

The Economics of Innovation

Innovation & Creativity

Intellectual Property Rights, by law, stem from the creation of something ***intrinsically new***:

in·no·va·tion

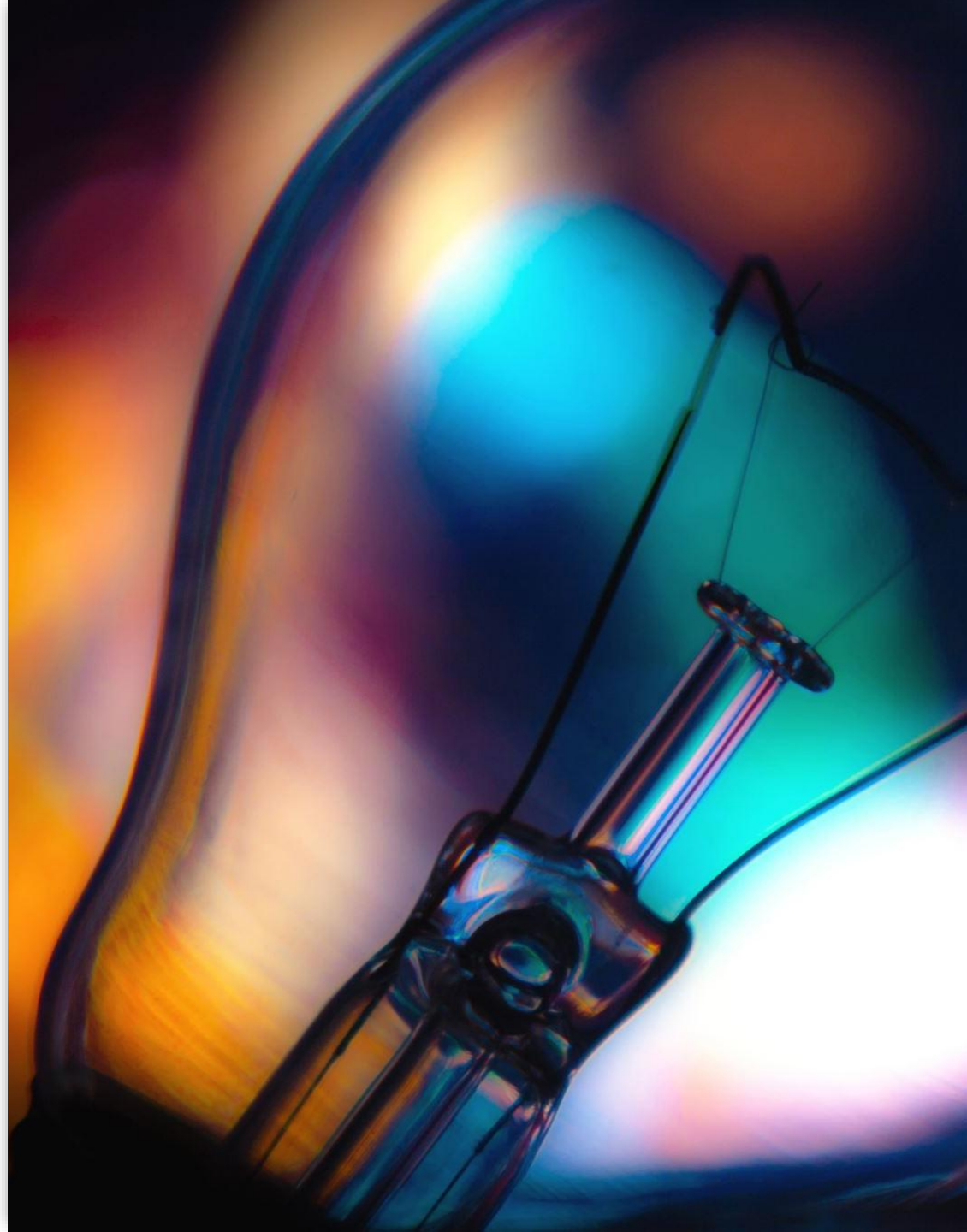
: a **new** idea, method, or device : **novelty**

: the introduction of something **new**

cre·a·tive

: having the quality of something **created rather than imitated** : **imaginative**

Source: Merriam-Webster Dictionary



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Economics of Innovation Topics

