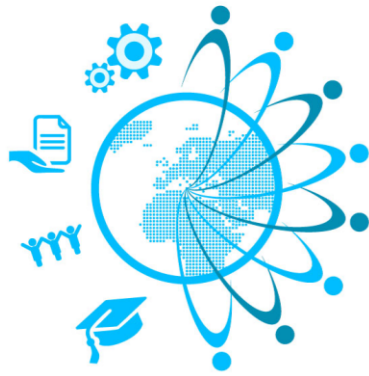




FoTRRIS

Fostering a Transition towards Responsible Research and Innovation Systems

Financing, rewarding and compensation strategy

Deliverable D2.4

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About the FoTERRIS project

FoTERRIS develops and introduces new governance practices to foster Responsible Research and Innovation (RRI) policies and methods in Research and Innovation (R&I) systems.

FoTERRIS stresses that RRI is a collaborative activity from the very beginning. Therefore FoTERRIS adds the prefix 'co' to the acronym RRI. Important present-day challenges are of a global nature but manifest themselves in ways that are influenced by local conditions. Thus, FoTERRIS focusses on glocal challenges, i.e. local or regional manifestations of global challenges and on local opportunities for solving them.

FoTERRIS performs a transition experiment, i.e. an experiment to support the transformation of present-day research and innovation strategies into co-RRI-strategies. It designs, tests and validates the organisation, operation and funding of co-RRI competence cells. A competence cell is conceived as a small organisational unit, which functions as a local one-stop innovation platform that encourages various knowledge actors from science, policy, industry and civil society to co-design, -perform, and -monitor co-RRI-projects that are attuned to local manifestations of global sustainability challenges.

Since research and innovation systems and practices in EU member states and within different research performing organisations vary, FoTERRIS experiments the implementation of new governance practices in five member states. These five experiments are evaluated, validated and constitute the basis for FoTERRIS policy recommendations towards EU and member states policy makers so as to enforce co-RRI into the national and EU R&I systems. Training is dispensed to various stakeholders, so as to form them to establish other co-RRI competence cells.

For more information see <http://www.fotrris-h2020.eu>



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1 Presentation of the deliverable's content

1.1 Requirements from the DOA¹

This deliverable is part of **WP2 'Design of a multi-actor experiment'** and reports on the activities carried out under **Task 2.4 'Activity model for the competence cells, and alternative funding and evaluation methods for RRI projects and solutions'**.

We present below what the DOA (Description of Action) required for WP2 and T2.4.

Objectives of WP2:

The conceptual framework developed in WP1 will be put into practice in WP2. A Co-RRI competence cell and a co-RRI web-based platform will be designed. The co-RRI competence cells will be designed as the new social spaces that foster and facilitate co-RRI. They will form a network entirely and specially dedicated to research on RRI and promotion of RRI. The co-RRI web-based platform will embody the process architecture, integrating co-RRI standards and methods, to co-design RRI project concepts. An activity model will be developed in order to assure the competence cell's sustainability over time. While an activity model will be developed for the competence cells, a rewarding and compensation strategy will be sought for stakeholders contributing to the co-design of co-RRI project concepts. After being tested in real situations in WP3, co-RRI competence cells, platform specs, activity model and rewarding and compensation strategy will be refined and improved where found needed. Different finance sources (public procurement, special contests, local public financing, special RRI funds etc) will be investigated for financing co-RRI projects and marketing of developed solutions, products and services.

Objectives of T2.4:

Co-RRI projects and competence cells will be confronted with current barriers. In order to promote co-RRI projects within research performing organisations, an appropriate rewarding and compensation strategy will be sought to value the quality of both formal and informal knowledge actors' contributions to co-RRI project concepts and to compensate for the investment of time and other resources. To ensure the competence cell's sustainability over time, an appropriate activity model will be sought.

These models will be built on the reorganisation of researchers' work to allocate more time to co-RRI activities. The reorganisation will be based on enlarging the scope of criteria that allow for research funding in order to fund equally, and even more, RRI projects based on their responsible innovation excellence, and to provide researchers with more time and recognition for the work they carry out in co-RRI projects. Money and reputation flows will be rethought in order to reward each stakeholder participating in co-RRI projects and to internalise external costs of innovation. The reorganisation will also deal with how to promote better RRI in scientific journals and in the ranking of universities.

Public procurement and other financial means such as new funding rules, special contests for RRI projects, crowdfunding, local public financing, venture capital and dedicated funding from special RRI funds will be studied and further developed in order to finance co-RRI projects.

Rewarding and compensation strategy and activity model will be based on the outcomes of WP1. Further interviews, especially with direction board of research organisations, scientific journals, R&I departments of businesses, and with policy makers will be conducted.

¹ Initially, the DOA referred to "knowledge arena" and "business model", these terms have been respectively replaced by "competence cell" and "activity model" during the course of the project, for the consortium deemed them more appropriate.

1.2 Deliverable's structure

Table 1: Clarification of the objectives and means to be investigated in this deliverable

Objectives as per the DOA	Rationale	Means to achieve objective as per the DOA
Co-RRI projects are promoted	The idea behind this objective is to motivate formal and informal actors to undertake co-RRI projects.	Rewarding and Compensation strategies: • Providing researchers with more recognition for the work they carry out in co-RRI projects • Valuing the quality of informal contributions • Compensating or the investment of time and other resources
More time is allocated to co-RRI activities	This objective is based on the appraisal that not sufficient time is currently dedicated to co-RRI activities, and that a transition towards co-RRI require a complete shift in time allocation.	Providing researchers with more time for co-RRI projects • Reorganising their work • Enlarging the scope of funding criteria, so that more co-RRI projects are funded, and ultimately, more time is dedicated to co-RRI projects
Valuing and rewarding any (formal/informal) contributions to co-RRI and compensating for the time and resources spent in co-RRI projects	The rationale for this objective is that in the mainstream R&I system, co-RRI activities are not valued as they should be, given their potential for solving the grand societal challenges. Often, co-RRI activities rely on voluntary resources.	Rethinking money and reputation flows: • Enlarging the scope of funding criteria • Rewarding and compensation strategies
Co-RRI is promoted in scientific journals and in the university rankings	As just above, this objective has been set so that the true value of co-RRI is recognised. Today's rankings and journals usually promote specialised knowledge with an economic potential.	Rethinking money and reputation flows: • Enlarging the scope of funding criteria
At least as much co-RRI projects are funded as typical R&I projects	This goes with the "more time for co-RRI" objective. For solving the grand societal challenges, way more budget should be dedicated to co-RRI activities.	• Investigate public procurement, new funding rules, special contests, crowdfunding, local public financing, and special RRI funds • Enlarging the scope of funding criteria
Co-RRI solutions are largely deployed	Co-RRI solutions are usually not the type of solutions that attract investors, so they have difficulties reaching their targets and full application	• Investigate public procurement, new funding rules, special contests, crowdfunding, local public financing, and special RRI funds to finance the deployment of co-RRI solutions

Table 1 above presents our understanding of the DOA while Table 2 presents how the deliverable is structured to answer all the DOA's requirements.

Table 2: Deliverable's structure and relation with the DOA

Deliverable section	DOA's objective	DOA means investigated	Other means investigated
Section 1: Presentation of the deliverable's content	n/a		
Section 2: Brief overview of the co-RRI concept	This section informs the reader on the principles of co-RRI, which is necessary for him/her to understand the rest of the deliverable.		
Section 3: European R&I systems and comparison with a co-RRI system	We have deemed necessary to provide the reader with a relatively detailed description of what a R&I system is, and especially, how the EU R&I system is defined and structured. This is essential for the reader to understand the difference with a co-RRI system. In this section, we propose therefore: • A presentation of a generic R&I system • An overview of the current EU R&I policy • A presentation of the functioning of the EU R&I system • A brief analysis on the reason why a co-RRI system is needed, and how the current R&I system is far from embodying the co-RRI principles		
Section 4: Propositions to reorganise R&I systems as co-RRI systems	The DOA is very much about proposing solutions for completely reorganising the R&I system. Therefore, this section addresses all the DOA's objectives as presented in Table 1.	• Providing researchers with more time and recognition • Reorganising researchers work • Enlarging the scope of funding criteria • Rethinking money and reputation flows • Investigating public procurement, new funding rules, special contests, crowdfunding, local public financing, and special RRI funds	• Motivations • Mindsets • Management of R&I organisations • Sustainable Transition Management
Section 5: Rewarding and Compensation strategies for external participants	This section focuses on rewarding and compensation for it was a key objective of the project as a whole.	• Valuing the quality of informal contributions • Compensating or the investment of time and other resources	n/a
Section 6: Final recommendations and conclusion	This section concludes the deliverable and proposes policy recommendations to implement the solutions investigated for a reorganisation of the R&I system as co-RRI systems.		

1.3 Task process and method

To elaborate this deliverable, we have started to study what a co-RRI system is (section 3 and annex 1), based on a literature review. Then, we have investigated the current European R&I policy, to see how much it frames the behaviour of the R&I system. For that we have relied mostly on texts from the European institutions. Then we have briefly analysed the differences between the current systems and an ideal co-RRI system, based on a literature review and interviews with external actors (annex 4).

In section 4 we propose solutions for a co-RRI system, based on a literature review and interviews with external actors (annex 4) to find inspiring initiatives that embody the co-RRI values and the field of sustainable transition management studies.

In section 5, we have carried out a specific piece of work on rewarding and compensation strategies, based on a literature review, interviews with external actors (annex 4 and annex 5), a subcontracted report on knowledge vouchers as implemented in the Flemish transition experiment (annex 3), and a questionnaire to FoTERRIS partners (annex 2) to know which kind of rewarding and compensation strategies they have implemented in their transition experiment.

2 Brief overview of the co-RRI concept

As this deliverable deals with a new co-RRI system, we here present a summary of what co-RRI (co-created Responsible Research and Innovation) is. A first essay of the co-RRI concept is available in deliverable D1.2 'Conceptual Framework for co-RRI', while the final concept can be found in deliverable D4.3 'Policy recommendations for co-RRI'.

Conceptualisation of R&I:

The co-RRI concept recognises that R&I processes are embedded in societal and political discourses and institutional structures, and that co-RRI is inextricably linked with **making choices with ethical and political implications**, such as giving a voice to marginalised and silent social groups.

It also assumes that all stakeholders (from the quadruple helix) have the **joint responsibility** in creating knowledge and taking actions for solving grand environmental and social challenges.

Values embodied in co-RRI:

The values embodied in the co-RRI concept are:

- **Strong sustainability**
- Acknowledgement of **different forms of knowing**
- **Social inclusion**

Positioning regarding other concepts:

The co-RRI concept regards the United Nation's Sustainable Development Goals as important themes for R&I.

Subjects of co-RRI:

Co-RRI aims at understanding and bringing solutions to the complex societal and environmental problems of today, in ways that are compatible with co-RRI values. Especially, co-RRI projects target the **local manifestations** of these grand societal challenges, by looking at the local needs, values and opportunities.

Methods and approaches:

To conduct co-RRI, the first step is to acknowledge that the problems we face today are pointing out systemic failures that have gradually become part of our societal systems. Contrary to market failures, they cannot be corrected by conventional policies but call for a transformation of our societal systems. The second step is then about deciding **what the real values and needs in society are**.

To understand these problems, the co-RRI concept requires to take a **complex systems perspective, and a relativist perspective**. Indeed, the co-RRI concept assumes that any description of our societal systems depends on who is describing. So, coming to a broad understanding of the problems' causes and to a broad range of thinking about possible alternative solutions necessitate the involvement of a diverse array of actors, that is the **quadruple helix**.

When solving a global problem, it is important to consider which combinations of traditional and non-traditional knowledge are appropriate to effectively respond to this global problem. This combination, or better called, co-creation of knowledge, should be based upon the **cross-fertilisation** of values, norms, experiences and expertise among all actors engaged, and the ability to **transcend** disciplines, established research cultures and practices, and categorisations such as public-private and academic- non-academic.

Overall, co-RRI requires a transdisciplinary spirit and to provide space for dialogue among all actors engaged so as to create room for guided reflections on the inherent values and norms of the R&I system.

However, **inclusiveness** and actors' selection are to be carefully chosen depending on the particular context in which the co-RRI projects take place so that a productive and constructive working atmosphere can be fostered.

In any case, economic growth cannot be the main output, but only a means to realise social justice, prosperity, and ecological sustainability within planetary boundaries.

Lastly, the co-RRI concept asks for **reflexivity** upon the choices to be made and their implications, and upon the alignment of co-creation processes at the local level and broader societal developments. This reflexivity in co-RRI processes relies on **transparency, and the accessibility** of data, results, and other information.

Process:

Co-RRI processes touch upon a variety of possible options for addressing global challenges and should be understood as **on-going, open and long-term processes involving lasting relationships** between traditional and non-traditional knowledge actors and engagements transcending project-based knowledge creation.

3 European R&I systems and comparison with a co-RRI system

In this section we present how a generic R&I system can be described, and then, an overview of the current European R&I policy. We have decided to focus on the European R&I policy only and not national R&I policies since the FoTERRIS project has been asked for by the European Commission, since the European R&I policy is framing MSs policies, and since it was too heavy to carry out such work for each of the MSs represented by FoTERRIS partners. Our analysis framework for describing a R&I system is based upon the following sources:

- (Empirica, Dialogic, & University of Applied Sciences on Northwestern Switzerland, 2013)
- (Lepori, 2017)
- (OECD, 2014)
- (Reale et al., 2013)
- (Correa, 2014)
- From Freeman in (Dore, 1988)

At the end of this section, a comparison is provided between the current R&I systems and an ideal co-RRI system. As this section is only informational, we present here a shortened version of it, while the full content of this section can be found in annex 1.

3.1 Overview of a generic R&I system

3.1.1 Definitions and classifications

The R&I system comprises of research, education, development and innovation activities. The term R&I is relatively new, for before the term R&D prevailed.

Definition of R&D: research & experimental development (R&D) comprise creative and systematic work undertaken in order to **increase the stock of knowledge** – including knowledge of humankind, culture and society – and to devise **new applications of available knowledge** (OECD, 2015).

Three types of R&D can be distinguished (OECD, 2015):

- **Basic research:** experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view
 - *Pure basic research*
 - *Oriented basic research*
- **Applied research:** original investigation undertaken to acquire new knowledge. It is directed primarily towards a specific, practical aim or objective.
- **Experimental development:** systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

The following activities **are not counted as R&D** in the Frascati manual:

- scientific and technical information services,
- testing & standardisation,
- feasibility studies,
- specialised health care,
- policy-related studies,
- programmatic evaluations,
- purely R&D-financing activities,
- indirect supporting activities

Classifications: several nomenclatures exist to classify R&D&I activities.

- Statistical classifications (Lepori, 2017):
 - The Nomenclature for the Analysis and Comparison of Scientific programmes and Budgets (NABS) is the one used in the Frascati manual to classify public research funding according to its specific **policy intentions**
 - The NACE is the classification of R&D activities as **economic activities by sectors of activity**
- Non-statistical classifications (Lepori, 2017):
 - The Key Enabling Technologies (KETs) classification distinguishes technologies that are knowledge intensive, multidisciplinary, of systemic relevance since cutting across many technology areas with a trend towards convergence and integration. They are associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment.

3.1.2 Characterisation of a R&I system

In this section we present what a generic R&I system is, covering both national and EU levels. We define a R&I system as all artefacts (practices, technologies, policies, employment, etc.) which ultimately result, in whatever sectors, in:

- Knowledge
- New or better products and services, technologies, methods, processes
- Other outcomes that built on these latter, such as:
 - Research and innovation excellence
 - Productivity and growth
 - Education
 - Sustainable development

Our analysis framework consists in detailing the following artefacts of the system:

Inputs: by inputs we mean all the resources that are needed to carry out the activities that will ultimately result in the outputs and outcomes described above. We consider the following inputs: Capital; Knowledge and information; Workforce; Infrastructure.

Motivations: we thought it interesting to present the motivations of the main actors that undertake R&I activities. We have distinguished between public, private and individual motivations.

Framework: it consists of all artefacts that have an influence on the R&I system. We have distinguished the following influential categories:

- Mindsets
- R&I and related policies
 - Policies as such
 - Policy instruments
 - Supply-side measures
 - Demand-side measures
 - Integrated measures
- External structure, that is all the structural elements of other sectors and systems that frame the way the R&I system behave.

Actors: we present the main public, public-private and private actors that undertake R&I activities and distinguish them according to their role (governance, funders, performers, demand, etc.).

Functional organisation: this last unit of analysis serves to present important R&I activities, and who initiate and carry them out. We have selected the following activities as important ones:

- Political game
- Policy-making
- Appointment of missions
- Allocation of public and financing budgets
- Elaboration of project-funding programmes
- Management of structural organisations
- Policy-based evaluation of the R&I system
- Informal evaluation of HEIs
- Core activities
- Validation of research results
- Valorisation of outputs

3.1.2.1 Inputs

Capital: Two types of capital stream can be distinguished

- Public streams: public funds can be seen as policy instruments, so they are presented in the section on policy instruments
- Private streams: private funding is more important than public funding. It serves to finance private but also public organisations.

Knowledge and information

Science, R&I and education activities are a continuous construction on existing knowledge. Access to existing knowledge is therefore **crucial**. Furthermore, as innovation is linked to economic competitiveness, information can be seen as a **competitive weapon**.

Workforce

Two categories of workforce can be distinguished: **private and public workforces**. The public workforce must abide by the current policy framework and follows what is traditionally called an academic career, which is well formalised (PhD, Postdoc, Lecturer, Professor, Dean, etc). The private workforce is more adapted to the necessity of private organisations: engineers are most found in for-profit companies, while less traditional profiles can be found in independent research centres, NGOs, or not – for profit organisations.

Infrastructures

As already said, access to knowledge and information is crucial for R&I and education activities. Therefore, a lot of (infra) structures exist to provide this access: publishing system, libraries, databases, etc.

3.1.2.2 Motivations

The motivation of public bodies is to provide **education**, to increase **economic growth and competitiveness**, to gain **international prestige** (through national statistics, including numbers of Nobel prizes, etc.), and to **comply with EU R&I policy**. In the private side, **for-profit companies** usually think of R&I as a means to increase their competitiveness on existing markets and access new ones. Certain non-profit organisations rely on R&I to **improve and change** what presently exists in various domains. While individuals, who choose to have professional or side activities related to R&I, are most of the time driven by **curiosity**, a taste for **intellectually challenging** activities, or the **prestige** associated with scientific discovery and entrepreneurship.

3.1.2.3 Framework

3.1.2.3.1 Mindsets

As any activity, R&I and education activities are framed by **individual and collective mindsets**. Current R&I policies in Europe are shaped by a certain idea of progress, which assumes that progress and thus well-

being results **from economic growth and competitiveness, as well as from technological innovation**. Innovation is thought as their prerequisite.

Due to the recent, in an historical perspective, successes of the scientific method (starting with the Enlightenment, followed by the industrial revolution, and present major innovations (artificial Intelligence, spatial exploration, genetics, etc.)), Science, R&I and education activities have long been considered as prestigious and **fixed mindsets on what constitutes good and bad science** have developed, based on the type of science that led to these successes. However, nowadays, the problems R&I is confronted to are not the same as in the past. **When the first aim of past scientific inquiry was to understand the world, we now face the challenge of ensuring a sustainable living for all Earth's inhabitants**, which means that the main subject of R&I has switched from natural to human and natural sciences. This shift asks to overcome the fragmentation of Science and R&I in areas of expertise and types of activities and to develop new types of knowledge.

However, as all the prestige is associated to the past type of science, it is extremely difficult to shift mindsets. But **new mindsets emerge**, leading to concepts such as co-RRI, citizen sciences, etc., and the reorientation of R&I activities towards sustainability and the use of different, usually more inclusive, approaches and methods.

3.1.2.3.2 R&I and related policies

Even though R&I activities are naturally human activities and would exist whatsoever, it is important to remember that most of them are part of national and European political strategies. Despite the supposed objectivity of Science, **R&I activities are framed by politics**, since deciding what to research and invest on with public capabilities, is a political act. We present here the main policy elements that frame R&I and education activities.

Policies

All the following policies go hand in hand and influence R&I and related activities: education, science, economy, industry.

Policy instruments

To enforce policies, there exist a variety of policy instruments, which can be classified according to whether they serve the supply or the demand side. We present here a brief classification of these instruments, that we elaborated from (Edler & Georgiou, 2007; Empirica et al., 2013).

Supply – side measures

For managing the R&I system

Some instruments serve to manage the R&I system, by providing institutional support to R&I performers. Some others serve to optimise performance:

- Internal rules for reporting to the State, for allocating funds...
- Intellectual Property (IP) regulation: protection of academic outputs, licensing contracts, ...
- Links between the research and innovation worlds and technology transfer policies
 - Instruments to bridge institutions (businesses and research), and strengthen linkages within innovation systems such as the creation of infrastructure and opportunities for scientists and business people/engineers to meet, communicate, and collaborate (Empirica et al., 2013)
 - Strategic programmes for industry
 - Including intermediary results of tech transfer, such as patent applications or granted patents in academic appraisal procedures

For providing the necessary inputs to R&I activities

Knowledge and information

- Open access policy and related instruments (rules to publish under the open science model all publicly funded research, ...)
- Provision of public services such as contact databases, brokerage events, advisory services, etc.

Workforce

Policy instruments here aim to form the minds to the scientific (mainstream) methods, improve capabilities, and attract the best researchers and entrepreneurs: education methods, tailored innovation courses for firms, entrepreneurship training, mobility grants, etc.

Capital: public funding and financing instruments

Public funding and financing instruments are specific mechanisms to allocate public budgets to performers (Lepori, 2017). The variety of such public instruments is considerable (Heinze, 2008) and they can be classified according to (based on (Empirica et al., 2013; Lepori, 2017; OECD, 2015):

- Their purpose / thematic
 - Education and capabilities, basic research, applied research, innovation...
 - Other policies and priorities such as grand societal challenges, economic innovation, etc.
 - Cooperation between performers (academic – private, quadruple helix, etc.)
 - Etc.
- Whom they benefit
 - Individuals (researchers, entrepreneurs, ...)
 - Organisations (public, private, public-private; large companies, SMEs, NGOs, etc.)
 - Mixed groups (intra or inter organisation consortia)
- Their content
 - Positive (meaning it is directly received by the beneficiary)
 - Money or capital
 - Guarantees for R&D&I loans
 - Etc.
 - Negative (meaning that the instrument will diminish due expenses)
- The transaction's nature
 - Whether it is a funding (funds are contracted or transferred without compensation) or a financing instrument (funds are transferred against compensation – dividend, etc.).

Grants: institutional and project-based instruments, the two main grants for R&I

- **Institutional funding** is funding attributed to public R&D&I performing organisations for their running activities and, usually, for an unlimited period (the yearly amount might vary). Institutional funding is usually not earmarked to specific activities and to organisational subunits: the internal allocation is left to the performing parent organisation. Institutional funding can be performance-based or not, and there exist different bases for calculating the amount that will be transferred. The transfer can be lump-sum or according to a budget-line, depending on the level of autonomy granted to the organisation ((Jongbloed & Vossensteyn, 2001) in (Reale, 2017)).
- **Project funding** is defined as money attributed to a group or an individual to perform a research activity limited in scope, budget and time. It can be identified and distinguished from institutional funding based on three main characteristics: i) funds are attributed directly to groups and not to a whole organisation, ii) they have a limited activity scope and duration and iii) they are attributed by a research funding organisation outside the performing organisation to which the beneficiary belongs (Reale, 2017).

Demand-side measures

- **Systemic policies:** Some policies have a more systemic focus, to improve the functioning of existing and new markets, such as cluster and supply chain policies.
- **Regulation:** are developed to set standards and innovation targets, to create technology platforms coordinating key technologies development, among others.
- **Support of private demand:** Some instruments aim to support the private demand of R&D&I outputs, such as demand subsidies and tax incentives.

