Accelerator technology markets and economic benefits of accelerator R&D from an economist's perspective

Accelerator-Industry Co-Innovation Workshop

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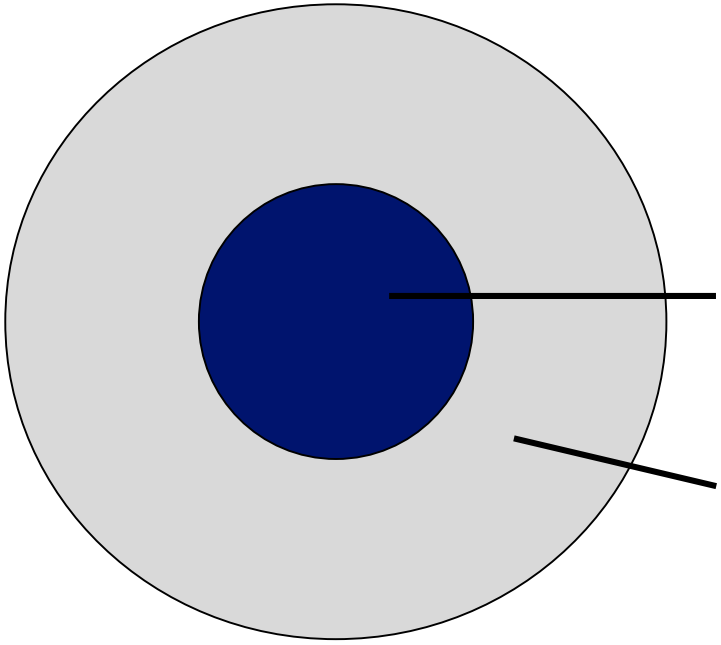
“Underutilization” of technologies

“Underutilization” of technologies is an eminent phenomenon.



Expected returns on R&D investments in academia in 2016 (EU-28):
EUR 19.2 bn

Potential returns on R&D investments in academia in 2016 (EU-28):
EUR 68.7 bn

Welfare loss
EUR 49.5 bn

Central question:
How can the commercial potential of technologies be utilized more effectively?

Sources: Eurostat, 2016; Mansfield (1991);
Frontiers Economics: Rates of return to investment in science and innovation (2014)

Reasons for this lack in commercial exploitation

Depending on the origin of an innovation, there are different reasons for the lack in commercialization.