Continuum of Knowledge & Technology

Intangible Assets & Intellectual Property Rights

Ownership, Investment & Risk

The Business of Innovation

Innovation Lifecycle

Innovation Ecosystem

Research & Development

Start-ups

Innovation Financing

Technology Standards

Commercialization

Technology Transfer

A Continuum of Knowledge & Technology

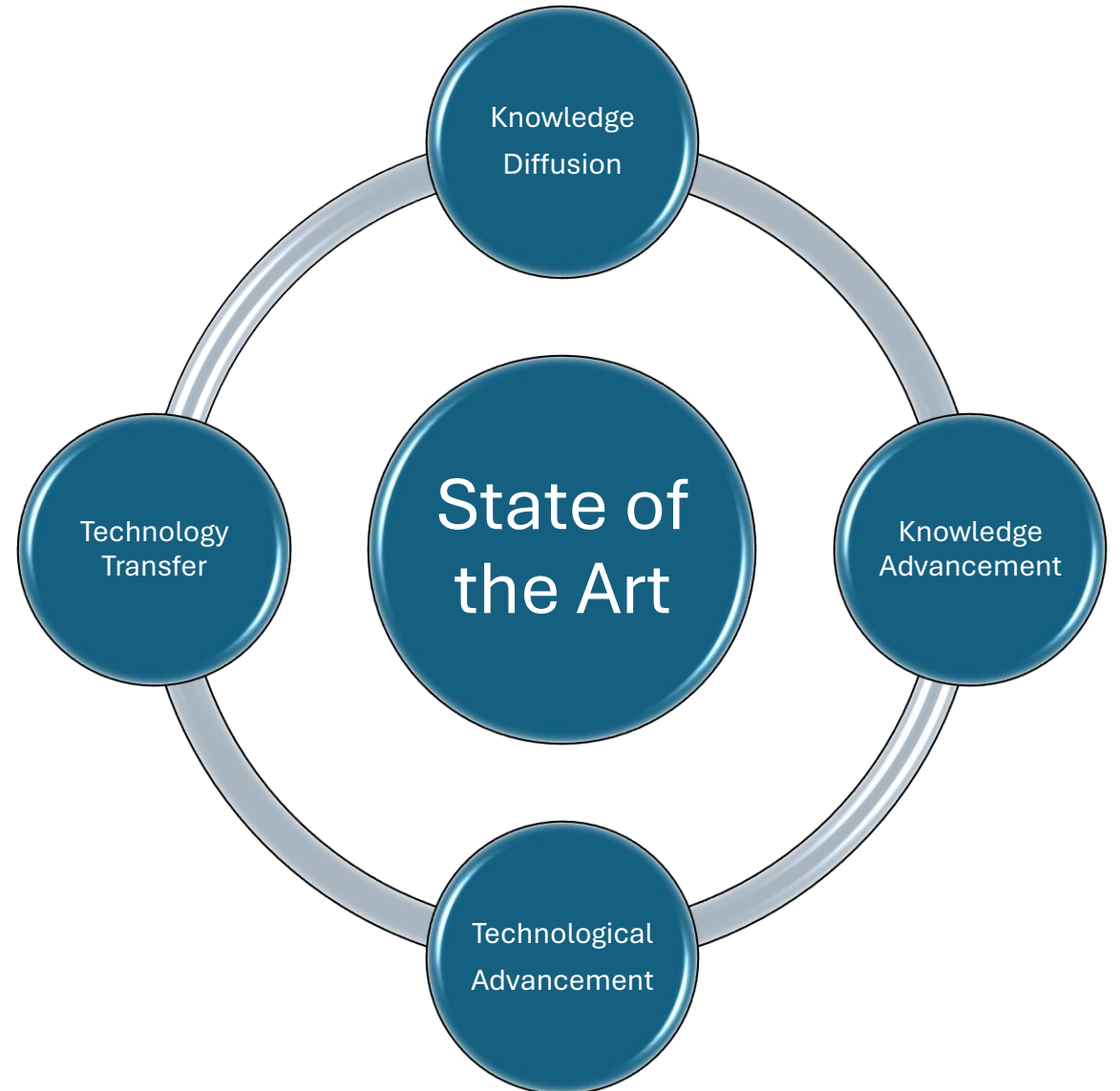
Knowledge Diffusion: education up to the limits of current human understanding.

Knowledge Advancement: research to expand the current limits of human understanding.

