EPS: its role in promoting physics research for economic, technological and social advancement in Europe

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NI Big Physics Summit, CERN 11 February 2016

Outline

- **The European Physical Society Perspective**
  - **EPS Roles, Policies & Activities**
  - **the Culture of Scientific Research**

- **Physics for Society, Development and Economy**

- **An IBM Perspective**
  - **The Cognitive Era**
  - **The Internet of Things**
  - **The Future will be worn**

EPS founded in 1968 in Geneva

"… as a further demonstration of the determination of scientists to collaborate as close as possible in order to make their positive contribution to the strength of European cultural unity"
Gilberto Bernardini

…..**but also Science for Peace!**

Initial signatories: 62 individual members, 20 national societies

http://tinyurl.com/EPShistory

EPS 2015 (www.eps.org)

Umbrella Organisation and Learned Society

- 42 Member Societies
  representing over
  130'000 physicists in EU
- > 3500 Individual Members
- 11 Divisions, 7 Groups
- 6 Committees
- 40 Associate Members
  (CERN, DESY, IOPP, ESA
  ESRF, PSI, IBM, Edison…)
- 22 Collaborating Societies

- Headquarter: Mulhouse (F)

Key roles of EPS

- **Enhance cooperation with National Societies & Collaborating Societies**

- **Define priorities in areas of common interest such as funding of fundamental research, science & innovation programs, education and equal opportunity, outreach and promotion of talented students, physics students networks, links between industry and academia, large scale infrastructures, physics for development and north-south cooperation, etc..**

- **Decide on strategic initiatives and get involved in EU policies (research, energy, environment, health, ethics, etc.) and better represent physicists in Brussels (local office opened)**

EPS Policies

- **Through its broad membership base EPS represents the views of the physics community in Europe.**
- **EPS provides information to policy makers and general public to understand issues from the point of view of physics on**

  - **Science and Research**
  - **Education**
  - **Energy and Environment**
  - **Physics and Society**
  - **Physics and Economy**
  - **European cooperation**
  - **International cooperation**

Activities

❑ Scientific excellence

- Conferences
- Publications
- Prizes, Grants

❑ Community Services

- Networks
- Representation
- Information
- Integration
- Equal opportunity

❑ Physics Education

- Specification for Bachelors, Masters and Doctoral Studies
- European Science Education Academy ESEA with ICTP, UNESCO, CEI, EPS…

❑ EU Projects

- Horizons on Physics Education (HOPE)
- Inspiring Science Education (INSPIRING)
- CREATIONS, MUSE, LIGHT2015

Activities

❑ Publication

- EPN (Europhysics News
- EJP (European J. of Phys.)
- EPL (Europhysics Letters)
- e-EPS

epl A Letters Journal Exploring the Frontiers of Physics

❑ Outreach

- International Year of Light 2015
- EPS Historic Sites (26 in 15 countries)
  (ex. CERN 600 MeV Synchrocyclotron)
- EPS Young Minds Project

