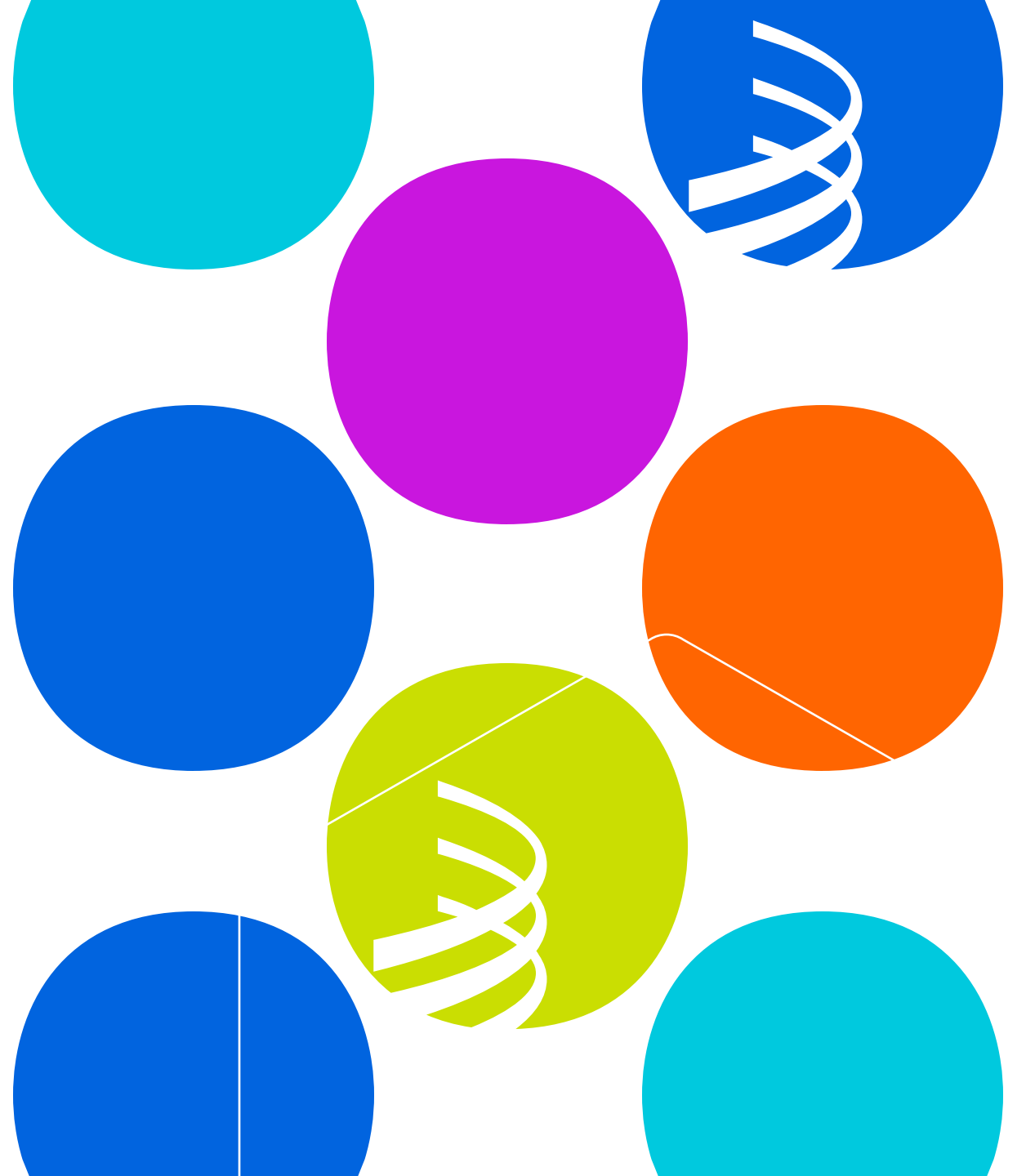


# WIPO

## Module 1: Intellectual Property in Innovation Ecosystems: characterization, key actors and metrics

Innovation Economy Section - WIPO

CDIP training - April 2026



# Agenda

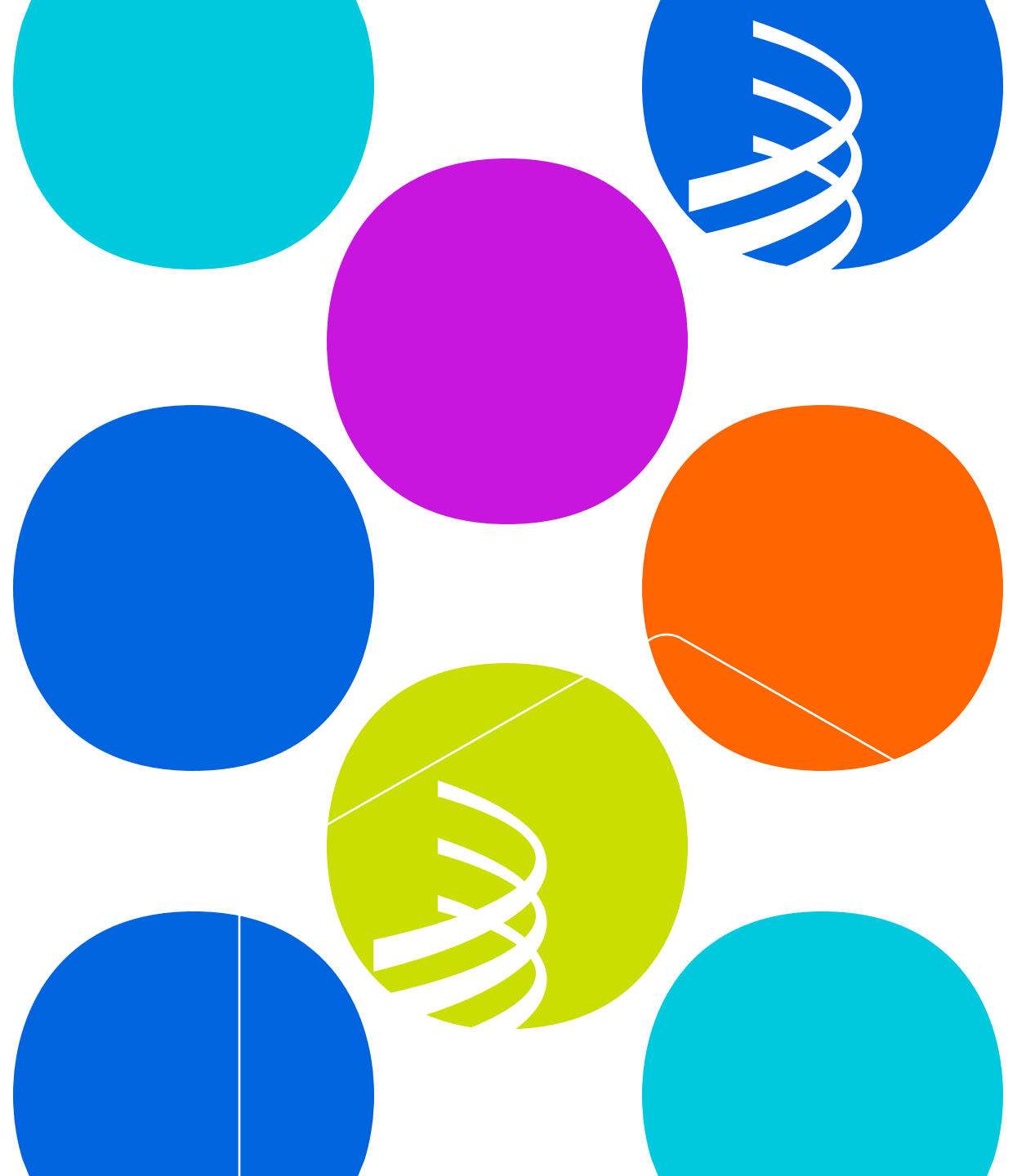
1. Understanding Intellectual Property Markets
2. Innovation Ecosystems Actors, networks, and knowledge flows
3. Subnational Innovation Ecosystems Regional and city-level innovation dynamics

# WIPO

## Understanding Intellectual Property Markets

Innovation Economy Section - WIPO

CDIP training – April 2026



# 1. What is intellectual property?

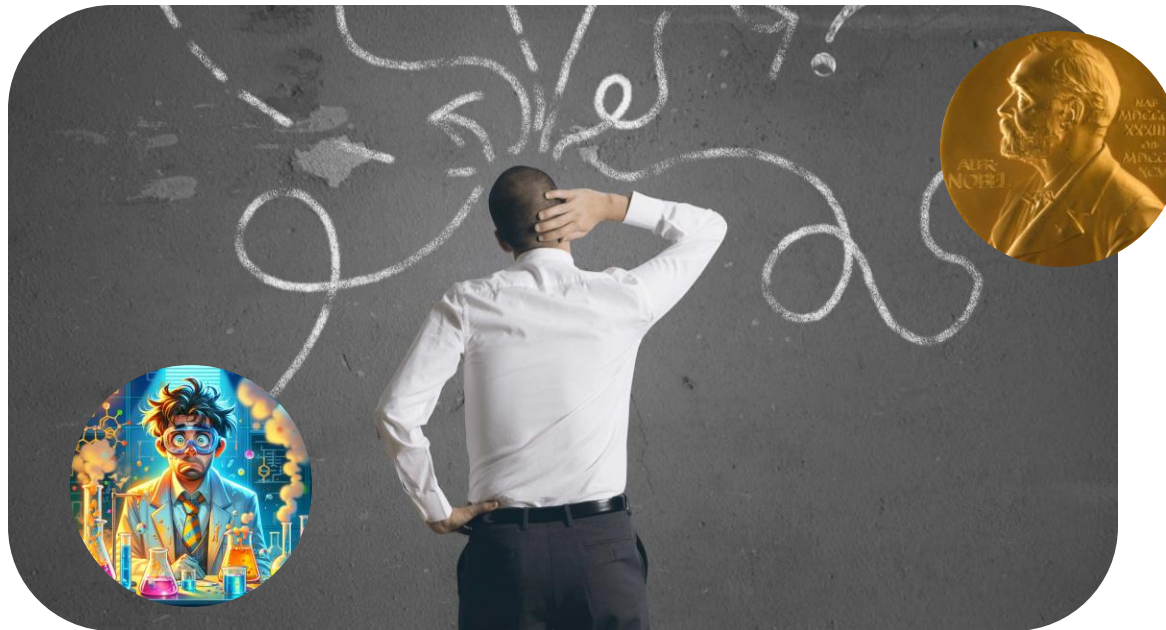
“

**Intellectual property (IP) refers to creations of the mind - everything from works of art to inventions, computer programs to trademarks and other commercial signs.**

”

...however, it has two main difficulties:

Problem solving involves **risk and uncertainty**



The resulting information has **public good** characteristics



Companies try to reduce this market failure, but it is usually not enough.

**Risk mitigation** through the grouping of inventive activities



Companies that own inventive efforts are the first to market and gain **reputation**.



# Consequently, markets will not invest enough in inventive activities in terms of social welfare (1)

## Suboptimal Investments in Research

- ❖ To avoid wasting resources on problem-solving, firms in competitive markets will pass up opportunities for invention due to the risk of failure.
- ❖ If competitors can immediately copy the successful solution (free ride), the inventive firm will receive less financial reward.



Fuente: Kenneth J. Arrow, 1962

# However...

There are other important factors that drive creativity and invention:

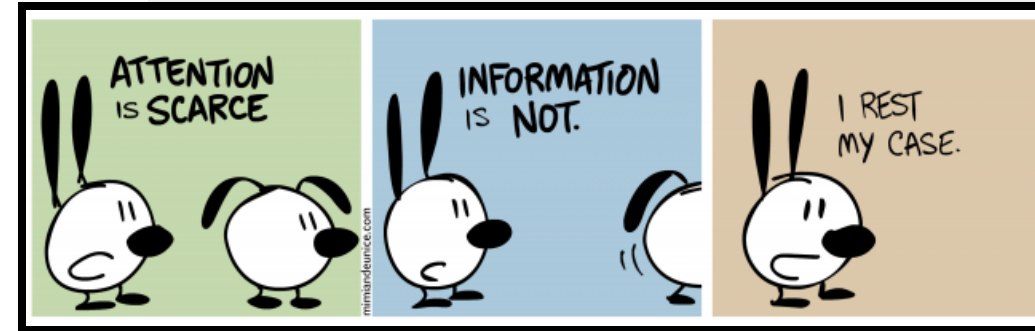
- Inventors' innate curiosity.
- Recognition from peers or society for solving a complex problem.
- Reputation.

**Absorptive capacity:** information is not synonymous with knowledge.

The dissemination of knowledge has positive effects:

- GPTs
- Standards

Sources: Polanyi, 1946; Cohen & Levinthal, 1989



# Consequently, markets will not invest enough in innovation activities in terms of social welfare (2)

## Suboptimal investments in **quality**

Suppliers and consumers do not have the same information about the quality of the product or service.

**Information asymmetry** causes prices to fail as a mechanism for transmitting information.



Source: Akerlof, George A. 1970.



# Intellectual property rights and what they protect

These rights vary in what they protect, for how long, and how strongly.




**COPYRIGHT**

Creative works such as artwork, writing, music, video, and software




Life of the creator + ~50 years




**COMMERCIAL SECRET**

Confidential information




As long as it is kept secret



**INDUSTRIAL DESIGN**

2D or 3D features, such as shapes, patterns, lines, or colors



~ 10 years




**TRADEMARKS**

Words, phrases, and images




Initially 10 years and then used for a long time



**PATENTS AND UTILITY MODELS**

Inventions



7-20 years

There is no protection against others that develop independently.

Protected, even if developed independently.

# Trademarks vs. other IP rights

---

<b>ASPECT</b>	<b>Trademarks</b>	<b>Patents and copyright</b>
<b>Market failure they address</b>	Asymmetric information between buyers and sellers	Public good character of inventive and creative production
<b>Economic problem</b>	Lack of consumer information about products/services	Lack of incentives to invest in R&D without protection
<b>Nature of good</b>	Hybrid (public and private elements)	Pure public good

---

# Innovation policies take many forms...

Its objective is to *promote new ideas*, inventions, processes and technologies within an innovation ecosystem.

- IP Instruments
  1. Patents / Utility Models / Industrial Designs
  2. Trademarks / Copyrights / Trade Secrets
- Awards / Patronage
- Skilled Migration
- R&D Subsidies
- Education Scholarships
- Infrastructure Investments
- International Cooperation

Typically with  
public funds



# Intellectual property rights as a policy

- ❖ An elegant mechanism for governments to mobilize market forces and guide innovative and creative activity.
- ❖ Decisions about which innovation opportunities to pursue should be made in a decentralized manner.
- ❖ Creators at the frontier of knowledge are better informed about the likely success of innovative projects.
- ❖ The IP system seeks to promote an efficient allocation of resources for inventive and creative activity.



