WIPO

Module 1: Intellectual Property Systems

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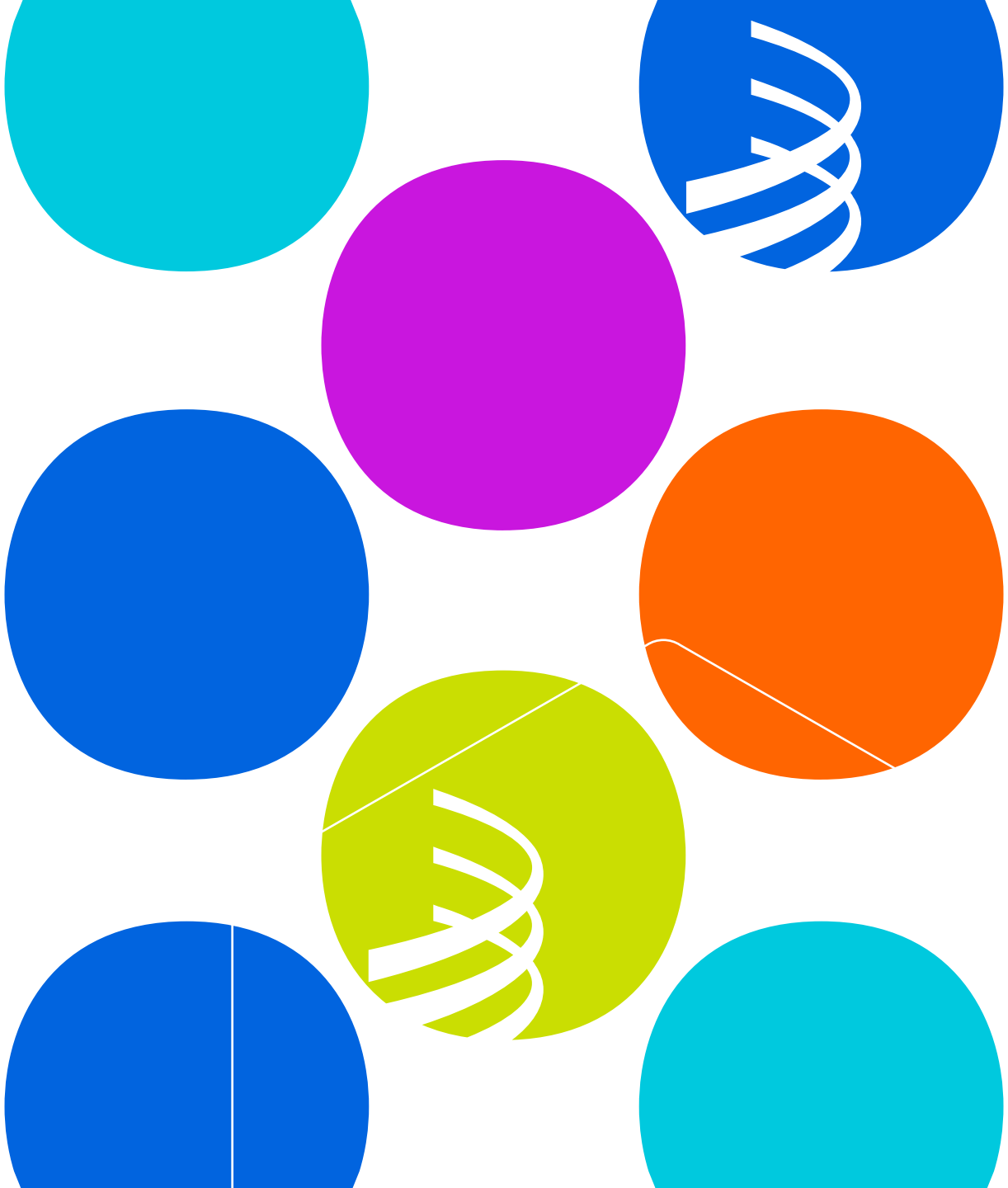
Innovation Economy Section - WIPO



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.**

What is intellectual property? https://www.wipo.int/publications/en/details.jsp?id=4528

...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

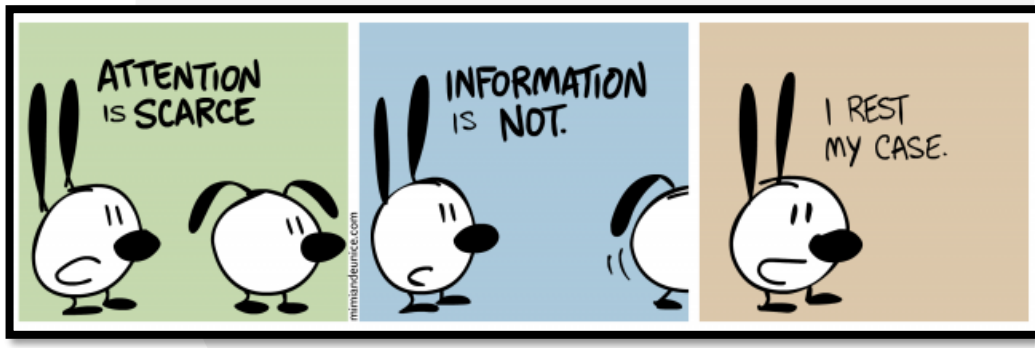
- To avoid wasting resources on problem-solving, firms in competitive markets will pass up opportunities for invention due to the risk of failure.
- If competitors can immediately copy the successful solution (free ride), the inventive firm will receive less financial reward.

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.

Types and categories of intellectual property

IP right	Subject matter	Acquisition of right	Nature of right: prevent others from…
Patents and utility models	Inventions that are new, non-obvious and industrially applicable	Granted by government authority, typically following substantive examination	… making, using, selling, offering for sale or importing
Industrial designs	Industrial designs that are new and/or original	Granted by government authority upon registration, with or without substantive examination	… making, selling or importing
Copyright	Creative expressions	Automatically, upon creation	… reproducing and related acts
Plant variety rights	Plant varieties that are new, distinct, uniform and stable	Granted by government authority following substantive examination	… using and multiplying propagating materials
Trade secrets	Any valuable confidential business information	Automatically, upon creation	… unlawfully disclosing

Note: This table offers an intuitive overview of the main forms of IP and, only incompletely, describes the legal character of these rights, as established through national laws and international treaties. For a detailed legal introduction, see Abbott *et al*. (2007). Trademarks are not included here, as explained in the text.

WIPO

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

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

Fuente: WIPR 2013

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").

