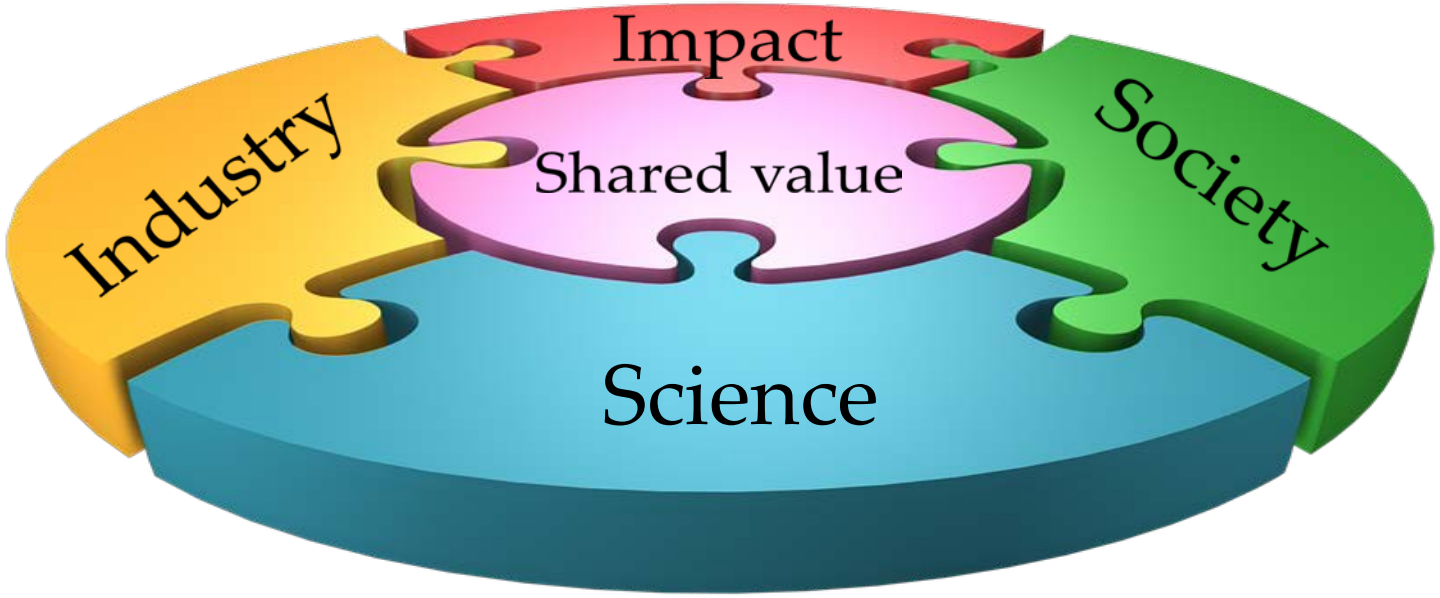
How to organize and support large *collaborations* in Big Science endeavours during many years, maintaining the *innovation* chain, and assuring spin-off and technology *transfer* along the way?

- Some personal reflections



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Symposium over Connecting Strength of Big Science, Brussels, June 8th, 2017

Organizing and Supporting Large Big Science Collaborations

For more details, see e.g. Max Boisot et. al, Collisions and Collaborations, OUP, 2012

CERN Ideas

Organizing and Supporting Large Big Science Collaborations Example:

- The LHC Experiments at CERN are founded on 7-page Memorandum of Understanding which lays out
  - Goals and Principles of Collaboration (Shared Values)
  - Organization Structures, Deliverables
  - Resourcing (personnel, funding)
- Not a legal document, rather an informal agreement relying on a best-effort basis of all participating countries and institutions
  - e.g. in ATLAS and CMS, some 40 countries and over 170 institutions committed to over 540 MCHF each, 1996-2008
  - describes the deliverables and sharing of responsibilities and principles of decision-making (e.g. voting rights; one institute one vote)