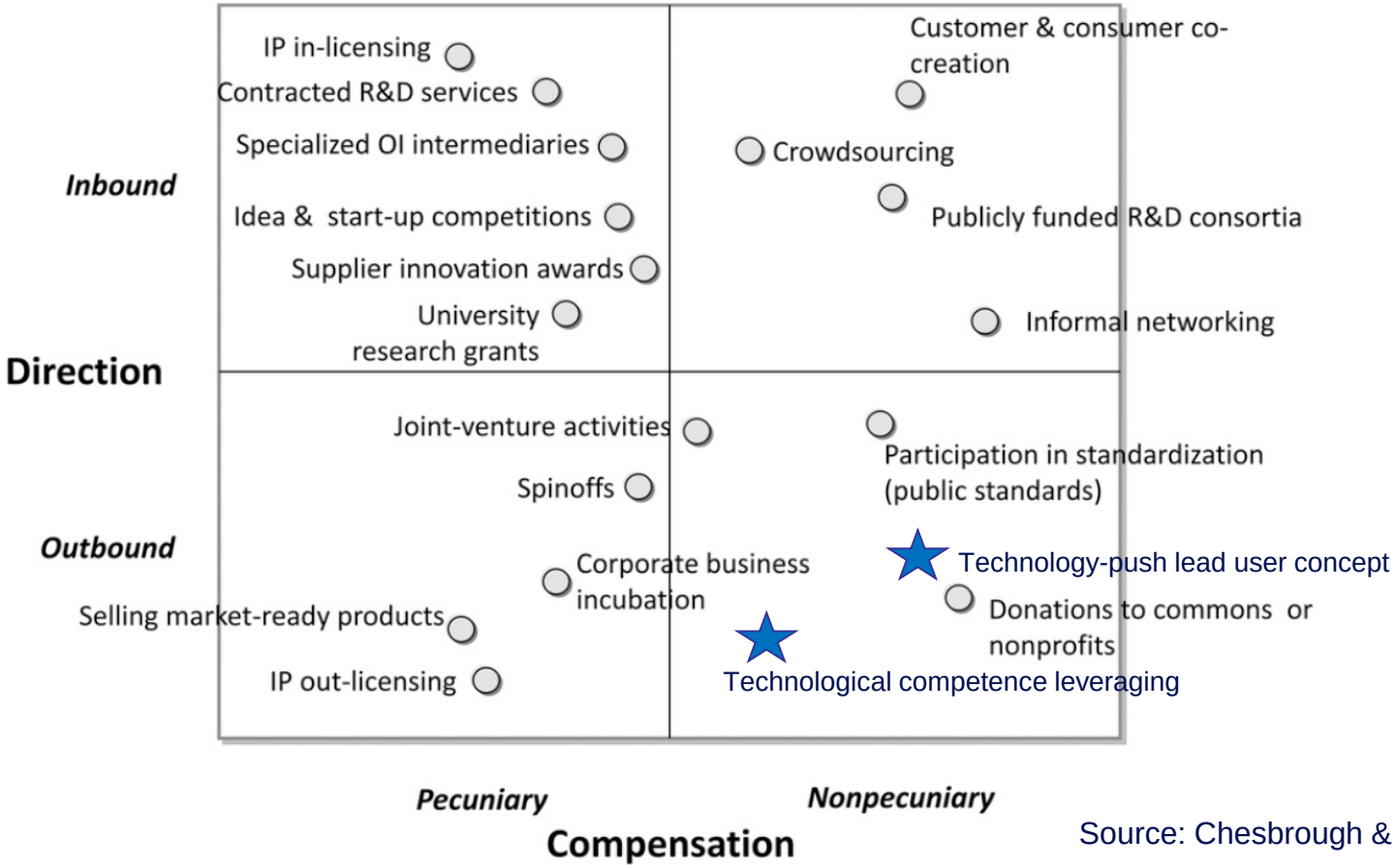
- **Scientists/Research departments do not commercialize, because…**
  - they like to do research but are not interested in management activities.
  - they are afraid of the entrepreneurial risk related to such a project.
  - they do not have sufficient funds to incorporate.
  - they often do not know exactly who could be interested in their inventions.

- **Companies do not commercialize, because…**
  - they cannot make use of their inventions due to resource constraints.
  - they are used to technological diversification (patents) more than to market diversification.
  - they do not know any fields of application for their inventions.

Sources: Keinz & Prügl (2010), Gambardella & Torrisi (1998)

Open innovation practices

In order to decrease the underutilization of R&D, inbound and outbound open innovation practices can provide tools for the creation of new technology-market links.



Source: Chesbrough & Brunswicker, 2013

Technology-Push Lead User Concept

T-PLUC is a systematic method to identify and integrate lead-users in application ideas for (existing) technologies.

	Identification of trends supported by the character-istics of focal technology	Identification of industries and markets where trends are important	Identification of lead users social search techniques: pyramiding, broadcasting	Development of novel product concepts

