AESIS

NETWORK FOR
ADVANCING & EVALUATING THE SOCIETAL IMPACT OF SCIENCE

4 - 6 November

AGH

We welcome you to

Ministry of Science and Higher Education
Republic of Poland

Impact of Science

Technote

VERTIGO VENTURES

ELSEVIER

researchfish by interfolio

Fraunhofer ISI

The role of Universities in fostering knowledge and technologies for economic growth and development

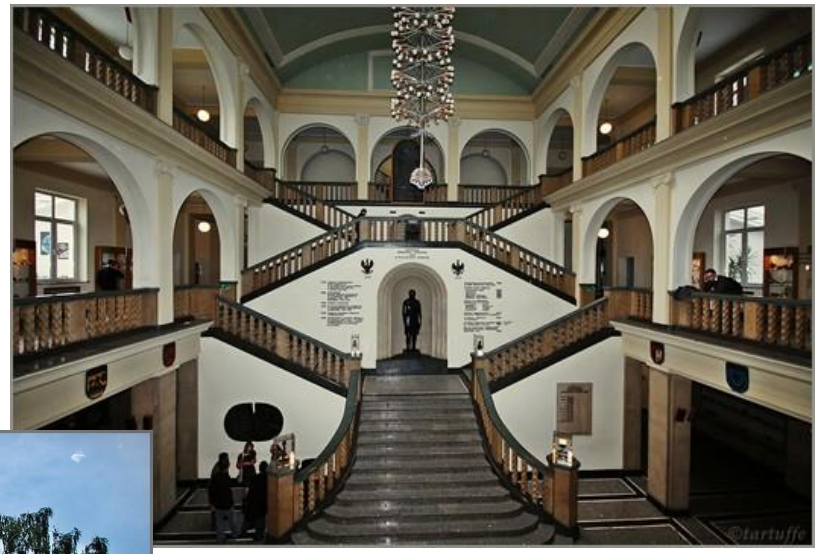
Tadeusz Uhl

University of Science and Technology AGH

AGH University of Science and Technology

History

The Academy of Mining in Krakow was founded on October 20, 1919

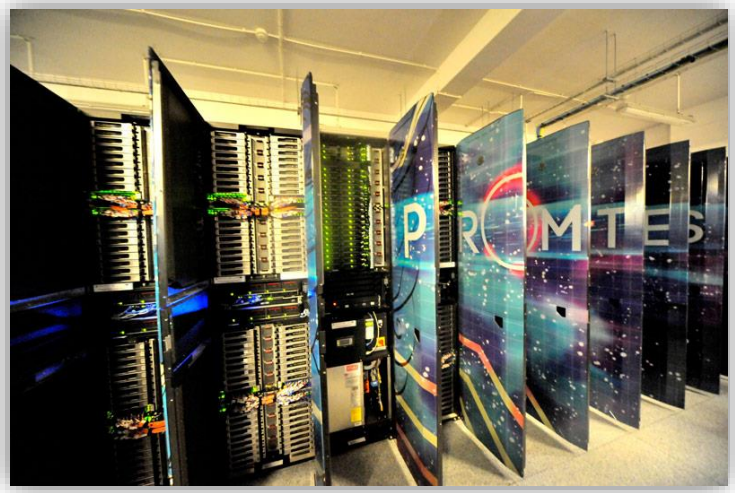


https://www.agh.edu.pl/en/

AGH University of Science and Technology

Present

Research and laboratories



Prometheus among 50 most powerful computers in the world

The latest generation analytical electron microscope (S)TEM FEI Titan Cubed G-2 60-300

Facts and figures

Number of faculties:16; numer of teaching programs: 58, including 200 specializations

Number of students (as on 30th November, 2017) **total number: 33 455**

- full-time students: 25 193
- part-time students: 5 069

(full time and part time foreign students: 548)

- doctoral students: 990 (including foreign students: 43)
- postgraduate students: 2 203 (including foreign students: 9)

Number of staff (as on 31st December, 2017) **total number: 4 138**

1) teaching and research staff: 1 940

full professors: 172
associate professors: 259
assistant professors: 1 129
assistants: 380

2) teaching staff: 260

AGH University of Science and Technology

- Strong cooperation with industry (education, research)
- AGH ranks first in the ranking of Polish universities in terms of the number of graduated who are businessmen whose wealth exceeds EUR 100 million
- 6,11% of CEO of Polish companies (among 1000 biggest companies) are graduated at AGH
- 79% of AGH graduates took up jobs that were in line with or partially in line with their education,
- 68% of them were employed before graduation

AGH

AGH offers students a market-oriented and business-friendly environment

Department of Robotics and Mechatronics

Teaching: Supervisor of 56 graduated PhD students (21 of them are professors at Universities), Supervisor of 134 master thesis,

Research interest; Structural dynamics, SHM and diagnostics, Mechatronics and Robotics, Numerical modeling and simulation, Artificial Intelligence,– measuring systems design, Modeling and simulation – multiphysics, multiscale, Identification, smart structures and materials, signal processing, drones design and application, space technologies

Administration: Director of Center of Space Technologies at AGH

Experinces: 30 years of research in Poland (AGH - University of Science and Technology, Professor on Mechatronics since 1991); 3 years of experience in France, 1 year in Belgium, 1 year in The Netherland, 2 years in USA, 1 year in Japan

Contribution: Contributed to almost $24 M of research funding (EU FP5 (SNECMA, Rolls-Royce, MAN Turbo, Alstom) , FP6 (Airbus, Dassault, Onera, LMS) , FP7 (FIAT, RENAULT, LMS, Siemens, Bombardier Transport, Alstom Transport, ABB, Alstom Power, Tauron, MPWiK, Grupa Azoty, Solaris, FAMUR, Wielton SA) H2020 SIEMENS, LMS, ….

Publications: Over 1000 research publications (includes over 150 peer-reviewed journal papers); citation – h=26 (Scopus), h= 36 (Google Scholar);

Entrepreneurships: Running up of 29 start-up in high –tech; EC Engineering, EC Electronics, EC Test Systems, EC Systems, RS Solutions, RCC Nova, SHM Monit, InnoBiosens, Enetech.

Prof. Tadeusz UHL

AGH

R&M

Role of University

- **Education** - „their function is to provide able, self-directed learners that are independent and confident, and will go out into society and give to society through leadership or through civic duties”
- **Knowledge generation -** „to provide new knowledge, to change paradigms, to aid society in its development and in meeting new challenges as they come along”

Role of Companies (Business)

- Continuous generation of **revenue**
- Continuous increasing of company **value**

Main differences between science and business

Science should be opened and should cover more then needs form business, results should be published and discussed by research community

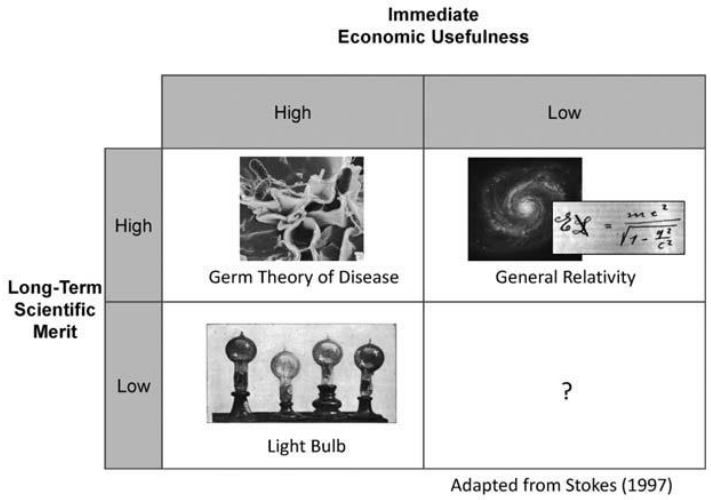
Business should be focused on particular process and work in confidence, should be limited to market needs

Research institutions are focused on spending money

Business is focused on earning money

Science doesn't understand business and business doesn't understand science

To achieve success in commercialization of research results the bridge between science and business has to be build.



Adapted from Stokes (1997)

Transferring a people from academia (project team) to industry seems to be most efficient way of technology transfer. Start ups, spin offs, etc.

Main problem of cooperation

Output from Universities:

Talents

Knowledge

Research Ideas (new technologies or products)

Output from Companies:

Profit

Value of the company

Knowledge
Talents

Value

Very complex and risky process, nonlinear and dynamic with uncertainty

Three ways of achieving value from University research results

1. **Joint projects Industry – Academia** (direct contract, co-finansing from agencies)- to big differences and goals to work together, who should has benefits from the project ?
2. **IP development at Universities** – no well known mechanism to sale IP, a little money for building of value of IP, no interest from Universities (boring for researchers)
3. **Spin – off, start –up companies** with academic background

What should be done to get a success

1. **Develop strategies** to induce or upscale cooperation between academia and the private sector
2. Analyse and propose a strategic approach to **support spin-offs** and investments in medium/high-risk entrepreneurial endeavours
3. Secure legally sound, competitive, **model cooperation** agreements focusing on specific collaboration for given sector (eg. Space sector, agriculture, etc..)
4. **Strengthen human capital in research and innovation**, by enabling balanced brain circulation between academia and socio-economic entities, including strategies in having work mobility between academia and the private sector.

Source: discussion with prof. Eric Tschirhart (University of Luxemburg)

Develop strategies to induce or upscale cooperation between academia and the private sector

A key component for academia and private sector collaboration is the **interfacing and sharing** of knowledge, research and innovation.

A mix **university- and industry-driven structure** may remove the barriers of collaborations – eg. Joint Research Centers

Intensify the breadth of individual team member roles, or even cross-train members irrespectively of their affiliation, with a coupling to feedback loops that may help individual members understand how they work together, and how their work may affect that of other teams.