United Nations Educational, Scientific and Cultural Organization

International Year of Light 2015

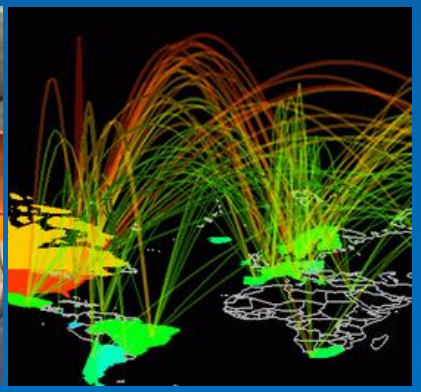
The International Year of Light

and Light-based Technologies

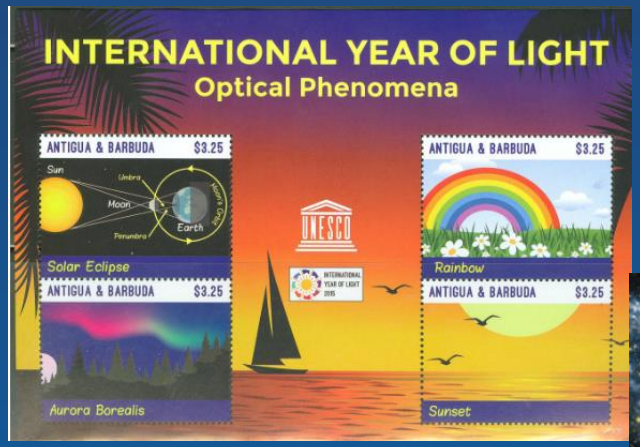
2015

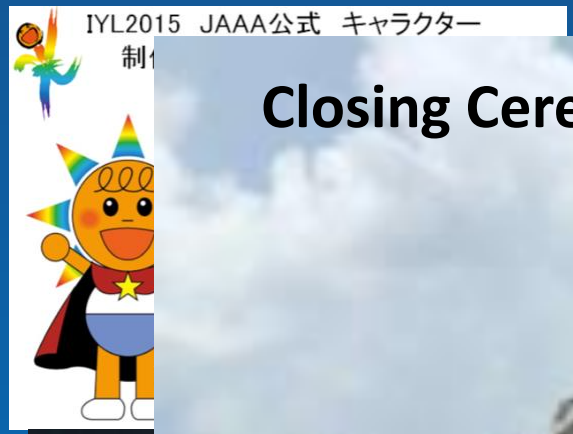
INTERNATIONAL YEAR OF LIGHT 2015

Health **Communications** **Economy** **Environment** **Social**

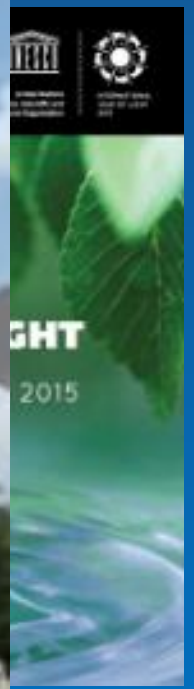




IYL2015


INTERNATIONAL YEAR OF LIGHT
Optical Phenomena
ANTIGUA & BARBUDA $3.25
Sun
Moon
Earth
Umbra
Penumbra
Solar Eclipse
ANTIGUA & BARBUDA $3.25
Aurora Borealis
UNESCO
ANTIGUA & BARBUDA $3.25
Rainbow
ANTIGUA & BARBUDA $3.25
Sunset


IYL2015 JAAA公式 キャラクター

Closing Ceremony, Mérida, Mex., 4-6 Feb. 2016


2015

Activities 2014-15 Historic Sites

Inauguration in 2014

- National Physical Laboratory [NPL], Teddington, UK
- CERN 600 MeV Synchrocyclotron, Geneva, CH
- Blackett Laboratory, Imperial College , London, UK
- Fabra Observatory, Barcelona, Spain
- G. Nadjakov study, Inst. of Solid State Physics [ISSP], Sofia, Bulgaria

Inauguration in 2015

• Kamerlingh Onnes Laboratory, Leiden, NL	9 February
• The Fasor Lutheran Secondary School of Budapest , H	23 April
• Ludwig-Maximilians-Universität [LMU], Munich, D	6 May
• Vesuvius Observatory, Italy	23 May
• Boltzmanngasse 3, Vienna, A	28 May
• Einstein house, Bern, CH	14 September
• Hotel Metropole, (Solvay), Brussels, B	24 October

→ TOTAL OF 26 sites in 15 countries

Activities 2014-15 Historic Sites

BERN

CERN

BRUSSELS

Young Minds Project

Modelled on OSA “student chapters” for…

- **International networking,**
- **Young researchers in the scientific community,**
- **Professional development**
- **Promotion of science in local communities**
- **Seminars & workshops**

- **34 sections in 19 countries**
- **Over 400 members**
- **4 Leadership meetings**

2014: EPS YM section involved in COST Network for Young Scientists

- SPAIN
- ITALY
- GERMANY
- UK
- UCRAINE
- IRLAND
- RUSSIA
- FRANCE
- US
- SWITZERLAND
- TURKEY
- HUNGARY
- DENMARK
- THE NETHERLANDS
- LATVIA
- LITHUANIA
- PORTUGAL
- POLAND
- CZECH REPUBLIC

EPS Statements & Reports

2012: On the Use of Bibliometric Indices in Assessment
2013: Opportunities in Horizon 2020
2013: Managing the Transition to Open Access
2013: Impact of Physics on EU Economy

2015: On the Importance of Funding Basic Natural Science
2015: European Energy Policy and Global Reduction of CO_2 emissions
2015-16: Importance of Nuclear Science in the Preservation of Cultural Heritage
2015: Debrecen Declaration on access to pan-European research infrastructures by scientists of small and medium-size countries

INARIE Workshop Debrecen (H) 30.11 – 2.12. 2015
Integrating Access to Pan-European Research Infrastructures in Central and Eastern Europe

Participants

- *European Strategy Forum on Research Infrastructures (ESFRI)*
- *International Atomic Energy Agency (IAEA) Vienna (A)*
- *Research Infrastructures in Centre East Europe (CERIC-ERIC, Trieste (I))*
- *Institut Laue-Langevin (ILL) Grenoble (F)*
- *Facility for Antiproton and Ion Research in EU, FAIR GmbH, Darmstadt (D)*
- *European Task Force on Laboratory Astrophysics (ETFLA) (ASTRONET)*
- *Extreme Light Infrastructure, ELI Delivery Consortium AISBL,Brussels (B)*
- *Deutsches Elektronen Synchrotron (DESY), Hamburg (D)*
- *European Synchrotron Radiation Facility (ESRF),Grenoble (F)*
- *"The Gran Sasso National Laboratory“, Assergi L'Aquila (I)*
- *National Instruments*

Research Infrastructures

Strategic Priorities, Funding and Pan-European Co-operation for Research Infrastructures in Europe (Survey report Jan. 2016)

Recommendations by Science Europe

On the need to:

- develop a landscape analysis on existing and planned RIs
- define strategic priorities to support the decision-making process
- explore different funding sources for RIs
- make budget plan covering full life cycle cost of RIs, and decommissioning costs
- foster multilateral co-operation and join forces in funding research facilities.

