Mapping Forest Innovation activities in Europe: factors, barriers and solutions

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EUFORE
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Aims

Provide an **overview and analysis of innovation activities** within the sector and of its **trends**, in terms of innovation frequency and state of development and type, and **factors affecting innovation development**, such as the objectives, sources of information, networks and expenditures for innovation.

Methods

- Innovation review in forestry and forest-based sector

Forest Ecology	Forest Management	Forest Products	Social Aspects of Forests and Forest Policy

- Europe

- Data collection methods

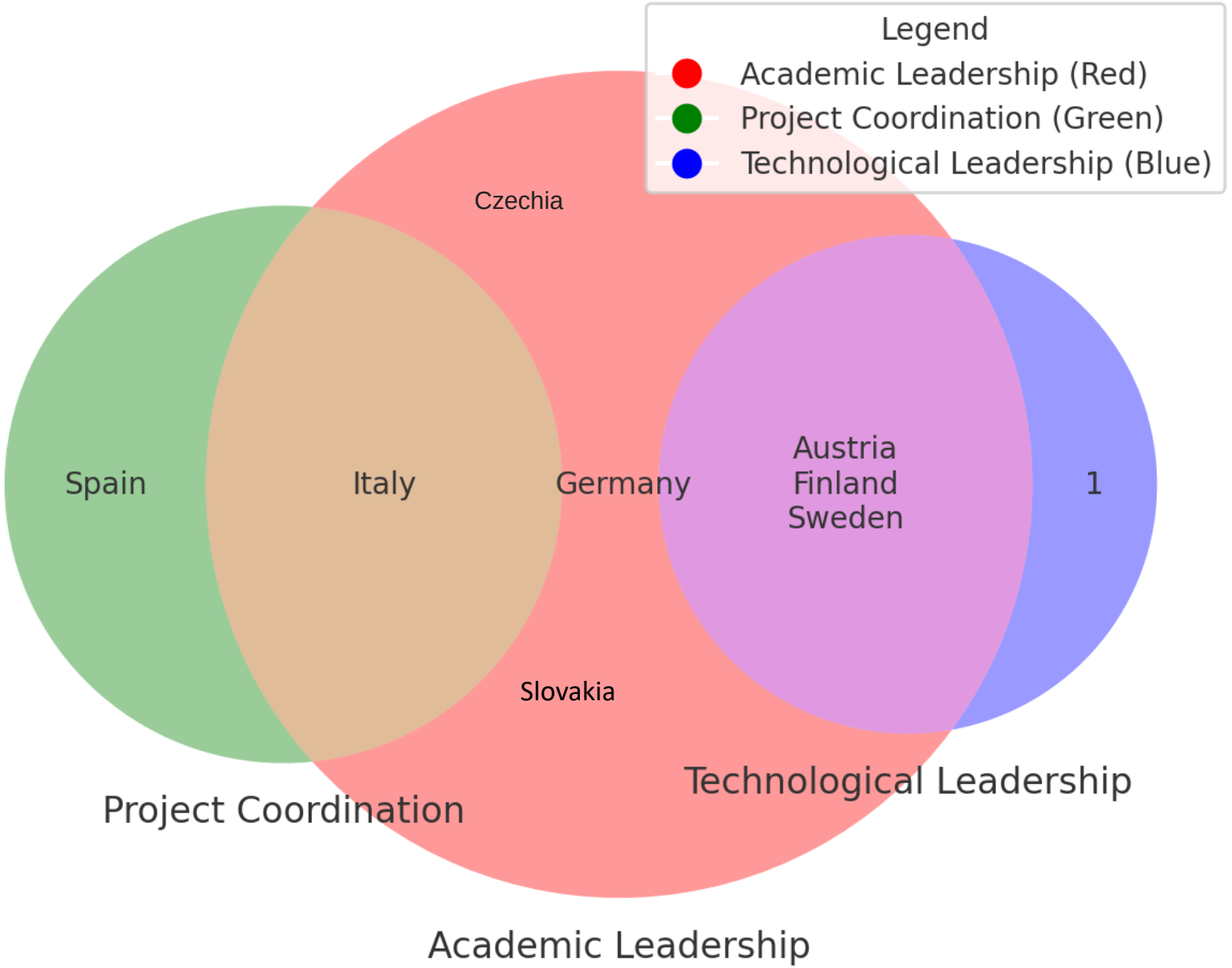
(1) analysis of **literature review** of previous innovation (mapping) studies (**812 papers**)

(2) analysis of **forest-related innovation activities from various EU project databases** (**CORDIS (614), EIP-Agri (189), LIFE (370), Interreg (194), Espacenet (372)**)

(3) conducting **expert interviews (71)** with selected key experts to uncover factors affecting innovation activities