Push members of the team **to work as one cohesive and flexible structure**, with only one profit-and-loss bottom line for universities and the private sector

Analyse and propose a strategic approach to support spin-offs and investments in medium/high-risk entrepreneurial endeavours

- **Valorisation of knowledge is a goal**, it must be considered within a strategic context **to maximise value creation for all parties involved**: universities, members, private partners.
- An investigative process to synthesise the existing best practices in successful spin-offs
- A strategic process to encourage transversal usage of human capital and qualify the leadership of creators, by breaking boundaries between disciplines and supporting multitasking for the benefit of the company created;
- A strategic process to manage knowledge valuable transfer from the Universities; IP brokers may be of considerable help by providing the highest quality of service to the Universities;
- A process to support, verify and adapt the execution of a business plan in a spin-off; actually, company performance may be stalled by innovation, due to specific investments

Spin – off companies should:

- Concentrate on their innovation to bring it to the end of their vision;
- Control their budget rather than succumbing to the ease of fundraising, which is in fact extremely destabilising;
- Preserve their independence rather than allying themselves with those who may have no interest in the outcome of their innovation.

Entrepreneurships friendly environment vs. University policy

- Positive prejudice to entrepreneurs for University community and mentoring of business oriented action (during education process)
- Acceptance of business risk – University staff consider only technical risk
- Innovation in administration, creation of new and friendly oriented mechanisms of company creation at the university

Secure legally sound, competitive, model cooperation agreements focusing on specific collaboration for given sector

In the existing judicialization of the collaboration between public entities such as universities and the private sector, the legal factualization of the collaboration is an essential asset for all parties.

To my knowledge, most of the times industry partners are in front of less-experienced contract negotiators from universities, with a limited, if any, background in IP and commercial law.

- A sober re-equilibration of the partners' respective power in the negotiation of a collaboration agreement;
- A full compliance to state-aid regulation fixed by the Treaty on the Functioning of the European Union, Article 107(1);
- A fair return on investment to the public bodies;
- A dissemination of the public knowledge and research to economic entities generating added value for the society;
- A scaling excellence by joining forces with other partners in the same area

Strengthen human capital in research and innovation, by enabling balanced brain circulation between academia and socio-economic entities, including strategies in having work mobility between academia and the private sector

Human Resource Strategy for Researchers (HRS4R) supports higher education and research institutions and funding organizations in the implementation of the Charter & Code in their policies and practices. Still, this support is limited to the public institution itself and **does not address cooperation between universities and the private sector.**

Key aspects in this exchange between academia and industry may incorporate the followings:

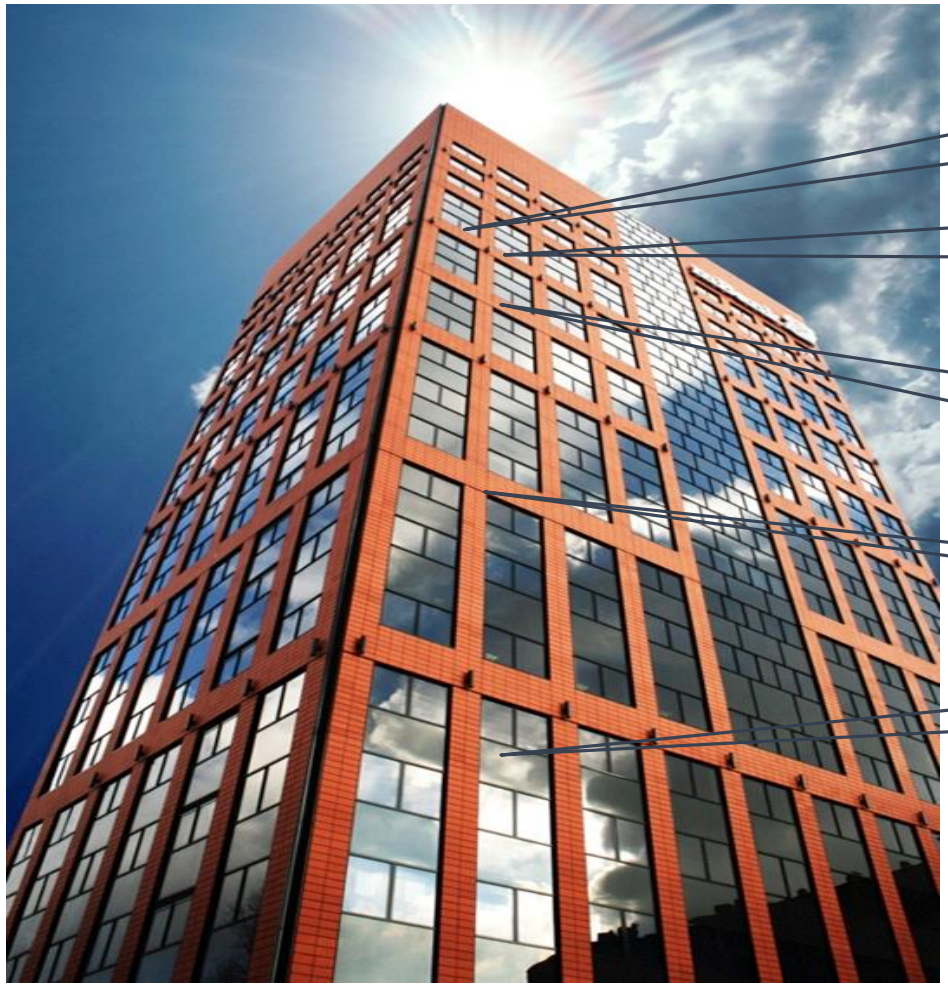
- **Promoting exchanges of academics and scientists between academia and industry**, this needs the identification of the conditions, incentives a strategic facilitation scheme is a fundamental point in favouring mixed careers;
- **Promoting talents (skills and competences**): career mobility is determined by training possibilities, coaching, mentoring, support staff and supporting regulation; irrespective of an technology level readiness analysis which is most of the time arbitrary or even obsolete; by contrast, market analysis, which is most of the times restricted to the industrial operator, has to be shared with the academics who are at the forefront of science;
- **Strategic key actions must be developed to eliminate the regulatory barriers preventing human capital mobility and brain circulation between universities and the private sector. A social protection and pension systems diversity is an obstacle of career mobility in Europe**, already starting at the doctoral level; for example, **the RESAVER pension scheme is a key feature to alleviate occupational pension barriers for example, but remains far too restricted;**.

Causes of unsuccessful start ups

Only 3 to 5 % of start-ups are successful

1. **Barrier on market entrance, no sales channels.**
2. **Non professional management of companies**
3. **Lack of sales organization**
4. **Lack of ability to change company strategy**
5. **Some misunderstandings between founders**

Entrepreneur friendly environment



Offices of big companies and VCs

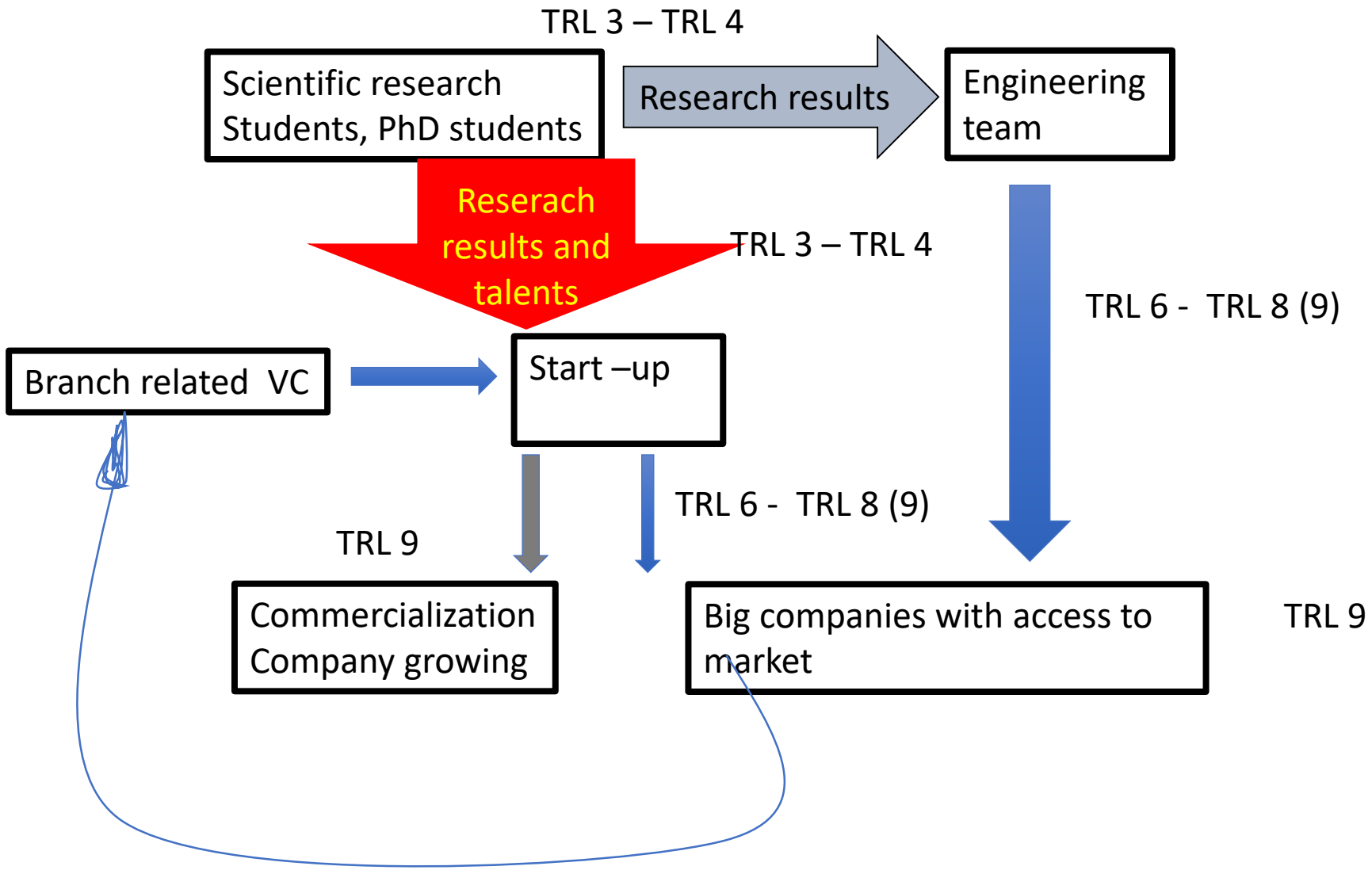
Experienced researchers/ Leaders

PhD students/Graduate Students

Engineers/Mentors

Start -up

Possible path for value generation



Innovation ecosystem

Innovation ecosystem evaluation system	Innovation institutions	Innovation companies
		Number of higher education institutions
		Scientific research institutes
	Innovation resources	Innovation talents
		Innovation capital
		Innovation technologies
		Makerspaces
	Innovation environment	Innovation strategy
		Innovation foundation
		Innovation atmosphere
		Innovation cost