Input provided by 26 SE member organizations from 19 countries

http://www.scienceeurope.org/

Debate on Research Culture

As viewed by learned Societies like EPS

- The culture of scientific research must support and encourage ***high quality, rigorous, original, ethical and valuable*** science
- Research ***assessment by funding bodies*** and promotion panels affects what science is carried out and by whom
- ***Dissemination*** of science (outreach) and critical responses can influence how scientists work and behave
- Research scientists must ***take responsibility and encourage good practices***
- Scientific discoveries must ***benefit society*** on top of curiosity satisfaction and ***nurture technological applications and innovation***
- Regular assessments ***of societal and/or economical impact*** of research are needed

Editorials – Opinion columns

Advising on Science

Editorial of EPN 46/4

- **Science advisory at EU level is very important**
- **Demonstrate that scientists are responsible and concerned by today's grand challenges**
- **Provide objective scientific advices, based on careful studies**
- **Communicate better with politicians**
- **Follow the codes of scholarly conduct and ethical behaviors**
- **Show the good example and keep a respectful attitude in front of the public opinion**

Science in Europe (I)

Science in Europe (II)

European Commission

HORIZON 2020

The EU Framework Programme for Research and Innovation

The future of European science is changing

- **how can Horizon 2020 further develop the EU as an attractive place for new, innovative research?**
- **How can Europe stay an attractive region for new, young scientists?**
- **What role will Horizon 2020 play in the development of Europe's research infrastructures?**

H2020 pillars:

Excellent Science
Industrial Leadership
Policy & Research
Global Collaboration

http://horizon2020projects.com/

Science in Europe (III)

ERF-AISBL
Association of European-level Research Infrastructure Facilities

17 members

EIROforum
Serving European Science

8 members:

CERN - European Organisation for Nuclear Research
EMBL - European Molecular Biology Laboratory
ESA - European Space Agency
ESO - European Organisation for Astronomical Research in Southern Hemisphere
European XFEL - European XFEL Free-Electron Laser Facility
EUROfusion - European Consortium for the Development of Fusion Energy
ILL - Institut Laue-Langevin

Science in Europe (IV)

And many more…! We are not alone !

ICSU
International Council for Science

Physics and Society

The EPS Forum Physics and Society (FPS) holds regular meetings discussing various issues of physics and society and makes recommendations to the EPS and policy makers for actions.

Workshops:

2014 Belgrade, Serbia: ***Improving the image of physics***
2012 CERN, Switzerland: ***Physicists in the market place***
2010 El Escorial, Spain: ***Science Journalism and Communication***
2009 Ratnieki, Latvia: ***Physics Teaching, a New Deal***
2007 Zakopane, Poland: ***Physics Education***
2006 Graz, Austria: ***Physics & Society, Grand Challenges***

Physics for Development

Missions of PfD Group

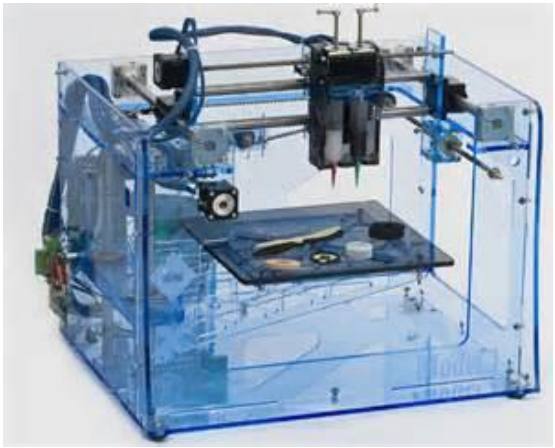
Strengthen research and training potential of Developing Countries in Physics (sharing of knowledge)
with
a) Grants for advanced schools and workshops aimed to lecturers and students (ex. Southern European School of Physics)
b) Short-term travel grants to European countries for young physicists training.
c) Access to low-cost instrumentation and simulation tools
d) Cheap solutions for renewable resources (energy, water, light….)


First EPS conference « Physics for Development »

Physics for Development

Water purification in Peru

3D printers Lab in Yaoundé, Cameroon



Special Activity Fund

- Promote physics projects and activities in developing countries, specifically in Africa
- Support physics teaching and teachers at all levels, including low cost lab equipment
- Support the career development for physics students and young professionals
- Support networking and outreach programs such as the EPS Young Minds
- Promote innovation and entrepreneurship through the organisation of "innovation fairs"
- Promote the image of industrial physicists
- Recognise outstanding achievements with awards and honours

