Institute for Entrepreneurship and Innovation
Vienna University of Economics and Business

Technological Competence Leveraging | Identifying New Application Fields for Technologies

Philipp Topic

The Institute for Entrepreneurship and Innovation is a leading entity at the Vienna University of Economics and Business.

Vienna University of Economics and Business

Facts & Figures

- >22,000 students (Europe‘s biggest business school)
- >6,000 international students
- >600 faculty
- 500 non-academic staff
- 5 bachelor programs
- 14 master programs
- 3 doctoral/PHD programs
- 7 special focus research fields (among them open and user innovation)

The Institute for Entrepreneurship and Innovation is concerned with identifying and utilizing new business ideas and market chances.

Who we are

Facts

Founded in 2002
2 Profs, 2 Post-docs, 11 Prae-docs, approx. 100 external guest professors and lecturers
>2000 alumni and 250 current students
Host of the Entrepreneurship Center Network and the University Knowledge Transfer Centers

Research

User & Open Innovation
User Innovation Research Initiative Vienna
Research cooperations with MIT, Harvard Business School, Copenhagen Business School, Technical University Munich, Ludwig Maximilians University Munich, Bocconi University and others

Teaching

Bachelor and international Master level program
MBA in cooperation with Technical University Vienna
Cooperations with int. leading business schools
Training of entrepreneurial thinking and acting
High quality competences and knowledge

Method

>35 real application projects in cooperation with companies and research organizations per semester
Theory | Application | Linkage
Science | Practice

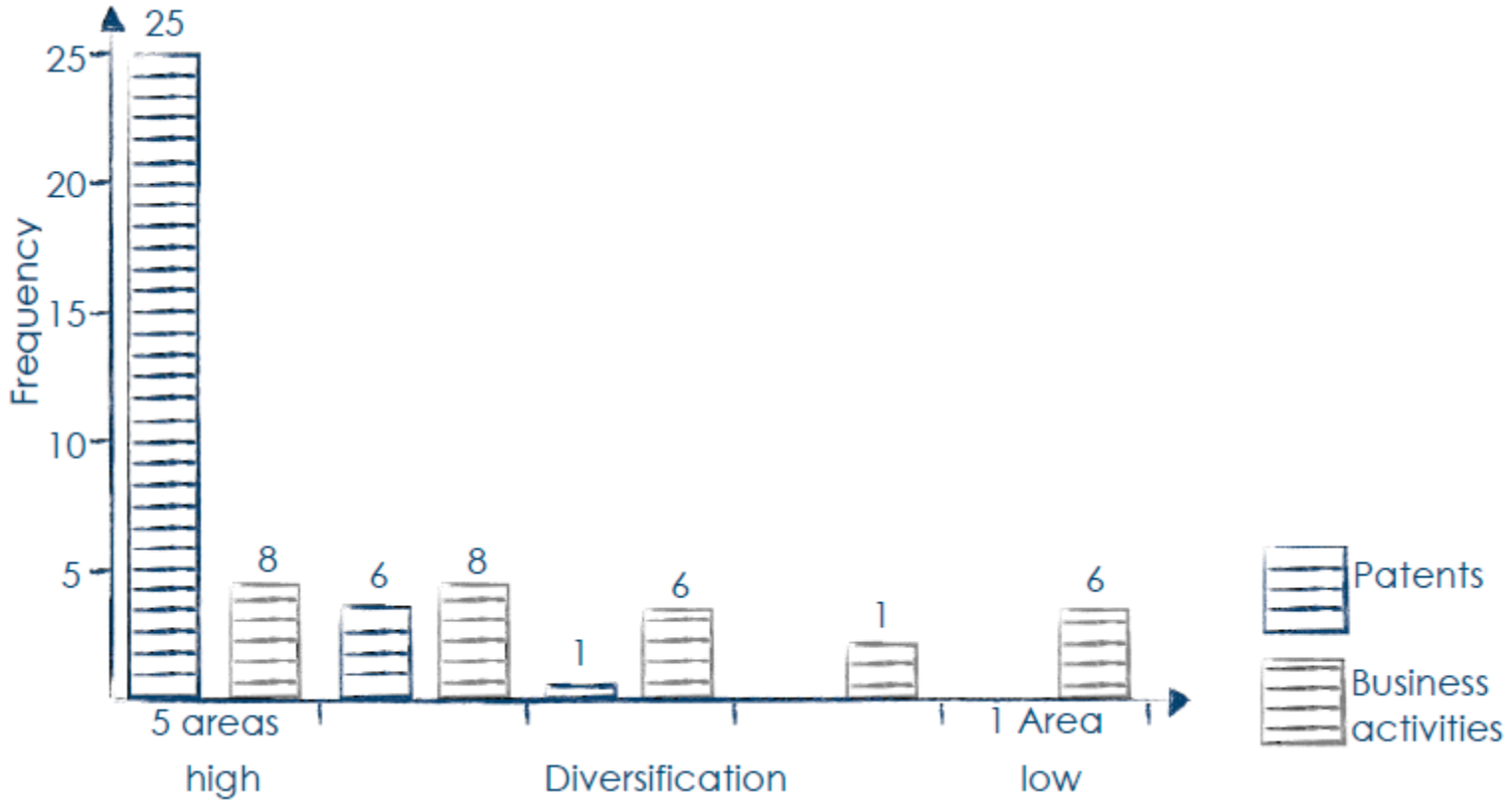
Innovation types

Innovations are “new” means-end combinations. They might be triggered by a new market need as well as a (new) technology.

(based on Pearson: Innovation Strategy, in: Technovation, 1990, S. 186)

“Under-utilization“ is a wide-spread phenomenon

A study among 32 European and US electronic-goods companies show that technical diversification is high while market diversification is low.



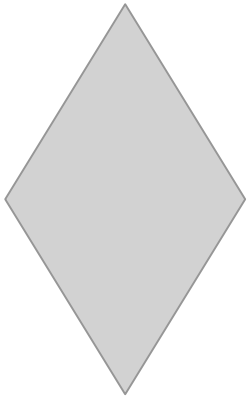
Source: Gambardella & Torrisi 1998.

Why do we even look for new ways of applying existing technologies/products?

Reasons why we look for new applications and market potentials.

Search for **markets** with the **highest** commercial **attractiveness** if resources are limited

Search for **additional markets** in order to **maximize** the **revenues** generated by innovations (or **production**)



Search for **additional markets** in order to **reduce** the **dependency** on single markets.

Search for **additional markets** in order to achieve a better **capacity utilization**.

Source: Danneels, 2007

Some reasons for this lack in commercial exploitation

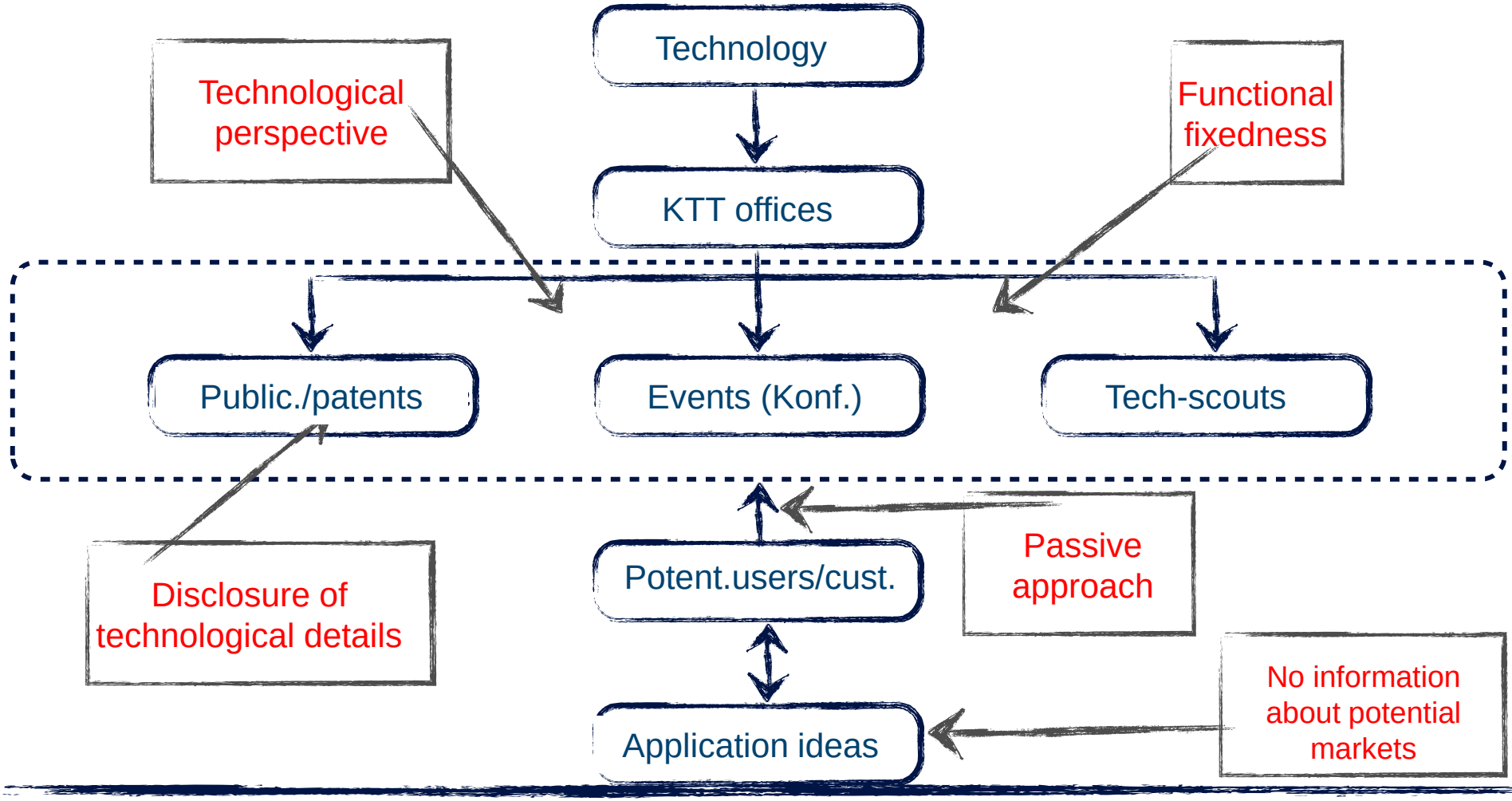
Depending on the origin of an innovation, there are different reasons for the lack in commercialization.

- **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 invention due to resource contraints and have only filed a patent in order to prevent others from doing so.
  - they do not know any fields of application for their invention.