Basic concepts for the statistical analysis of intellectual property (IP) systems

Content

- Inventors vs. Applicants
- Residents vs. Non-Residents
- Counting by sector
- Application Counting Features
- Common Problems

Inventors vs. Applicants

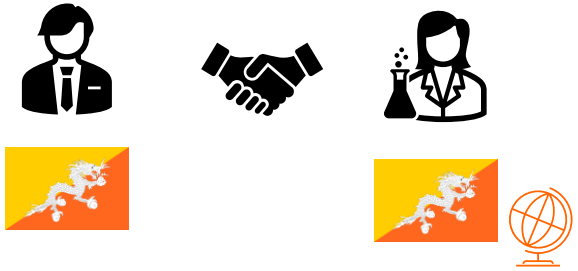
Inventors

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

Applicants

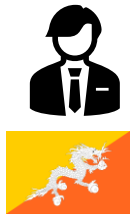
- Legal entities seeking patent protection
- Typically corporations, universities, or research institutions
- Own intellectual property rights
- Control marketing decisions

What is a resident IP application?



Patents and UM: National applicant working with national or foreign inventors

Industrial designs: National applicant working with national or foreign designers

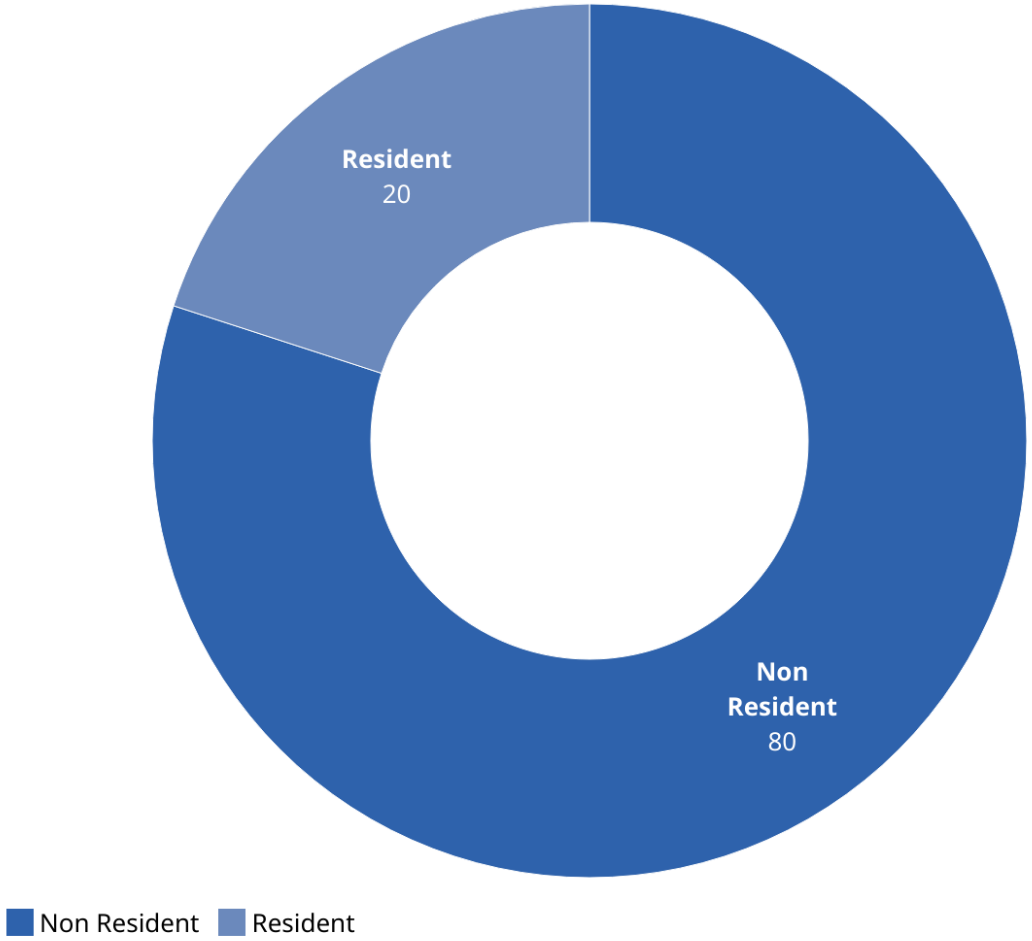


Trademarks: National Applicant

Scientific publications:
At least one National Author

Figure 2. Patents filed in Bhutan are mostly from non-residents

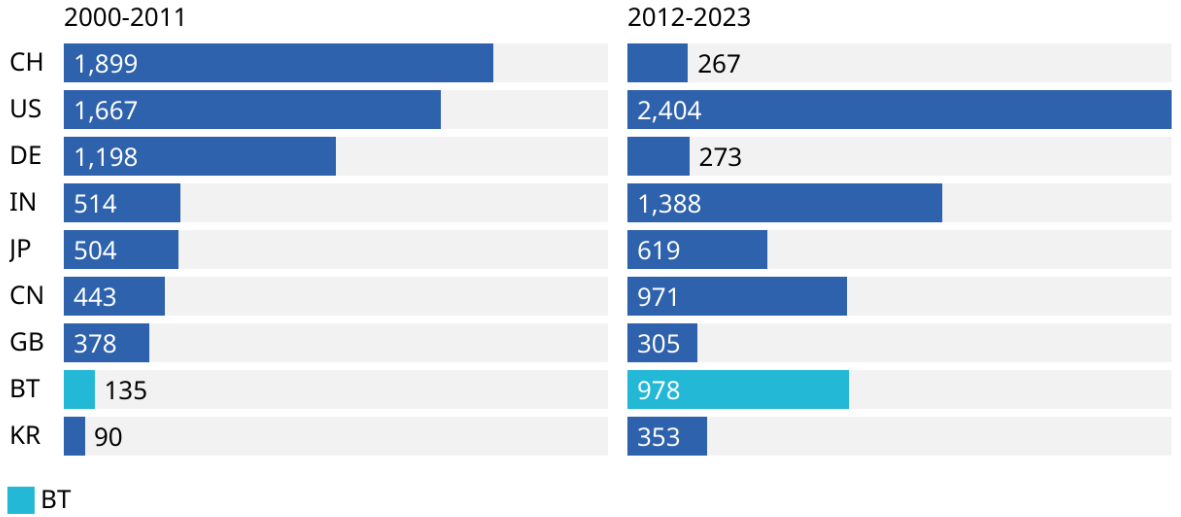
Patent applications count per applicants' country of residence, 2012 - 2023