Integrated measures, concerning both the supply and demand sides

- **Public-private partnerships:** Public-private partnerships can be created to coordinate the supply and demand sides in a particular domain. Examples include: the European Technology Platforms and the European Innovation Partnerships, among others.
- **Public procurement:** Public procurement instruments serve to support R&D&I providers, by opening a sale channel towards demanding public organisations.

3.1.2.3.3 External structure

The external structure refers to the structure of non-R&I sectors that **influence the R&I system**. Such structural influences include markets, commercial strategies of big players, infrastructures' quality, standards.

3.1.2.4 **Actors**

3.1.2.4.1 Public and public-private actors

Political actors

Public political actors, those who have an influence on the existing policy, include **European institutions and national institutions**.

Policy and governance actors

At European level, these actors are the **European Commission** and the related organisations that it has created to enforce the European R&I policy (ERA, ERC, Structural funds, etc.).

At national level, **ministerial bodies and affiliates** are in charge of developing the R&I and related policies, while **specific institutions** have been created to support the implementation of policies, monitor and regulate R&I activities.

Structural supply organisations – those organisations that are public or semi-public and are the vital players of the policy

National funding and financing organisations

Research Funding Organisations (RFO) are organisational entities which **distribute public funding** for R&D on behalf of the State (Lepori, 2017). They cover both independent agencies such as research councils, and ministries and offices. Most of the time RFOs allocate project funding but in certain cases, they can also allocate institutional funding (Lepori, 2017).

Other organisations distribute different funds and financing (awards, prizes, negative funding in form of tax reductions, guarantees, public venture capital etc.), and are **more oriented towards innovation**.

National Umbrella Public Research Organisations (UPROs)

UPROs are national-level organisations which mission is to **organise research activities in a specific field** of national research policy (Lepori, 2017). They usually have a dual function: hosting and managing research laboratories distributed over the national area (managing laboratories and researchers' careers) on the one hand, and to provide project-funding on the other (Lepori, 2017).

National Higher Education Institutions (HEIs)

HEIs are organisations whose main mission is to **offer education** at the tertiary level as well as to **perform R&D activities** (Lepori, 2017). They are generally funded through a core institutional allocation (Lepori, 2017).

National Public Research Organisations (PROs)

PROs are public-sector organisations, which **perform R&D activities** as their core mission. There exist different types of PROs (Sanz-Menendez et al., 2011):

- **Mission-Oriented Centres (MOCs)** are owned and sometimes run by government departments or ministries at the national and sub-national levels; they undertake research in specific topics or sectors to provide knowledge and technological capabilities to support policy-making.
 - Example: CIEMAT (Investigation Centre for Energy, Environment and Technology) in Spain
- **Public Research Centres and councils (PRCs)** perform and sometimes fund basic and applied research in several fields; they tend to be of considerable size in certain countries
 - Example: CNRS (National Centre for Scientific Research) in France
- **Research Technology Organisations (RTOs)**, or industrial research institutes, are dedicated to the development and transfer of science and technology to the private sector and society; although some of them are owned by government, usually their links with the government tend to be looser than the rest. They operate in the semi-public sphere and in the non-profit sector.
 - Example: Tecnalia in Spain
- **Independent Research Institutes (IRIs)** perform both basic and applied research focused on 'issues' or 'problems' rather than just fields. Most IRIs may be termed as 'semi-public' as they are founded under different legal forms and work at the boundaries between public and private but develop their activities with substantial public support and/or participation of public representatives in their governance.
 - CNIO (National Cancer Research Centre) in Spain

Supranational and international funding / financing organisations

Other organisations, at EU level, or joint between MSs, can provide funding to national or international organisations (to project consortia, or even RFOs). Example include the [European Research Council](#) and [Interreg](#).

R&I Performers

Those who really produce R&I are **R&I units and groups**. They either belong entirely to one HEI, UPRO, PRO, or are joint units between the latter. The units that belong only to one organisation are not autonomous and, in most cases, are funded through a combination of institutional resources from their parent organisations and from external third-party funds (Lepori, 2017) (project-funding in most cases). Joint units are usually autonomous and funded by government allocations.

Innovation and technology-oriented organisations

Specific public organisations are created to **support innovation and technology developments** such as techno parks, technology transfer and innovation centres, incubators.

Demand

Public demand can be **policy-oriented or public-service oriented**. In case it is policy-oriented, it includes all ministerial and other institutional units which command R&I activities to **orientate their policy-making** according to their outputs. In case it is public service-oriented, it includes the public bodies such as cities that directly deliver public services. They command R&I activities and buy innovative outputs to **improve their delivery**.

3.1.2.4.2 Private actors

Political actors

Apart from lobbies, mostly from performers organisations (network of national and international HEIs, high-tech and large companies, etc.), **R&I is little discussed** by private political actors such as political parties and by citizens in the public debate. To be noted, new organisations promote new kinds of Science and R&I (this includes RRI and citizen-science oriented organisations).

Funders and financiers

- Philanthropic organisations
- Companies, which can fund public R&I by commanding R&I activities, and their own R&D&I departments
- Banks, both mainstream and ethical banks, business angels and investors
- Crowdfunding and crowdsourcing platforms

Performers

- For profit organisations
 - Large companies with R&D&I departments
 - Innovation driven joint ventures
 - Start-ups
 - Certain for-profit fablabs
 - Etc.
- Not for profit and NGOs organisations, including fablabs, science shops, makerspaces
- Communities and individuals that innovate for solving a problem they directly encounter, or that participate in citizen science projects.

Support organisations

As for the public section, there exist private organisations for supporting innovation: techno parks, incubators, accelerators, science shops, mentoring organisations etc., but there exist also different organisations which aim at supporting the side activities of R&I such as: publishers, altmetrics providers, conference organisers, etc.

Demand

R&I activities benefit society as a whole (citizens, companies, public organisations, etc.). However, certain categories are more in need such as patients or certain communities.

3.1.2.5 **Functional organisation**

We present here some further insights on specific activities in the R&I system and by whom they are carried out/initiated. While these activities occur both at national and European levels, we here present the national ones, for they are the most common. The European activities follow more or less the same scheme.

3.1.2.5.1 Political game

The political game is hardly democratic. R&I and education policies are not the main subject of any political campaign. The political game takes place at the European and ministerial levels, between the government in power (both EU and national government) and lobbies.

3.1.2.5.2 Policy – making

Policy-making include two types of activities: policy-making at such, which is the resort of ministries and affiliates, and preparation of policy-making. These latter activities are carried out by governmental organisations or dedicated R&I performers such as MOCs or IRIs.

3.1.2.5.3 Appointment of missions

R&I policy is translated into missions, mandated to the various structural organisations: RFOs and innovation funding organisations, HEIs, PROs, UPROs, knowledge transfer and innovation centres, platforms, etc. This is the resort of ministerial and affiliates bodies.

3.1.2.5.4 Allocation of public and financing budgets

Specific funding lines inside the whole public budgets (national or regional) are intended to be spent for R&I and related purposes. The Government Budget Allocations for R&D (GBARD) accounts for all public money spent for R&D (Lepori, 2017). These budget lines are then allocated to the various R&I organisations. We present here the allocation of institutional and project-funding, for there are the most important and common ways to allocate public funds.

Allocation of institutional funding

Institutional funding is allocated by the government or supra- and international agencies to UPROs, HEIs, PROs, and joint units, and by UPROs, HEIs, PROs to their internal units.

Allocation of institutional funding can be **performance-based, or not**. Recently, there has been a clear trend towards inserting performance or quality-based funding, to **enhance the accountability of organisations, provide incentives for improving research performance, and to concentrate resources** in the best performing organisations in order to increase the probability of a return on investment (Jonkers & Zacharewicz, 2016; Reale, 2017). A Performance – Based Research Funding (PBRF) system usually implies to assess research on an ex-post basis, to evaluate the outputs and/or impacts of research, and to base the allocation of funds on the outcome of the assessment (Jonkers & Zacharewicz, 2016).

The usual criteria for allocating institutional funding in a non-performance-based way are:

- **Education metrics**
 - Inputs: number of students enrolled, personnel's costs, ...
 - Outputs: number of BSCs, MCSs graduates, PhD awarded, ...
- **Historic indicators:** allocation is partially or fully based on the allocation distributed in the preceding years
- **Budget negotiations**

Common performance-based criteria include:

- **Bibliometric:** counts of publications, impact factor, citation analysis, ...
- **Performance indicators:** academic quality, topicality to national R&D policy, ...
- **Other formula elements:** number of patents, number of international research projects, external funding, diversity measures (gender, internationalisation), ...

Allocation of project funding

Project-funding is allocated by UPROs, RFOs and innovation funding organisations and **has increased substantially** in a number of countries in the past decade (Reale, 2017). The allocation is usually based on a **competitive process**, among several applications submitted in response to calls for tenders issued by the funding organisation (Reale, 2017). For selecting the 'best' applications, several types of peer-review process exist (Reale, 2017). Project funding can also be contract- based, with specific objectives and milestones (Reale, 2017). In project-funding, the evaluation is therefore ex-ante, and the criteria can be:

- Performance indicator (academic quality, efficiency of the implementation, ...)
- Topicality to calls
- Potential for economic innovation and public/private cooperation
- Who the applicants are (HEIs, Government, NGOs, etc.)

3.1.2.5.5 Elaboration of project-funding programmes by funding organisations

RPOs and innovation funding organisations receive a certain budget from the government, which they allocate as project-funding to R&I performers. However, they do not allocate the funding randomly, but on the basis of funding programmes designed according to their attributed missions.

3.1.2.5.6 Management of structural organisations

The head units of UPROs, HEIs, and RFOs, and innovation funding organisations have to ensure that they carry out the **missions that they have been attributed**. Especially, UPROs have the capacity to supervise a whole R&I field. With regards to **PROs, their autonomy is usually more important**, so they can select their role in a certain extent. The two dimensions that affect the capacity of PROs to select and perform their roles are (Sanz-Menendez et al., 2011):

- Their autonomy against the political system in place, based on their power in the negotiation processes with regards to their budget, employment and structure.
- Their internal distribution of authority: in systems where such distribution is decentralised and researchers very autonomous, PROs may find it harder to develop strategic approaches towards role selection.

3.1.2.5.7 Policy-based evaluation of the R&I system

To ensure that the R&I system will deliver according to the R&I and related policies, it is regularly evaluated, at different levels.

Evaluation of the R&I system as a whole

Several organisations monitor the R&I systems: countries themselves, the EU, Eurostat, the OECD, etc. The main indicators are:

- R&D&I budgets and expenses: private, public; to the private, to the public sectors; within the national territory, externally; at country level, at regional level, etc.
- Workforce: by sector, by gender, by educational degree, by ages, by type of organisation, career's evolution, mobility paths, etc.
- IP: numbers of patents, trademarks, etc.
- Bibliometrics and citation metrics
- Infrastructure's quality
- Investments
- Cooperation
- Employment
- Market value generated

Evaluation of performing organisations

Performing organisations are usually evaluated through **case studies, bibliometrics, peer review, patents analysis, user surveys, and cost-benefit analysis** by specifically mandated organisation (national or international, independent, etc.).

Evaluation and valorisation of researchers and units

Researchers, academics and R&I units are evaluated by their parent organisation, as most usual employees are. However, in the public sector, evaluation is intrinsically linked with **peer esteem**, as shown below.

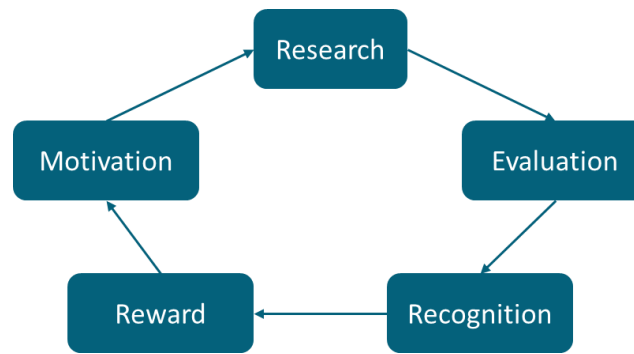


Figure 1: Research reward cycle (O’Carroll et al., 2017)

If the evaluation is successful, then one gets recognised and can receive a reward, which can increase his/her motivation to continue his/her R&I activities. Researchers and academics can be evaluated thanks to ‘business as usual’ criteria and [altmetrics](#). The ‘business as usual’ criteria are as follows:

- Research quality:
 - Academic record
 - Amount of publications
 - Amount of citations
 - Quality of the publications used as publishing channels for the research
 - Research relevance
 - Valorisation (patents, economic fallout, ...)
 - Etc.
- Network and peer esteem:
 - Invitations to give lectures at conferences and publications in proceedings
 - Participation in doctoral committees
 - Reviews for scientific journals
 - Prize, awards
 - Etc.

Several tools and indicators support the evaluation process. The [journal impact factor](#) is used to evaluate academic journals. Publications in high-impact factor journals are then better noted. The [h-index](#) is used to measure the publishing activity (number of articles published) of researchers and their scientific influence (number of citations). Many publishers have an [online platform](#) that allow evaluators to determine how often a researcher has been cited, such as [Web of Science](#), [Scopus](#), [Google Scholar](#), [the Publish or Perish application](#).

When evaluating a [research team/group](#), the criteria are roughly the same, but indicators are not directly available from online databases.

Altmetrics are alternative metrics that complement ‘business as usual’ metrics and are based on recent [digital technologies](#). They are meant to emphasise the informal dissemination of research outputs (articles, papers, etc.) through online platforms such as Twitter, Facebook, blogs, Wikipedia, and specific science-based platforms such as [Mendeley](#), [ResearchGate](#), [Academia.edu](#) etc. (Vuorikari et al., 2015). These new altmetrics platforms can be seen as [emerging reputational mechanisms](#) (Vuorikari et al., 2015). A report on altmetrics platforms indicate that their large majority of services serve traditional research activities, and that activities such as teaching attract little notice (Vuorikari et al., 2015).

It is to be noted that the purpose of the [evaluation is not the same depending on the parent organisation](#). For example, intra-organisational evaluations in PRCs and IRIs would relate to the research outcomes of individual researchers. Outcomes such as publication impact and success in competitive block funding would inform the decision related to the allocation of rewards. [In the contrary, MOCs would have different](#)

evaluations, where the evaluation variables and resulting managerial decisions may be more ‘political’ than ‘scientific’ (Sanz-Menendez et al., 2011).

Based on formal evaluation and altmetrics, a researcher can receive the **following rewards**:

- Appointment or extension of a contract
- Funding for further research
- Travel or post-doctoral fellowship
- Prizes and awards (the most known being the Nobel Prize)
- Etc.

Advancing one’s career

To advance one’s career, a researcher must perform well according to the evaluation criteria, must access the most renowned HEIs, UPROs, or PROs, and must publish in journals of a high impact factor. Ultimately, given the nature of the evaluation system, a good researcher is a researcher that publishes a lot, according to the famous ‘**Publish or Perish**’ quote. This means that the **researchers must conform to the political criteria of what good or bad research and innovation is**. As seen in section 3.1.2.3.1 Mindsets, these criteria depend predominantly on the past successes of natural sciences and expectations towards technological progress and economic growth.

3.1.2.5.8 Informal evaluation of HEIs

Informal evaluations of HEIs exist, which aim at informing the wider audience on which HEIs perform better. One of the three most known informal evaluations of HEIs is the **QS World University Rankings²** (the other being the Times and the Shanghai rankings). It is an annual, worldwide, ranking of universities. It ranks universities according to six metrics:

- Academic reputation for 40% of the grade
- Faculty/student ratio for 20% (to assess the number of teachers, lecturers, tutors, etc. per student)
- Citations per faculty for 20%
- Employer reputation for 10% (reputation of the university according to their students’ employers)
- International faculty ratio for 5% (percentage of international employees, researchers, etc.)
- International student ratio for 5% (percentage of international students)

3.1.2.5.9 Core activities

In order to get further insights on the R&I system, rather than just looking at the traditional public system which consists mainly of public organisations and large companies, we mapped more than 140 R&I organisations to see what types of activities they undertake. This list of organisations is presented in Annex 6. From this mapping we have distinguished the following activities:

- **R&I in the strict sense of the term**
- **Academic activities**
- **Supporting academic activities**
 - Many markets and organisations have developed at the side of academic activities such as publishers; altmetrics and big data providers; patents, markets and technology watch providers; support software providers (Zotero, Mendeley), etc.
- **Financing and funding**
 - As already seen, funds and finance are the sinews of R&D&I. So, many organisations and platforms have developed accordingly. New organisations such as ethical banking and investment, crowdfunding and crowdfunding have emerged specifically for the R&I sector.
- **Empowering**

² <https://www.topuniversities.com/qs-world-university-rankings/methodology>

- Especially for innovation in the field of the social and circular economies, and for citizenship-related R&I activities, many organisations have emerged to ignite, inspire, incubate, accelerate and empower new initiatives, and motivated individuals and groups.
- **Labelling**
 - Certain organisations have developed a label to distinguish certain types of innovation, R&I projects or organisations. For example, it is the case in France with the development of a label for innovative and green projects that have been crowdfunded.
- **Sharing information and thoughts**
- **Influencing**
 - As in any sector, lobbies and advocacy represent vested interests, some mainstream and some other alternatives.
- **Collaborative approaches**
 - While all the activities presented above are often carried out by single individuals and organisations, collaborative approaches have started to develop such as co-production of knowledge, co-innovation, etc. Accordingly, organisations have developed to foster these kinds of collaborative approaches and coordinate the collaborating organisations.

3.1.2.5.10 Validation of research results

A research project produces outputs, which normally have first to be **reviewed by peers** before being validated and joining the existing corpus of knowledge. This process starts when the results are proposed to a publisher. Most publishers have peer-reviewers, but certain just publish what they receive, on the basis of simple reading or automated review.

3.1.2.5.11 Valorisation of outputs

Outputs of R&I activities can be valorised in different ways:

- In academic conferences, papers, books and in new R&I projects, even in opening new R&I fields
- If produced by academic or public research units, they can be transferred to commercial organisations
- Providing evidence for policy – making
- Commercial exploitation
- Direct implementation without commercial exploitation

Commercial valorisation of public results requires **HEIs and PROs to interact with commercial organisations**. These interactions are fostered by current policies and the greater emphasis on patents and technological innovation in PROs' evaluations, rather than being initiated by PROs themselves (Sanz-Menendez et al., 2011). As a result the number of patents filed and licensed by PROs and the number of spin-off companies in which their research findings are commercialised have grown (European Commission, 2009) in (Sanz-Menendez et al., 2011). One-one relationship can establish between HEIs, PROs and commercial organisations, but also multiple relationships, with the establishment of **hybrid organisations** in which more than one type of organisation participate. Some PRCs have a long history in the set-up of hybrid (sub-) organisations with HEIs. PRCs, MOCs, and RTOs have also engaged in establishing hybrid organisations in which the R&D laboratories of private firms take part (Sanz-Menendez et al., 2011).

3.2 Overview of the EU R&I policy

In this section we present the main developments of the European policy on Research and Innovation since 2010 in order to understand and characterise the current state of the European R&I system.

3.2.1 Europe 2020 and the Innovation Union

Europe 2020 or ‘**Europe 2020**, a European strategy for smart, sustainable and inclusive growth’ (European Commission, 2010a), adopted in 2010, is the EU’s strategy for growth and jobs for the decade 2010 – 2020. The reason why we include it here, is that one of its flagship initiatives was the creation of the **Innovation Union**, which has several consequences for the European R&I system.

The Innovation Union

The Innovation Union is the EU strategy to **re-focus R&D&I policy on the challenges**³ facing the European society, such as climate change, energy and resource efficiency, health and demographic change (European Commission, 2010a).

In the same time, it aims to create an innovation-friendly environment that makes it easier for **great ideas to be turned into products and services** (European Commission, n.d.-x).

The Innovation Union includes over 30 action points coinciding towards 3 main objectives (European Commission, n.d.-c):

- Making Europe into a **world-class science performer**
- **Removing obstacles to innovation** – like expensive patenting, market fragmentation, slow standard-setting and skills shortages – which currently prevent ideas getting quickly to market
- **Revolutionising the way public and private sectors work together**, notably through Innovation Partnerships between the European institutions, national and regional authorities and business

3.2.2 EU’s view on Responsible Research and Innovation (RRI)

On the website of the EC (European Commission, 2016b), dedicated to Swafs it is indicated that the EC understands RRI as an approach to R&I in **which all societal actors** (researchers, citizens, policy makers, businesses, civil society organisations, etc.) work **together** during the whole R&I process, with the aim to **better align research and innovation outcomes with societal values, needs and aspirations**. A document of the EC about RRI indicates that RRI is a way to find the right answers to the grand societal challenges since the only way to face them is by involving as many stakeholders as possible in the R&I process (European Commission, 2012), to co-construct innovative solutions, products and services. A framework for RRI has been developed, which consists of 6 keys (European Commission, 2012):

- Engagement of all societal actors
- Gender equality
- Science education
- Open access
- Ethics
- Governance

³ In H2020, and in many other documents, these challenges are called ‘the grand societal challenges’

3.2.3 EU strategy for R&I since 2015

Open innovation, open science and open to the world are the 3 main policy goals for EU R&I set by Commissioner Moedas in 2015 (European Commission, n.d.-r) which still drives the EU's R&I strategy.

A book, entitled "Open innovation, open science, open to the world – a Vision for Europe" (European Commission, 2016a) explains in detail the thinking behind these policy goals and how they will be achieved (European Commission, n.d.-r).

3.2.4 Towards an Innovation Principle Endorsed by Better Regulation

The EC has an in-house think tank, the European Political Strategy Centre (EPSC)⁴, which has written an insightful document about the role of Innovation in the EU, entitled 'Towards an Innovation Principle Endorsed by Better Regulation' (European Political Strategy Centre, 2016). We present here its main insights.

An innovation principle

This document sees **innovation** as an essential element of the internal market, a **precondition of 'sustainable and job-creating growth'** because innovation is seen as leading to higher productivity and competitiveness while yielding social and environmental benefits. It recalls that Art. 3 (3) of the Treaty on European Union (TEU) **does not permit**, when innovating, **to focus one-sidedly on economic benefits and higher growth**.

With regards to the role of MSs and the EC, this document implies that legal and regulatory requirements must aim at optimising outcomes in all policy fields and have to demand a high level of environmental, health and consumer protection, in accordance with Art. 114 (2) of the TFEU. The EU and the MSs must also ensure that the **conditions necessary for the competitiveness of the Community's enterprises exist**.

After showing that innovation is a core principle of the EU, and that, public bodies (MSs and EC) must ensure that it leads to sustainable and job-creating growth, the document further argues that it is possible to deduct an innovation principle from key EU legal texts:

'the guarantees embodied in the EU charter of Fundamental Rights are important for deducing an implicit innovation principle' (European Political Strategy Centre, 2016).

An innovation principle means ensuring that, **whenever a policy is developed, the impact on innovation is fully assessed**. The principle provides guidance to ensure that the choice, design and regulatory tools foster innovation, rather than hamper it (European Political Strategy Centre, 2016).

Another facet of this innovation principle, is the **fundamental right to innovate**. This right implies certain limits on the regulatory capacity of MSs, as shown below:

'Under the rule of law (Art. 2 TEU) fundamental rights [to innovate] imply a duty to respect freedom for state authorities. In their subjective dimension they serve as a benchmark for the assessment of all public action interfering with individual freedom.

'Any action taken by state authorities is considered as an intervention in individual freedom and, as such, faces the pressure of legitimization. If state authorities want to interfere in the scope of protection of a fundamental right, they are obliged to legitimise their action. The burden of proof lies with public

⁴ European Political Strategy Centre: https://ec.europa.eu/epsc/about_en

authorities wishing to regulate. They must prove their ‘better right’ to regulate’ (European Political Strategy Centre, 2016).

However, there are other principles stated by the European treaties, that have to be balanced with the Innovation principle, such as the integration principle, and the precautionary principle, among others.

In the end, the EPSC implies that, to respect all these principles, it is important to find the right regulatory mix, which explains the EC’s ‘better regulation’ agenda. For that, regulation should find the right balance between information, flexibility, and stringency, and should distinguish between general regulation, innovation-specific rules and sector-specific regulation (European Political Strategy Centre, 2016).