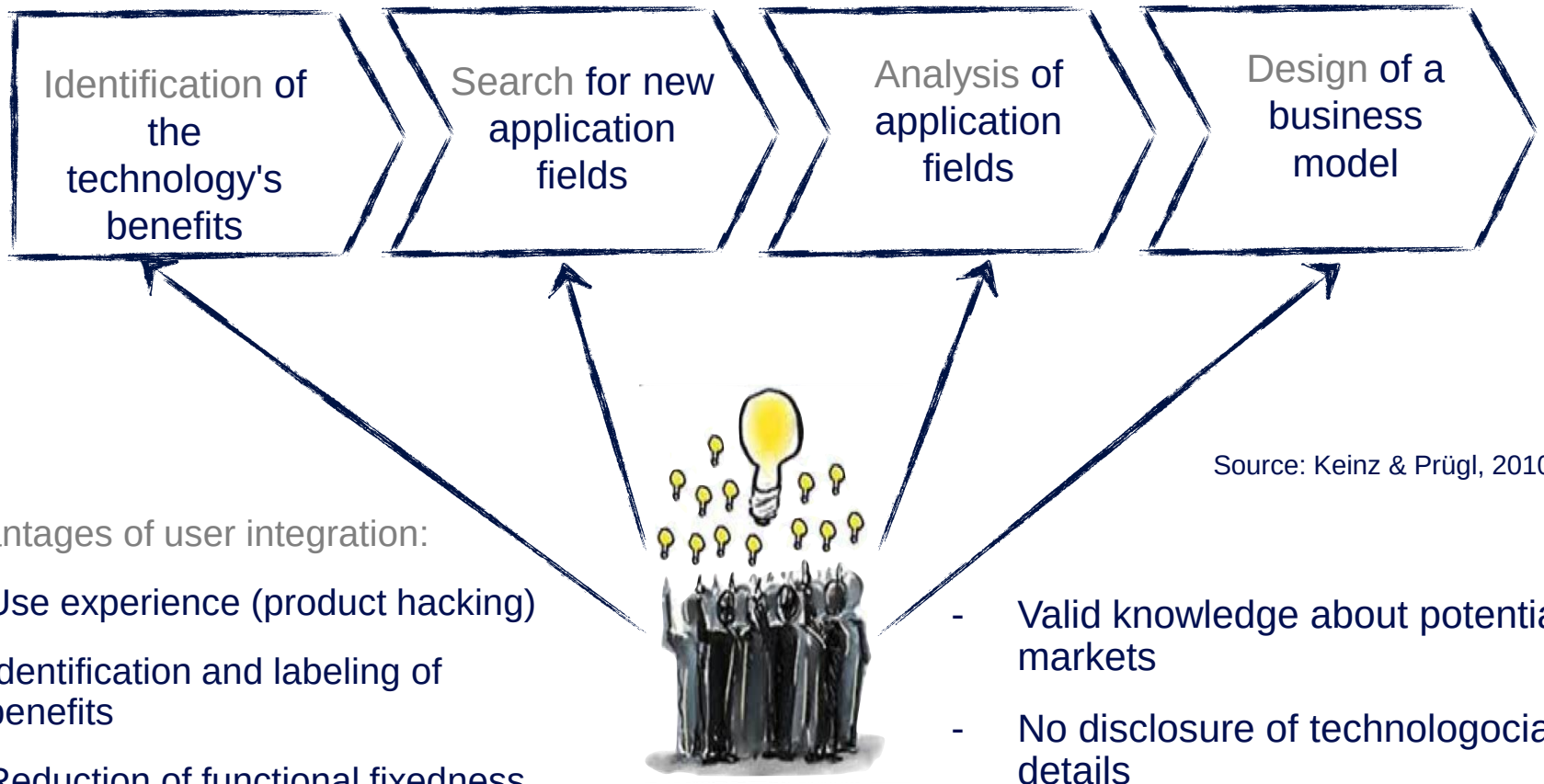
Frequent problems with knowledge and technology transfer

Traditional methods to create a technology-market link face similar problems



Solution: 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

Proof of Concept

In over 70 knowledge and technology transfer projects, on average 17 commercially attractive and technologically feasible application ideas were identified

Extract of our track record

(Multinational) Companies	Research organizations	Start-ups
SIEMENS	CERN	CLEVER CONTOUR
AICHELIN Heat Treatment Systems	Fraunhofer	CYBERITH
amun	JOANNEUM RESEARCH	NUBIGON

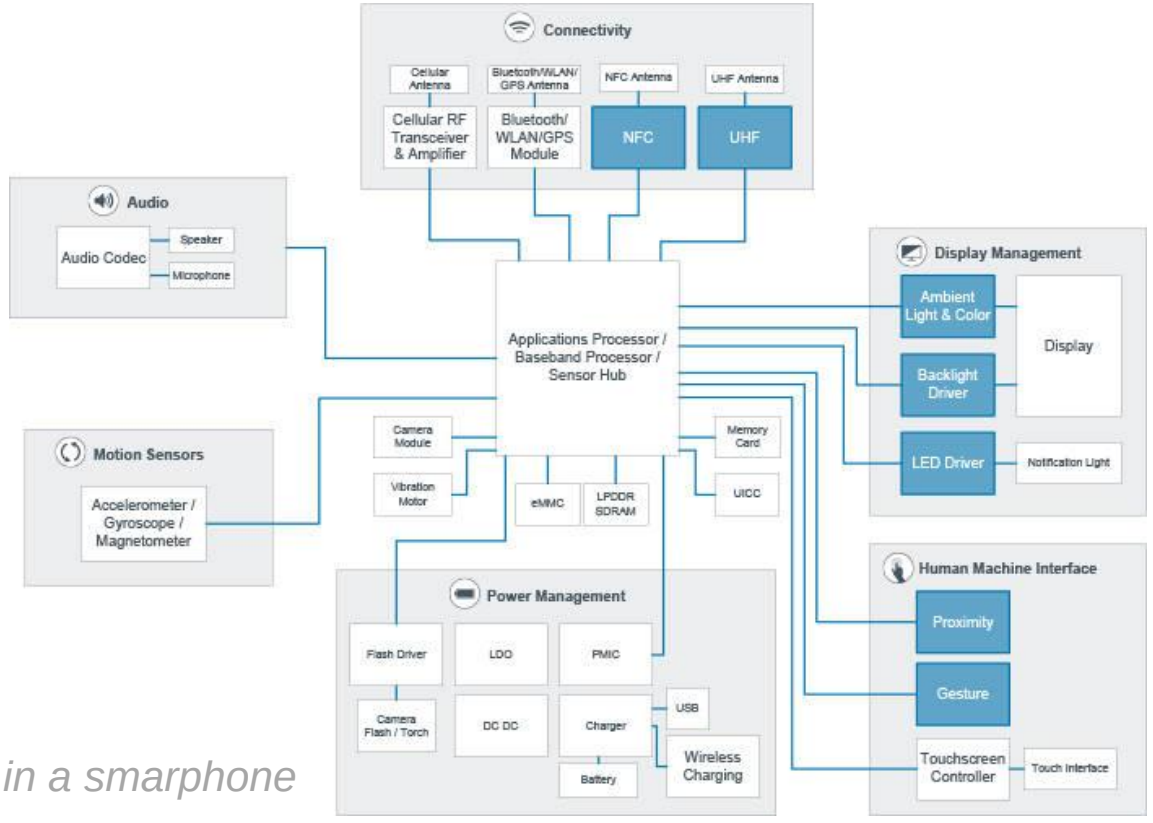
Case study: ams

Development of high-performance sensor solutions for applications in the consumer (e.g. smartphones), industrial (e.g. industrial robotics) and automotive sectors (e.g. battery applications)

HQ Premstätten, Austria

5,800 employees

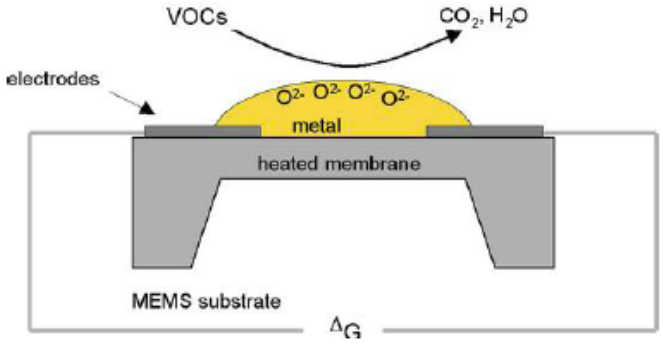
€ 550 Mio. turnover



ams sensors in a smarphone

Case study: ams

New sensor technology



Features:

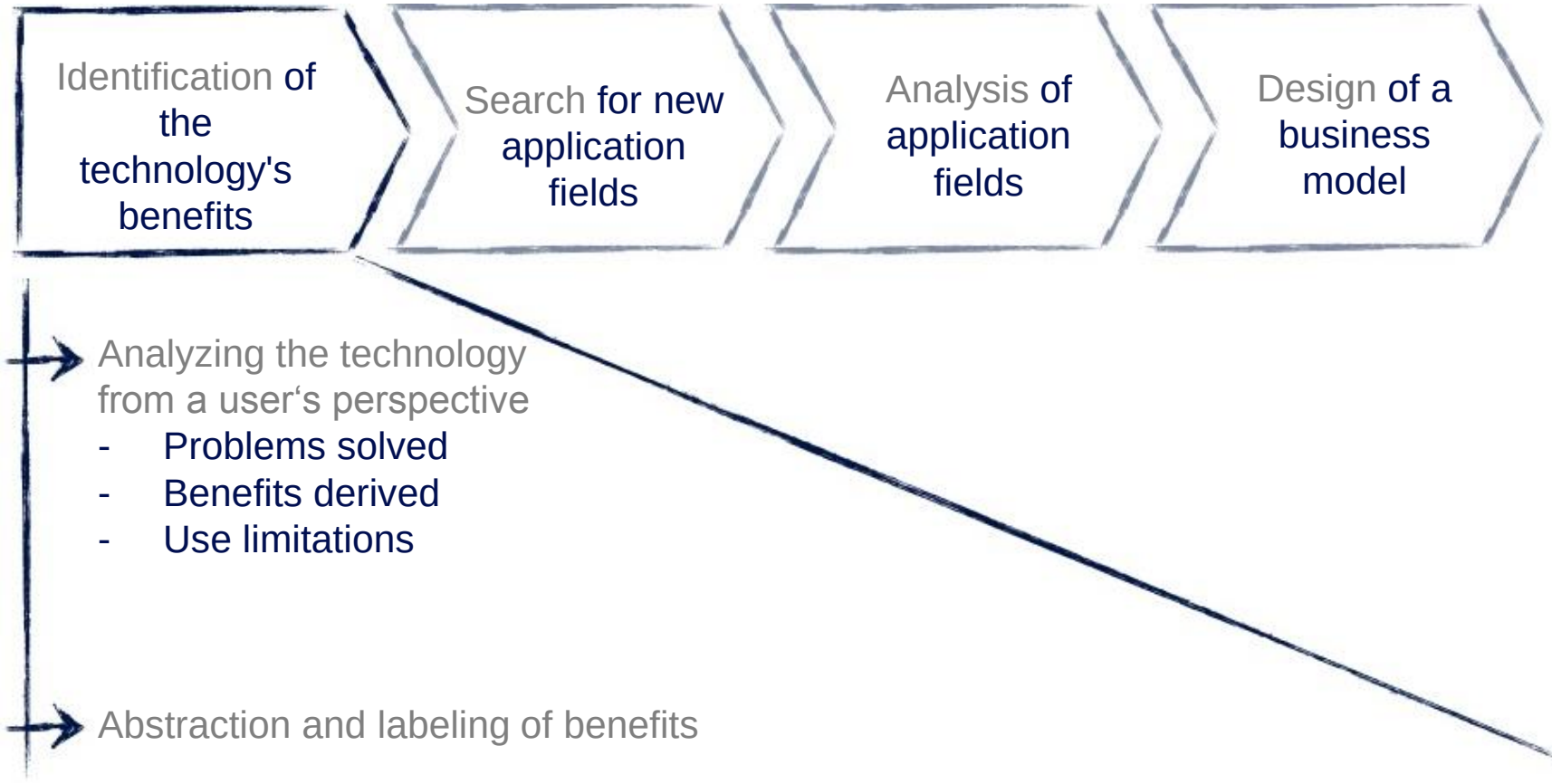
Chip size:	2 x 2 x 0.8 mm
Selling price: chip	0.7-1.0 USD per
Supply voltage	1,8 V up to 16.5 V
Ambient temperature range	-40° to 85°C
Power consumption	20 mW
Ambient humidity	5 to 100% RH, non-condensing
Typical acquisition time	1 second
Detectable gases	Volatile organic compounds (VOC) : Alcohols, aldehydes, ketones, organic acids, amines, aliphatic and aromatic hydrocarbons, Carbon dioxide (CO2), Carbon monoxide (CO) , Nitrogen dioxide (NO2), Ammonia (NH3), Methane (CH4)

Miniature chemical sensor

Note: Not the exact specification of the ams sensor

Step 1

The first step is about looking at the technology from a user's perspective.