# Intellectual property rights are not perfect and generate distortions



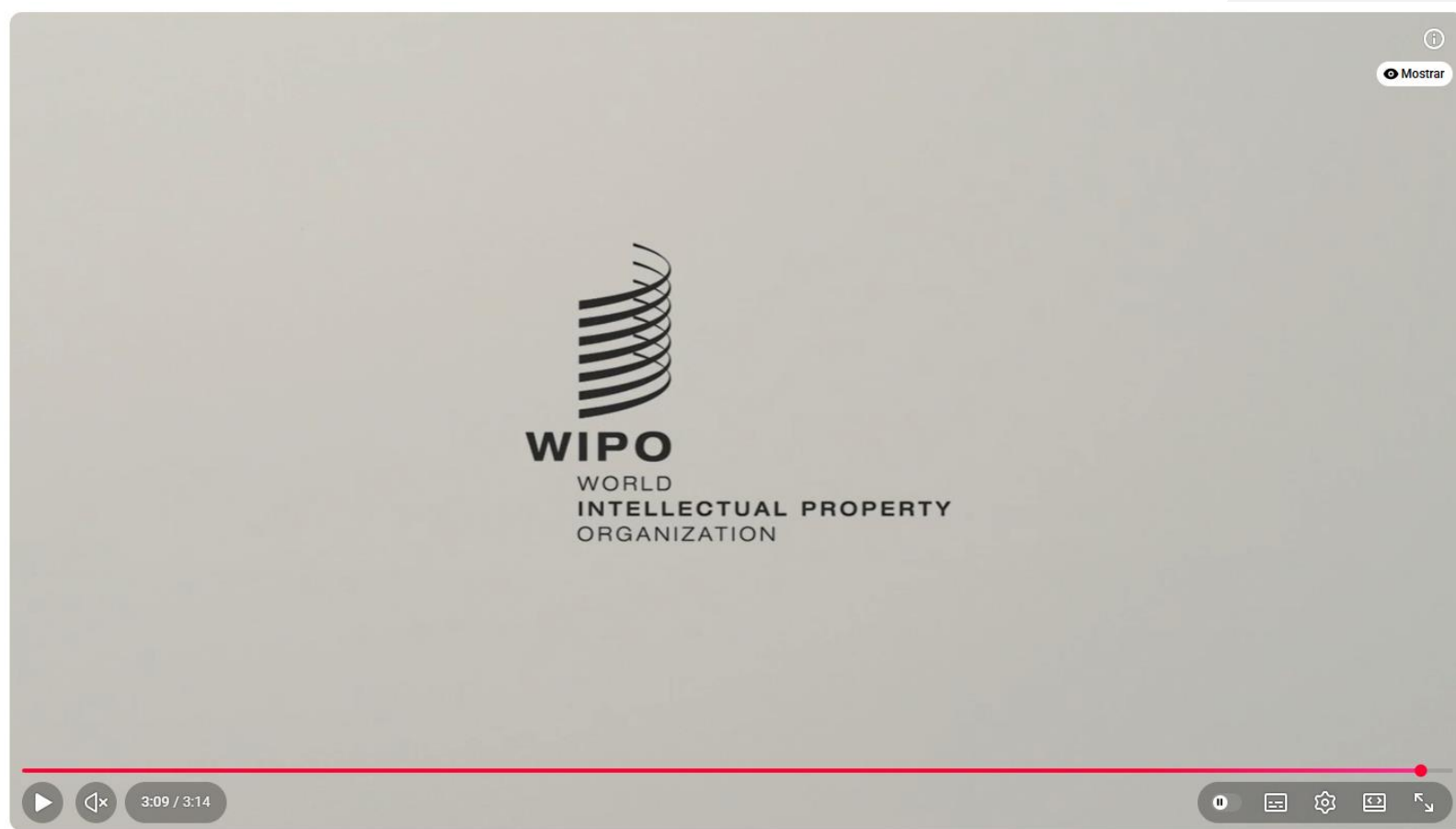
## Pros

- Market-driven.
- Intellectual property rights holders can recover initial investment costs.
- Mobilizes resources for high-risk innovations.
- Facilitates firm specialization.
- Creates markets for technologies.
- More informed consumers

## Cons

- They grant (temporary) monopolies.
- Bias against basic research.
- They can discourage innovation ("patent thicket").

# Video



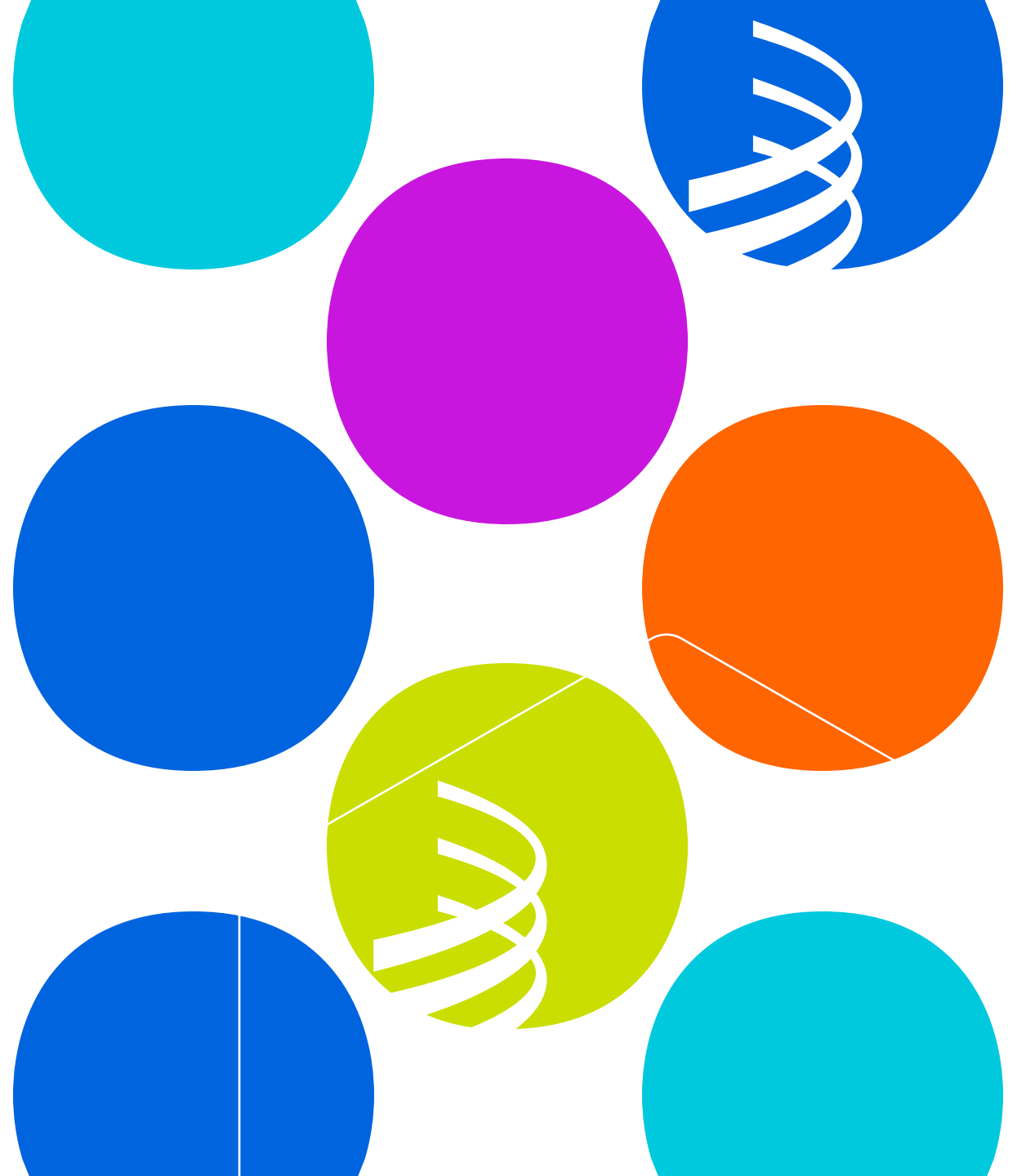
[What is WIPO? - YouTube](#)

# WIPO

## Module 2: Innovation Ecosystems Actors, networks, and knowledge flows

Innovation Economy Section - WIPO

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# Why do economists care about intellectual property?

## Innovation drives economic growth through a variety of mechanisms...

- **Capital** intensification.
- Improving **human capital**.
- Increased **business productivity**.
- Changes in the **productive structure**.

“The invention of all those machines that so facilitate and shorten work seems to have originally been due to the division of labor.”

Source: Adam Smith, Wealth of Nations, 1776



## Questions:

Who is part of the Innovation Ecosystems?

Why do we call it Ecosystem?



# Innovation Ecosystems



# Innovation ecosystems



Government



Policy-makers

A community of interconnected actors that facilitate the generation, acquisition, and dissemination of new knowledge



Researchers

Academia



Companies



Entrepreneurs

# Innovation Ecosystems



Researchers

**Academia**

**Government**



Policy-makers

*Knowledge Flows*

*Knowledge Exchange Platforms*

*Educational Programs*

*Economic Flows*

*R&D Activities*



Entrepreneurs

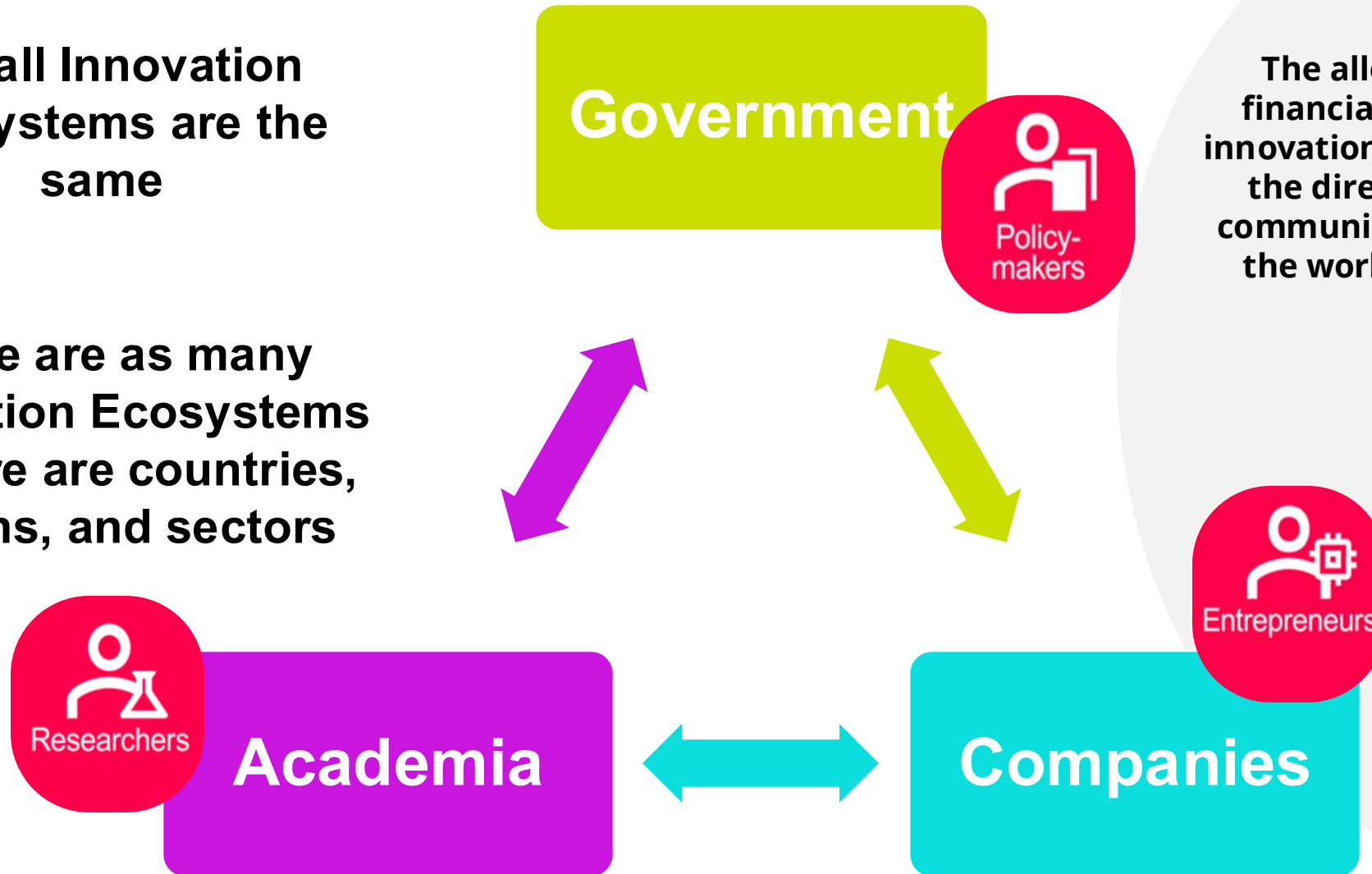
**Companies**



# Innovation Ecosystems

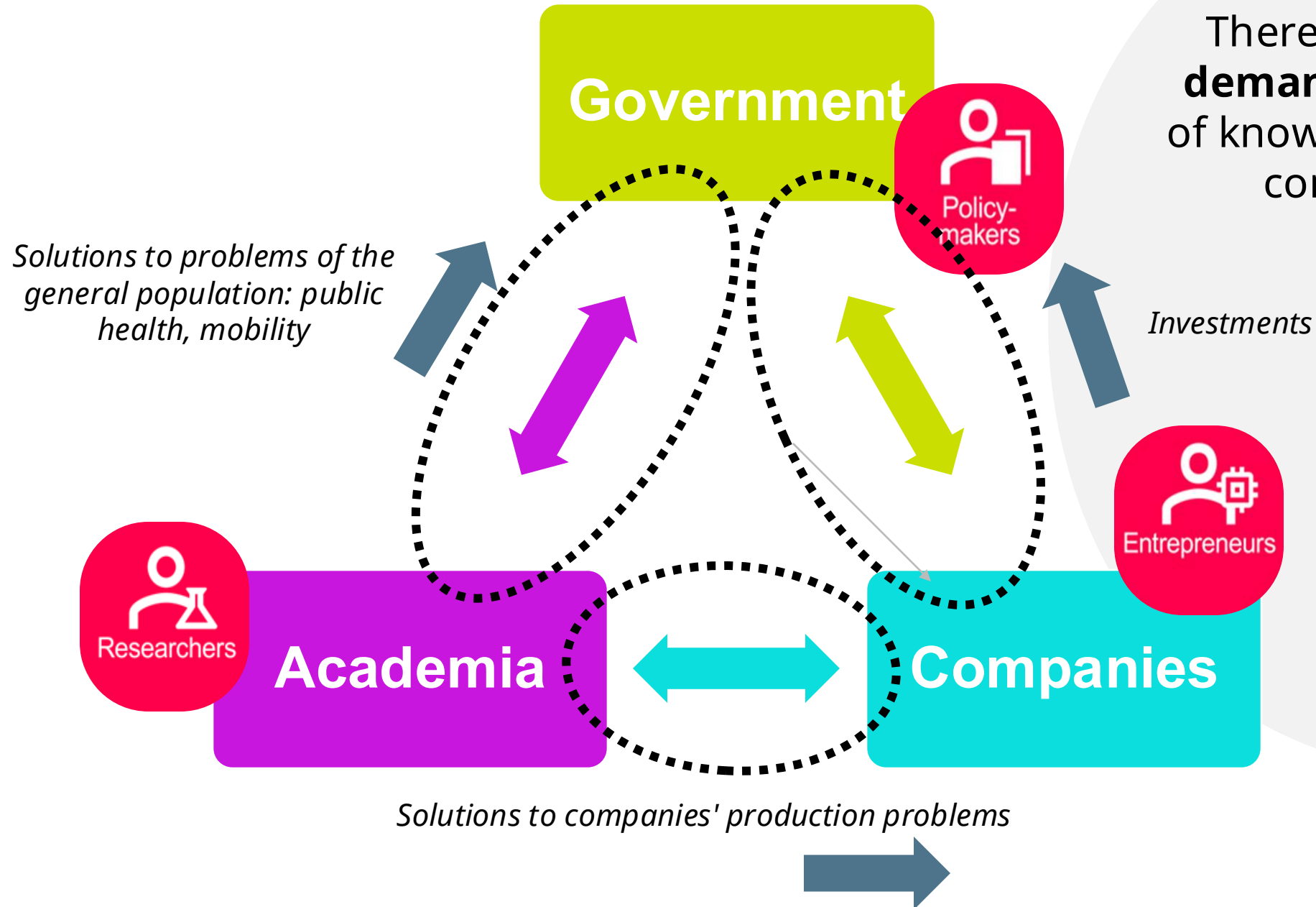
**Not all Innovation Ecosystems are the same**