The State of the Art: the frontier of what humans have achieved in various fields of science and technology.

Technological Advancement: development of breakthroughs that advance the state of the art.

Technology Transfer: the teaching in whole or in part of a new technology and the know-how and skills necessary to adopt, utilize, and reproduce it.



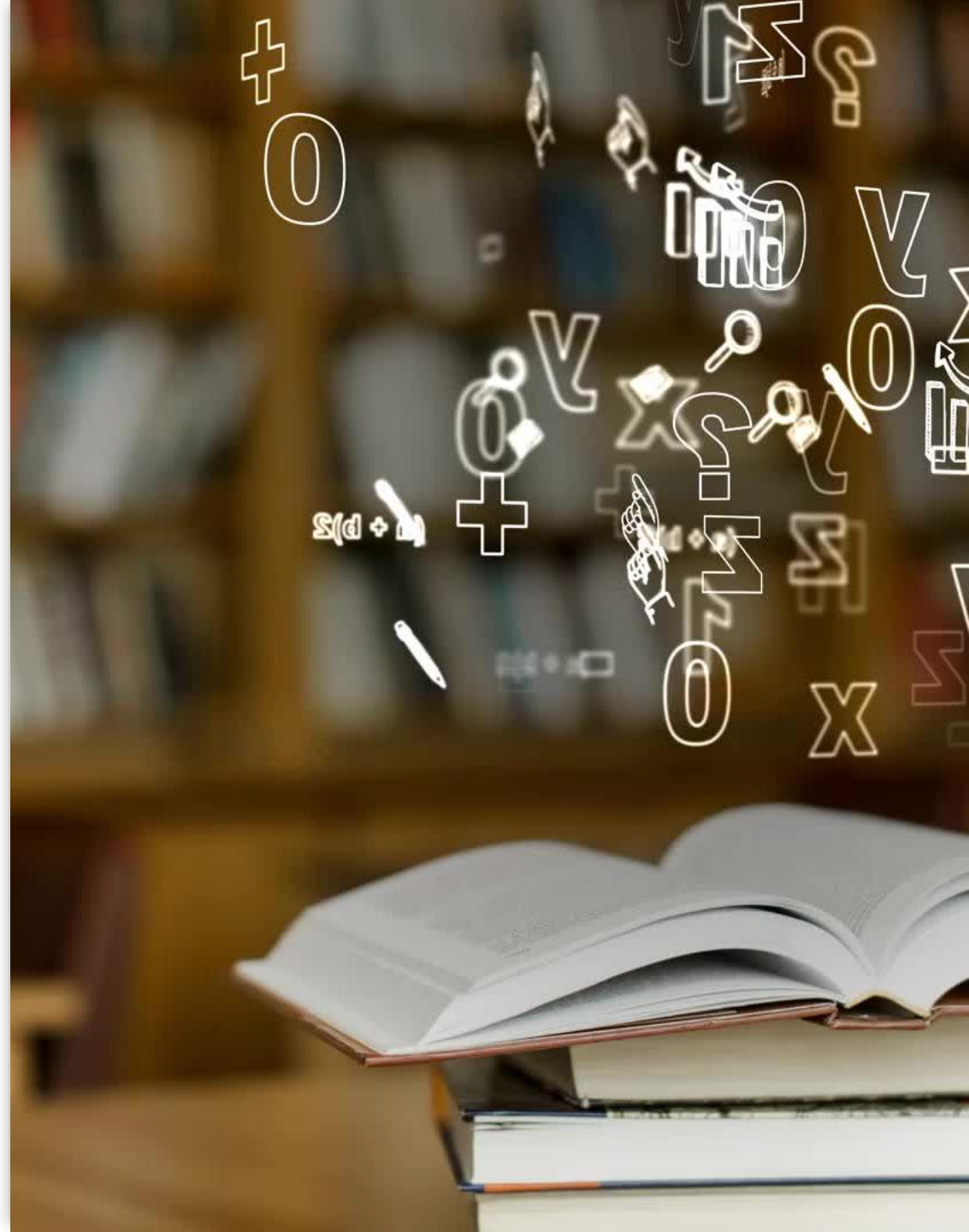
Knowledge Creation and Intangible Assets

Assets are resources that hold economic value.

Intangible assets are resources that lack any physical characteristics yet still hold value.

When investments in education and research result in **new knowledge or skills**, intangible assets are created.