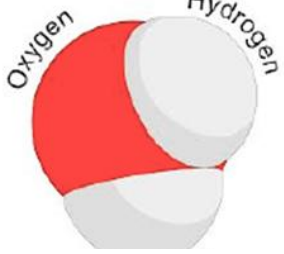


Source: Keinz & Prügl, 2010

Attributes vs. Benefits

Distinguishing between attributes and benefits is not easy and should be done by applying three indicators.

Attributes



- describe the technology
- are independent from specific applications
- can be measured

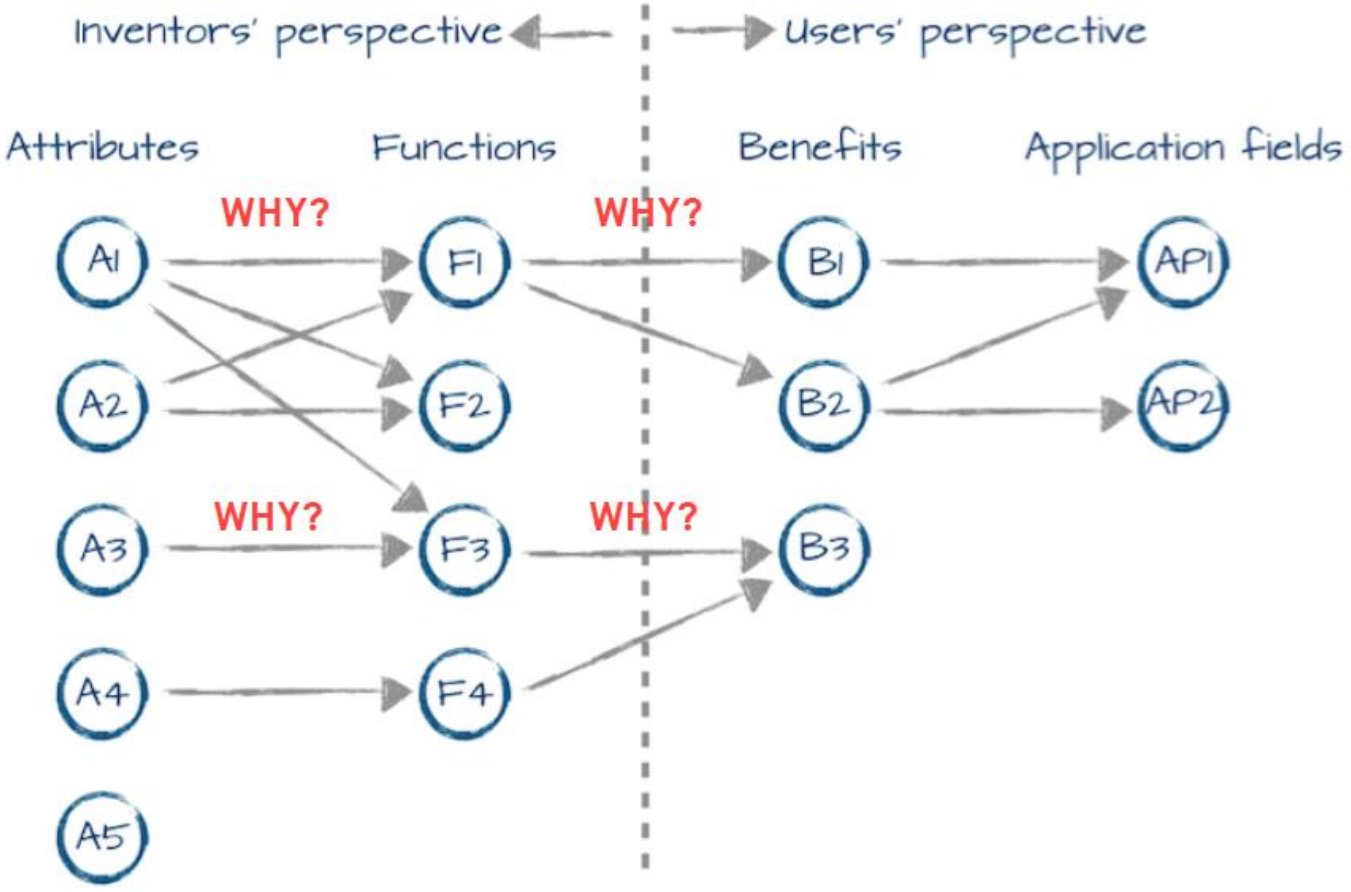
Benefits

- describe how people gain advantages from using the technology
- arise in specific use situations
- can not be measured reliably

Source: Keinz & Prügl, 2010

Attributes vs. Benefits

You can reveal a technology's benefits by the "laddering" technique.



Source: Keinz & Prügl, 2010

Case study: ams

Interviews with potential users showed 2 main benefits

Features:

Chip size:	2 x 2 x 0.8 mm
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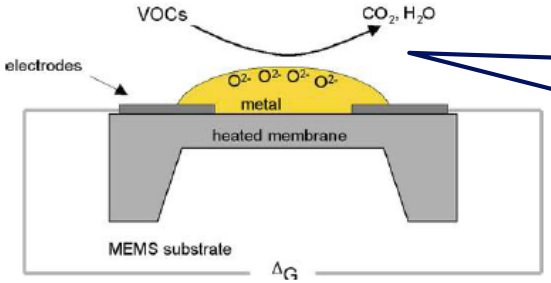


Image 2:Function Principle of Metal Oxide Sensors (©AppliedSensor GmbH)

„It´s like having an artificial nose. With it you can smell precisely and even odorless components“

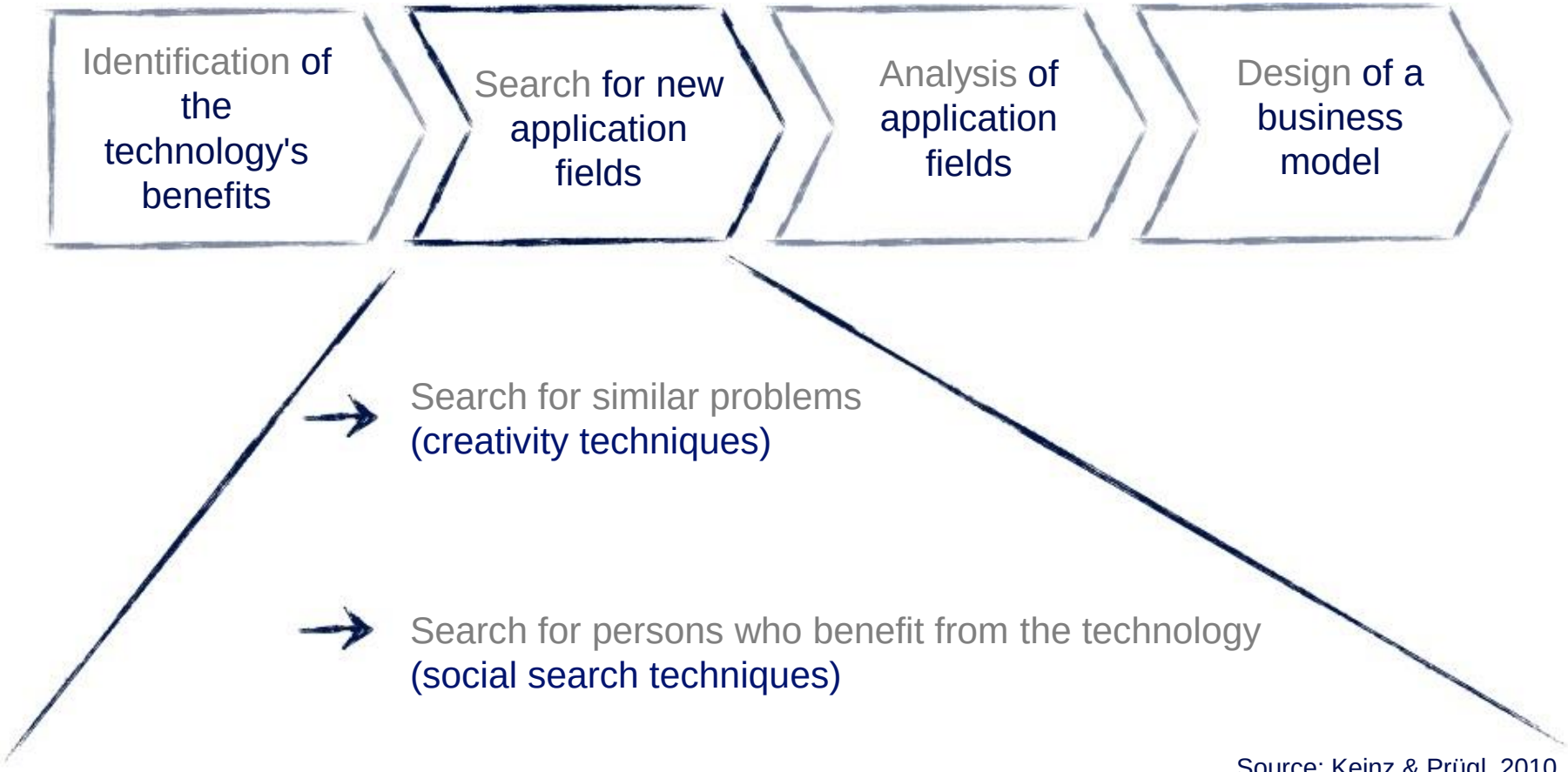
„You can always carry it around easy and discreet“

