Innovation Finance:
The Nexus of Public and Private Financing

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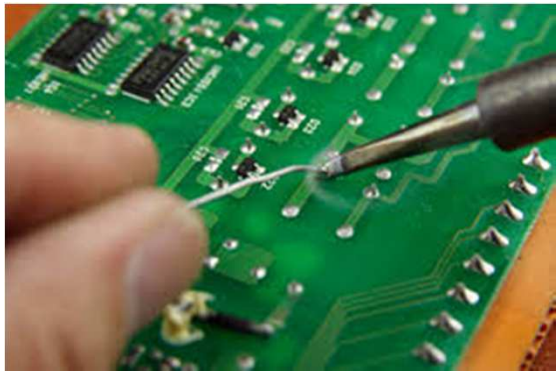
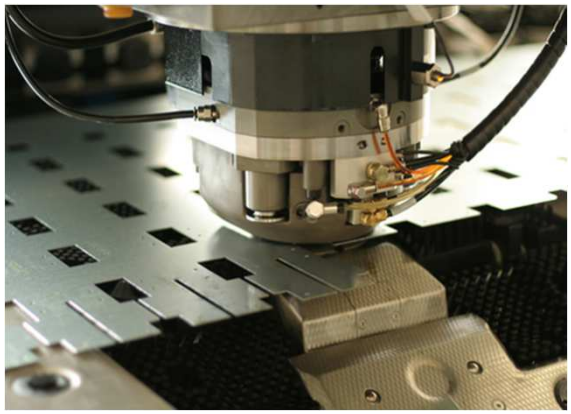
Innovation Finance

- Innovation Process defined
- Public and Private Financing of Innovation
- Trends affecting financing





The Innovation Process

- Innovation has many different definitions
- ***Incremental*** (evolutionary)

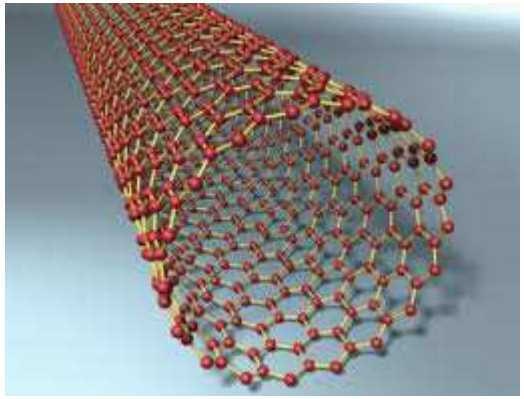
  versus
- ***Disruptive*** (revolutionary, transformative)
- ***Garage-Based*** (low resources)

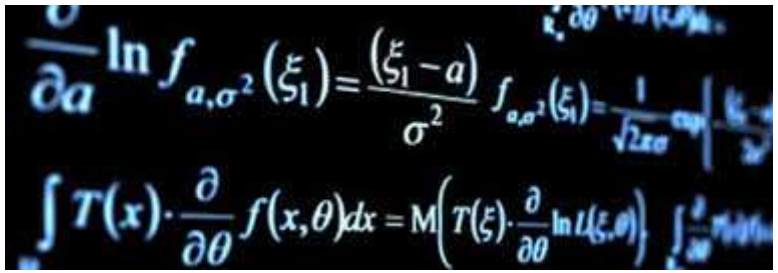
  versus
- ***Big Science*** (capital-intensive, high resources)
- Different resources and processes for these types
- Different risks
- Need to define what you are talking about
- Often innovation involves commercialization

The Innovation Process

- Scientific innovation process can be broken down into four stages: discovery/research, development, demonstration, and deployment

1. ***Discovery/Research*** – curiosity-driven, scientific discovery, for knowledge and understanding itself