Source: IPAS and DoMCIIP

Figure 7. USA is leading applications while China is retracting from Bhutan

Trademarks applications count per applicant's residency



Source: IPAS and DoMCIIP

Sectorial categories based on classifications

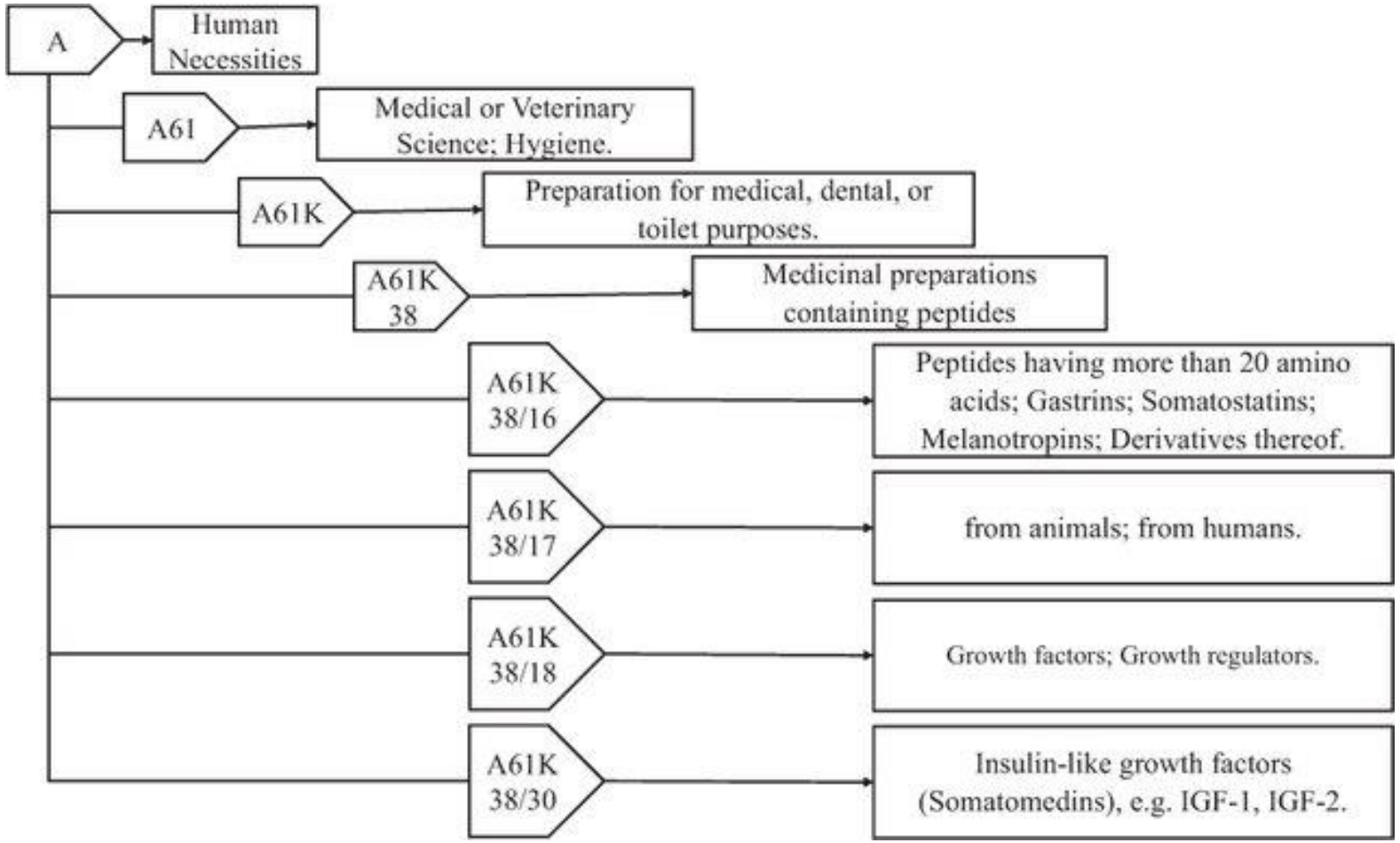
Using technology categories to track innovation

- 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

- **OpenAlex classifications**:
  - 19 broad fields (Level 0)
  - ~300 narrow fields (Level 1)
  - ~1,500 detailed fields (Level 2)
  - ~65,000 topics (Level 3, most granular)
- **IPC classes**: 8 sections, ~120 classes, >600 subclasses.
- **Nice classes**: 9 Edital sector, 45 classes (34 goods, 11 services).
- **Locarno classes**: 9 Edital sector, 32 classes (designs), ~220 subclasses.

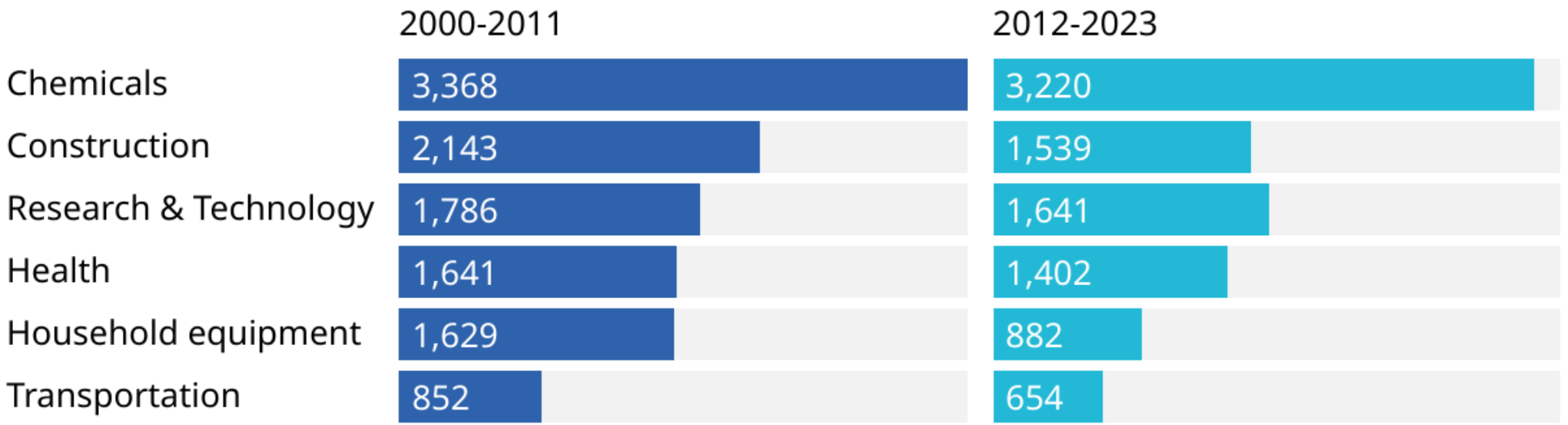
Sectorial categories based on classifications



DOI: 10.1007/s12020-022-03063-2

Figure 6.Trademark applications in Bhutan show consistent decline across all sectors with Health remaining the dominant category

Trademarks applications count per sector



Source: IPAS and DoMCIIP

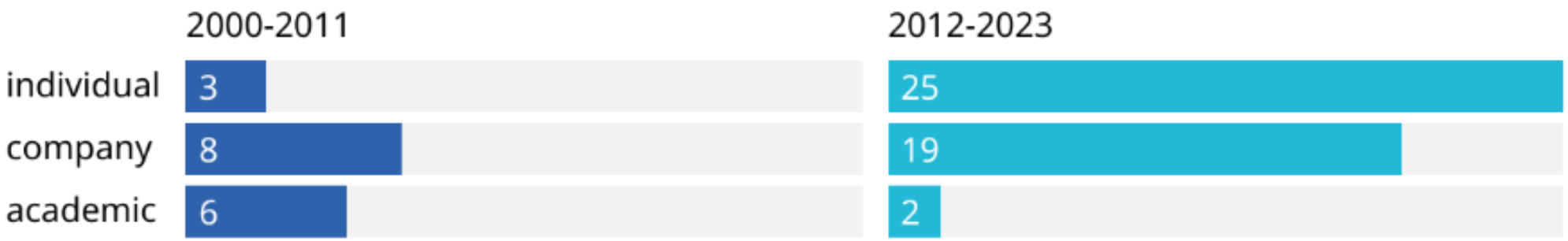
Type of applicants

Why distinguish applicant types?

