



# O futuro da ciência cidadã

Paulo Gama Mota

Encontro Nacional da Ciência Cidadã



UNIVERSIDADE DE COIMBRA



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Gay, Southern Illinois University Edwardsville • Pedro Curioso, Universitat de València, Valencia • Paula Tavares, José Falcão Secondary School • Paulo A. M. Marques, IEPH-UI and MHNAD • Paulo Tama, Meta, Museu da Ciência da Universidade de Coimbra • Pavle Szecsenyi, Institute of Biochemistry and Biophysics (IBB) • Pedro Russo, Leiden University • Pinar Hironaka, The University of Sydney • Peter van der Weijden, Wageningen Open Wetlab • Pilar Peña, Herald de Aragón • Pinar Negrea, CSIC • Paddy Laker, Imperial College London / Open Air Laboratories (OAL) • Ferron Sanquessa, La Mandarina de Newton SL • Raymond Lewis, Marine Sans, Rockét, PAVI, Inc. • Rémy, Euro-Mediterranean Sociological Centre • Rhonda Smith, Minnesota • Ricardo Gavero, Ayuntamiento de Zaragoza • Rita Gabriela Monteiro da Rocha, Mundo Científico, Lda • R. 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Diniz, Centre for Ecological Evolution, University of Coimbra • Susana Hecker, Leibniz Centre for Agricultural Landscape Research • Teresa Holsteh, Centre for Social Innovation • Teresa Xavier, Agrupamento de Escolas Vão do Tâmega • Tony Fox, chair of People's Parks • Ulf Garderfors, Swedish Species Information Centre • Valeriya Dzmitryeva, Senior University of Coimbra • Václav Čížek, The Open University • V. Her. Saalste, CSIC • Victor Lopez • Virginia Brucato • Xavier Quera, Pascale • Xue-Kang, University of Göttingen • Yun Gordenko, G.V. Kurdyumov National Academy of Sciences •

# WHITE PAPER

ON CITIZEN SCIENCE FOR EUROPE

Uma definição para ciência cidadã (Livro branco da ciência cidadã)

## CITIZEN SCIENCE

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Citizen Science refers to the general public engagement in scientific research activities when citizens actively contribute to science

either with their intellectual effort or surrounding knowledge or with their tools and resources.

## Socientize – Um projecto de ciência cidadã



The screenshot shows the Socientize website interface. At the top, there is a navigation bar with the Socientize logo (a stylized 'v' shape) and the text 'socientize citizen science projects'. To the right of the logo are links for 'Login | Register' and a language dropdown menu set to 'English'. Below the navigation bar is a teal header with menu items: 'Join', 'Citizen Science', 'News & Events', 'Share', and 'The Project'. A search bar is located on the right side of this header. The main content area features three project cards: 'Cell Spotting' (Analyses of real cells under treatment in the Cancer's drug delivery research), 'Mind Paths' (What is the perceived relation between words?), and 'Temperature maps' (An alternative collection of thermal data.). Below these cards are three columns of content: 'Citizen Science Guide' with a sub-section 'Guide' and a 'Read more' link; 'News & Events' with two news items dated 10/29/2013 and 10/23/2013; and a Twitter feed for 'Socientize Project' showing a tweet from 'Fundación Ibercivis' dated 23 Oct.

# Parceiros do projecto



<p>Universidad Zaragoza</p>	Universidade de Saragoça - BIFI, UNIZAR	Saragoça	Espanha
<p>MUSEU DA CIÊNCIA UNIVERSIDADE DE COIMBRA</p>	Museu da Ciência-Coimbra, MUSC	Coimbra	Portugal
<p>UNIVERSIDADE DE COIMBRA</p>	Universidade de Coimbra	Coimbra	Portugal
<p>UFMG UNIVERSIDADE FEDERAL DE CAMPINA GRANDE</p>	Universidade Federal de Campina Grande, UFCG.	Campina Grande	Brazil
<p>tecnara CENTRO PARA INOVAÇÃO SOCIAL CENTRE FOR SOCIAL INNOVATION</p>	Tecnologias da Informação, Electrónica e Telecomunicações de Aragón	Saragoça	Espanha
<p>ZSI</p>	Centro de Inovação Social	Viena	Áustria