The Innovation Process

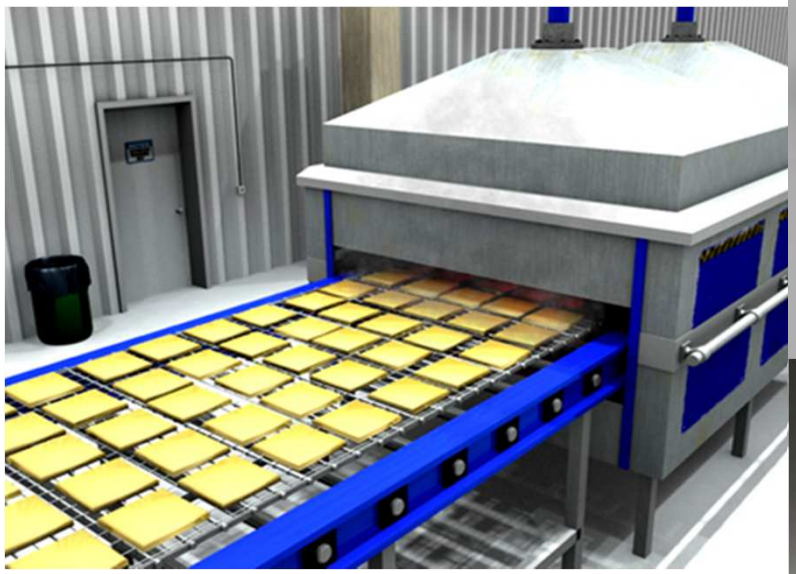
2. ***Development*** - continued advancement of knowledge and the application of research. Thus, development is the translation of scientific research into some tangible form.

The Innovation Process

3. ***Demonstration*** - bridges scientific discovery and viable commercial application. The demonstration phase can include engineering, testing, building prototypes, experimentation, validation, proof-of-concept, and small-scale operations. The purpose of these activities is to refine and improve inventions and knowledge so that they will be suitable for wide-scale utilization.

The Innovation Process

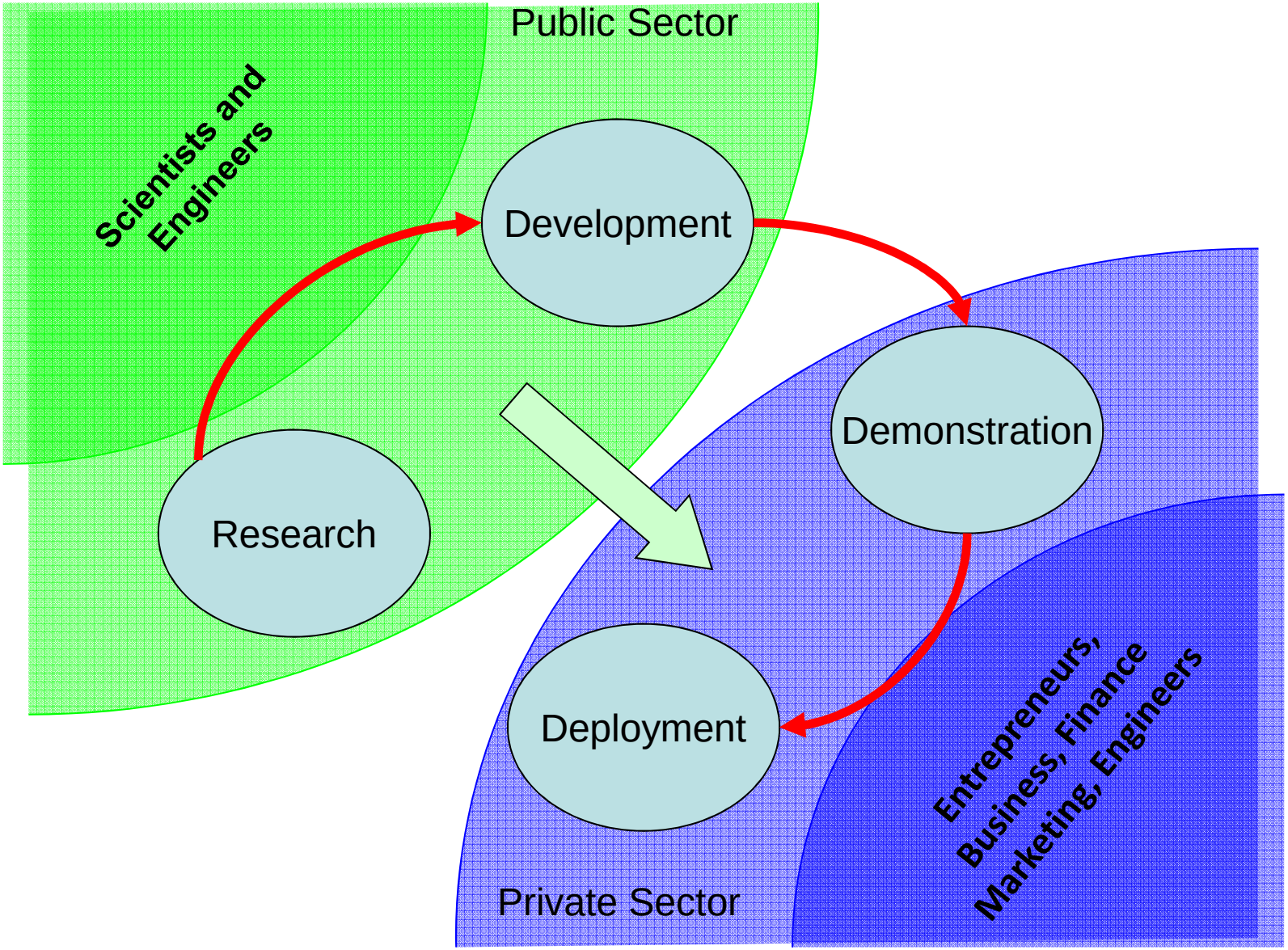
4. ***Deployment*** - roll-out, diffusion, and utilization of technology in some application where economic returns can be realized, such as commercial products and services.