3.2.5 Framework Programme n#9: likely possibilities

The next framework programme to succeed to H2020 is Framework Programme n#9 (FP9). One of its likely key features is to be designed around **Missions**, such as the ‘Man to the moon’ (Apollo) mission, to solve the grand societal challenges. Carlos Moedas has invited Mariana Mazzucato to provide her recommendations on the design of these missions. She elaborated on the topic in her publication ‘*Mission-oriented R&I in the European Union, a problem-solving approach to fuel innovation-led growth*’ (Mazzucato, 2018). We provide below her main messages.

Rationale for missions:

Although the H2020 programme introduced seven Societal Challenges and cross-cutting Focus Areas such as the circular economy, its **broad societal impact remains limited**. It may be the consequence of the erroneous definition of the programme’s objectives. According to her, Societal Challenges and Focus Areas, such as the SDGs, on the one hand, are useful to focus, but remain too broad to be actionable. On the other, most of R&I projects that deal with very concrete problematic achieve only isolated impacts. In FP9, Missions should be designed to make the most of a collaboration between fundamental and applied research and should be based upon the consideration that **grand societal challenges cannot be solved by scientific and technological solutions only**.

Framing missions:

Definition:

Missions should allow problems to be framed and reflected upon by a combination of **different understandings**. Their objective is to activate innovation across sectors and disciplines to develop **systemic solutions** to solve these problems.

Mission design:

Missions are imagined as a portfolio of research and innovation projects and supportive measures. Contrary to the H2020 logic, which focused on sectors or technologies, **the starting point of FP9 Missions should be the grand societal challenges themselves**.

The selection of the Missions’ topics should be the result of a participatory process and should be based on five criteria:

- **Bold, inspirational with wide societal relevance**
- A clear direction: **targeted, measurable and time-bound**
- **Ambitious but realistic**
- **Cross-disciplinary, cross-sectoral and cross-actor innovation**
- **Multiple, bottom-up solutions**

Flexibility is to be a watchword of FP9 to create impact with utmost societal relevance. Even if Missions set clear and ambitious objectives, it impossible to define one canvas on ‘what a mission should be and how it

should be structured'. Missions set only a direction for potential solutions and do not specify how to solve a challenge. On the contrary, **the Missions' approach is to stimulate the development of a range of different solutions through multiple forms of cross-actor collaborations**. Research projects under FP9 should gather all the interested stakeholders, from fundamental research to applied research and cutting-edge innovations to develop different type of solutions and achieve measurable success. **Bottom up and 'outside of the box' solutions should be encouraged through incentives**.

The missions should also focus on supporting R&I developments that otherwise would not be undertaken by private actors, providing the justification and legitimacy for public intervention. Overall, the Missions' approach is the opportunity to review the role of the public sector by **escaping the narrow market failure framework and shifting towards a more active market 'co-creation' framework**.

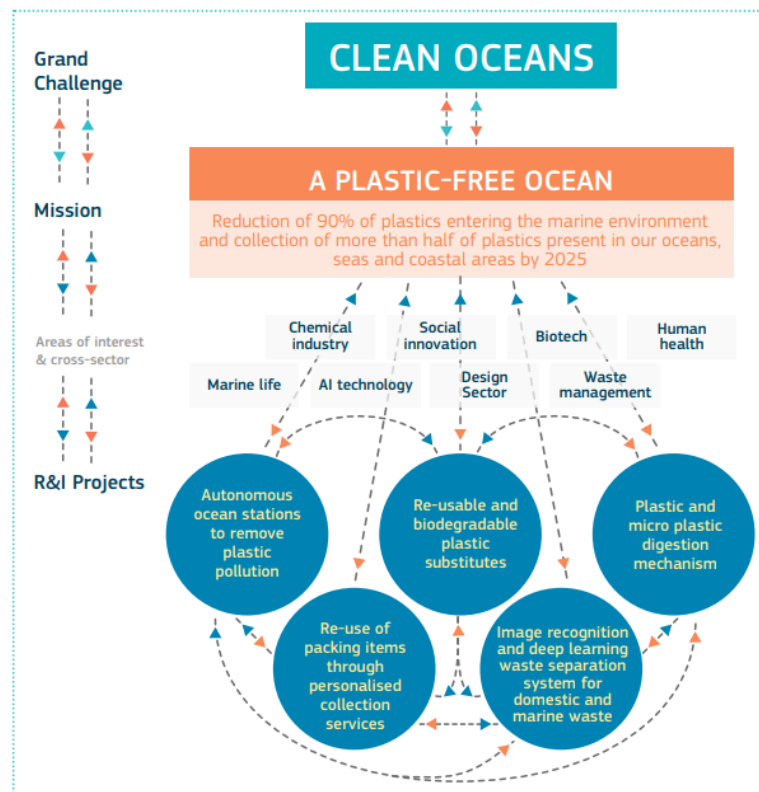


Figure 2: Example of the proposed Mission 'A plastic-free ocean' (Mazzucato, 2018)

Implementation:

Missions should be understood as an innovative frame that requires:

- **Engagement of diverse national and regional stakeholders**
- Definition of goals and milestones to **measure the success** of Missions
- **A portfolio of instruments to foster bottom-up solutions**
- **Flexibility, pro-active management and building in-house capabilities**
- **Public engagement**

3.3 Functional organisation and policy instruments of the EU level

This section deals with the organisation of the EU governance system and with EU's policy instruments for R&I.

3.3.1 Organisation

The European Commission is organised into policy departments, known as Directorate – Generals (DG), which develop, implement and manage EU policy, law, and funding programmes. Services Departments (SD) deal with administrative issues while Executive Agencies (EA) manage programmes set up by the Commission.

For R&I, the relevant EU's organisations are the following:

- **Directorate – Generals:**
 - Research and Innovation (RTD)
 - Joint-Research Centre (JRC), which is the Commission's science and knowledge service. The JRC employs scientists to carry out research to provide independent scientific advice and support to EU policy
- **Executive agencies:**
 - European Research Council (ERC)
 - Research Executive Agency (REA)
- **Service departments:**
 - European Political Strategy Centre (EPSC)
- **Expert groups**

3.3.2 Other relevant R&I organisations and groups

Smart Specialisation Platform (European Commission, n.d.-s)

The smart specialisation platform proposes advice to MSs and regions for the design and implementation of their **Smart Specialisation Strategy**. This strategy aims to boost growth and jobs in Europe, by enabling each region to identify and develop its own competitive advantages (European Commission, n.d.-aa).

European Institute of Innovation & Technology (EIT)

The EIT is an independent body of the European Union to spur innovation and entrepreneurship across Europe. It brings together leading higher education institutions, research labs and companies to form dynamic cross-border partnerships – **Knowledge and Innovation Communities (KIC)** - that develop innovative products and services, start new companies, and train a new generation of entrepreneurs.

European Technology Platforms (ETPs)

ETPs are independent industry-led stakeholder recognised by the European Commission as **key actors in driving innovation, knowledge transfer and European competitiveness** (European Commission, n.d.-n).

European Innovation Council (EIC) and the high-level group of innovators

The EIC pilot aims to **support top-class innovators, entrepreneurs, small companies, and researchers with bright ideas and the ambition to scale-up internationally**. It focuses on funding and opportunities for innovators, start-ups and companies with ideas and innovations which are radically different from existing products, services, or business model, and are highly risky (European Commission, n.d.-a).

The high-level group of innovators supports the EC in developing the EIC.

Start-up Europe

Startup Europe is an initiative of the European Commission designed **to connect startups, investors, accelerators, entrepreneurs, corporate networks, universities and the media** through an array of networks. Furthermore, it intends to connect local startup ecosystems around Europe and enhance their capacity to invest in other markets such as Silicon Valley or India.

3.3.3 EU's policy instruments

EU's instruments for R&I are numerous. We provide here an overview of the main ones.

Funding and financing instruments

The EU has several different funding programmes, split in two types: **direct and indirect funding** (European Commission, n.d.-g). Direct funding comprises of grants, other financing instruments and contracts, while indirect funding is managed by national and regional authorities and comprises nearly 80% of the EU budget, mainly through five big funds that come under the umbrella of the European Structural and Investment Funds (ESIF) (European Commission, n.d.-g).

Some of the direct funds are:

- **Horizon 2020**, the main EU's funds for R&I (European Commission, n.d.-q)
 - *RRI activities* are funded (462,2M€) in the Swafs' calls of Horizon 2020 (European Commission, n.d.-b)
- **LIFE programme**, the EU's funding instrument for environment and climate action, which proposes grants for projects, NGOs, and financial instruments (European Commission, n.d.-q)
- **Research fund for Coal and Steel** (European Commission, n.d.-q)
- Fellowships and individual research grants (European Commission, n.d.-o)
- **ERC Proof of Concept** (ERC, 2017) : made available only to those who already have an ERC award to establish proof of concept of an idea that was generated in the course of their ERC-funded projects.
- **InnovFIN schemes** (eib, n.d.), financing tools and advisory services offered by the European Investment Bank Group.
- **EU programme for the Competitiveness of Enterprises and SMEs (COSME)** supports access to finance and markets for small and medium businesses (European Commission, n.d.-e)
- **EIC funding for innovators** (European Commission, n.d.-a) - €2.7 billion in funding for the period 2018-2020 via the following funds and services:
- **Innovation procurement support** (European Assistance for Innovation Procurement⁵): Pre-Commercial Procurement (PCP) and Public Procurement of Innovation solutions (PPI) are underutilised in Europe (European Commission, n.d.-w). In order to increase the use of innovation procurement in Europe, the EC is taking several actions: a better policy framework, and EU co-financing.
- **Prizes and contests** (European Commission, n.d.-p)
 - *Horizon prizes*
 - *The European Capital of Innovation Award*
 - *EU Prize for Women Innovators*
 - *EIC Horizon Prizes*

Support services for innovators:

- **European innovation partnerships:** they bring together all relevant actors at EU, national and regional levels to set-up research and development efforts, coordinate investments in demonstration and pilots, anticipate and fast-track any necessary regulation and standards, and mobilise the demand side (European Commission, n.d.-j).

⁵ <http://eafip.eu/>

- **Knowledge and innovation communities** (eit, n.d.): partnerships between businesses, research centres and universities that develop new services, and can start new companies
- **The Seal of Excellence** (European Commission, n.d.-p) is a quality label awarded to projects submitted to H2020 which were deemed to deserve funding but did not receive it due to budget limits. It recognizes the value of the proposal and supports the search for alternative funding.
- **Enterprise Europe Network** (European Commission, n.d.-f) has 600 members including national chambers of commerce and development agencies. It helps businesses innovate and grow on an international scale.

The European Research Area – ERA

The ERA is the EU's programme to unify MSs' efforts on R&I, to create a unified area in which scientific knowledge, technology and researchers can circulate freely (ERA, n.d.-b). It operates around the following priorities:

- **More effective national research systems** (European Commission, n.d.-l): it is thought that national-level competition is crucial to deriving maximum value from public money invested in research.
- **Optimal transnational co-operation and competition** (European Commission, n.d.-m) to coherently achieve the scale of effort and impact needed to address grand challenges with the limited public research fund available.
- **An open labour market for researchers**
- **Gender equality and gender mainstreaming in research**
- **Optimal circulation, access to and transfer of scientific knowledge**
- **International cooperation**

Better regulation agenda

Innovation is the spearhead of the EU's strategy for growth. However, the regulatory environment may constitute **enabling factors or perceived or real regulatory bottlenecks** to innovation (European Commission & DG R&I, 2016). Furthermore, the importance of a high quality and cost-effective regulatory framework has been confirmed for fast growing firms as well as for the innovation behaviour of traditional firms (European Commission & DG R&I, 2016).

That is why the European Commission has proposed the 'Better regulation agenda' to create innovation-friendly regulatory frameworks in the EU. The agenda proposes to:

- Further improve the design of existing and future regulations about their impact on innovation
- Achieve an optimal balance between predictability of the regulatory environment and adaptability to technological and scientific progresses
- Ensure an overall approach to the assessment of the combined impacts of regulations that impact multi-technology and multi-domain innovations
- Check implementation issues that can affect outcomes, including at national, regional and local levels of administration

The 'Better regulation agenda' rests upon the **innovation principle** which means ensuring that whenever policy is developed, the impact on innovation is fully assessed (European Political Strategy Centre, 2016).

An instrument of the 'Better regulation agenda' is the **Innovation Deals**, which help innovators who face regulatory obstacles by setting up agreements with stakeholders and public authorities (European Commission, n.d.-v).

3.3.4 EU-based evaluation of R&I

Evaluation of national and regional R&I systems

Under the Europe 2020 strategy, the Innovation Union priority sets several tools for measuring and evaluating how the EU, and each MS, perform in terms of R&I. These tools are:

- **The self-assessment tool of national and regional R&I systems** (European Commission, 2010b) which shows what the features of well performing national and regional research and innovation systems are
- **The European Innovation Scoreboard** (European Commission, n.d.-k) provides a comparative analysis of innovation performance in MSs and other countries and regions. It assesses relative strengths and weaknesses of national innovation systems. In 2017, the criteria for the national scoreboard were (European Commission, 2017b):
 - *Framework conditions*
 - **Human resources:** New doctorate graduates, Population aged 25-34 with tertiary education, Lifelong learning
 - **Attractive research system:** International scientific co-publications, top 10% most cited publications, Foreign doctorate students
 - **Innovation-friendly environment:** Broadband penetration, opportunity-driven entrepreneurship
 - *Investments*
 - **Finance and support:** R&D expenditure in the public sector, venture capital expenditures
 - **Firm investments:** R&D expenditure in the business sector, non-R&D innovation expenditures, Enterprises providing training to develop or upgrade ICT skills of their personnel
 - *Innovation activities*
 - **Innovators:** SMEs with product or process innovations, SMEs with marketing or organisational innovations, SMEs innovating in-house
 - **Linkages:** Innovative SMEs collaborating with others, Public-private co-publications, Private co-funding of public R&D expenditures
 - **Intellectual assets:** PCT patent applications, Trademark applications, Design applications
 - *Impacts*
 - **Employment impacts:** employment in knowledge-intensive activities, employment fast-growing enterprises of innovative sectors
 - **Sales impacts:** Medium and high-tech product exports, knowledge-intensive service exports, sales of new-to-market and new-to-firm product innovations
- **Key indicators selected by the Research and Innovation Observatory – Horizon 2020 Policy Support Facility.** They cover the following four innovation dimensions (European Commission, n.d.-y):
 - *Inputs – Investments and Human Resources (HR):*
 - **HR in Science and Technology:** HR in science and technology by sub-groups, new doctoral graduates per thousand population aged 25-34, number of researchers (male, female) by sector (public and private), scientists and engineers as % of active population
 - **Investment – sectors of performance:** Business enterprise R&D expenditure by source of funds, private enterprise expenditure on R&D, public R&D expenditure as % of GDP, and other indicators...
 - **Investment – source of funding:** Business enterprise R&D expenditure financed by public funds, government budget appropriations or outlays for R&D, ...
 - *Framework conditions*
 - **Collaboration and knowledge flows:** international co-patenting, share of enterprises cooperation with academia, ...

- **Digital economy:** households having access to the internet
- **Education and skills:** new graduates from tertiary education, students in tertiary education by gender, ...
- **Entrepreneurship:** Innovative enterprises as % of total enterprises, venture capital investments, ...
- **Foreign Direct Investment and trade:** High-tech exports
- *Innovation outputs*
 - **Bibliometrics:** highly cited publications
 - **Innovation Output:** innovation output indicator, turnover from innovation
 - **Patents**
- *Impacts*
 - **Economic structure:** value added for knowledge-intensive services and high-tech and medium-high-tech industries as % of total value added, ...
 - **Employment:** Employment in knowledge intensive activities as % of total employment, gender breakdown of employment in knowledge intensive business industries, ...

3.3.5 H2020 funding programme: evaluation and selection procedure

R&I projects submitted to H2020 funding instruments are evaluated on three dimensions: **Excellence**, **Impact and Quality and efficiency of the implementation**, as follow (European Commission, n.d.-t):

- For the Excellence dimension:
 - Clarity and pertinence of the objectives
 - Soundness of the concept
 - Credibility of the proposed methodology
- For the Impact dimension:
 - The extent to which the outputs of the project would contribute to each of the expected impacts mentioned in the work programme
- For the Implementation dimension:
 - Quality and effectiveness of the work plan
 - Appropriateness of the management structures and procedures
 - Complementarity of the participants and extent to which the consortium as whole brings together the necessary expertise
 - Appropriateness of the allocation of tasks

A **threshold is set**, and proposals which mark is below are discarded. Above the threshold, only a certain number of proposals is selected, by order of mark, and according to the total funding available.

3.4 Framing the issue: analysing the performance of the current systems against co-RRI criteria

In this section we present the differences between the current systems, and an ideal co-RRI system. This serves as a basis for the recommendations of co-RRI solutions proposed in sections 4, 5 and 6.

3.4.1 Focus on political motivations

Crises and EU's losing momentum, innovation as the holy grail to regain the leader's role

For the European Commission, **Europe is economically lagging behind its major competitors**. There is a productivity gap compared to its main competitors which creates loss of investment interest and market shares in global trade (European Commission & DG R&I, 2016). The European market is judged too fragmented and not enough-innovation friendly (European Commission, n.d.-ad). There are also wide variations between MSs in terms of part of public funding and mechanisms and criteria for its allocation.

In this competitive process for market control, **innovation and productivity have become a prerequisite for winning the battle**:

- 'A growing body of evidence suggests a strong relationship between entrepreneurship, innovation, and economic growth' (Lerner, 2010) in (European Commission & DG R&I, 2016)
- 'Another factor is the ability to generate fast growing firms that bring innovation on a large scale to the market. The capacity of an economy to create jobs in fast growing firms in the most innovative sectors is the main source of GDP growth' (European Commission & DG R&I, 2016).
- 'Productivity is a key driver for competitiveness, investment and growth. The link between innovation and productivity is well established through the impact of R&D investment on productivity' (European Commission & DG R&I, 2016)

Accordingly, the European Union has based its R&I policy on regaining the economic battle. Its discourse is therefore that 'Innovation is essential for our well-being' (European Commission, n.d.-ac) and that 'R&I ideas should be turned into products and services that create jobs and prosperity, as well as help preserve the environment and meet the societal needs of Europe and the world' (European Commission & DG Research, 2013).

3.4.2 Misalignment with co-RRI and barriers

Motivations are not aligned with the co-RRI concept

The current political motivations (research prestige, economic competitiveness and growth) that frame the R&I system are not the ones that have elaborated the (co-) RRI concept. **As a consequence, the system does not behave as a co-RRI system** and is not solving the grand challenges as it should. The desire for predictable innovation reduces the chances for experimentation, as research financing depends on the expected outputs. This keeps the system from changing and encourage researchers to stay within the safe zone and adopt the approaches that are valued by the policy in place.

Inputs issues: lack of resources

Logically, **there is a lack of resources for co-RRI**, in terms of time, capabilities, infrastructures and political and managerial commitment. Thus, the time, knowledge, capacities of RRI researchers is hardly remunerated, compared to conventional activities.

Fixed mindsets prevent co-RRI uptake

As already said, mindsets are fixed by this political project and by the type of Science that produced the great progresses of the past, pre-modern, centuries. As a consequence, there is **lack of openness to see**

research and innovation activities as real learning processes and possibilities to get unexpected outcomes, and there is a lack of interest and distrust in taking a systemic and overarching perspective on systemic causes of grand challenges.

This is also visible in the ways R&I is defined, categorised and statistically evaluated: for instance, if reproducibility is paramount in natural sciences, it becomes less crucial in co-RRRI activities that are contextualised, and where **the focus is not on gaining definitive knowledge**, but on delivering an appropriate solution for solving a global challenge. In the Frascati manual, several activities are not counted as R&D such as feasibility studies, policy-related studies, whereas they can be **key prerequisites to co-RRRI**. So, they are not made visible as they could be. **R&I classifications are thematic, technology or sector based, whereas they could be focused on the solving of the grand societal challenges.**

R&I and related policies are not sufficiently coordinated

To follow the European policy, many countries are now introducing economic steering mechanisms and economic ways of organising, incentivising and structuring their R&I system. Consequently, oriented towards economic growth, **current policies lack a clear vision on how to transform research results into outcomes for the society** (Marcel & Szmatala, 2017). Instead, policies focus on delivering massive capabilities for market innovation through mega-budgets that lack manoeuvrability and **do not allocate sufficient budgets for transformative R&I and co-RRRI**. Furthermore, the allocated budgets do not match the needs of co-RRRI: co-RRRI takes time and this is not compatible with the current funding mechanisms (Marcel & Szmatala, 2017). In one transition experiment workshop (WP3), participants stated that **reflexivity**, albeit key to delivering relevant outputs, is an activity generally not funded (D3.3). This implies that either such activity does not happen, or researchers have to do it on their own resources.

Policies are mostly fragmented in separate domains and **lack a holistic perspective to address the root causes of the grand societal challenges**. Furthermore, the study of research system, or the 'science of science policy' is rare and rather weakly funded. A neutral reassessment of the course of the system is therefore lacking.

Locked by the external structure

The external structure, as well stuck in the logic of economic competitiveness, **reinforces the lock-in of the R&I system**. For instance, if an innovation deals with the public good, it has a very diffuse value according to the current valuation system, and so it is difficult to catch it. This prevents entrepreneurs and investors to dedicate their time and money to such innovation. Pushed by the necessity to innovate to keep their profitability, companies are less and less inclined to engage in basic research, reporting this investment effort to the public sector, itself constrained by limited budgets (Marcel & Szmatala, 2017).

Allocation of public and financing budgets favours business as usual R&I

Current political changes reduce the proportion of institutional funding in favour of more selective and competitive systems (Reale, 2017). This latter mode of funding, despite its aim of increasing the quality of R&I projects, is quite debated since it results in short-term, low-risk projects, far from long-term basic research (OECD, 2011). **Some studies show that certain types of needed research are difficult to fund with common project grants.**

According to Laudel and Gläser (2014), **the predominance and standardisation of project-based funding, appears to reduce the chances of unconventional projects across all disciplines**. On the contrary, funding programmes of the 'ERC-type' (featuring large and flexible budgets, long time horizons, and risk-tolerant selection processes) enable such research. However, while the ERC funding and other new funding schemes for exceptional research attempt to cover these requirements, they are unlikely to suffice (Laudel & Gläser, 2014).

For Heinze, short-term funding tends to encourage the exploitation mode which favours risk-averse research strategies and leads to proximate and often predictable outcomes, while high-impact research seems to be connected to the explorative mode conducted using long-term funding. He concludes his study on funding instruments for ground-breaking research by arguing that **external, peer-reviewed grant funding alone is insufficient if scientists are expected to conduct multidisciplinary research and thereby contribute to the advancement of science** (Heinze, 2008).

In addition, the system of performance-based institutional funding is preventing performers to undertake alternative research, **since their funding depends on whether they comply with what is expected from them**.

Management of organisations: not agile and too fragmented

Structural supply organisations are often top-down organisations, structured in an old-fashioned style, where **social engagement can be seen as an administrative burden**. Engagement with the wider society is an issue that rarely figures in discussions of university management or strategic positioning (Goddard, 2009). Many universities now have pro-vice chancellors with external engagement portfolios, but most have limited influence over the discipline-based financial silos (Goddard, 2009). As a consequence, there is an enormous distance between academia and society, which is many times reflected in the distance between technologies and societies (Marcel & Szmatala, 2017).

The private sector is also entangled by the silo's organisation. R&D departments do not collaborate with Innovation department nor with CSR departments (Marcel & Szmatala, 2017). This leads to unoptimized utilisation of internal resources and prevent deep innovation.