- Universities, companies, and individuals pursue innovation with different goals.
- Their resources, incentives, and constraints are not the same.
- A single policy will affect each group differently.
- Tailored measures are needed to maximize overall innovation output.

Figure 6. Most patents are applied by individual inventors

Patent applications count per applicant type



Source: IPAS, DoMCIIP and WIPO collection

By geographical location

- From an addresses, obtain location (latitude, longitude), city, and province.
- Location can be used to identify clusters.
- For a regional analysis, province is sufficient.
- Allows us to compare region specificities:

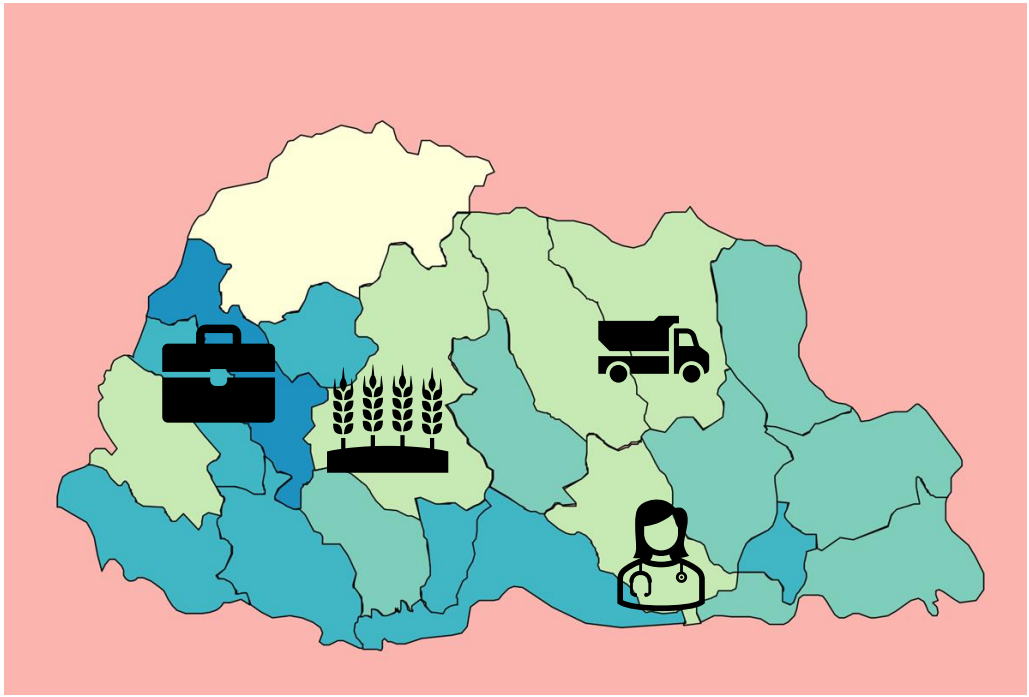
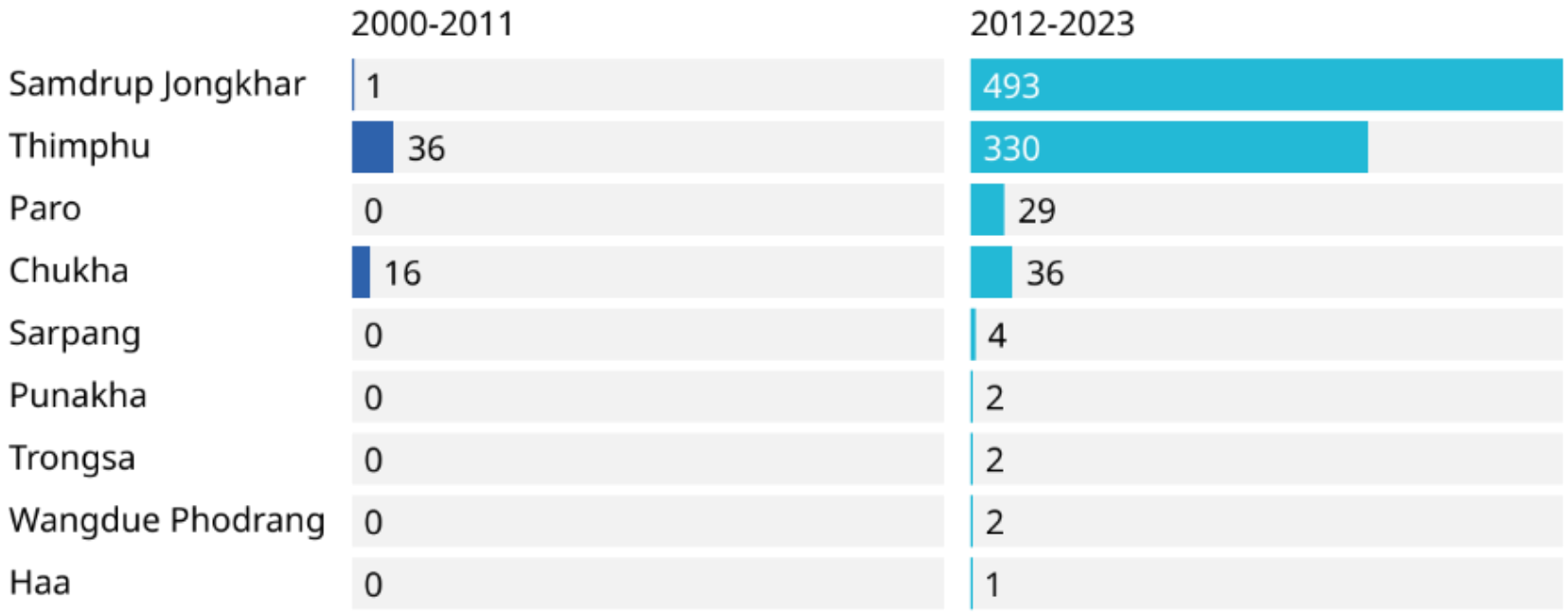


Figure 13. Samdrup Jongkhar and Timphu concentrate most of the entrepreneurial activity

Trademark applications per region



Source: IPAS, DoMCIIP and WIPO collection

Counting applications

- Absolute
- Unique
- First
- Fractional

Counting applications

- Absolute

- Counts all occurrences without distinction.
- Useful to measure raw volume and intensity of participation, even if some actors appear repeatedly.

