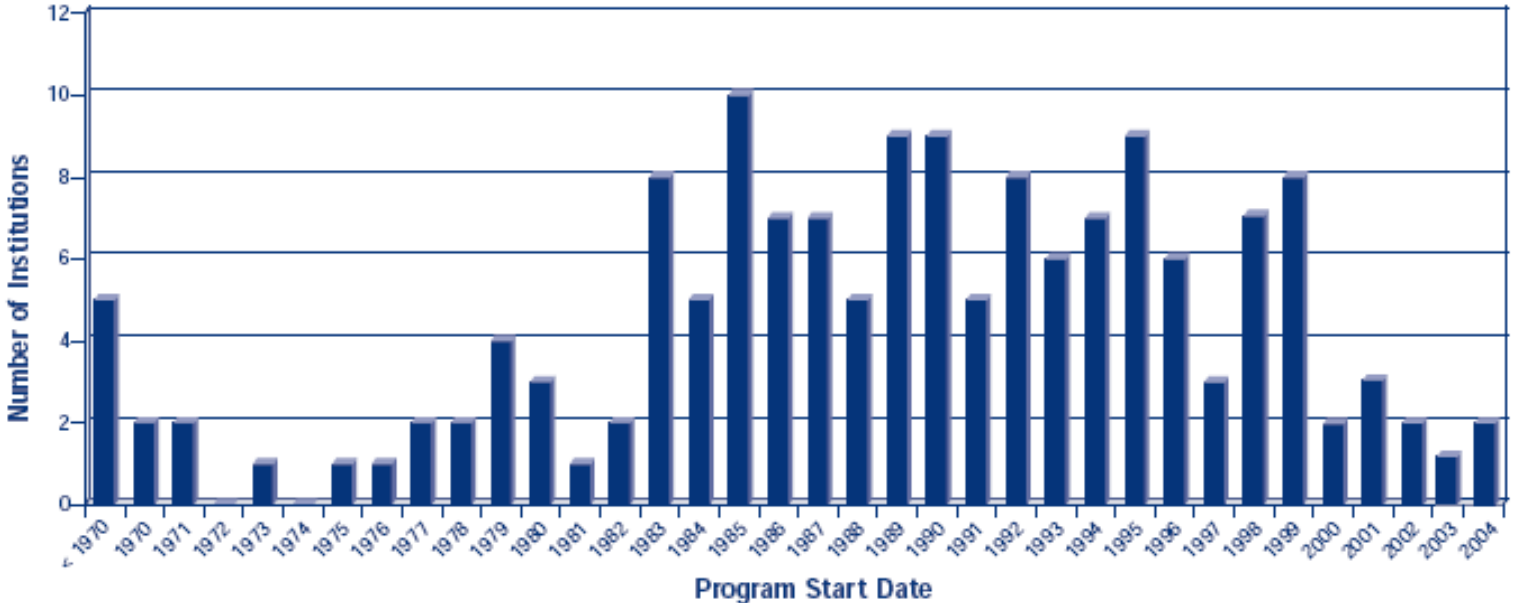
Federal Labs



Universities

Academia

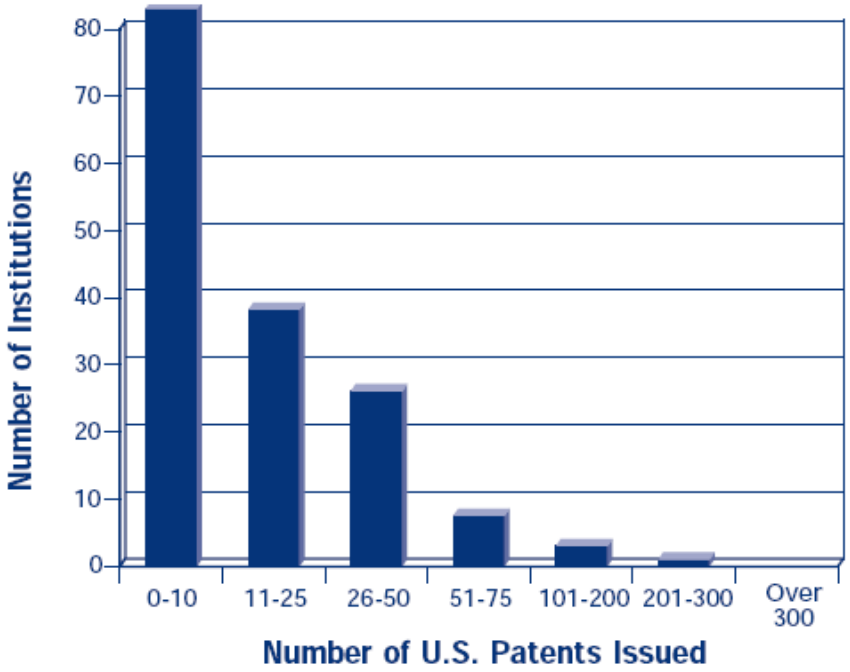
Technology Transfer Program Start Date of U.S. Universities