Current metrics cannot capture the added value of co-RRRI activities

Most researchers want their work to have an impact and contribute to the public good. But they rarely consider their influence on the outside world in the way that governments or university managers do. As already shown, these latter measure performance and impact based on the political objectives of research prestige and economic competitiveness, and rarely look at qualitative measures such as improvements in the way a public service is provided (Goddard, 2009). Therefore, the description, production and consumption of **metrics remain contested and open to misunderstandings across the research community** (Wilsdon, 2015). In 2013, the American Society for Cell Biology and several scientific journals launched the San Francisco Declaration on Research Assessment (DORA) intended to end the practice of using the impact factor of journals to assess individual researchers or research groups or even institutions. To date, close to 13,000 institutions and individuals worldwide have signed the DORA (O'Carroll et al., 2017).

Current metrics are too narrow, and indeed, favour excellence and economic outcomes over the resolution of grand societal challenges. As such they frame the behaviour of performing organisations and depreciate co-RRRI projects. For example, most HEIs are autonomous bodies which are free to increase their civic engagement, but most choose not to, because there is no direct reward for doing so since metrics will not take into account such action (Goddard, 2009).

Apart from the fact that they are not based on the objective of solving the grand societal challenges, current **economic and narrow metrics can create perverse incentives or can be gamed** (Wilsdon, 2015). For instance, the valorisation of publications is given too much weight which push researchers to publish as much as they can to not 'perish'. This has led to many fallacious practices, such as slicing results in several publications, falsification of data, and competitive behaviours.

Science Europe (2017) states that societal progress often results from the combination of research outcomes with other inputs (however, not all cultural, social, environmental and economic benefits rely on research) but that the value generated by research and its numerous applications is frequently unanticipated and unexpected. According to them, it is why the assessment of research impact is so

difficult and contestable (Science Europe, 2017). **They further imply that no impact assessment can ever fully capture the value of research.**

Valorisation of performers

In parallel to this formal evaluation of R&I activities, the esteem system is based on a certain idea of excellence, as already shown. As a study on open science demonstrates, common, albeit narrow, perception of scholarly reputation being all about research performance is still very much true (Vuorikari et al., 2015). **This implies that co-RRR activities, which are based on a different value basis, are not valued by peers and by the academic system, preventing researchers to orientate their career towards co-RRR activities.** In addition, external stakeholders, although key parties according to the co-RRR concept, are not compensated nor rewarded when they participate in a co-RRR project.

Informal evaluation of HEIs

Even though not elaborated by government, **informal ranking of HEIs are framed by the same mindsets**, and as such, do not allow one to choose a HEI according to its performance against co-RRR criteria.

Co-RRR activities are too rare

Consequences of such design of the R&I system, **time for R&I activities is now wasted by the necessity to write many proposals to get funded and to publish.** Thus, there is not time to build sufficient expertise in new fields, and to build societal support for innovations since such practice is not funded. As R&I activities should comply with the policy direction, **unconventional subjects are rarely explored.** For example, the model of economic growth itself is hardly ever considered as an object of innovation, and there is few meta research projects.

The economic valorisation of outputs limits their optimal use

Knowledge is being more and more considered as a commodity, which limits its diffusion and sharing, and ultimately, prevents further innovation. Such understanding of knowledge departs from its original purpose which is to be shared among all on an equal basis. Indeed, **now a lot of knowledge is monetised and accessible only to those who have sufficient resources.**

3.4.3 *Synthesis*

To conclude this section, we can take over Deliverable D1.1's analysis that the 'European R&I systems are organised and funded **in the service of a specific political project: maintenance and strengthening of Europe's economic competitive position in a globalising neoliberal market economy**' (Karner et al., 2016).

The preceding sections help base this statement. Indeed, as we have seen, **there are many R&I policy instruments** (better regulation agenda, innovation principle, start-up Europe, European Technology platforms, EIC, ...) **that are not oriented towards solving the grand societal challenges** but destined to entrepreneurs, companies and industrials, for supporting their market growth. **The innovation principle is not candid**, most of its instruments suggest that precedence is given to innovation over other considerations. Furthermore, it gives importance to a kind of innovation that is not the most necessary to solve grand societal challenges in a co-RRI way. Co-RRI asks to find new ways to organise society in the respect of planetary boundaries. These ways are more of a human nature (changing mindsets, organisations, structure, ...) and does not require an innovation principle as the current one, which is destined to supervise hazardous technologies, and market products and services, and distinguishes clearly the public from the private sphere. A co-RRI approach does not rely solely on markets and technologies and does not oppose the public and the private spheres: they work collaboratively.

The whole system is oriented towards productivity: as the indicators show it, what matters is the amount of PhD, investments, patents, etc. **Current indicators do not say a thing about how the R&I system is contributing to solving grand societal challenges. The structural organisation of the system is symptomatic of the political goals** that frame its behaviour: most funding goes to organisations that are public or semi-public, while interactions are mostly encouraged between academia and market players.

Some elements of the European policy have a design that is more compatible with the co-RRI values such as the instruments destined to enforce collaboration between different categories of actors, the Open Science policy, or the partnerships for circular economy. However, **they remain for the most superficial and far from the co-RRI values**. As it is written about the Open Science policy, 'open science does not mean 'free' science [and that] it is essential to ensure that intellectual property is protected before making knowledge publicly available in order to subsequently attract investments that can help translate research results into innovation' (European Commission, 2016a).

As a consequence of this system's design, **there are few (almost none) policy instruments for co-RRI**. Furthermore, it is not clear whether RRI will be reconducted in the next framework programme.

If we look at Joly (2017) **classifications of models of innovation** (Table 3), we can see the difference between a co-RRI model (which column we made and added to the initial table) and the current model, which is a mix of the linear model and the demand innovation model.

Therefore, much needs to be done to foster a transition towards co-RRI systems, since there is almost nothing implemented, at system level, yet. This is a shared opinion with the Oslo Research Group on Responsible Innovation, which we interviewed, since they say that despite some initiatives for RRI, it is important to **urge the political sphere to change the current system** (see Annex 4).

Table 3: Models of innovation adapted from (Joly, 2017)

	Linear model	Demand innovation	Distributed innovation	Social innovation	Co-RRi model
Role of demand	Potential adopters	Demand actors are also innovators	No strict boundary between users and innovators	Demand actors are also innovators	No boundary between users and innovators; emphasis on local needs
Sources of innovation	New science and technology	Fine-tune adaptation to demand's needs	Crowd effects	Empowerment, collective action	Empowerment, collective action, inclusivity, reflexivity, complex system perspective
Key actors	Firms, academic labs	Firms, Consumers	Creative communities	Local communities, knowledge brokers, social entrepreneurs	Quadruple helix, local communities, knowledge brokers, social entrepreneurs
Property rights	Exclusive rights	Innovations embedded in the social	'Commons'	Auto-regulation	'Commons', free access to knowledge
Frame	Competitiveness, economic growth, Fordism	Economic growth, post-Fordism	Counter-culture, hacking, sharing	Social transformation	Societal transformation
Values	Economic welfare	Satisfaction of demand's needs	Autonomy, creativity	Reduction in inequality, fight against poverty	Strong sustainability, acknowledgement of different forms of knowing

4 Propositions to reorganise R&I systems as co-RRI systems

This section investigates the solutions needed to reorganise R&I systems as co-RRI systems. It covers most of the DOA's objectives, investigates on the means proposed in the DOA, and even develops on other themes (mindsets, motivations, management). A first section is based on a literature review and concerns the R&I system as a whole. A second section focuses specifically on crowdfunding and crowdinancing as these were deemed key for the uptake of co-RRI in the DOA. A third section provides some insights on the field of sustainable transition management studies, which are then used in the fourth section, where final propositions for a co-RRI systems are proposed, based on the FoTERRIS project learnings.

4.1 Inspirations from the literature and practitioners

4.1.1 On motivations

For Goddard (2009), we should reinvent the notion of the broadly based **civic university**, which sees universities as strongly connected to people and to place, committed to generating prosperity and well-being and to balancing economic and cultural values (Goddard, 2009). For Marcel and Szmatala (2017), it is important to **get rid of the cultural and structural inertia**, to open up and to **think of a research that aims for a higher purpose** (Marcel & Szmatala, 2017). They assume that passion and engagement need to be combined and canalised towards meaningful research projects (Marcel & Szmatala, 2017).

4.1.2 On mindsets

Marcel and Szmatala proposes that we stop limiting our thinking or saying that changing is impossible (Marcel & Szmatala, 2017). For them **it is possible to do meaningful research dedicated to the public good** if we adopt the right mindset and create the conditions to foster co-RRI.

4.1.3 On the management of performing organisations

According to Heinze (2008), a **suitable environment for creative research** is constituted of (Heinze, 2008):

- freedom to define and pursue individual scientific interests
- facilitative group leadership
- small group size
- an organisational context that includes a complementary variety of scientific skills and instrumentation
- organisational arrangements that support unplanned multidisciplinary contact
- the presence of a guiding research vision and scientific reputation. These factors together make up an environment conducive to creative research

4.1.4 On funding and financing instruments (DOA specific)

New funding conditions for creative, ground-breaking research

Lauder and Gläser (2014) argues that, as epistemic properties of research are linked to the funding conditions, we should create new funding conditions for fostering creative research (Laudel & Gläser, 2014). Such conditions include:

- **Long-term funding mechanisms** as they tend to support the exploration mode, which yields higher outcomes and greater impacts than short-term sponsorship of research (Heinze, 2008). This is complemented by Laudel and Gläser that have found that funding programmes of the 'ERC type' (featuring large and flexible budgets, long time horizons, and risk-tolerant selection processes) enable research with unconventional epistemic properties (Laudel & Gläser, 2014)

- Flexible research funds, as they have been identified as a key factor to undertake original and path-breaking research. D3.3 argues that flexibility give space for changes in the course of research and to adaptation to new findings. These funds include (Heinze, 2008):
 - Organisational core funding
 - Funds from agencies with a mission to fund nonmainstream research and large multi-year awards with few budget restrictions regarding the use of personnel, equipment, consumables or operating costs.

For Varantola (2017), better funding schemes should (Varantola, 2017):

- Encourage researchers to **adopt innovative, experimental and interdisciplinary** approaches
- Foster curiosity and promote a **risk-taking attitude**
- Give enough **freedom** to researchers to define their own research questions

Heinze (2008) estimates that the following funds are suitable for funding ground-breaking research:

- Howard Hughes Medical Institute
- Alfried Krupp von Bohlen und Halbach Foundation: Junior University Professor Program
- James S. McDonnell Foundation: 21st century science initiative
- European Science Foundation: European Young Investigator Award
- ERC Starting Grant by the European Research Council
- Wellcome Trust: Commemorative Award for Innovative Research
- Engineering and Physical Sciences Research Council
- Israel Science Foundation: Focal initiatives in Research in Science and Technology
- Volkswagen Foundation: off the beaten track

Priority Setting Partnerships

We propose a small case-study on the Priority Setting Partnerships (PSPs), a fund of the James Lind Alliance⁶ (JLA), to fund research on the uncertainties of certain medical treatments.

PSPs enable clinicians, patients and carers to work together to identify and prioritise uncertainties about the effects of treatments that could be answered by research. Focusing on specific conditions or healthcare settings, the JLA facilitates PSPs which:

- bring patient, carer and clinician groups together on an equal footing
- identify treatment uncertainties (questions about treatments which cannot be answered by existing research) which are important to all groups
- work with all groups to jointly prioritise identified uncertainties
- produce a final list (often a Top 10) of jointly agreed research priorities, publicise them widely, and make sure that other uncertainties are recorded and available for researchers and research funders to access. The aim of the Top 10 is to highlight important areas for research, but not necessarily to come up with the specific research questions. The Top 10 may include broader areas of importance where patients, carers and health professionals have agreed that there is a need for research. This informs researchers and research funders about priorities so that they can make their research as meaningful as possible to the people who need it.
- provide a rare and valuable opportunity for patients and clinicians to shape the health research agenda.

PSPs are facilitated by a small team of JLA Advisers. To ensure consistency, the JLA asks each PSP to follow a specific method and to conform to a set of underpinning principles. These are:

- transparency of process
- balanced inclusion of patient, carer and clinician interests and perspectives
- exclusion of non-clinician researchers from voting (they may be involved in all other aspects of the process)

⁶ <http://www.jla.nihr.ac.uk/>

- exclusion of groups or organisations that have significant competing interests, for example pharmaceutical companies
- a maintained audit trail from original submitted uncertainties, to final prioritised list.

This kind of funding programme is in line with the co-RRRI concept: it is designed for collaborative and multidisciplinary project, acknowledges and protects against vested interests, is equal and gives voice to minorities, and gives open access to the research questions generated.

Deliverable D3.3's recommendations follow the same path. Indeed, they propose to preserve certain budgets for co-RRRI projects, to tailor funding programmes to the specific needs of those projects (experimental, open process, possibility to learn from failures as well as from successes). Similarly, these recommendations particularly emphasise on the flexible quality of such programmes, to **allow researchers to test new ideas on a small scale, without commitment to large scale implementation, and to have the possibility to change the course of the project if need be.**

Setting up a new agency for ground-breaking research

Heinze (2008) proposes an answer to whether funding programs for ground-breaking research should be set from scratches or if they should be integrated in an existing funding organisation. His empiric analysis suggests that if a ground-breaking funding programme is established within an existing funding agency, it tends to be either a residual funding category or secondary funding category that reflects the outside world trends. Therefore, he argues that science policy makers should reconsider the 'easy option' of adding just another funding line to their agency's portfolio and **may do better by setting-up a new agency dedicated exclusively to ground-breaking research** (Heinze, 2008).

A civic status conditioning funding

Goddard (2009) suggests that there should be a **special pot of funding** for civic universities. This funding would be conditional to the signature of a five years contract specifying outcomes defined in terms of local, national and international societal impacts, and the undertaking of a self-evaluation. This self-evaluation would be led in partnerships with peers and partners and would assess the university's strategies, structures and processes underpinning its civic engagement (Goddard, 2009). Further he proposes the creation of a **special civic status**. Universities could ask for this status, that would be associated with funding, in exchange for demonstrating their ability to generate worthwhile impact (Goddard, 2009).

A new social public procurement instrument

We propose here a case study on the **Social Value Exchange**⁷ since it represents a **very innovative model of public procurement with obvious social impacts.**

The Social Value Exchange is an online marketplace where **resources are channelled into solving local problems**. It matches three types of stakeholders, public authority, communities and suppliers in a win-win partnership. It takes place in the UK where suppliers of goods and services to governmental bodies are asked to put something back into the local communities but where this system does not work as it should. There are two problems, one is that not enough is given back to local communities, the second, that governmental bodies are not able to measure what has been given back. The Social Value Exchange platform gives to

- Public contracting authorities: a straightforward and efficient way to maximise and measure community benefits in their procurement process
- Communities: free access to key resources
- Suppliers: a higher chance to get a procurement contract

⁷ <https://www.socialvalueexchange.org/>

It works as follow: the contracting authority chooses the contract it wants to create additional community benefits from and posts it to the Social Value Exchange platform. Then the platform matches potential suppliers with accredited local charities, social enterprises and community groups which are in need of resources to deliver their social/environmental projects. Suppliers can provide these latter with free resources (money, professional expertise, office space and IT equipment) in return for extra credits for the Social Value component of the tender. To do so, suppliers make a bid to provide communities with resources. The platform ensures that these auctions maximise the resources from suppliers to communities, and that the bid process is open and transparent.

4.1.5 On funding criteria and evaluation processes (DOA specific)

New models of project-funding programmes

A study by the RAND Corporation (RAND, 2013) elaborates new models of project-funding programmes and compares them with the usual model, called TRM (for Traditional Review Model) in the following paragraph.

Identification of scientific priorities and definition of the types and modes of R&I expected

The TRM model is driven by a strategic programme planning logic: the funding organisation defines a set of priorities and a fixed amount of resources is allocated given the programme area and the approach selected.

The alternative model developed by **RAND rests upon milestones**. To deal with the complexity of certain issues, the idea is to break it into smaller questions. Then, the funding organisation invites researchers to compete to provide the best possible solutions to these questions. The stepwise logic of this approach enables an easier judgement of whether a particular project aligns with the funder's aims. Nonetheless the success in achieving research objectives depends on the accuracy of the problem's unravelling. This approach is driven by the logic of unconstrained excellence. The excellence of the researcher takes precedence over fixed research priorities. The funder provides resources to the researcher who has more flexibility to address the questions as he/she prefers.

Procedures and rules for submitting proposals

The TRM approach may be considered as passive because of the low level of interactions between the funder and the applicants: the funding body releases a call and applicants have to submit their applications by a specific deadline.

RAND proposes to **make this submission period more interactive**. The funding body could adopt a proactive attitude to generate as much as possible interest and proposals. It would solicit directly researchers and teams to incentive them to answer to the research question. In some case, the funding body could establish a team to help the applicants in the design of their solutions.

Furthermore, in the TRM approach, the competitive spirit takes precedence over the logic of cooperation. Isolated researchers submit research proposals that have been developed in closed settings. **An another possibility proposed by RAND bets on cooperation**. Researchers and diverse groups of experts cooperate through brainstorming sessions during a workshop organised by the funding body. At the end of the workshop, funding is allocated to the most refined ideas/proposals. The added-value of this logic rests upon its transparency and the possibility to make change to improve the selected ideas/proposals.

Proposals' evaluation

The selection of the best proposals is based on an ex-ante approach in the TRM. The call defines the criteria and the expected research outcomes and deliverables to assess all the proposals.

RAND suggests four alternatives: portfolio, ad hoc/discretionary, ex-post award/prize, and renewal models.

In the portfolio approach, the selection of proposals is driven by balanced risk logic. This model enables the funding body to invest in risky solutions which may lead to ground-breaking results by balancing such investment with funding more conservative projects with predictable and less ambitious outcomes. This is an application of the ‘not all the eggs in the same basket’ strategy.

The ad hoc/ discretionary model reserves a portion of the funds to original projects. Funding body adopting such model can support cross-cutting, interdisciplinary research that is difficult to justify within a single programme area for instance.

The ex-post award/prize model implies that the funding is only allocated after a positive evaluation of the results. Consequently, the risk is shifted from funders to researchers. This model is adapted to funding bodies that want to ensure that a specific goal is met.

Contrary to the one-shot funding logic that is usually the norm, is the renewal model. This possibility gives a chance to long-term research projects. Researchers are accountable for intermediate results. Unlike milestones, projects seeking renewals must demonstrate the standalone value of the short-term gains to progress, although not necessarily having a larger goal as the ultimate objective.

Proposals’ selection

The TRM approach ranks the proposal according to ex-ante criteria and then a panel makes a group decision on which proposals will be funded.

RAND’s alternative models are an allocation by score, or a random or iterative (the panel decides through several rounds) decision.

Composition of the decision-making panel

In the TRM, the decision to fund the research projects is in the hand of academic peers.

In alternative approaches, the selection is either realised by a single person or by interdisciplinary/multi-stakeholder committee who take into consideration the social relevance and policy impact of the project.

Deliverable D3.3 proposes that the **decision-making bodies that evaluate and select R&I projects to be funded are interdisciplinary**.

Goddard (2009) suggests **using external non-academic review** similarly to what has been experimented in Finland and transferred to the OECD. Their approach involves a written self-assessment commissioned by all universities and their civic partners prepared using a standard template and covering the impact of the universities on economic, social, cultural and environmental development. This is followed by a peer review by a team of national and international experts. The peer review is published and subject to open debate and may be followed up to assess progress against agreed actions (Goddard, 2009).

4.1.6 ***On evaluation and reputation of performers (DOA specific)***

4.1.6.1 ***On metrics for performers' evaluation***

For Wilsdon (2015), peer review, although imperfect, should not be supplanted by metrics. He considers this system as the least problematic form of academic governance which should remain the primary way for assessing research papers. He suggests that it could be improved by quantitative indicators complementary to other forms of evaluation and decision-making. For him, it is necessary to introduce flexibility to the research system; **assessment of research papers should be undertaken with regards to their context and the disciplinary diversity** – there is not one single measure of quality (Wilsdon, 2015). He judges that the implementation of metrics is worthless without an **open, transparent and interoperable data infrastructure**, relying on principles and guidelines commanding the use of technologies to improve its trustworthiness. It is crucial to define the right identifiers, standards and semantics to design a system in which higher education institutions (HEIs), funders and publishers interoperate better. For him, these measures are necessary to avoid the perverse consequences of wrong metrics (see section 3.4.2).

Based on the RRI concept, he defines **responsible metrics**⁸:

- Robust: basing metrics on the best possible data in terms of accuracy and scope;
- Humble: recognising that quantitative evaluation should support – but not supplant – qualitative, expert assessment;
- Transparent: keeping data collection and analytical processes open and transparent, so that those being evaluated can test and verify the results;
- Diverse: accounting for variation by field, and using a range of indicators to reflect and support a plurality of research and researcher career paths across the system;
- Reflexive: recognising and anticipating the systemic and potential effects of indicators, and updating them in response

Lastly, he provides additional recommendations to support the effective leadership, governance and management of research practices (Wilsdon, 2015):

- The research community should develop a **more sophisticated and nuanced approach to the contribution and limitations of quantitative indicators**
- At an institutional level, HEI leaders should develop a **clear statement of principles** on their approach to research management and assessment, including the role of quantitative indicators
- Research managers and administrators should champion these principles and the use of responsible metrics within their institutions
- Human resource managers and recruitment or promotion panels in HEIs **should be explicit about the criteria used for academic appointment and promotion decisions**.
- Data providers, analysts and producers of university rankings and league tables should strive for **greater transparency and interoperability** between different measurement system
- Publishers should **reduce emphasis on journal impact factors** as a promotional tool, and only use them in the context of a variety of journal-based metrics that provide a richer view of performance

Science Europe has recently elaborated its position for a more meaningful evaluation of research impacts. First, that could start with including social value in the evaluation's criteria (Science Europe, 2017). Another of their ideas is to define the evaluation's criteria according to the objectives of the activities being evaluated and the level of analysis (programme, project, research group....). **Ultimately, they claim for a new vision of impact evaluation in which:**

- A broad notion of impact that **incorporates the societal value of research** in the practices and policies is implemented by RPO, stakeholders, and policy-makers.

• ⁸ <https://responsiblemetrics.org/about/>

- Investing in understanding of **how impact processes vary across different environments**
- Flexible and diverse approaches for impact evaluation are adopted. The availability of specific indicators should not drive evaluation
- Process of mutual trust between researcher and society is encouraged**. This includes facilitating close interaction between evaluators, researcher, policy-makers, and research managers, as well as developing tools and incentives for researchers to reward their societal engagement
- Meaningful strategies to emphasise the creation of knowledge that broadens the options (options value) available to society are adopted.

This is in accordance **with the lessons of the PRIME project** (Lepori et al., 2007) in (Reale, 2017)) which recommends the definition of indicators according to the policy question, the programme and the objectives that underpinned the research project. Instead of an ex-ante and rigid approach, it could be better to develop an interactive approach (progressive refining) when developing indicators. In all the cases, ‘careful consideration must be given to data collection and its method’ (Lepori et al., 2007) in (Reale, 2017)).

We have found **two other studies on new ways to evaluate R&I careers** that we found in line with the co-RRI concept. We show a selection of the most interesting criteria in the tables that follow.