**There are as many Innovation Ecosystems as there are countries, regions, and sectors**



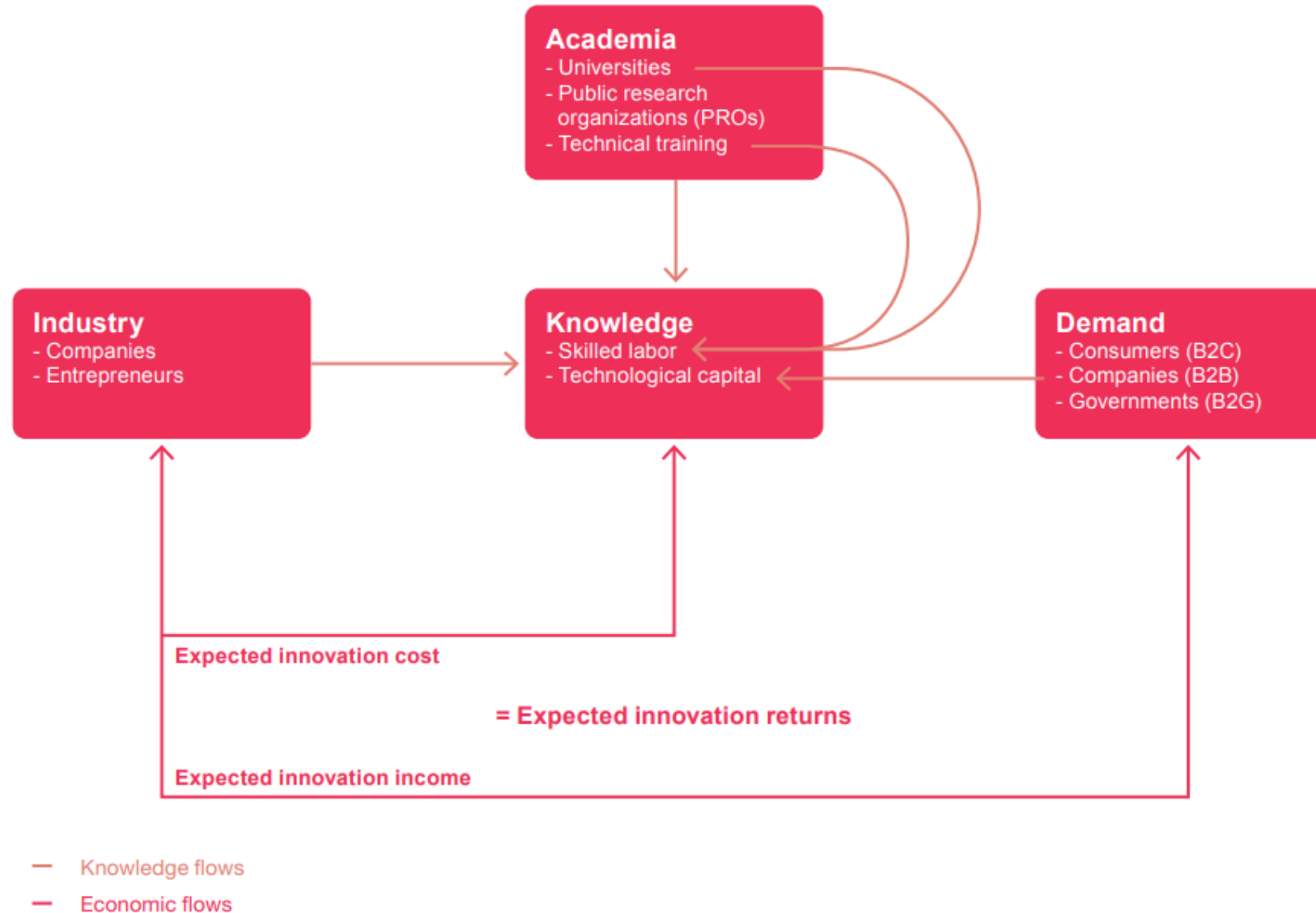
# Innovation Ecosystems

There are different **demands and offers** of knowledge from the components.



# Innovation ecosystem stakeholders interact to achieve innovation

Figure 1.2 Conceptual summary of innovation stakeholders' interactions



Source: WIPR 2022

Source: Adapted from (Schmookler, 1962a) and (Kline and Rosenberg, 1986).  
Note: B2C, business-to-consumer; B2B, business-to-business; B2G, business-to-government.

# Innovation Ecosystems

## Airplanes

- Interaction among inventors.
- Evolution of aeronautical advances
- Government interest in aircraft development

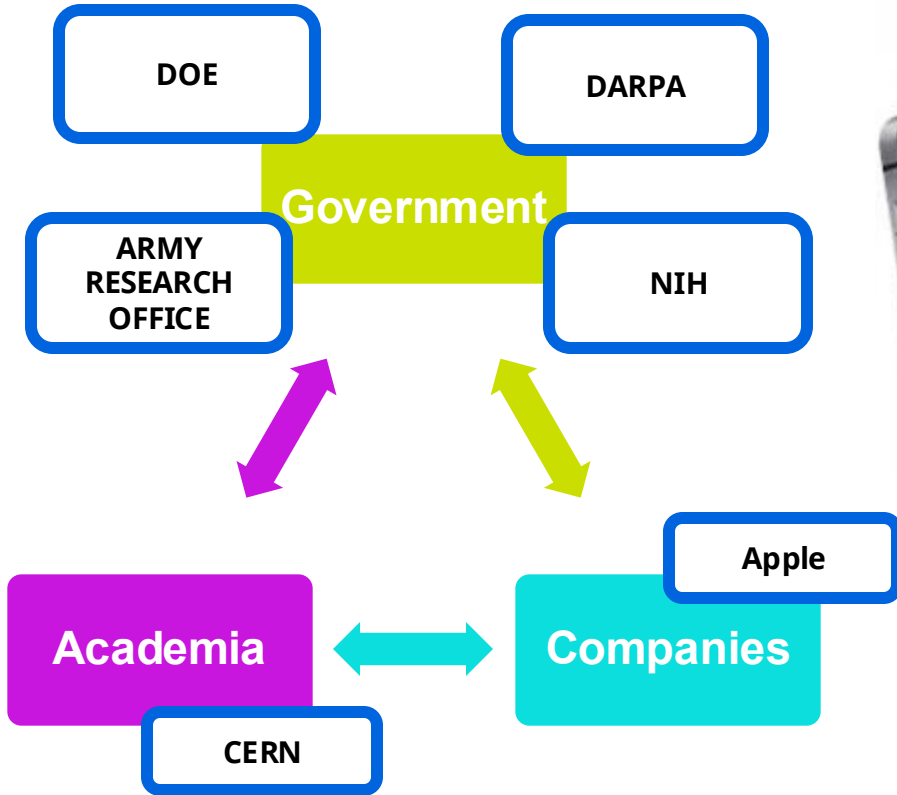
## Antibiotics

- Public academic institutions
- Public and private incentives

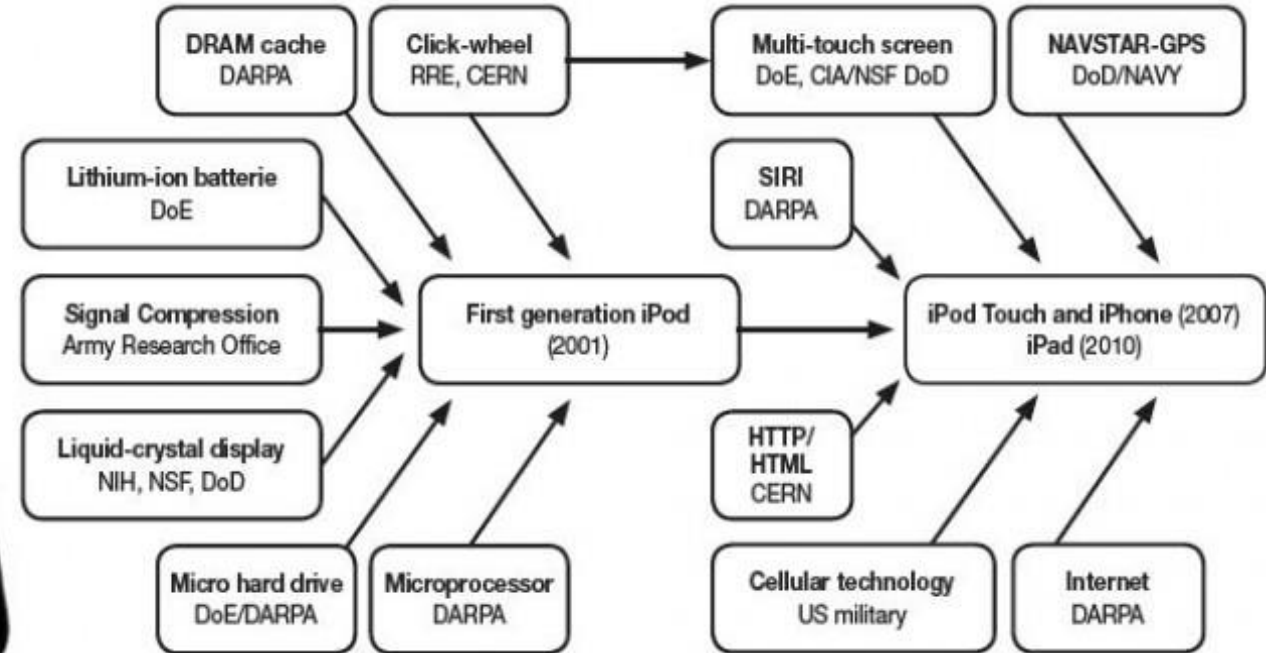
## Semiconductors

- Contributions of basic science and its links with public and university research
- Support and state policies

# Example: Iphone

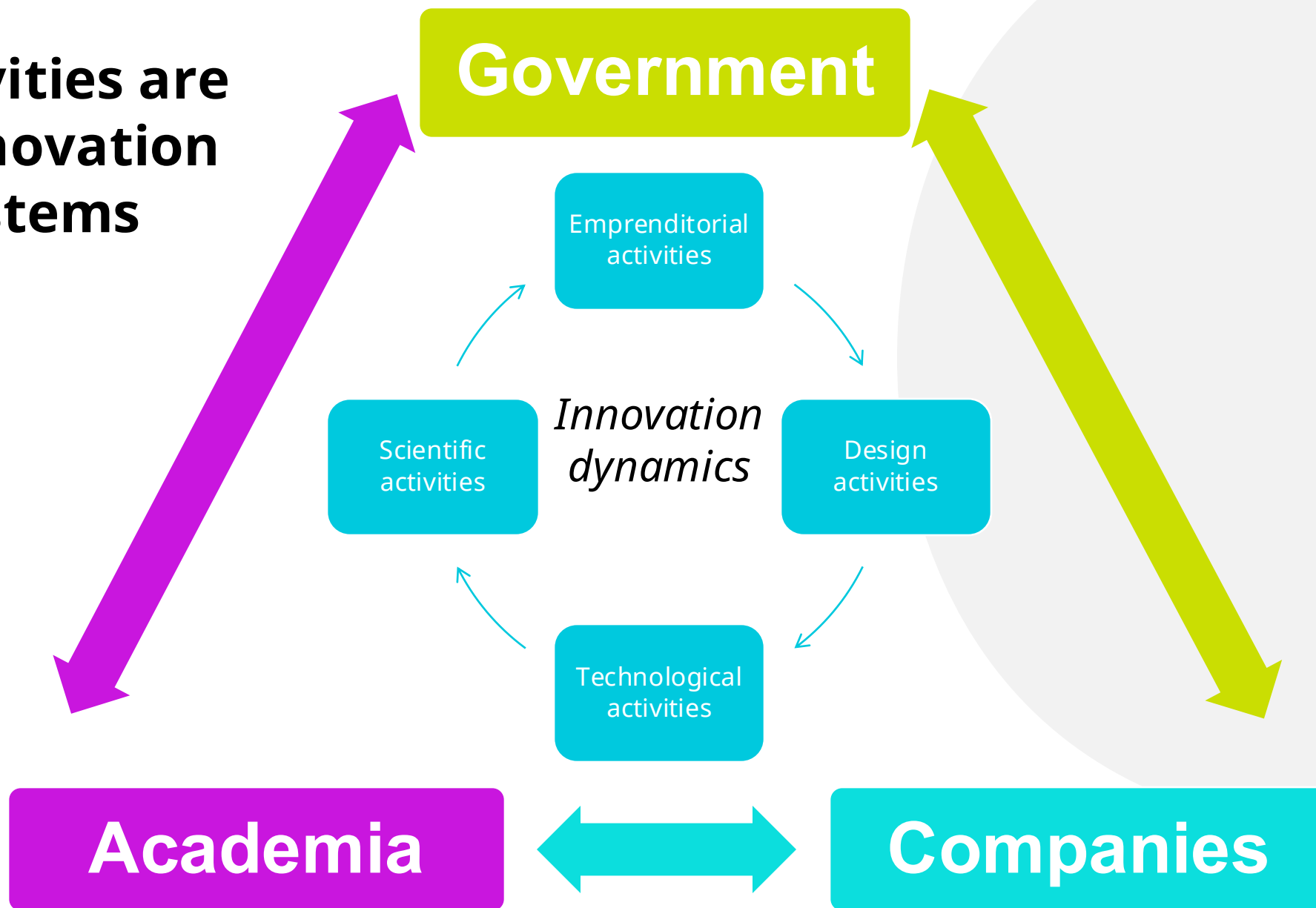


## What Makes the iPhone so Smart?

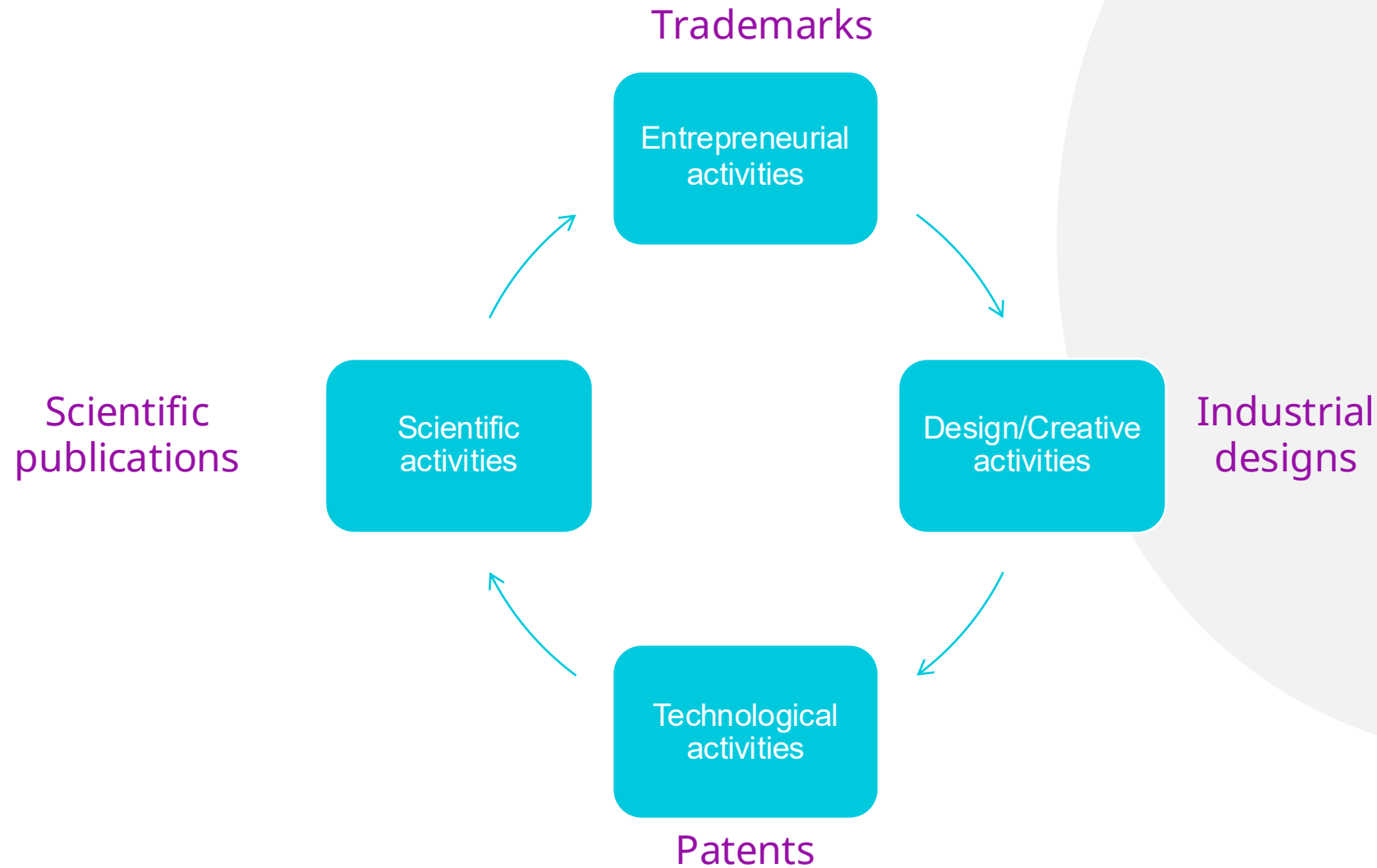


Source: *The Entrepreneurial State: debunking public vs. private sector myths* (Mazzucato, 2013), p109. Fig 13

Four activities are key in innovation ecosystems



# How do we measure scientific, technological, creative and entrepreneurial activities?



# Characterizing innovation ecosystems through data

The different types of agents in innovation ecosystems can be identified through data:

- Patents
- Trademarks
- Designs
- Scientific publications

- Inventors vs. Applicants
- Applicant Name
- Categories
- Sector Classifications
- International vs. Domestic IP
- Diversification vs. Specialization