http://www.eps.org/

Physics and EU Economies

- EPS report 2013, over years 2007-2010, in 27 EU countries + CH & NO

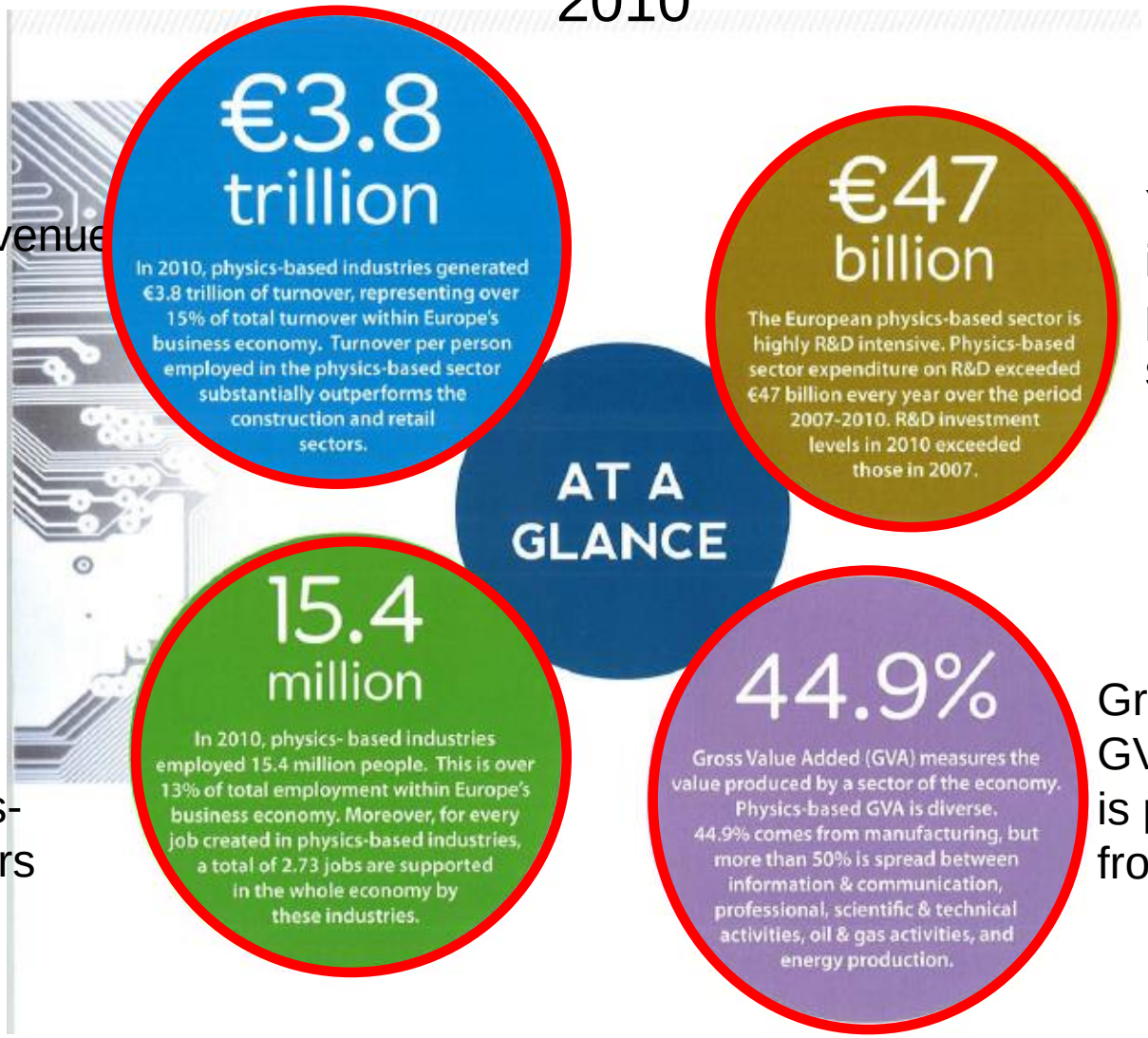
- **Physics-based industries** are defined as those sectors of the European economy where the use of physics – in terms of technologies and expertise – is critical to their existence

- Electrical, civil, & mechanical engineering
- Energy& environment
- Information technology & communications
- Design & manufacturing
- Transportation
- Medicine & related life-science fields
- Technologies used in space