Source: Deloitte Research

Case study

Reliability Solutions sp. z o.o. spin – off company started by students and researchers at two leading university in Poland (Jagielonia University Department od Matematics and University of Science and Technology AGH Department of Robotics and Mechatronics) 4 years ago.

Numbers:

At the start 2, now 41 employes

2016 income about 3 000 000 PLN - 2019 about 10 000 000 PLN

3 big contracts

Now Office in Rotterdam

Who we are and what are we doing?

- Reliability Solutions is a spin-off from the AGH University of Science and Technology and Jagiellonian University in Krakow.
- Our mission is to transfer knowledge and novel solutions from the academia into the industry.
- We are experts in data analyses for RAMS, technical maintenance and the machine exploitation optimization purposes.
- Within those fields we:

Design and implement own IT products, especially Predictive Maintenance

Conduct data analyses

Technical expertise and assistance

Reliability Solutions

Management

Prof. Tadeusz Uhl
Founder, R&D consultant

Prof. Piotr Oprocha
R&D consultant

Mateusz Marzec
CEO and Founder

Paweł Morkisz
CTO and Founder

Krzysztof Płachta
CIO and Founder

Mateusz Marzec CEO

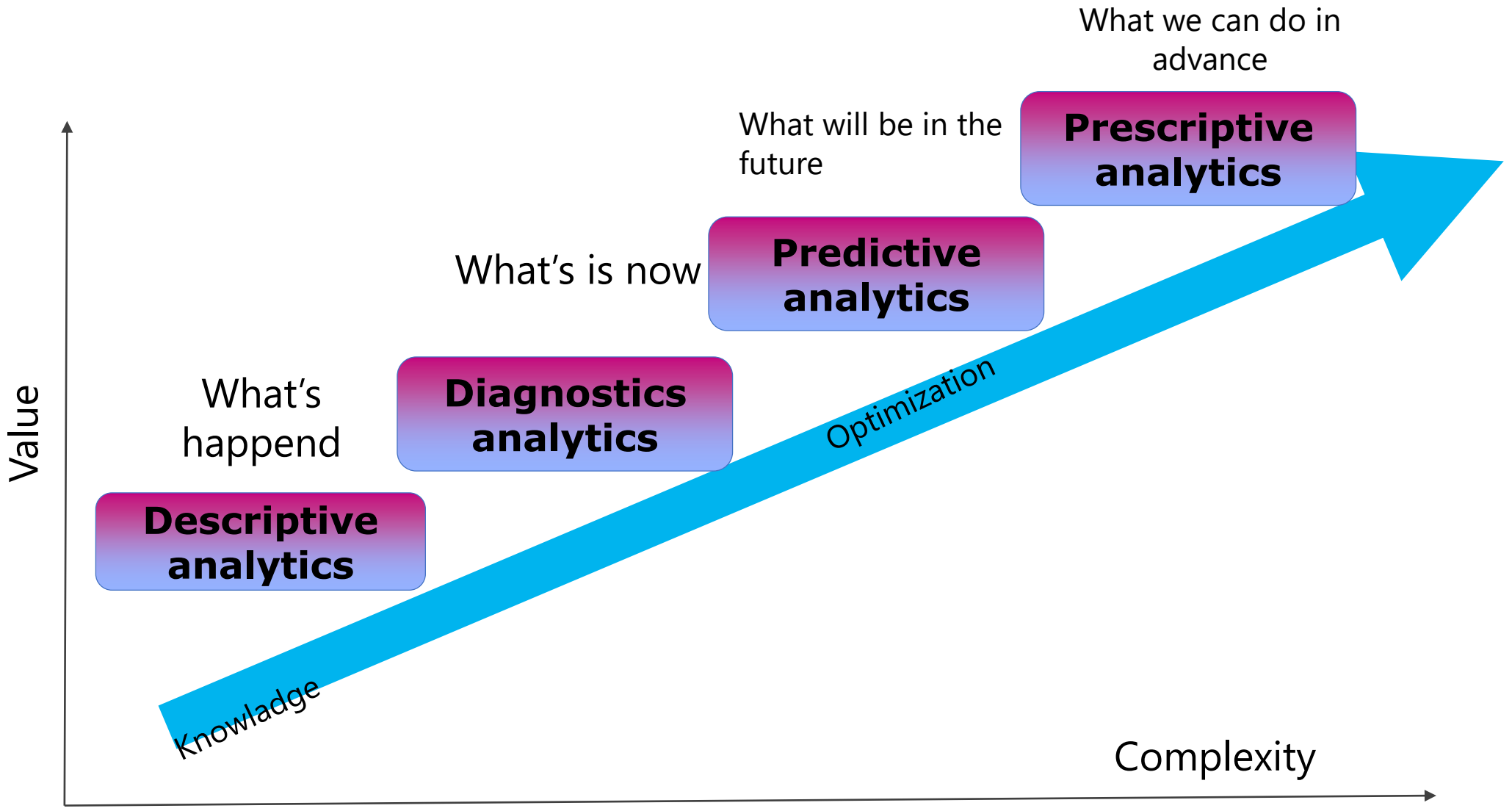
Krzysztof Płachta CIO

Paweł Morkisz CTO

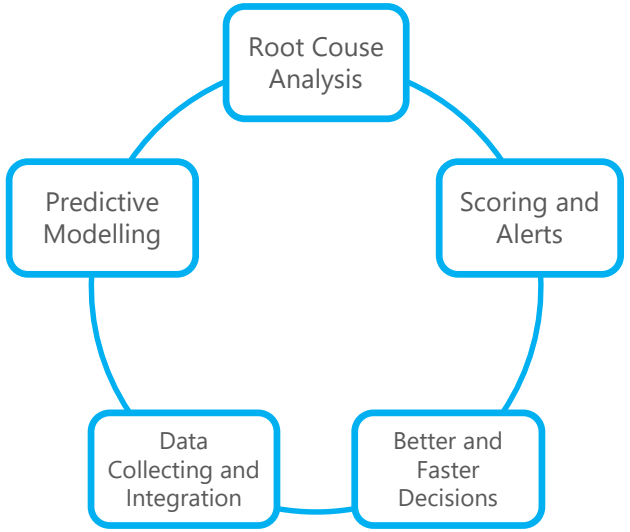
Prof. Tadeusz Uhl

Prof. Piotr Oprocha

Predictive maintenance procedure

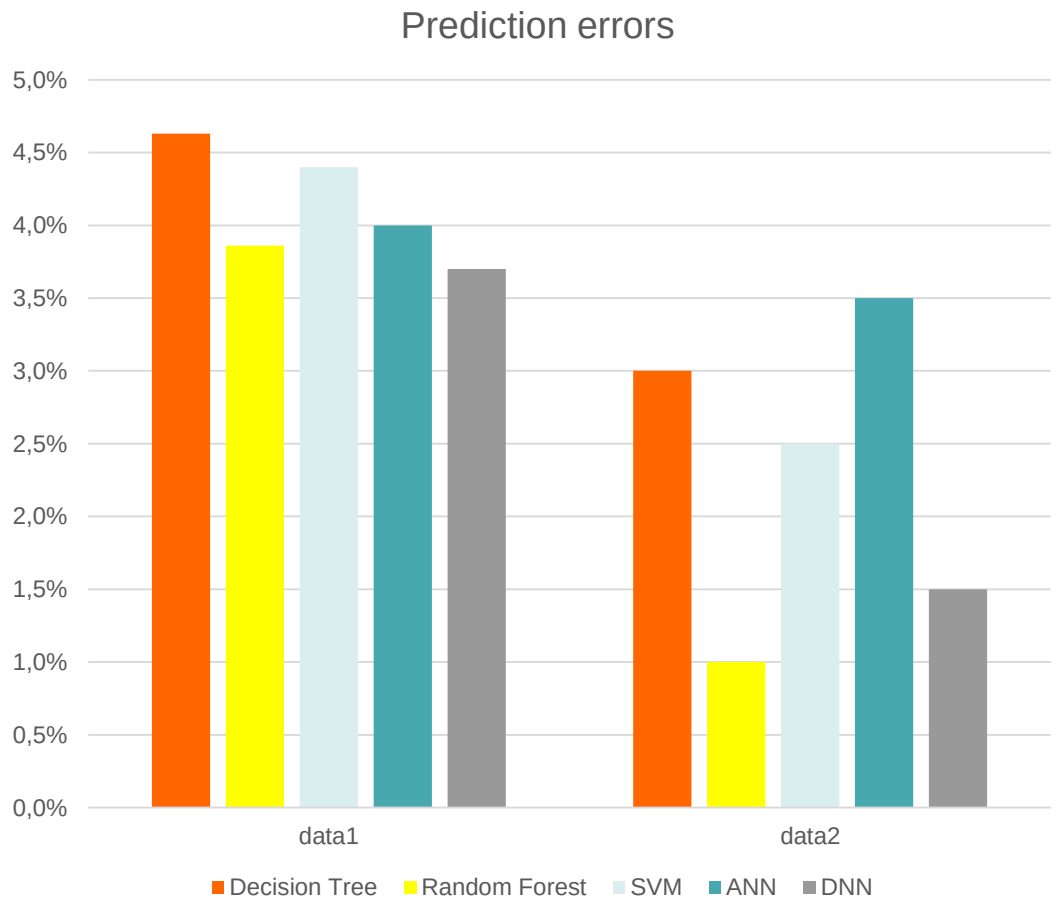


Predictive maintenance procedure

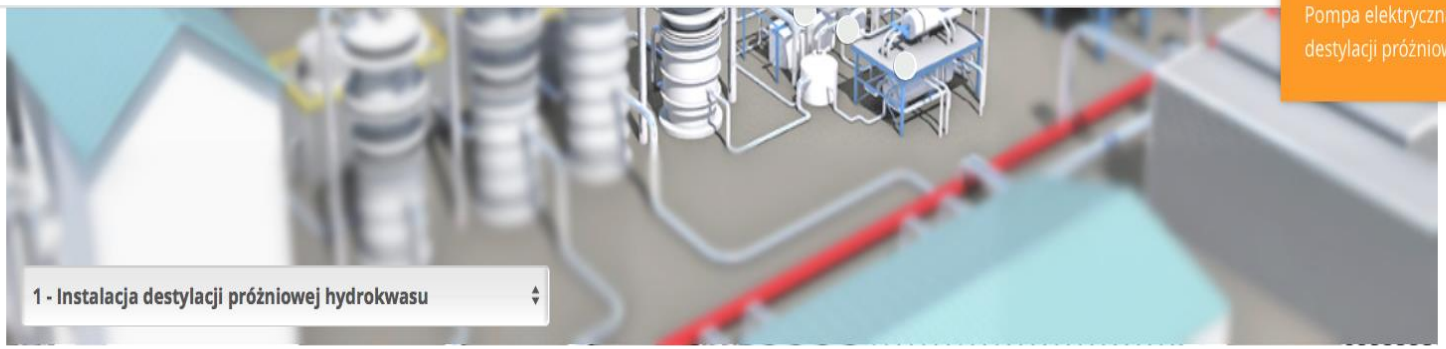


We can use any of the classification type machine learning or artificial intelligence methods, including:

- Decision Trees,
- Random Forests,
- Artificial Neural Networks,
- Deep Learning,
- Supportive Vector Machines

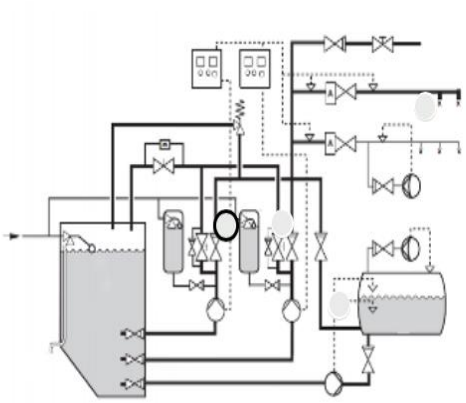


Przekroczono próg ostrzegawczy na: Pompa elektryczna EAD-5H (instalacja destylacji próżniowej hydrokwasu)!



Instalacja destylacji próżniowej hydrokwasu

Schemat techniczny instalacji



Pompa elektryczna

EAD-5H

35%

Prawdopodobieństwo awarii

Ustawianie progu alarmowego

Pompa spalinowa

KD771

34%

Prawdopodobieństwo awarii

Ustawianie progu alarmowego

Pompa jockey

FK 80-250

7%

Prawdopodobieństwo awarii

Ustawianie progu alarmowego

Sprężarka

GG510

50%

Prawdopodobieństwo awarii

Ustawianie progu alarmowego

Conclusions

The most efficient way of transforming knowledge to value (grow of business) is transferring technology with transferring research staff to company.

One possibility is promotion of entrepreneurial behavior of academic staff.

Success of entrepreneurs depends on; level of research, friendly environment, innovative ecosystem (talents, research institutions, infrastructures, makerspaces, innovation capital, etc.)

Successful entrepreneur should; accept high business risk, accept long term investment, find technological leaders/ academic stars, find business cases (who needs solution, who is competitor, who will pay for solution, etc.), create friendly environment for inventors, consider both technological and business risk

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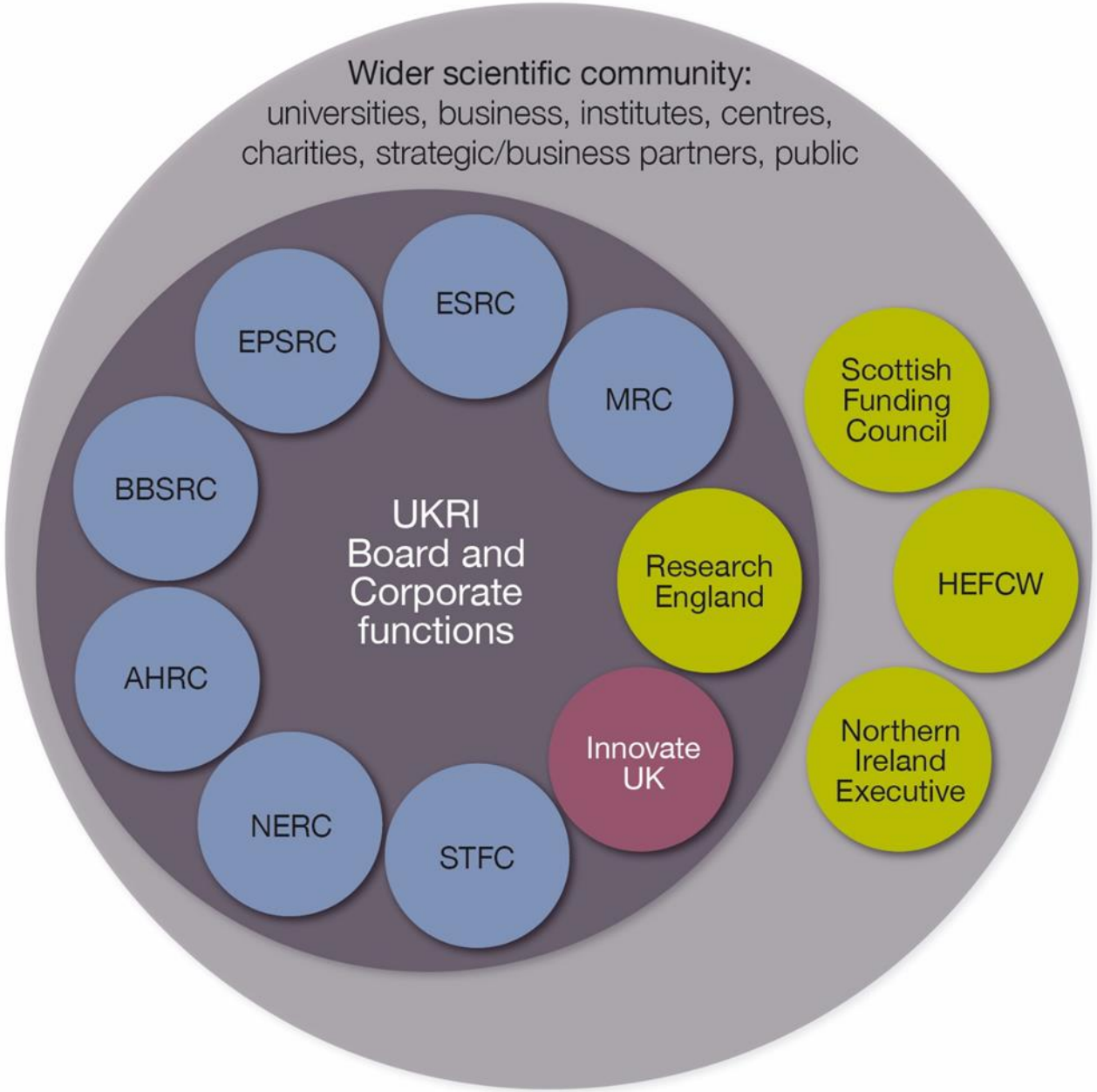
UKRI
Research England
Welcome

The current role of Knowledge Exchange Framework (KEF) and the potential for the future