# Applicants and inventors in the functioning of innovation ecosystems



## Inventors

- Individual creators who develop real innovation
- **Scientists, engineers, researchers, entrepreneurs**
- Provide the creative and technical foundation
- Often employed by larger organizations

## Applicants

- Legal entities seeking patent protection
- Typically corporations, universities, or research institutions
- Own intellectual property rights
- Control marketing decisions

# What is a resident Patent application?



→ A national company working with a national inventor



→ A national company hiring with a foreign inventor

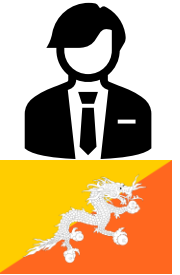


→ A foreign company working with a national inventor

# What is a resident design application?



→ A national company working with a national designer



→ A national company hiring with a foreign designer

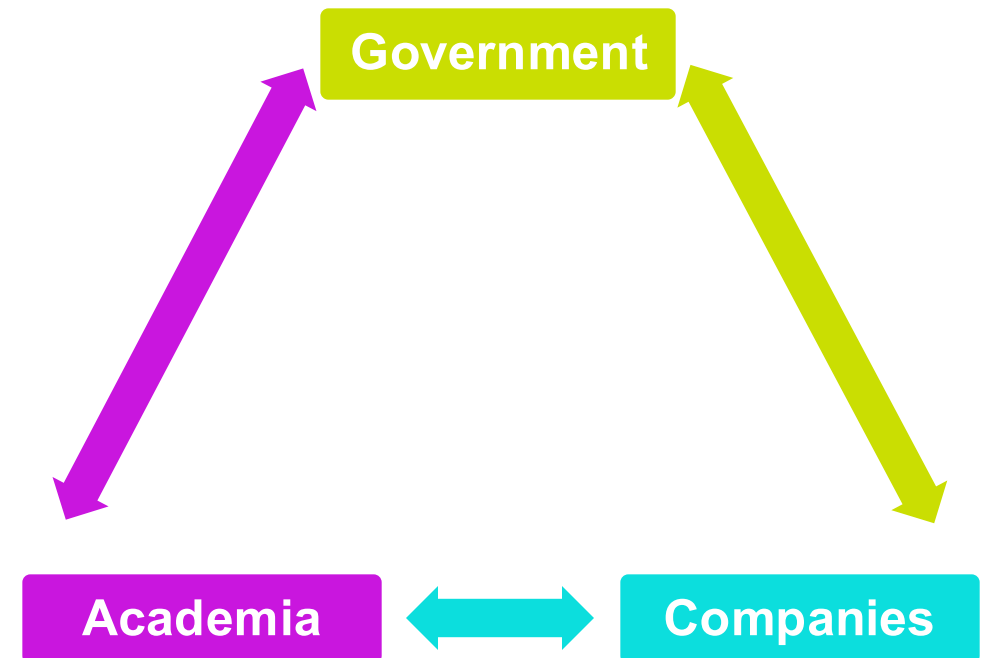


→ A foreign company working hiring a national designer

# Applicants and inventors in the functioning of innovation ecosystems

## Knowledge flow patterns

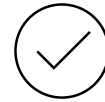
- University-Industry: Professors (inventors) → Universities (applicants)
- Corporate R&D: Employee inventors → Company applicants
- Startup ecosystem: Founder-inventors often play both roles



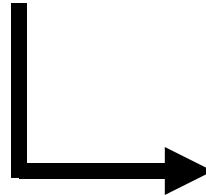
# Type of applicants

Based on the keyword of the names:

University,  
campus,  
Departments



**Academics**



company,  
corporation,  
startup,  
ltd, inc...



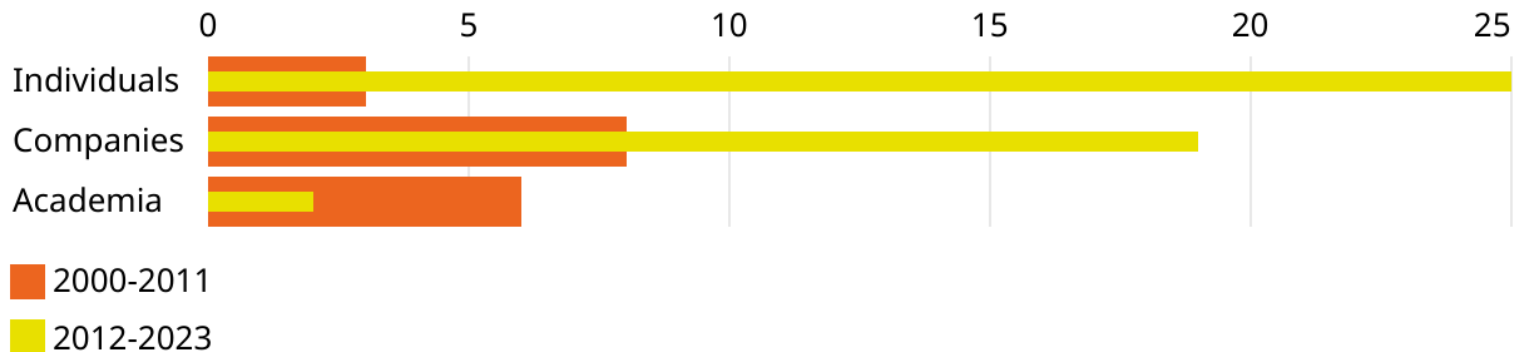
**Companies**



**Individuals**

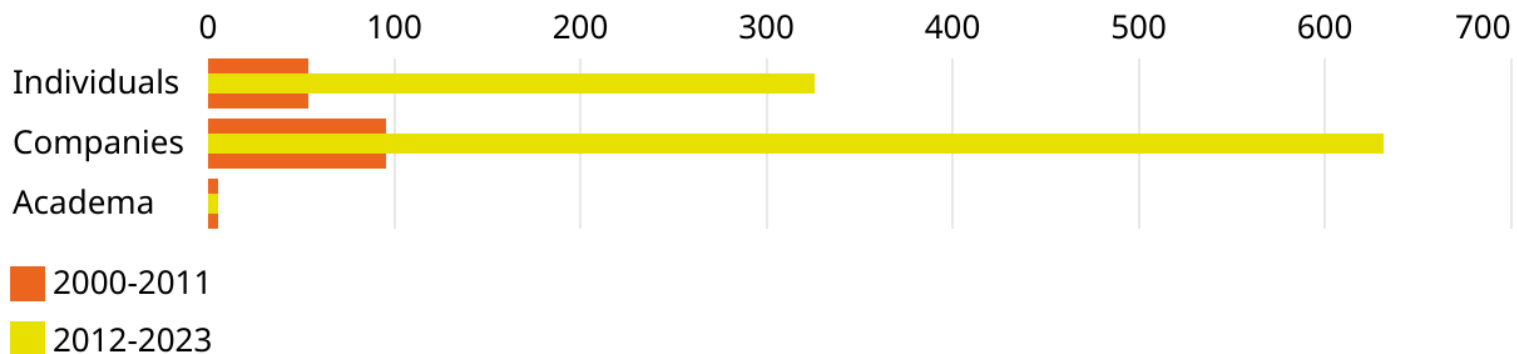
## Patent applications count per applicant type

Most patents are applied by individual inventors



## Trademarks applications count per applicant type

All categories of applicants demonstrate consistent upward trends

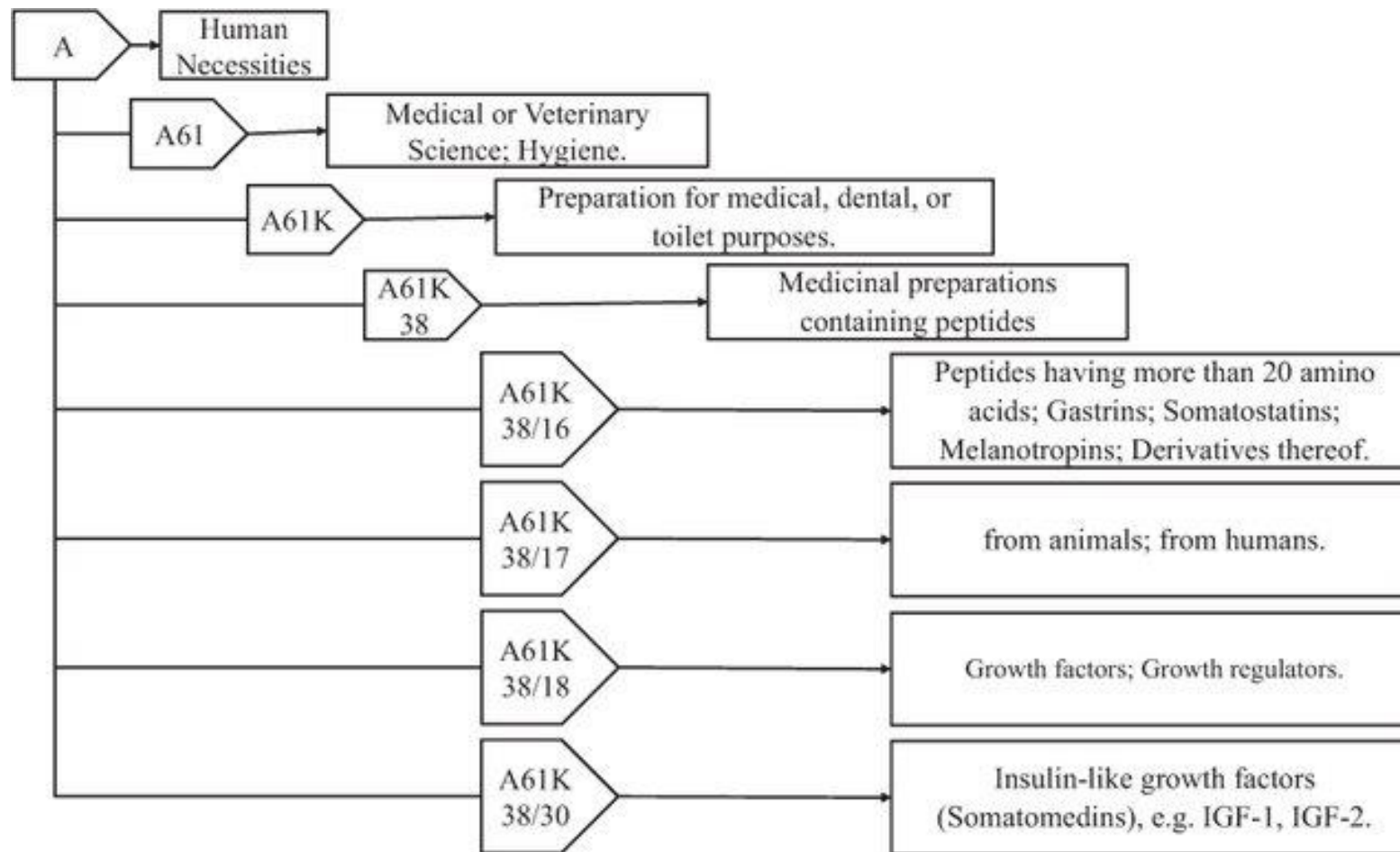


# Sectorial categories based on classifications

## Using technology categories to track innovation

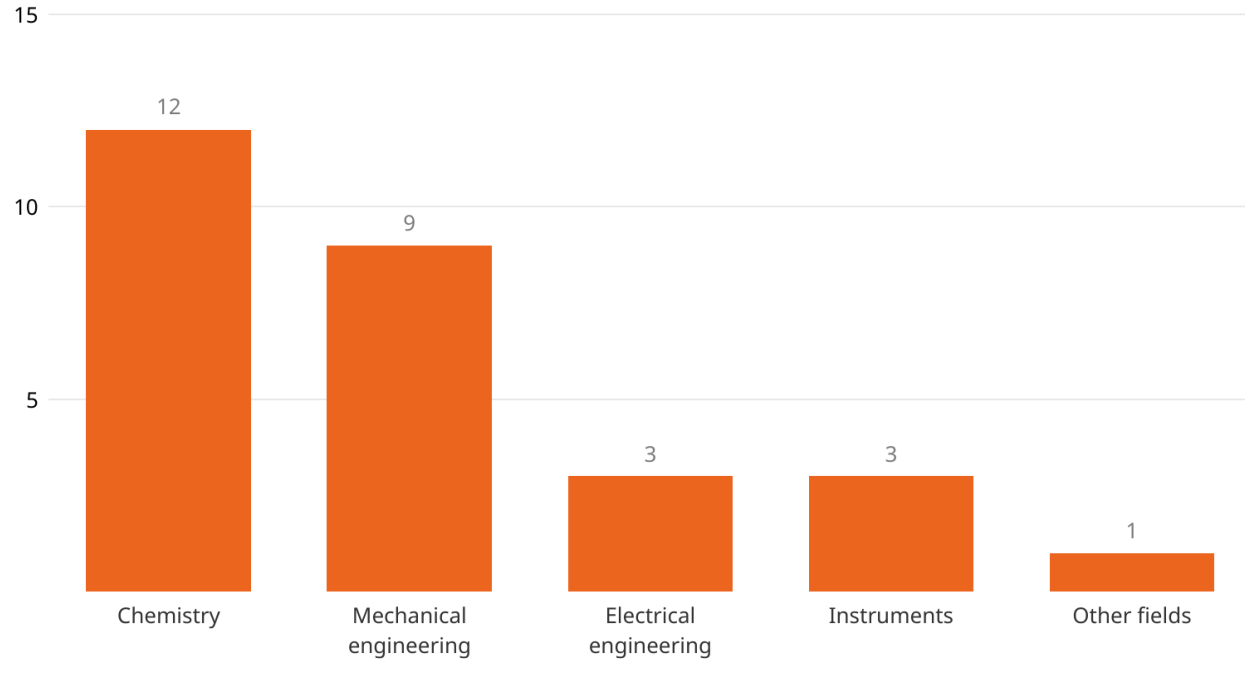
- Technology categories reveal where innovation is moving.
- They allow comparison across fields and time.
- Mapping categories shows clusters of activity and emerging areas.
- This helps assess innovation strategies and guide policy or investment.

# Sectorial categories based on classifications



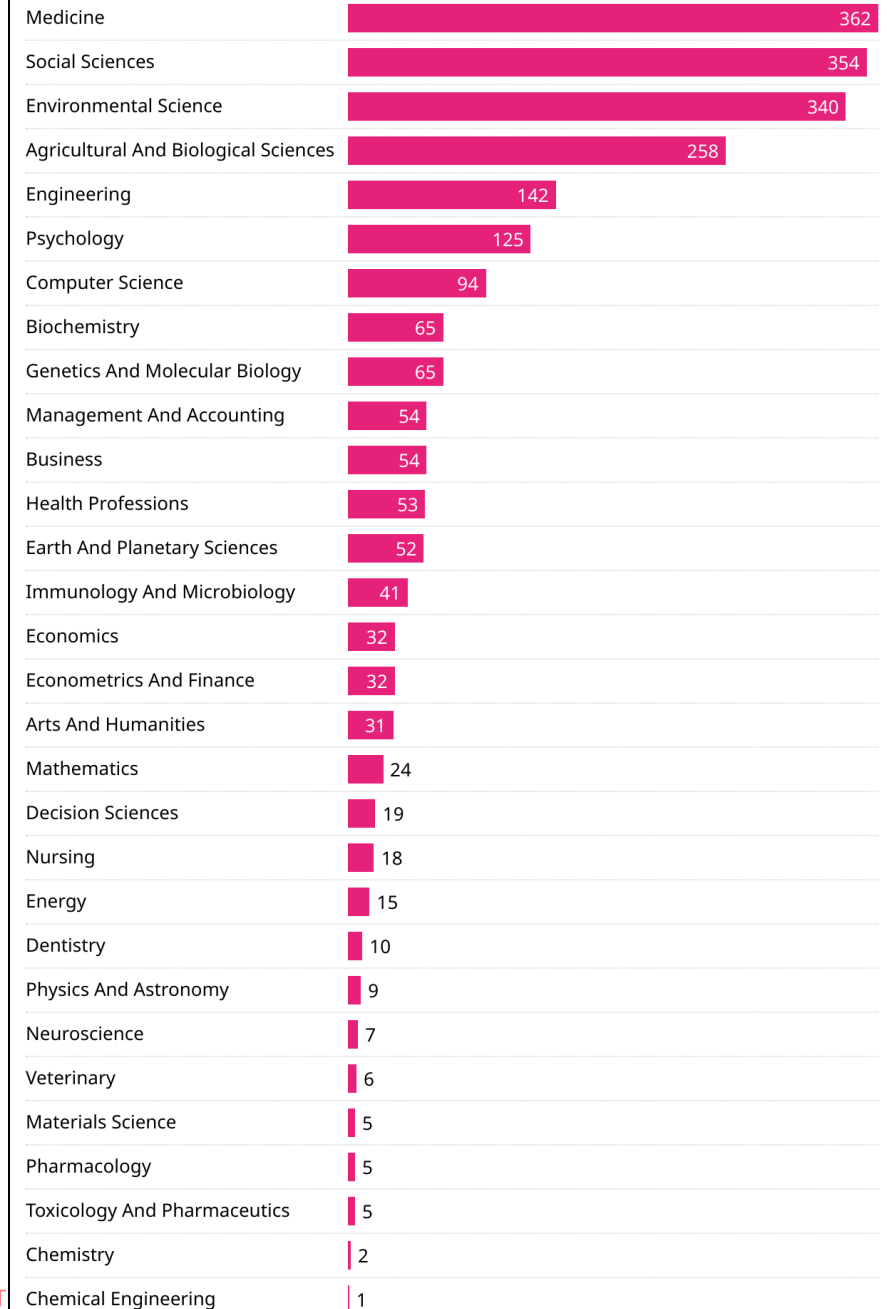
## Patent applications count per Technological Sector (2012-2023)