Physics and EU Economies

2010

turnover or revenue ~ 15% of total EU business economy



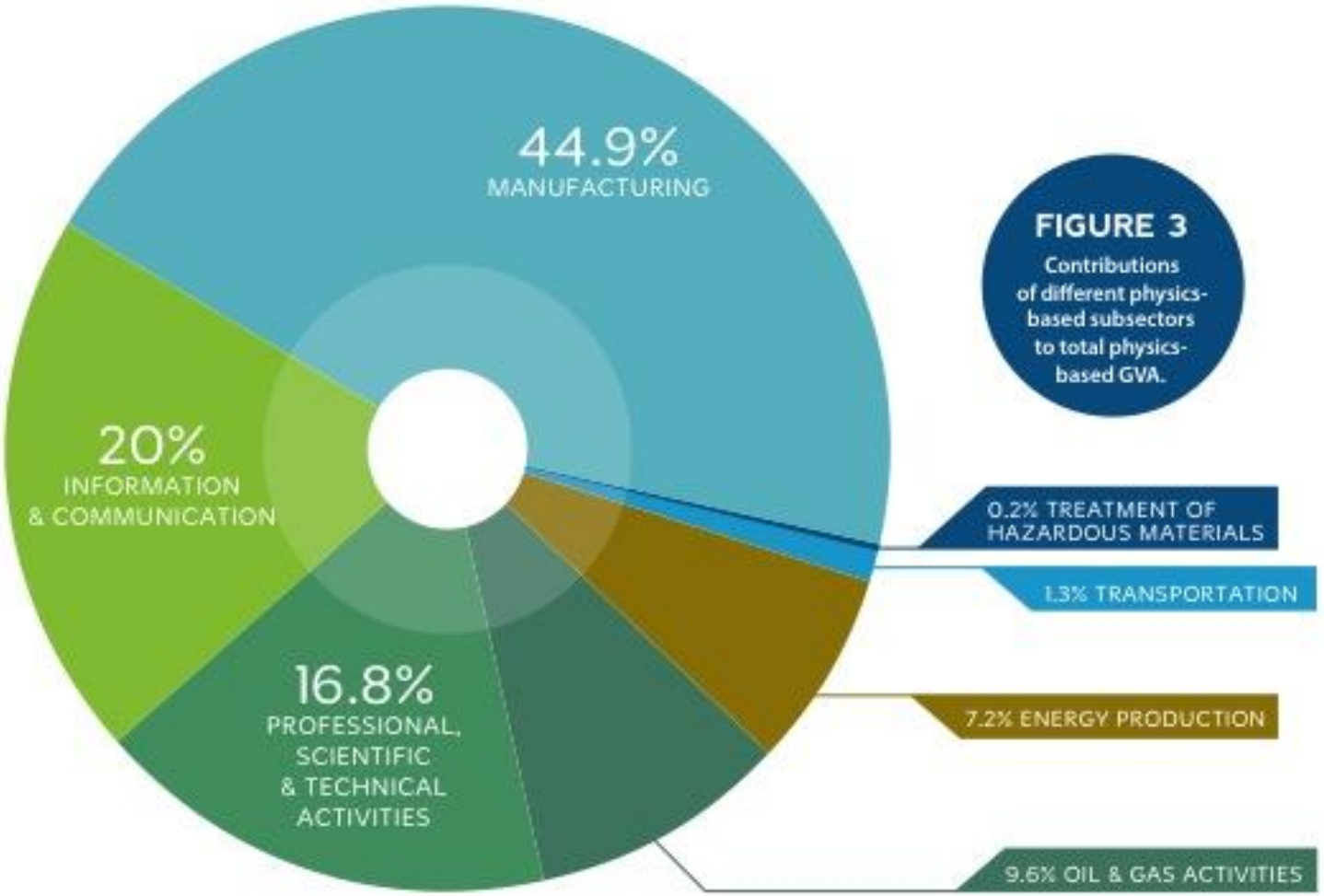
Yearly investment in R&D for physics-based sectors