(4) conducting **surveys (125)** with companies, governments & interest organizations

Overlapping Roles in Research & Innovation

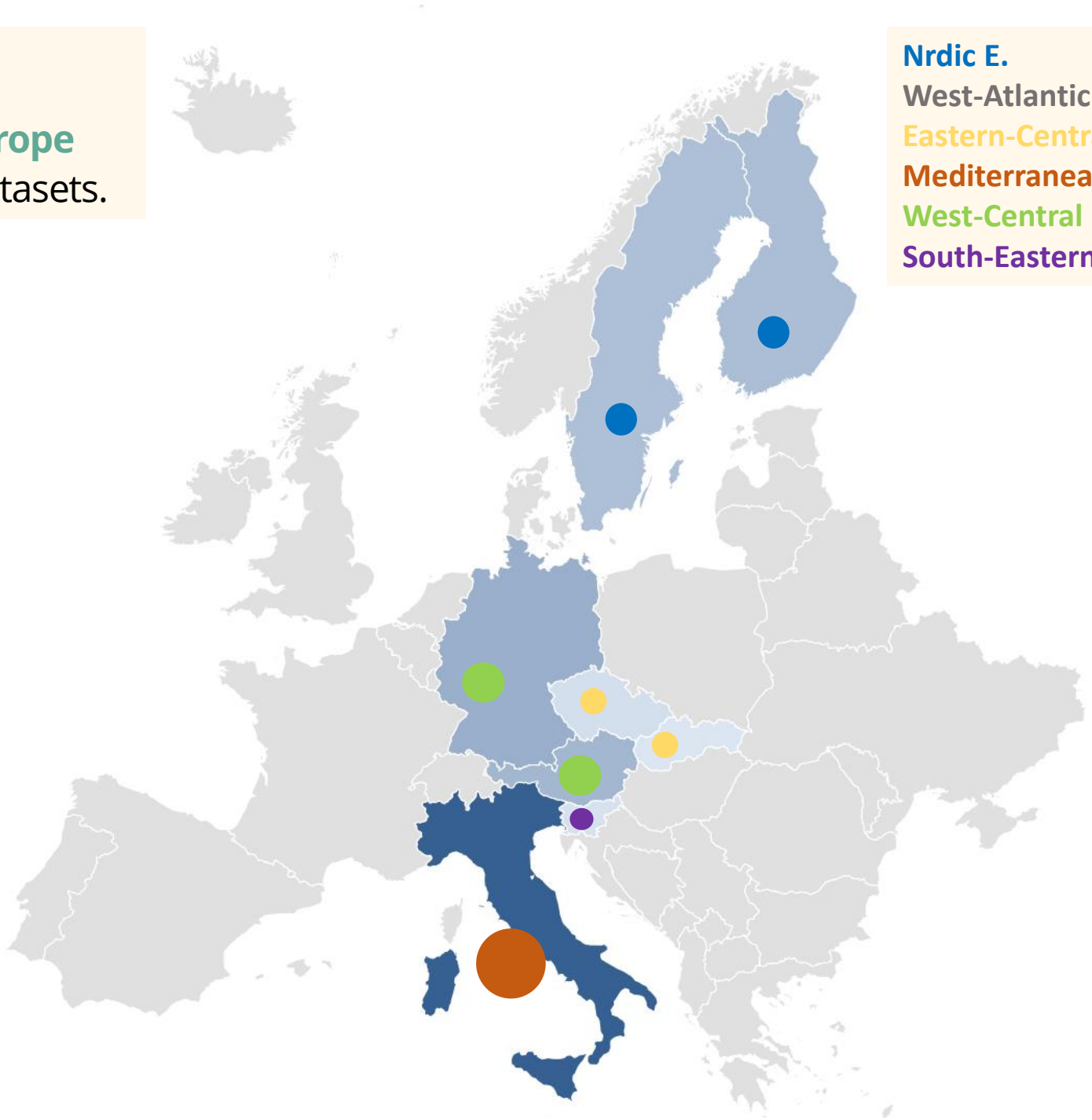


GEOGRAPHY

Strong presence of **Western, Northern Europe and Mediteranean organisations** in all datasets.