Artificial nose

Mobile sensing

Step 2

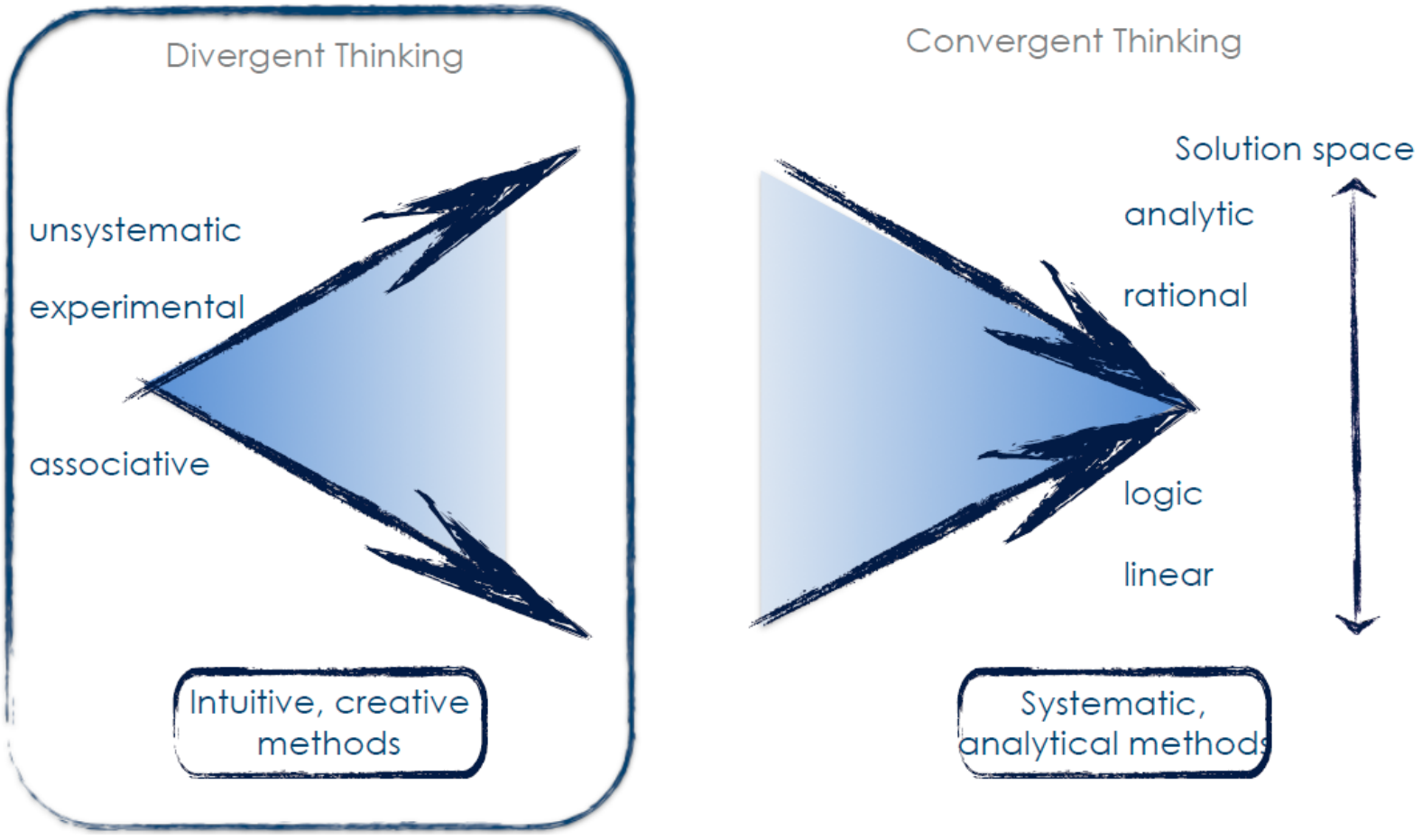
The second step is about searching for concrete application fields.



Source: Keinz & Prügl, 2010

Overview: creativity techniques

Creativity techniques can be devided into two categories.



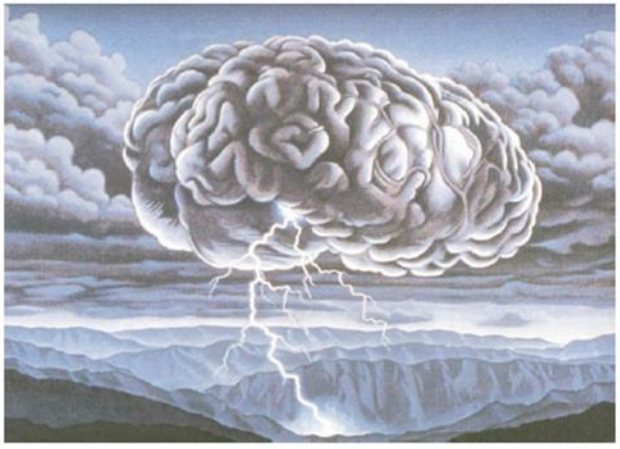
Brainstorming

Brainstorming is the best known and easiest creativity technique.

Goal: generation of as many ideas as possible

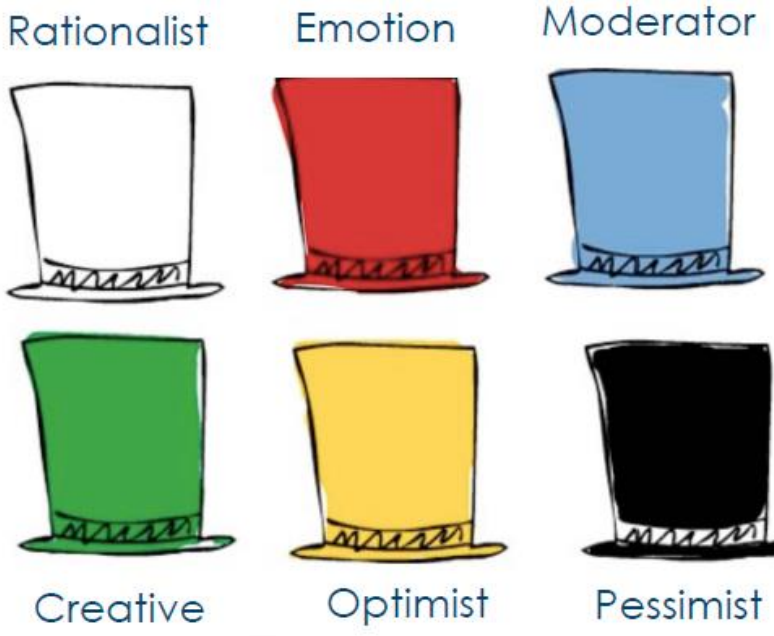
Duration: 30min

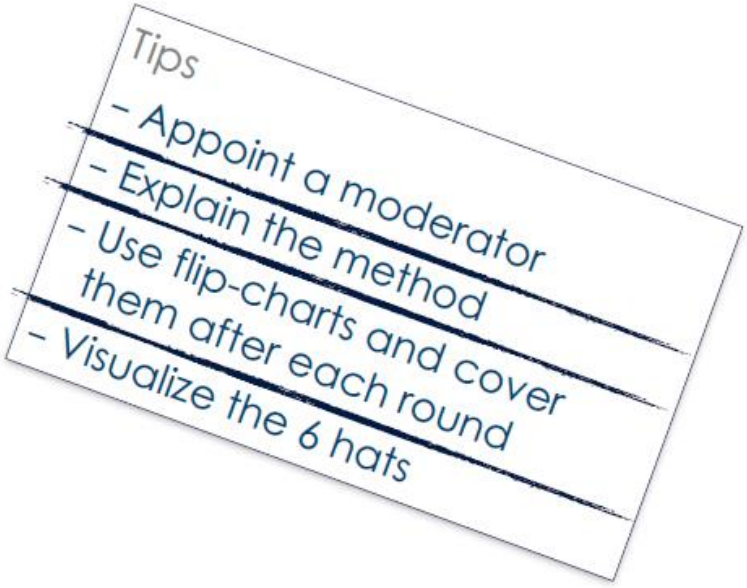
Basic rules:
– Quantity before quality
– Everything goes
– No feedback or critique during the ideation process
– Build on ideas of others



6 Thinking Hats

The 6 Thinking Hats is a creativity techniques by Edward de Bono that allows for applying different perspectives on a problem.





Group discussion/Brainstorming with different roles

The whole group takes on each and every perspective step by step

Ideas are visualized

Reflection of all findings after the discussion phase(s)

Start with the white hat, end with the blue hat

Word Association analysis

The Word Association analysis triggers unsystematic thinking and new associations.

Goal: Find completely new associations by "getting out of the box"

Duration: 15 min

Steps:
– Define the problem
– Chose a random word or picture that is completely unrelated to the problem
– Try to find connections between your problem and the word/picture

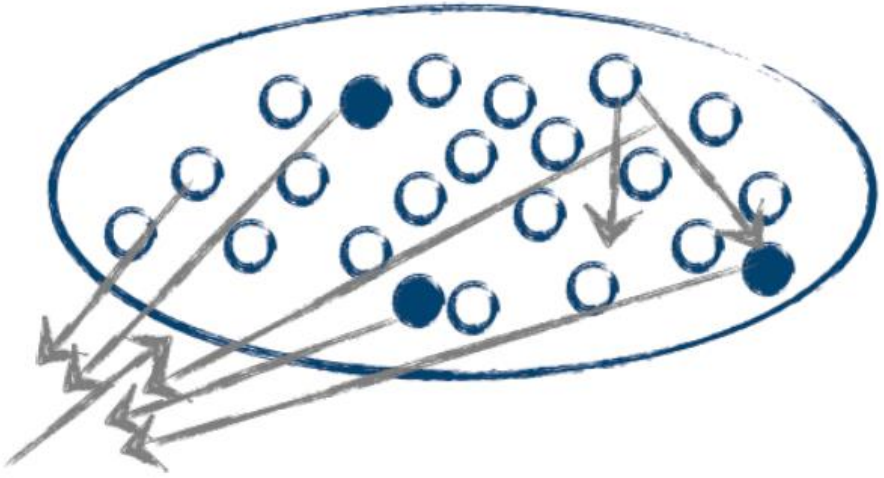
Tips
– Chose a random word out of a staple of books/magazines
– No moderator needed
– do short brainstorming on the connections/associations

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

(Postings in online forums & User Communities)



... Postings
(75% result in valuable ideas)

... Users with relevant problems

... Users in a forum

Who could benefit from a solution, that ...