Nb. of jobs from physics-based sectors

Gross Value Added GVA = value of what is produced, here from manufacturing

Physics and EU Economies

subsectors contributing to GVA (Gross value added) ~ GDP



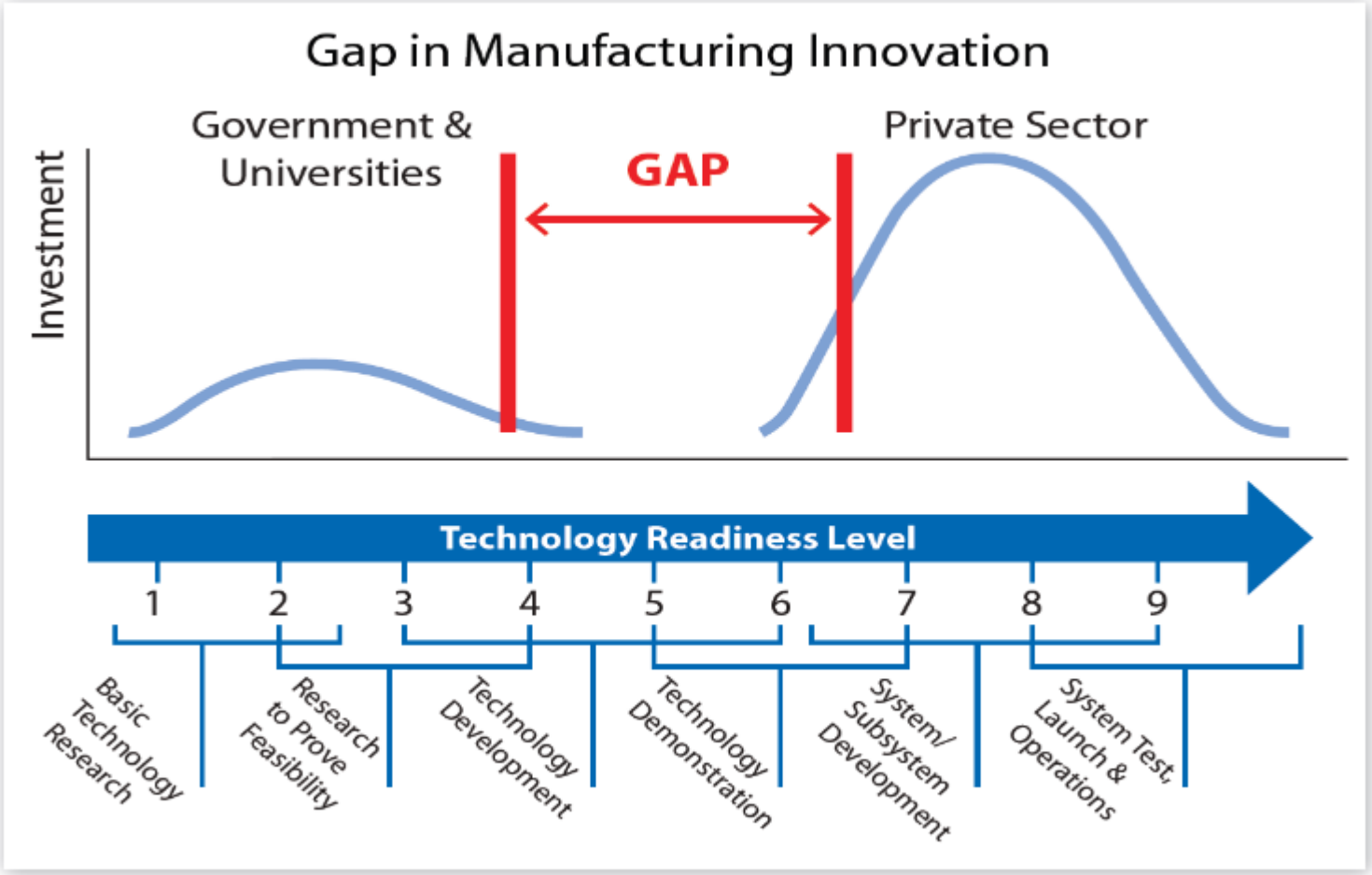
Physics and innovation

- Private sector is largest employment base for physicists
- Huge opportunity for physics graduates with training on entrepreneurship and innovation to
  - become industrial physicist developing new technologies
  - translate cutting-edge research into viable products on market

- C. Moedas @EU commission to initiate a European Innovation Council (EIC) similar to ERC
  → 'Time to Act' and 'Way to Act' calls

Physics and innovation

The Valley of Death



Missions of EIC

Key missions: (open consultation)

1. **Build a strong integrated Innovation Strategy to bring research results to the market (valley of death)**
2. **Unleash EU's potential by integrating EU's Innovation Strategy across the numerous initiatives.**
3. **Keep up with worldwide competitors (US, Canada, Japan, South Korea, China, India)**

But possibly only with FP9 starting in 2021

Physics and innovation

EU Science, Research & Innovation Policy

Excellence Science

ERC (knowledge), Proof of Concept,

Deliver Excellent Innovation with Impact

EIC (technology) with prototyping transfer to industry with related instruments

Infrastructures for Science: ESFRI

Infrastructures for innovation: MISSING STRATEGY & EU SUPPORT

ERA related actions on researchers' mobility, gender, alignment of national programmes supported by initiatives such as the Marie Curie, JPIs/COFUNDs, etc.

Conclusions

- ***Physics has been for centuries one of the important drivers of our society, with constant progress in knowledge, discoveries, innovation and technology . Since 1968 EPS is part of it***
- ***The impact of physics on our economy is enormous***
- ***EPS is strongly involved in promoting physics research for economic, technological and social advancement in EU***
- ***…. But we are not alone in the EU landscape***

IBM Perspectives

Cloud Analytics & Big Data Mobile Social Security

= “CAMSS”

- **The Cognitive Era**
- **The Internet of Things (IOT)/ of Everything (IOE)**
- **The Future will be worn**