- Unique

- Counts only once per list, regardless of repetitions.
- Highlights the spread or presence of an actor across multiple sets rather than its internal weight.

- First

- Keeps only the first element in each list.
- Relevant to analyze leadership as first applicants or authors may be team leader, manager or director.

- Fractional

- Weights contributions according to the size of each list.
- Provides a balanced measure when sets vary greatly in length, avoiding bias from long lists.

Counting applications-**Absolute**

- Patent A: ["FR", "DE", "FR", "IT"]
- Patent B: ["US", "FR", "ES"]
- Patent C: ["JP", "US", "US", "DE"]

FR = 2 (in A) + 1 (in B) = **3**

DE = 1 (in A) + 1 (in C) = **2**

IT = 1 (in A) = **1**

US = 1 (in B) + 2 (in C) = **3**

ES = 1 (in B) = **1**

JP = 1 (in C) = **1**

→ Every repetition is counted, so FR and US stand out.

Counting applications-**Unique**

- Patent A: ["FR", "DE", "FR", "IT"]
- Patent B: ["US", "FR", "ES"]
- Patent C: ["JP", "US", "US", "DE"]

FR = 1 (A) + 1 (B) = **2**

DE = 1 (A) + 1 (C) = **2**

IT = 1 (A) = **1**

US = 1 (B) + 1 (C) = **2**

ES = 1 (B) = **1**

JP = 1 (C) = **1**

→ Each country counts once per list, rewarding presence across lists.

Counting applications - **Fractional**

- Patent A: ["FR", "DE", "FR", "IT"]
- Patent B: ["US", "FR", "ES"]
- Patent C: ["JP", "US", "US", "DE"]

→ Normalizes contributions so patent with more inventors don't dominate.

Patent A (4 items): FR = 2/4 = 0.5, DE = 1/4 = 0.25, IT = 1/4 = 0.25

Patent B (3 items): US = 1/3 ≈ 0.33, FR = 1/3 ≈ 0.33, ES = 1/3 ≈ 0.33

Patent C (4 items): JP = 1/4 = 0.25, US = 2/4 = 0.5, DE = 1/4 = 0.25

→FR = 2/4 (A) + 1/3 (B) + 0 (C) = 0.5 + 0.33 = **0.83**

→US = 0.33 (B) + 0.5 (C) = **0.83**

→DE = 0.25 (A) + 0.25 (C) = **0.50**

→IT = 0.25 (A) = **0.25**

→ES = 0.33 (B) = **0.33**

→JP = 0.25 (C) = **0.25**

Counting applications - **First**

- Patent A: ["FR", "DE", "FR", "IT"]
- Patent B: ["US", "FR", "ES"]
- Patent C: ["JP", "US", "US", "DE"]

FR = 1 (first in A) = **1**

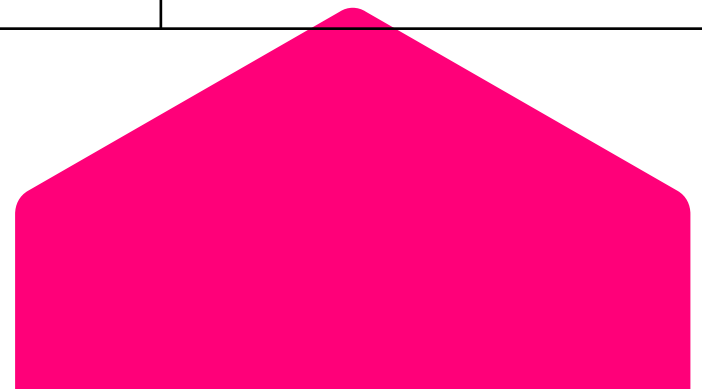
US = 1 (first in B) = **1**

JP = 1 (first in C) = **1**

→ Only first positions are counted, showing who leads inventor teams.

Counting applications

Method	What does it do	Pros	Cons
Absolute	Count every occurrence	Captures overall volume and intensity	Emphasize repetitions within the same list
Unique	Count only once per list	Highlights the variety	Ignore the intensity within each list
First	Consider only the first element of each list	Identifies leaders or initiators	Discards useful information about secondary participants
Fractional	Weighs the contribution by list length	Balanced measure in lists of different sizes	More complex to calculate and less intuitive to interpret



Counting applications

Absolute (count all occurrences)	**Unique** (count once per list)	**First** (count only first element)	**Fractional** (1 ÷ list length)
FR – 3 (2 in A + 1 in B)	FR – 2 (A, B)	JP – 1 (first in C)	FR – 0.83 (0.5 in A + 0.33 in B)
US – 3 (1 in B + 2 in C)	US – 2 (B, C)	FR – 1 (first in A)	US – 0.83 (0.33 in B + 0.5 in C)
DE – 2 (1 in A + 1 in C)	DE – 2 (A, C)	US – 1 (first in B)	DE – 0.50 (0.25 in A + 0.25 in C)
IT – 1 (A)	IT – 1 (A)	0	ES – 0.33 (0.33 in B)
ES – 1 (B)	ES – 1 (B)	0	IT – 0.25 (0.25 in A)
JP – 1 (C)	JP – 1 (C)	0	JP – 0.25 (0.25 in C)

Common problems:

- High volatility: Data fluctuates drastically from one period to the next
- Insufficient data: Limited sample size makes trends unclear
- Noise vs. signal: It is difficult to distinguish real patterns from random variations
- **Impact on analysis:**
  - Unreliable forecasting
  - Misleading trend identification
  - Poor decision-making basis
- **Solution:**
  - **Smooth and aggregate data to reveal underlying patterns**

Solution?

1. **Grouping data by periods**

- **Method**: Combine shorter periods into longer periods
- **Example**: Monthly data → quarterly data → annual data
- **Benefits:**

➢ Reduces noise and outliers

➢ Reveals long-term trends

➢ Increases sample reliability

Solutions?

2. Moving average (3-5 years)

- **Method:** Calculate the average of consecutive periods
- **Formula**: $\frac{(Year_1 + Year_2 + Year_3)}{3}$

Benefits:

- Smooths out volatility
- Maintains data timelines
- Easy to interpret and communicate

Patent application by field (2012 - 2023)

Patent applications in Bhutan are concentrated in chemistry technologies.

