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Use Cases from biodiversity and medicine and implications of data openness

A short reflection based on the analysis of research ecosystems

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Workshop of the OECD's Committee for Scientific and Technological Policy

Revision of Recommendation concerning access to research data from public funding:

use cases of enhanced access to software, algorithms and workflows

Special thanks to Lara Lloret, David Rodriguez, Fernando Aguilar, Alvaro López from IFCA

OECD Conference Center

October 15th 2019 @PARIS

Disclaimer: all statements presented are based in the personal experience as researcher and do not state any institutional position

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MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

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Understanding the research ecosystem

Who eats whom (what is the biomass? money? knowledge!)

SCIENCE IS IN THE BUSINESS CORE IN OUR CENTURY !

Science is no longer only the main interest of scientists…

GOVERNMENT AND PUBLIC ADMINISTRATION

PRIVATE AND PUBLIC COMPANIES

PUBLIC RESEARCH FUNDING & PERFORMING ORGANIZATIONS

-research (academic system)

-libraries and repositories

-technology transfer offices

-students

-citizens

SOCIETY

*"Publishing journals as a **profit-maximizing business** is certainly as legitimate as it is for other **distributors of digital content based on intellectual property protections**. The research enterprise and its stakeholders are responsible for the future of scholarly communication"*
*From "**Open Science by design**" NASEM*

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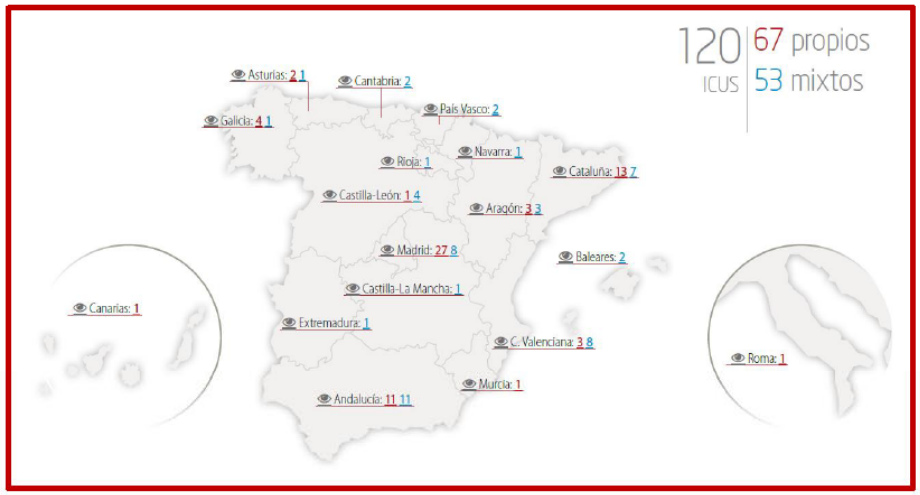

INDICADORES ANUALES: >13.000 artículos / >1.600 contratos / >125 patentes solicitadas

10.642 Empleados	3.644 Investigadores	1.263 Investigadores en formación	4.472 Personal de apoyo a la investigación	1.263 Gestión
5.220 mujeres	2.285 hombres	654 mujeres	2.445 mujeres	761 mujeres
5.422 hombres	1.360 mujeres	609 hombres	2.027 hombres	502 hombres