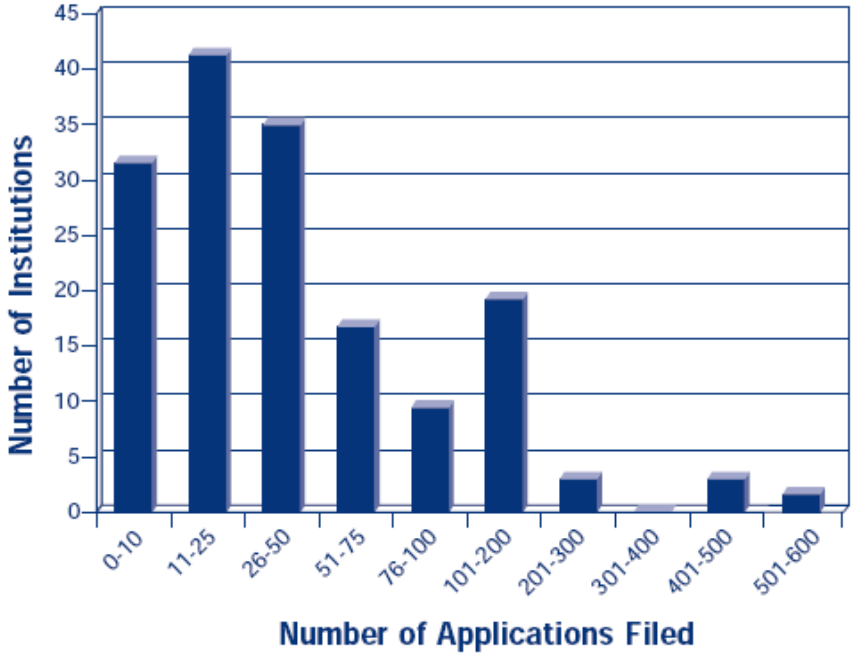


	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Licensing FTEs	237.1	304.1	299	310.6	N.A.*	415.4	452.6	494.2	552.5	627.7	733.7	793.7	832.9
Other FTEs	176.4	211.6	211.9	202.8	N.A.*	461.6	476.0	538.7	575.5	630.8	717.8	759.5	817.0
Total FTEs	413.5	515.7	510.9	513.4	N.A.*	877.0	928.6	1,032.8	1,128.0	1,258.5	1,451.4	1,553.3	1,649.9

** The FTE question asked in the FY 96 Licensing Survey was not consistent with the question asked in subsequent years. For FY 92-95, two questions were asked, one of which was consistent with the 1997 and subsequent questions.*

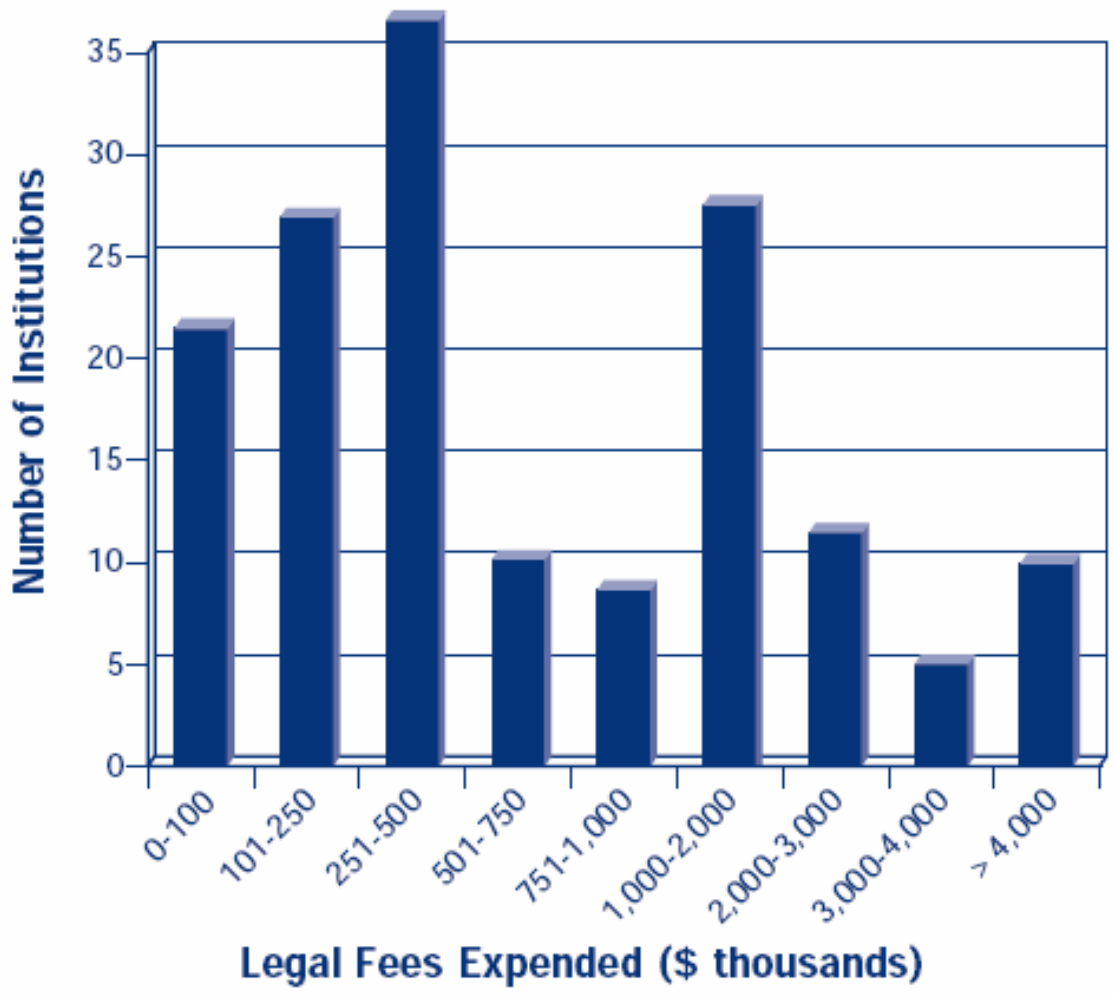
New U.S. Patent Applications Filed/Issued U.S. Universities, 2004