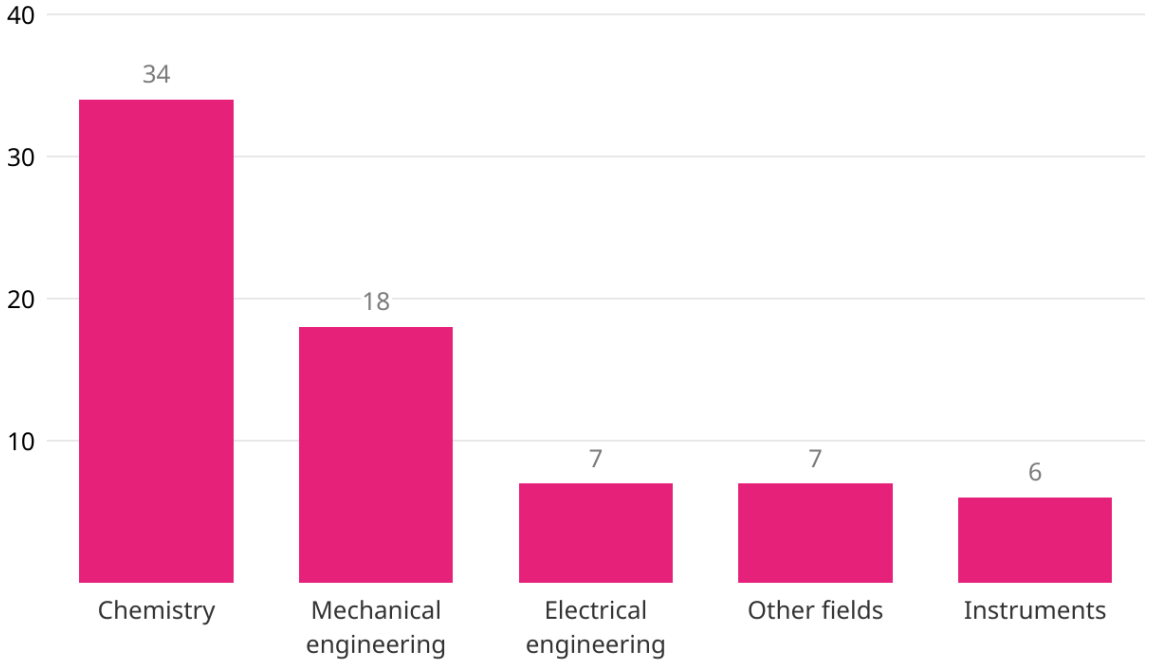
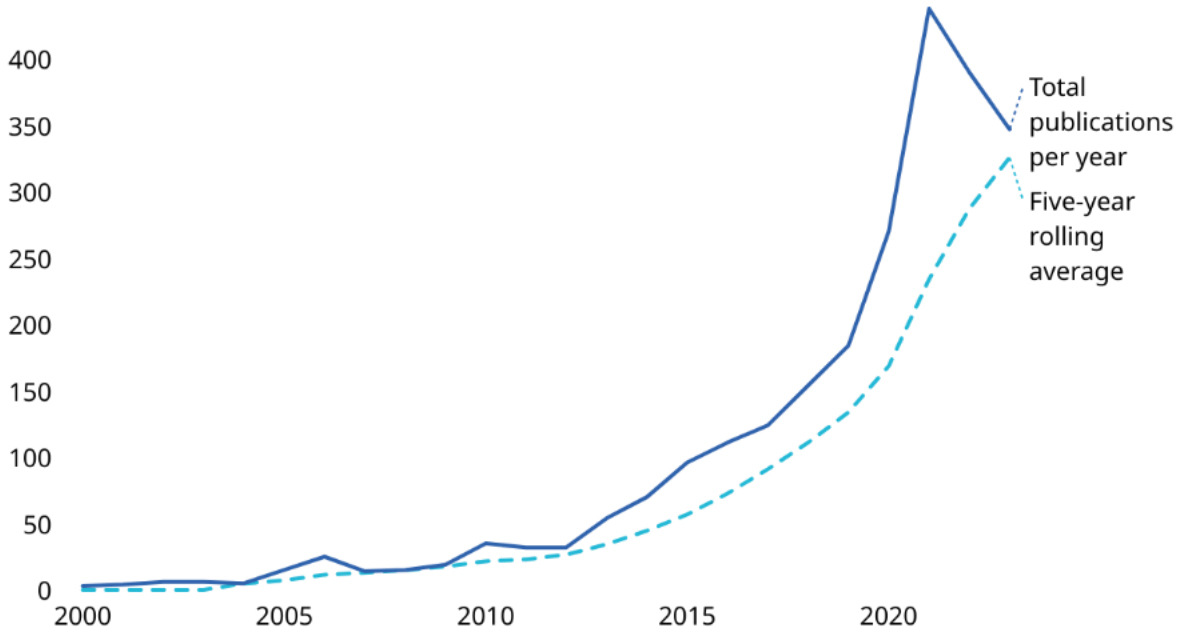


Figure1. A constant growth of scientific production in Bhutan

Scientific publications count per publication year



Source: OpenAlex

Other indicators

IP Granted

- Patents, utility models, industrial designs: quality indicators
- All: registration process indicator

Monitoring pending time

- Analyzing the time between application and publication:
- This can be monitored by technology type to anticipate the need for specialized examiners.
- This leads to faster dissemination of knowledge,
- improving the benefits of IP for users (companies, inventors).

Reference materials

- World Intellectual Property Report 2011
  https://www.wipo.int/publications/en/details.jsp?id=227
-
- Understanding Industrial Property
  https://www.wipo.int/publications/en/details.jsp?id=4080
- What is intellectual property?
  https://www.wipo.int/publications/en/details.jsp?id=4528