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Ideas

Maintaining the Innovation Chain

- It is understood here that by *Innovation* we mean developing and constructing leading-edge scientific instrumentation, involving (external) research laboratories and industry

- How to maintain this capability?
  - continuous instrumentation R&D initiatives (e.g. in detection & imaging)
  - going for "order of magnitude jumps" (not incremental)
  - engaging young researchers, students
  - actively snooping around new technologies and technical capabilities in industry

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Ideas

Spin-Offs and Technology Transfer

- It is understood here that by *Spin/Offs and Technology Transfer* we refer (actively) finding additional use of our scientific instrumentation or related technologies in society at large, involving (external) partners such as industry, research organizations, NGOs etc.

- This requires a different skills set
  - understanding user needs or experiences ("market pull")
  - understanding of (business) earning logics
  - understanding of partner capabilities and technology trends
  - understanding the importance of marketing (value proposition "packaging")
  - understanding the importance of making an *impact*

- Scientists motivated by their primary research very seldom possess these skills, nor are they motivated to obtain these skills

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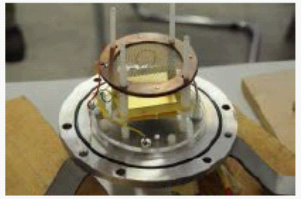
Ideas

Spin-Offs and Technology Transfer Example:

Knowledge Transfer

Home | Intellectual Property Dissemination | Medical Applications | Aerospace Applications | E

Flame Detector



Highly sensitive GEM based UV flame and smoke detectors

Description

Supersensitive UV flame detectors based on wire- or GEM-type amplification structure were developed at CERN in close collaboration with Ecole des Mines in St Etienne (France) and Oxford Instruments (Finland). In contrast to commercial UV flame sensors, in these detectors either semiconducting solid photocathodes or vapours with small ionization potential are used as main photosensitive elements. As a result, the sensitivity is 100-1000 times higher than the best commercial sensors, depending on a particular design. Wire and GEM-based gaseous detectors operate in proportional mode and can detect various flames, including sparks, in direct sunlight conditions. Combined with compact pulse UV sources they can detect simultaneously not only flames, but also smoke and some dangerous gases, for example benzene or toluene vapours. GEM-based detectors supplied with a lens can also provide information on the position of the flame and smoke. To make the detector robust, modified versions of GEMs were developed and successfully used in the latest designs: ether a so-called thick GEM or a resistive GEM, both manufactured from printed circuit boards.