Cell  
Spotting

Mind  
Paths

Sun  
4All

Anti  
Matter



Mapas de  
Temperatura

Urban  
Bees



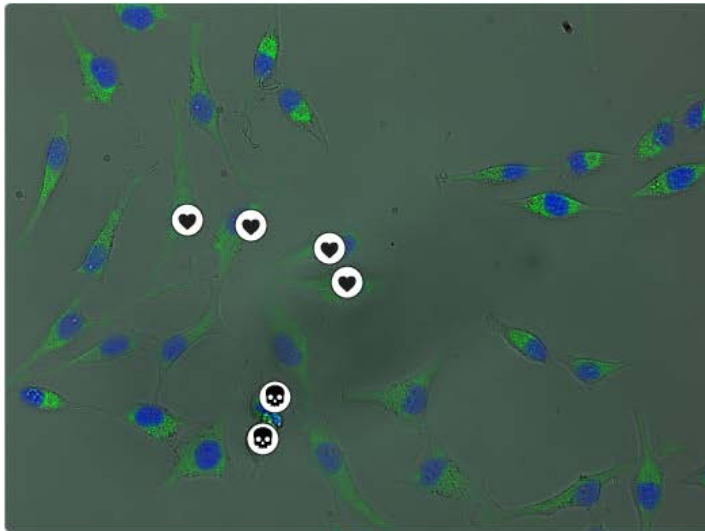
# Cell Spotting

Análise de dados de combate a células cancerígenas, concebido em U. Saragoça. Uma base de dados de mais de 100 000 imagens para analisar.

Quantas células **vivas** observa?

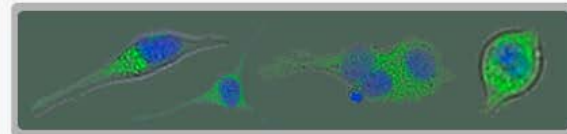
Canais

Normal  Azul  Verde

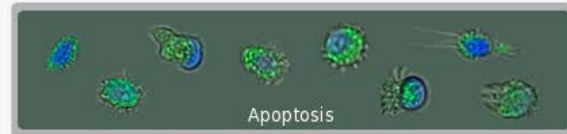


Quantas células **vivas** observa? E mortas? No primeiro exemplo, as células estão **vivas**, enquanto que na imagem seguinte estão **mortas**.

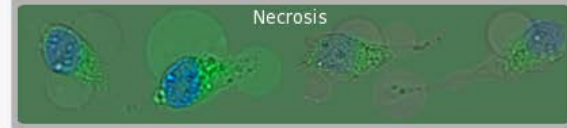
*Exemplo de células **vivas***



*Exemplo de células **mortas***



Apoptosis



Necrosis



## Escolas secundárias

Concurso com formação em escolas de Portugal e Espanha com:

- 2030 participantes de 50 escolas, realizaram 59653 tarefas.
- 81% imagens analisadas.
- Avaliação







## Escolas secundárias



Teachers' comments in focus group evaluation:

*"This project allowed the contact with different realities and also opened students' horizons to the world. This is a singular opportunity to involve students with the reality of Research in Science."*

*"This project allowed the contact with a reality that we, as teachers, can try to explain but have not lived."*



## Com universidades seniores

Trabalhámos com 3 academias seniores, que estiveram envolvidas nos projectos [Cell spotting](#) e [Sun4all](#).





Foram produzidas unidades didáticas



### Cell Spotting

Let's fight cancer together!

DIDACTIC UNIT

#### CELL DEATH: APOPTOSIS AND NECROSIS

Cells have the extraordinary ability of division. This way they ensure the growth of the organisms, cells renovation and the reproduction of all living beings.