Table 4: Selection of elements of the Open Science Career Assessment Matrix from (O’Carroll et al., 2017)

Open science activities	Possible evaluation criteria
Research output	
Research activity	Pushing forward the boundaries of open science as a research topic
Publications	Publishing in open access journals; self-archiving in open access repositories
Research process	
Stakeholder engagement / citizen science	Actively engaging society and research users in the research process; sharing provisional results with stakeholders through open platforms (Arxiv, Figshare); involving stakeholders in peer review processes.
Collaboration and interdisciplinarity	Widening participation in research through open collaborative projects; engaging in team science through diverse cross-disciplinary teams.
Research impact	
Societal impact	Evidence of use of research by societal groups; recognition from societal groups or for societal activities
Knowledge exchange	Engaging in open innovation with partners beyond academia

Table 5: Elements of the framework for co-creating open scholarship (Garnett & Ecclesfield, 2012) from (Boyer, 1997)

Type of co-creative R&I	Measures of performance
Purpose	
Aggregate new forms of knowledge through the co-creation of research agendas	Performing creative work in education; identifying useful domains for research; publishing collaboratively in peer-edited fora
Integration	
Enable the use of knowledge across disciplines	Preparing comprehensive literature reviews; enabling generative network effects to occur
Application	
Aid society and professions in addressing problems through serving community and public needs and purposes	Working with community groups and on public engagement strategies mentoring colleagues collaboratively

4.1.6.2 On informal ranking of HEIs

Not as known as the QS World University Ranking's type, there exist a type of HEIs' evaluation linked with their performance against sustainable development criteria. Shi et Lai (2013) compares three of these sustainability ranking frameworks: STARS, ACUPCC, and the Green Report Card. Then, [they propose a new framework, that we find more aligned with the co-RRi concept.](#)

Table 6: Comparison of sustainability ranking frameworks (Shi & Lai, 2013)

Major categories	Total no. of criteria	Number of criteria covered		
		STARS	ACUPCC	Green Report Card
Emission data	34	8 (24%)	29 (85%)	5 (15%)
Mitigation data	14	5 (36%)	12 (86%)	2 (14%)
Emissions inventory methodology	10	0 (0%)	10 (100%)	1 (10%)
Contextual data (population, space)	25	15 (60%)	17 (8%)	6 (24%)
Administration	52	34 (65%)	0 (0%)	27 (52%)
Green purchasing	14	8 (57%)	0 (0%)	7 (50%)
Energy efficiency	27	17 (63%)	0 (0%)	11 (41%)
Recycling	26	19 (73%)	0 (0%)	11 (42%)
Dining services	14	14 (100%)	0 (0%)	0 (0%)
Green building	14	10 (71%)	0 (0%)	10 (71%)
Water management	7	6 (86%)	0 (0%)	4 (57%)
Transportation	21	17 (81%)	0 (0%)	15 (71%)
Landscaping management	7	7 (100%)	0 (0%)	1 (14%)
Business opportunities	2	2 (100%)	0 (0%)	0 (0%)
Employee engagement	16	14 (88%)	0 (0%)	3 (19%)
Student involvement	24	15 (63%)	0 (0%)	11 (46%)
Curriculum	18	18 (100%)	0 (0%)	2 (11%)
Research	10	10 (100%)	0 (0%)	0 (0%)
Public engagement	8	8 (100%)	0 (0%)	0 (0%)
Sustainability outreach & publication	10	10 (100%)	0 (0%)	1 (10%)
Sustainability investment	11	9 (82%)	0 (0%)	2 (18%)
Innovation	1	1 (100%)	0 (0%)	1 (100%)
Total criteria covered	365	247 (68%)	70 (19%)	120 (33%)

Their framework proposes to assess the sustainability performance of HEIs through the following dimensions (Shi & Lai, 2013): Formal statement (stated vision and mission, legislative and financial drivers); Governance (sustainability office, management plan or sustainability report, senior representatives); Strategies for fostering sustainability (education, research, outreach and partnership, campus sustainability).

They have completed their framework with indicators for each dimension and a scoring system, as shown below.

Table 7: Scoring system based of a new sustainability ranking framework (Shi & Lai, 2013):

	#	Criteria	Score
1 Formal statement	1.1	Sustainability is a core value of the university	1
	1.2	Stated vision in sustainability report or management plan	1
	1.3	Stated mission in sustainability report or management plan	1
	1.4	Drivers: Legislative or financial	1
2 Governance	2.1	The establishment of a sustainability office	1
	2.2	The establishment of a carbon management task force team or committee	1
	2.3	Involvement of key players in the university	1
3.1 Education	3.1.1	Formal course: A specific degree in sustainability or environmental management	1
	3.1.2	Formal course: PhD or master research degree in sustainability	1
	3.1.3	Student grants	1
	3.1.4	Student champions	1
	3.1.5	Informal education courses	1
3.2 Research	3.2.1	Sustainability research institution or centre	1
	3.2.2	Sustainability research programs/project	1
3.3 Outreach	3.3.1	Joined any voluntary offset program	1
	3.3.2	Participate in any forum or network to support carbon management/sustainable development	1
	3.3.3	Participate in any inter-university carbon reduction commitment	1
	3.3.4	Awards	1
3.4 Campus sustainability	3.4.1	Policies (general and detailed policies)	2
	3.4.2	Carbon management plan	1
	3.4.3	Reduction target	1
	3.4.4	Access to funding	1
	3.4.5	Greenhouse gas inventory (direct and indirect emissions)	2
	3.4.6	Demonstration (Green buildings and technology)	2
	3.4.7	Implementation	1
		Total score	28

4.1.6.3 On reputation

In France, the 'French Tech' brand is the open and collaborative brand of a public policy dedicated to valorising all types of French entrepreneurs. A community of French tech entrepreneurs working in the tech for good movement has suggested to develop a similar brand and a [label for valorising and federating all the innovations for the Common Good](https://www.lesechos.fr/idees-debats/cercle/030445896271-federer-linnovation-au-service-du-bien-commun-2102152.php)⁹.

⁹<https://www.lesechos.fr/idees-debats/cercle/030445896271-federer-linnovation-au-service-du-bien-commun-2102152.php>

4.2 Focus: Investigation of crowd funding and financing possibilities for co-RRI (DOA specific)

The DOA asked to investigate crowdfunding possibilities for co-RRI. We present here some platforms that could be suitable to crowdfund/finance co-RRI projects and their solutions.

4.2.1 Presentation of crowdfunding & crowdfinancing

The emergence of new technologies and the development of the Web 2.0 industry enabled the flourishing of new business models changing the way goods and services are exchanged and consumed (Gierczak, Bretschneider, Haas, Blohm, & Leimeister, 2016). In this context, emerges not only crowdsourcing but also many peer-to-peer (P2P) and shared economy projects and businesses. This is when the possibility of financing and funding a project with the crowd's help becomes real.

Many of today's leading crowdfunding platforms appeared in the United States since the 2000's. From this time on, crowdfunding gained relevance specially in countries such as the UK, Germany and the Netherlands. In 2012, the European crowdfunding market had a share of 25% of the global market and was the second biggest crowdfunding market in the world. **Nevertheless, crowdfunding has not yet reached its full potential. Experts believe that by 2020 the global crowdfunding volume will increase up to 35 billion USD (Gierczak et al., 2016).**

Today there are many platforms where to launch a crowdfunding campaign. The money raised through crowdfunding platforms keeps growing, hence crowdfunding is proving to be a relevant alternative funding method. In some fields, such as the arts or development crowdfunding is already the mainstream funding method. Most of those sites are similar in design and structure, but often they are specialised in niche or a domain, such as medical research, arts, start-ups, etc. Often those platforms are for-profit business and they take a percentage of the money raised by each project varying from 8% to 12% (Wheat, Wang, Byrnes, & Ranganathan, 2012).

Presentation of crowdfunding and financing

Crowdfunding consists in an internet-based method of fundraising for any type of project, varying from start-up, non-profit or even personal travel project. The fundraisers are the project leaders and they solicit donations for their projects through a fundraising campaign in a specialized webpage of crowdfunding.

Crowdfunding campaigns often run for a limited timeframe, from one single day to several weeks, with the attempt of reaching the desired funding target before the end of the campaign. Different from traditional funding methods, when raising funds through crowdfunding, the main goal is to get many small donations from the 'crowd', instead of requesting a large sum from a funding institution.

In general, crowdfunding platforms provide two key ways to pitch about a project: a narrative in a text format and/or a video (Wheat et al., 2012). The narrative can be quite useful for research projects for clarifying the research outline, methodology and objectives. However, a good video can have a powerful communication impact and raise a lot of interest.

As illustrated in Figure 3, crowdfunding is often based on the interactions of **three types of stakeholders: the project initiator who launch the crowdfunding campaign to raise money for their project, the supporter who is willing to support economically a project, and the crowdfunding platform who acts as intermediaries.**

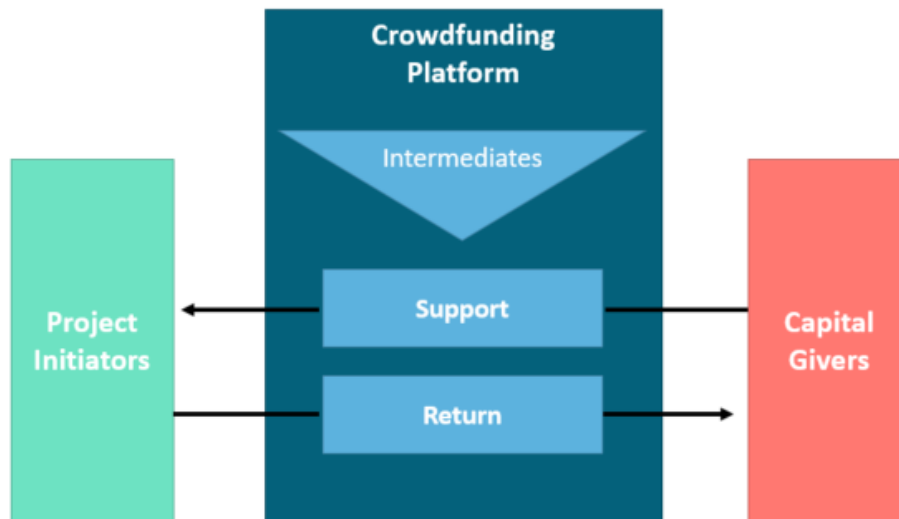


Figure 3: Interactions between crowdfunding’ stakeholders from (Haas, Blohm, & Leimeister, 2014)

Project Initiators and Supporters

To raise funds from the crowd, a project needs to reach a platform where the project initiator will describe the project idea and objectives with the aim of convincing capital givers to support their projects. Oftentimes, the project initiators and the supporters are private persons. Nonetheless, projects can also be initiated by organisations, namely start-ups, research institutes or non-governmental organisations (NGO) (Gierczak et al., 2016).

In crowdfunding, the relationship between project initiators and supports is expected to have some level of reciprocity, project initiators are expected to give back some sort of compensation to their supporters. Gierczak et al. have identified three types of returns: 1) No compensation- In this case supporters make a donation to contribute to the common good; 2) Reward- Supporters get a non-monetary compensation in return of their contribution; and 3) Pre-ordered product- Supporters money is used as a pre-payment, they get the product sometime after the end of crowdfunding campaign.

In crowdfinancing, there is a financial return, in the form of interests, mini-bonds or profit-shares.

To date, not enough studies have been made on the decision-making process of supporters to invest in a specific project and the motivations that determine their choice. However, evidence has shown that family and friends are often a great source of support for crowdfunding project to which they have an emotional reason to provide funding (Gierczak et al., 2016). The motivation of project supporters to participate in a crowdfunding campaign can be based on hedonistic reasons, on altruism or can be based on for-profit interests. What is clear is that supporters investment decisions are influenced by social networks and other people’s behaviour.

Crowdfunding platform

The intermediary between project initiators and capital givers is the crowdfunding platform where projects are published, and crowdfunding campaigns are held. As mentioned before, crowdfunding platforms can differ in multiple ways. They can be general, for all types of projects, or they can focus on a specific niche (e.g. Art, science or innovation/start-ups).

Crowdfunding intermediaries can offer different types of funding mechanisms. On some websites, only if the fundraising goal is reached by the end of the campaign the project can receive the money from the donors. This type of platform is typically referred to as ‘all-or-nothing’ platform. On the other hand, in some

sites partial funding is allowed and the project receives everything it managed to raise even if it doesn't reach the funding target. This principle is known as keep-it-all and is particularly used for charity projects. Crowdfunding platforms can also request a minimum pledge amount or allow a variety of pledges level (Gierczak et al., 2016). The percentage that they take of the money raised can also vary depending on their reputation and the benefits they offer to the project initiators.

Project assessment & Criteria for crowdfunding R&I projects

Crowdfunding platforms are as successful as the crowdfunding campaign they list in their web, therefore most of the platforms specialised on R&I **perform a pre-quality screening before listing new projects**. Each crowdfunding platform establishes its own criteria of selection for choosing the projects they list in their platform. Often, factors such as project feasibility or economic impact are the main conditions for the selection of R&I projects. Other factors, namely the number of people supporting or involved in the project, the overall image or innovation rate, are also taken into account.

Figure 4 is based on a study made by (Gierczak et al., 2016) in which they interviewed representants from ten crowdfunding platforms specialized on R&I to understand the main criteria that determine crowdfunding projects choice.

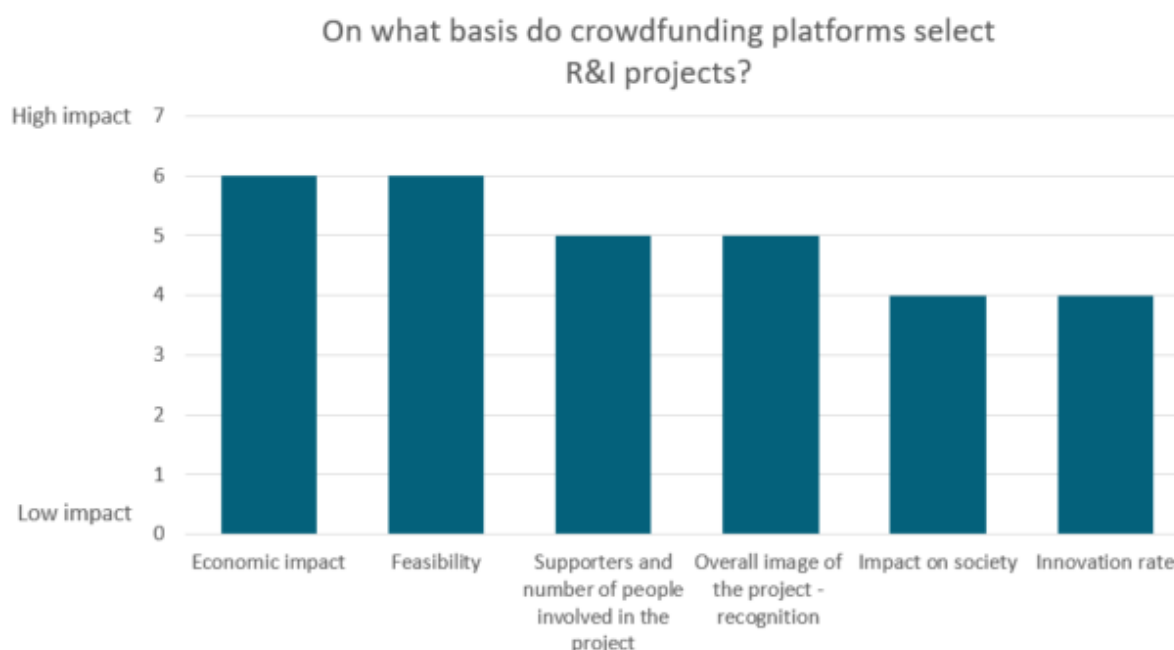


Figure 4: Selection criteria used by platforms based on ten interviews from (Gierczak et al., 2016)

As shown in Figure 4, the overall image of the project, its supporters and the number of people involved is almost as important as the project feasibility and economic impact. When it comes to **research-oriented and innovation-oriented platforms**, platforms often used specific criteria in their select of projects for crowdfunding. Table 8 lists that main criteria used for each case.

The criteria of the quality check are determined also according to the scope of the platforms (strict specialisation/market knowledge in the field). **Research platform attempt to assess the scientific aspects of the project and make a background check to ensure the credibility of the researchers involved and their capacity to succeed. For instance, some platforms only admit project submitted by well-known universities or research institutions, while others require projects to be on a specific branch of sciences (Jakimowicz et al., 2017). On the other hand, platforms specialised on innovative start-ups require previous references and information on the fundraisers' background and their ability to intercept new investors, for example.**

Table 8: Pre-selection quality criteria of platforms specialised in R&I from (Jakimowicz, Osimo, Gallo, Pappalepore, & Weber, 2017)

Research-oriented platforms	Innovation-oriented platforms
A scientific board assess projects according to a set of quality criteria, namely:	An expert panel selects projects based on:
Background of researchers to check their credibility, To be well-known and/or an experienced institutions or researcher, Projects must relate to a clear brunch of science, Projects must have a measurable goal.	Previous references, the background of fundraisers, Ability to intercept new investors and demonstrated initial funding, Registered legal entity, Meet criteria set by a national chamber of commerce.

4.2.2 Selection of platforms for crowdfunding/financing R&I

In science, since public funding is limited, and competition is continuously increasing, crowdfunding is becoming progressively popular. The use of crowdfunding for science is also beneficial because it connects science and society. It raises support to research projects even before the research is initiated, instead of the traditional logic based on research results and then dissemination (Wheat et al., 2012).

Table 9: Selection of Science, R&D and Innovation crowdfunding and crowdfinancing platforms

Science and Research Platforms		Innovation and Start-ups Platforms	
	Crowdfunding	Crowd finance	Crowd finance
Thematic	Digventures Archalogy (UK)	My pharma company Pharmaceutical research (FR)	Blue Bees Food and Agriculture (FR)
	ADHD Fund ADHD (NL)		Lumos Energy(FR)
	Tudigo Local development (FR)		Collecticity Public projects (FR)
	Consano (US) Medical research		Lendosphere Sustainable development (FR)
	FutSci Life sciences (UK)		LITA.CO Social business (FR)
	Medstartr (US) Healthcare		
General	Precipita (ES)		Startnext (DE)
	Vorticex (ES)		Investing Zone (UK)
	Crowd.Science (UK)		KissKissBankBank (FR)
	DavinciCrowd (FR)		Indiegogo (ES)
	Experiment (USA)		Investiere (CH)
	SciFund Challenge (US)		The Crowd Angel (ES)
			1000x1000 (AT)
			Seedmatch (DE)
			Oneplanetcrowd (NL)

Case studies

Among the platforms presented above, we estimate that certain could be used to crowdfund and crowdfinance co-RRR projects or that share co-RRR values. We provide further information on these platforms below.

Precipita		
Link		
Identity	Field(s): Scientific research	Crowdfunding for Research
	Project owners (academics, innovators, individuals)	Country: Spain
Brief description	Precipita aims to offer a space where scientific projects are accessible to everyone interested in sciences and research .	
Model and success rate	Precipita is a crowdfunding platform specialized on scientific projects. Crowdfunding campaigns stay online for a maximum of 90 days. If in the first 15 days the project does not get any support it is removed from the platform. The project need to reach the minimum funding target in order to have access to the donations. Precipita takes 2% of the transactions made to successful project for covering its operations and the platform maintenance costs. Project donors can give a minimum of 5 €. Key figures of success: Number of projects crowdfunded: 47 Capital raised: roughly 530 thousand Euros	
Selection criteria	1) The project owner needs to be member of a public research centre 2) Scientific publications of his/her own or in collaboration with other researchers in the last 2 years 3) The budget requested should be of less than 25 000 € 4) The project should have been evaluated positively in a national or international call 5) The project should have a high social impact in the short or medium term	
Pros & Cons	Pros: - Precipita has the support of the Spanish research community, as it has been created by the Spanish Foundation of science and Technology (FECYT); - It takes only 2% of the capital raised. Cons: - Precipita has a limited geographical scope, it operates only in Spain; - If the project does not get contribution in the first 15 days it is removed from the platform.	

ADHD Fund		
Link		
Identity	Field(s): ADHD Research	Crowdfunding platform for ADHD Research
	Project owners: researchers	Country: Netherland and other European countries
Brief description	The objective of the ADHD Fund is to unite patients and researchers to form a community that enables independent and self-finance ADHD research .	

Model and success rate	No information available on the platform model. Key figures of success: Project completely funded: 5 Projects partially funded: 2 Estimation of capital raised: 33 050 €
Selection criteria	No information available.
Pros & Cons	Pros: • A specialised platform can facilitate the communication between project leaders and funders, as they are all familiar to the topic; • The ADHD Fund operates in more than one country. Cons: • Lack of details about the platform model on the webpage.

BlueBees

[Link](#)

Identity	Field(s): Food and agriculture	Crowdfunding and crowd finance for Innovation
	Project owners: Associations, individuals and entrepreneurs	Country: France
Brief description	Blue Bees is a crowdfunding platform specialised on food and agriculture projects. Its objective is to promote sustainable agriculture and nutrition by supporting projects that are ecological and economically viable, and that create new employment and contribute to the local development.	
Model and success rate	BlueBees gets in contact with fabricants and distributors and support their collaboration with projects from the platform. It offers help and support for all projects crowdfunding communication campaign. Project donors can give a minimum of 5 € and investors can give a minimum of 20 €. Key figures of success: Capital raised since inception: 3 408 743 € Refunds paid (To lenders with interest): 959 370 € Number of projects funded: 199 Number of contributors: 24 769	
Selection criteria	1. Resilience and agroecological approach 2. Financial Analysis 3. Personality of the project leader 4. Ecosystem of the project 5. Existence of guarantee	
Pros & Cons	Pros: • A specialised platform can facilitate the communication between project leaders and funders, as they are all familiar to the topic; • It offers both crowdfunding and crowd finance services;	

- For crowdfunding, Blue Bee stays with up to 4% of the sum raised. No interest is subsequently charged by Blue Bees.
- It has 24 769 contributors.

Cons:

- Bluebee has a limited geographical scope, it operates only in France;
- For crowd finance, Blue Bee stays with up to 8% of the amount raised by the project leader.

LITA

Link

Identity	Field(s): Social and environment impact	Crowd finance for Innovation
	Project owners: entrepreneurs, innovators and individuals	Country: France
Brief description	LITA.co is a crowd finance platform that has the ambition to channel investment with transparency to support companies with a social and environmental positive impact.	
Model and success rate	LITA.co selects impact projects that meet the selection criteria. The fund-raising campaign is launched. Once fund is raised LITA.co helps animating the community of impact shareholders and monitoring the project's impact. Investors can monitor their venture online and they receive both financial and non-financial reports. Project investors can give a minimum of 100 €. Key figures of success: Individuals who have invested their capital: 2000 Number of companies who have benefited from financial resources: 25 Capital raised on the platform during the last three years: 7 000 000 € Number of jobs created thanks to the investment made through the platform: 500	
Selection criteria	1) Seed of scale up 2) A strong social or environmental impact 3) Real prospects for development 4) Commercial company as a SAS 5) Have one of the following objectives: economic development, energy transition, social real state, inclusion, health o community support.	
Pros & Cons	Pros: • It offers a secured investment procedure; • LITA.co is approved by the Financial Market Authority (AMF); • Offers tax advantages for donors; • It is committed to transparency; investors can follow their investment. Cons: • LITA.co has a limited geographical scope, it operates only in France; • LITA.co has a small community of investors and has succeeded to support only 25 companies.	

GOTEO

[Link](#)

Identity	Field(s): Social, cultural technological and educational projects	Crowdfunding for Innovation
	Project owners: Innovators and individuals	Country: Spain with replicas and alliances in several countries
Brief description	Goteo is a non-profit foundation and a platform for civic crowdfunding and collaboration to support citizen initiatives. It aims to generate resources on a 'drop by drop' for community projects.	
Model and success rate	Goteo is not only about money, it is also a crowdsourcing platform. Donors can share a skill, a tool or a hand. And donors that contribute with money have tax advantages. On the other hand, projects are founded only if the target is reached on time. After crowdfunding, Goteo guarantees the project development, including rewards fulfilment. Key figures of success: Users community: 119 426 Successful projects: 73% Money raised: 5 776 107 €	
Selection criteria	1) Free/open licences and sharing knowledge projects 2) Creative and innovative projects 3) Social impact projects in the fields of education, science, technology, ecology, among others	
Pros & Cons	Pros: • International platform that has been replicated and has alliances in many countries; • Supports crowdsourcing in addition to crowdfunding; • Offers tax advantages for donors; • Big user community and high success rate.	

4.2.3 Good practices for Co-RRI crowdfunding/financing

Public outreach is essential for a successful crowdfunding campaign. It requires cultivating the project popularity among a vast audience, which can be challenging for a scientific project that often uses technical terms and vocabulary (Wheat et al., 2012). The logic for success is the following: the larger and more enthusiastic the public you engage more money can be raised from the crowdfunding campaign.