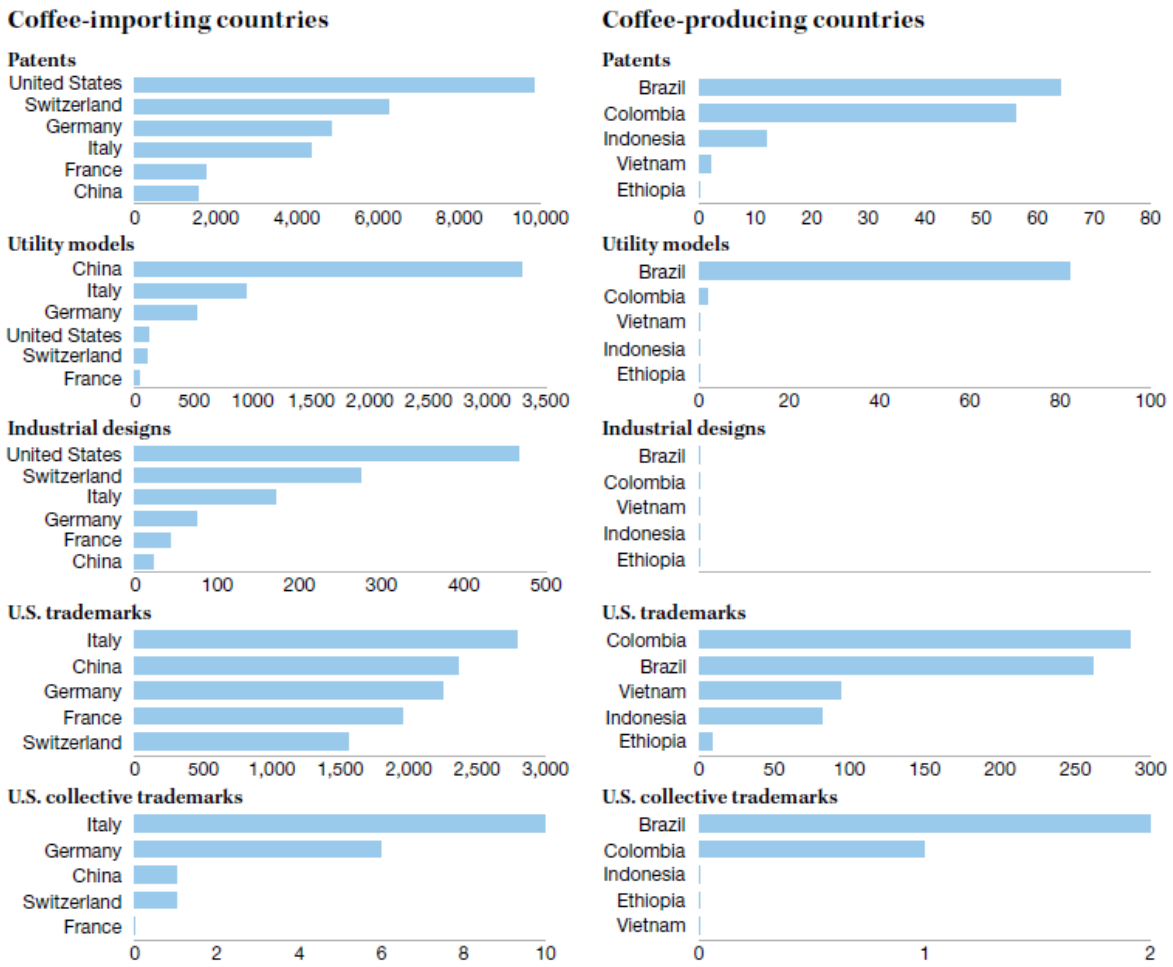
Thank you!

Photo credits:

Figure 2.4

Participants in importing countries own most of the IP related to coffee

Totals of different IP rights owned by participants based in the top coffee-importing countries versus equivalent rights owned in coffee-importing countries and China, 1995-2015



Source: WIPO based on PATSTAT and USPTO; see technical notes.

Note: Data on patents, industrial designs and utility models come from the PATSTAT database, while data on trademarks come from the USPTO (see note 36).

Outline indicators

1. Counting applications
    i. What to do when you have few year data points?
2. Origin
    1. ~~Residents vs non-residents / Inventors vs.~~ **~~Applicants~~**
    2. What to do when you have too many countries? (aggregate by region vs. top 10 + ROW)
3. Industries, technological fields, etc.
    1. ~~Absolute vs fractional count~~
    2. (aggregate fields vs. top 10 + Other)
4. Other Indicators
    1. Direct filings vs subsequent filings (IP families)
    2. ~~Type of applicant~~
    3. Registration (grant) counts
    4. Pendency
    5. Citations: Backwards vs. Forward

Counting applications

Mode	What it does	Strengths	Limitations
Absolute	Counts every single occurrence	Captures overall volume and intensity	Can overemphasize actors repeated within the same list
Unique	Counts once per list, regardless of repeats	Highlights spread and presence across multiple contexts	Ignores intensity within each list
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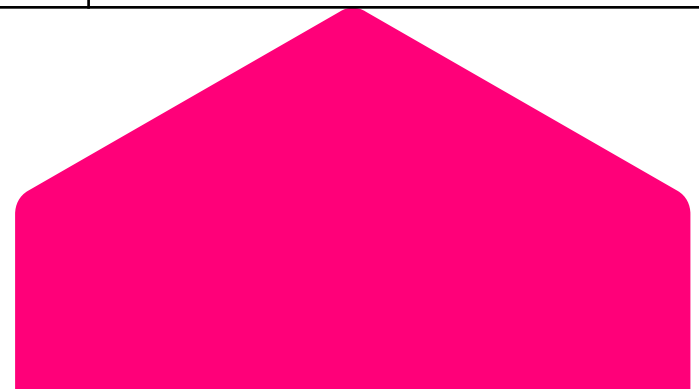

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→IT = 0.25 (A) = **0.25**

→ES = 0.33 (B) = **0.33**

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.

Counting applications - **First**

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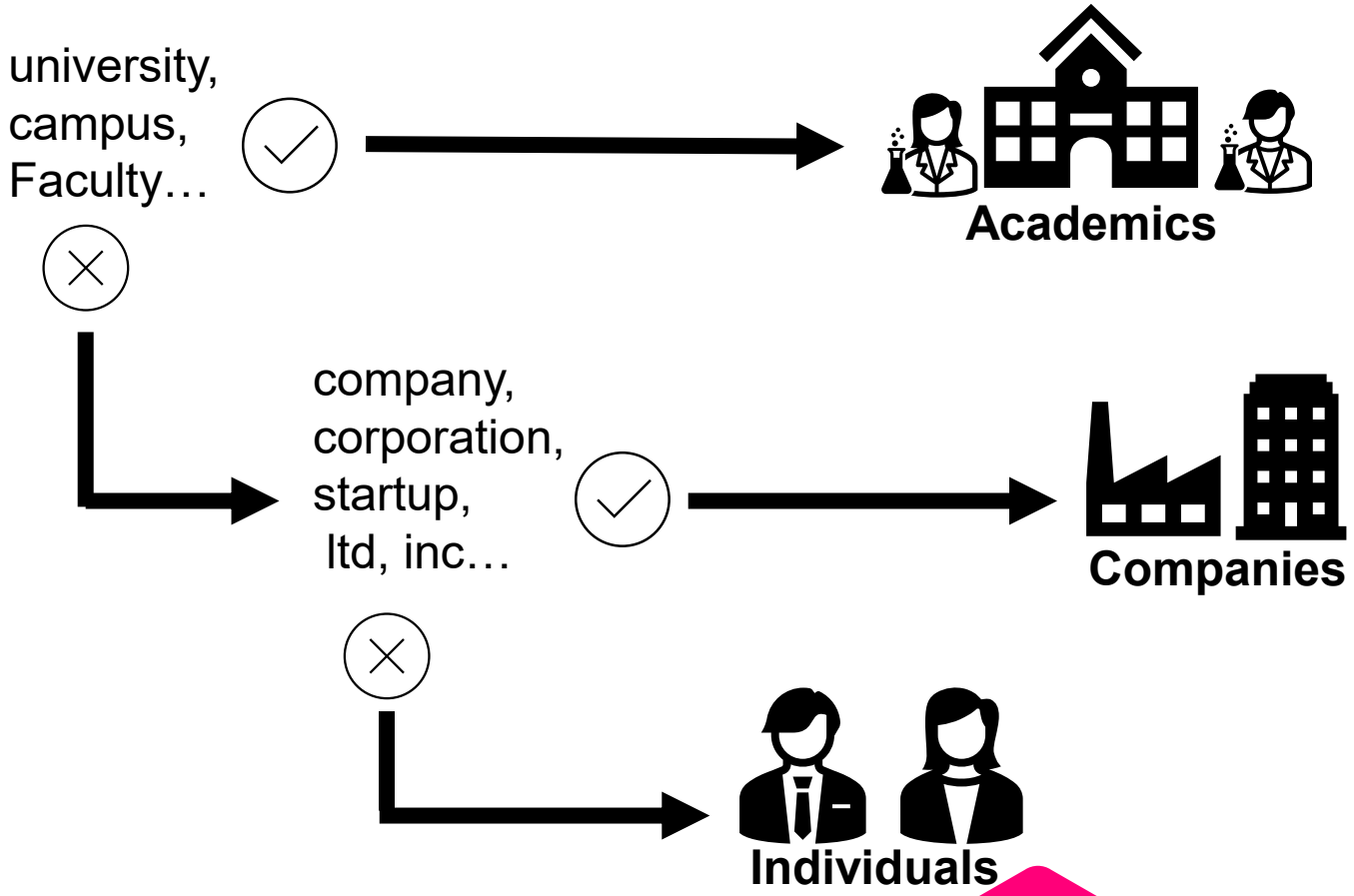
US – 3 (1 in B + 2 in C)	US – 2 (B, C)	FR – 1 (first in A)	US – 0.83 (0.33 in B + 0.5 in C)
DE – 2 (1 in A + 1 in C)	DE – 2 (A, C)	US – 1 (first in B)	DE – 0.50 (0.25 in A + 0.25 in C)
IT – 1 (A)	IT – 1 (A)	–	ES – 0.33 (0.33 in B)
ES – 1 (B)	ES – 1 (B)	–	IT – 0.25 (0.25 in A)
JP – 1 (C)	JP – 1 (C)	–	JP – 0.25 (0.25 in C)