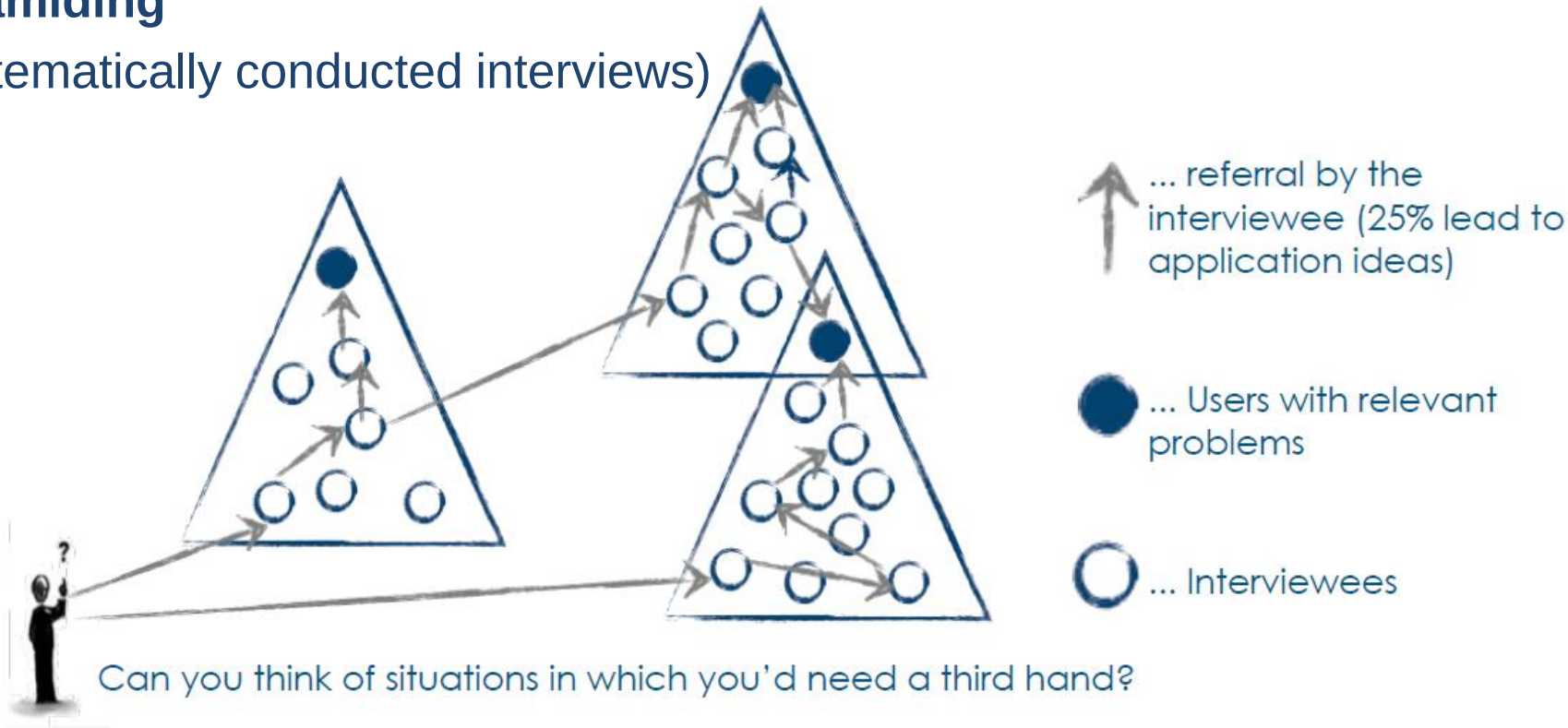
Can you think of any other areas where people suffer from similar problems like…?

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)



Information to be gathered during Step 2

In this step, you want to learn everything about the potential user's problems.

Essential information:

- problem in the application

- Current solution and potential solution as offered by the technology
- Technical requirements

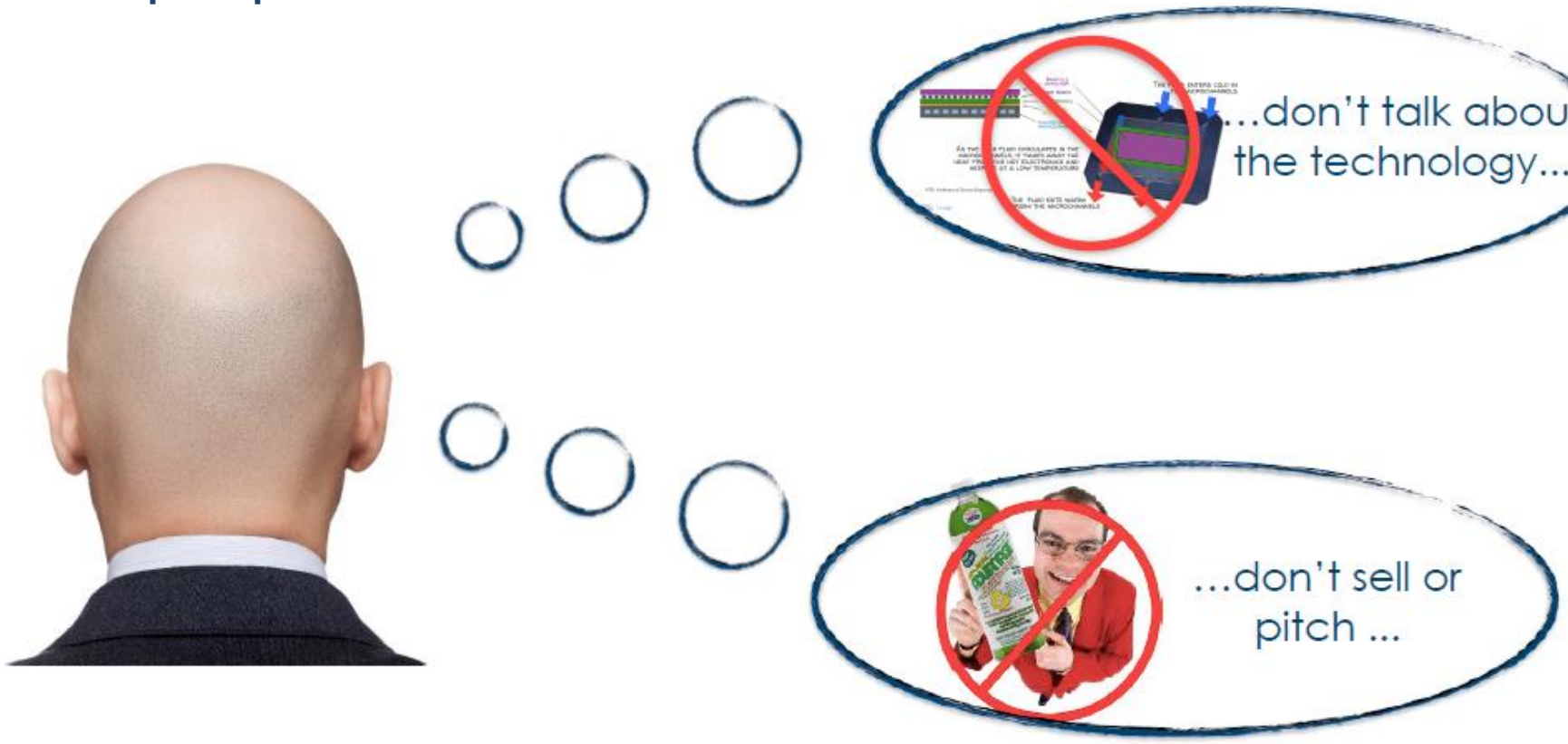
- Information on Benefit relevance
- Information on Strategic Fit

- Number of mentions
- Willingness to pay
- Contact data and referrals

Conducting customer-insight interviews

When conducting customer-insight interviews, beware of two common mistakes.

2 central principles:



A possible solution

110+ interviews and some 18 postings yielded nearly 47 application fields, 11 of them highly feasible and commercially attractive