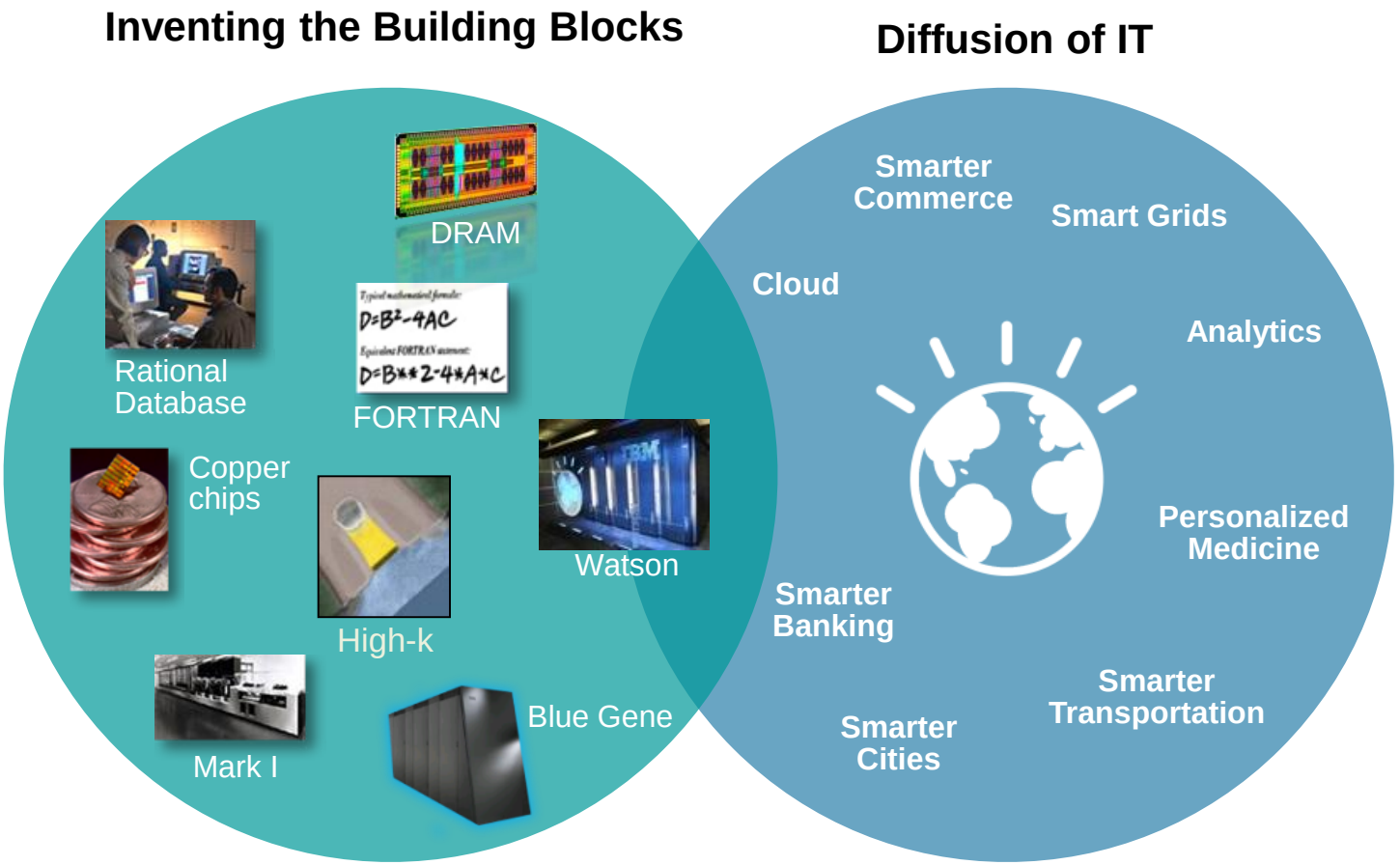
IBM Research: *The World is Our Lab*

World's largest information technology research organization

More than 3,000 scientists and engineers

IBM spent $6.2B on R&D in 2013

IBM Research: A Culture of Innovation



Five Nobel Laureates

Nine Medals of Technology

Five National Medals of Science

Six Turing Awards

The Cognitive Era

How humans and machines are forging a new age of understanding

*Cognitive computing refers to systems that **understand**, **learn** at scale, **reason** with purpose, and **interact** with humans naturally*

- **Tabulating Era** (mechanical systems) ,1900s -1940s
- **Programming Era** (digital computers), 1950s-present
- **Cognitive Era** (computing with augmented intelligence, 2010 -), the *most important transformation* in computing's evolution ….from deterministic to probabilistic systems