As an organism ages, cells lose the ability to divide becoming more liable to errors in the process. When irreversible errors occur, the cell triggers a self-destructing mechanism, called apoptosis. Apoptosis is an extremely important mechanism to the prevention of genetic diseases, like cancer.

However, besides to active participation in the regulation of the cellular division, apoptosis has other functions in the organism. For example, during the human embryogenesis, the cells that occupy the interdigital gaps of hands and feet are destroyed by apoptosis to create fingers. Another example, is the proliferation of the mammary gland cells to produce maternal milk. During pregnancy, once breast-feeding is over, the surplus cells activate their apoptosis program and reduce the size of the glands.

**Group Work:** Search in books or the Internet other examples where apoptosis takes place and prepare a short presentation to your class.

Besides apoptosis, there is another type of cell death with perhaps, nature, called necrosis. Necrosis can be caused by microorganisms, virus or chemical agents, and, unlike apoptosis, the cell does not control it. This type of cell death induces inflammation at the tissue and organs level triggering an inflammatory response that is not observed in the apoptosis process.

#### Characterization of the Apoptosis and Necrosis Process

Apoptosis and necrosis are two types of cell death biochemically and morphologically distinct from one another. Therefore, it is very easy to determine through the observation with the microscope the type of cell death suffered by a cell.

Observe the figures 3 and check the main characteristics of apoptosis and necrosis.

#### APOPTOSIS

- Cell shrinking
- Nucleus condensation
- Blistering (blebs)
- Nuclear condensation and fragmentation
- Formation of apoptotic bodies
- Apoptotic bodies are engulfed by all the neighboring cells through phagocytosis

#### NECROSIS

- Swelling of the cell and organelles
- Nuclear rupture
- Cell contents release
- Cell contents release (leakage)
- Presence activation of an inflammatory response

Fig. 3 Representation of cell death: apoptosis and necrosis



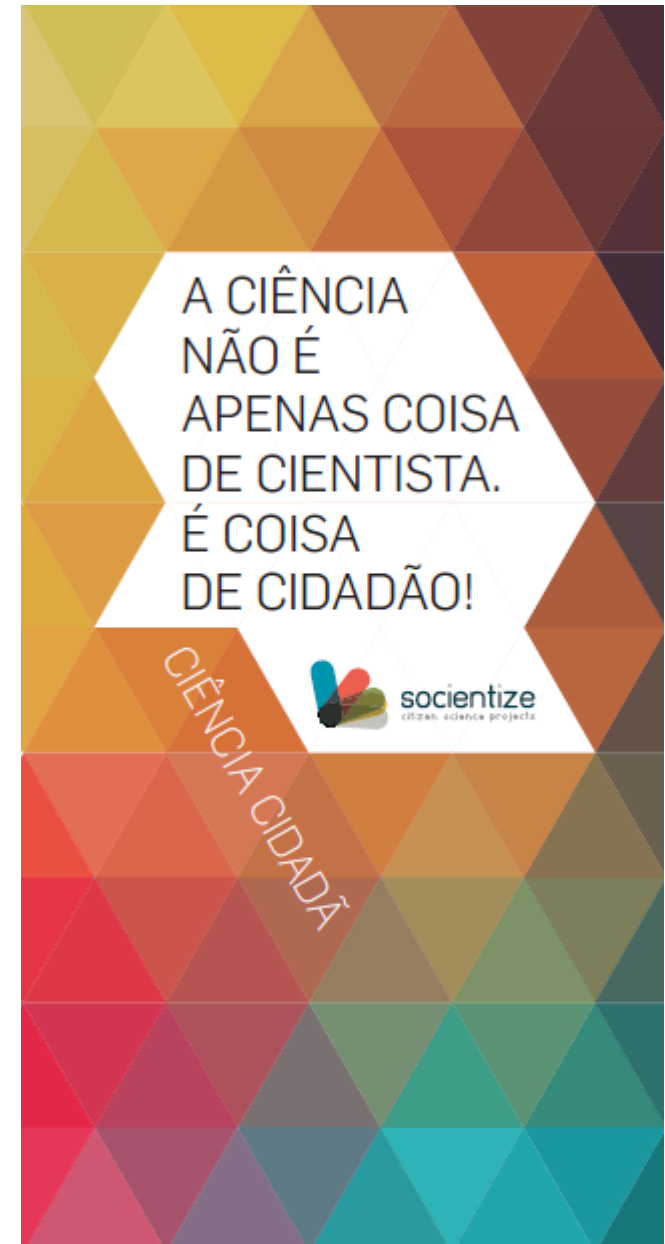
**casa das ciências**  
PORTAL GULBENKIAN PARA PROFESSORES