Dr Hamish McAlpine
Head of Data & Evidence

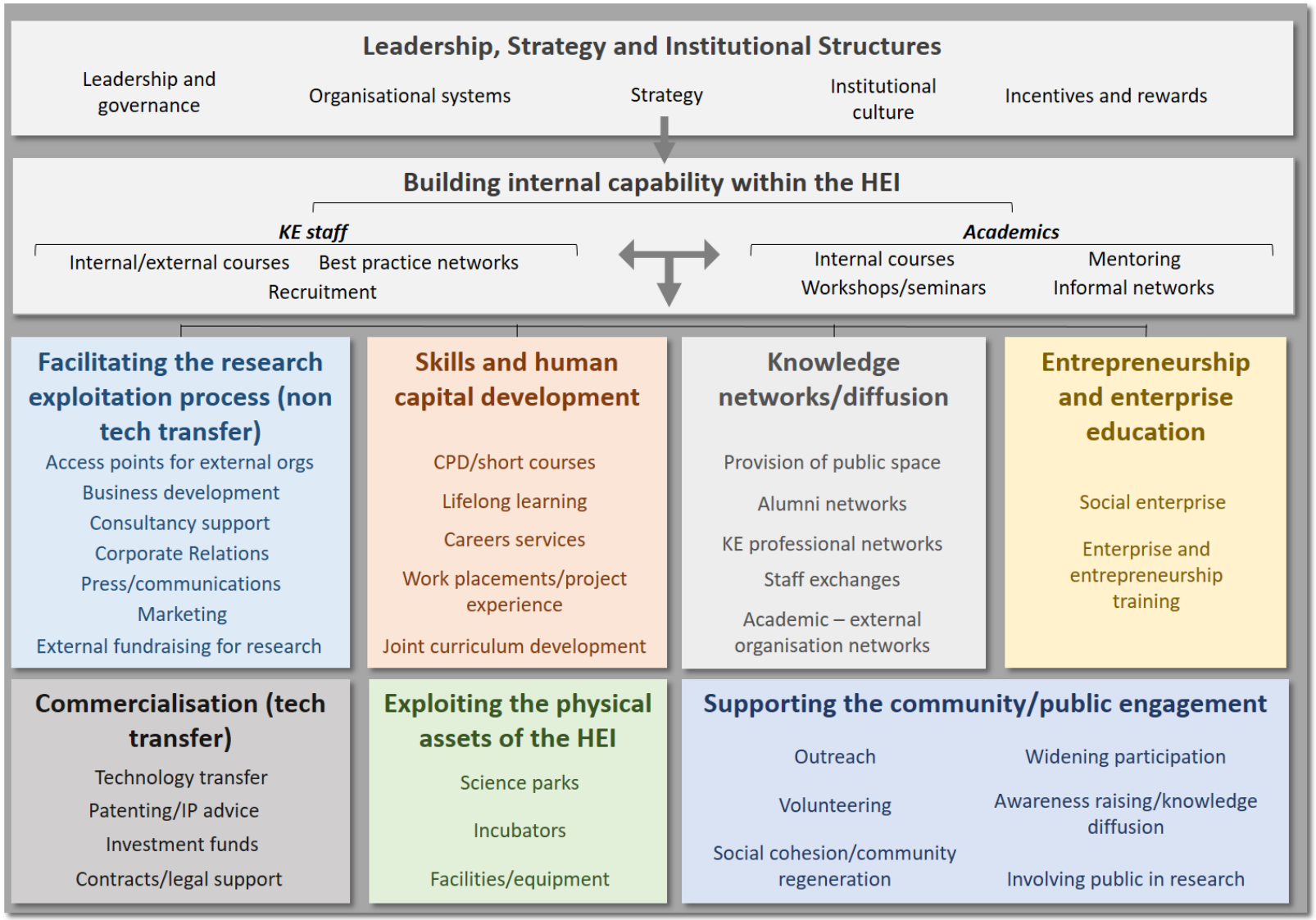
AESIS Impact of Science Conference
Thursday 5th November 2020

UKRI and Research England



UKRI Research England

What is Knowledge Exchange anyway?



UKRI Research England

Tomas Coates-Ulrichsen, 2017

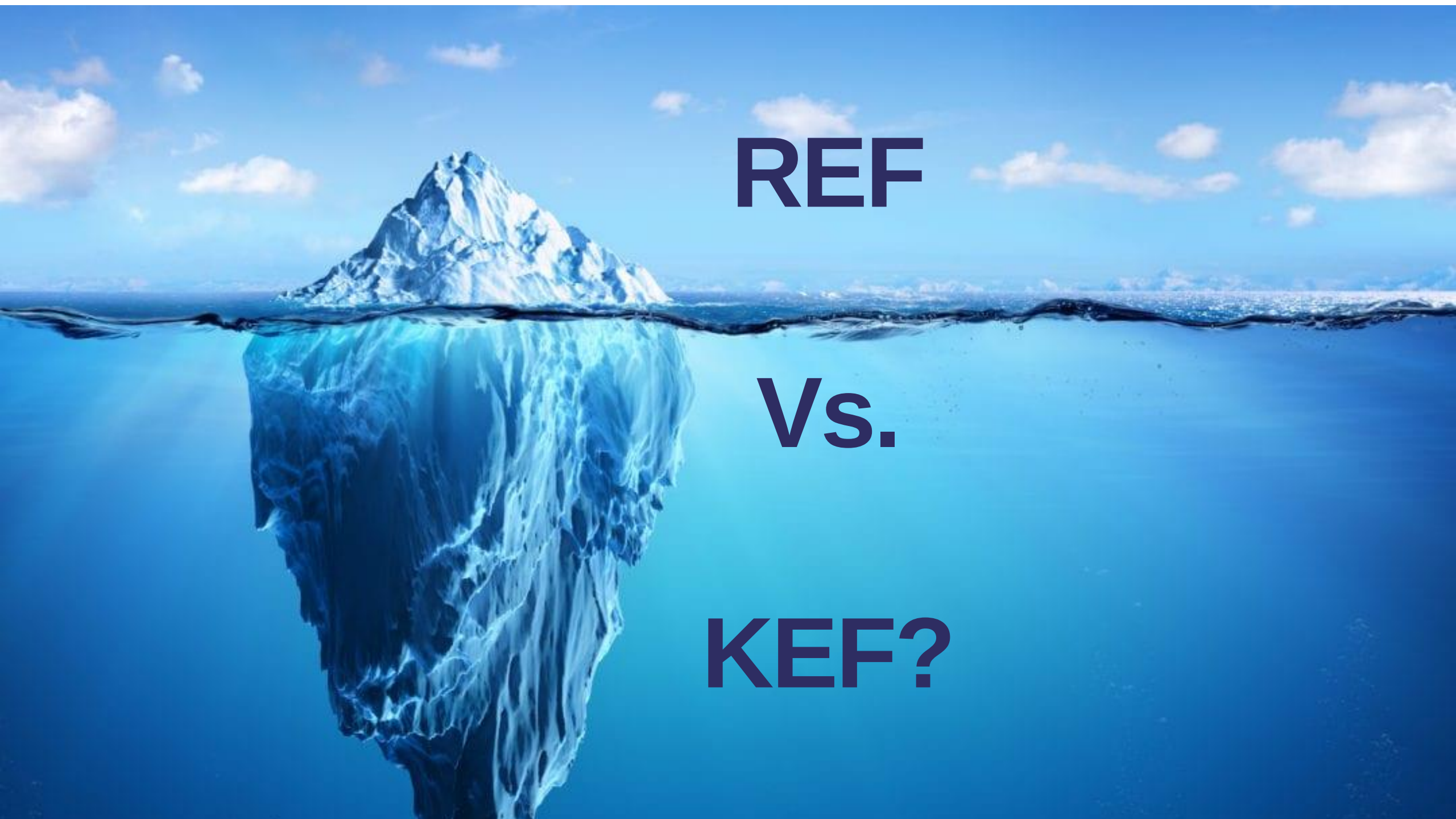
KEF Purpose(s)

1. More accessible information and data for institutions to understand and improve their own performance in knowledge exchange, ultimately increasing their impact.

2. More information for businesses and other users of university knowledge and resources

3. Increased public visibility and accountability for funding (currently £250m pa.)

UKRI Research England


REF
Vs.
KEF?

Evaluation of research Excellence against international norms

Strong link to underpinning research

c. 7000 peer-reviewed case studies – rich descriptions of outcomes from different disciplines

Vs.

Seeks to describe performance within clusters of English universities

Not just research-related impact – e.g. public engagement, role in local growth & regeneration etc.

Largely metrics-based assessment of broad set (hundreds of thousands) of interactions at institutional level

UKRI Research England

Adapted from: https://blogs.lse.ac.uk/impactofsocialsciences/2019/05/20/knowledge-exchange-or-research-impact-what-is-the-difference-between-ref-and-kef/

Current trajectory

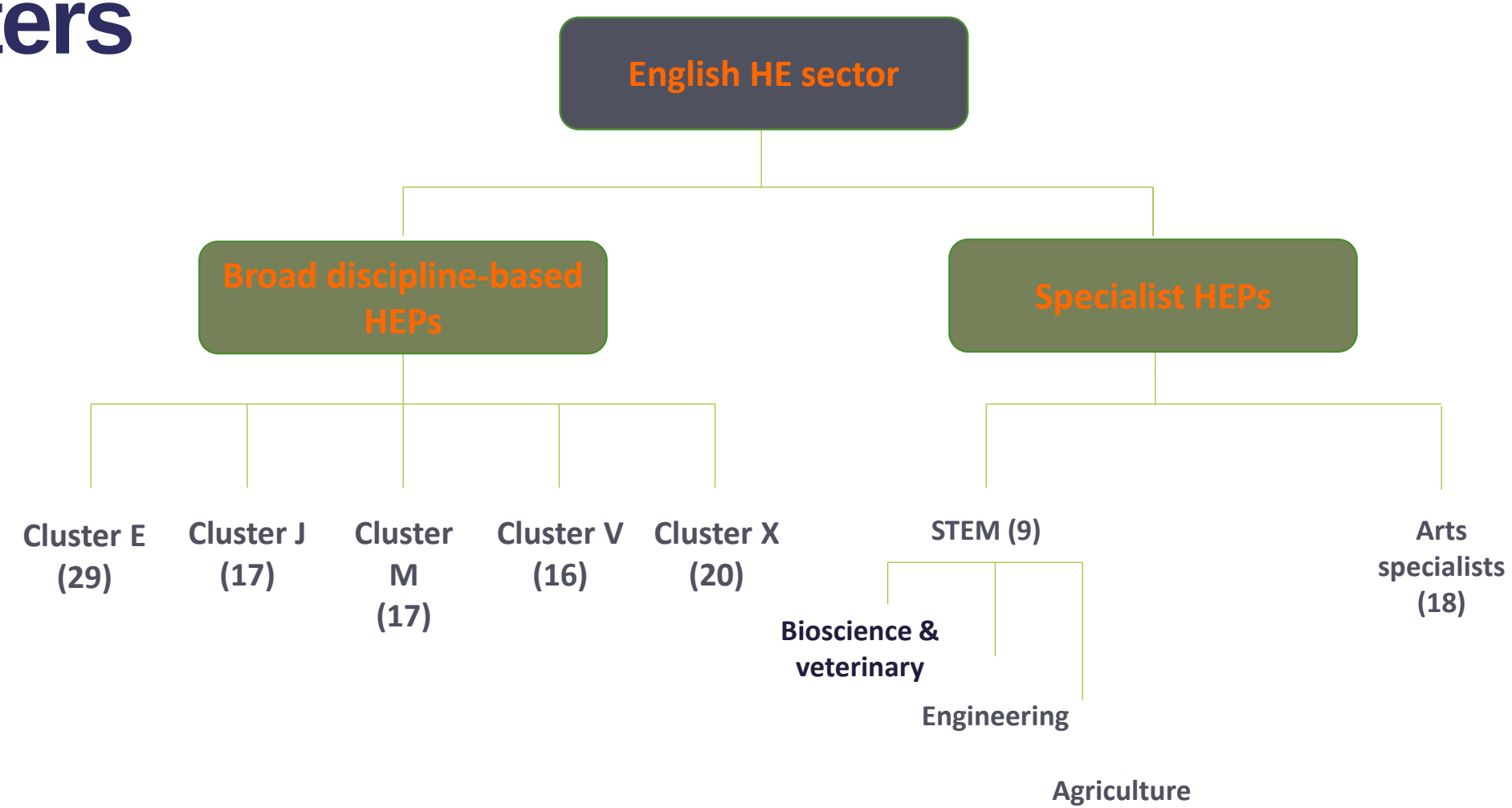
1. Institutional-level
2. Annual
3. Largely metrics-driven, with some narrative component
4. Not comparing everyone to everyone (fair comparison)