Bhutanese technological activity is mostly oriented toward engineering

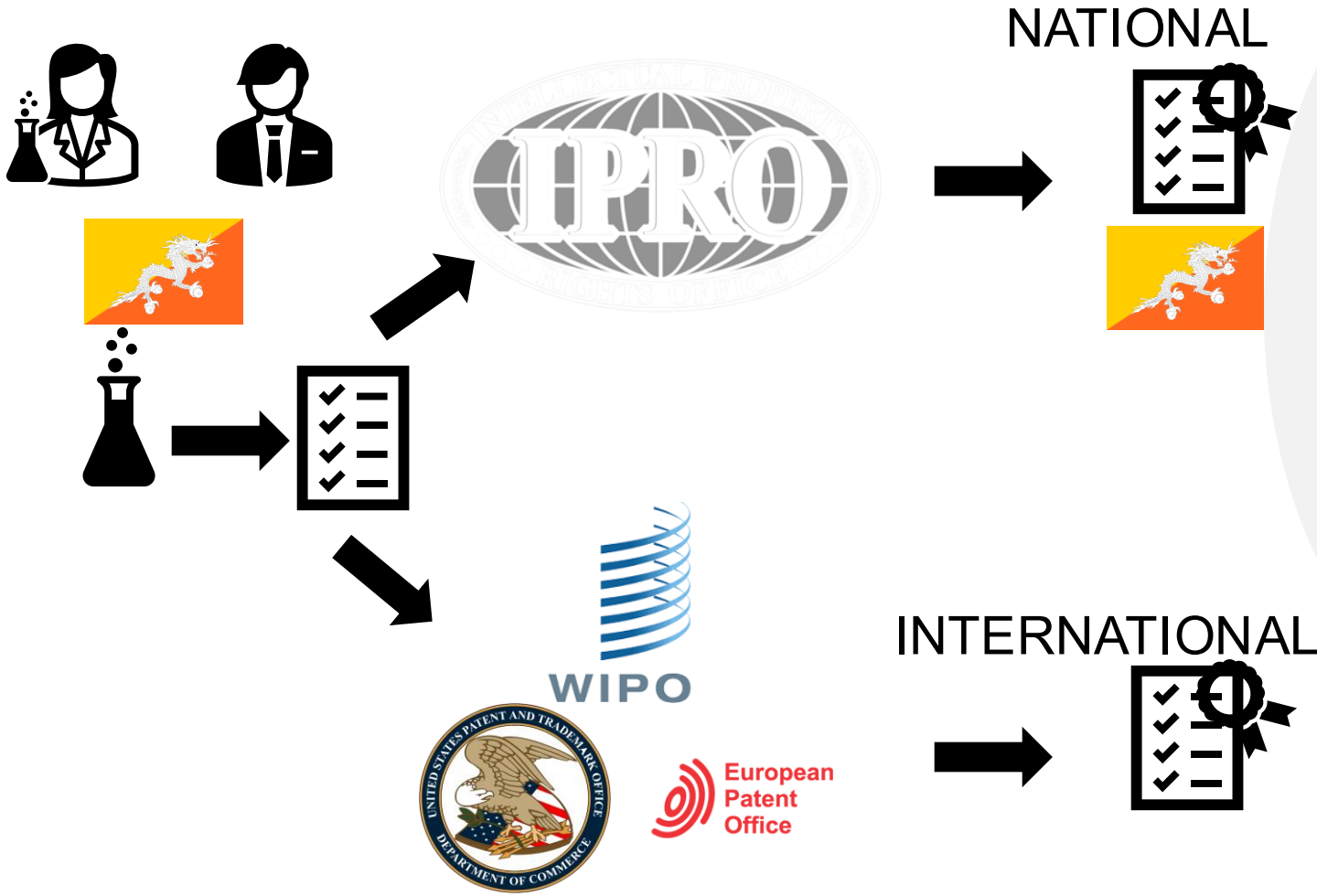


## Scientific publications count per fields (2012-2023)

Scientific publications are mostly happening in 3 fields



# The role of foreign IP applications in international market selection



IP applications abroad act as tools that shape knowledge flows and competitive dynamics within interconnected innovation ecosystems.

## Patent applications per applications offices (2012-2023)



# Thank you!

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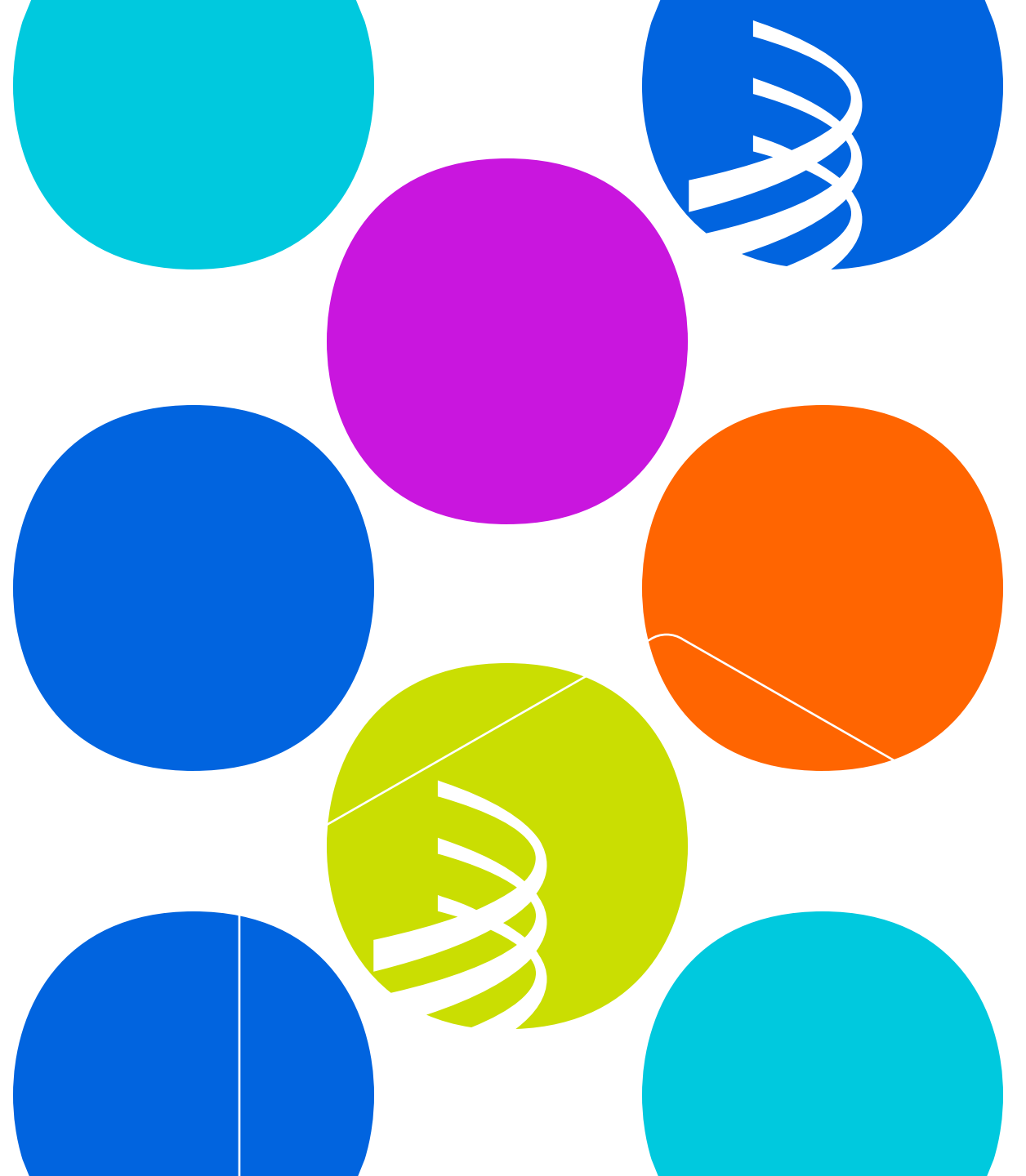
Photo credits:

# WIPO

## Subnational Innovation Ecosystems Regional and city-level innovation dynamics

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# Recapitulating some concepts from the previous module

- **Technological innovation** is the engine that drives **economic growth** and fosters improved living standards.
- Innovation does not occur in isolation.
- Innovation ecosystems made up of **interrelated agents** facilitate the generation, acquisition, and dissemination of **new knowledge**.
- Innovation ecosystems are **not easily transplantable or reproducible** as they develop in institutional environments and social fabrics with a high degree of territorial specificity

 focus on the **Geography of Innovation**.

# In this module we will try to answer the following questions:



What forces can explain why innovation has been concentrated in certain geographical areas and has spread only unevenly?

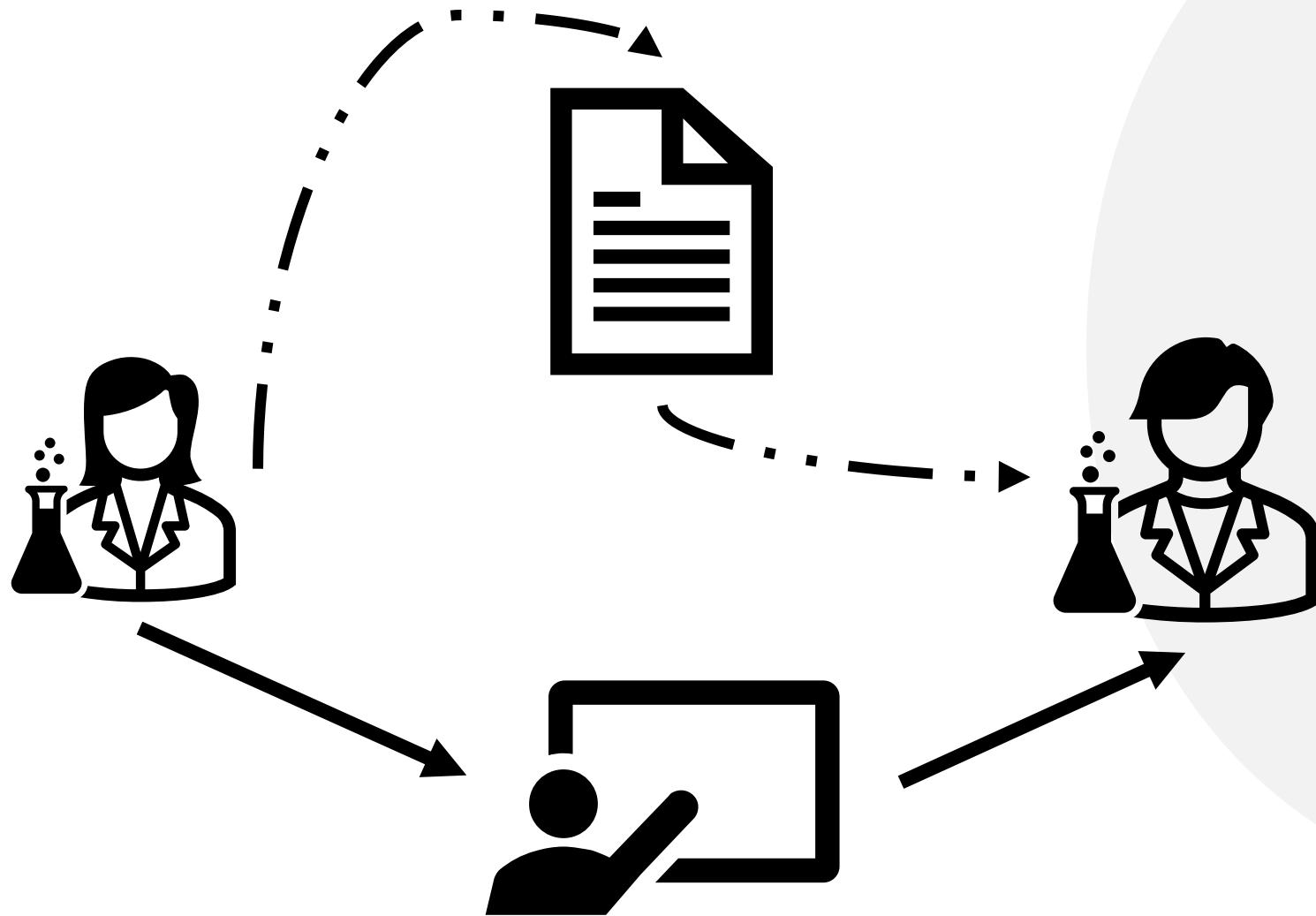


How exactly is the global geography of innovation changing?



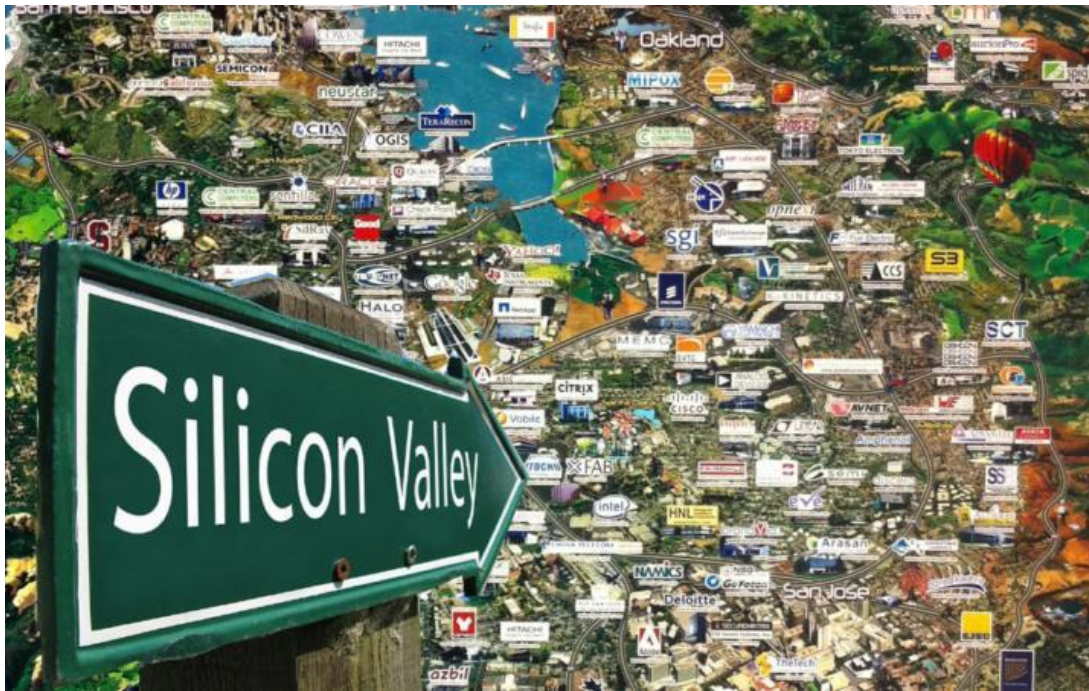
How do companies organize their innovation activities around the world in today's globalized era?