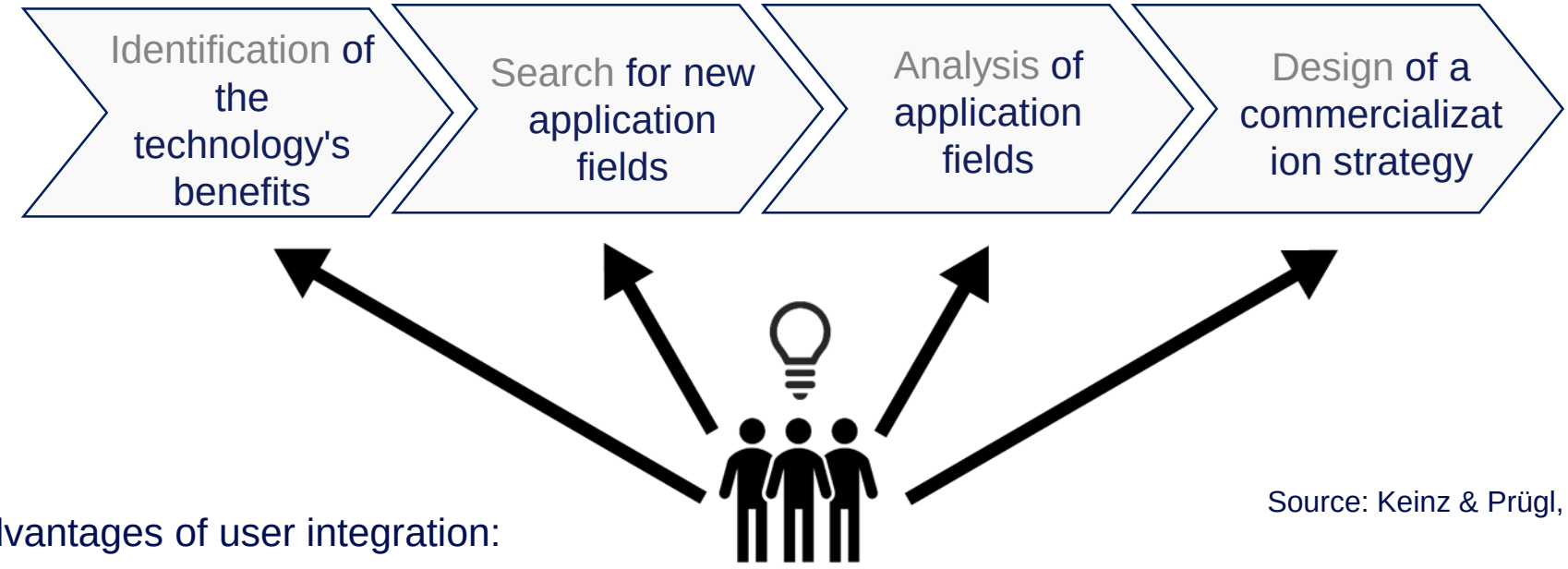
Source: Henkel & Jung, 2009

Advantages

- Focus on trends, dynamic aspect of potential target markets
- Involve lead users, increase odds for really novel concepts → high commercial attractiveness (Franke, von Hippel & Schreier, 2006)

Technological Competence Leveraging

TCL is a systematic, proactive and crowdsourcing-based method to identify and evaluate application ideas for (existing) technologies.



Source: Keinz & Prügl, 2010

Advantages of user integration:

- Use experience (product hacking)
- Identification and labeling of benefits
- Reduction of functional fixedness
- Valid knowledge about potential markets
- No disclosure of technologocial details

Step 1

The first step is about understanding user benefits arising from the technology and formulation of search specifications.

Understanding the technology and identifying its use benefits

- Which problems does the technology solve for the user?
- Which benefits does the technology meet?
- What are the technological limits?

Formulation of search specification

How can the benefits derived from the technology be labeled in a way that people from other knowledge domains understand them?

Step 2

The second step is about searching for concrete application fields.