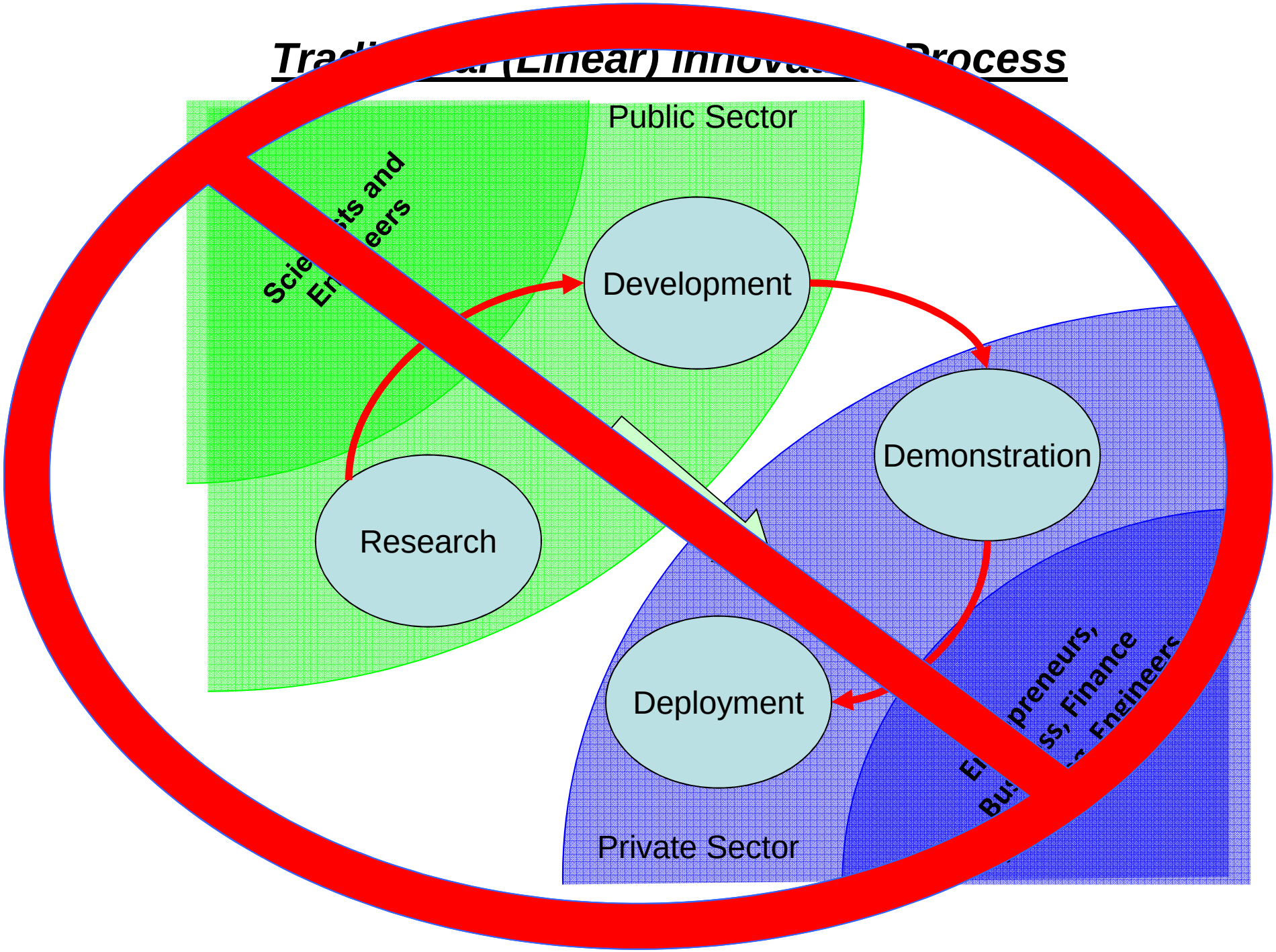


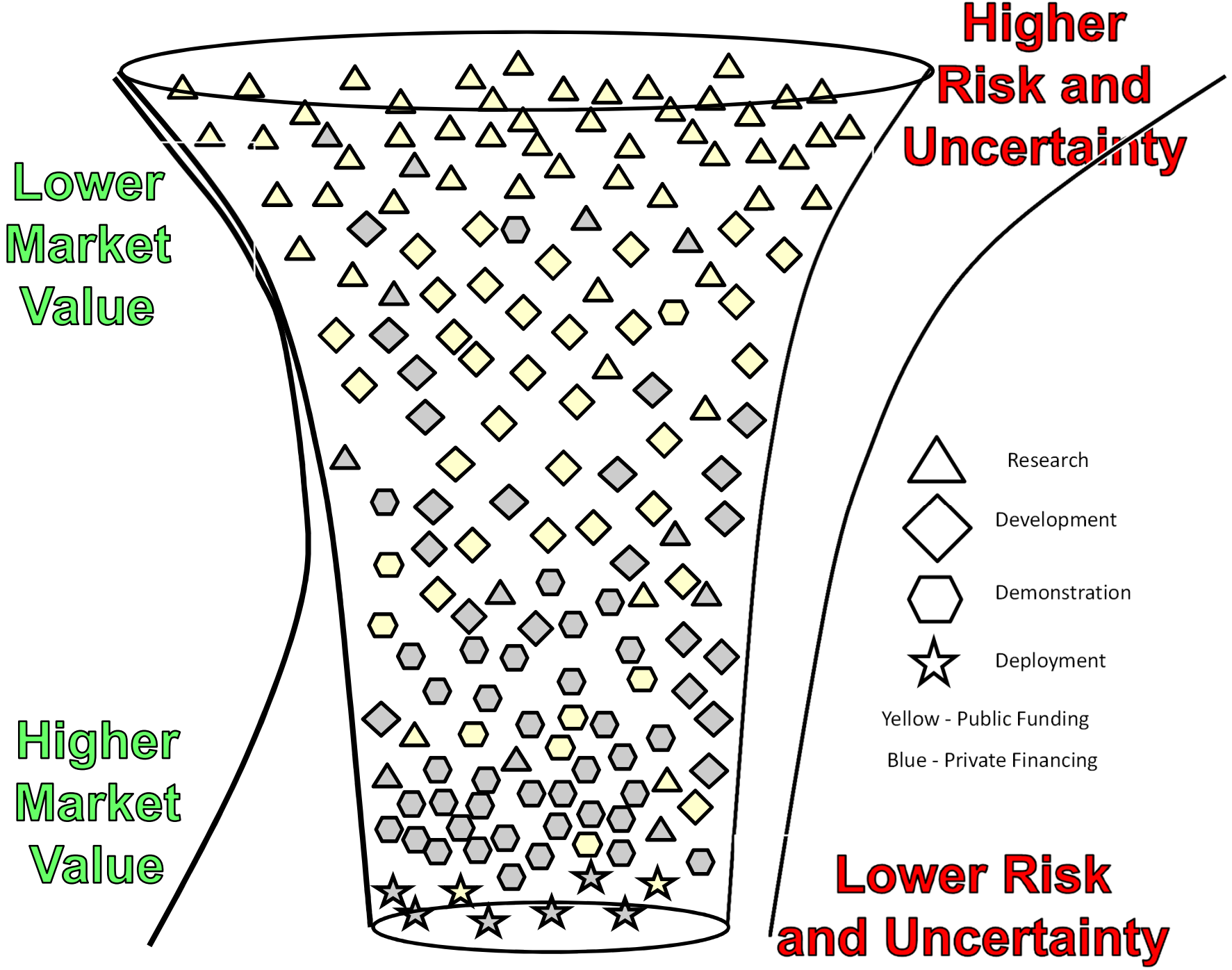
The Innovation Process

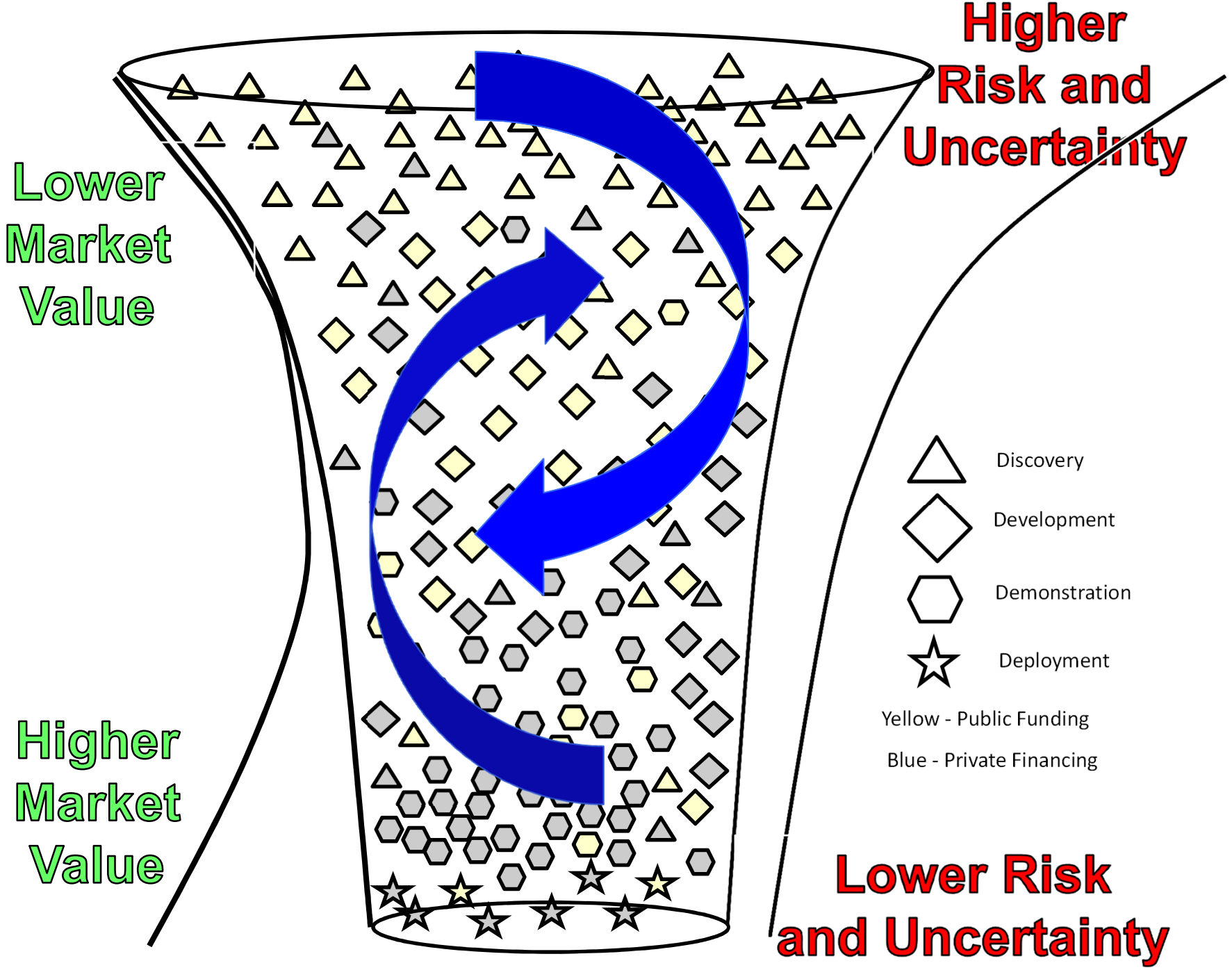
- Traditionally viewed as linear process, though much debate about this.
- Most S&T policy scholars recognize not linear (work on collaboration, networks, and technology transfer)
- Public sector focused on R&D
- Private sector focused on demonstration and deployment
- Lack of integration