A **college degree** is an example of an intangible asset. Other examples include such things as a trained workforce, individual or business reputation, and customer lists.





IP Rights


Under U.S. law, certain intangible assets - namely inventions and discoveries, creative works, identifying brands and logos, and trade secrets - are eligible for legal protection as **intellectual property (“IP”) rights**.

- Patents: Inventions and Discoveries
- Copyrights: Creative Works
- Trademarks: Brand Names, Marks, and Logos
- Trade Secrets: Proprietary Information and Knowledge

Risky Business: Innovation

- **Business Risk** – All entrepreneurs accept risks related to economic cycles, supply and demand, changing consumer tastes, and a myriad of other factors as a cost of doing business.
- **Technical Risk** – Innovators face an additional layer of risk from doing something intrinsically new, untested, and subject to high rates of failure.
- **Political Risk** – A third layer of risk is added when public policy measures reduce legal certainty, especially in an arbitrary or retrospective fashion.






IP Ownership, Investment, and Risk

- Intellectual Property Rights overcome risk aversion by protecting, *for limited times**, the property rights of inventors, creators, and brands to the innovative or creative **outputs of mental labors**.
- Ownership affords the possibility of **return on investment** in mental labors enabling inventors, artists, and the private sector to commit time and money that would otherwise be directed to **less risky** projects.
- When effectively protected by law, IP rights create a reliable basis for **investment** in innovation and creativity and **mobilization of capital** at a scale to realize breakthrough technologies and form creative industries.

*“***For limited times***”: Recognizing the public benefit from dissemination of knowledge, the U.S. Constitution authorizes Congress to enact laws that, unlike those protecting physical labor, afford inventors and authors exclusive rights to their mental labors for only a set period of time before those works enter the public domain.





“Non-Rival” Goods

- Intangible assets, including IP-protected works, are considered “non-rival” goods.
- The same physical or tangible product can be used by only one person in only one place at any given time (making it a “**rival**” good); however, the same intangible product may be used by many people in many places at the same time with equal usefulness to each, making it a **non-rival** good.
- Despite the non-rival nature of the **utility** of an intangible asset or IP right, the economic **value** of that product to its creator may be reduced – sometimes to zero – if it is made freely available.
- The U.S. Constitution deftly balances the benefit of non-rival utility against the economic imperative of rival-enabled value by making intellectual property rights available “**for limited times.**”

The Business of Innovation

Ownership of intellectual property rights enables investment in innovation and creativity and the assumption of attending risk through the possibility of return on investment. It also **facilitates transactions** in intangible assets.

The transfer of ownership or control among parties through the licensing, sale, and acquisition of IP rights:

1. allows ideas to **advance** through the **innovation lifecycle** from idea to product; and,
2. encourages **collaboration** among stakeholders with diverse specialties and skills to develop an **innovation ecosystem**.