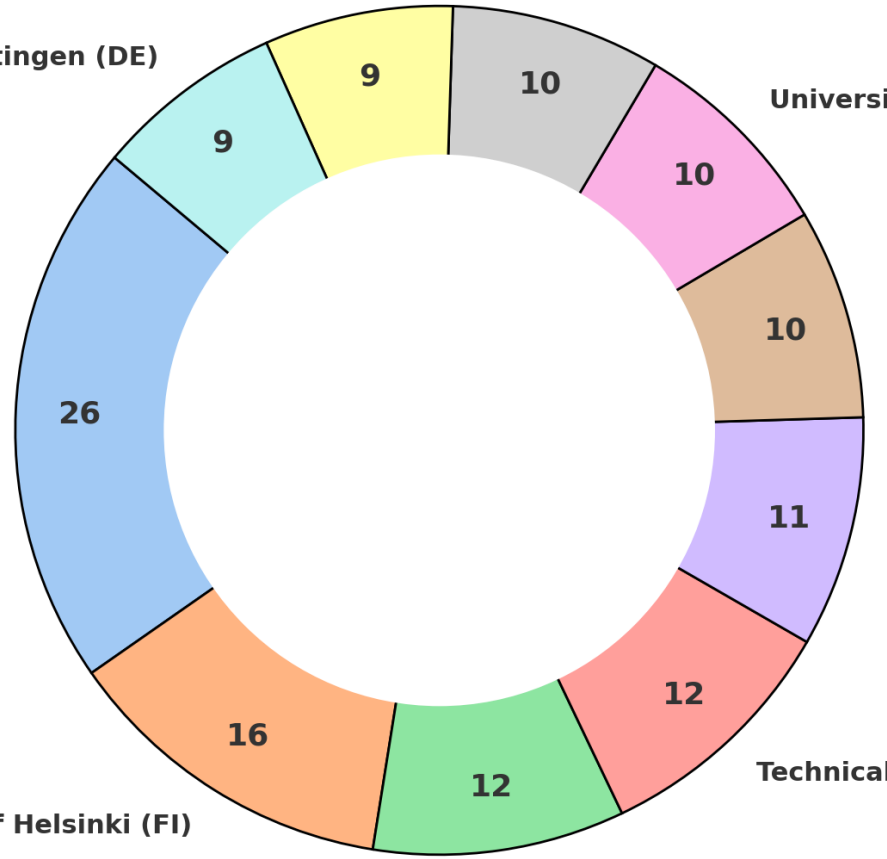
Literature review 2013-2023

Italy 138
Germany 68
Austria 61
Finland 55
Sweden 53
Czech Republic 26
Slovenia 23
Slovakia 20



Country-level contributions to forest innovation research

Leading Universities in Innovation Research



University of Padua (IT)

National Research Council (CNR) (IT)

University of Goettingen (DE)

University of Florence (IT)

Czech University of Life Sciences Prague (CZ)

University of Natural Resources & Life Sciences, Vienna (AT)

Swedish University of Agricultural Sciences (SE)

Technical University Zvolen (SK)

University of Helsinki (FI)

University of Eastern Finland (FI)