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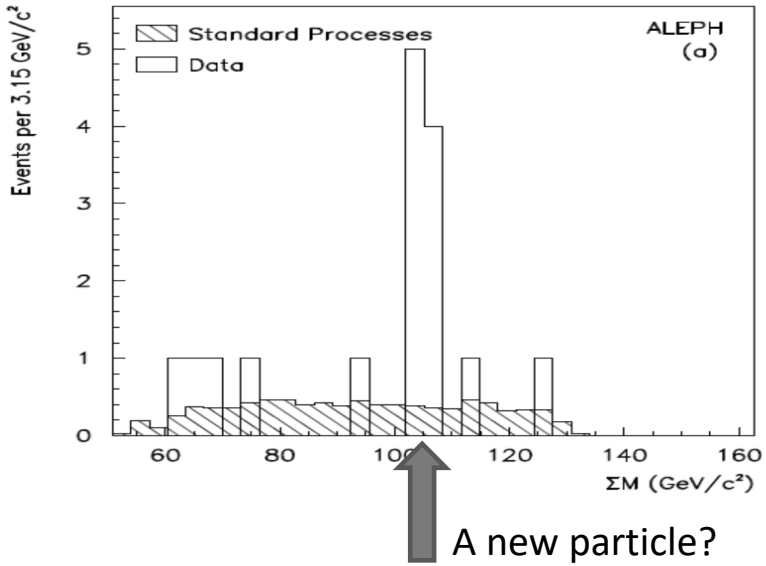
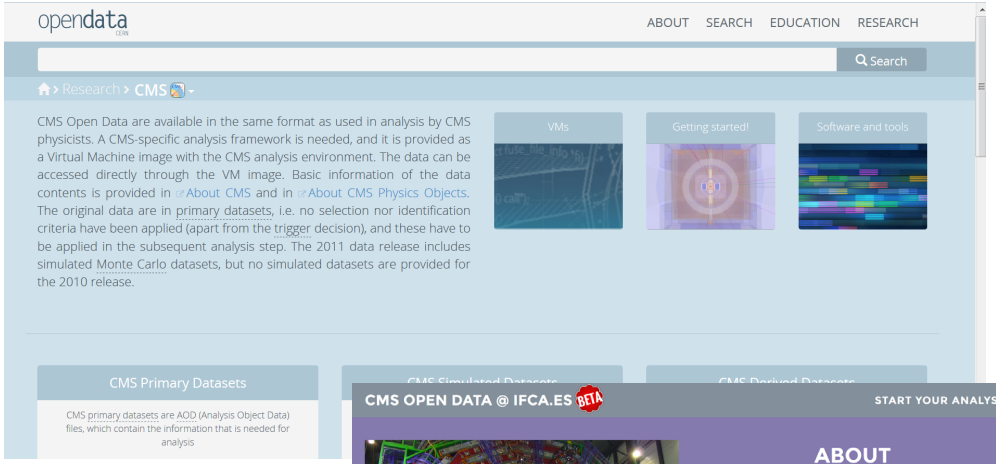
20 years towards open science in particle physics...

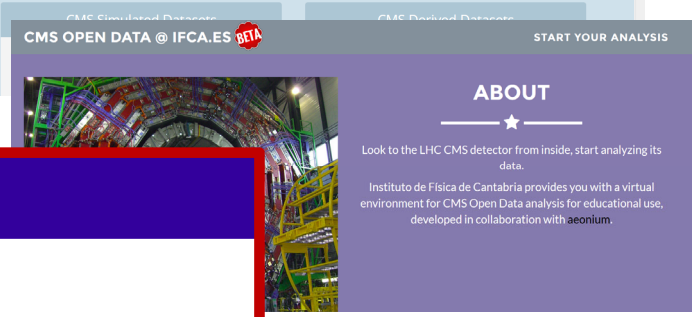
#CSIC *in one slide*

1995, LEP, CERN



2015, LHC, CERN





Many, many technical advances
Ecosystem: HEP community
Key factor: **REPUTATION**
Status: **PROGRESSING ADEQUATELY**

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12 years project on Eutrophication coordinated by an SME