Innovation is a Process

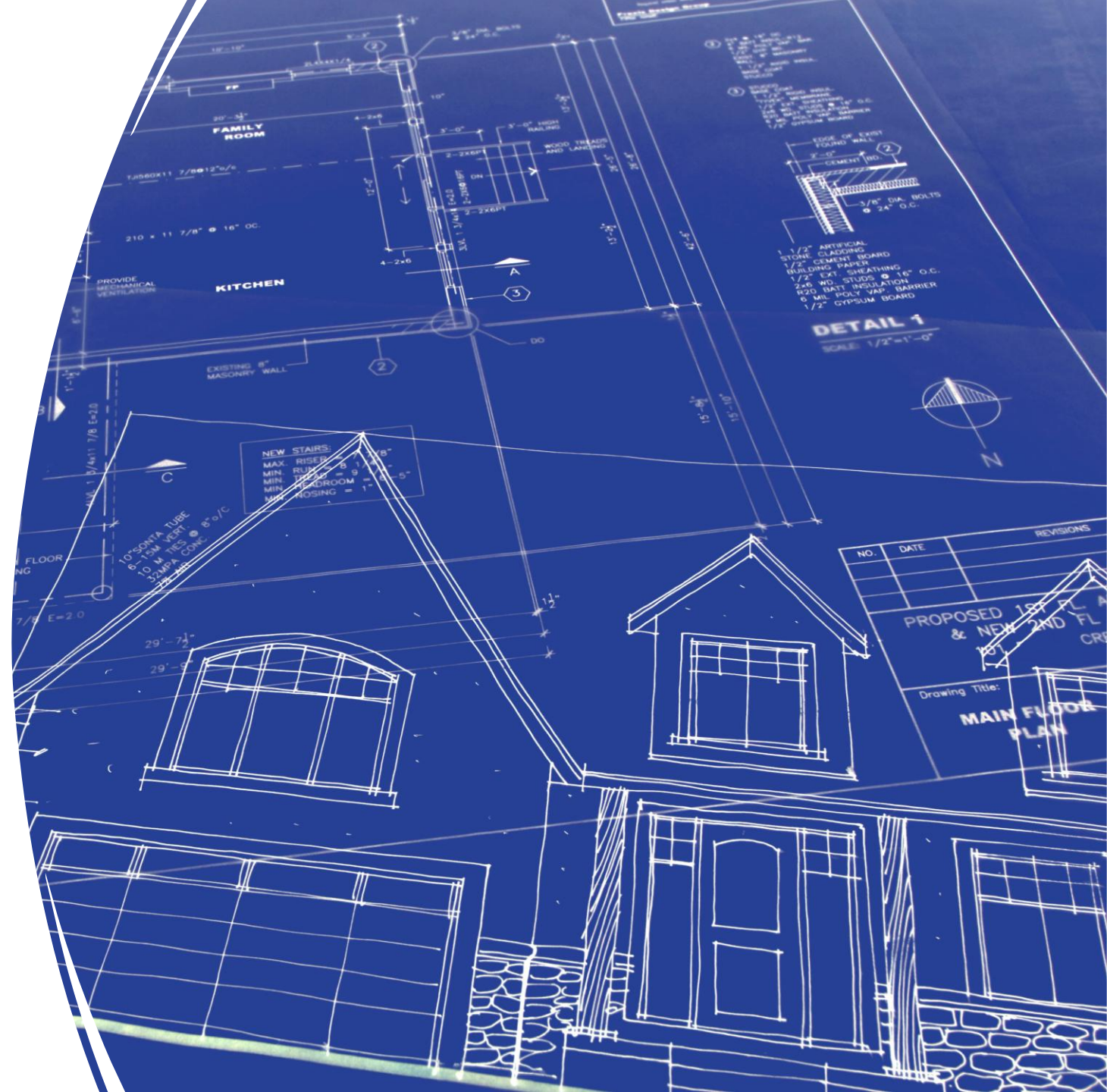
- The A-ha! moment is the essence of transformative innovation.
- However, innovation cannot be reduced to a single a-ha moment, however significant.
- Innovation should be thought of as an ongoing process connecting a series of large and small a-ha moments.
- These breakthrough realizations and discoveries may be made by one person or entity, or more often in consecutive fashion by stakeholders with various specializations.
- IP-enabled mobility of knowledge assets allows this process to advance smoothly through a lifecycle of innovation.

Building Innovation

Innovation is an ever-evolving blueprint:

- Innovation tends to incorporate numerous patented inventions or discoveries, which form the building blocks of the final product. For example, a 2012 study* found tens of thousands of inventions in 14 separate patent technology classifications in use by the smartphone industry.
- Improvements to existing inventions and discoveries have been eligible for patents since the very first U.S. patent law enacted in 1790, which covered among other things, “any new and useful improvement... not known or used before the application.”

*[The Impact of the Acquisition and Use of Patents on the Smartphone Industry](#), Center for Law and Information Policy Fordham Law School, commissioned by the World Intellectual Property Organization



Innovation Lifecycle

New innovative products, creative works, and breakthrough technologies follow a **path from mind to market**:

- Societal and individual **investments in education** and talent development cultivate skills and knowledge.
- Early-stage scientific **research** and creative **experimentation** identify potential breakthroughs.
- **Applied science** and creative work develop new products.
- Investment and innovation in **production at scale** (or “commercialization”) enables the widespread availability of a new product, service, or technology to end-users.