# How do you transfer knowledge?



Bengaluru, India

# What forces explain the agglomeration of innovation?

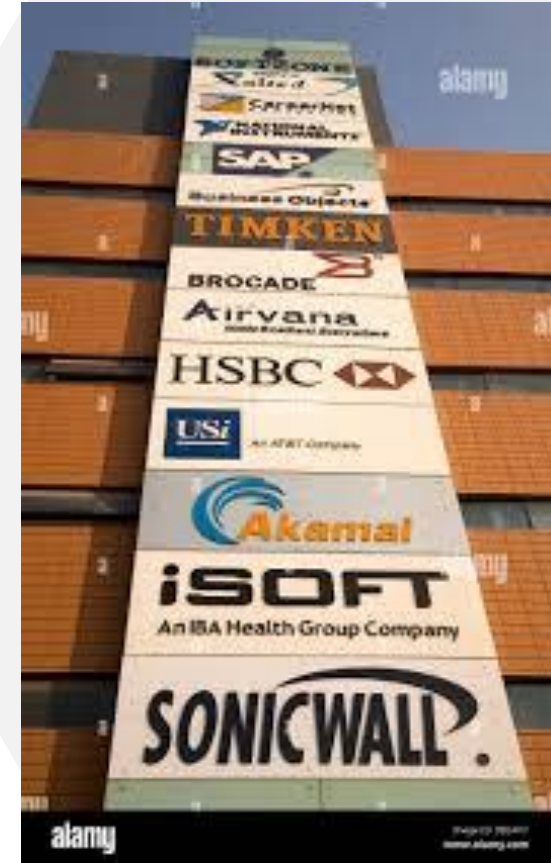


The geographical distribution of innovation determines the economic **development** trajectory of **cities and regions**.

# What forces explain the agglomeration of innovation?



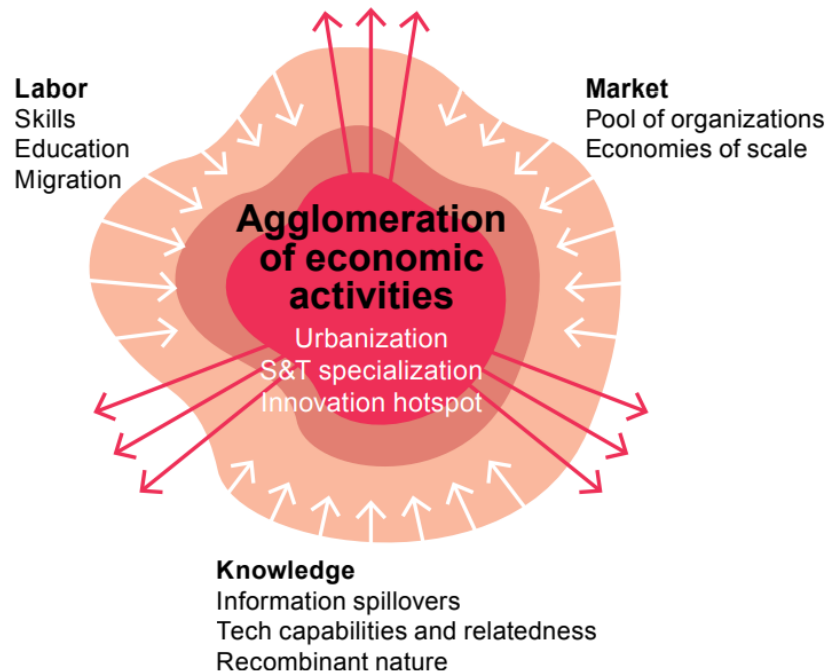
Bengaluru, India



The geographical distribution of innovation determines the economic **development** trajectory of **cities and regions**.

# Main economic forces driving geographic concentration in innovation

Figure 1.1 Main economic forces driving geographical concentration of innovation



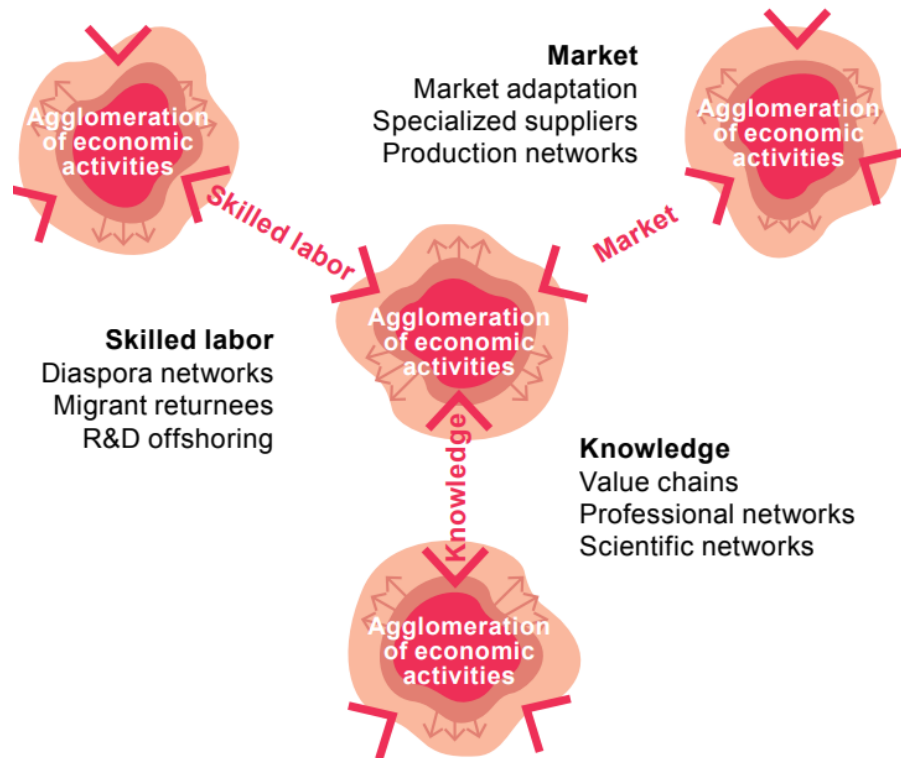
Note: S&T = Science and technology.

## Forces of urban agglomeration

- Businesses find skilled workers
- Skilled workers find jobs and value urban services
- Ideas flourish with innovators working in close proximity

# Main two-way economic forces that favor the diffusion of innovation

Figure 1.2 Main bidirectional economic forces spreading innovation

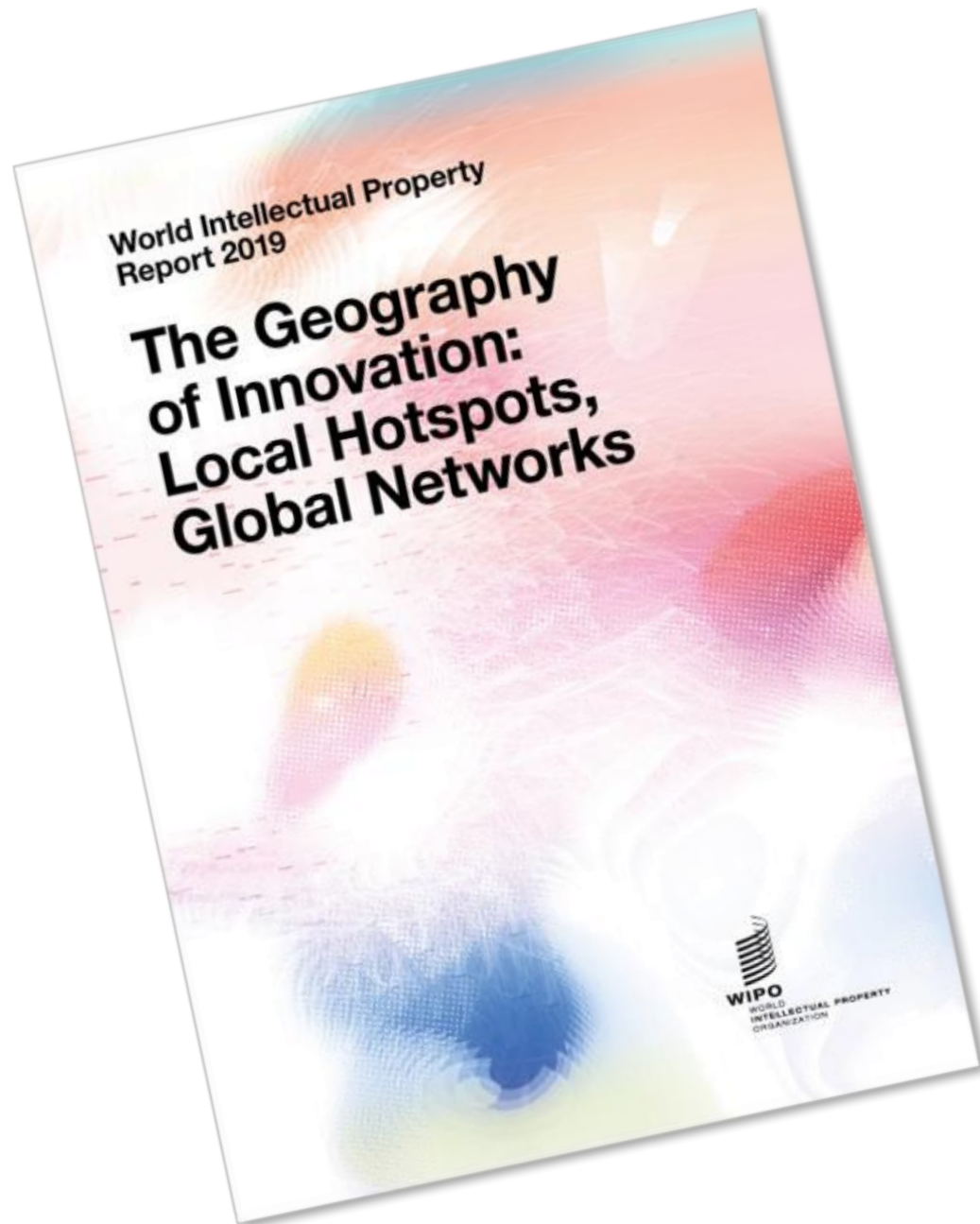


Forces of urban agglomeration

Businesses find skilled workers

Skilled workers find jobs and value urban services

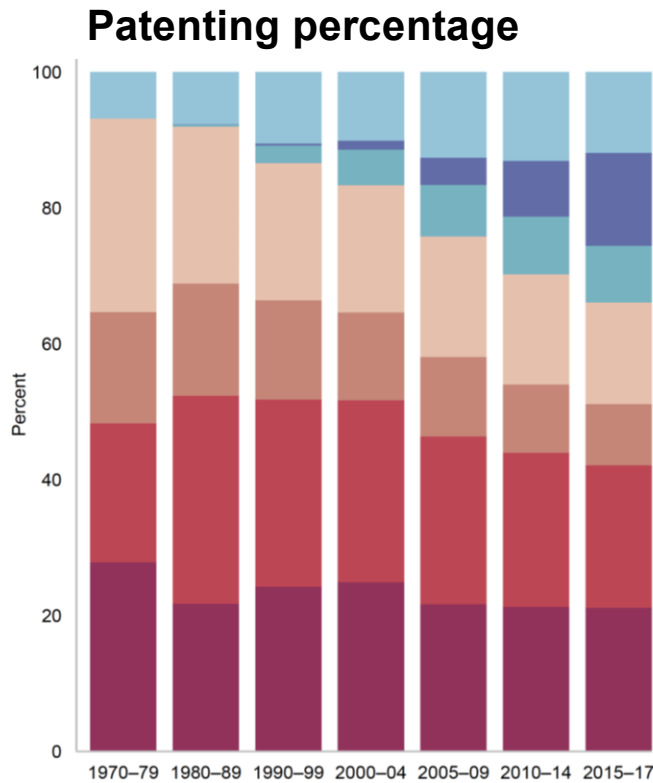
Ideas flourish with innovators working in close proximity



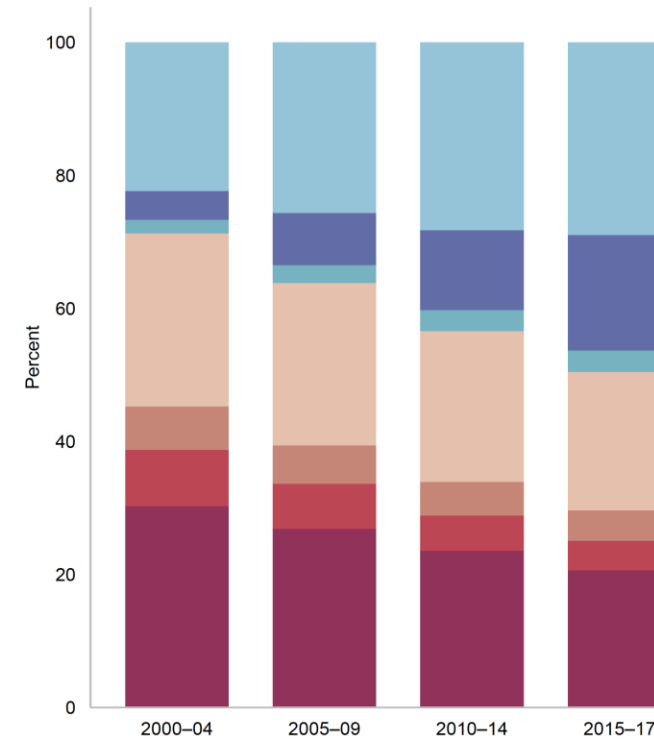
## 5 Stylized facts about the geography of innovation

# #1 More and more countries are participating in global innovation networks.

Knowledge production is spreading and shifting eastwards.