Indicators based on Categories

- Resident applications
- Sectorial categories based on classifications
- Type of applicant or author’s institution (Academics, Company, Individuals)
- Gender of applicants / inventors / scientist / designers

Type of applicants

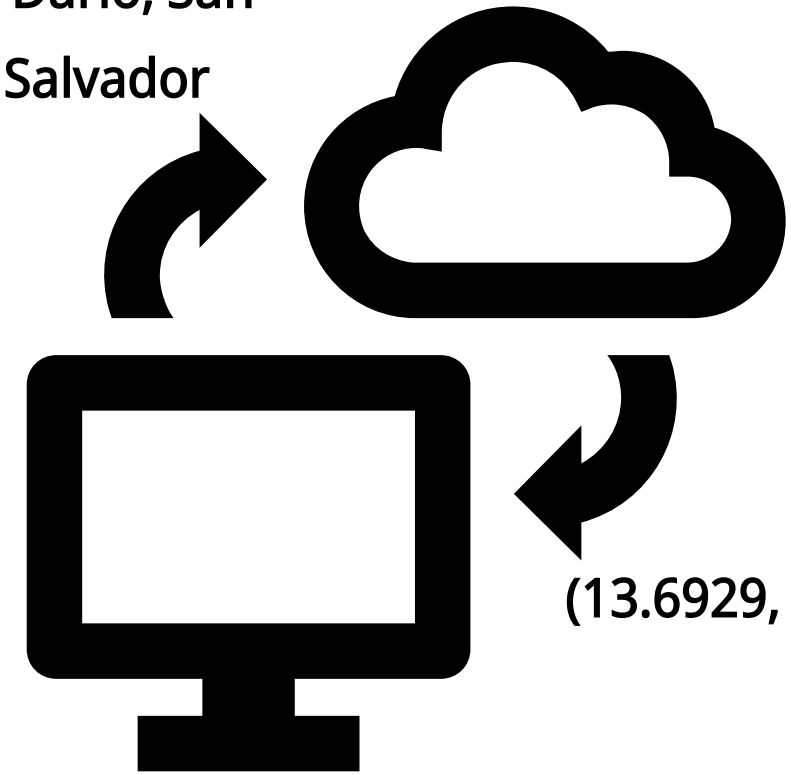
Based on keyword in names:



Geocoding addresses

Methode1: API

Calle Rubén Darío, San Salvador, El Salvador



(13.6929, -89.2182)

Pros +:

- Simple, automated

Cons - :

- Expensive (Google) and Long (2s/addresses)
- Partial Coverage
- Non adaptable

de Rassenfosse, G., Kozak, J. & Seliger, F. Geocoding of worldwide patent data. Sci Data 6, 260 (2019). https://doi.org/10.1038/s41597-019-0264-6

Geocoding addresses

Method 2: Name Matching

Calle Rubén Darío, San Salvador, El Salvador

san salvador oeste	604.0	60409.0	nejapa	6.0	san salvador	NaN	13.81472	-89.23139	SV
chalatenango centro	401.0	40124.0	san francisco morazán	4.0	chalatenango	NaN	14.18333	-89.05000	SV
sulután norte	1102.0	110216.0	san buenaventura	11.0	usulután	NaN	13.35000	-88.45000	SV
san miguel norte	1202.0	120219.0	sesori	12.0	san miguel	NaN	13.71667	-88.36667	SV
san miguel centro	1201.0	120117.0	san miguel	12.0	san miguel	NaN	13.48333	-88.18333	SV

Pros: Costless, Tailored data, Faster (30 addresses/sec)

Cons: More complex

Common Issues:

- **High Volatility**: Data fluctuates dramatically from period to period
- **Insufficient Data**: Limited sample size makes trends unclear
- **Noise vs. Signal**: Hard to distinguish real patterns from random variations

Impact on Analysis:

- Unreliable forecasting
- Misleading trend identification
- Poor decision-making basis

Solution Approach:

→ Smooth and aggregate data to reveal underlying patterns

Solution?

1. Data Grouping by Periods

Method: Combine shorter periods into longer ones

Example: Monthly → Quarterly → Annual data → Periods

Benefits:

- Reduces noise and outliers
- Reveals long-term trends
- Increases sample reliability

Solution?

2. Moving Averages (3-5 years)

Method: Calculate average of consecutive periods

Formula: $(Year_1 + Year_2 + Year_3) \div 3$

Benefits:

- Smooths volatility
- Maintains data timeline
- Easy to interpret and communicate

Monitoring pending time

Analyzing the time between application and publication:

- can be monitored by type of technology to anticipate the need of specialized examiners,
- leads to faster dissemination of knowledge,
- improve benefits of IP for users (companies, inventor).

References

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