Ecohydros, SPAIN

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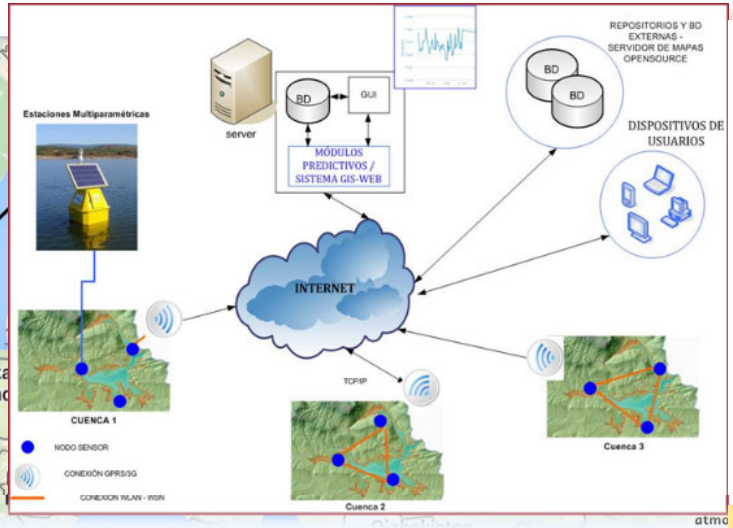
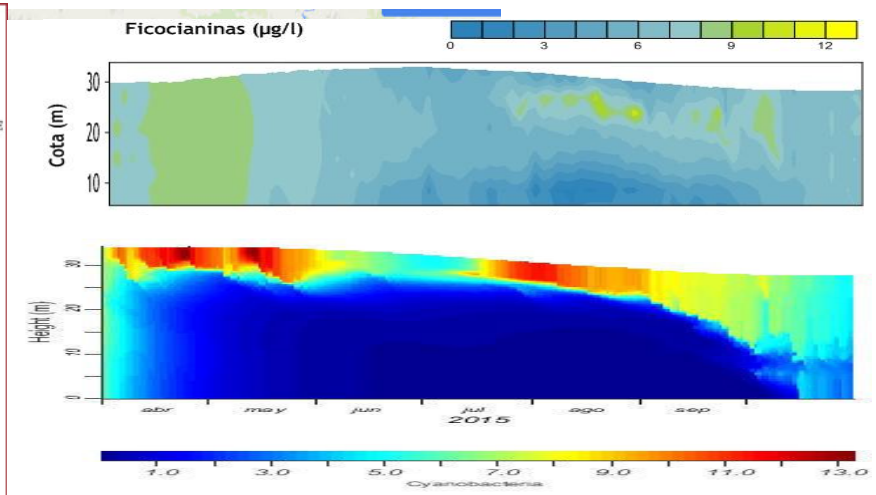
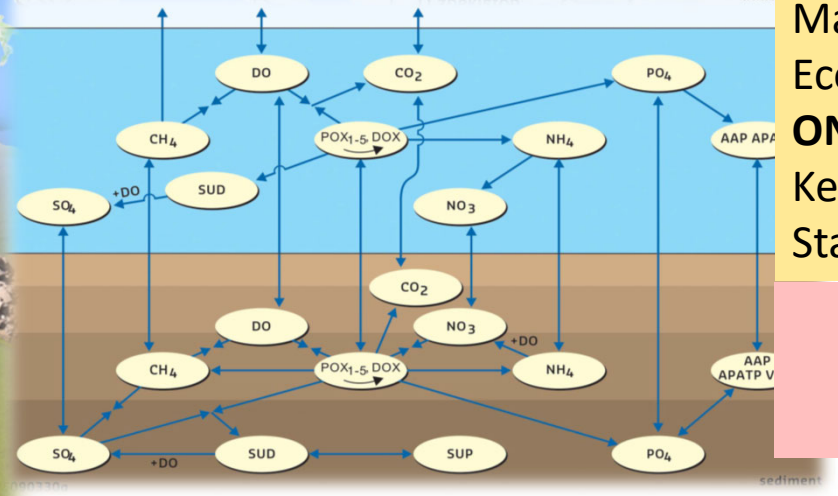
Cuerda del Pozo Watershed (Soria, SPAIN)







Many, many technical advances

Ecosystem: **PRIVATE-PUBLIC COLLABORATION ON INTERDISCIPLINARY COMPLEX PROBLEM**

Key factor: **BUSINESS MODEL**

Status: **PROGRESSING ADEQUATELY?**

EXPLOIT SENTINEL DATA ON GOOGLE EARTH?