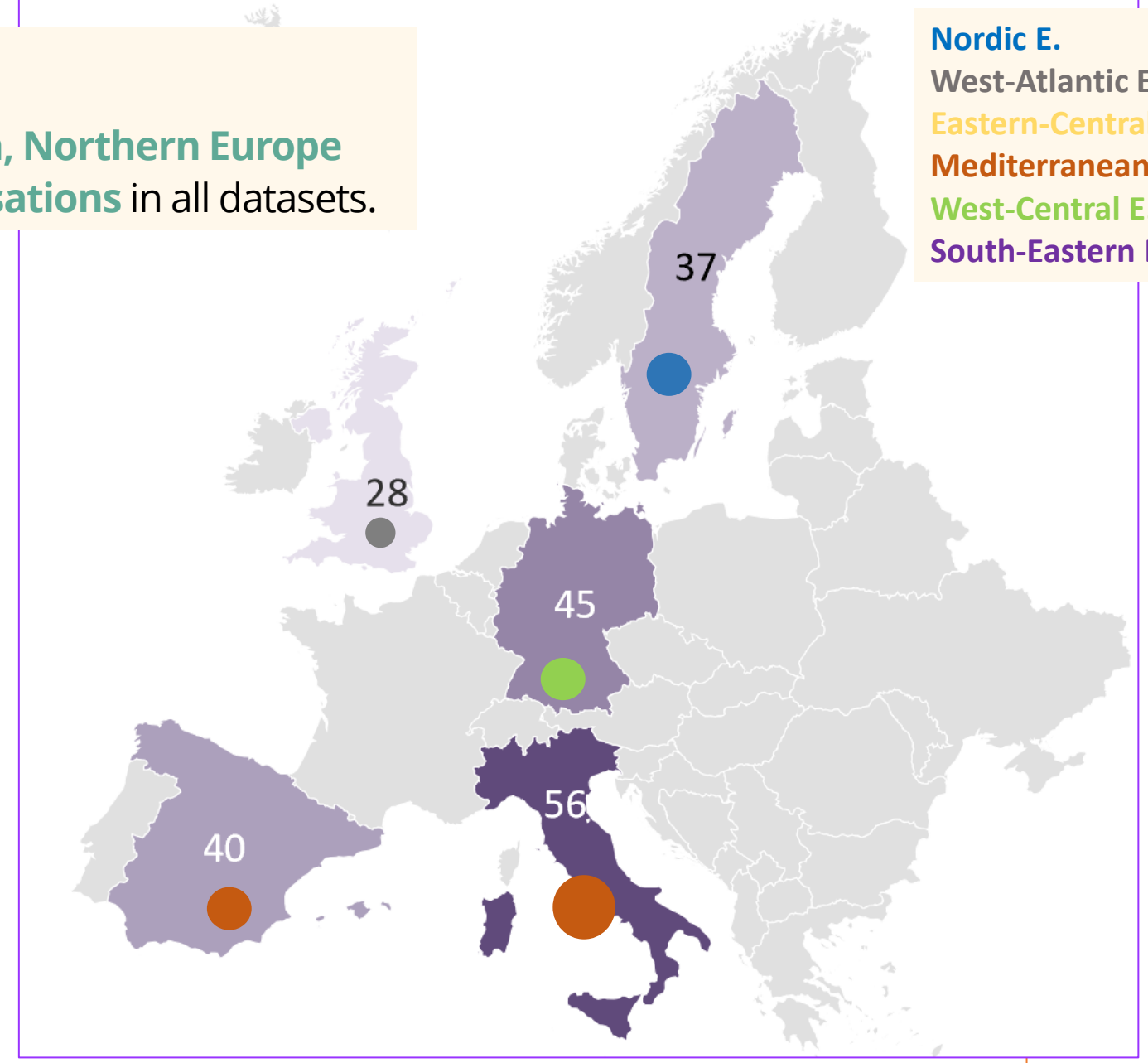
GEOGRAPHY

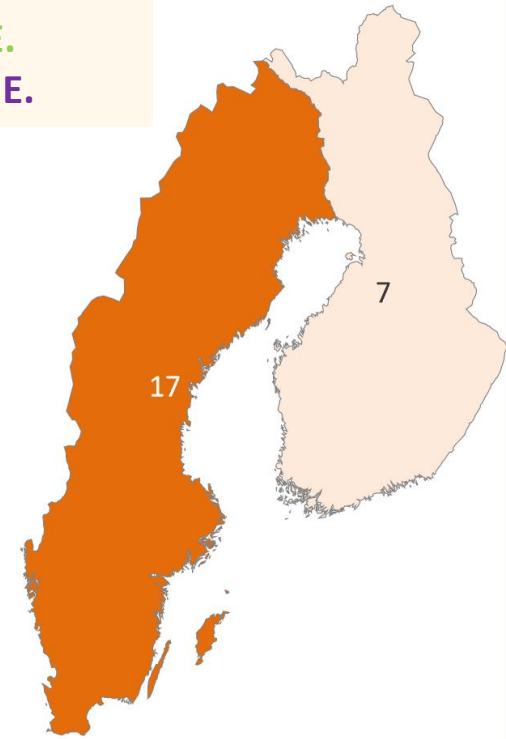
Strong presence of **Western, Northern Europe and Mediteranean organisations** in all datasets.