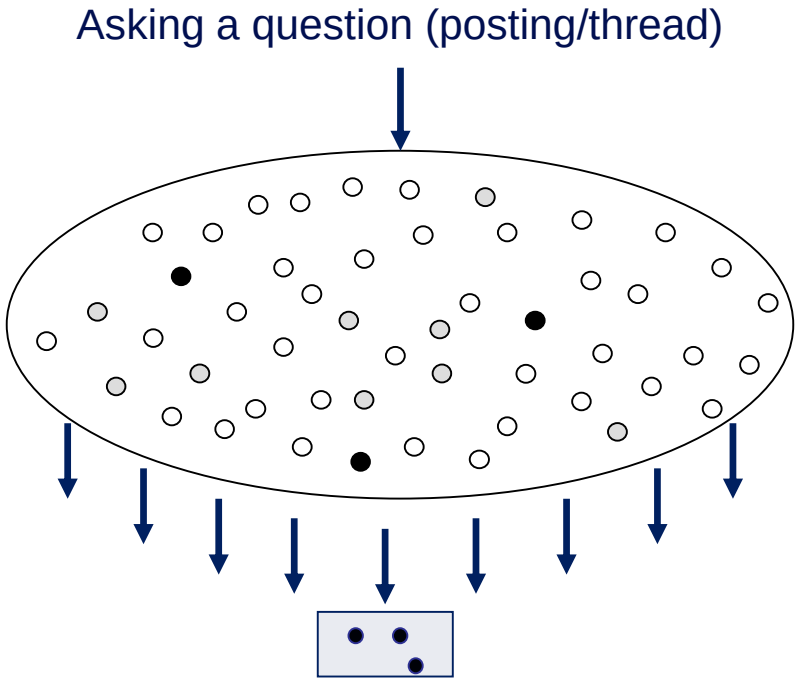
Identification of problems which can be resolved by the technology → Which users encounter situations in which they could benefit from the technology?

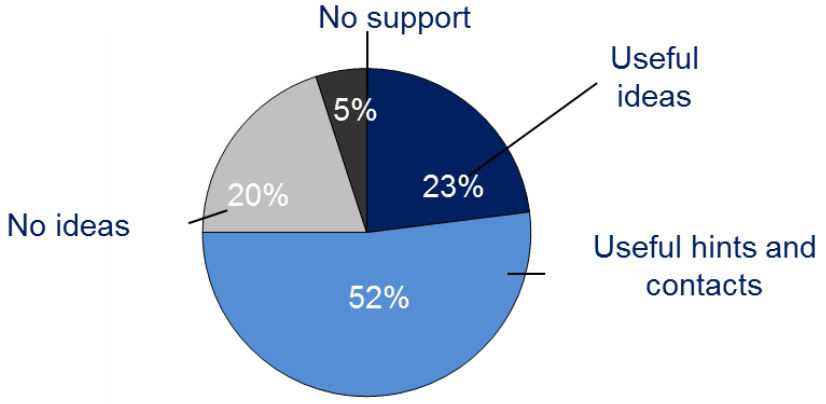
Deriving possible markets → Which markets/industries underlie such situations and what are their specific requirements?

Social search techniques: broadcasting

Latest developments in the field of ICTs have paved the way for social search techniques, e.g. Broadcasting and Pyramiding.

Broadcasting: Presentation of the technology in different online communities and asking for application ideas