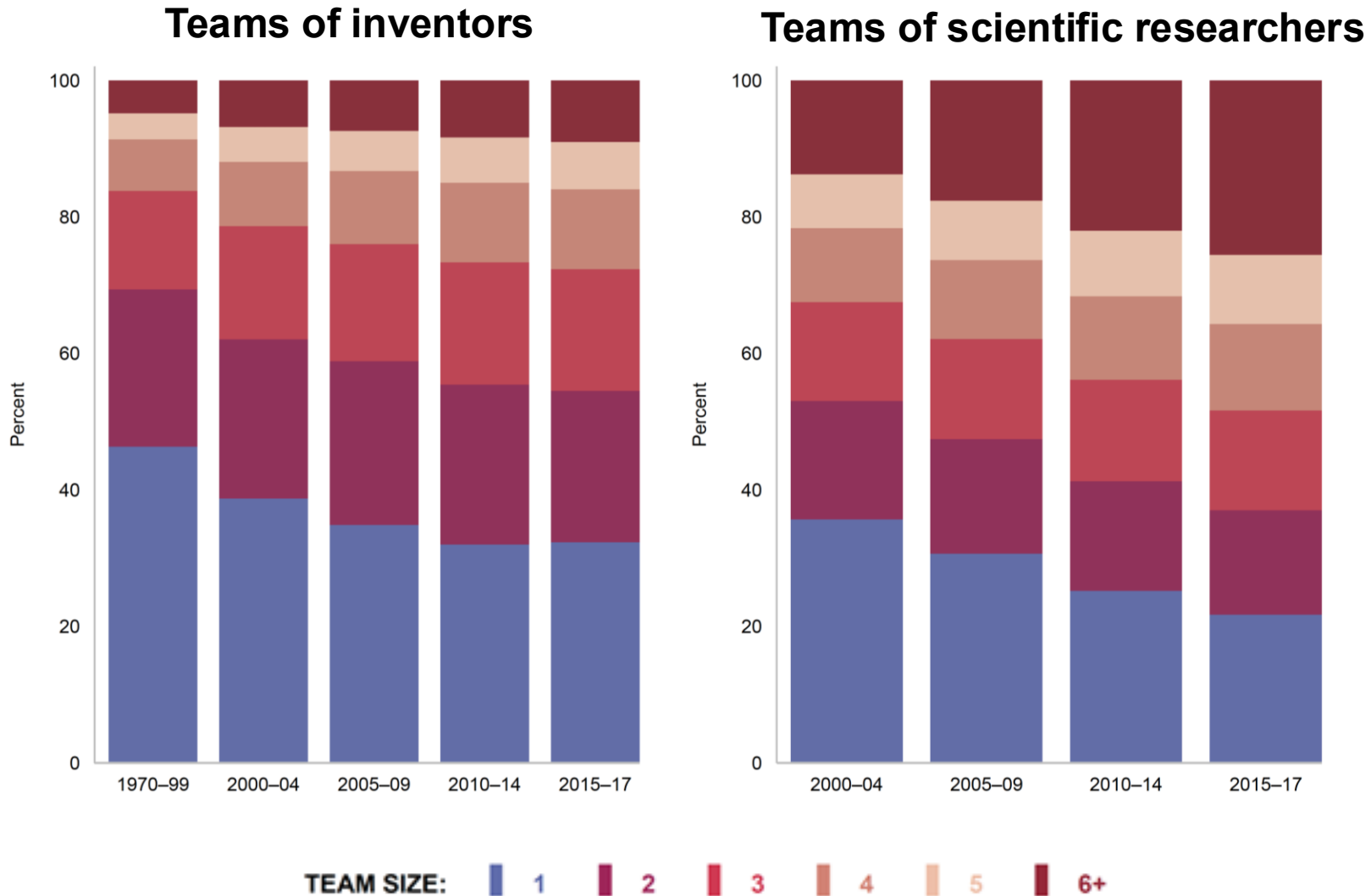


### Percentage of scientific publications



■ U.S.    ■ JAPAN    ■ GERMANY    ■ OTHER WESTERN EUROPE  
■ REP. OF KOREA    ■ CHINA    ■ REST OF THE WORLD

# #2 Collaboration is increasing



# #3 Innovation is increasingly local

Innovation is geographically concentrated in a limited number of areas

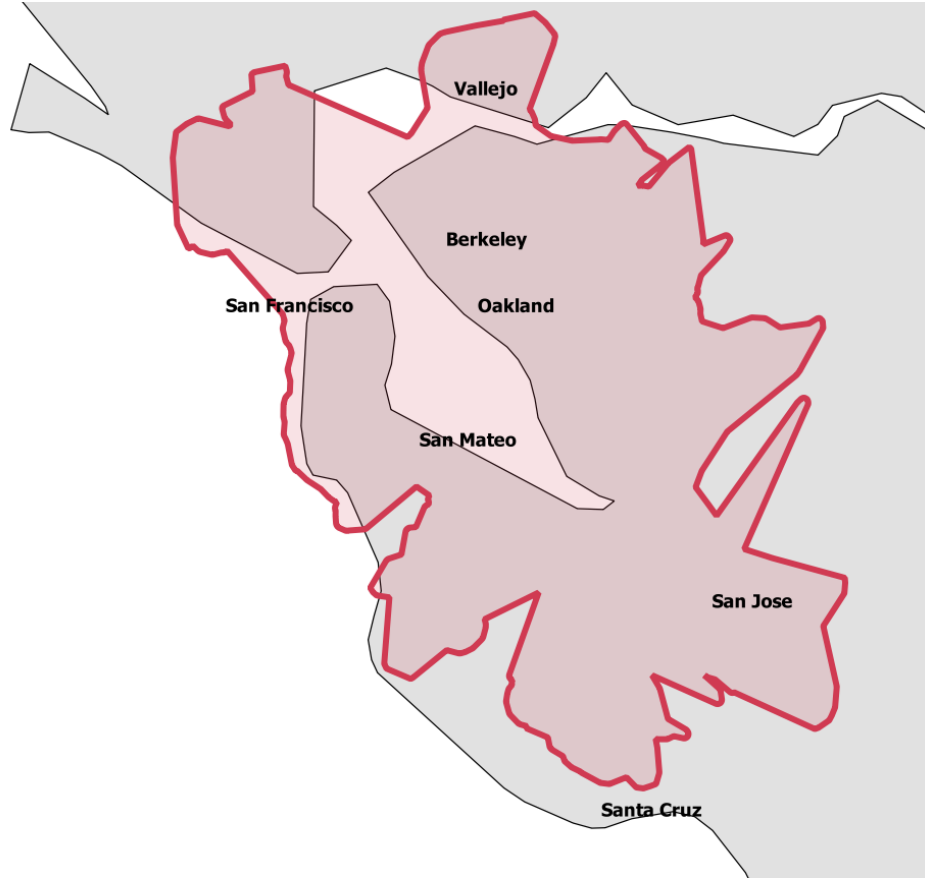
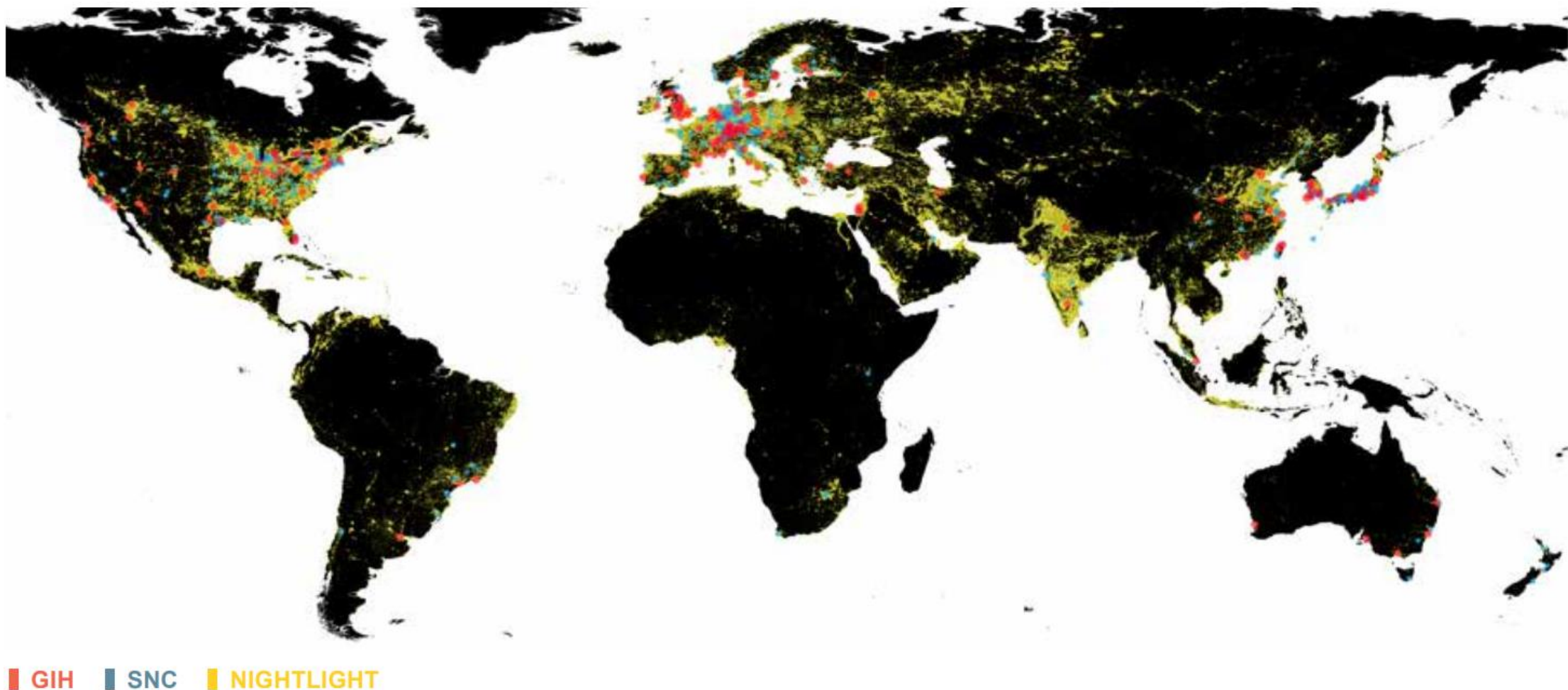


Figure 2.4 Worldwide distribution of innovation (GIHs and SNCs) and DMSP nightlight



A few places concentrate most of the scientific and inventive activities

# #4 More international collaboration between countries

## International co-invention



1998-2002



2011-2015



## International co-publications



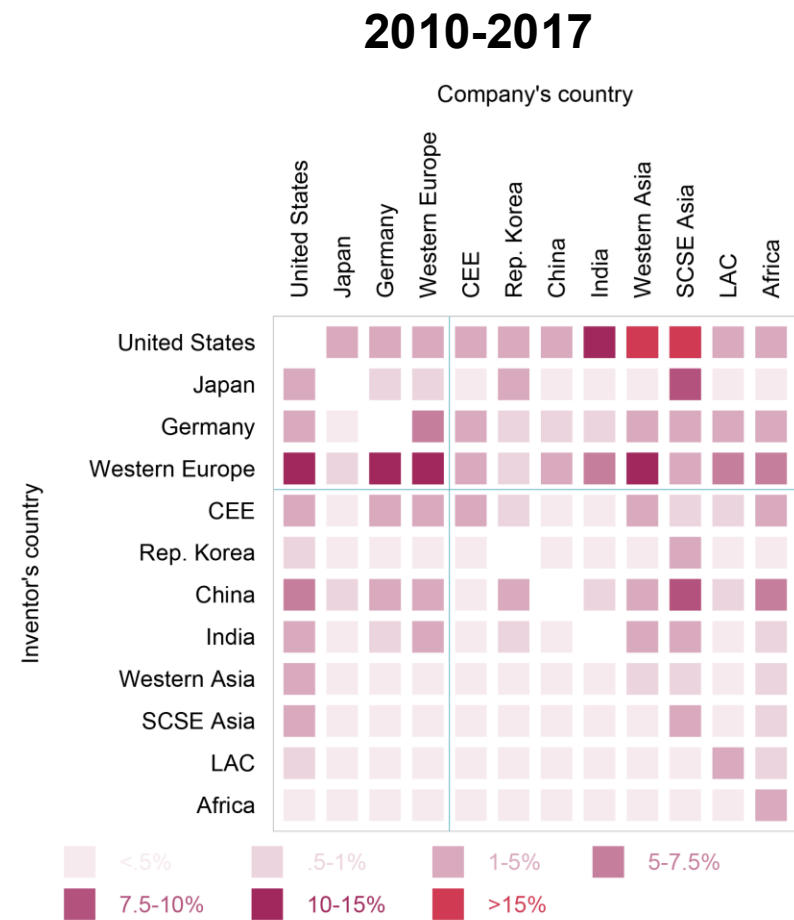
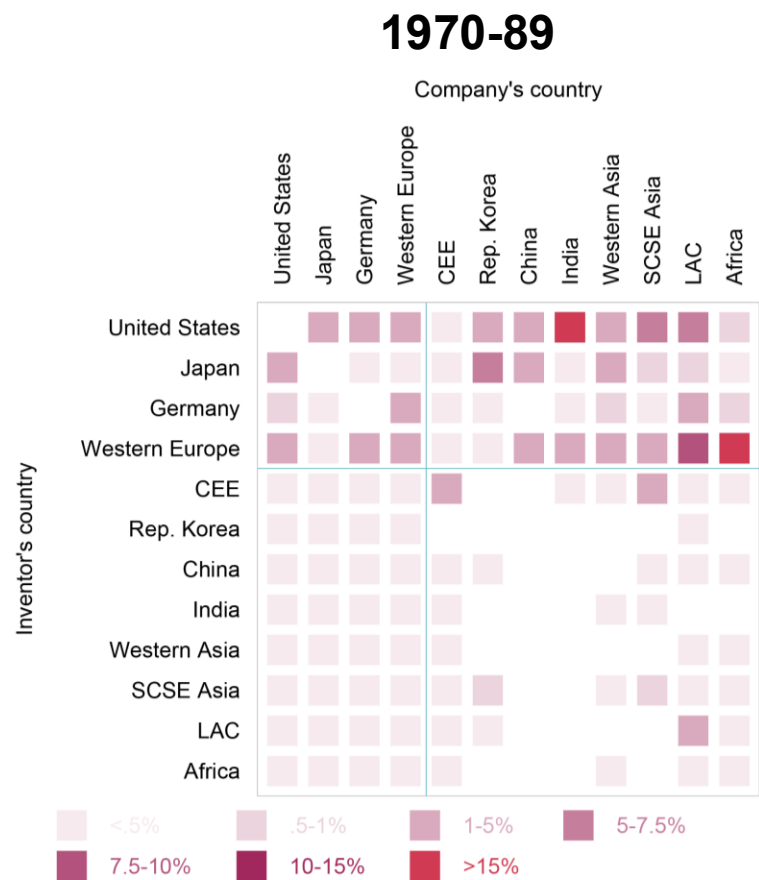
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# Multinational companies are at the heart of global innovation networks.

## International patent sourcing

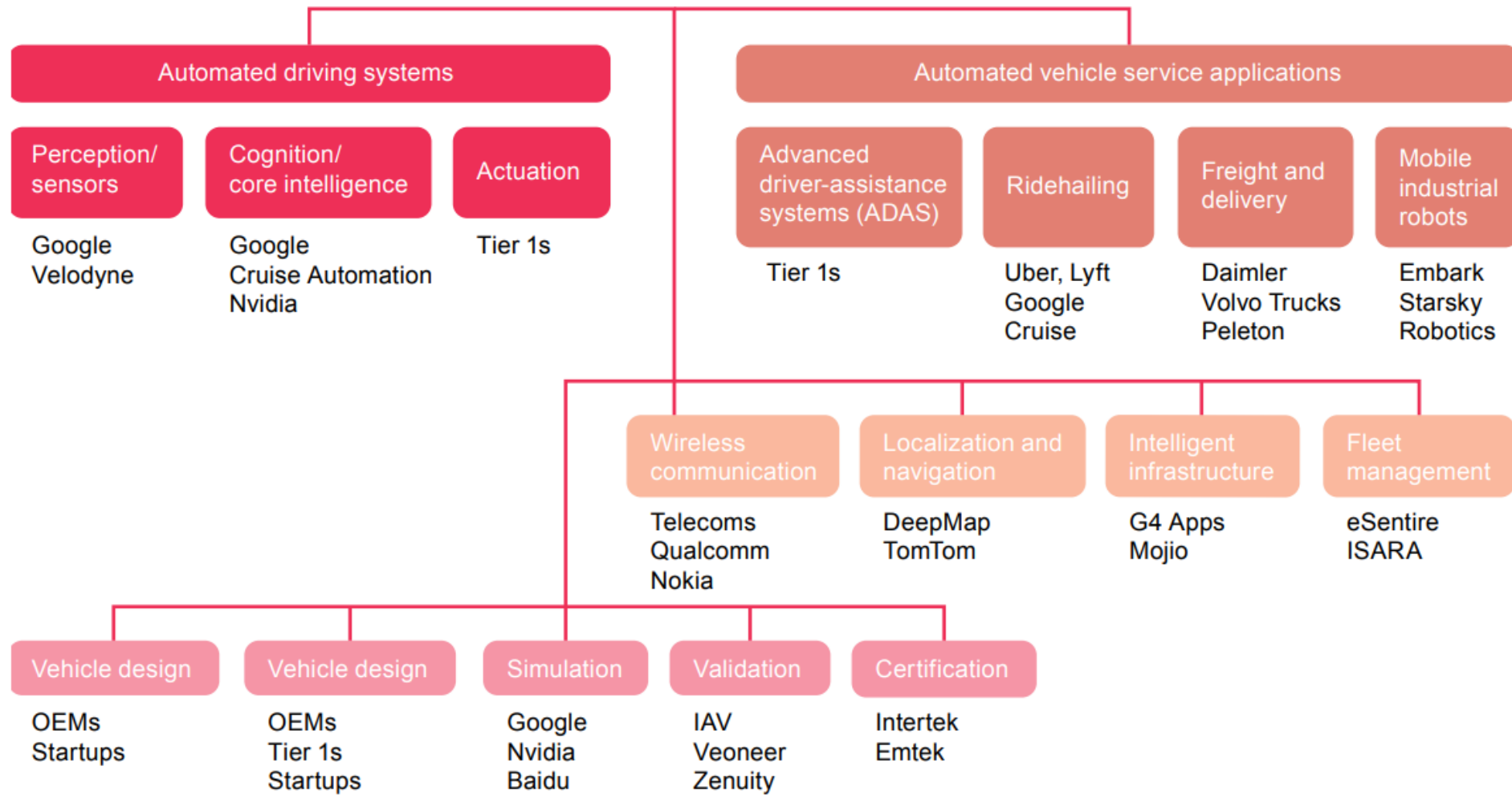
<b>(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)</b>		
<b>(19) World Intellectual Property Organization</b> International Bureau		
<b>(43) International Publication Date</b> 2 April 2015 (02.04.2015)	<b>WIPO   PCT</b>	<b>(10) International Publication Number</b> <b>WO 2015/047123 A1</b>
<b>(51) International Patent Classification:</b> <i>H02H 3/04</i> (2006.01) <i>H01H 47/00</i> (2006.01) <i>G01R 31/327</i> (2006.01) <i>H02H 3/05</i> (2006.01) <i>G05B 23/02</i> (2006.01) <i>H02H 1/00</i> (2006.01)		<b>(81) Designated States</b> ( <i>unless otherwise indicated, for every kind of national protection available</i> ): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
<b>(21) International Application Number:</b> PCT/RU2013/000836		<b>(84) Designated States</b> ( <i>unless otherwise indicated, for every kind of regional protection available</i> ): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).
<b>(22) International Filing Date:</b> 25 September 2013 (25.09.2013)		<b>Published:</b> — <i>with international search report (Art. 21(3))</i>
<b>(25) Filing Language:</b> English		
<b>(26) Publication Language:</b> English		
<b>(71) Applicant:</b> SIEMENS AKTIENGESELLSCHAFT [DE/DE]; Wittelsbacherplatz 2, 80333 Muenchen (DE).		
<b>(72) Inventors:</b> DORRER, Johann; Diendorfer Str. 18, 92431 Neunburg v. Wald (DE). PARFENOV, Stanislav Sergeevich; Lunacharskogo pr. 19-1-340, St. Petersburg, 194354 (RU). VINOGRADOV, Sergey Valerievich; Rimskogo-Korsakova str., St. Petersburg, 190121 (RU). NIKOLAEV, Maxim Alexandrovich; Savushkina str. 131-64, St. Petersburg, 197374 (RU).		
<b>(74) Agents:</b> LAW FIRM "GORODISSKY & PARTNERS " LTD, et al.; Mitko Alexander Vladimirovich, B. Spasskaya		