Lifecycle of Creativity

- Artistry is born of education, practice, and repetition
- Artists learn from and build upon the work of others
- They invest in their own talent and skill sets, putting at risk their time, energy, and money
- As they develop, the most successful artists create their own product, style and brand
- To earn a livelihood from their art, they must have control of the resulting creative work



Innovation Ecosystem

“[A]n effective innovation ecosystem [is] an **interconnected network** of governmental, industry and research institutions and enabling factors (such as human capital, technology transfer structures, and sophistication of businesses and market) [where] the parties bring their resources and expertise together to **collaboratively achieve innovation.**” – World Intellectual Property Organization

Innovation Ecosystem Stakeholders

Diverse sets of stakeholders contribute to the realization and **commercialization at scale** of new products, services, and technologies:

- Governments frequently serve as **funder and director** of education and early-stage scientific research.
- Universities provide a forum for open-ended **scientific inquiry**.
- Start-ups emerge to attempt **proof of concept** for untested potential breakthroughs.
- Venture capitalists and equity markets fund high-risk/reward projects.
- Businesses directly develop or **acquire** promising new technologies and **test** and **manufacture** at scale.
- Consumers and end-users are the ultimate arbiters of a new product or technology's **commercial success**.





Creative Ecosystem Stakeholders

A multitude of stakeholders come together to bring artistry together with audience:

- Teachers **educate** young artists, develop talent, and pass on skills.
- Artists invest in their talent and take **risks** to build a career in the arts.
- Collaborators lend encouragement and **creativity**.
- Professionals contribute technical **production** skills.
- Studios aggregate professional tools and bring **expertise** in the business of the arts.
- Audiences purchase artistic works bringing **commercial success**.

Research & Development (R&D)

Research and Development: Research and experimental development comprise creative and systematic work **undertaken to increase the stock of knowledge**—including knowledge of humankind, culture, and society—and to devise **new applications of available knowledge** (i.e., technology).

- Basic Research: Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.
- Applied Research: Original investigation undertaken to acquire new knowledge—directed primarily toward a specific, practical aim or objective.
- Development (or Experimental Development): Systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

Source: Congressional Research Service

Financing Innovation

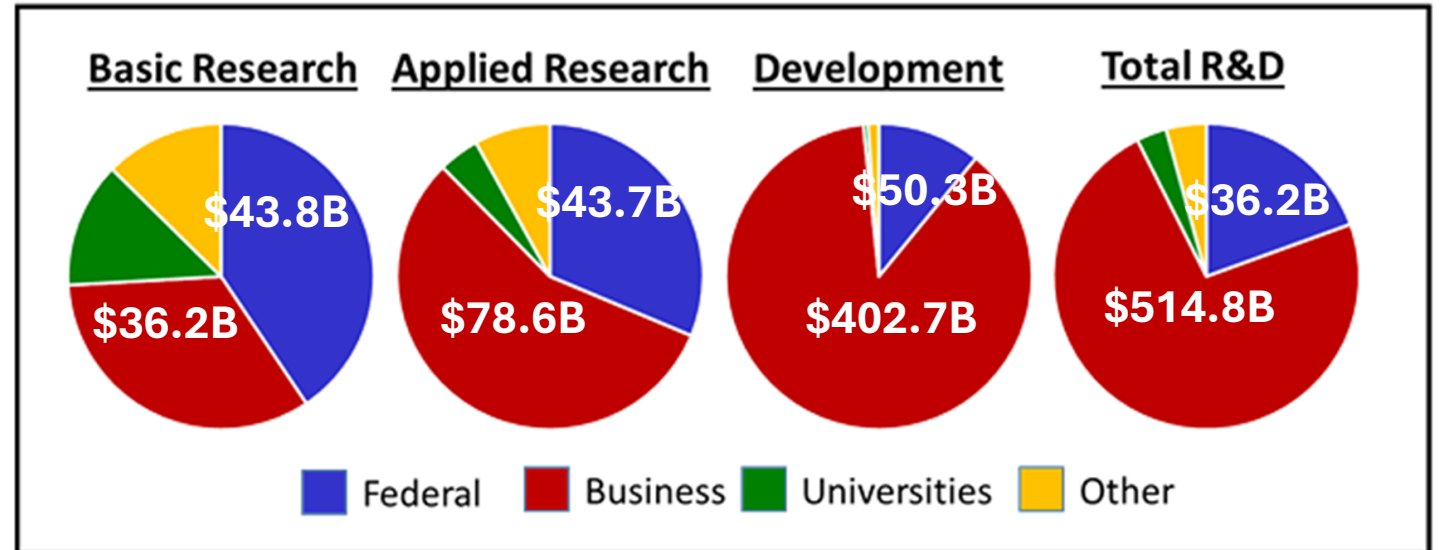
Resources for innovation come from numerous sources within the ecosystem:

- The federal government **funds** both national laboratories and research grants that are a critical source of early-stage scientific research.
- Universities **cultivate and host** a wide range of researchers, research facilities, and capabilities.
- Financial markets, including venture capital, angel investors, banks, and private and public equity **invest** into start-ups and larger businesses throughout the innovation lifecycle.
- Established innovative businesses **expend working capital for** internal development or acquisition of breakthrough technologies to test and produce at commercial scale.
- **Purchases** by end-users, including individual consumers, support the entire ecosystem.