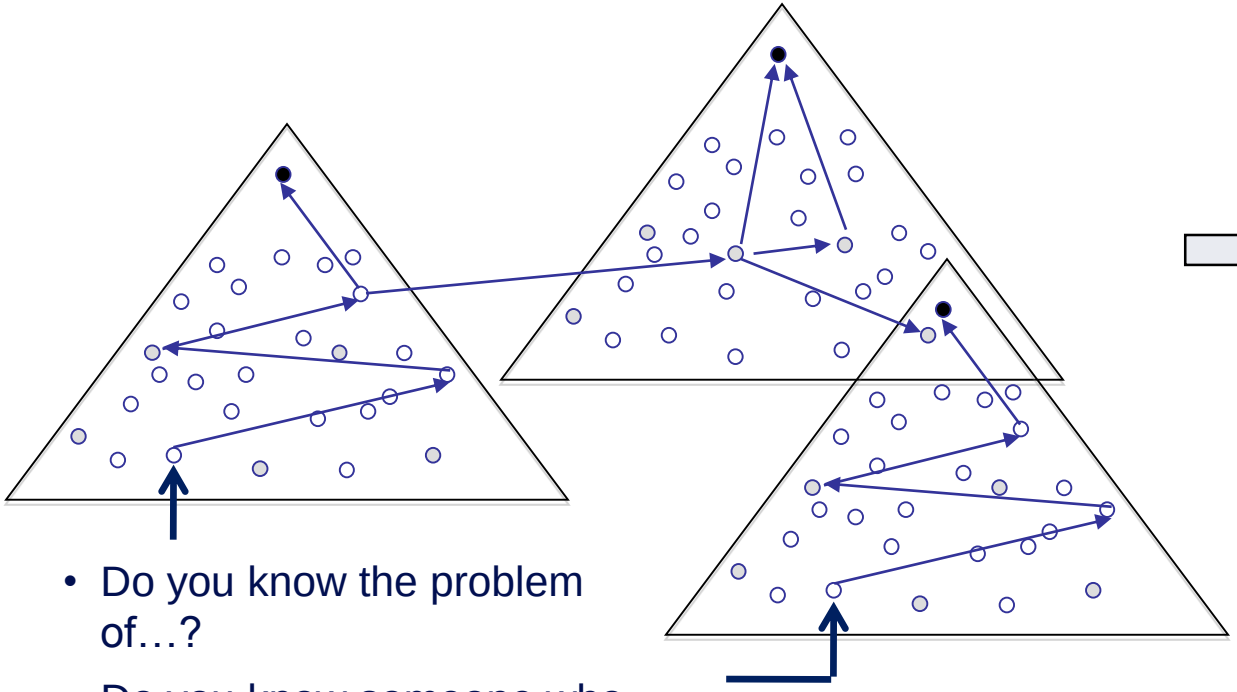


Source: Pötz & Schmit, 2008

Social search techniques: pyramiding

Latest developments in the field of ICTs have paved the way for social search techniques, e.g. Broadcasting and Pyramiding.

Pyramiding: Systematically conducted interviews



- Do you know the problem of…?
- Do you know someone who suffers from a similar problem?