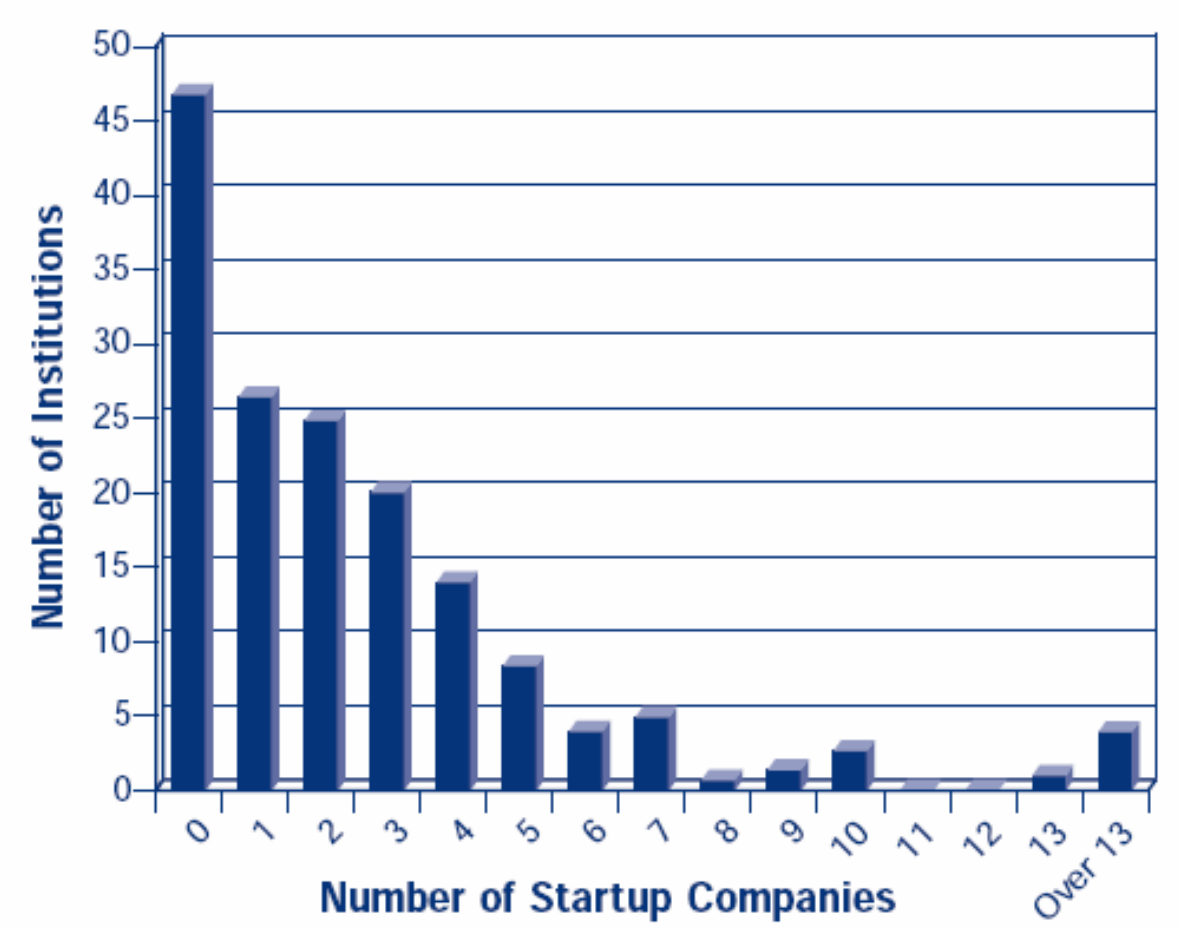


AUTM Survey 2006

Legal Fees Expended by U.S. Universities, 2004



Startup Companies Formed by U.S. Universities, 2004



Sources of Funding for New Startups Formed U.S. 2004

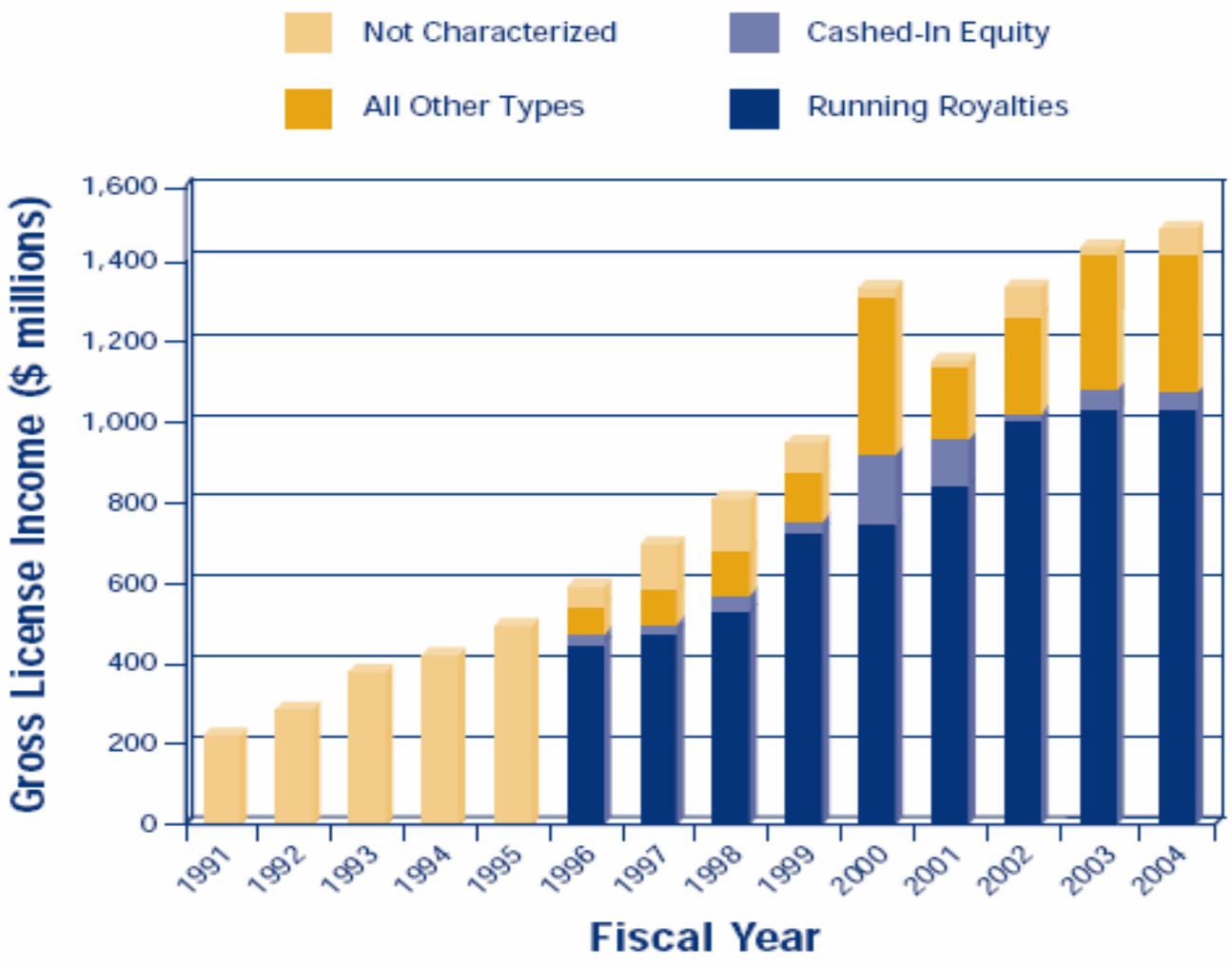
Individuals	Number	%
Friends and Family	94	20.5%
No External Funding	57	12.4%
Individual Angel(s)	49	10.7%
Angel Network	26	5.7%
Institutional Sources		
Venture Capital	85	18.6%
State Funding	36	7.9%
SBIR/STTR	32	7.0%
Corporate Partner	25	5.5%
Institutional Funding	26	5.7%
Other	28	6.1%
Total	**458**	**100.1%***
Number of U.S. Respondents	155	