Funding of Research & Development (R&D)

Figure 4. U.S. R&D Funding by Character and Sector, 2020



Source: CRS analysis of National Science Foundation, *National Patterns of R&D Resources: 2019–20 Data Update*, NSF 22-320, Tables 7-9, February 22, 2022.

Note: 2020 data are preliminary and may be revised.

Start-Ups and IP

1

Protection: “[F]or startups, the value of IP lies in... the protection it provides against imitation and the value it can provide in securing funding.” – *Business Review at Berkeley*

2

Financing: “[S]tartups that possess [IP] rights during their initial seed or early growth stages are up to 10.2 times more likely to successfully secure funding.” – *European Patent Office*

3

Collaboration: “[I]ntellectual property rights... are not only legal safeguards for investment in intangibles, but the key to securing financing and collaborations.” – *President, European Union Intellectual Property Office*

Innovation Realized

Translation: Putting the “D for development” into “R&D”, translation is the process of applying new knowledge to create a useful, new product, service, or technology.

Product Testing: Many industries are required to demonstrate that innovative products are safe and effective for their intended use prior to entering the market.

Standard-Setting – Some inventions serve as foundational technologies or critical components in a wide range of end-user products produced by third parties; standards development facilitates the functionality and interoperability of such products.

Commercialization: In order to be useable, a useful new product, service or technology must be capable of being reproduced economically at scale, a process of commercialization that often requires extensive additional innovation in the manufacturing or replication process.

Technology Standards

“The ability of the United States to sustain a position of **global technological leadership** is directly related to sustained strategic and tactical U.S. **engagement in standards** for **critical and emerging technologies** (CETs).”

- National Institute of Standards & Technology



Technology Transfer

- Closely related to knowledge transfer, technology transfer is a collaborative process that allows scientific findings, knowledge and intellectual property to flow from creators to public and private users.
- The sharing or transfer of legal rights through IP licensing or acquisition paves the way for technology transfer.
- While a new invention, discovery, or creative work enters the public domain upon expiration of time-limited intellectual property rights, additional technology transfer may be required for the widespread adoption of such know-how.
- Where facilitated by robust and reliable IP rights, technology transfer takes place organically and continually within the innovation ecosystem, supporting the life cycle of technology from inception to market diffusion and commercialization.

Source: World Intellectual Property Organization



IP and Technology Transfer

“The ability of university technology transfer to achieve its societal benefits depends on a strong patent system. Because the inventions emerging from university research tend to be early-stage, high-risk inventions, successful university technology transfer transactions require a patent system that protects such innovations. Without robust patent protections, licensees and venture capitalists will not take on the significant risk associated with investing in and developing such inventions..”

- Association of Public & Land Grant Universities, APLU

Primary Sources

- U.S. Research and Development Funding and Performance: Fact Sheet, Congressional Research Service, updated September 13, 2022, <https://crsreports.congress.gov/product/pdf/R/R44307/17>
- The Startup's Guide to Intellectual Property, Business Review at Berkeley, <https://businessreview.studentorg.berkeley.edu/the-startups-guide-to-intellectual-property/>
- U.S. Government National Standards Strategy for Critical & Emerging Technologies (USG NSSCET): IMPLEMENTATION ROADMAP, June 26, 2024 - https://www.whitehouse.gov/wp-content/uploads/2024/07/USG-NSSCET_Implementation_Rdmap_v7_23.pdf
- The relationship between Standards and Intellectual Property, 4iP Council, January 26, 2024, https://www.4ipcouncil.com/application/files/5817/0626/3355/Booklet_Standards_and_Intellectual_Property.pdf
- Intellectual Property and Technology Transfer, World Intellectual Property Organization, <https://www.wipo.int/web/technology-transfer>