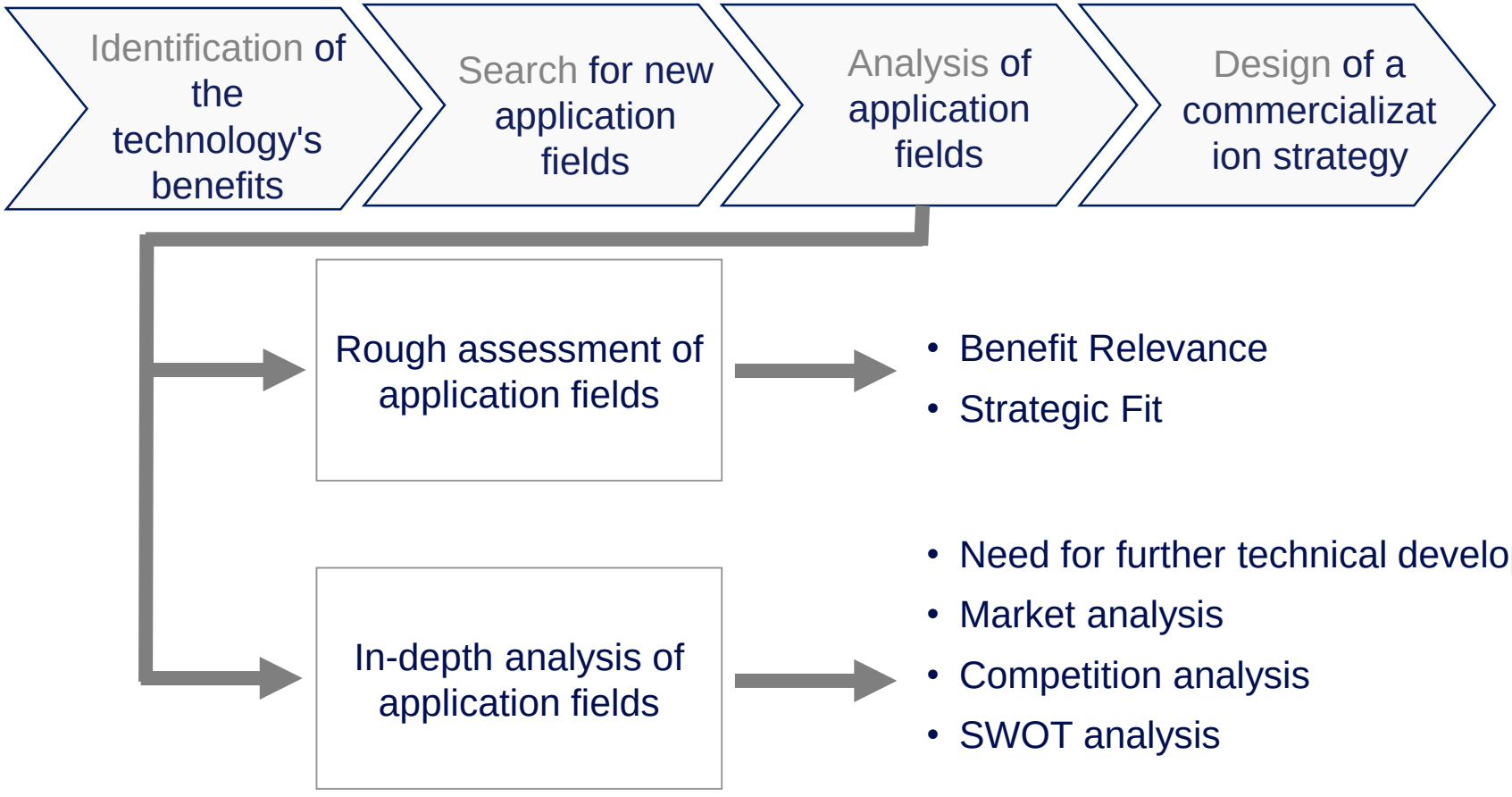
Problem holder

Average length until finding a new application field: 4 links

Source: Keinz & Prügl, 2008

Step 3

The third step is about evaluating the identified application fields.



Step 4

The fourth step is about designing an actionable business model / commercialization strategy for chosen application fields.

Commerciali-zation strategy

For each application field:

- How to deliver value?
- To whom?
- How to earn money?
- Key stakeholder?
- Key resources?

Accelerator technology markets

Output of the application search and market data based on 12 TCL projects with CERN.

Technologies: superconductors | Direct laser soldering | Depleted CMOS sensor | Micro-Scint | Optical data transmission | HV CMOS Technology | Gigabit Data Aggregator | Personal safety augmented reality system | Carbon structure simulation and design | Quantum dosimetry | Diaphragm system | Atlas Pixel Detector

Markets (extract): uninterruptable power supply | sorting machines for fruits | large loudspeaker systems | solar panels | CdTe dental imaging | 3D integrated circuits | dosimetry | quality management for food | mine sweeping | positron emission tomography | hadron therapy | implantable radiation detection | non-destructive quality testing | data transmission in satellites | inflight entertainment systems | electron microscopy | particle therapy | financial market data mining | public video surveillance | algorithmic trading | factory fire brigades | nuclear power plants | airplane heating surface hydrogen fuel systems for satellites | stationary environmental monitoring | monitoring of critical places | prostheses | rear-bicycle racks | spindle bearing | jaw chucks | permanent magnet motors | sensor fixation | medical imaging | spot welding | railroads | non-destructive testing | chemical analysis of minerals | civil engineering

→ 313 markets found in total

Accelerator technology markets

Output of the application field search and market research based on 12 TCL projects with CERN.