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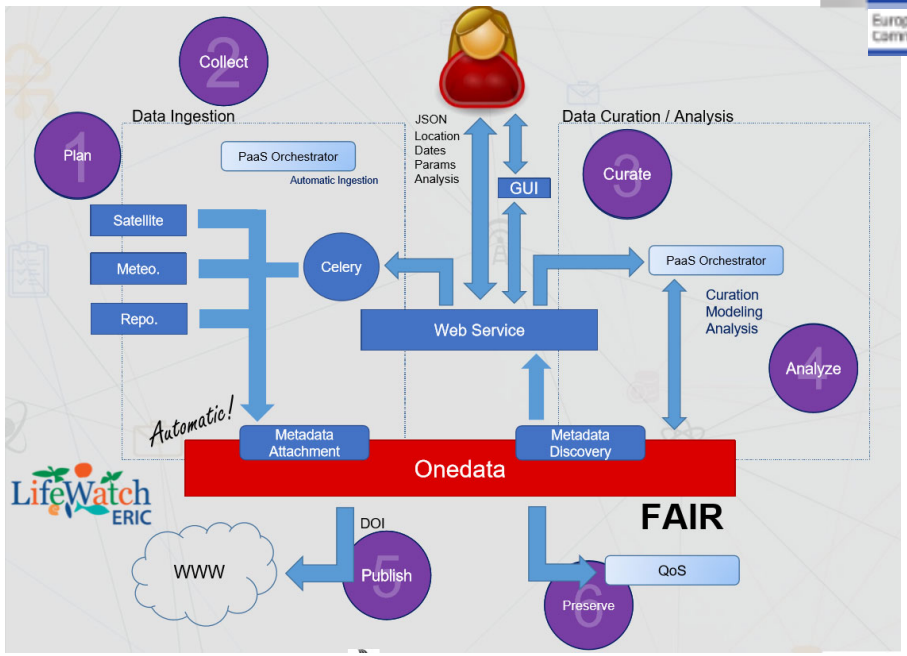
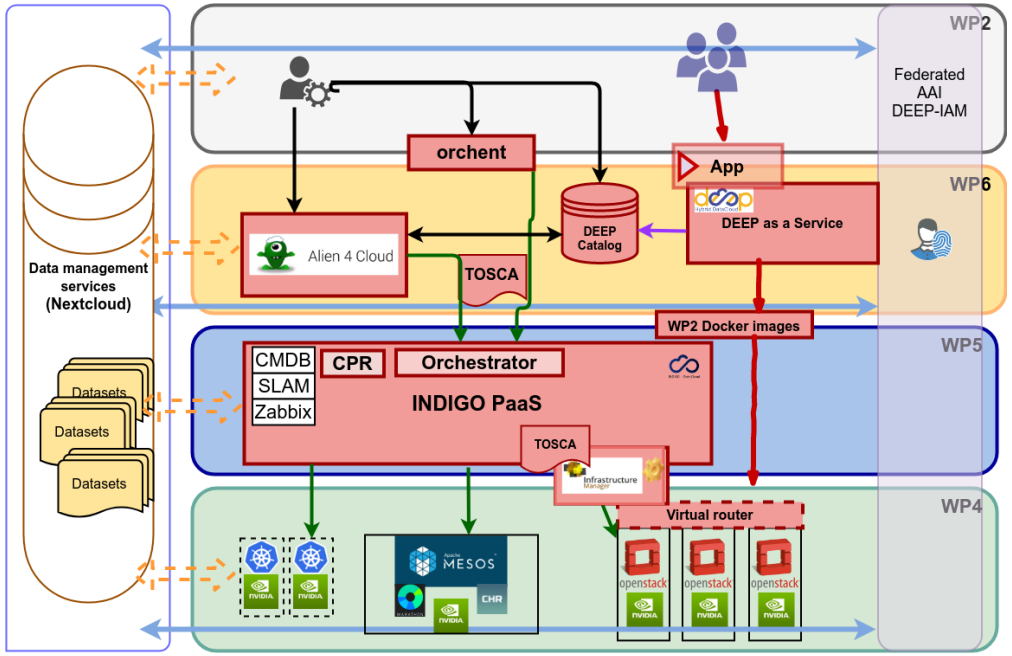
Research Data Life Cycle and Cloud Platforms



F. Aguilar, XDC H2020 project



A. López, DEEP Hybrid DataCloud H2020 project

implemented following

A set of Common Software Quality Assurance Baseline Criteria for Research Projects

https://github.com/indigo-dc/sqa-baseline

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Examples: understanding data and AI for research

Application to biology and medicine (examples)

IFCA Instituto de Física de Cantabria

- Successful projects developed on classification of plans and snails using a CNN.
- Some projects being started right now on CNN for medical imaging applications:
  - Mental diseases through nuclear magnetic resonances.
  - Fatty liver: Classification of liver biopsies
  - Brain hemorrhage through TAC images.