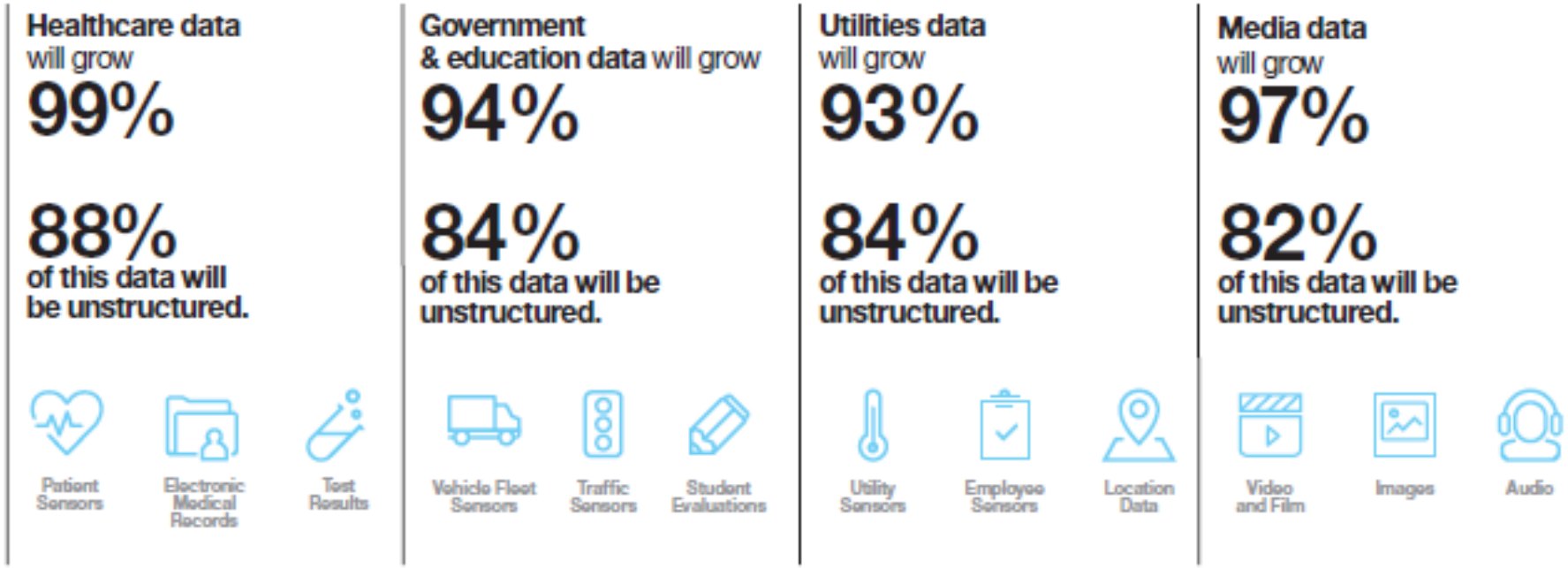
IBM Watson Analytics

delivers cloud-based guided analytics, data visualization and predictive analytics that make understanding data easier for practically everyone

The Cognitive Era

A new era in technology, a new era in business

Data is transforming industries and professions via mobile devices, social networks, media and many other sources



Source: IBM Watson business unit

Internet of Things (IoT)

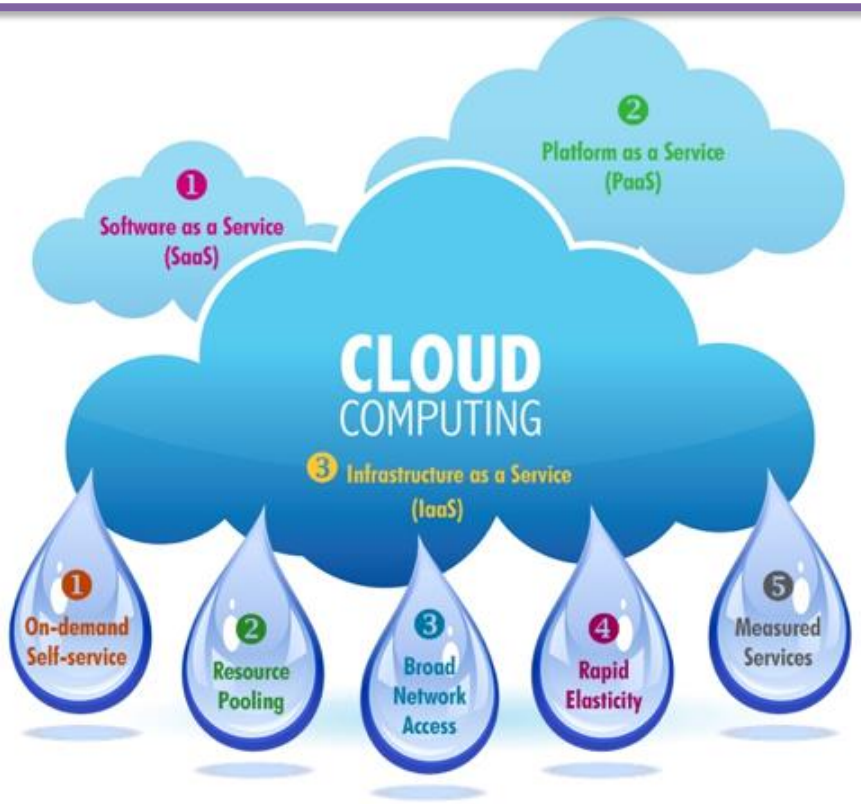
Instrumented – interconnected – intelligent

Huge market for semiconductors and IT companies

- **to reach $22.9 billion by 2020, the wireless IoT sensor market alone will be worth $12 billion by 2020**

Paradigm shift coming in powering wearable devices

- **Low-power design and proper energy management at the system level are a prerequisite**
- **IoT devices must integrate multiple blocks onto a single substrate (SoC) either with 2D or better 3D co-integration of functions**
- **Must be cost effective, rugged & durable, scalable to varying environments and communities**



The Cloud and IoT (IoE) promise to deliver convenience like never before

→ COT or COE

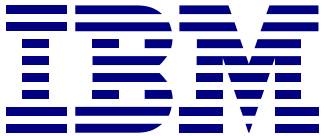
The Future will be... worn

Wearable technology is **exploding** thanks to smaller and better interacting systems

- Global sales of wearables to hit $30 billion by 2018.
- **Today's market** : ***Fitness & Wellness (+30% /y) , Healthcare & Medical, Infotainment, Industrial & Military***
- Many innovations to emerge to overcome technological inhibitors
- **Key inhibitors**: ***Power, Network Bandwidth, Pricing & Aesthetics, User Interaction, Accessibility (voice, visual interfaces), Security & Privacy***




Conclusions



- Thanks to the Cloud and IoT, the future IT technology will become more instrumented, interconnected and intelligent
- The market of wearable technology will explode
- New cognitive computing tools will be needed to treat the ocean of unstructured data

But……

What impact will this have on our life,
on the development of a fair and peaceful society
respectful of its environment and of the planet resources ?