Search process
(average numbers / technology):

Benefits: 3.75

Users contacted: 304

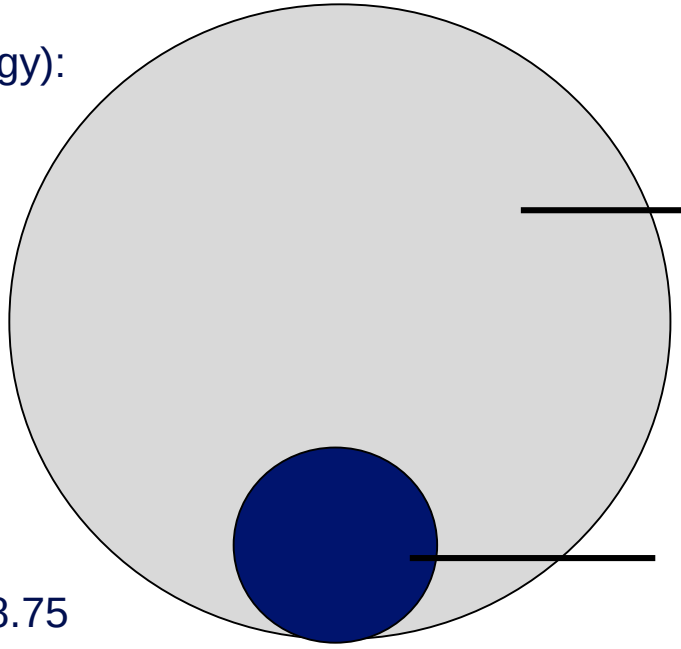
Interviews: 99

Posts: 43

App. fields found: 26

Highly attractive app. fields: 8.75

Top fields investigated: 3.25



Economic benefits:

Accum. market potential
(n=24)
EUR 190 bn

Accum. market volume
EUR 23.8 bn

87% untapped market potential
EUR 166.2 bn

Learnings

Learnings from 12 TCL projects with CERN.

- Definition of the technology leveraging object is important
- Technology's benefits bridge the gap between inventor/research perspective and user/industry perspective
- Business case development: market and feasibility analysis
- Further co-creation activities with identified users/industry as a means to initiate an actual joint commercialization

Future collaboration modes

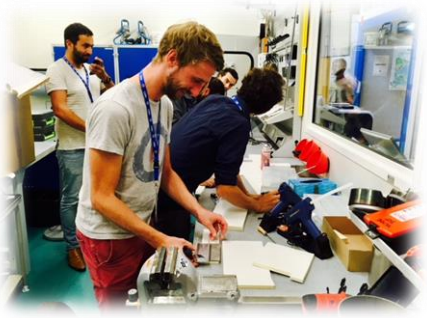
Technological competence leveraging paving the way for industry co-creation.

- First CERN Superconductivity Hackathon with industry
- Goal: Development of prototypes with industry partners/users identified in the TCL search process

Future collaboration modes

Industry co-creation: CERN Superconductivity Hackathon.

- 3 focal application fields
- 3 industry partners/users
- 3 days
- 6 hackathon teams
- 16 technical students
- 6 business students
- 7 industry experts
- 6 method experts
- 2 KTT experts
- 5 evaluators
- 2 winning concepts



"Measuring the internal fruit quality by means of superconductors could become the next innovative leap in the fruit processing industry and open new possibilities, which, after all, will be for the benefit of the customer"
Federico Giudiceandrea, Microtec CEO

Contact

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WU Vienna in numbers:

- 22,000 students (Europe's biggest business school)
- + 600 academic faculty
- 5 bachelor programs
- 14 master programs
- 3 doctoral/PHD programs
- 7 special focus research fields (among them open and user innovation)

Institute for Entrepreneurship and Innovation in numbers:

- founded in 2002
- 2 Profs, 2 Post-docs, 11 Prae-docs, approx. 100 external guest professors and lecturers
- +1000 alumni and 250 current students
- Bachelor and master level program, MBA together with the Technical University Vienna
- Host of the Entrepreneurship Center Network, the University Knowledge Transfer Centers
- Research cooperations with MIT, Harvard Business School, Copenhagen Business School, Technical University Munich, Ludwig Maximilians University Munich, Bocconi University, etc
- + 35 consulting projects per semester