* *Because of rounding, total does not equal 100%.*

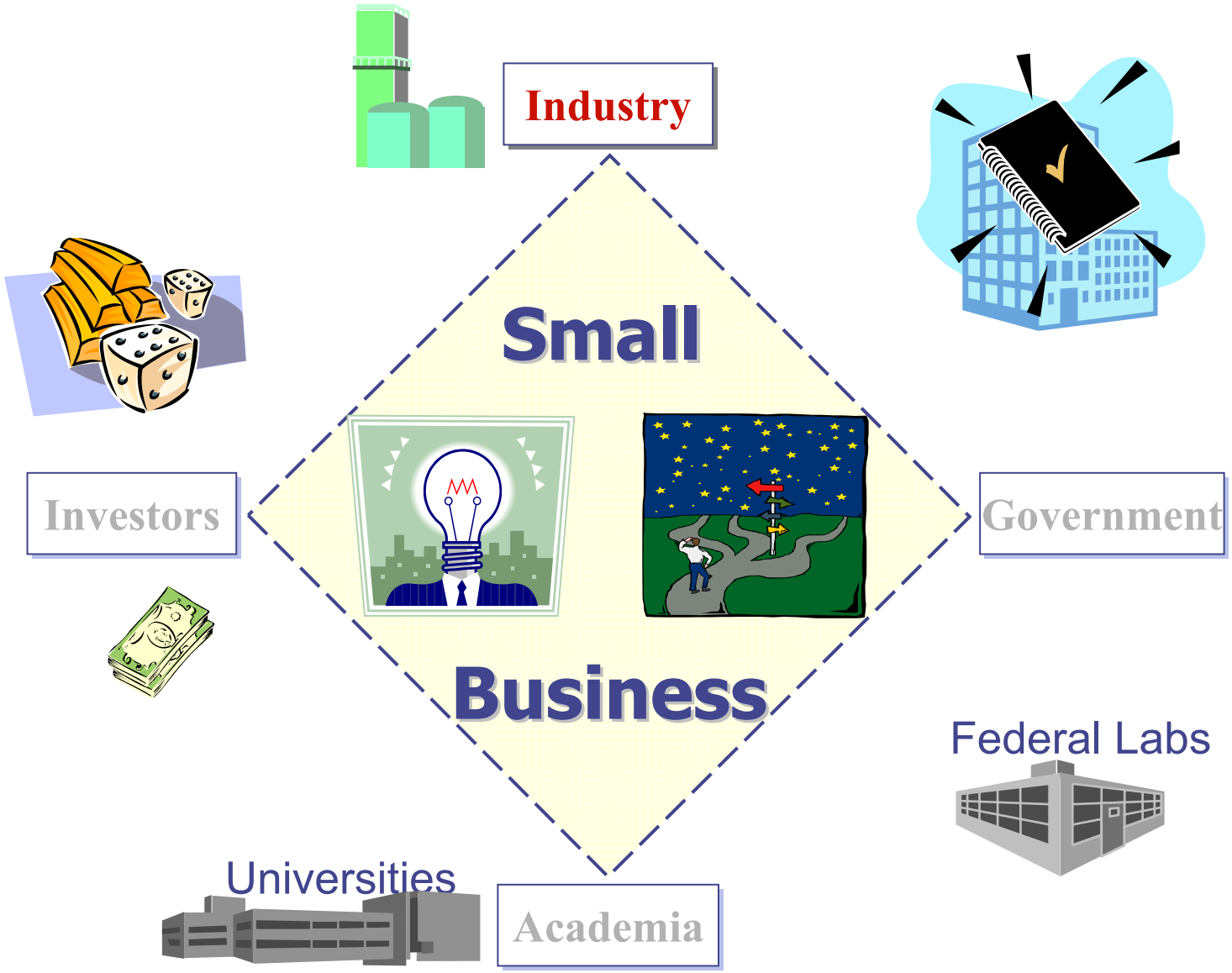
Startups Formed by U.S., 1980–2004

	FY 1980 to 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 1980 to 2003
Number of U.S. Institutions Responding	136	145	157	156	155	157	168	167	167	183	190	191	
Number of U.S. Institutions Reporting One or More	128	75	84	77	86	98	98	116	116	118	120	128	
Startup Companies Formed	1,013	212	192	202	275	306	294	424	426	401	374	462	4,543