**SCIENCE in SCHOOL**

Highlighting the best in science teaching and research

## SOCIENTIZE em números

- 36 000 voluntários
- > 20 projectos científicos apoiados
- 15 artigos científicos
- 2 teses de doutoramento



## Fenómenos à escala global e participação dos cidadãos

- Alterações climáticas
- Biodiversidade
  - Extinções
  - Invasões
  - Destruição de habitats
- Qualidade ambiental
- Saúde

Trata-se de abordar grandes problemas sociais e de interesse científico, ou em que a ciência pode ter um contributo decisivo.

Potencial de dar poder aos cidadãos para resolverem os seus problemas.

## Projectos

CIBIO – Biodiversity: collaborative research and educational projects

Darwin sparrows – Cape Verde

Lichens in the Northern style (Iberian Red list of Lichens)

Serralves Bioblitz



## White paper and recommendations

• Ferrnán Serrano-Sanz, Universidad de Zaragoza • BFFH Iberovis • Fernando Tomás • Philippe Aden • The Young • Obafemi • Francesca Rodriguez, York University • Francisco Brazález, Universidade Federal Campina Grande • Francisco Casado • EEMN • Francisco Sanz García, Universidad de Zaragoza – Iberovis • Francisco Vialondo, Universidad de Zaragoza • François DNY, Citizen Cyberscience Centre (CCC) • Giuliana Rubini, Istituto Nazionale di Geofisica e Vulcanologia – INGV Roma • Greg Newman, Natural Resource Ecology Laboratory, Colorado State University • Helena • guandú • José Estévez, Secondary School • Helena Mendes, University of Coimbra • Inês Machado, Centre for Functional Ecology (CFC) • Ian Morgan, Optimat • Ise Merschfolk, Zentrum für Sozialinnovation • Jérémy Labbé, La Mandarine de Newton SL • Inês Castro, Centre for Social Studies (CIS) • Isabel Bonifácio, Universitat de Barcelona • Jéssica Borrali • Jan Theunis, Environmental Risk and Health • Javier Garcia, Iobio, Centro de Supercomputación de Galicia (CESGA) • Jayna Ventan, Keene, Inspiring Academics • Jean-fer, Open-Shift, Cornell Lab of Ornithology • Jesús María, CSIC • João Almeida, UCL, Centre for Social Studies (CIS) • Joaquim, PhD Student of the Seioner University of Aguado • Joana R. 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Wlazul, De Montfort University, United Kingdom • Leiza Ferrando, CSIC • Laura Dealing, Imperial College London / Open Air Laboratories (OPAL) • Leticia Ferrando, Universidade Federal Campina Grande • Libby Heston, Atlas of Life • Linda Davies, Centre for Environmental Policy • Lotta, Commission, Vetenskap & Annanhet, VTI Public & Science • Luca Mantovani, Space Science Institute – Laboratory of Meteorology, Civitavecchia, Italy – University of Oxford • Lucy Robinson, Natural History Museum, London • Luisa Catarina, José Estévez, Secondary School • Luz Guenaga, Decathlon Learning • Marc, Mastro, Cologno Sanzauna de Zaragoza • Manuel Perez, ITC SARA Ciudad TIC Aragón • Maria Manuel, Mariana, Pedro Hispano, methods • Mariana, Jose Estévez, Secondary School • Maria Piant, University of Goettingen • Mari Carmen, Iberia, Francisco, Iberovis • Manuel, Guenaga, Devoto, Research • Martin, Horta, Diseases, ZIN • Centre for Social Innovation • Matt, Pashley, British, Natural, History, Consortium • Melinda, Hughes-Went, Nature, Afronics • Michail, Kalogiannakis, University of Crete, Department of Preschool Education • Michelle, Brook, Open Knowledge Foundation • Miguel, Colorado, Universidad Politécnica de Madrid • Mikko, Tuuska • Mónica, Lara, CSIC • Mónica, Lara, British Science Association • Mônica, Soares, Leiria, Centre for Agricultural Land Use Research • Muki, Håkviik, University College London • Nazwan, Androvi, Universidade Federal Campina Grande • Nicola, Fraser, Southern Cross University • Nuno, Negroes, Biology Department, Aveiro University • Oleg, Lyubovskiy, ENRS • Osvaldo, Sorrellinos, Universidad de Zaragoza • Patricia, Day, Southern London University, Edwardsville • Paulo, Carinhão, Universitat de Girona, Weneis • Paula, Alves, José Estévez, Secondary School • Paulo, A. 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**WHITE PAPER**  
ON CITIZEN SCIENCE FOR EUROPE