112 interviews

18 postings

>40 applications
16 industries

Detection of alcohol intoxication

Wine quality analysis

Air quality analysis

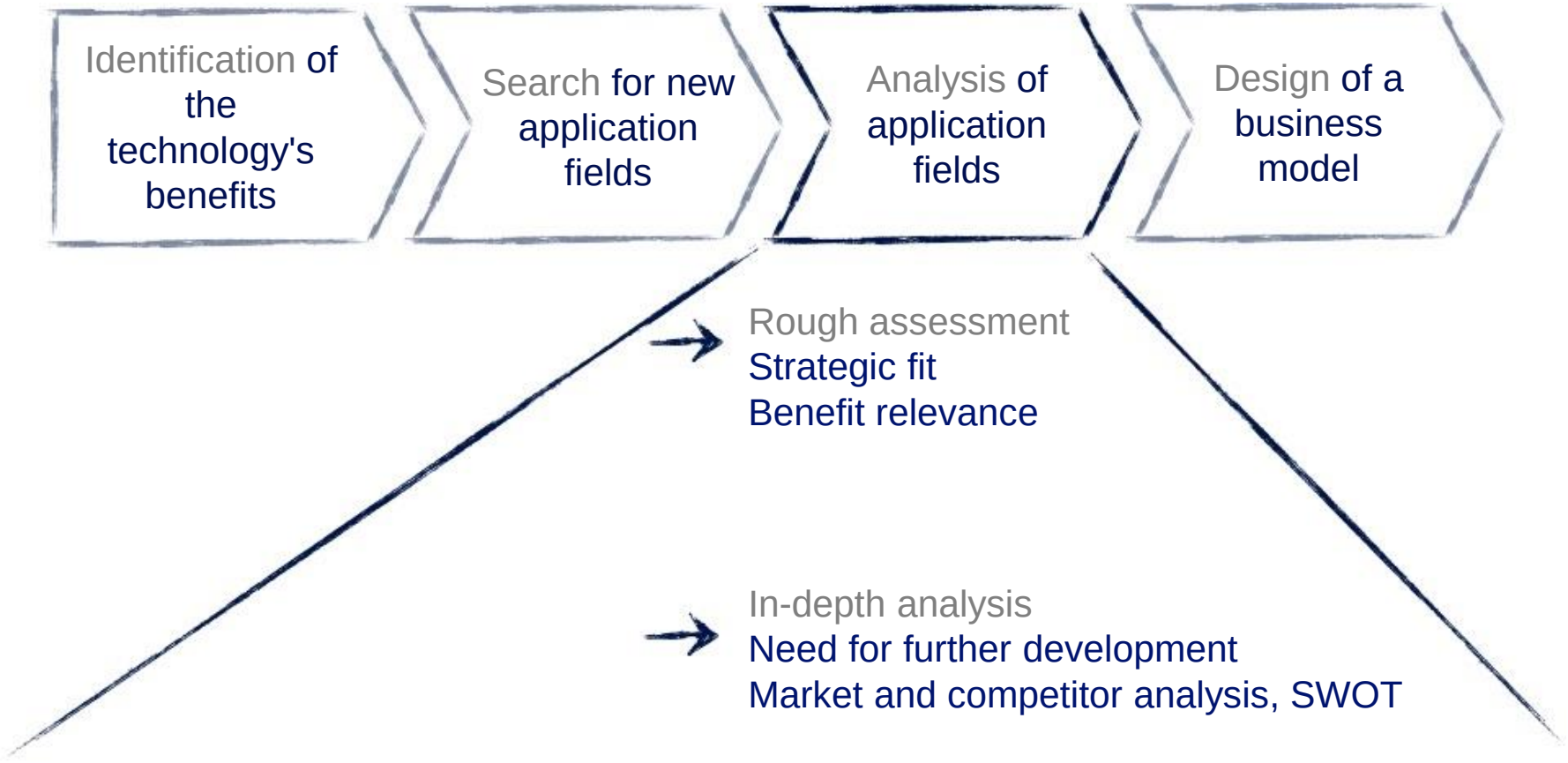
Air quality metering in animal breeding

Bad breath detection

Smart workwear in mining

Step 3

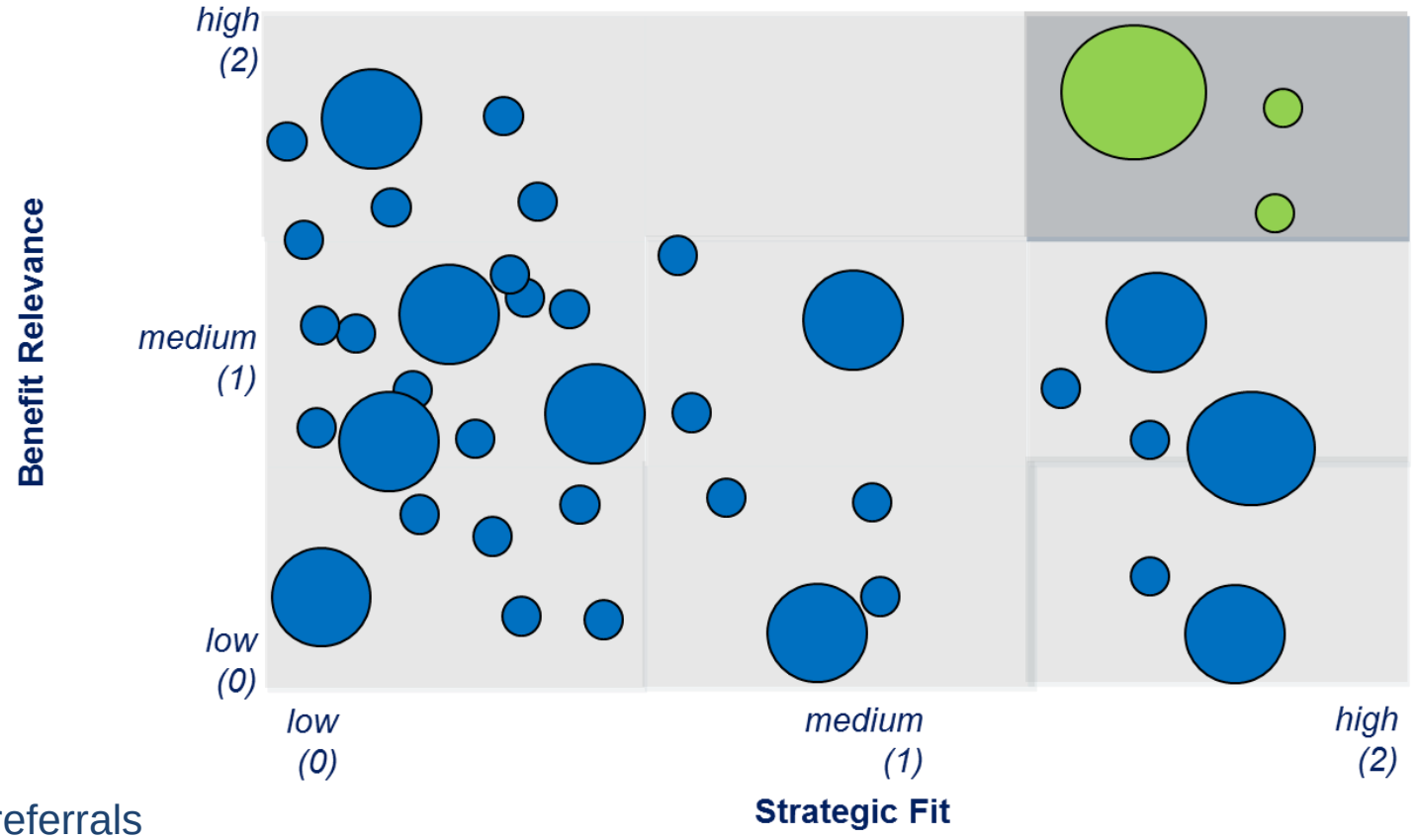
The third step is about evaluating the identified application fields.



Source: Keinz & Prügl, 2010

Rough assessment of application fields

A first but valid assessment of the application fields can be done using the indicators Benefit Relevance and Strategic Fit.



Bubble size = # of referrals

Application field “Air quality analysis”

A first but valid assessment of the application fields can be done using the indicators Benefit Relevance and Strategic Fit.

Air pollution is drastically increasing in big cities worldwide

Heavy air pollution can cause major health issues

Official measurement stations often unreliable

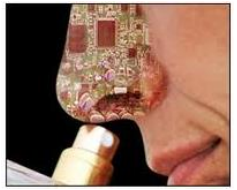
Residents often have limited access to information

Solution through ams miniature chemical sensor

Portable device with integrated sensor

Measurement of the level of air pollution at their current location

Artificial nose



Mobile sensing

Application field “Air quality metering in animal breeding”

A first but valid assessment of the application fields can be done using the indicators Benefit Relevance and Strategic Fit.

Different species in livestock breeding are a trigger of numerous gases (CO2, CO, NH3)

Can be harmful to the animals’ and the agriculturist’s health in high concentrations

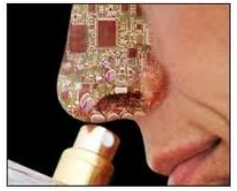
Current solutions extremely expensive and require high maintenance

Not able to detect more than one gas

Solution through ams miniature chemical sensor

Multiple built-in sensors in sheds
Broader coverage of gases
Less expensive

Artificial nose



Mobile sensing

Calculating Benefit Relevance

Benefit Relevance is a valid indicator of market attractiveness.

$$\frac{\text{\# of benefits relevant in AF}}{\text{\# of all benefits}} \times \text{Relevance index *}$$

= Index built from 4 items; 3-point multi-item likert scale (0 = I don‘t agree, 1 = I agree, 2 = I fully agree)

Items: The problem is highly relevant; The problem will become even more relevant in the future; There is no solution to this problem yet; Many people suffer from this problem.

Calculating Strategic Fit

Strategic Fit describes the application field's fit with the organization's strategic requirements towards new applications.

$$\frac{\text{Time horizon } * + \text{Resource fit } *}{2}$$

* = measured using 3-point single item likert scales (0 = not at all, 1 = somehow, 2 = perfectly)

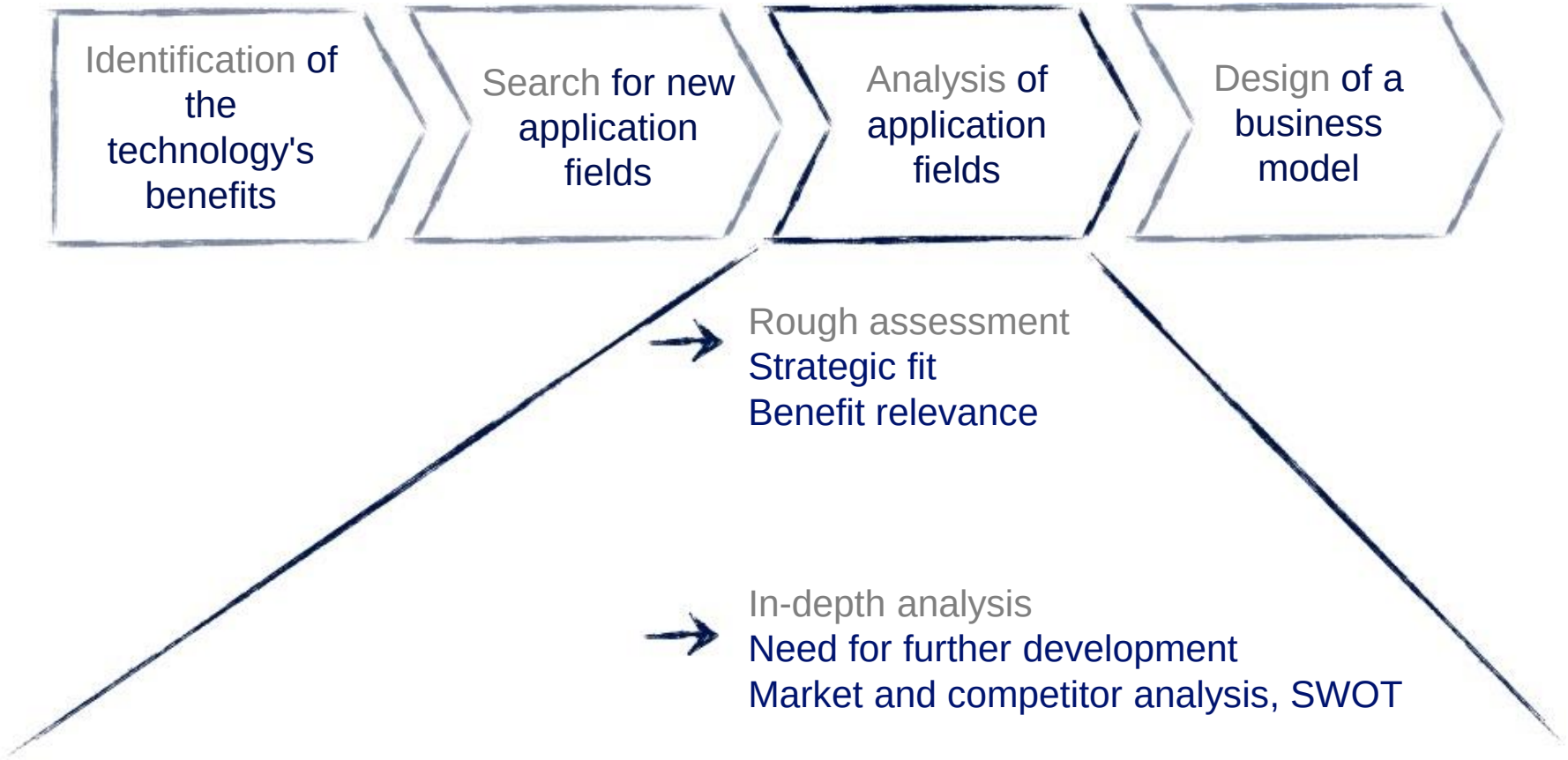
Items:

Time horizon -> Desired and actually possible market entry coincide.

Resource fit -> Market can be served with existing resources.

Step 3

The third step is about evaluating the identified application fields.