UKRI Research England

Perspectives

UKRI Research England

Clusters



UKRI Research England

http://re.ukri.org/sector-guidance/publications/kef-metrics-cluster-analysis-hei/

Knowledge Exchange Framework (KEF) | Provider Overview

Select provider

University of STEM3

Click here to see perspective breakdown

Legend

University of STEM3 =

Cluster: Specialist: STEM =

Cluster Description

STEM-focused in relation to share of academics, which could be further divided into those focusing on biological and veterinary sciences, engineering and technology, and agriculture.

Click to see all clusters

UKRI Research England

Research England

https://www.youtube.com/watch?v=Icq_B7DeLwY&t=4s

Areas of interest for future KEF

UKRI Research England

KEF and policy impact

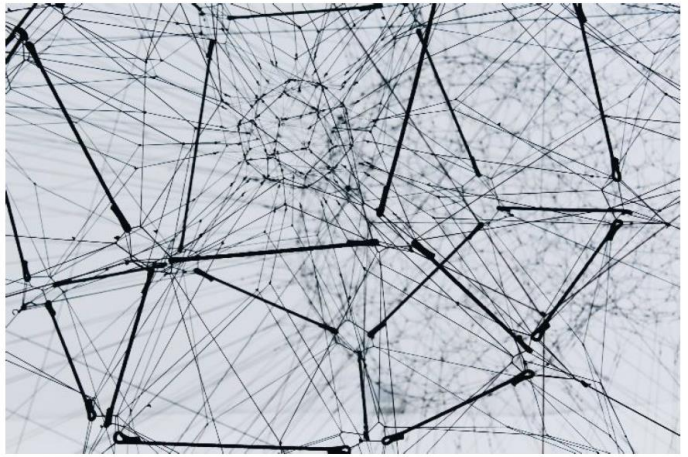
- Having **an impact on public policy** an important type of KE, particularly for some disciplines and institutions.

- Initial work focussed on KE with legislatures (UK Parliament)

UK Parliament · The Scottish Parliament Pàrlamaid na h-Alba · Cynulliad Cenedlaethol Cymru National Assembly for Wales · Northern Ireland Assembly

February 2020

Knowledge Exchange and Legislatures



Overview

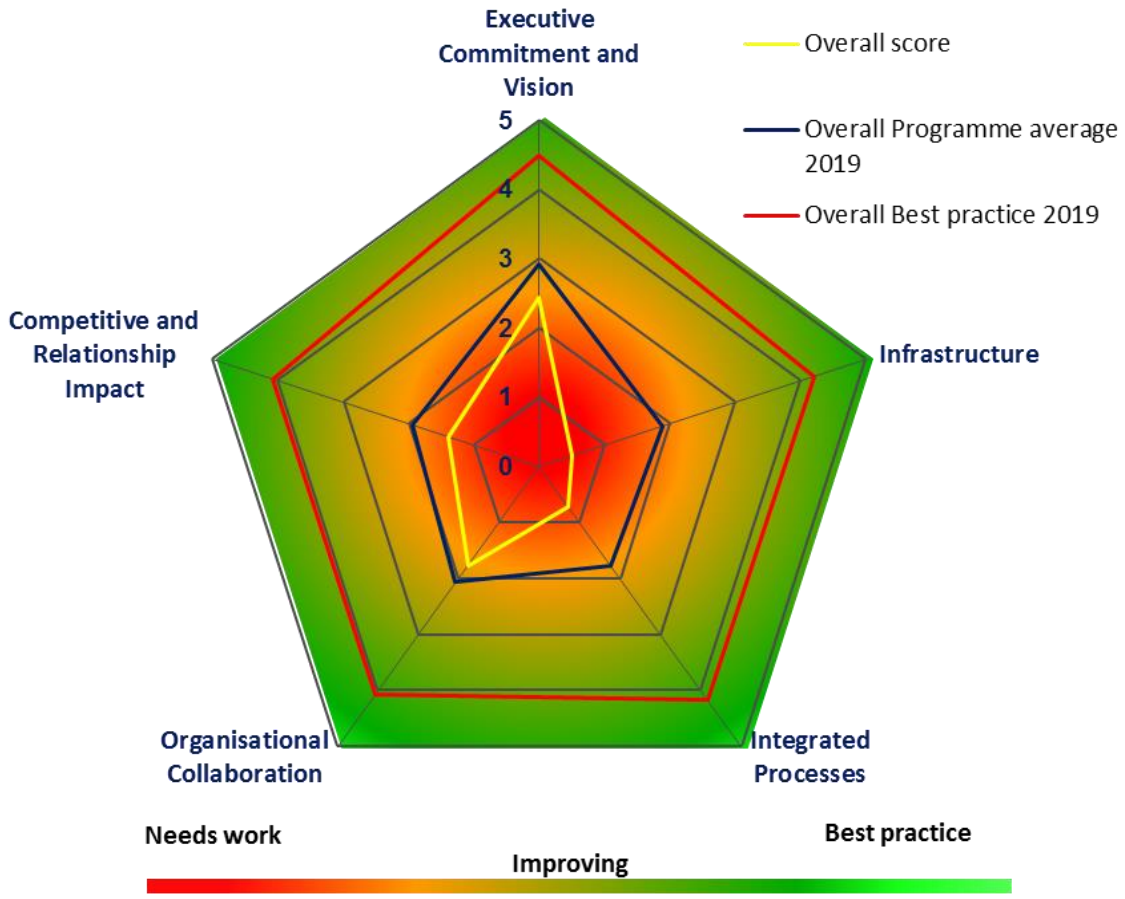
- Knowledge exchange (KE) between legislatures and academic researchers has been increasing in recent years.
- KE with researchers is important to legislatures because research that is relevant, credible and independent helps contribute to more effective scrutiny, legislation and debate.
- KE between legislatures and researchers includes providing information and advice, and researchers conducting peer review.

UKRI Research England

https://www.parliament.uk/documents/post/Final_KE%20and%20Legislatures_WEB%20(2).pdf

Incorporating the ‘Voice of the User’

- Undertook initial benchmarking study
- Sample of universities assessed against maturity in five dimensions
- A non-trivial measurement problem!



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ED&I in KE

"For every £1 of venture capital (VC) investment in the UK, all-female founder teams get less than 1p"