Patents 2019-2023

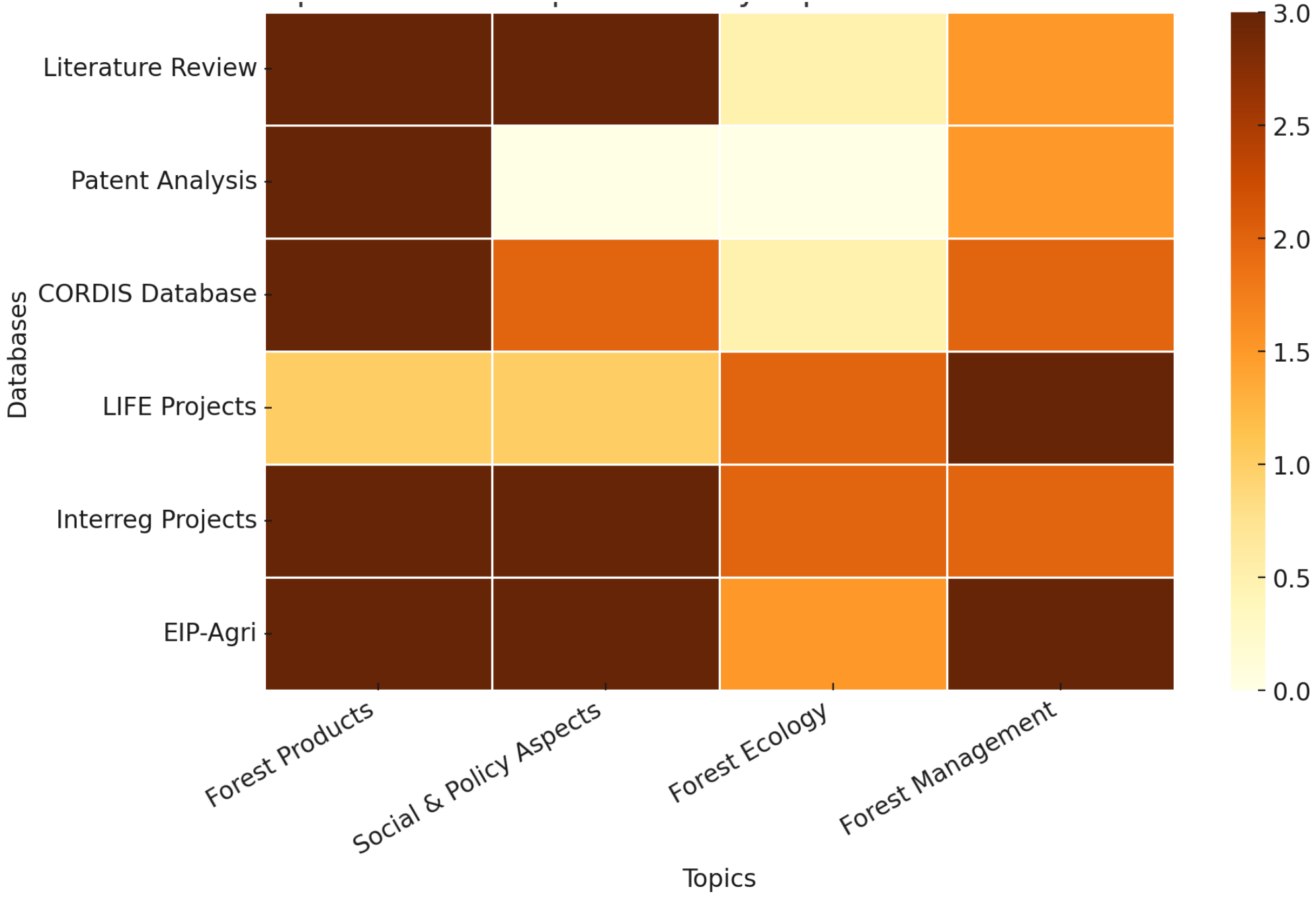
Italy 56
Germany 45
Spain 40
Sweden 37
UK 28

Swedish (17), Austrian (7) and Finish (7) individual companies having the most patents