Those considering raising money through a crowdfunding campaign should be aware that **it is not as easy as it seems**. The failure rate is rather high, and many campaigns fail to reach their fundraising goals. In 2017 for example, more than 53,000 projects failed to raise money on Kickstarter's platform (Kickstarter, 2012).

For this reason, when launching a crowdfunding campaign the project team should have few things in mind (Nesta, n.d.):

- **Have a realistic budget:** The budget should be estimated taking into consideration all the project costs and the cost related to the crowdfunding campaign.
- **Build a good communication strategy:** The communication strategy is a central part of the puzzle. The project goals and objectives need to be clearly communicated with the help of appealing visual content and an effective remuneration strategy.
- **Chose the right platform:** There are hundreds of crowdfunding platforms, each one offering special conditions for a specific niche of projects. So, it is worth doing some desk research to find out which platform is more suitable to the project and from which it can benefit the most.

4.3 Insights from sustainable transition management studies

In order to build efficient and effective solutions for co-RRI systems, we have decided to enrich FoTERRIS learnings and the solutions found in the literature review (section 4.1) with insights from the field of sustainable transition management studies.

The Science of transition management studies what a sustainable transition is, and what its dynamics are, in order to optimise our transitioning towards more sustainable societies. According to Rotmans et al. (2001), and Grin et al. (2010), a transition is a process of structural, non-linear systemic change in dominant culture, structure and practices that takes place over a period of decades' (Grin, Rotmans, & Schot, 2010; Rotmans, Kemp, & van Asselt, 2001). To transition, we need to use current crises and tensions strategically to dismantle unsustainable regimes and rapidly build up sustainable systems (Loorbach, 2014). There are four mechanisms to transition (Loorbach, 2014):

- **Destabilising the regime**
- Proposing a diverse **set of alternative** practices, technologies, and initiatives that can be presented as building blocks for the transition (Loorbach, 2017)
- **Institutionalising** the alternatives that work
- **Phasing-out** the unsustainable practices, structures and mindsets

Several principles should be carefully considered when transitioning.

First of all, visions of a desirable future are necessary, although they should remain a way to align and motivate the stakeholders, since many visions are usually competing against each other.

Then, it is important to reflect on who to invite in the transitioning process. Participation should be selective (distinguishing between change actors and incumbents) yet diverse and inclusive (Loorbach, 2017). The key is to achieve synergy between all these actors while maintaining diversity. **The reason why inclusivity is key is that new solutions can only be considered to be legitimate, diverse, resilient and effective when they are (co-) developed, implemented, and sustained by societal actors** (Clark, W.C., Crutzen, P.J. en Schellnhuber, H.J. 2005) in (Loorbach, 2014).

Transitioning is about finding new ways to organise society. Therefore, **adaptability and strategy** should frame any transitioning actions, in order to recognise what is already there, and to strategically adapt the transitioning action accordingly. Especially, the transitioning process needs to be **context-dependent** (Werbelloff, Brown, & Loorbach, 2016). **Multiple goals, as well as multiple solution pathways** are required, and since a transition happens at system level, we need to **mix various innovation types** (products and services, ideas, new mindsets, behaviours and business models, etc.), as well as instigating a number of scenarios, experiments and work streams in different areas (Nesta, 2013).

Ultimately, the transitioning **process is one of innovation, of doing-by-learning and learning-by-doing and must include times for evaluation of its course and critical reflection**. Places and contexts should be

developed to make transitioning actors reflect, rethink and reshape their thoughts and actions (Loorbach, Frantzeskaki, & Avelino, 2017). The transition process should be open and secure social learning.

Transitioning requires to **understand the root causes of the grand societal challenges** using system analysis in a participatory way, so as to overcome as much as possible the subjectivity bias.

Obviously, the question of governance is at the heart of the transitioning process (Loorbach et al., 2017). The role of governance is to answer the question of how different types and forms of agency can influence the speed and direction of transitions and how they can be engaged, can be empowered, and can more effectively contribute to desired transitions (Loorbach et al., 2017). As for now, transition management studies say that transition governance is about **mediating growing numbers of transformative change networks and change-inclined regime actors so as to co-construct hybrid transition pathways. Such pathways are multi-actors processes in which systemic solutions, disruptive innovations, and (reflexive) institutions are formed by experimenting and learning** (Loorbach et al., 2017). To make this happen, transition management proposes to **develop informal networks in which individuals and later, organisations, are provided the mental, social, and physical space to develop new ideas, common language, and ambitions, as well as new joint projects** (Neuens et al., 2013) in (Loorbach, Frantzeskaki, & Lijns Hufferreuter, 2015). As transition happens in various contexts, it is important that governance is multi-level (Loorbach, 2016). The kinds of organisation that are the most likely to foster a transition are advocacy coalitions, networks of networks, new systems of value (Loorbach, 2014).

In this transitioning process, **governments can (have to) play a major role**. They need to shift from seeking generic solutions to **offering a more generic framework that create space for and help to enable the transitioning actors** (Loorbach et al., 2015). Such generic framework can be described as follow: **bottom-up scaling X top-down steering X phase-out X reflexive institutionalisation** (Loorbach, 2016). To enable bottom-up scaling, **governments can connect, legitimate and empower transitioning actors by creating an enabling environment and mainstreaming their transformative innovations**. To do so, we need officials that become embedded governmental agents working with innovation networks, cooperatives, arenas (Loorbach, 2014). For top-down steering they can **prioritise the transition in their agendas, reframe their analysis of the problems using system analysis in a participatory way**. Phasing-out requires them to **stop unsustainable practices, while reflexive institutionalisation requires to embed emerging new structures as the new mainstream**, and to review regularly the institutional system in place to assess whether it remains relevant as time and things change.

4.4 FoTERRIS propositions for a co-RRI based reorganisation of the R&I system

4.4.1 A new Co-RRI policy...

In a co-RRI system, the main priority cannot be market innovation. **Therefore, the goal of European R&I systems should be to make the European society strongly sustainable, especially by meeting the UN Sustainable Development Goals**. Therefore, R&I activities should aim at changing the ways societies are organised, produce and consume, and at determining these new ways (new practices, new economic models, new production models, etc.).

Co-RRI principles should frame the R&I system, although leaving place to get back to current practices when they are more appropriate. To achieve this goal, a core activity of the R&I system would be to understand the root causes of the current unsustainability of our societies.

The kind of policy that is needed to meet this goal is yet to be thought about. In any case, it would include clear and long-term agendas, and should be systemic (addressing all the elements of the R&I system, at each of its levels – regional, national, European). Indeed, there is no sense to fund single projects to define

new RRI instruments. The current system is far from a co-RRI system, and therefore, few and isolated RRI instruments have no chance to transform it towards more co-RRIness.

As such, we recommend creating a working group on a co-RRI policy. This working group should be composed of actors from the quadruple helix, from different levels (regional, national, European). Its main role would be to think about what kind of co-RRI policy would be the most appropriate to change the goal of the European system and to meet the new, sustainability-based, goal. This group would therefore think about the content of the policy, and whether it should be one that substitutes to the current one, or one that is integrated to existing ones, etc. It would also reflect on how to overcome the political resistance that for sure will raise against such co-RRI policy.

Actors to be part of this working group include:

- European bodies (Commission, Parliament, Council)
- European R&I actors (DG R&I, all DGs related to sustainability, JRC, ERC, REA, EPSC, ERA, Experts groups, Smart Specialisation Platforms, EIC, EITs, ETPs, structural funds, joint partnerships, ...)
- MSS' ministries and affiliates on R&I and all related to sustainability
- Local governments
- Main Research and Innovation Funding Organisations, PROs, HEIs
- Market actors such as R&D-intensive companies, private financiers (banks, investors, etc.)
- Niche actors (independent R&I centres, sustainable communities, science shops, citizen science association, etc.)
- Civil society

This working group should work in a transparent and equal manner: there should be no power inequalities to make decisions on a democratic basis. To do that, a third-party organisation could be mandated as a neutral party and would arbitrate the decision-making processes. In addition, this working group should extensively consult with actors not directly involved in it. The elaboration of this co-RRI policy should be terminated **before 2020 to feed the next framework programme.**

4.4.2 ... With appropriate policy instruments

This co-RRI policy could include the following policy instruments:

- **The innovation principle could be reviewed**, in order to put more emphasis on the types of innovation that the co-RRI concept asks for
- **New funding and financing instruments** (see section 4.4.3)
- Development of **'co-RRI' training and education**, especially in HEIs, with the requirement to validate a certain number of 'co-RRI' based ECTS; but also, for all R&I actors (incumbent, niches, public, private, etc.). This education would also aim at changing mindsets
- Granting **legal authorisation** to new HEI, PRO, etc. on their respect of co-RRI principles
- **Regulation** on private actors so that they engage in collaborative approach and develop co-RRI projects instead of close R&D activities
- **New missions** for HEIs, RPOs, aligned with the new co-RRI policy. For example, the concept of Civic University could be the new mission of HEIs
- Development of **knowledge vouchers and rewarding and compensation strategies**
- **Services and support**, such as the ones developed for entrepreneurs, start-ups, etc. The design of the co-RRI policy should ask R&I actors what they would need to implement the co-RRI policy. **Their needs could then be met by policy support instruments**

4.4.3 Reorganisation of money flows: a new funding and financing system (DOA specific)

4.4.3.1 Purposes of the co-RRR public funding system

The content of these new funding instruments should be decided by the co-RRR policy. The examples of funds for ground-breaking research could be an inspiration (section 4.1.4). In any case, some of these new funds should be dedicated to targeting 'real life situations' and fund **experimental and interdisciplinary co-RRR approaches, to allow testing new ideas on a small scale**. They should encourage **risk-taking attitude and non-mainstream R&I subjects**, such as the innovation of the economic model itself.

Overall, **the funds should be orientated towards practical and context-based solutions to grand challenges**, instead of being orientated towards knowledge mass production. They should **fund the development of new socio-economic models** (such as the Commons model), and cooperation among quadruple helix actors (in a different and more optimised ways than the current Coordination Support Actions). Some funds could also serve to fund the **establishment /institutionalisation** of solutions to grand societal challenges, especially when the solution is based on a different economic / value model.

Next Framework Programme

On the design of FP9, we particularly agree on the following points developed by M. Mazzucato (Mazzucato, 2018):

- Grand societal challenges cannot be solved by scientific and technological solutions only
- Participatory process to select the missions
- Cross disciplinary missions and projects
- Multiple-bottom-up solutions
- Flexibility, pro-active management and building in-house capabilities
- Engagement of diverse national and regional stakeholders
- Escaping the narrow market failure to adopt a market co-creation approach
 - On this last point however, the co-RRR concept goes further, the emphasis should not be on markets, but on the goals of the R&I system, which is to be decided upon when developing the co-RRR policy.

We therefore support this Mission approach for FP9. **However, we recommend that the next framework programme is based upon the co-RRR policy**, and that missions address the root causes of the problems they aim to solve. For example, the 'A plastic-free ocean' mission (Figure 2) does not address the root cause of why there is plastic in the oceans.

4.4.3.2 Funding and financing instruments for co-RRR

Long-term and flexible funding mechanisms are required so that long-term societal change can become the main goal of R&I actors. It would be also necessary to fund **reflexive processes**, to make sure that the grand societal challenges are effectively being solved. A way to do so would be to reserve a certain percentage of institutional funding especially for reflexive activities.

In H2020, R&I projects offer isolated and fragmented answers to the grand challenges, and the Coordination Support Actions have not the capabilities to overcome this fragmentation. **Funds as well should be less fragmented**.

Funds for career development should be adapted to support researchers that undertake co-RRR projects.

As suggested by Goddard (Goddard, 2009), **a special pot of institutional funding, linked to a label**, could be dedicated to HEIs, RPOs, that meet certain co-RRR criteria.

Crowdfinancing and crowdfunding could be further supported by policy, as suggested by (Jakimowicz et al., 2017). As we have seen in section 4.2, there exist crowdfunding and crowdfinancing platforms that are compatible with co-RRR values.

In order to incentivise co-RRR projects, **tax incentives** could be given, on the same principle than currently, but based on co-RRR criteria.

In any case, the logic of a monetary return on investment should be discarded when financially supporting co-RRR projects. To support local innovation, the **Social Value Exchange** (section 4.1.4) platform could be generalised to other MSs than the UK.

In order to not destabilise the system, we could imagine that, in the next years, 60% of the funding (GBARD) remains as it is now. The remaining 40% would be dedicated to new funding instruments, aligned with the co-RRR policy. This 60% -40% distribution should change as time goes on, and the new funding instruments should then take priority.

Co-RRR funding criteria and evaluation processes

To incentivise co-RRR initiatives, the **funding rate could vary** according to the proposal's performance against ex-ante co-RRR criteria. For example, a proposal that would not match all co-RRR criteria could be funded less than 100%.

R&I performers could be asked to prove that they have changed their institutional settings in favour of co-RRR in order to receive a percentage of their usual institutional funding.

Elaboration of project funding programmes by funding organisations

How to identify scientific priorities and define type and mode of research and innovation expected

While this would be investigated by the co-RRR policy, **a more iterative and collaborative approach** could be taken for this step (such as the milestones approach suggested by (RAND, 2013)).

How to define procedures and rules for submitting proposals

To increase transparency, ex-post evaluations in project-funding could be published in **open access**, so that practitioners would know better what is expected from them, and they would increase their success rate.

Instead of dividing budget allocations in predefined shares of funding for specific calls, the contrary could be done: proposals could be called, and then, based on the evaluation of the proposals, funding would be allocated to the selected ones. However, funding could still be provided for the proposal writing phase.

To define calls, **the logic of interaction with the funding body and cooperation among proposers should prevail**, as presented by RAND (RAND, 2013), and implemented by So Science (Annex 4).

To open-up the R&I system, funding could be opened to more types of actors, when it is not already the case.

How to define procedures and criteria for proposals evaluation and selection

Project-funding could be allocated based on the following ex-ante criteria, by an interdisciplinary decision-making body:

- **Systemic analysis** of the problem at stake
- **Inclusive and collaborative** methodology
- **Deep sustainability**
- Capacity to be implemented and **effectively delivering a solution**
- **Context-based**

- An analysis, similar to the life-cycle analysis approach, of the solutions proposed and a benchmark against other type of solutions possible, in order to be sure that the solutions to be delivered will **maximise social and environmental values**
- **Engagement of societal stakeholders**
- **Transdisciplinary**

4.4.4 Reorganisation of the evaluation and reputation system (DOA specific)

4.4.4.1 Evaluation metrics compatible with co-RRR

Quantitative indicators based on measuring productivity have long been used because data was available. However, current indicators do not indicate at all how societal challenges are met. Therefore, it would be better to use qualitative indicators, that may not be as precise, but would have a better utility. Peer-review should also remain the main way to evaluate R&I performers, instead of metrics. **Especially, bibliometrics should not constitute the primary criteria.** Instead, new criteria could include:

- For researchers:
 - Participation in co-RRR projects
 - Number of open access publications and archiving in open access repositories
 - **Qualitative assessment of how one's field of research is contributing to solving a (part of a) grand societal challenge.** For example, creation of knowledge that broadens the options to society (**options value**)
 - **Search for systemic answers**, use of interdisciplinary/ transdisciplinary approaches
- For structural supply organisations (HEIs, UPROs, PROs)
 - MoRRR indicators
 - Number of open access publications
 - **Institutional settings for co-RRR**
 - Courses dealing with the co-RRR principles
 - **Collaboration with local communities and outreach**
 - Sustainability ranking, as developed by (Shi & Lai, 2013)
 - Involvement of stakeholders in peer review processes
 - Presence of a unit for societal engagement
- For evaluating the system as a whole: again, the indicators through which national and European R&I systems have nothing to do with the solving of the grand societal challenges. We recommend instead the following indicators:
 - **% of GBARD and private expenses dedicated to co-RRR projects**
 - Number of open access publications
 - **Number and types of quadruple helix collaborations**
 - Number of R&I performers that know about co-RRR and have been trained to
 - **Number of co-RRR solutions implemented and viable**

As for funding, these **new criteria should be further supported by the co-RRR policy.** An iterative approach when developed them is more likely to be efficient. New criteria should be robust, humble, transparent, diverse, and reflexive (Wilsdon, 2015), context-based and designed according to the co-RRR policy objectives and the objectives of the activities being evaluated (Science Europe, 2017) and should emphasise the societal and environmental values of the R&I projects. **Ultimately, institutional performance-based funding on productivity indicators should be stopped.**

4.4.4.2 Reputation and valorisation of outputs

Many prizes exist to reward excellent researchers and creative entrepreneurs, but very few exist for rewarding R&I actors that carry out co-RRR projects. Such prizes could be collaborative instead of focusing on single individuals. Prizes could reward HEIs that are the most grounded in their context, or solutions

elaborated by quadruple helix collaborations, that have been implemented and viable. Labels could constitute an additional way to reward co-RRI performers.

Institutionalisation of co-RRI solutions is absolutely paramount. It is a waste of resources to see that solutions have developed but their main valorisation is concretely restraint and consists mostly in a publication that is even not read by policy-makers (that is the case of thousands of articles that propose new alternatives but have only an academic value).

Obviously, open access should become the norm. Public journals for co-RRI could be created, instead of private ones.

4.4.5 Functional organisation in a co-RRI system

As there exist many organisations for supporting market-based innovation (such as Technology platforms, RTOs), **new organisations, embodying the co-RRI concept should be developed.** They should be hybrid (having both public and private actors) and have the characteristics defined by transition management studies (section 4.3), such as: free spaces for transdisciplinarity, learning, experimenting, building networks and communities, reflecting. **These organisations should aim at increasing the information flow and collaboration between all quadruple helix actors and regime/change actors.** Potential candidates for such role are the innovation ecosystems that embody smart specialisations strategies, cities and regions, ex-situ researchers who can connect the local solutions with higher levels. At the European policy level, all DGS related to sustainability could interact more to align their policies and instruments. **It is paramount that R&I actors are given the power to self-organise to create the co-RRI system.** The creation and running of these new bodies should absolutely not be done in a top-down way as before. In order to increase the cohesion of different projects and initiatives, a coordinating entity could be created. However, it should only coordinate and support, and not direct in a top-down way.

Heinze's recommendations could orientate the management of R&I organisations (Heinze, 2008)

- freedom to define and pursue individual scientific interests
- facilitative group leadership
- small group size
- an organisational context that includes a complementary variety of scientific skills and instrumentation
- organisational arrangements that support unplanned multidisciplinary contact
- the presence of a guiding research vision and scientific reputation. These factors together make up an environment conducive to creative research
- New agency for ground-breaking research

5 Rewarding and Compensation strategies for external participants in co-RRI activities

The FoTERRIS project revolved around a series of **Transition Experiments (TE)**, which served to test the co-RRI concept and methods developed. The experiments were run by FoTERRIS competence cells. There was one cell for each of the following partners: CESIE (Italy), ESSRG (Hungary), IFZ (Austria), UCM (Spain), VITO (Belgium). The experiments consisted in a series of workshops, where the competence cells members (FoTERRIS partners and sometimes invited stakeholders) **invited external participants to elaborate an idea/concept of a co-RRI project**, via specific FoTERRIS methods. To read about these experiments, see Deliverables D3.1, D3.2 and D3.3¹⁰. The DOA asked for the development of a **rewarding and compensation strategy** to make the respective contributions of these external participants visible, to value their efforts and to compensate for the time and resources they invested in these experiments. Also, these strategies aimed at developing **new interactions between formal and informal stakeholders of the R&I system**.

Based on a literature review, a first section presents an analysis of the ins and outs of rewarding and compensating external participants in R&I activities. The second section completes this analysis with a presentation of the most found strategies in the literature. The third section presents the strategies defined and implemented for each of the transition experiment, while the fourth section gives the feedback of FoTERRIS partners and elaborates on advice and recommendations for those who would like to set rewarding & compensation strategies for their co-RRI activities that involve external participants.

FoTERRIS partners were asked to fill in a questionnaire (Annex 2) to report on how they chose and implemented the strategies. These results have been completed with a report by Muntuit (subcontracted by VITO) which deals with alternative forms of compensation such as knowledge vouchers, and by interviews with researchers from the [MNHN](#), [CETAF](#) and [PUSH](#) (Annexes 4 and 5) involved in co-creation projects.

Defining rewarding and compensation strategies

Before starting with section, we present how we have conceptualised these strategies.

The DOA says:

- *“Rewarding and compensation strategies will be developed in order to reward each stakeholder participating in co-RRI projects”*
- *“FoTERRIS will elaborate a rewarding strategy that will suggest ways to make the respective contributions of the various stakeholders visible and to value their efforts”*
- *“The R&C strategy is meant a) to evaluate, acknowledge and make visible the societal value of knowledge actors’ contributions and b) to compensate knowledge participants for the time and other resources they invested in a co-RRI project. The rewarding strategy can function as a basis to measure the ‘innovation excellence’ of respective contributions”*

From this, we have distinguished several types of rewarding and compensation strategies, to cover all the DOA’s expectations, which are:

- Participants should be compensated for the resources they invest in the project
- Participants should be rewarded for their participation
- Participation should be acknowledged and valued
- Participation is meant to be evaluated

¹⁰ <http://fottris-h2020.eu/deliverables/>

We present below the different types of rewarding and compensation strategies that we have distinguished:

- **Remuneration.** Participants receive a monetary compensation in national currency. The amount of the compensation can be decided on a “salary/wage” logic or a “market” logic;
- **Compensation.** It corresponds mainly to in kind compensation but can also take the shape of financial compensation. It differentiates from remuneration by the amount of money or the use of complementary currencies;
- **Respect of ownership.** In the name of intellectual property (IP) law, participants may have the right to claim ownership of the products/solutions as the fruits of their labours. In all cases, it seems logic to let participants claim some part of the value created based on their contributions. The distribution of this ownership can be realized on an egalitarian logic or according the level of participants’ contribution. This form of compensation gathers together different practices: redistribution of monetary benefits, quotation of participants as co-author, IP licence, etc;
- **System-esteem.** The R&I system can recognise stakeholder’s contribution by conveying them the results gained thanks to their participation. Another way is to inform participants on their capability to produce consistent data/knowledge;
- **Reward.** Because of their exceptional contribution, some participants may receive an additional gratification, which goes beyond mere compensation. It indicates a special achievement within the project and can take the form of a citation in a newsletter, a certification of gratification, etc.
- **Systems to match compensation with the “value” contributed:** referring to the DOA’s expectation of basing reward/compensation on an evaluation of participation, we have included in the reward/compensation strategies new systems that allow to evaluate one’s contribution and reward/compensate accordingly

All strategies (but the knowledge voucher developed by Muntuit and VITO) have been described through a generic template as shown in Figure 5).