Traditional (Linear) Innovation Process




Public Sector
Development
Demonstration
Research
Deployment
Private Sector


Higher
Risk and
Uncertainty
Lower
Market
Value
Higher
Market
Value
Research
Development
Demonstration
Deployment
Yellow - Public Funding
Blue - Private Financing
Lower Risk
and Uncertainty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Yellow - Public Funding
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Public Funding

- Public investment in innovation is traditionally justified as being most needed in the earlier phases of innovation for two reasons:
  1. Firms cannot get all returns for their investments
  2. Cost of capital difficult to determine (difficult to assess risks)
- Public funding provides for the production of a public good (in this case, the production of knowledge of an emerging technology) and mitigates risks associated with putting knowledge to commercial use.

Private Finance

- Private financing tends to focus on young, entrepreneurial firms, and includes internal resource decisions, venture capitalists, angel investors, private equity, capital markets, and bank loans.
- Private financing of innovation traditionally does not come until R&D has advanced sufficiently to provide private investors a reasonable assurance of their realizing a financial return.
- Thus, private financing concentrates on lower risk phases of deployment (with some demonstration allowed).

Complementary Financing

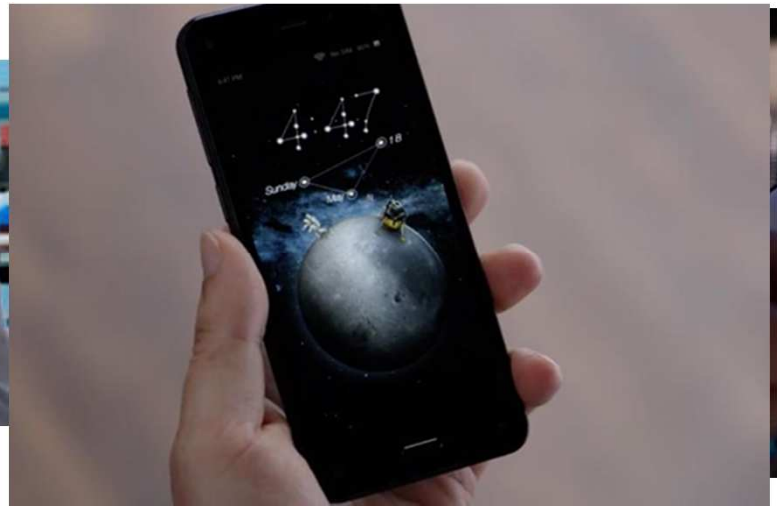
- Despite an enduring tension and interaction between these two funding sources, both types are essential. They are complementary, rather than competitive.
- Despite their essential role in supporting innovation, government cannot take over the function of private financing.
- Private financiers undertake the risk of commercial failure and they rightfully expect to be compensated for bearing this risk.
- Without private financing, entrepreneurs would have little ability to obtain the resources that they need to survive and advance.