Area of expertise

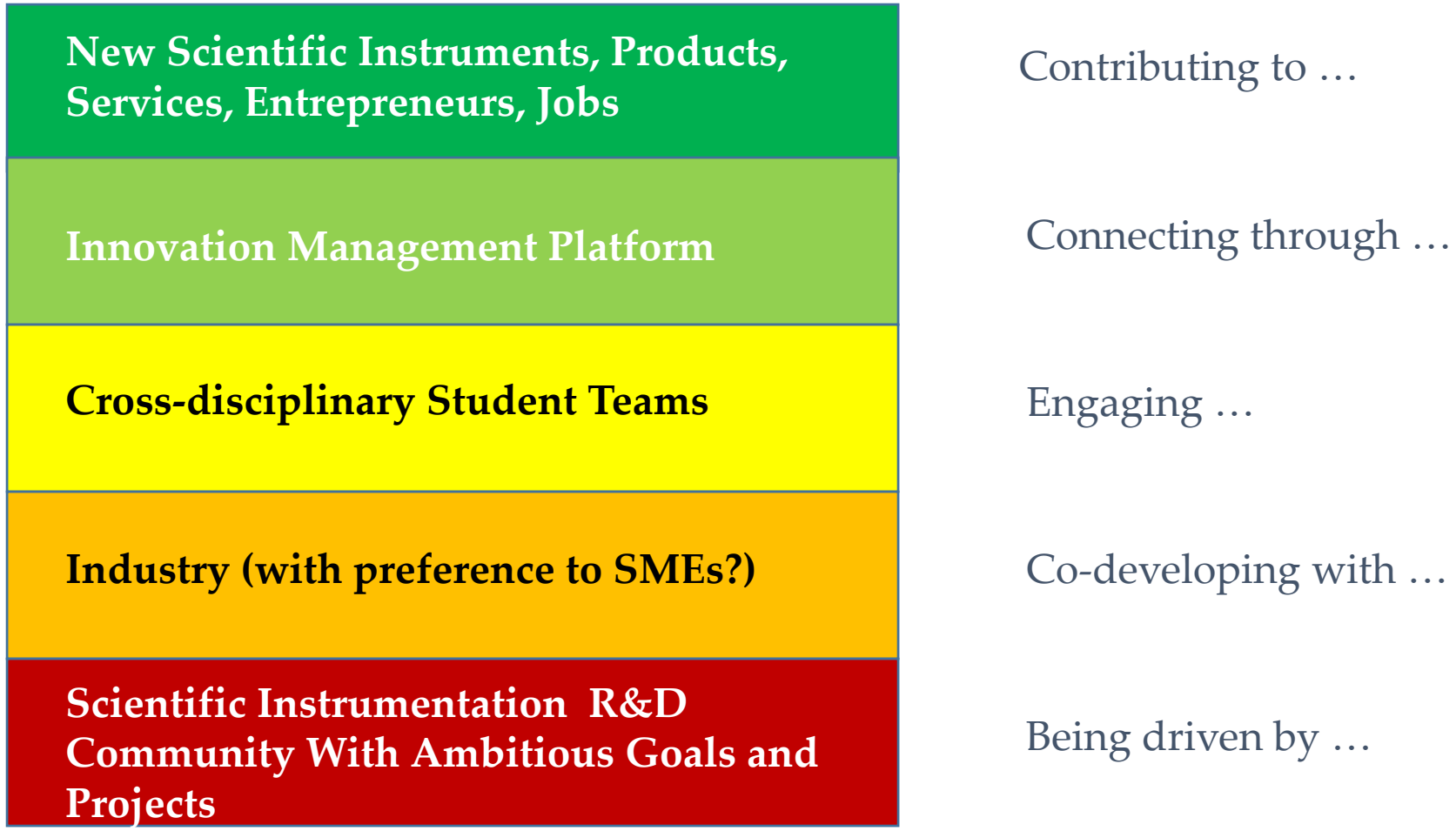
Detectors and Instrumentation

Possible applications

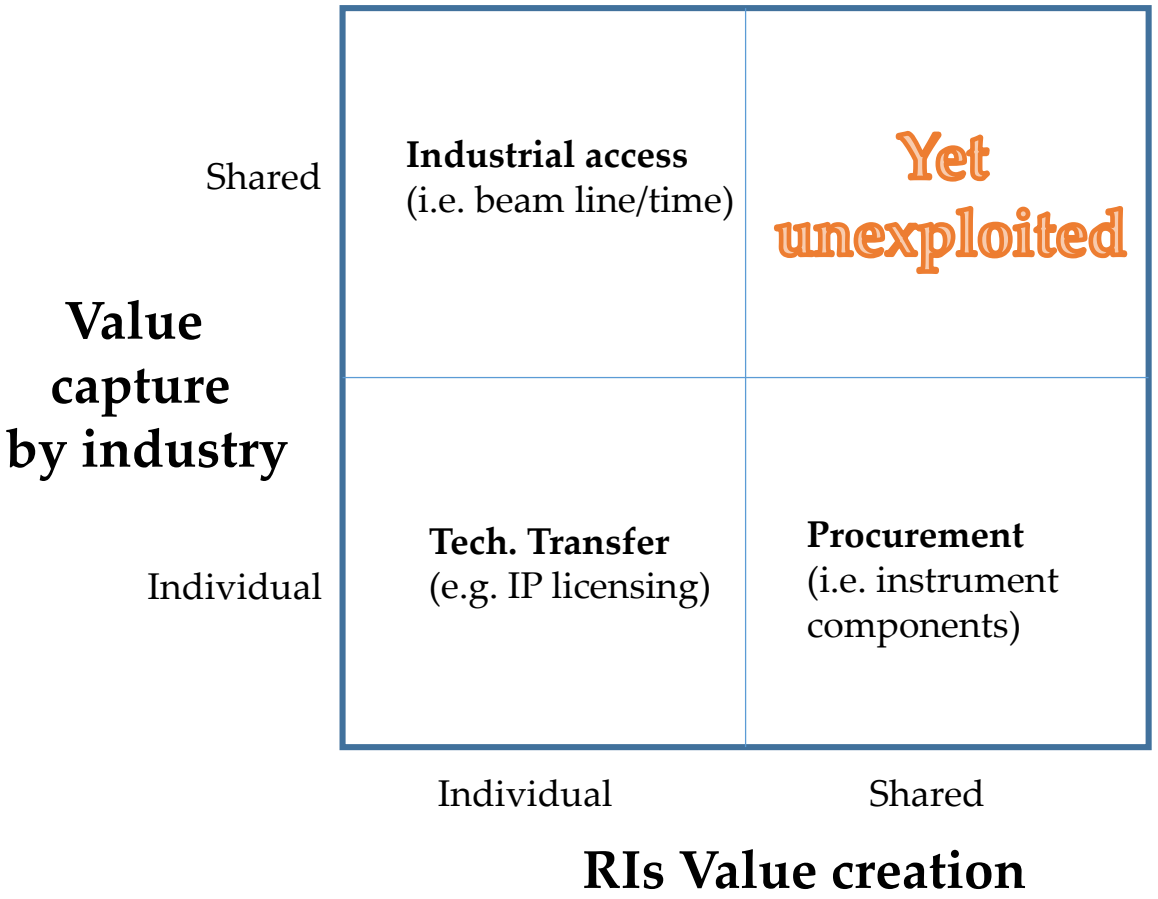
Wire and GEM-based gaseous detectors operate in proportional mode and can detect various flames, including sparks, in direct sunlight conditions. Combined with compact pulse UV sources they can detect simultaneously not only flames, but also smoke and some dangerous gases, for example benzene or toluene vapours. GEM-based detectors supplied with a lens can also provide information on the position of the flame and smoke. The new detectors are ideal for spark detection or fire safety survey of large areas: hangars, storage buldings and forests. RETGEM-based detectors ware able to reliably detect a $1{,}5m^3$ fire at a ~1 km distance.

CERN Ideas

What is Being Asked From Us? An Ecosystem?



Could we create shared value opportunities for innovation and knowledge transfer??