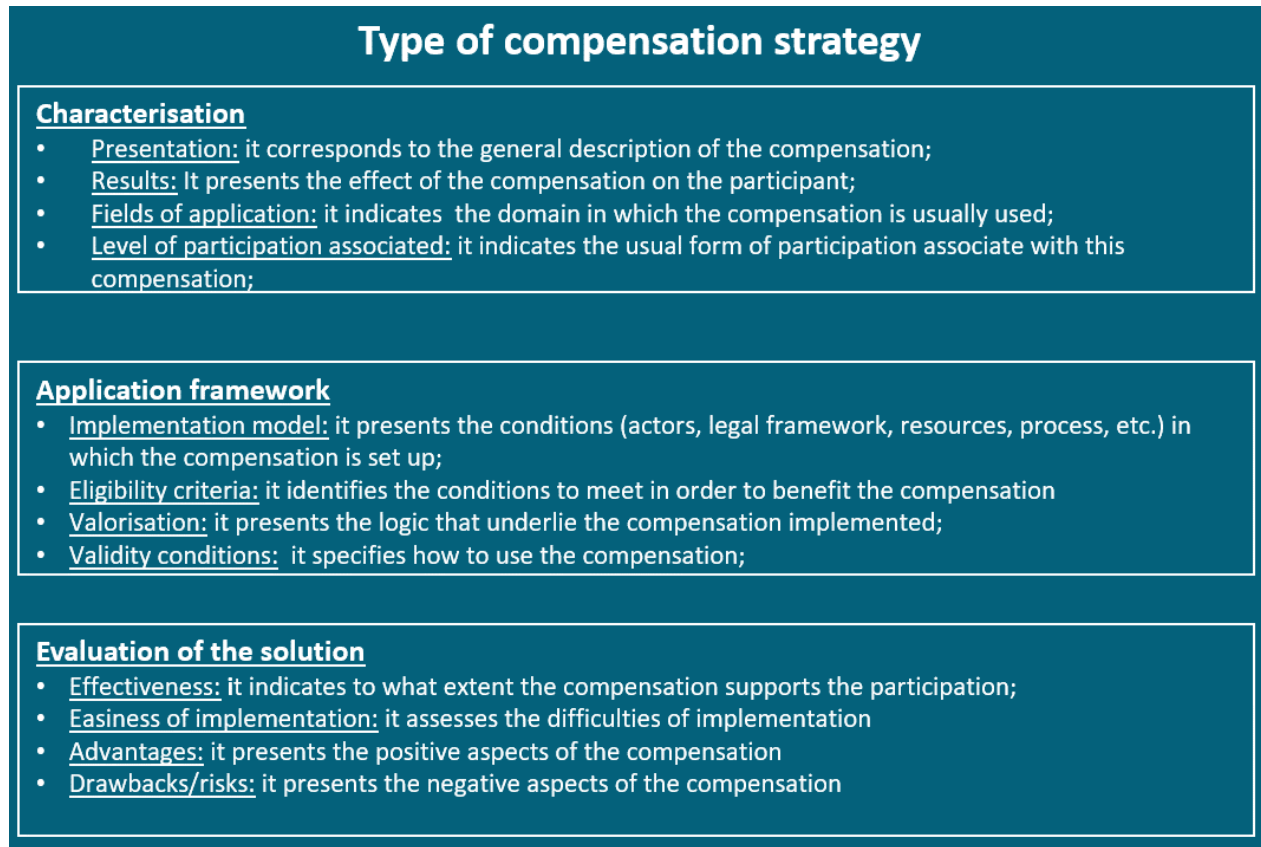


Figure 5: type of compensation strategy

Table 10: summary of rewarding & compensation strategies studied

Example of rewarding & compensation strategies	Type of rewarding & compensation strategies
Found in the literature	
Market model	Remuneration
Wage model	
Reimbursement	Compensation
Lottery	
Knowledge currencies: insights from Muntuit & Witcoin	
In-kind compensation	
Access to results	Compensation/ respect of ownership
Quoting participants as co-authors	Respect of ownership
Intellectual Property schemes	
Thanking participants & regular updating	System-esteem
Communicating about results and their use	
Certification / academic credits	Reward
Invitation to a conference	
Blockchains & Sensorica	Systems to match compensation with the “value” contributed
As experimented in the Transition Experiments (TE)	
Austrian TE	Remuneration + reimbursement+ system-esteem
Belgium TE: knowledge voucher	Compensation + system-esteem
Hungarian TE	Compensation + system-esteem
Italian TE	Compensation + system-esteem
Spanish TE	System-esteem

5.1 Participation of external actors in R&I

Participation of external actors in R&I is not, as perhaps it is believed, a recent practice that emerged in the last decades. Before the professionalisation of science at the end of the 19th century, scientific researches were not only conducted by professional astronomers, oceanographers or naturalists but by amateur observers. Monks and sailors compiled information on nature, climate events or cartography for centuries. As an example, Christopher Columbus kept his logbooks up-to-date during his journeys (Wheeler, 2005). After a lull during the 20th century, participatory science enjoyed recently a new lease of life under a large variety of approaches. Under different names – citizen science, open science, citizen research, community-based research, etc. – **participatory science sprouts out through different kinds of forms, initiatives and projects in both research and innovation area.**

5.1.1 Reasons to involve external actors in R&I

Through different points of view, this section develops arguments to support the involvement of external actors in R&I.

Opening new fields of research

Although it may state the obvious, the involvement of external actors in R&I opened new perspectives in science. It is particularly true in medicine. For instance, thousands of molecules are tested on human guinea pigs to validate the medication circuit of future drugs. This approach that considered human as object of research prevailed for a long time. Today, the involvement of external actors in R&I takes different forms in a variety of fields (life sciences, technical sciences, social sciences, etc.). **Even if it appears negligible compared to the number of publications in conventional research, it is interesting to note the exponential growth of publication resulting from co-creation projects since the 2000s** (Houiller, 2016).

Increasing efficiency & capabilities for all the stakeholders

R&I projects involving external actors often create win-win experiences which benefits to both the participants and the researchers. **First, participation augments considerably the researcher's observation and analysis capabilities.** Whether it is only the collection of data or the provision of new skills, the scientist enjoys a multitude of resources across time and space. This approach can lead to incredible results.

Developed by the University of Washington in 2008, Foldit, an online video game about protein folding, exceeded all expectations. In a matter of ten days, gamers were able to “decipher the structure of a protein called retroviral protease, an enzyme that is key to the way HIV multiplies” (Armstrong Moore, 2011). The 60,000 participants achieved an important breakthrough in a few days where biochemists have been failing for a decade. Success stories in participatory science does not concern only the medical domain. Since 2007, Galaxy Zoo is a crowdsourced astronomy project that enable amateurs to classify galaxies.

Secondly, this approach does not imply an important additional charge in the budget. The different forms of compensation – examined in the next sections – enable numerous rewarding strategies that usually limit the cost of participation. The quality of the data collected by the participants is an argument often mentioned by researchers involved in participatory science. In light of quantity and quality of the information obtained, this approach seems beneficial for researchers. Participants all stand to gain from participatory science. Among all its possible benefits, “the most remarked upon and most important aspect of participation is its educative potential” (Kelty & Panofsky, 2014): **“One of the easiest way for the researchers to positively influence non-academic stakeholders is the knowledge transfer.** That one is commonly defined as a process in which knowledge is transmitted unidirectionally from academics to external stakeholders, who benefit by using such knowledge for their own objectives” (Rossi & Rosli, 2015).

Participants, whoever he is a novice or a devotee, gain knowledge upon contacts with professional researchers. The share of information or the appropriation of a scientific protocol contribute to increase everyone's knowledge.

The benefits of co-production of knowledge and co-creation

Co-creation has emerged due to the coincidence of several developments: the mainstream adoption of internet technologies, the orientation towards services and experiences, an open approach to innovation (Chesbrough, 2015) and the growth of social, collaboration and customization technologies. These are all relatively recent developments, but co-creation did not appear fully formed after its announcement by (Prahalad & Ramaswamy, 2004). Co-creation has rich and diverse roots that stretch back into the Twentieth Century. Rather than adopting a narrow view of the concept, our argument is that the diversity of co-creation's heritage should be recognised by bringing together psychotherapy, management science, innovation and open innovation, design, literary theory and creative practice.

Defined as a management initiative, or form of economic strategy, the co-creation approach brings different parties together (for instance, a company and a group of customers), **in order to jointly produce a mutually valued outcome**. It brings the unique blend of ideas from direct customers or viewers (who are not the direct users of the product) which in turn gives a plethora of new ideas to the organisation (Prahalad & Ramaswamy, 2004) (Ind & Coates, 2013).

In participatory design

Involving end users leads to more relevant and usable products and services, while reducing risk. This implies a willingness to engage with participants and incorporate their suggestions for the benefit of the user and the organisation. Participatory design (like design thinking) can involve the development of iterative prototypes as a means of testing user reactions (Ind & Coates, 2013).

In literature

From literary theory - meaning is co-created and interpretation is a two-way process. While there is authorial (or organisational) intent in creating something, meaning emerges as the idea is used and in the conversations that recipients have with each other and the organisation in naturally occurring communities, face-to-face interactions, and organisation-led interventions (Ind & Coates, 2013).

In the open source community

Usually starting an interaction with a gift produces more generous returns. Giving something to people that creates meaning or utility generates reciprocal behaviour and strengthens the sense of community. People are willing then to share their personal experiences and opinions for intrinsic benefits associated with participation (Ind & Coates, 2013).

In psychotherapy

From psychotherapy – the answer or insight isn't already out there waiting, it has to be discovered with others. It is the process of co-creation and the co-discovery through interaction (Shotter, 2006) that generates new ways of seeing the world and leads to the opportunity for self-development.

In R&I

In R&I, many studies confirm that co-production processes, which include both stakeholders and academics, **produce clearer understanding for all the parties involved and results beyond academia**. In fact, as we will explain further, different experts state that including researchers impact the entirety of the community they are working with. "This impact can be measured in serendipitous findings and strong co-production of knowledge benefiting many stakeholders in ways that often cannot be anticipated and unfolds and persist over a long period" (Rossi, Rosli, & Yip, 2017).

A growing number of studies exploring the connection between management research and practice are investigating how the interactions between academic and practitioners work (Knight & Pettigrew, 2007). **“The evidence suggests that such interactions involve the co-production of knowledge rather than a simple transfer of knowledge from one party to another”** (Antonacopoulou, 2010). In knowledge co-production, all stakeholders are active participants in a process of knowledge construction, validation and adaptation (Brudney & England, 1983).

So, the impact of knowledge processes depends heavily on ongoing interactions among highly committed participants who purposefully engage in deep interactions to generate new knowledge collaboratively with many potential stakeholders, since the intangible benefits can be easily dispersed otherwise. **Studies show that these knowledge co-production processes affect many stakeholders in unforeseeable ways since they largely depend on contingencies and serendipitous events.** This also highlights the difficulty of identifying and quantifying impact, reflecting the complex problems addressed by management science (Anderson et al., 2017). The studies seem to confirm that impact emerges and persists beyond the duration of the initial engagement, with many of the immediate outcomes designed at the beginning of the collaboration, but with the most significant impact emerging and persisting over a longer time as the cumulative outcome of many unanticipated interactions.

Also, breakthroughs often come from ‘group genius’ not lone epiphanies. Innovations since the renaissance have been dominantly generated by groups (Johnson 2010). This does not deny the creativity of exceptional individuals, but beneath the surface of the claims of individuals lies the involvement of others (Ind & Coates, 2013).

Creating new social configurations that are necessary to solve the grand societal challenges

Nowadays, **a more democratic approach to scientific research** is needed in order to solve “wicked” (climate change, immigration, equality, etc.) issues that have a high number of stakeholders, impacts, interdependencies and uncertainties (Rittel, 1973) (Hirsch Hadorn, 2008); Weichselgartner and Truffer, 2015). Co-creation seems the most effective approach to develop win-win solutions. Dialogue, attentiveness and consultations lead to compromise that unite all the stakeholders.

Tailoring innovation to the beneficiaries’ needs

Co-created value arises in the form of personalised, unique experiences for the customer (value-in-use) and ongoing revenue, learning and enhanced market performance drivers for the firm (loyalty, relationships, customer word of mouth). Value is co-created with customers if and when a customer is able to personalise his or her experience using a firm's product-service proposition – in the lifetime of its use – to a level that is best suited to get his or her job(s) or tasks done and which allows the firm to derive greater value from its product-service investment in the form of new knowledge, higher revenues/profitability and/or superior brand value/loyalty.

Democratising R&I

In addition to the gain of knowledge, the participation of external actors in R&I has the potential to redistribute the cards within the classic R&I system. The old paradigm “participants as an object of research” becomes more and more outdated. It is interesting to note the thrust of new paradigm: **“participants as an actor of research”**. Participatory science assumes then a democratic dimension by reducing the gap between researchers and members of the civil society. It contributes globally to more transparency which results in a climate of trust among all the stakeholders. This new approach of research meets a need of citizen who “wish to be further consulted on the debates and issues of the research” (Morin, 2016).

Regardless of the level of participation, the role of researchers changes in participatory projects. The image of researcher as a hermit isolated in his laboratory is even falsier in participatory science where they

become “learners, facilitators and catalysts” (Cornwall et Jewkes 1995). Another difference highlighted by Cornwall and Jewkes concerns the methodology. Contrary to the rigid design of protocol in conventional science, the methodology implemented in participatory research are “reflexive, flexible and iterative”. Such features are necessary to compromise with the diversity of stakeholders involved in participatory science.

5.1.2 *Characterising participation in R&I*

Usually, one hears about participatory & citizen sciences in research. However, participation of external actors exists also in innovation. A definition including participation in both Research & Innovation projects is lacking. That is why, in the following sections, we will use the expression “participation of external actors in R&I”, to cover all types of participation in R&I (therefore including participation in clinical trials, sociological studies, etc.).

Because participation of external actors in R&I “covers a welter of approaches, domains and applications” (Cornwall & Jewkes, 1995), it is almost a catch-all concept that is difficult to clearly define. Ranging to volunteered computing to data analysis and involving a great diversity of actors, it is difficult to find its bearings. Nonetheless, **the objective of this section is to propose a categorisation of R&I projects involving external participants**. Before this categorisation, we propose an overview of the participants’ profiles.

An overview of who engages in R&I (as external participants) and why - the great diversity of R&I projects in its domains and applications makes impossible to draw the typical profile of participants involved in participatory projects. Only the identification of categories seems possible:

Invulnerable types of participants	Vulnerable types of participants (who may need an authorisation from a legal representative to participate):
○ Novices ○ Enthusiasts ○ Local inhabitants ○ Elected representatives ○ Students ○ Professionals ○ Companies ○ Public institutions ○ NGO ○ Communities	○ Children ○ Patients ○ Pupils ○ Prisoners

It is interesting to note the **general diversity of profiles among participants**. Heterogeneity in term of gender, age, geographical localisation and background is often the norm in participatory project. Similarly, although it is impossible to connect a specific type of motivation with a category of participants, **different reasons explain why stakeholders take part in participatory research**. According to a survey on participatory science realized in France in 2016 (Mercier & Dusseaux, 2016), it is possible to rank the participants’ motivations:

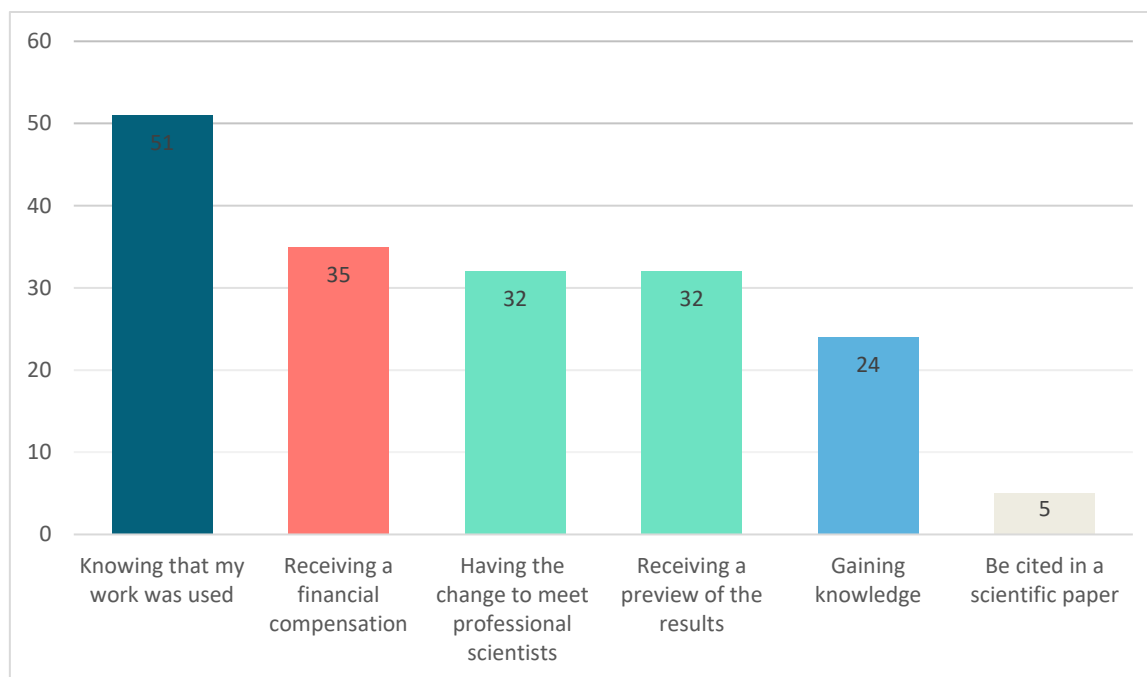


Figure 6: Results (%) of a survey asking participants their motivations to engage in participatory science from (Mercier & Dusseaux, 2016)

The results of this opinion pool are not completely aligned with the insights gained from the TE:

According to the questionnaire on R&C strategies, participants in the FoTERRIS experiments were firstly motivated by the gain of knowledge and by the hope of solving an issue. According to a professional researcher in the [MNHN](#) that we interviewed (see Annex 5) about the motivations of the participants involved in their participatory science projects, the main drivers are also the desire to contribute to science and to gain knowledge. Feedbacks from participants highlighted the desire to help researchers. Contrary to the results of the survey, participants very rarely raised questions about the financial compensation of their contributions. The financial aspect does not seem as important as indicated.

Categorisation of R&I projects with external participants - for categorising R&I projects that involve external participants, we have distinguished 4 dimensions:

- Who the beneficiaries are;
- Who is initiating the project;
- The level of participation;
- Where the project geographically takes place.

Who the beneficiaries are:

This dimension distinguishes projects which address the needs/problems of a given group, from other projects for which it is more difficult to find direct/specific beneficiaries. Some examples for these two categories are provided below:

- Projects that address the needs/problems of a given group
 - User-driven innovation projects;
 - Clinical trials and projects for specific diseases;
 - Austrian, Hungarian, Italian and Spanish Transition Experiments;
- Projects with “wider” beneficiaries
 - Participatory projects in biodiversity;
 - NASA crowdsourcing projects.

Who is initiating the project:

While it is not so common, it is possible to imagine that the researcher or the innovator is not the only one who initiates a R&I project. Even, amongst the possible roles of a competence cell, it has been proposed that a competence cell could just act as a facilitator for groups/individuals willing to build a co-RRRI project. In that case, the ones initiating would be the groups/individual, and the cell would only have a supporting role.

- Projects where the initiators are the researcher(s)/innovator(s):
 - Spanish transition experiment
 - Foldit
- Projects where the initiators are not the researcher(s)/innovator(s):
 - Projects developed via So Science

The level of participation:

Five levels of participation are distinguished, stemming from the literature on participatory science. Houllier (Houllier, 2016) defines participatory science as “a form of production of scientific knowledge involving individuals and/or groups of non-professional researchers “. Cornwall and Jewkes (Cornwall et Jewkes 1995) adopted a different approach by comparing participatory science and conventional research. According to them, the first difference concerns the “alignment of power within the research process”. The cursor is not anymore focused only on the professional researcher but also on alternative stakeholders who takes part in the project by defining the problem, providing data and generating ideas. Depending on their level of participation, non-professional researchers have more or less a firm grip on the project. Based partly on Arnstein’s (Arnstein, 1969) work, Haklay (Haklay, 2013) proposed a ladder of participation ranking the different degrees of participant involvement, on which we elaborated the following ladder of participation in R&I projects.

Table 11: Level of participation in R&I projects based on Haklay 2013 and Arnstein 1969

Levels of participation	
Level 5: “extreme”	Collaborative Science – problem, data collection and analysis
Level 4: “participatory science”	Participation in problem definition and data collection
Level 3: “distributed intelligence”	Citizens as basic interpreters (Foldit)
Level 2: “crowdsourcing”	Citizens as sensors (volunteered computing)
Level 1: “passive”	External participants are the data themselves

“**Passive**” corresponds to the most limited mode of participation. Under the logic, “participant as the object of R&I project”, this approach considers the participant as a data. It is particularly true in medical science especially in clinical trials.

Akin to volunteered computing, “**crowdsourcing**” offers to professional researchers/innovators a certain level of control over the experiment and the quality of the data provided. The compensation for this relative control and reliability is the low-added value for the participants who would gain only little knowledge during the experiment/workshops.

The cognitive capacity of participants is further solicited in “**distributed intelligence**” project. Just like in the Foldit game (described above), the participants collect data and carry out simple analysis. Although it is a more collaborative approach, this level of participatory generally ensures the control of the data quality by the supervising team.

In the next level “**participatory science**”, the role and the influence of the participants are really marked.

Though they take part in the definition of the research problem and the construction of the methodology, they are not completely autonomous. Nonetheless, their level of expertise become high enough to let them suggest new research questions, innovation, business models and hypothesis to the professionals. Almost equal to equal, professional and non-professional researchers/innovators work hand in hand at the “**extreme**” participation level. Deciding together about the nature of the research problem and the scientific protocol, the participants assist the scientists in the analysis, the publication and the utilisation of the results.

Where the project takes place:

Another dimension to categorise R&I projects involving external participation, is whether the project has a local or broader geographical scope.

- Projects with a broad geographical scope:
 - Foldit
 - Royal Society for the protection of birds
- Projects with a local geographical scope:
 - Austrian, Belgian, Hungarian, Italian transition experiments

Projects with a local scope have the potential to galvanise the local commercial base and guarantee a productive territory development. It contributes to increase the resilience of a territory defined by Rebotier (2007) as “the ability of a social space to recover from disturbance and reduce impacts expected during a future disturbance”. **Indeed, by involving local stakeholders, projects like FoTERRIS enable the acquisition of know-how/skills and the integration of feedback experience in system characteristics that reinforce the territory.**

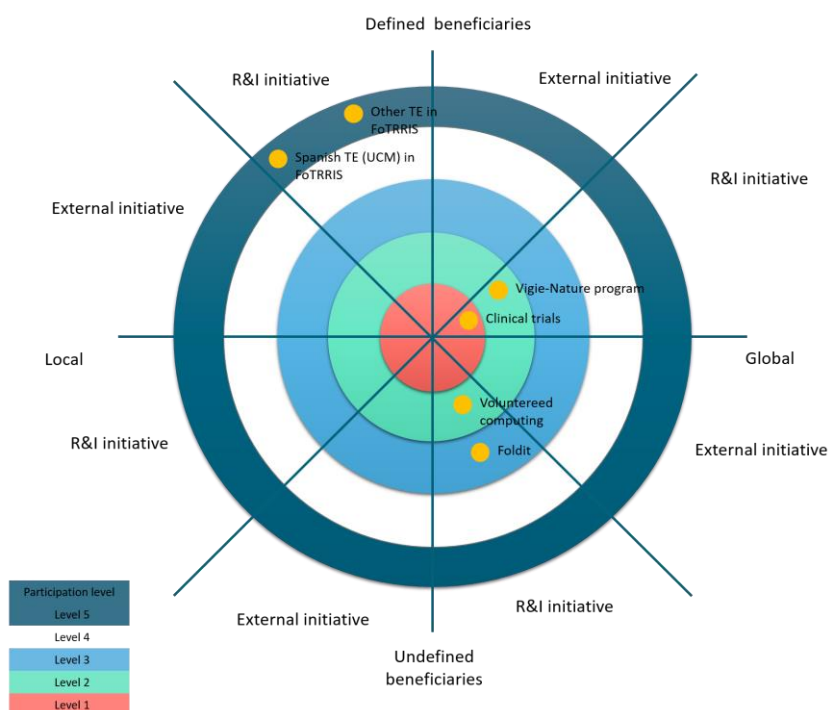


Figure 7: mapping of R&I projects that involve external actors^{11 12}

¹¹ [Vigie Nature](#) developed different programs that involve citizen.

¹² Volunteer computing is a type of distributed computing, “an arrangement in which people, so-called volunteers, provide computing resources to projects, which use the resources to do distributed computing and/or storage” ([source](#))

5.1.3 The ins and outs of Rewarding and Compensation strategies in R&I activities

In this section we present additional insights on the topic of rewarding & compensation, from the literature.

The value of participatory processes in R&I is not yet fully recognised at system level: Even if numbers about scientific publications indicates a rise of participatory research in the course of the last two decades (Houiller, 2016) it remains weak in respect of the absolute value of publications' number. Different types of limit explain the gap between participatory research and conventional research.