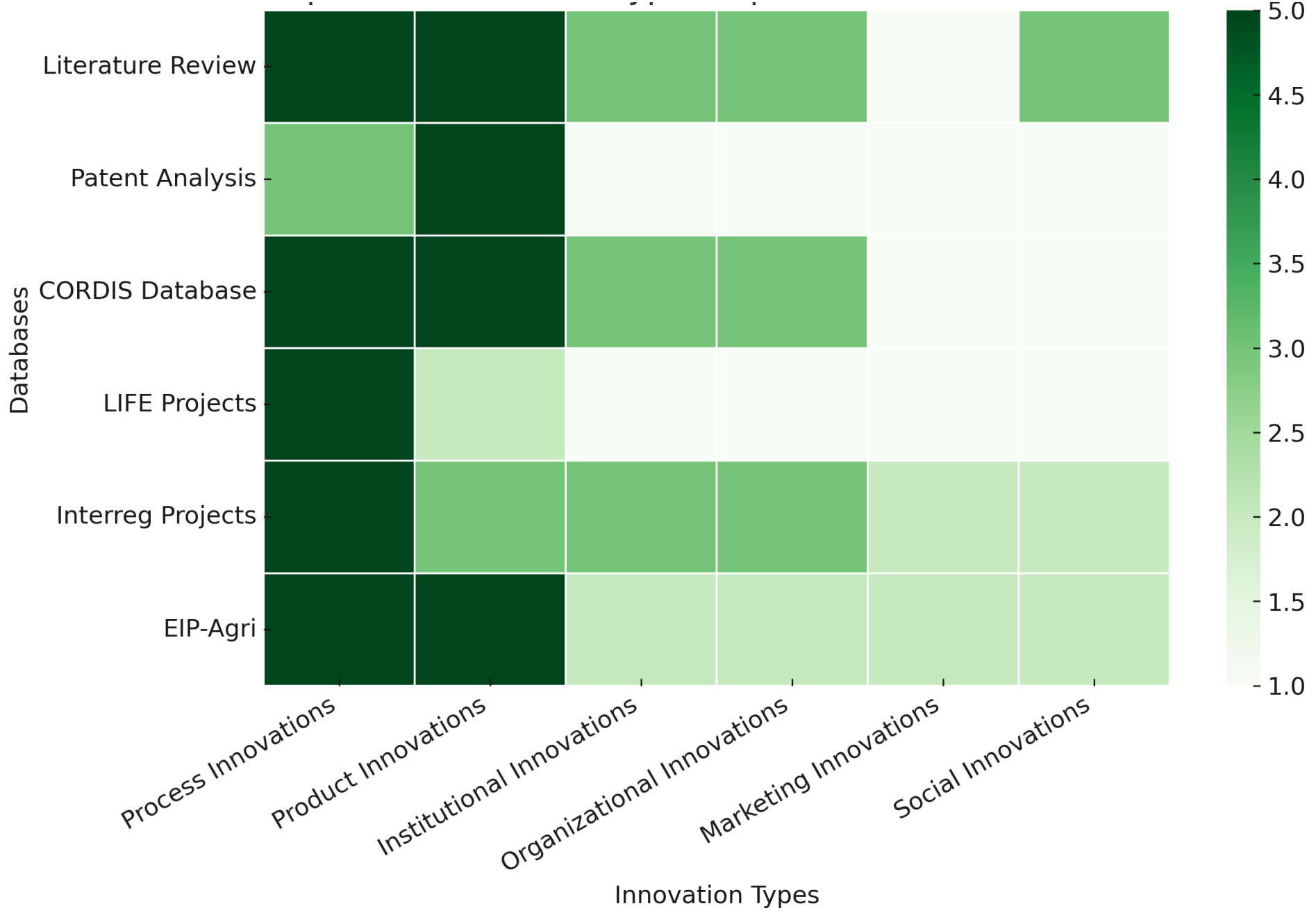




Main forestry innovation topics across databases