Research England

Source: *https://www.british-business-bank.co.uk/uk-vc-female-founders-report/*

Contact

Dr Hamish McAlpine
Head of KE Data & Evidence

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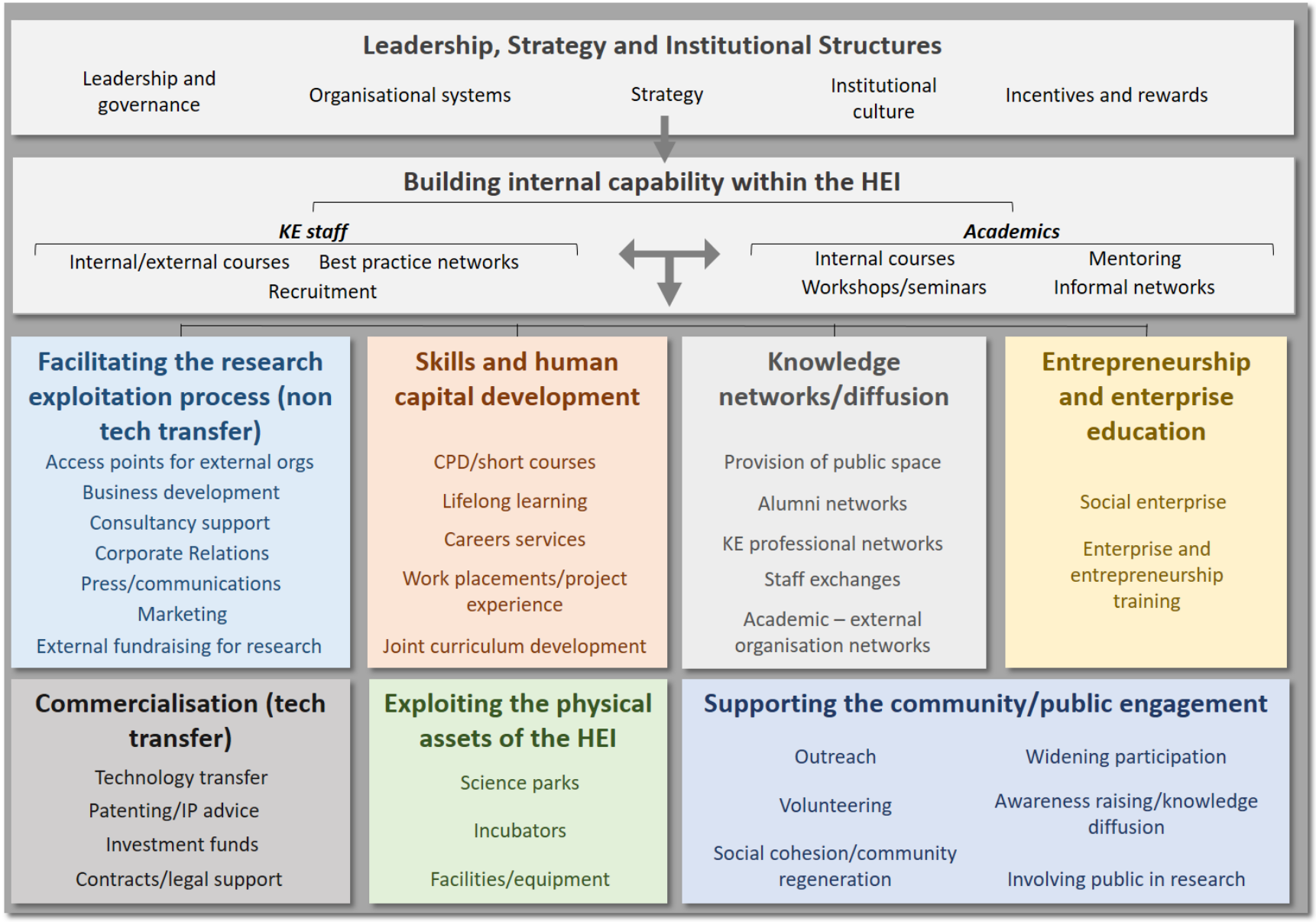
@Hamish_mcalpine, @ResEngland
https://re.ukri.org/

UKRI Research England

KE Concordat and KEF together…

How are you doing it (and how are you getting better)?

What are you doing ?



UKRI Research England

Business-science collaboration barriers and opportunities

Małgorzata Popławska

CEO

Malopolska Regional Development Agency

maRR
Małopolska Agencja Rozwoju Regionalnego SA

COUPLE OF FACTS

Innovativeness of the companies is one of the crucial aspects of the public policies on each administrative level (Regional Innovation Strategy, Smart Specialisations , increased funds for the knowledge –based economy, support of the business – science collaboration)

Dedicated public funds , institutions and platforms for business science collaboration (Clusters, Technology Parks, Innovation Brokering, Technology Transfer Centers)

In Malopolska only 17% of production companies and only 9,5% of service companies invest in innovations (decrease after the end of the EU financial perspective)

34,7% of production companies received 2014-2016 public aid for financing innovations (only 11,9% of the companies from service sector)

Only 9,4% of the companies declare the collaboration with others in terms of R&D

FINANSOWANIE
ROZWÓJ
INNOWACJE
NIERUCHOMOŚCI
INWESTYCJE

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Rozwoju Regionalnego SA

PROFIT

SCIENTIFIC DISCOVERY

DEBT / EQUITY FINANCING

PUBLIC GRANTS

BUSINESS JUSTIFICATION

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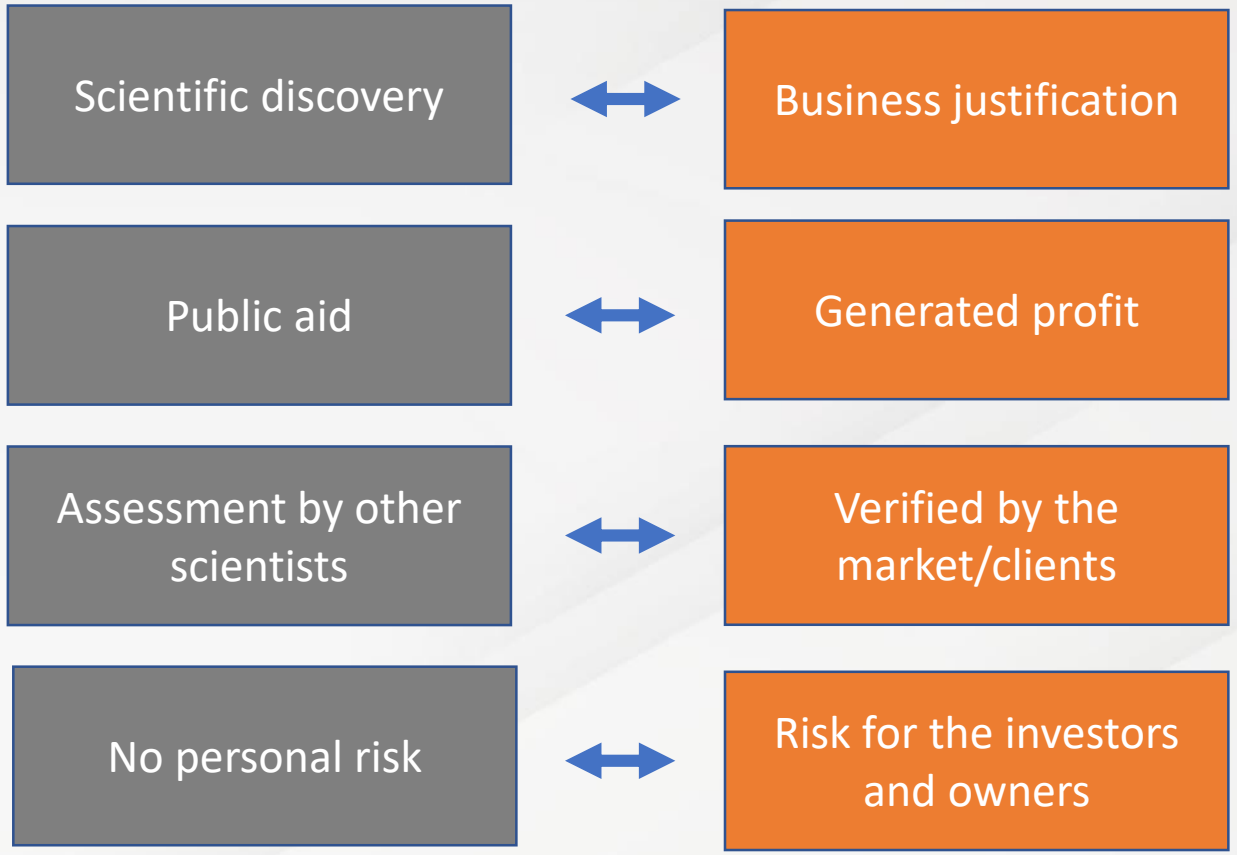
Rozwoju Regionalnego SA

SOURCES OF MISUNDERSTANDING

- GOALS
- SOURCE OF FINANCING
- MARKET VERIFICATION
- TIME TO MARKET
- APPROACH TO COSTS AND REVENUES



How does the business assess the perspective of the collaboration with academia? – main questions

- Initial Investment
- Operational cost
- Profit
- Business improvements
- Time to market
- Risk
- …….

Małopolska Agencja Rozwoju Regionalnego SA

Why the business science-collaboration is so important?

Małopolska Agencja
Rozwoju Regionalnego SA

Looking for the new business opportunities- development

Changing environment requires ongoing improvements

Even traditional segments of economy implement innovations

Business as source of inspiration for the science

Conditions for the successful business-science collaboration

- Financing system promoting successful implementation of R&D outcomes in the companies
- Mix of public and private money as a source of financing
- Increased awareness of the benefits of business – science collaboration on the both sides
- Business as inspiration for the science- providing products which can be sold
- Better understanding of the business among scientists (companies have to generate return for the investors)
- Companies have to be ready to invest in the cooperation (most of the networking initiatives die after the public money runs out)

Thank you for your attention

www.marr.pl

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INWESTYCJE

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Małopolska Agencja
Rozwoju Regionalnego SA

The impact of Open Science.

Collaborations between institutions, funders and researchers to make research count.