Exploiting same AI techniques:
From plants to plankton, to conus, to HEP collisions, to brain…

Ignacio Heredia

Arquitectura
ResNet50
Framework
Python con Lasagne/Theano
Training dataset
PlantNet *(6K especies | 250K imágenes)*

How to become the BEST expert in plant identification in your country in 10 minutes

- **Training dataset**
  Colección de imágenes de expertos (*68 especies | 1.5K imágenes*) que cubren tres regiones diferentes:
  - Región Panámica
  - Región de África del Sur
  - Atlántico Occidental y Mediterráneo
- **Resultados**
  Los resultados usando sets de imágenes de Google son prometedores

http://conus.deep.ifca.es/

Lara Lloret

Do you think experts understand how they identify "**by heart**"?

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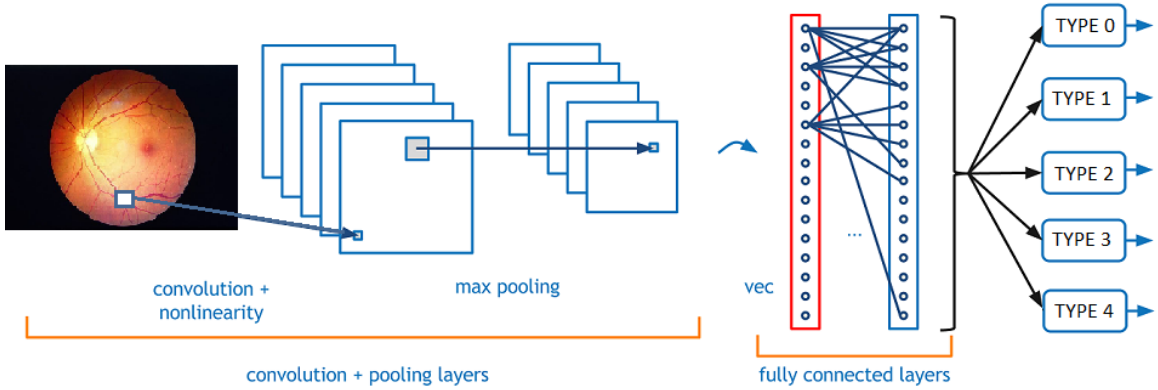
Research in Medicine: Joining Data and AI

- **Retinopathy** is a fast-growing cause of blindness over 400 million people at risk from diabetic retinopathy alone : successfully treated if it is detected early.
- Colour fundus retinal photography is analysed in order to document the presence of disorders and monitor their change over time.
- Specialized medical experts interpret such images and are able to detect the presence and stage of retinal eye disease such as diabetic retinopathy.
- **Deep Learning approach**: automated classification based on color fundus retinal photography images



Only an example *(but one of those few already accepted)* of **medical applications** where AI **should** help for good!

ECOSYSTEM:

-biomed researchers /
-doctors
-patients
-biomed companies
-authorities
-hospital owners
-assurance companies
-families

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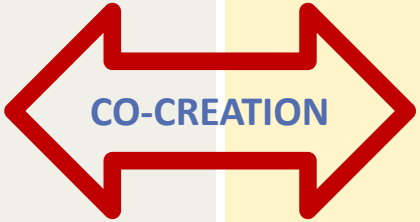
A proposal: Joining Data and AI in a public safe environment

- **Donation of Medical/Personal Data**
  - Clinical History
  - Activity, Exercise, Food, Environment
- **Data Safe Haven** ***(+ HPC framework)***
- **Legal Sandbox**
  - Joint (Public-Private) Research proposals
  - Open Research Software Tools (on IA)
  - Joint (Public-Private) Exploitation



ECOSYSTEM:
-biomed researchers /
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-families

Many, many technical advances
Ecosystem: **PRIVATE-PUBLIC COLLABORATION ON INTERDISCIPLINARY COMPLEX PROBLEM**
Key factor: **PRIVACY**
Status: **HOW TO PROGRESS?**

EXPLOIT MEDICAL DATA ON *"PUBLIC"* HPC CLOUD?
(IBM, Amazon, Google, Microsoft…)