Source: Keinz & Prügl, 2010

Step 3.2: In-depth analysis of application fields

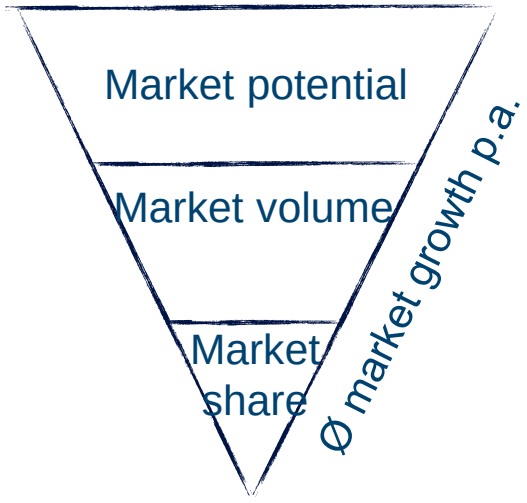
Market analysis

Important elements

Market definition

- factual
- geographic
- customer segments

Market measurements

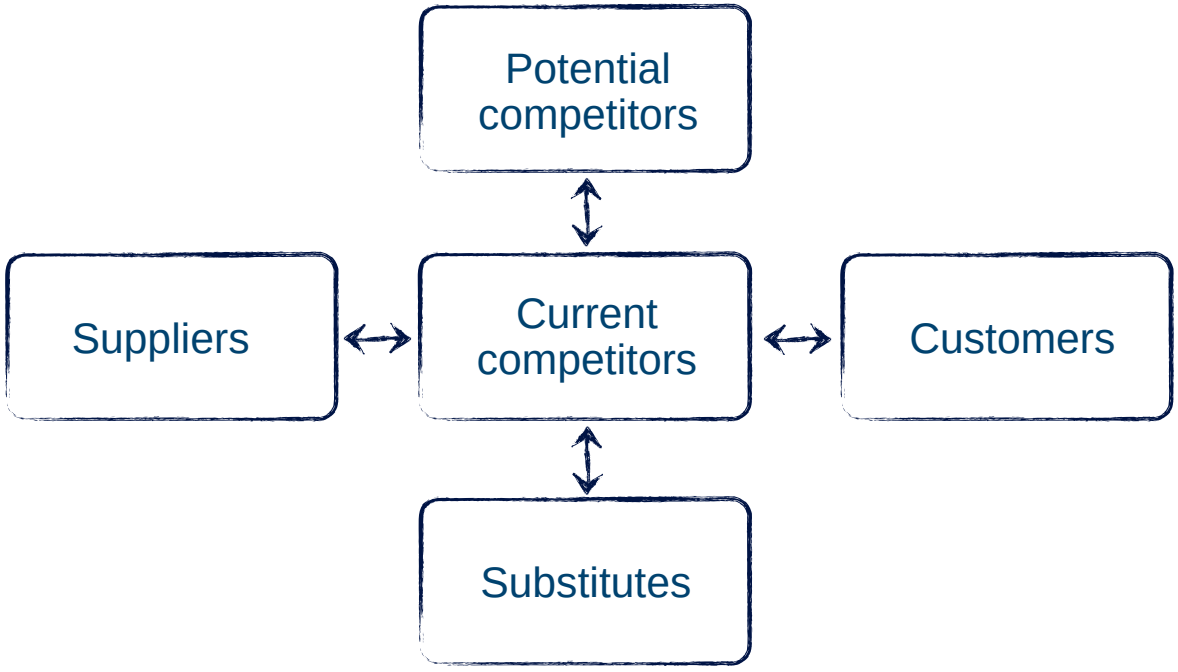


Market trends

- political
- economical
- societal
- technical
- environmental
- legal

Step 3.2: In-depth analysis of application fields

Competitor analysis

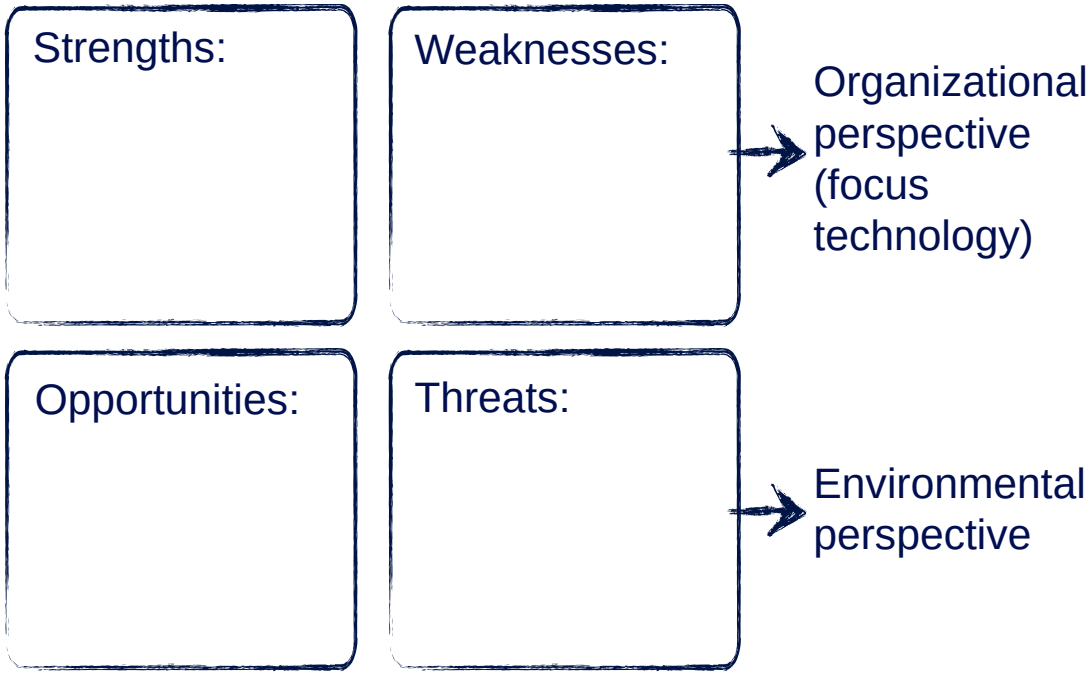


Important aspects

- A competitor is every organization that satisfies the same customer needs
- Focus on current competitors, substitutes and customers
- For all competitors: size, market share, attitude towards innovation

Step 3.2: In-depth analysis of application fields

SWOT analysis: comparing all insights of the previous analyses (technology/market/competitors) and deriving first suggestions for a feasible commercialization strategy.

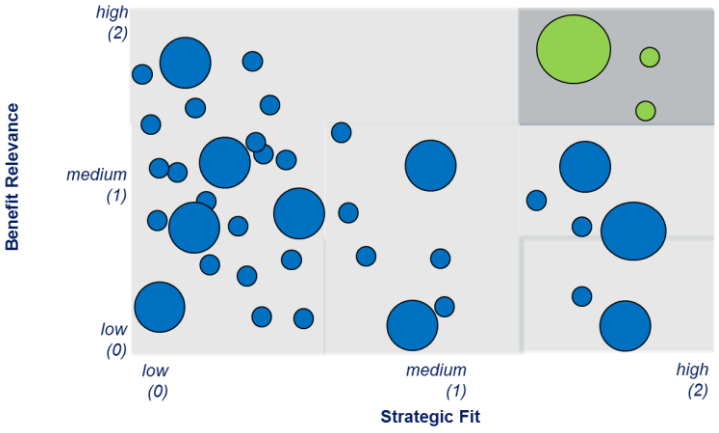


Important aspects

- Don’t include general points in the SWOT analysis, focus on specific insights/results
- SO strategies are highly useful for generating effective competitive advantages, ST strategies to reduce vulnerability to threats
- Strategy should focus on “doing the right things”, not on, “doing things right”
- Strategy answers the question what has to be done but not how to do it in detail.

Case study: ams

In-depth analysis of application fields



Technology integration and adaptation

e.g. mobile phones vs. wearables

Market analysis

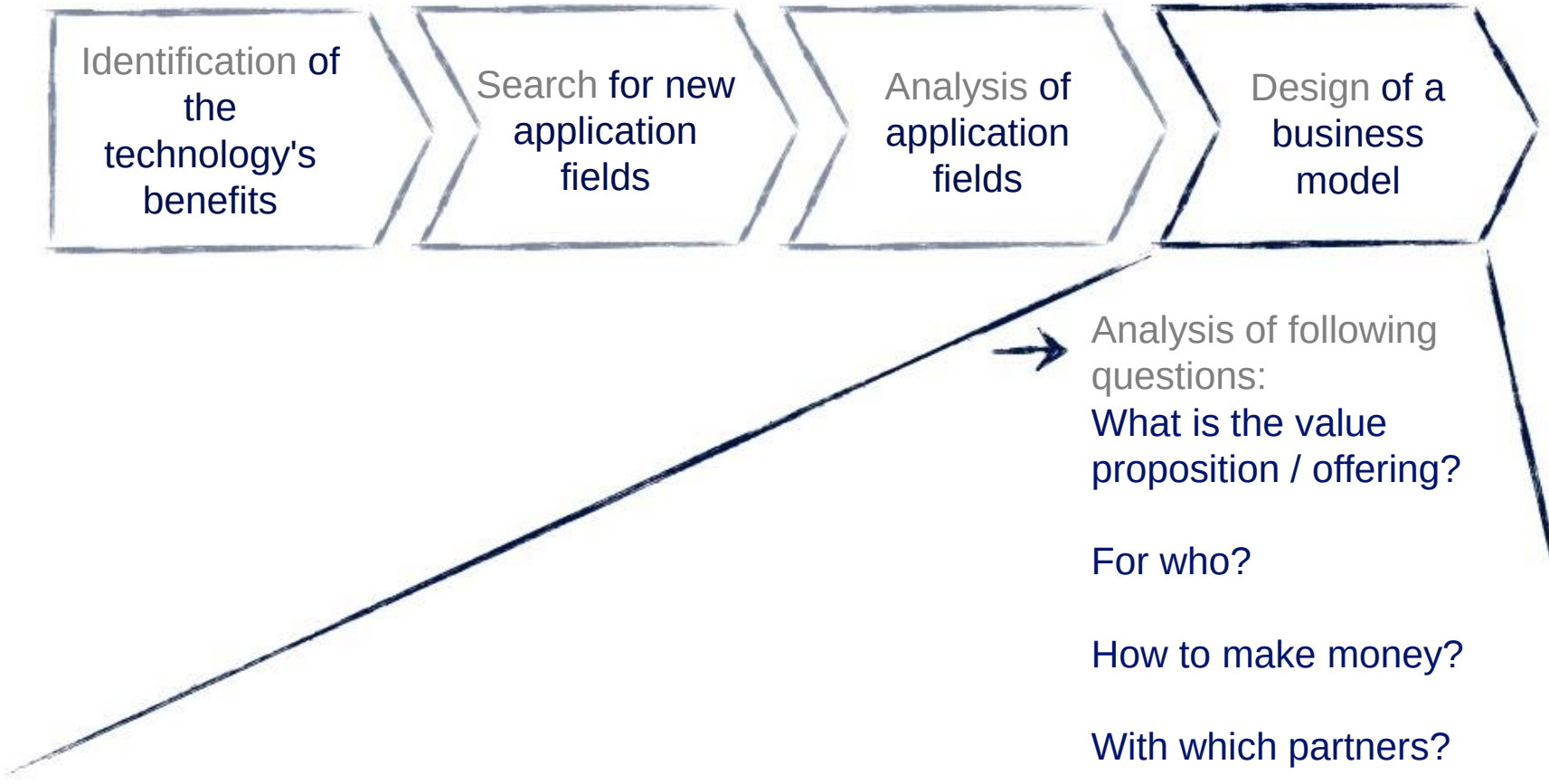
Sales volume of sensor
Sales potential of sensor