Uma definição para ciência cidadã (Livro branco da ciência cidadã)

## CITIZEN SCIENCE

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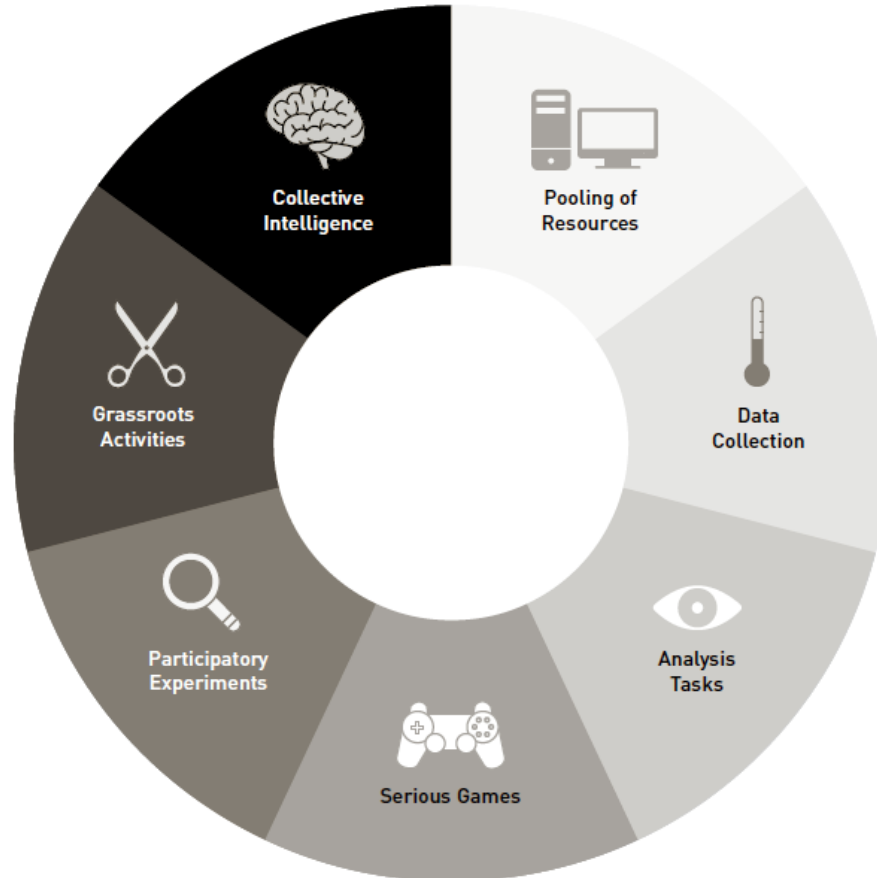
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# WHITE PAPER