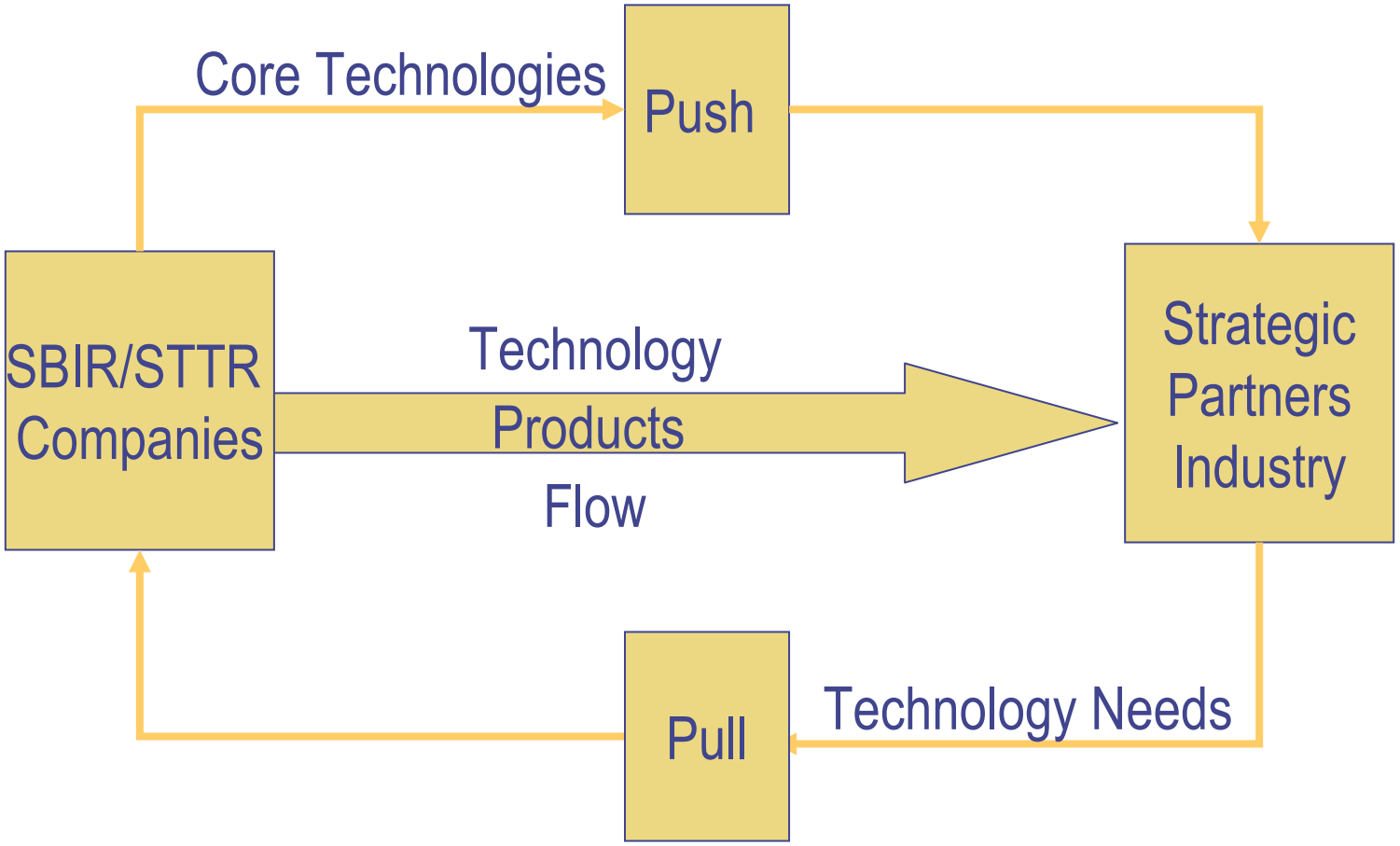
Gross Income Received by Income Type



Key Elements for Birth and Survival of Small Businesses



MatchMaker Process



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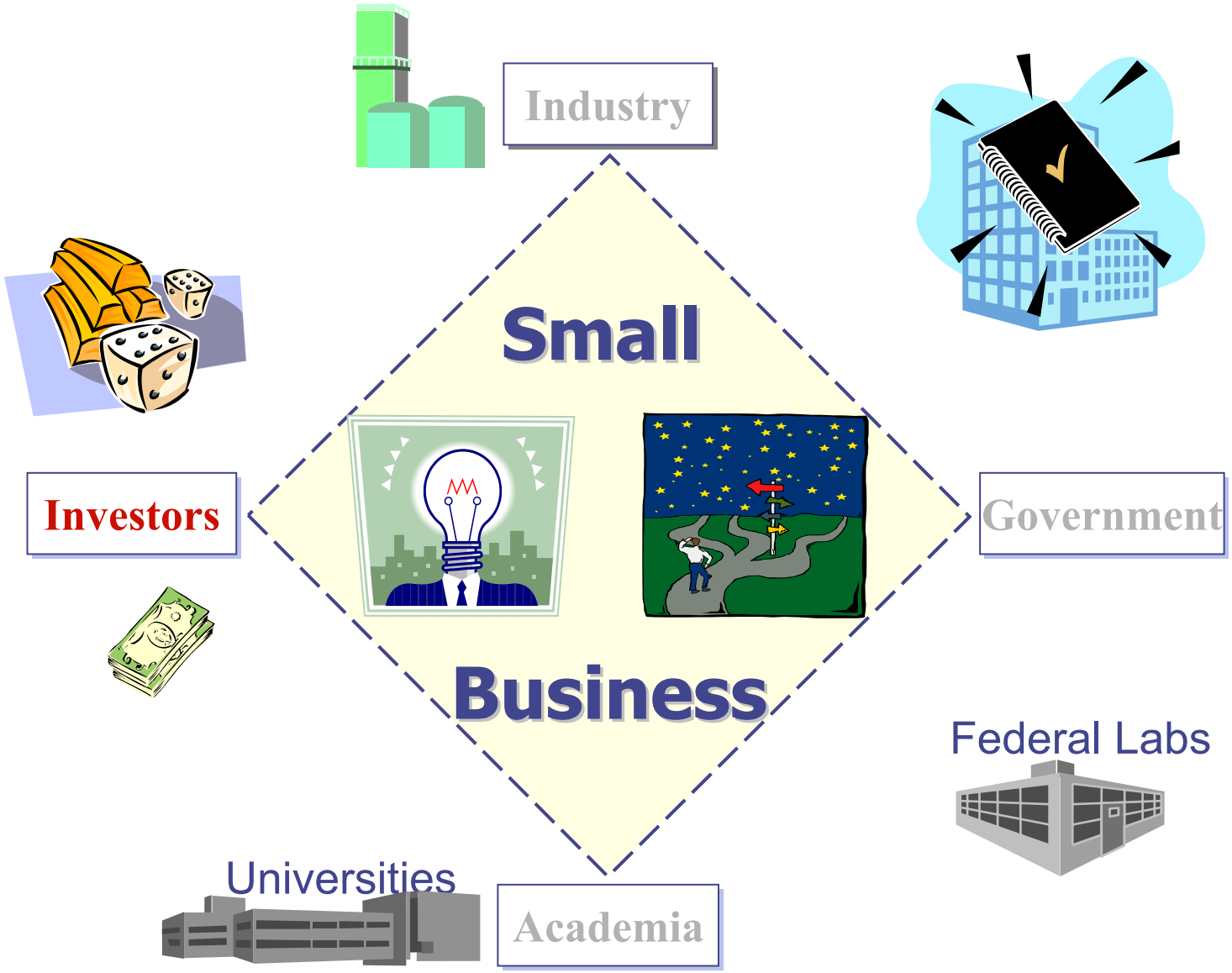

Venture Capital Industry

- A vibrant venture capital industry requires more than simply establishing the right structure for investments.
- The country needs
  - investors willing to fund the deals
  - plausible exit strategies for those investors
  - quality investment opportunities
  - deal flow, from a large cadre of risk-taking entrepreneurs.

Steps to Develop Investors Friendly Environments

- An appropriate legal and regulatory framework for local investment vehicles
- An appropriate legal and regulatory framework for foreign investment vehicles
- Appropriate corporate governance of portfolio companies
- Tax incentive for risk capital investments.
- Mechanisms for exiting investments
- Involvement of institutional investors
  - Encourage venture investments by pension funds
    - USA and Chile have
    - IN USA these funds are the most important source venture funds, ~50% of all such funding over the past 20 years
- Expansion of public sector programs to catalyze investments