Competitor analysis

Customers
Other sensor producers
New entrants
Substitute products

Step 4

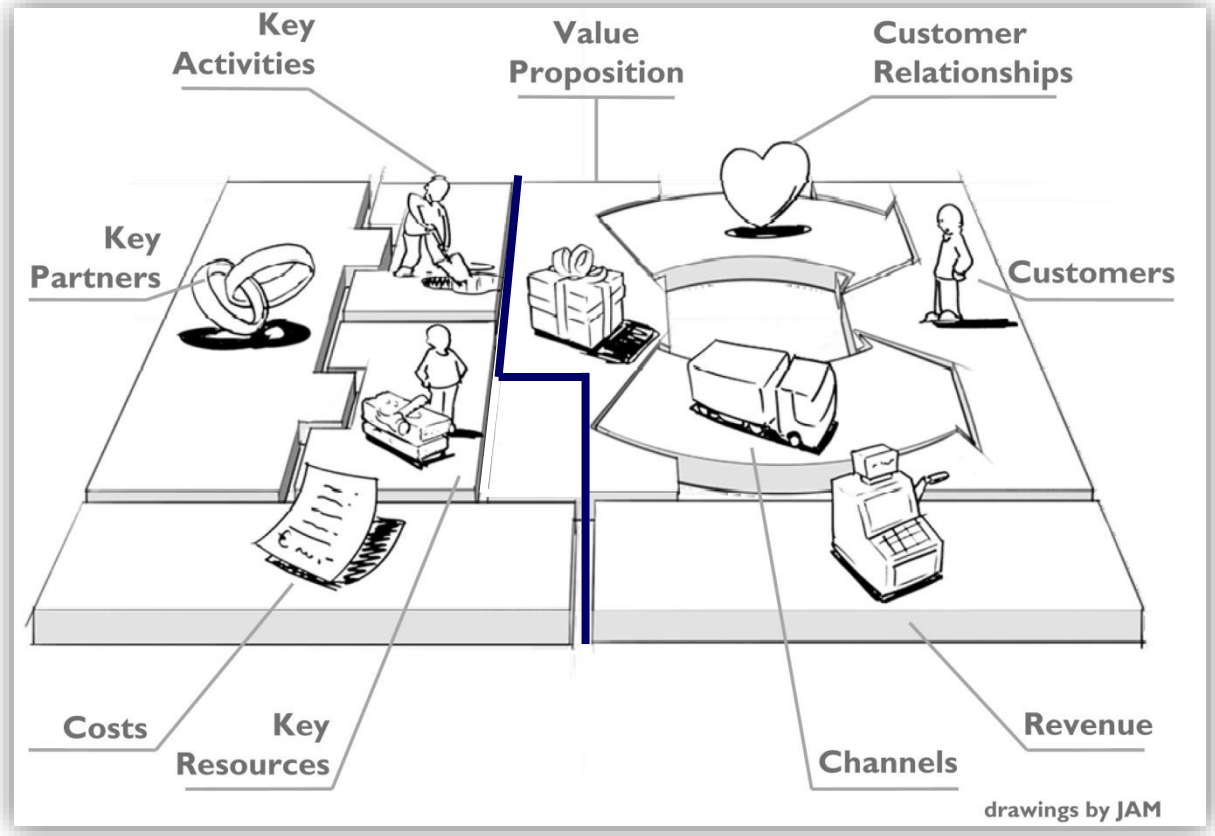
The fourth step is about designing an actionable business model / commercialization strategy for chosen application fields.



Source: Keinz & Prügl, 2010

Step 4: Business model design

Business model design with the “Business Model Canvas” tool



Source: Osterwalder & Pigneur, 2010

Important aspects

-Focus on customer/market perspective

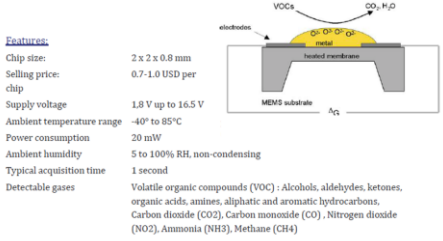
- Be as precise as possible

What is the value proposition / offering?
For who?
How to make money?
With which partners?

Case study: ams

Creation of a go-to-market strategy

ams



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Since 08/2016

hicling

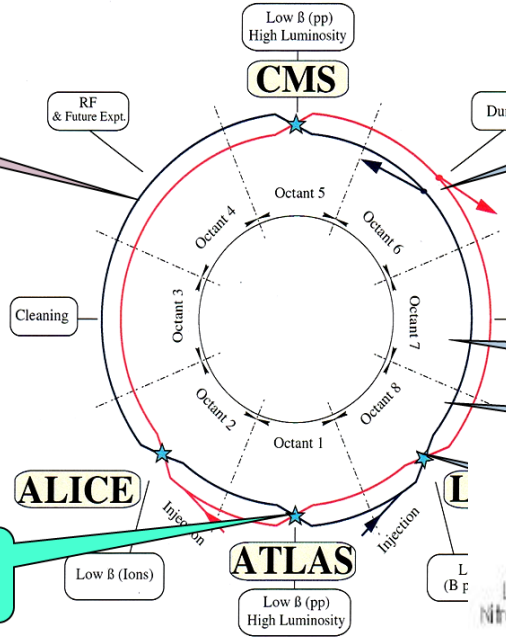
Cling VOC fitness wristband

Measurement of air quality and alcohol in breath by ams CCS801 and CCS803 sensors

Case study: CERN

CERN superconductors

Nb/Cu cavities for acceleration

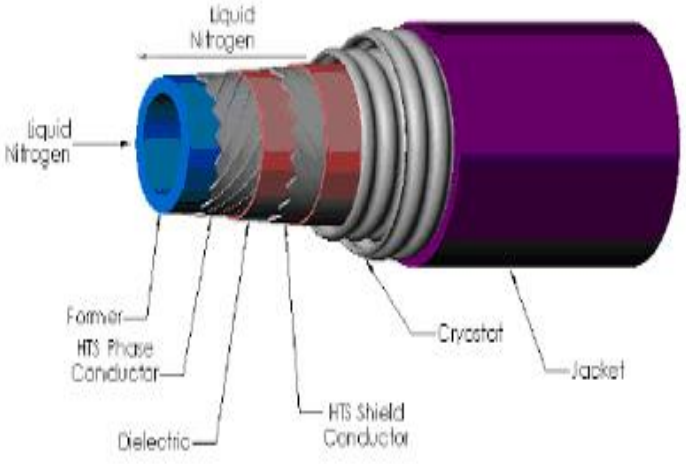


ATLAS and CMS detector magnets

1232 magnets for bending.

386 quadrupole magnets for focusing

~7000 Correction magnets



Single-Phase, Coaxial, Cold Dielectric Cable

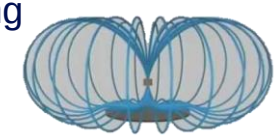
- HTS Phase Conductor
- HTS Shield Conductor
- Taped polymeric dielectric

Case study: CERN

Benefits & search for new application ideas

High current-carrying capacity on a small scale

Generating strong magnetic fields



Long-term energy storage & instant release of high power

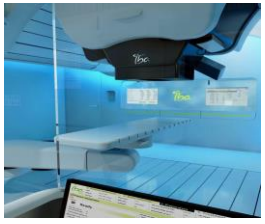
280+ persons contacted
90+ interviews with industry experts
30 application fields

Power transmission in major cities

Fault current limiters

Wind generators

Hybrid propulsion systems

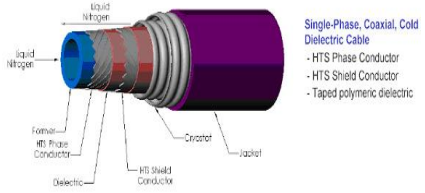


Particle therapy

Fruit sorting machines

Case study: CERN

Commercialization: R&D cooperation



- Invitation to CERN
- On-site research collaboration
- Use of CERN's superconductivity know-how
- Set-up of a collaboration
- Innovation for Microtec
- Media: next innovation in the fruit processing business (?)

MiCROTEC

South Tyrolean enterprise doing research with CERN scientists on solutions for fruit scanners with superconductor technology

Supraleiter-Technologie als Innovationssprung für die Frucht verarbeitende Industrie?

Und wie war die Zusammenarbeit mit dem CERN, einem Forschungszentrum mit äußerst klingendem Namen?

Combination of technological, methodological and market-and business related knowledge to generate innovative solutions

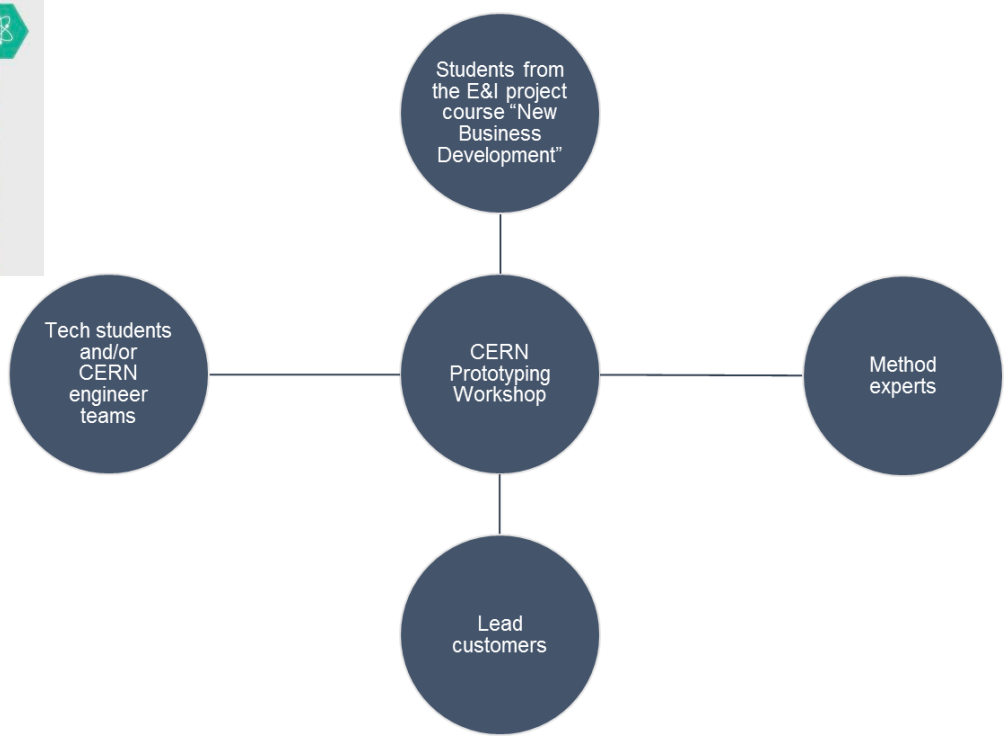
CERN Superconductivity Hackathon, September 22-24 2017, @Ideasquare

3 focal application fields
6 hackathon teams

Fruit sorting machines

UPS in data centers

Maglev space launch systems



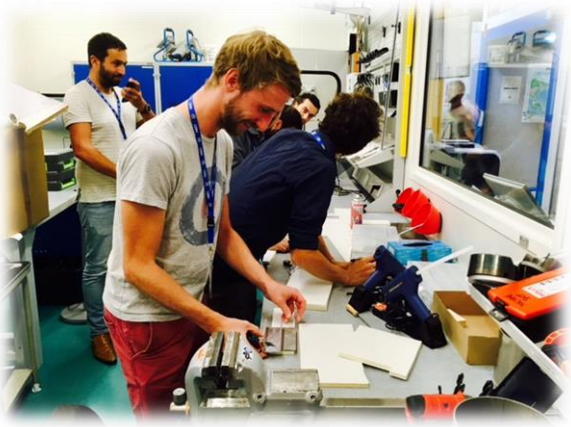
The outcomes of the project course „New Business Development“ were the starting point of the CERN Prototyping Workshop

Design thinking process

Day 1, September 22nd	Day 2, September 23rd	Day 3, September 24th
• Specification of product requirements with active involvement of lead customers • Ideation I: generation of low-fidelity prototypes applying the design thinking method	• Idea evaluation • Ideation II: development of conceptual prototypes using creative (sketches) and functional illustrations (mock-ups)	• Business modelling • Roadmap development: next steps to enter each market • Pitching contest • Jury evaluation & announcement of winners
With collaboration of NBD students and lead customers	With collaboration of CERN technology owners, designers and lead customers	With collaboration of NBD students and lead customers

CERN Superconductivity Hackathon

Some impressions



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Please write me an e-mail if you wish further reading materials on the topics