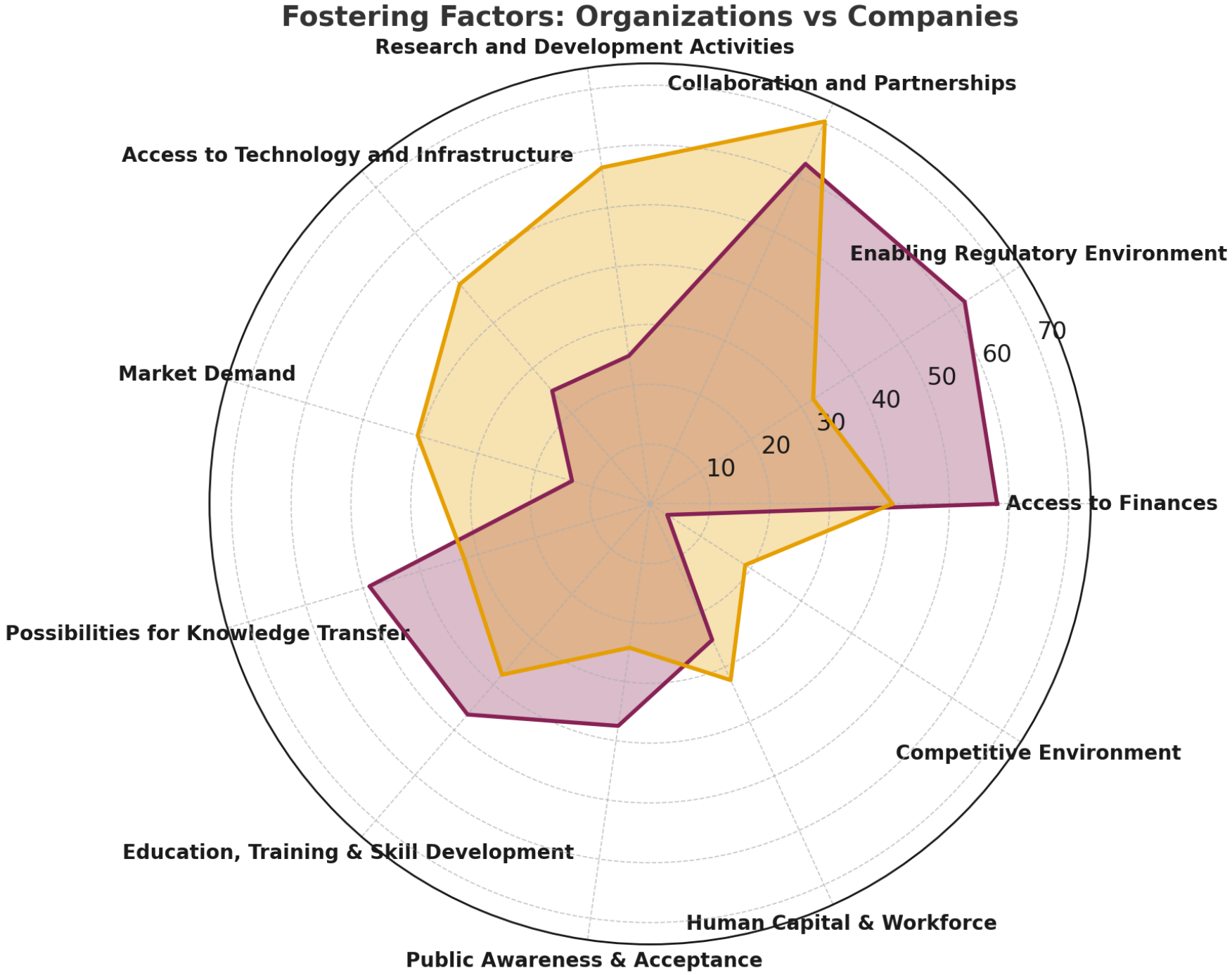


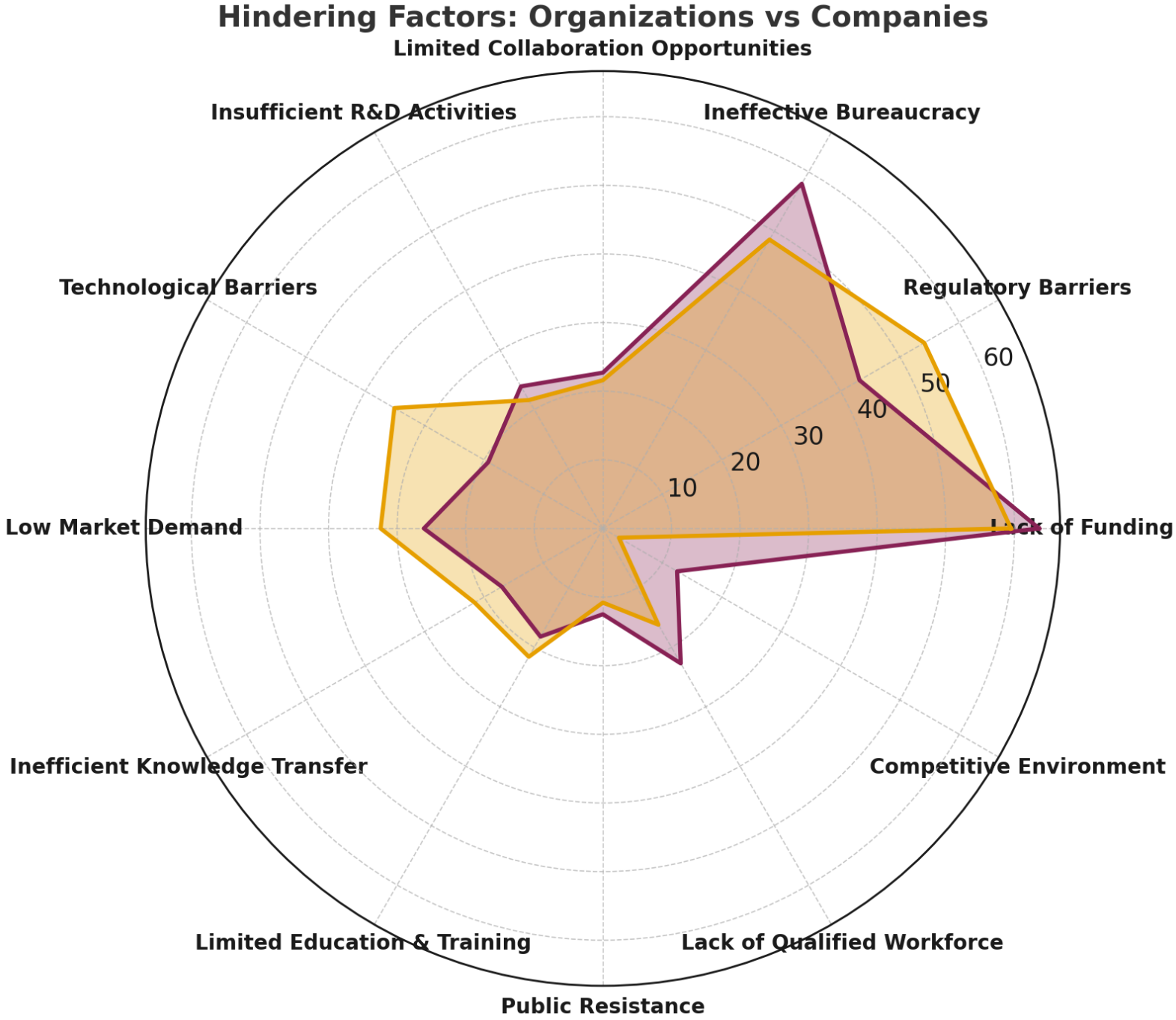
Main forestry innovation types across databases