## ON CITIZEN SCIENCE FOR EUROPE

### MODELS OF CITIZEN ENGAGEMENT IN SCIENCE



## VALUES

## ATTRIBUTES



### Open (culture)

- ◆ Trusted
- ◆ Transparent
- ◆ Global

- ◆ Engaging
- ◆ Self-learning
- ◆ Accessible

- ◆ Reusable
- ◆ Participatory
- ◆ Collaborative



### Social (by all/for all)

- ◆ Co-created
- ◆ Amateur
- ◆ Scattered

- ◆ Collective
- ◆ Democratic active
- ◆ Public assessment

- ◆ Creative
- ◆ Inclusive



### Digital (infrastructure)

- ◆ Powerful
- ◆ Ubiquitous
- ◆ Pervasive
- ◆ Massive

- ◆ Immediate
- ◆ Traceable interactions
- ◆ Networks

- ◆ Devices
- ◆ Empowerment
- ◆ Effective

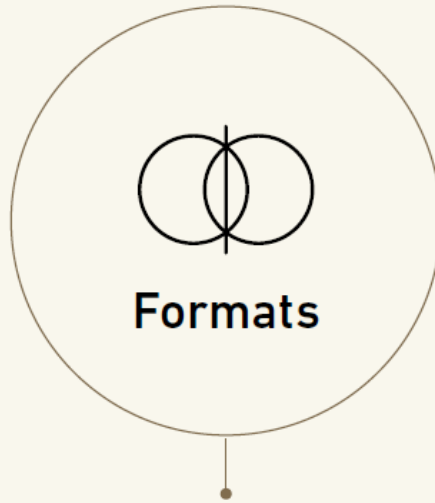


### Research (innovative)

- ◆ Unexplored
- ◆ Inspiration for innovations
- ◆ Transdisciplinary

- ◆ Innovative
- ◆ Educational
- ◆ Common
- ◆ Responsible

- ◆ Sustainable
- ◆ Skilled
- ◆ Experimental



Research driven / socially driven

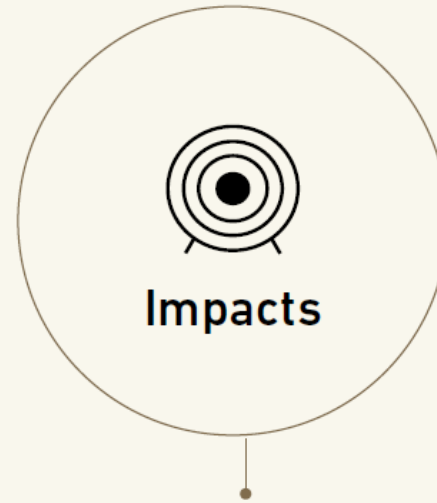
Online / offline

Amateur / Professional

Formal / Informal

One-day / permanent

Local / global



Scientific

Inspirational

Educational

Social

Economic

Environmental

Political

Elementos-chave:

**Envolvimento público, confiança e educação**

## ▪ Proposed Action 1: *Targeted Programming*

**Designing funding schemes and launching programmes specific to Citizen Science.** Targeted calls will achieve a broader uptake and will keep already-established networks and systems going. Programmes should contribute to a deeper analysis of Citizen Science practices and outcomes. Fostering co-production of knowledge will bring science into new scenarios with an even greater diversity of actors in the field of research to achieve higher creativity. The challenge lies in the design of these programmes which should allow for participation of grassroots initiatives driven by either civil society organisations or independent citizen scientists. Broad dissemination and support activities will be needed as well as minimal bureaucracy. The creation of a committee of researchers and citizens involved in the decision-making process regarding such funding programmes is recommended.