Shared value opportunities…

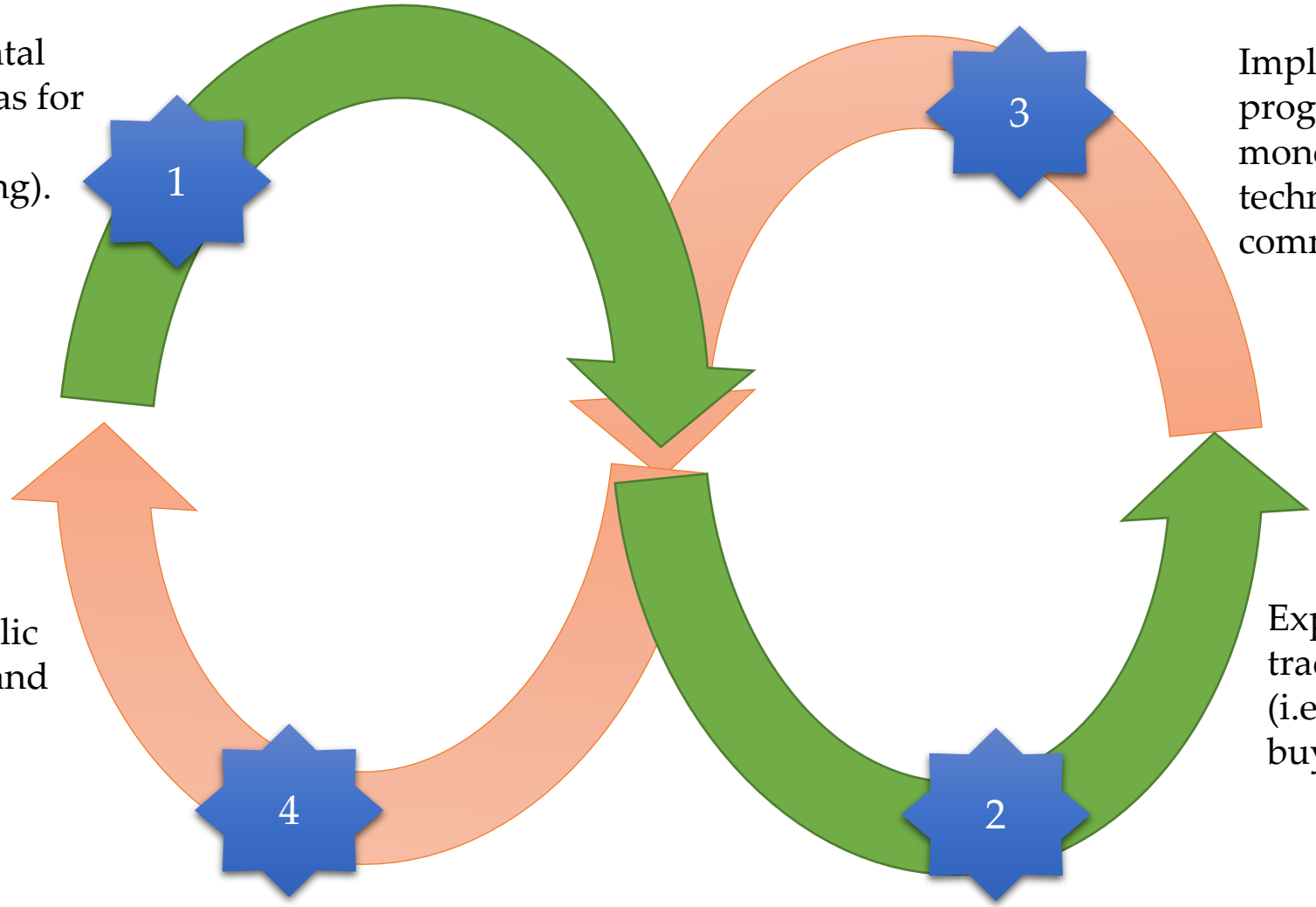
…what does it mean?

- ❑ Create economic and social value while respecting fundamental scientific mission of the research infrastructures (RIs).
- ❑ Fully exploit the synergies between national and pan-European RIs.
- ❑ Enhance existing (local) industrial collaborations and foster new (global) ones.

Adapted from Henry W. Chesbrough and Melissa M. Appleyard, Open Innovation and Strategy, *California Management Review* Vol. 50, No. 1, 2007.

Implementing a shared value approach: basic cycle elements

Identify common horizontal technological interest areas for RIs and industry (e.g. detection and imaging).