OBSERVATIONS ACROSS THE DATASETS	
STAGES OF INNOVATIONS All datasets reflect a **mix** of early-stage conceptualization & applied innovations.	• **Patent Analysis**: Primarily later-stage innovations, emphasizing commercialization and intellectual property protection. • **Literature Review**: Many studies deals with both development and implementation stages of innovations. • **CORDIS Database** spans the entire innovation cycle, integrating early-stage (TRL 1-6) and implementation (TRL 7-9) phases. • Most projects in **EIP-Agri** are in the development phase, while in **LIFE projects** the primary focus is placed on the implementation stage, reflects LIFE's role in bridging the gap between research and practice. **Interreg projects** encompass both the development and implementation stages of innovation, with a slight emphasis on implementation. This reflects a focus on applying and scaling up tested solutions, integrating them into practice, and fostering cross-regional collaboration.

OBSERVATIONS ACROSS THE DATASETS	
COLLABORATIVE EFFORTS Presence of **diverse stakeholders**	• **Literature review:** Universities are leading. • **Patent Analysis**: Led by private companies (e.g., Kemira, Lenzing), with minimal university involvement. • **CORDIS Database**: Balanced contributions from universities or research organisations (coordination), followed by SMEs and public bodies, depending on call types. • In **EIP-Agri, LIFE, and Interreg projects**, there is a notably diverse range of involved stakeholders, particularly those with a **practice-oriented focus**. This includes Operational Groups (OGs) in EIP-Agri, companies and SMEs in other programs, as well as regional and local governments, alongside research organizations. This diversity fosters strong links between research, policy, and practice, enhancing the relevance and applicability of project outcomes."


Fostering Factors: Organizations vs Companies
Research and Development Activities
Collaboration and Partnerships
Access to Technology and Infrastructure
Enabling Regulatory Environment
Market Demand
Access to Finances
Possibilities for Knowledge Transfer
Competitive Environment
Education, Training & Skill Development
Human Capital & Workforce
Public Awareness & Acceptance
10
20
30
40
50
60
70
Legend
Organizations
Companies


Hindering Factors: Organizations vs Companies
Limited Collaboration Opportunities
Ineffective Bureaucracy
Regulatory Barriers
Lack of Funding
Competitive Environment
Lack of Qualified Workforce
Public Resistance
Limited Education & Training
Inefficient Knowledge Transfer
Low Market Demand
Technological Barriers
Insufficient R&D Activities
10
20
30
40
50
60
Legend
Organizations
Companies


AI, Machine Learning & Digitalization in Forestry
Forestry for Public Health & Well-Being
New Production Technologies & Sustainable Processing
Recycling, Upcycling & Hybrid Engineered Wood
AI in Forest Inventory & Planning
Wood-Based Products & Bioeconomy
Forestry Education, Training & Knowledge Transfer
Risk Management & Adaptive Forest Planning
Circular Economy & Resource Efficiency
Reforestation, Afforestation & Genetic Improvement
Climate Resilient Forestry & Adaptation
Green Chemistry & High-Value Bioproducts
Participatory Forest Management & Community Involvement
Carbon Accounting, Biodiversity & Water Credits
Remote Sensing, LIDAR & Satellite Monitoring
Social Acceptance of Active Forest Management
Supply Chain Innovation & Traceability
Non-Wood Forest Products & Ecosystem Services
Urban Forestry & Forest Therapy
Multi-Functional Forestry & Sustainable Livelihoods

Conclusions

- **Foster STRONGER COLLABORATION between regions with high innovation capacity** (e.g., Nordic and Western Europe) **and underrepresented areas** (e.g., Eastern and Southeastern Europe).
- **Establish INNOVATION ECOSYSTEMS THAT SUPPORT SMEs** with targeted funding and incubation programs (SMEs play a critical role in implementation and niche innovations)
- **TRENDS for innovations and/or investing are in:**
  - **cutting-edge technology** (e.g. remote sensing, GIS, machine learning, blockchain, AI) & **leveraging digitalization** (digital twins, precision forestry techniques, and real-time data collection)
  - **product innovation in bio-based materials** (wood composites, bioplastics, and biorefineries)
  - **innovations in underexplored areas** (potentials of NWFPs, biodiversity credits etc.)
- **Encouraging POLICY AND GOVERNANCE INNOVATIONS** (carbon markets, payment schemes for ecosystem services, biodiversity incentives, social innovations)
- **Expanding FUNDING AND INCENTIVE MECHANISMS** (innovative financing mechansims, targeted funding for Eastern and Southern Europe, support commercialization efforts)
- **SCALING EDUCATION AND TRAINING for innovations** (interdisciplinary education that combines forestry sciences with digital technologies, bioeconomy, and governance)
- **MONITORING AND EVALUATING innovation IMPACT** (adopt standardized metrics, encourage cross-sector learnings)

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