## ▪ Proposed Action 2: *Mainstreaming Citizen Science*

**Embedding Citizen Science into existing funding schemes. Just as science communication, Citizen Science should become an integral part of ongoing scientific activities.** Research should be given greater credit for the inclusion of Citizen Science strands covering multiple disciplines, addressing the public's needs and concerns.

## ▪ Support Measure 1: Education

**Updating educational programmes in order to promote and to recognise new forms of community engagement and digital skills in the curriculum.** New tools and educational materials should foster citizens' autonomy and responsibility for change at an early age (encouraging curiosity, criticism, self-learning, self-expression) through lifelong learning. Educational programmes should stress collaboration between schools and scientific institutions, which needs to be reflected in scientific and educational value systems.

## ▪ Support Measure 2: Evaluation and Assessment

**Expanding current academic reputation systems and evaluation criteria to account for social impact and engagement.** Finding alternative metrics and incentives for scientific curricula that recognise social engagement. Potential social impact and citizen involvement should become selection and evaluation criteria in both existing and future funding schemes. Consequently, citizens and amateurs should take part in the evaluation and selection process.

## ▪ Support Measure 3: Access to Technology

**Broadening access to technology and improving the systems required to make the most of the power of networked communities,** paying special attention to the digital divide in Europe. Encouraging citizens to be actively involved in the development and deployment of technologies and educational materials.

## ▪ Support Measure 4: Data Policy

**Clear ethical guidelines are needed for EU-wide data policy.** We support a culture of openness for data and access to data. We ask stakeholders to extensively share public datasets collected and research data infrastructures (quality, reliability, interoperability) as well as data handling tools and methods (algorithms, descriptive, predictive, visualization, decision-making.) This implies handling data in a very sensible way, taking into account intellectual property rights, fundamental personal data protection rights, ethical standards, legal requirements and scientific data quality.

## ▪ Support Measure 5: Dissemination and Support

**All strategies and policy actions must be communicated by providing appropriate knowledge-based guidance.** Citizen Science communication, dialogue and training programmes (actors: public officials, researchers, journalists...) should aim at achieving broad dissemination and support activities that are consistently applied and communicated throughout EU science and innovation policies; and demonstrating the usefulness of and the need for new knowledge generation and application in Europe.

## Some conclusions

- Our society requires a *paradigm shift*, a new contract between all societal actors in order to address global challenges with a **stronger focus on scientific and social values, and not only economic ones.**
- New politics are needed that prioritize science-society-policy **interactions fostering knowledge-based, intelligent and responsible selection of choices.**
- We need **structural reforms** to increase the openness and the diversity of actors, narratives and scenarios in order to **encourage creativity opening new opportunities for all and new joint solutions.**



# Um Observatório da Ciência Cidadã

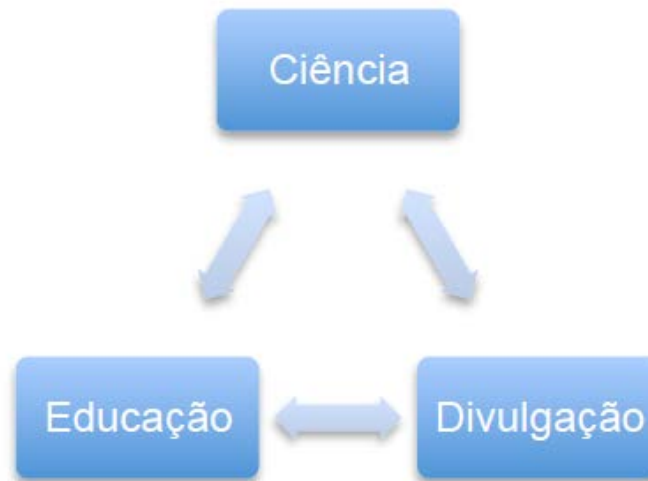
## Observatório da Ciência Cidadã

1. Identificação, catalogação e mapeamento das iniciativas de Ciência Cidadã em Portugal



## Observatório da Ciência Cidadã

2. Registo e repositório e divulgação das iniciativas de Ciência Cidadã para escolas e outras entidades



## Observatório da Ciência Cidadã

3. Monitorização e avaliação do impacto científico, educacional e social das iniciativas de Ciência Cidadã.



## Observatório da Ciência Cidadã

4. Participação em actividades transnacionais e internacionais para a implementação e divulgação de iniciativas de Ciência Cidadã.