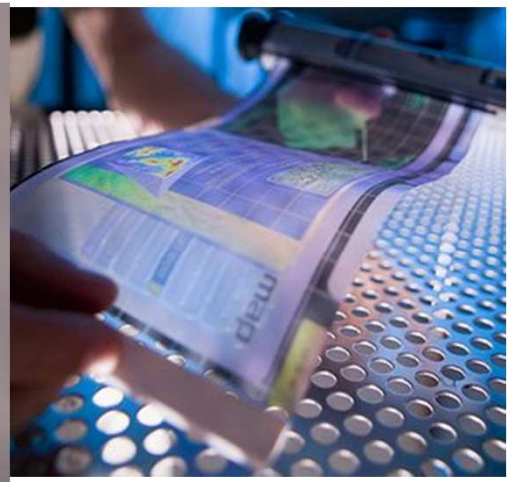
Public and Private Mechanisms for Funding the Innovation Process

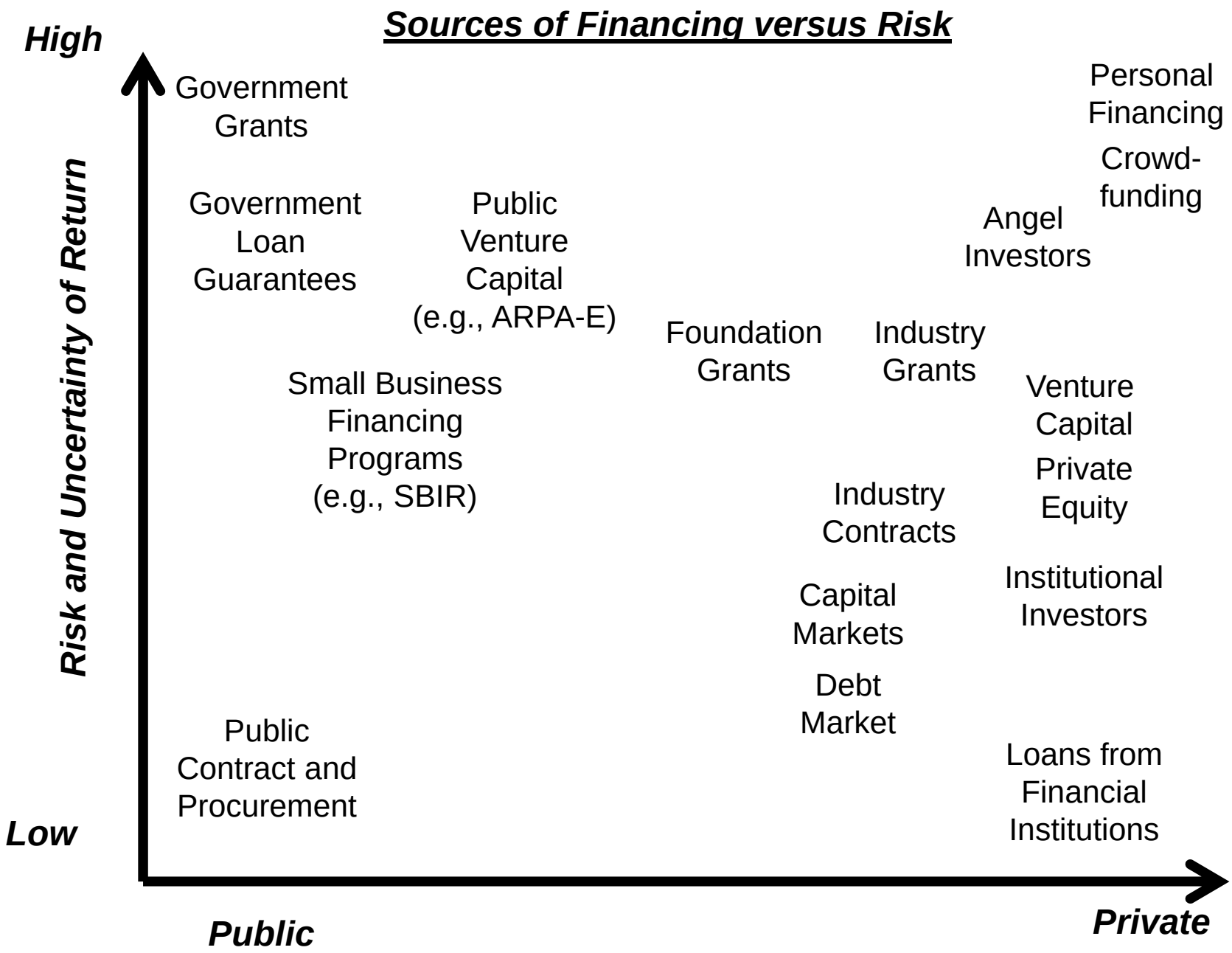
Phase of Innovation	Public Funding	Private Funding
Discovery/Research	Grants, Contracts, Loans Tax Credits Tax Expenditures	Corporate Private Foundations Personal Financing
Development	Grants, Contracts, Loans Tax Credits Tax Expenditures Innovation Investment Funds	Corporate Private Foundations Angel Investors Venture Capitalists Personal Financing
Demonstration	Grants, Contracts, Loans Tax Credits Tax Expenditures Innovation Investment Funds	Corporate Private Equity Angel Investors Venture Capitalists Private Loans and Credit Personal Financing
Deployment	Grants, Contracts, Loans Tax Credits Tax Expenditures	Corporate Private Equity Venture Capitalists Private Loans and Credit Entrepreneurial Finance Personal Financing