AESIS Conference, Krakow Poland
5 November 2020

Max Dumoulin
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ELSEVIER

NL Open Science

Benefits of Open Science

Global impact: stronger position of Dutch research

Re-use and transparency: outputs more frequently used by researchers and even a broader audience

Top talent: universities succeed better at attracting, collaborating with, and retaining top talent

Innovation: more innovation and collaboration between universities, industry and citizens

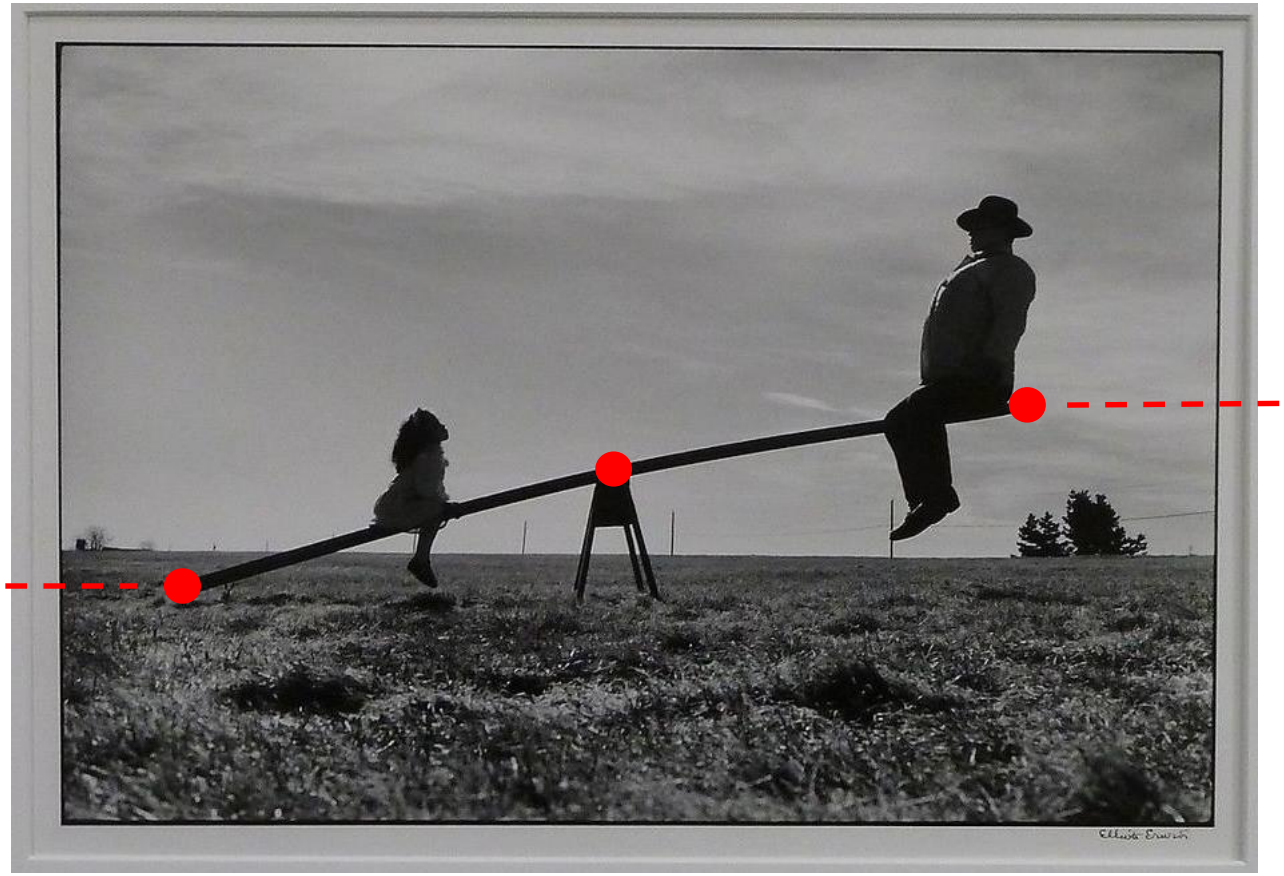
Assessment: funding and researcher careers are based on a more holistic (and fairer) picture

Impact on society: fruits from research benefit society directly

Less admin: admin burden on researchers decreases

The Seesaw Dilemma: Open Science benefits vs. Researcher workflow benefits

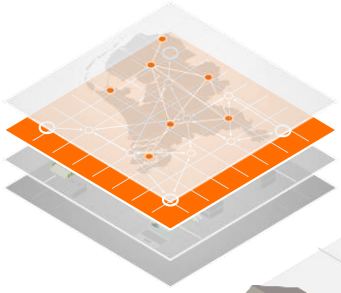
Open Science Benefits



Researcher workflow benefits

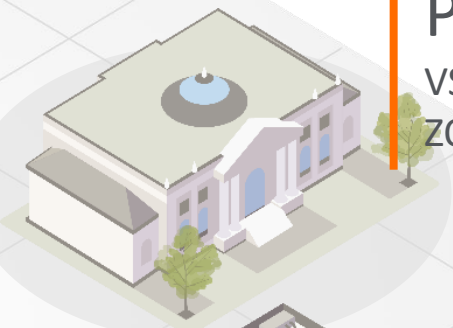
Actors

NL Open Science
Goals & Outcomes
Actors & Use Cases
Infrastructure
Building Blocks

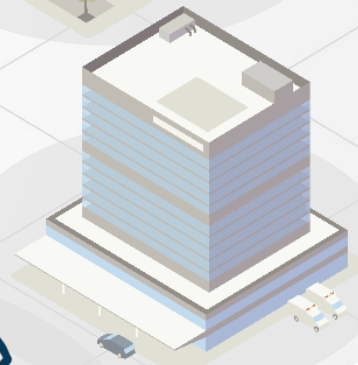


Researchers
~25,000

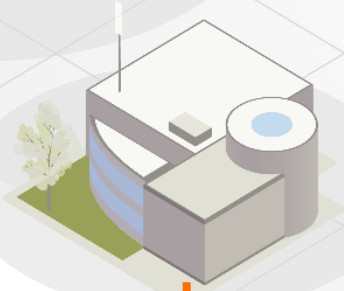
Funders & Policy Makers
VSNU, UKB, NWO, ZONMW, OCW, EZ



Institutions
18 universities
8 medical centers
36 uni's of applied sciences
24 NWO and KNAW Institutes



Industry



Technology Partners

Dutch Society (professionals)

Use-cases

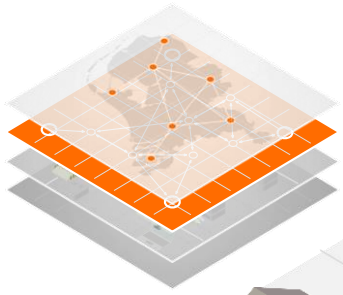
NL Open Science

Goals & Outcomes

Actors & Use Cases

Infrastructure

Building Blocks



Researchers

~25,000

- Showcase my work
- Find funding
- Stay on top of my field
- Read and assess content
- Be fairly assessed for all outcomes
- Organize my work
- Manage my data
- Collaborate

Funders & Policy Makers

VSNU, UKB, NWO, ZONMW, OCW, EZ

- Scientific review
- Monitor open science
- Steer strategic priorities (Horizon2020, NWA, Clusters, Sector, Infra)
- Develop portfolio
- National assessment
- Allocate funding
- Explain funding to society

Institutions

18 universities

8 medical centers

36 uni's of applied sciences

24 NWO and KNAW Institutes

- Stand out
- Evaluate, plan
- Enable researchers (lab, compute, tools, etc)
- Enable projects
- Manage funding
- Manage talent
- Manage institution
- Improve education

Industry

- More partnerships
- Innovation & start-ups
- Find experts, collaborators & facilities
- Access to latest scientific outputs

Technology Partners

Dutch Society (professionals)

- Citizen science
- Health portal
- Demasking fake news
- Increase trust in science

NL system/infrastructure landscape

most easily understood if clustered into logical building blocks

NL Open Science

Goals & Outcomes
Actors & Use Cases
Infrastructure
Building Blocks

Ideas for building blocks supporting Dutch infrastructure

NL Open Science

Goals & Outcomes
Actors & Use Cases
Infrastructure
Building Blocks

2 4 support discovery, access, and analysis of FAIR research data

do and enable research

6 support broader research outcomes; e.g. humanities

support discovery, access, and analysis of content

Validated interlinked system of record of research

Education systems

5 Public portal and showcasing systems

1

3 NL Funding flow system

3 strategic decision-making, assessment, & analysis

support flexible publishing & dissemination

6

Proposed pilots

NL Open Science

Goals & Outcomes
Actors & Use Cases
Infrastructure
Building Blocks

1. Support a national Open Knowledge Base: CRIS based aggregation
2. NL Research data collection
3. Funding information flow
4. Health Data Management
5. OA compliance as a service
6. Fair recognition and reward

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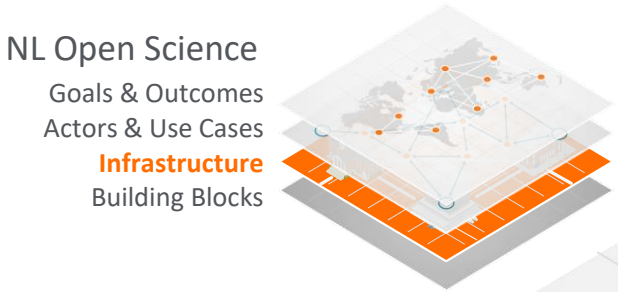
Core Principles that should drive the NL OS infrastructure



Core principles for the underlying infrastructure:

1. Interoperable: No vendor lock in, researchers and institutions can also use own tools
2. Future proof: system should be flexible to different setups and different agreements (there is an exit plan)
3. Vendor/publisher neutral
4. Researchers and/or institutions own the research data (not Elsevier)

Core infrastructure principles to be open, inclusive, and seamless:

5. All public research output available to everyone
6. This includes 100% Open Access
7. User in control what is public, private or shared; respect privacy & data integrity
8. Findable, Accessible, Interoperable, Re-usable Data (FAIR Data)
9. Balanced approach to evaluating research (basket of metrics and outcomes)
10. Support academic freedom, including the freedom of choice in dissemination approach of research
11. Support all research disciplines, all types of output
12. Support researchers doing research; system should help researchers to focus on core tasks (not admin)

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NL Open Science

Dziękuję Ci bardzo!

Thank you very much!

AESIS Conference, Krakow Poland
5 November 2020

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Break
10.40-11.00 (GMT+1)

Up Next

11.00-12.15	**Roundtable: Interdisciplinary approaches**	Tyniec room
	Roundtable: Fundamental vs. Mission-driven Science	Kościół Mariacki room
	Entrepreneurship	Barbakan room
	Role of Industry	Brama Floriańska room
	Grand Challenges	Nowa Huta room
	Funding Agencies	Smocza Jama room
	Science Policy Interface	Sukiennice room