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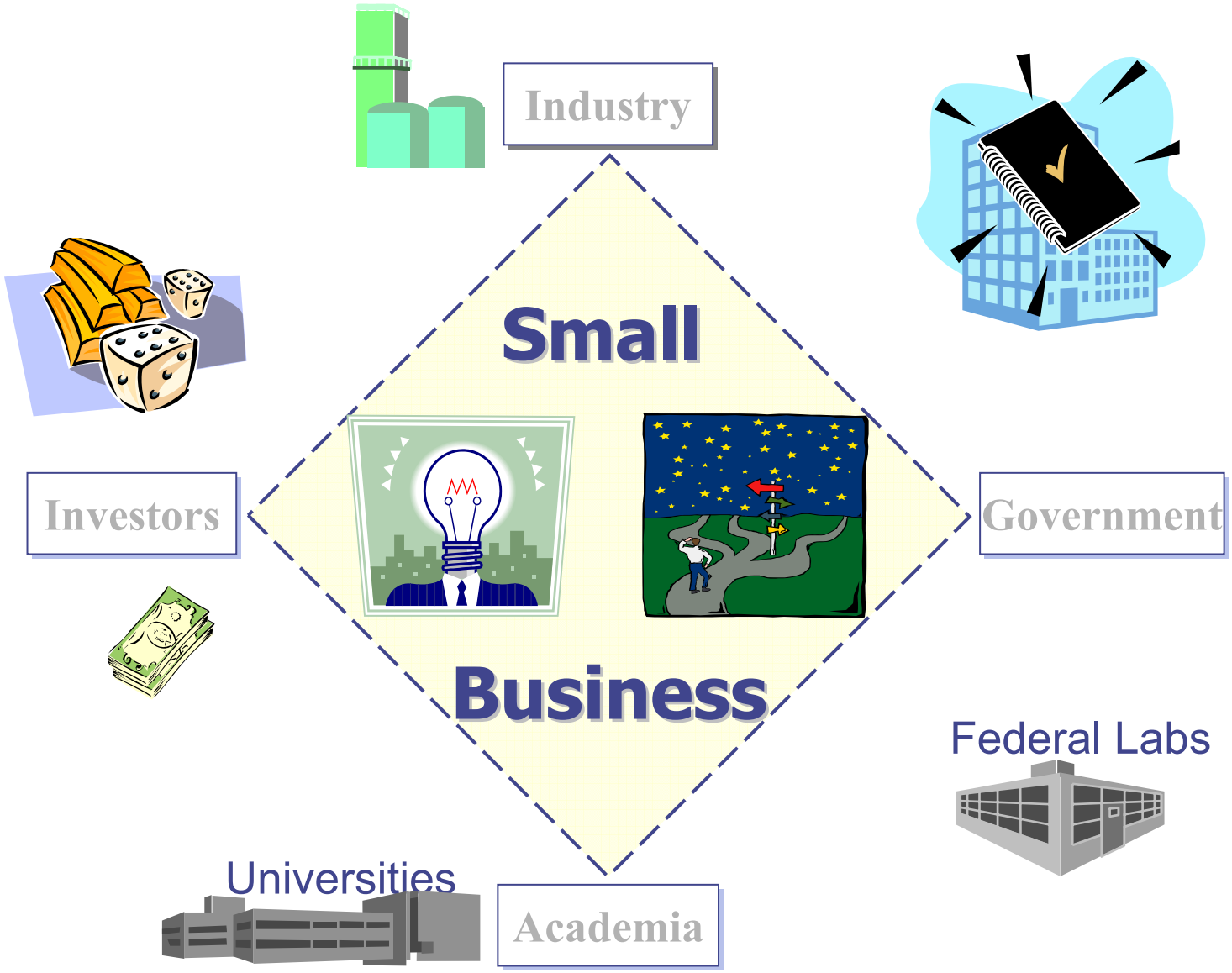

Essential Elements for Establishing Innovative Small Businesses

1. World-Class Research Institutions
2. Appropriate R&D Facilities
3. Effective Tech Transfer
4. Entrepreneurial Culture Supporting Innovation
5. Access to Capital
6. Experienced Entrepreneurial Talent
7. Knowledgeable Service Providers
8. Engaged Public Sector
9. Educated Workforce
10. Quality of Life Attractive to Creative Class

Research Institutions

Societal

Policy

Suggested Government Small Business Investment Guidelines

1. Attractive funding level available
2. No repayment required
3. High risk- High reward projects
4. Provide support tools
   - Incubators
   - Training
   - Financial benefits to investors
5. Potential leveraging tool to attract venture capital/other sources of $$$
6. Foster partnerships (e.g., large and medium corporations, academia, investors, Engineering Research Centers)
7. Create jobs and generates tax revenues
8. Intellectual property rights retained by the small business

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Summary and Recommendations

- All areas identified as needed for small business success are equally important
  - Do not neglect any
- Ecosystem development is a national activity but
  - International partnerships and agreements are necessary
  - Aim for global markets

Summary and Recommendations : Continue

- Each ecosystem is different and should respond to local economical and social realities
  - Affect realities when needed
- Natural selection process already being carried out in other places
  - Learn from them
- Strategy, implementation and results take time
  - No shortcuts
  - No substitutes
  - No magical solutions

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www.nsf.gov/eng/sbir