Innovation Finance

- Not all private finance is equal.
- Personal financing, private financial institutions (loans/debt), industry grants, institutional investors, venture capitalists, private equity, and angel investors each have a role to play in financing innovation.
- Different risk and reward expectations – value?






Sources of Financing versus Risk
High
Risk and Uncertainty of Return
Low
Public
Private
Government Grants
Personal Financing
Crowd-funding
Government Loan Guarantees
Public Venture Capital (e.g., ARPA-E)
Angel Investors
Foundation Grants
Industry Grants
Small Business Financing Programs (e.g., SBIR)
Venture Capital
Private Equity
Industry Contracts
Institutional Investors
Capital Markets
Debt Market
Public Contract and Procurement
Loans from Financial Institutions

Risks and Rewards of Funding

- Private sector financing

  greater risk = greater potential reward
- 70% of venture capital investments fail to yield any return.
- Small minority yield spectacular returns
- Early stage investments (very high risk) should yield lower successful returns = 95% failure rate?
- Cannot expect straight-line between investment and outcomes (i.e., economic, product, impact)

Five Important Trends

1. Increased collaboration and interdisciplinary research
2. Financial mobility and innovation
3. Financialization
4. Government (downside) risk bearer
5. Fiscal austerity and public expenditure justification

Increased Collaboration

- location and control of financial resources has changed.
- financial resources in networks are not necessarily under the control of one organization and side-payments and resource trade-offs become much more important.
- Thus, fiscal collaboration is as important as human collaboration.
- However, budgetary processes may not recognize the importance of shared resources. Budget cuts have larger impacts in networks, but these fiscal relationships are insufficiently understood.

Financial Mobility and Globalization

- Finance is no longer relationship-based. It is now transaction-based.
- Finance is now mobile; not constrained geographically or legally.
- fast

Financialization

- Shift to looking at financial wealth, rather than capital wealth.
- Private financial resources are now governed much more by the opportunities for short-term profit and avoiding financial losses.
- Therefore, private financiers are less willing to fund earlier stages of the innovation process because of the uncertainty of these activities and the difficulty in pricing them.

Government as Risk-Bearer

- Government has become responsible for economic stability, growth, jobs.
- Downside risk bearer
- With deregulation, companies less restrictions on speculation and risk-taking

Fiscal Stress and Accountability

- The need to justify public expenditures and increasing revenue pressures have pushed policymakers and university administrators to look for greater tangible benefits of R&D expenditures & look for other funding.
- In recent years, academic institutions have embraced greater participation in the commercialization of technologies, as state governments have reduced per student appropriations

Implications

- Private finance and companies looking for market-ready (or as close as possible) technologies (low risk)
- As private financing withdraws from financing innovation, public sector greater role in ensuring that research is carried through the development and demonstration phases to deployment.

Implications

- Innovation takes resources.
- Financing innovation has both public and private components
- Changes in financial systems affecting how innovation is being done