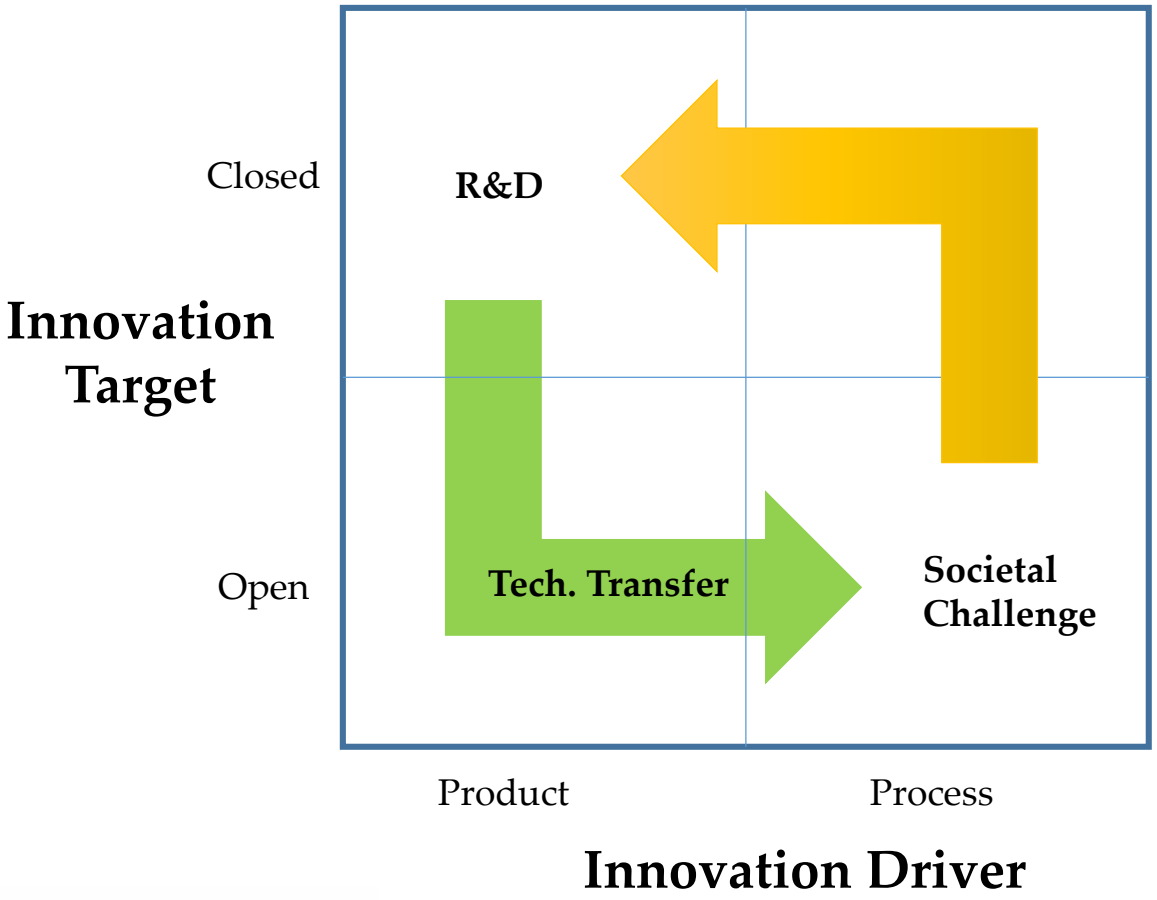
Implement bottom-up funding programmes in which public money absorbs initial technological and commercialization risks.

Explore relationships beyond traditional ones with industry (i.e. co-innovation vs. classical buyer/supplier).

Scale up private and public investment for both RIs and industry.

Adapted from Michael E. Porter, Greg Hills, Marc Pfitzer, Sonja Patscheke, and Elizabeth Hawkins, Measuring Shared Value: How to Unlock Value by Linking Social and Business Results, *FSG Report 2012*.

IdeaSquare@CERN: test initiative for ATTRACT



IdeaSquare Experimental Approach

Publicly funded R&D detection and imaging projects - co-innovation with industry; using open innovation principles.

From Societal Challenges to R&D, industrial and business value – using design thinking methodology and MSc interdisciplinary student teams.

More than 320 students since 2014 and 50% rate of demonstrated interest in entrepreneurship.

ATTRACT http://www.attract-eu.org/

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