EUROPEAN  
CITIZEN SCIENCE  
ASSOCIATION

**ecsite** 

EUROPEAN NETWORK  
SCIENCE CENTRES & MUSEUMS

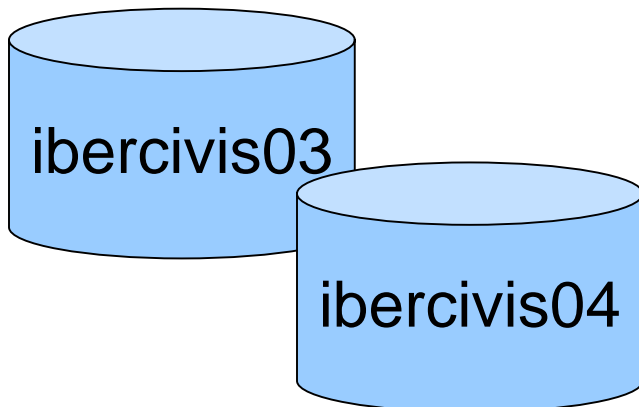


**iber**civis

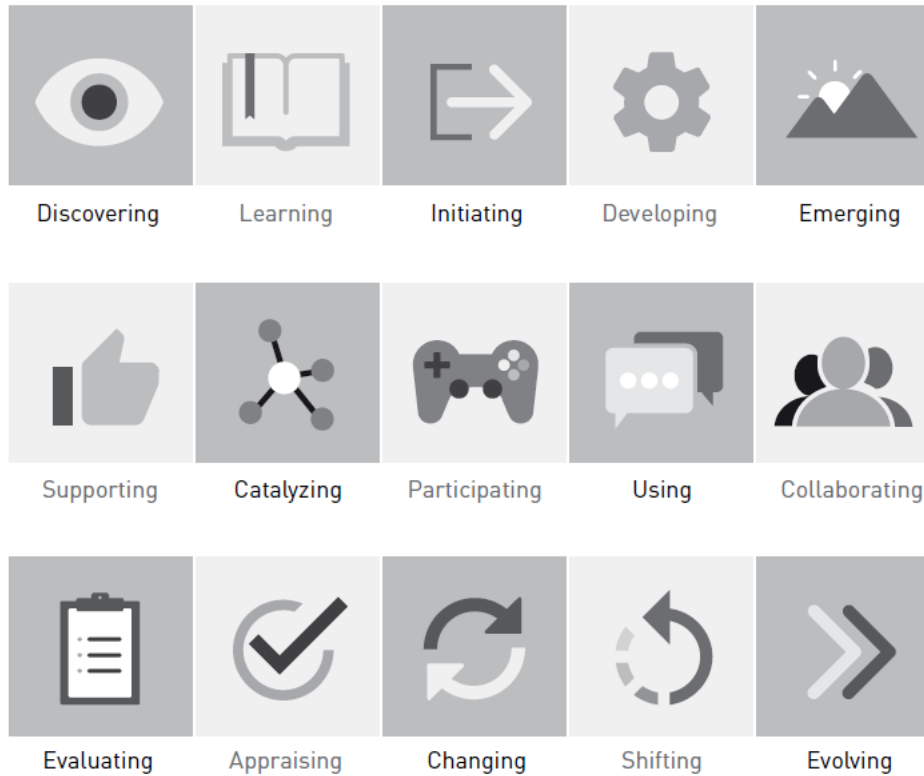
## Infraestructura em Portugal



Fundação para a Computação Científica Nacional  
*Foundation for National Scientific Computing*



## C I T I Z E N S   A R E . . .



## R E S E A R C H

# O futuro da ciência cidadã