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What next from CSIC

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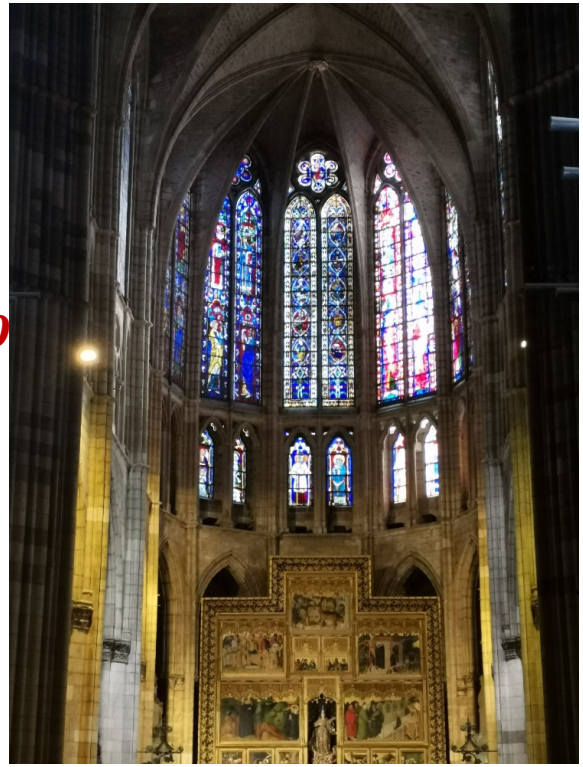
- **Better understand each ECOSYSTEM** in Open Science, and our role
  - NOT ONLY MONEY BUT KNOWLEDGE (AND INFLUENCE) CONTROL
  - POSITION AT RELEVANT FORA WITH ARGUMENTS AND EXPERIENCE
  - DISCUSS IN DETAIL IP RIGHTS AND LICENSES (**like N-C on data**)
- **Reinforce support to Open Access/Science**
  - **CSIC Open Access Mandate (effective 1st April 2019)**
  - EXPLOIT EOSC ADVANCES ***(from EOSC-Hub, EOSC-Synergy, INDIGO DataCloud, XDC, DEEP Hybrid DataCloud, Cos4Cloud)***
  - **E-INFRASTRUCTURE** AND EVOLUTION OF P-P AGREEMENTS
  - **REINFORCE TRAINING AND DISSEMINATION, NETWORKING!**
- **Support new ideas exploiting Open Access/Data/Software**
  - **Data with privacy constraints but key for improving life quality**
  - Long term data series
  - Involve society (education and dissemination)
  - Keep in mind "AI FOR GOOD"



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Answering Alan's question

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- **Should we broaden the scope of the Recommendation to software, algorithms and workflows? If so, how?**
  - *Yes, software, algorithms and workflows need to be included, and this can be done relatively straightforwardly by adapting some of the provisions of the Recommendation so that they can **apply to both data and software***
  - *Yes, software, algorithms and workflows need to be included, but it needs much more work to build a consensus, and thus our decision could be to go forward on the current revision with data only, and work on software, algorithms and workflows in the 2021/22 biennium*
  - *No, building consensus around software, algorithms and workflows is not likely to materialise in the near future so we drop it.*
- **My answer:**
  - Yes, **BOTH data and software** (including algorithms and workflows) need to be included, but **BOTH** need more work to build a consensus. Answering to **"as open as possible"** implies the analysis of the research ecosystem and the corresponding exploitation (licensing) schemes.
  - **DIFFERENT SOLUTIONS ARE REQUIRED FOR DIFFERENT RESEARCH ECOSYSTEMS**
  - **A GENERAL RECOMMENDATION ON HOW TO AGREE ON SUCH SOLUTION WOULD HELP A LOT (USE CASES)**
  - **INDEPENDENTLY, QUALITY METHODS GUARANTEEING DATA AND SOFTWARE FAIRNESS SHOULD BE IMPLEMENTED (FOR THE BENEFIT OF THE RESEARCH ECOSYSTEM)**

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Epilogue

« Je vis comme je peux dans ce pays malheureux, riche de son peuple et de sa jeunesse, provisoirement pauvre dans ses élites, lancé à la recherche d'un ordre nouveau et d'une renaissance à laquelle je crois.
Sans liberté vraie et sans un certain honneur, je ne puis vivre.»

« J'ai toujours pensé que si l'homme qui espérait dans la condition humaine était un fou, celui qui désespérait des évènements était un lâche. »

Albert Camus, 1958

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