# # 5 More international sources of patents, but concentrated



## Mapping the involvement of AV companies

Figure 3.7 Examples of companies working in various AV technologies

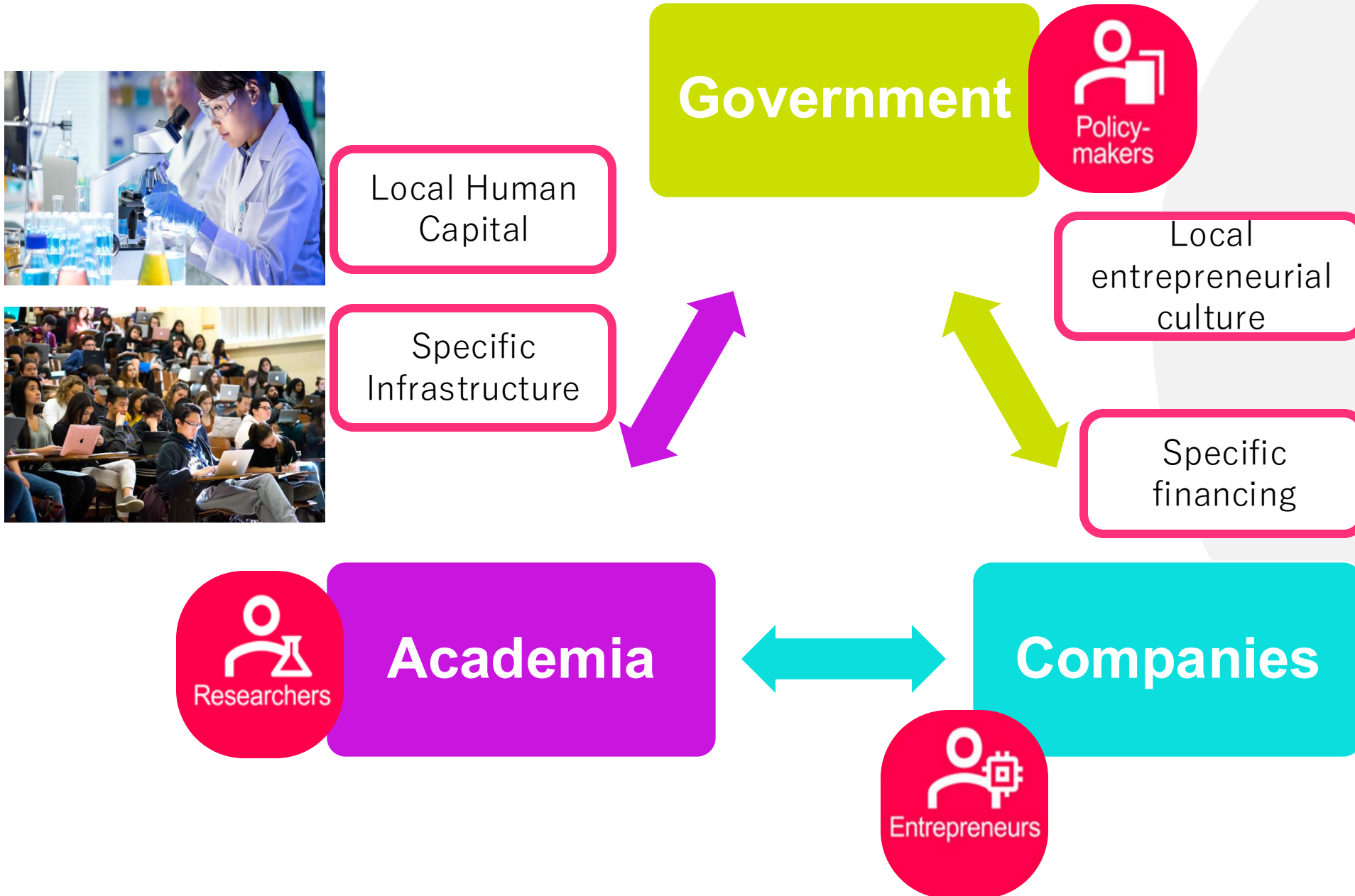


Source: Center for Automotive Research (CAR).

**Table 3.1 Comparison of the total share of patents with the AV patents of selected automakers in different clusters**

Cluster name	Total share (%)	AV share (%)	Cluster name	Total share (%)	AV share (%)
<b>Audi</b>			<b>GM</b>		
Ingolstadt	60.1	60	Detroit–Ann Arbor	45.3	54.7
Munich	10.7	18.8	Waterford	5.1	11.3
Frankfurt	3.9	6.2	Los Angeles	4.5	8.5
San Jose–San Francisco	0.4	6.2	Frankfurt	16.6	7.5
<b>BMW</b>			<b>Honda</b>		
Munich	72.5	84.1	Tokyo	90.8	82.3
Nürnberg	1.3	6.1	Los Angeles	0.2	3.7
Würzburg	0.4	3.7	Osaka	2.6	2.4
San Jose–San Francisco	0.4	3.7	Nagoya	3.1	1.8
<b>Bosch</b>			<b>Nissan</b>		
Stuttgart	69.1	77.6	Tokyo	97.0	87.7
Munich	2.6	5.0	Osaka	1.5	8.6
San Jose–San Francisco	1.0	4.6	San Jose–San Francisco	0.0	3.1
Braunschweig	0.5	4.1	Nagoya	1.2	2.5

# Sub National innovation ecosystems



# Sub-national Innovation Ecosystem Assessment Metrics

- Participation in **scientific activities** reveals a region's capacity for **knowledge generation**.
- **Technological activities** demonstrate a region's potential for **transformative innovation**.
- **Entrepreneurial dynamism** and the sophistication of local markets are manifested through business activities, evidenced by **trademark registration**.
- The development of **industrial designs** reflects both the **creative capacity** and the potential for competitive differentiation that distinguishes each region in the global economic context.

# Sub-national Innovation Ecosystem Assessment Metrics

- Technological territorial capacity
- *Scientific publications from at least one institution in region x of the country*

**Scientific activity**

- Territorial Creative Capacity
- *Industrial design applications submitted by at least one applicant from each country and region*

**Design activities**

- Territorial entrepreneurial capacity
- *Trademark applications filed by an applicant from the country and, by region x*

**Entrepreneurial activities**

- Territorial innovation capacity
- *Patent applications filed by at least one inventor or applicant from country x and region x, both within and outside the country.*

**Technological activities**

# Geocoding is the Google Maps of innovation.

## (12) International Application Status Report

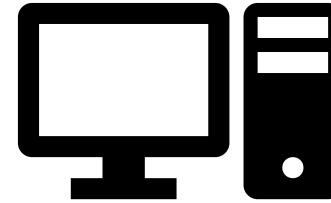
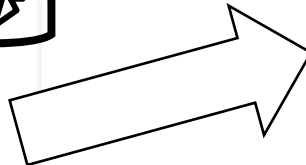
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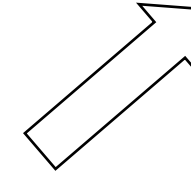
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**Statistics package**

- Text cleanup
- Information standardization

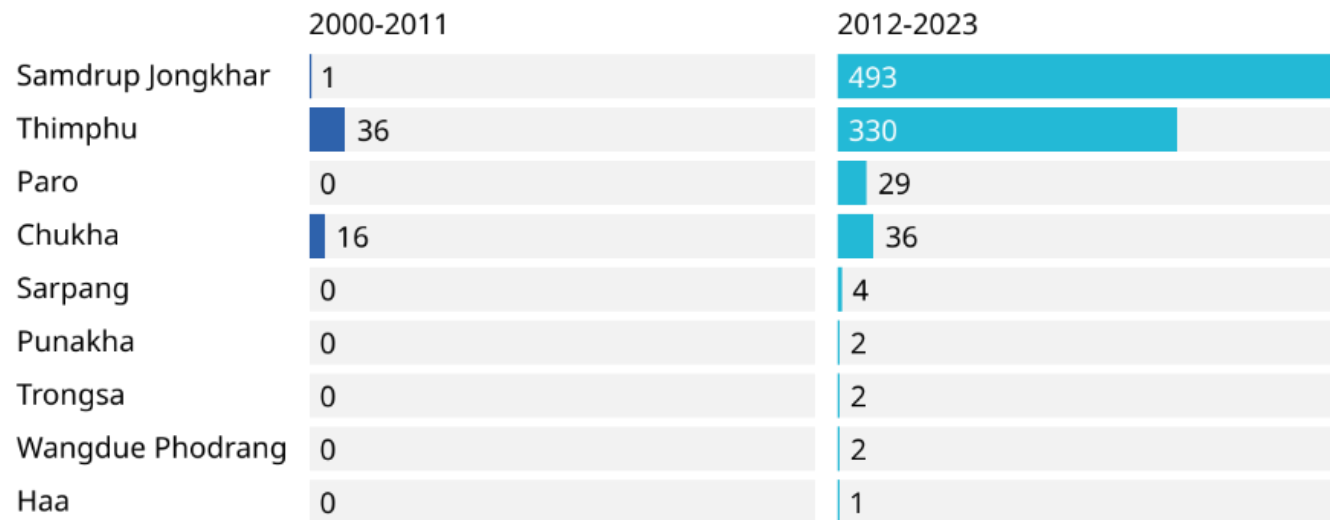


**Position  
(GPScoordinates)**

# Innovation ecosystem of Bhutan

**Figure 13. Samdrup Jongkhar and Thimphu concentrate most of the entrepreneurial activity**

Trademark applications per region



Source: IPAS, DoMCIIP and WIPO collection

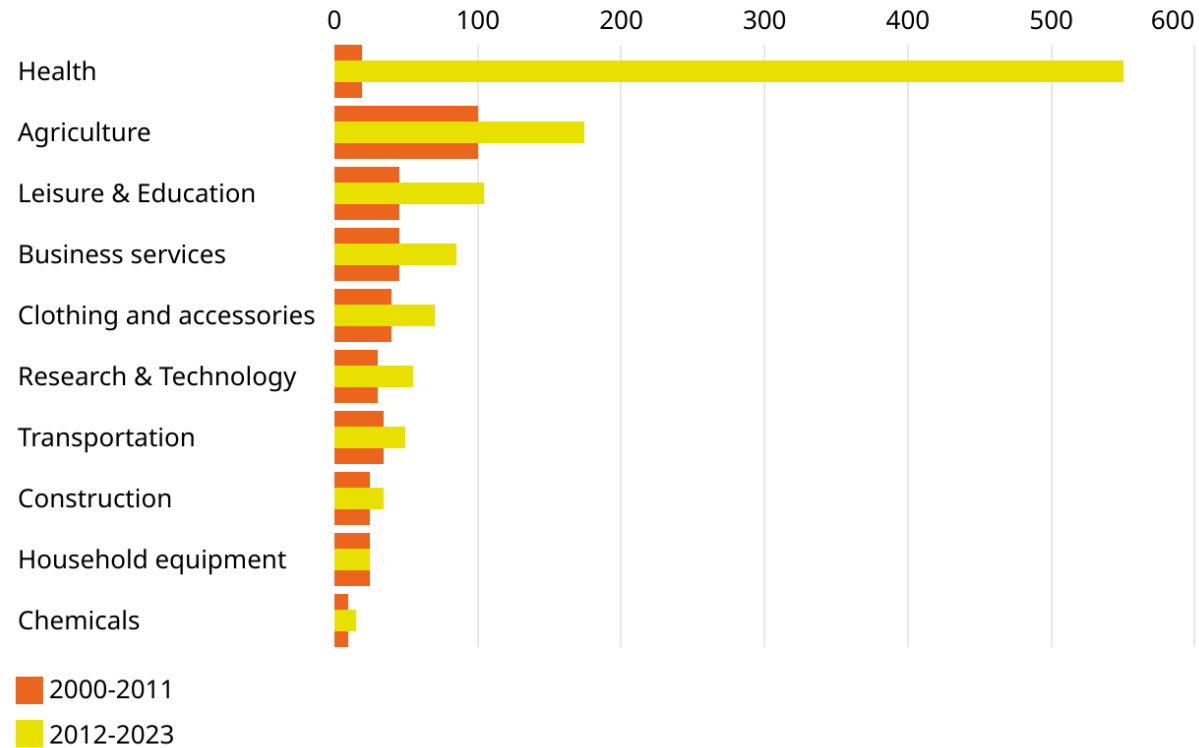
With geocoding we can perform analysis at the sub-national level.

Where is most of the Bhutanese entrepreneurial activity concentrated?

# Innovation ecosystems of Bhutan (2)

## National

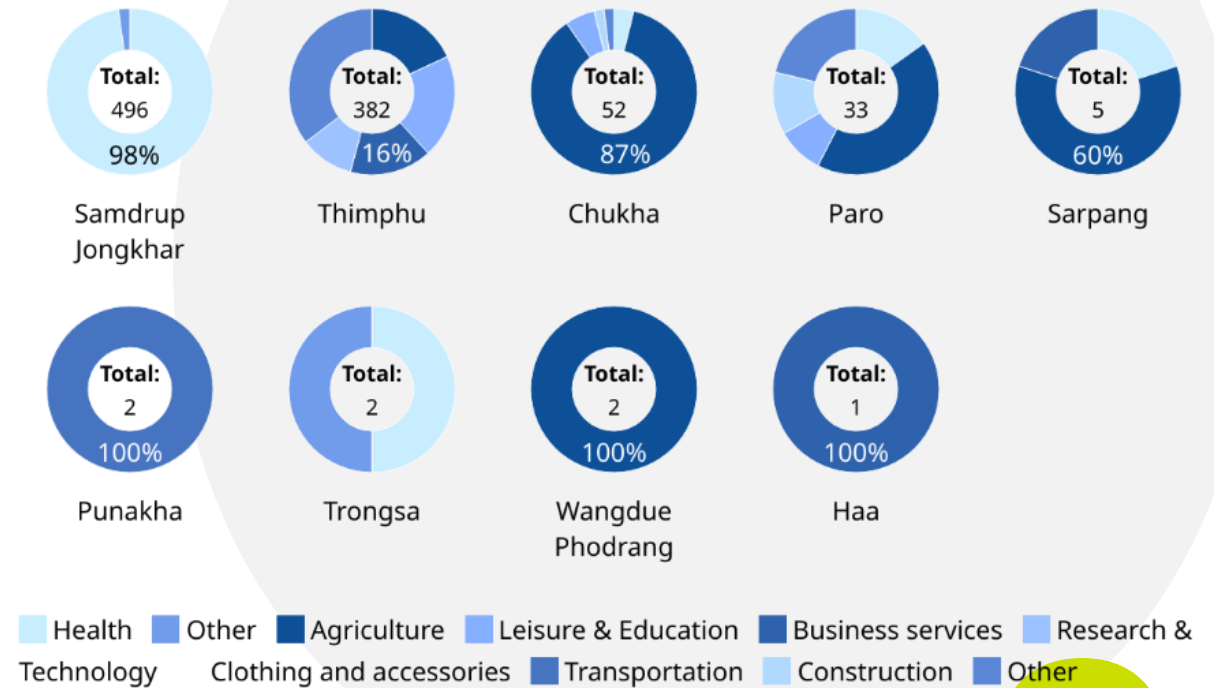
### Trademark applications by field



## Sub-national

### Figure 14. Thimphu displays an equilibrated profile

Trademark application share per sector per region



Source: IPAS, DoMCIIP and WIPO collection

# Thank you!

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