Among the most hindrance, it is interesting to note the researchers' reluctance who fear the questioning of their own autonomy. The right of intervention associated with participation could result eventually in researchers censorship (Stephanie, 2016). They also dread the discredit of their profession and more generally the trivialisation of participatory research. The conventional research and innovation system does not always look favourably on participatory research.

Another argument that contributes to participatory R&I bad press concerns quality. The participation of non-experts is, by some, considered as aggravating the risk of invalid data and inadequate methodology.

All that means that there are limited resources and will to provide reward/compensation to external actors in a more systematic fashion at system level. **It shows however, that the concept of rewarding and compensating participants on a fair basis makes sense for all the situations where participants are not treated in a fair way.** Indeed, in certain cases, the contributions of external participants are not truly appreciated, since less valued than contributions from R&I incumbent actors.

Reward/ compensation might endanger R&I projects' quality & integrity:

A counterpart of remuneration & compensation is that it might endanger R&I projects' quality and integrity. The problem is that when attractive reward/compensation is at stake, participants could only come for that, and would neglect to follow the project's methodology and rules since their interest lie in the gains and not in the project itself. This could bias the project's process and results.

Another aspect of systematising reward/compensation is that, in certain cases (especially clinical trials), it might endanger the participant themselves. However, UNCOVER results (European Commission, n.d.-h) draws attention to "publication bias". It is a cognitive bias that drives participants to conceal facts or what they consider as negative results. Taken on an extreme, this reasoning leads to professional guinea pigs that counterfeit their medical files and risk their lives to gain money (Barthélémy, 2015). In the same logic and without becoming totally paranoid, (Henry, 2012) draw the attention on vulnerable population who may undergo undue influence to participate. The more the participatory project involves vulnerable population, the more the researcher should execute his duty of vigilance.

Whereas it is unlikely that co-RRRI project could put some participants at risks, the instrumentalisation of participation, and quality losses should be thought about when developing rewarding & compensation strategies for co-RRRI. In rare cases, rewarding & compensation could be a way to get external participants to engage in a R&I projects whereas this participation is instrumentalised.

How to deal with Intellectual Property in participatory projects:

Associated with the topic of rewarding and compensation, the question of Intellectual Property is relevant in projects which involve external stakeholders. Although it can vary given the local regulatory framework, it is important to note that participation does not always enable the stakeholders to claim for intellectual property rights. It depends on the type of participation and on rules that are decided among the stakeholders of the project. Generally, the simple collection of data by participants is not enough to own IP rights such as copyright. Only when submitting a work that requires creativity, participants may receive a

copyright (Scassa, 2015). Generally, participatory projects do not lead to patentable innovation. However, if that is the case, the share of the patent among all the stakeholders is not automatic. Once again, the concept of creativity is key. Depending on the extent of their participation, stakeholders could be co-inventors only if their contributions contains enough inventive dimensions (Scassa, 2015).

In all cases, it is important to deal with all the IP questions ahead of the project. Logics of transparency and open governance that drive Co-RRR projects concern also the management of IP.

Rewarding & compensation as a way to manage motivation:

Especially within participatory research projects, the main pitfall concerns the motivation of both professional and non-professional participants. Another main obstacle to participation is time and distance (see Annex 5). It is particularly true for citizens or participants who live in isolated areas. Mobilizing a great variety of participants who have different logics and expectations is a challenge for the researcher. To succeed in engaging stakeholders, the researcher must build a climate of trust and let feel the participants indispensable (see Annex 5). Otherwise the collaboration risks to deteriorate rapidly. It is particularly true in countries where the level of confidence regarding institutions is low. Another solution to maintain the motivation of participants is to use incentives, that is rewarding & compensation strategies. For San et al. (San, Theen, & Heng, 2012), “reward is the compensation which an employee receives from an organisation for exchanging of the service offered by the employee or as the return for the work done”. According to Caza et al, rewards include valuable outcomes (based pay, incentives, non-salary benefits, etc.) and serve as a source of motivation for employees.

This is the “motivational” facet of rewarding & compensation strategies: they do not aim first at “being fair” to participants, but at getting their attention throughout the project.

Extrinsic vs. intrinsic motivation:

Experts define extrinsic motivation as “the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself” (Teoa, Limb, & A, 1997). Examples of extrinsic motivation include competing in a contest to win a scholarship or participating in a sport to win awards. Intrinsic motivation corresponds to the “performance of an activity for no apparent reinforcement other than the process of performing the activity per se” (Teoa et al., 1997). The intrinsic motivation is driven by internal desire to participate in activities like playing a game because the participants find it exciting and enjoyable.

Although both forms of motivation can be valuable, researchers draw attention on the context in which it occurs. Daniel (2009) and other researchers have shown their concerns regarding financial rewards.

Because of the over-justification effect, external rewards might contribute to decrease intrinsic motivation of participants and inspire short term thinking and frauds (Morrell, 2011). The choice of relying on intrinsic or extrinsic motivation should be made according to the context and profile of participants.

Monetary vs. non-monetary reward/compensation:

Monetary reward: According to Pink (Pink, 2009), it is an effective form of compensation when “the production processes are not “democratic” and participative and do not involve the community”. Morrell (Morrell, 2011) pointed also at the negative effect as it might contribute to decrease motivation and inspire short term thinking and frauds.

Non-monetary reward: Different schemes of non-financial rewards might engage and motivate employees or people more than monetary ones (Nel et al., 2004). Silverman (Silverman, 2004) states that non-financial recognition can be as simple as “Thank you” by the community to researchers or people involved in the project to acknowledge that they performed well or did something good for the local community. It does not cost anything but may produce enormous benefits.

5.1.4 Legal framework surrounding rewarding & compensation

The **essential of the regulation on rewarding & compensation for participation in R&I concerns clinical trials**. In Europe, EU Clinical Trial Directive (2001/20/EC) and Regulation (536/2014) (European Commission, 2014) decree the ban of incentives or financial inducements to “incapacitated participants or minors (or either of their legally designated representatives), or to pregnant women, except for compensation for expenses and loss of earnings directly related to participation in the clinical trial” (EUPATI, 2015). Except this population, the European regulation does not define an upper limit for compensation. It depends on the sponsor of the study. Member States addressed the situation by defining rules which are heterogeneous. For instance, the French regulation limits to €4,500 (Emery, 2016) per year the total amount received by a participant involved in clinical trials. In Belgium, the cap is €3,500 per year. Furthermore, the collaboration between Member States is near to zero to ensure that participants does not jump from country to another to avoid the waiting period.

Beyond the medical field, few or no regulations seems to be specifically in force. Researchers relies on Ethics Committee and ethic charter, which recommends to “avoid inappropriate or excessive compensation, which would affect the freedom to participate” (Feyereisen, 2011). A bottom-up initiative reviewing practices in terms of compensation would help researchers to determine a fair amount to give to participants.

Derived from reflections and practices in biomedical science, ethical code defined as rules of conduct in the specific socio-cultural context, were developed to protect the participants regardless of their original categories. While not exhaustive, (Goodnough, 2011) suggests that researchers/innovators working with stakeholders should:

Respect human dignity – it requires that R&I “involving humans be conducted in a manner that is sensitive to the inherent worth of all human beings and the respect and consideration that they are due” (Goodnough, 2011).

Respect free and informed consent – it is a process in which the participant a) has received the necessary information expressed in spoken words and writing by the project manager; b) has understood the information provided by the project manager; c) has made the free choice to participate without coercion. To participate in full knowledge of the cause, participant should have received information such as: R&I project description, risks/benefit of participating, alternatives to participation, contacts (person to contact with questions/concerns) and conditions of participation and withdrawal (ICAD, 2011).

Respect vulnerable persons – specific measures to protect those whose decision-making capacity is reduced to avoid induced agreement.

Respect privacy and confidentiality – when the nature of the project allows it, care must be taken to respect the privacy and needs of all participants. Decisions about privacy and confidentiality should result from a negotiation and consensus-building with all the participants.

Minimizing harms & Maximizing benefits – it corresponds to all the measure to “limit risk and maximise participants’ collective and individual benefits” (Sheffield, No date).

Equitable distribution of the burdens and benefits of research – when it is possible, “research participants should be selected fairly, with all segments of the population having an opportunity to be included in a study, provided that inclusion is scientifically and ethically justifiable”

The implementation of a code of ethics is the ethics committee’s responsibility which acts as a watchdog of the research project. Its role is to select participants if necessary and to make sure the ethical principles are respected.

5.2 Overview of rewarding & compensation strategies found in the literature

5.2.1 Remuneration: market model

Remuneration (market model)

Characterisation

- Presentation: following a liberal logic, the amount received by the participant depends on the law of supply and demand. The economic analysis of participation in research is based on the evaluation of costs and benefits;
- Results: the economic analysis of participation in research is based on the evaluation of costs and benefits. Low amount of money will probably attract low-income people or jobless individuals;
- Fields of application: usually applied in clinical trial but it is non-specific to medical field;
- Level of participation associated: non-specific;

Application framework

- Implementation model: the economic analysis of participation by an project management team is based on the evaluation of costs and benefits;
- Eligibility criteria: project's criteria;
- Valorisation: the amount of compensation is decided by the project management team on the cost-benefit evaluation;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: the low amount of money generally associated to market logic compensation should only be considered as factor that feed an existing motivation. The liberalism and unequal dimensions of the market logic may be frowned upon in some participatory project;
- Easiness of implementation: the main obstacle is to assess correctly the cost-benefit that define the amount for participation, it may be wise to check the local legal framework regarding compensation;
- Advantages:
 - It is well-suited to target recruitment numbers
 - It enables less financial sacrifice by participants
 - It leads generally to high completion rate;
- Drawbacks/risks:
 - It results in high compensation amount for projects that are highly selective (scarcity drives up price)
 - Participants may overlook the risks associated with participation

Figure 8: Remuneration (market model) strategy

5.2.2 **Remuneration: wage model**

Remuneration (wage model)

Characterisation

- **Presentation:** following an egalitarian logic, this form of compensation received by each participants is identical and often corresponds to the minimum wage which is applied locally;
- **Results:** comparable in some ways to a normal work, it may lead to a certain professionalisation. It strengthens the idea that participation in research requires little or no skill but does involve time, effort, and discomfort by the participants;
- **Fields of application:** usually applied in clinical trial but it is non-specific to medical field;
- **Level of participation associated:** non-specific;

Application framework

- **Implementation model:** the economic analysis of participation by an project management team is based on the minimum wage applied locally;
- **Eligibility criteria:** project's criteria;
- **Valorisation:** the amount of compensation is function of the minimum wage applied locally;
- **Validity conditions:** none;

Evaluation of the solution

- **Effectiveness:** the amount of money could represent a source of motivation. Especially for low-income or marginalized population;
- **Easiness of implementation:** because of its resemblance with a job, it is important to check the local legal framework;
- **Advantages:**
 - It reduces inter-study competition
 - It reduces discrimination between high- and low- income participants;
- **Drawbacks/risks:**
 - It may be seen as a commercialisation of research participation
 - it reduces risk perception
 - It may lead to professionalisation of participation in research.

Figure 9: Remuneration (wage model) strategy

5.2.3 **Compensation: reimbursement**

Indemnification (Reimbursement model)

Characterisation

- Presentation: following an egalitarian logic, this form of compensation covers the costs associated with the participation such as travel expenses, parking, loss of incomes;
- Results: participants have a complete freedom of choice insofar as the amount of the compensation equals their normal income;
- Fields of application: usually applied in clinical trial but it is non-specific to medical field;
- Level of participation associated: non-specific;

Application framework

- Implementation model: participants should provide the bill of expenses associated with their participation;
- Eligibility criteria: the project management team may decide to refund participants until a certain cap;
- Valorisation: the amount of compensation is function of the participation costs;
- Validity conditions: participants must notify their costs before a potential deadline;

Evaluation of the solution

- Effectiveness: this form of compensation appears to be fair;
- Easiness of implementation: relatively easy to implement;
- Advantages:
 - Participants are less likely to overlook the risks involved in participation
 - It reduces the risk of undue influence
 - It decreases the budget associated with participation;
- Drawbacks/risks:
 - It reduces the chance to recruit a great number of participants
 - It may produce a “selection” bias (researcher would rather recruit low-income people to respect the budget)
 - It may produce competition between participants.

Figure 10: Indemnification strategy (reimbursement model)

5.2.4 **Compensation: lottery**

Lottery

Characterisation

- Presentation: only one or several participants will receive a small amount of money or an in-kind form of compensation;
- Results: the probability to win is generally not sufficient to trigger the participation;
- Fields of application: probably not practicable in clinical trial or co-creation projects;
- Level of participation associated: non-specific;

Application framework

- Implementation model: ahead of the research project, the research should assign a number to each participant and inform them about the lottery's terms and conditions;
- Eligibility criteria: project's criteria;
- Valorisation: the project management team should decide on the number of winners and their rewards;
- Validity conditions: the winner(s) must claim his reward before a potential deadline;

Evaluation of the solution

- Effectiveness: the lottery approach reinforces the amateur dimension associated with participation by some researchers;
- Easiness of implementation: this form of compensation is relatively easy to implement. A number can be assigned to each participants during the registration;
- Advantages:
 - It is a low-cost form of participation that can take different forms (money, in-kind compensation)
 - It reduces the risk of discrimination between participants;
- Drawbacks/risks:
 - The bigger is the reward, the more likely participants would overlook the risks involved in participation
 - It may be difficult to recruit a large number of participants.

Figure 11: Compensation (lottery) strategy

5.2.5 **Compensation: in-kind**

In kind compensation

Characterisation

- Presentation: participants receive an in-kind compensation (cocktail, gift, etc.) as a reward for their participation;
- Results: this form of is generally not sufficient to trigger participation in a research project. It should only be considered as an additional factor of motivation;
- Fields of application: non-specific;
- Level of participation associated: non-specific;

Application framework

- Implementation model: It is important to check the fiscal regulation concerning in-kind compensation. Use a supplier/catering service may be time-saving;
- Eligibility criteria: attendance to conference/workshops;
- Valorisation: depending on the budget, the project management team should decide on the type of in-kind compensation and its amount;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: this neutral form of compensation can take different forms and adapt to the local context to strengthen participants' engagement;
- Easiness of implementation: depending on the number of participants it may require an important organisation;
- Advantages: it is pretty low-cost form of compensation;
- Drawbacks/risks:
 - It may difficult to recruit a high number of participants with this only form of compensation
 - It may be not considered as a real compensation by participants

Figure 12: Compensation (in kind) strategy

5.2.6 Compensation/respect of ownership: access to results

Access to results

Characterisation

- Presentation: as a reward of their involvement, participants receive results of the research project/ consolidated data;
- Fields of application: non-specific;
- Level of participation associated: non-specific even if researchers in “crowdsourcing” projects usually share data among the participants;

Application framework

- Implementation model: beyond the agreement that authorize data sharing, it may interesting to use an online platform to share results. In case of confidential/restricted project, it may be wise to make the participants sign a non-diffusion clause;
- Eligibility criteria: signature of agreements and clause;
- Valorisation: depending on the confidentiality of the project, the project management team may decide on the rule of data diffusion
- Validity conditions: data may be only available on the platform during a certain period;

Evaluation of the solution

- Effectiveness: this classic form of compensation keeps the motivation of participants up. Except for enthusiast people, it is may be not enough to trigger initially the participation of a large number of participants;
- Easiness of implementation: while the signature of clause/agreement is classic in research project, the development of a platform to share data may require resources;
- Advantages:
 - It is pretty low-cost form of compensation that can be implemented easily
 - It may interest participants who are expert in the field of research and interested by the domain;
- Drawbacks/risks:
 - It may difficult to recruit a high number of participants with this only form of compensation
 - It may be not considered as a real compensation by participants.

Figure 13: Access to results strategy

5.2.7 ***Respect of ownership: quoting participants as co-authors***

Quote participants as a co-author

Characterisation

- Presentation: participants are quoted as co-author in the different publications;
- Fields of application: non-specific
- Level of participation associated: non-specific

Application framework

- Implementation model: inform participants about the statute of co-author and the possible implications associated to let them decide in full knowledge of the cause. In a commercial perspective, the question of possible royalties and their mode of sharing should be absolutely addressed in compliance with the local regulation;
- Eligibility criteria: signature of agreements and clause;
- Valorisation: the project management team that supervises the project may impose a certain level of contribution to be quoted as a co-author of the research;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: this form of compensation grants importance to participants' contributions. Nonetheless, some participants, especially enthusiast, may consider this form of compensation as normal;
- Easiness of implementation: expect the question of royalties sharing, this form of compensation does not require a lot of resources;
- Advantages:
 - It accredits in a very formal form the contribution and the knowledge of the participants
 - It contributes to transparency and democratize Research and Innovation;
- Drawbacks/risks:
 - Participants may consider that being co-author is out of their area of expertise
 - It may be difficult to recruit participants with this form of compensation only.

Figure 14: Quote participants as a co-author strategy

5.2.8 ***Respect of ownership: intellectual property schemes***

Intellectual property schemes

Characterisation

- **Presentation:** participants are granted with intellectual property assets (copyright, patent, share of royalties, licence (creative commons...) etc.) enables them to take advantage of the results of the research;
- **Fields of application:** probably non practicable for clinical trials;
- **Level of participation associated:** non-specific but more likely associated with high level of participation;

Application framework

- **Implementation model:** the implementation of IP schemes can take different form:
 - Copyright: generally, the ownership of a contribution depends of the nature of the contribution. Simple observation/data collection does not usually give right to copyright. However interpretation and specific arrangement of data consists in a work may create a work in which copyright subsists;
 - Patent: many citizen science projects will not give rise to patentable inventions. However, co-invention could lead to a patentable invention. In co-creation projects, participants who contribute with specific skills /knowledge may be considered as co-inventors;
 - Share of royalties: it should be logically decided at the beginning of the research project in an agreement form. It is an ethic question but the amount of royalties shared with the participants depend on the nature of contribution

In all cases, it should be scrupulously supervised in a IP licence that specifies the different rules. This framework should be in compliance with the local regulation concerning IP and provide all the judicial remedies;

- **Eligibility criteria:** signature of agreements and clause;
- **Valorisation:** the project management team that supervises the project may impose a certain level of contribution to let the participant benefit an operating licence. It can also adopt an egalitarian logic and that any contributor can use a licence;
- **Validity conditions:** the IP scheme may stop at a specific expiry date;

Evaluation of the solution

- **Effectiveness:** in line with open-science practices, this form of compensation may create economic opportunities;
- **Easiness of implementation:** because of the legal framework associated with IP management, this form of compensation may be difficult to implement. It is especially true if it is required to monitor the use of all the scheme;
- **Advantages:**
 - It may interest participants with high profile only
 - It may create synergies between participants that result in business opportunities;
- **Drawbacks/risks:**
 - This form of compensation may not be fitted for all type of research project
 - It may also create competition between participants and reduce their motivation to share data/ideas
 - It may attract only certain category of participants (entrepreneurs).

Figure 15: intellectual property schemes strategy

5.2.9 ***System esteem: thanking participants & regular updating***

Thanking participants & regular updates

Characterisation

- Presentation: participants receive a “thank you” for their contributions and are informed about the progress of the research;
- Fields of application: probably not practical in clinical trials in which participants usually receive monetary compensation
- Level of participation associated: rather associated with “crowdsourcing” and “distributed intelligence” levels;

Application framework

- Implementation model: use of a platform such as “mailchimp” to send a thank-you note to the participants or a newsletter to acknowledge their contribution. Otherwise, this form of compensation does not require many resources;
- Eligibility criteria: none;
- Valorisation: this form of compensation goes almost without saying;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: this form of compensation is not a trigger of participation;
- Easiness of implementation: it is the easiest form of compensation;
- Advantages:
 - It cost almost zero
 - Its implementation is very simple;
- Drawbacks/risks:
 - This form of compensation may not be fitted for all type of research project
 - Participants may not consider a “Thank you” as a form of compensation;

Figure 16: Thanking participants & regular updates

5.2.10 ***System esteem: communicating about results and their use***

Communication about the results and their use

Characterisation

- Presentation: participants are informed of how their contributions contributed to some results in the projects;
- Fields of application: probably not practical in clinical trials in which participants usually receive monetary compensation;
- Level of participation associated: rather associated with “crowdsourcing” and “distributed intelligence” levels;

Application framework

- Implementation model: use of a platform such as “mailchimp” to send emails to the participants or a newsletter to inform them about the results of project. Otherwise, this form of compensation does not require many resources;
- Eligibility criteria: none;
- Valorisation: this form of compensation goes almost without saying;
- Validity conditions: depending of the confidentiality of the project, data may not publicly released;

Evaluation of the solution

- Effectiveness: this form of compensation is not a trigger of participation but it could strengthen the engagement of participants within the project;
- Easiness of implementation: it is one of the easiest form of compensation;
- Advantages:
 - It cost almost zero
 - It can be a source of motivation for participants
 - Its implementation is very simple;
- Drawbacks/risks:
 - This form of compensation may not be fitted for all type of research project
 - Participants may not consider a this as a form of compensation;

Figure 17: System esteem (communicating about the results and their use) strategy

5.2.11 Reward: certification / academic credits

Certification/academic credits

Characterisation

- Presentation: participants receive a certification that recognizes their gain of knowledge or receive academic credits that help them to validate a semester (especially practicable for students);
- Results: this form of compensation would probably interest people who are already engaged in a learning process. This win-win solution may result in interesting contributions;
- Fields of application: non-specific;
- Level of participation associated: non-specific;

Application framework

- Implementation model: it is important to check that the participation result in a certification that is acknowledged by third parties;
- Eligibility criteria: give the participants an exam in order to validate their knowledge or check the student's attendance;
- Valorisation: the project management team should decide on the grade or on the number of hours a student should attend;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: this form of compensation is linked with knowledge economy. It may be of interest for students or professionals who already have knowledge;
- Easiness of implementation: it requires an important organisation and generates administrative work to get skills and certifications set recognized in university and the professional environment;
- Advantages:
 - It is win-win solution that cost almost zero
 - It enables to recruit motivated participants;
- Drawbacks/risks:
 - It may be difficult to decide on the right grade to reach in order to fair
 - It may be difficult to have a great diversity of participants in some case.

Figure 18: reward (certification / academic credits) strategy

5.2.12 **Reward: invitation to a conference**

Invitation to a conference

Characterisation

- Presentation: as a result of his/her exceptional contribution to the research project, a participant may be invited to co-present the results of the research;
- Fields of application: non-specific
- Level of participation associated: “extreme”, “participatory science”;

Application framework

- Implementation model: a special line in the budget could be anticipated to cover the cost associated with the participation in the conference;
- Eligibility criteria: this reward should be associated to high-flying contribution only;
- Valorisation: the researcher responsible for the project could present some profiles and their contributions to the project management team that would approve the decision;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: this form of compensation may reinforce the place of alternative actors in the classic Research and Innovation system;
- Easiness of implementation: no particular issues regarding implementation;
- Advantages: it may increase participants’ motivation and creativity;
- Drawbacks/risks:
 - This form of compensation may not be fitted for all type of research project
 - Participants may feel out of their area of expertise and refuse to participate in the project/conference

Figure 19: reward (invitation to a conference)

5.2.13 **System to match compensation with the “value” contributed: blockchains & Sensorica**

Knowledge platforms

Characterisation

- **Presentation:** knowledge platform such as Backfeed, Colony, and D-Cent are online tools that enable the collaboration of many stakeholders in a transparent and self-organised way without the coordination of any central authority;
- **Results:** the compensation of participants occurred the distribution of tokens resulting from works and the the reallocation of individual influence or reputation within a given community;
- **Fields of application:** non-specific;
- **Level of participation associated:** non-specific;

Application framework

- **Implementation model:** the project management team that supervises the research project may decide to use an already existing platform currency or to create one. In the first case, it is important to contact the platform provider to select the one that fits the most your expectation. In the second case, different steps are necessary to create a complementary currency:

1. Write a charter that defines the approach and the objectives
2. Define the rules that underlie the system
3. Develop the solution
4. Prepare marketing and public relations
5. Launch the operation

Non-virtual solution provider also exists. Sensorica is a common based peer production system that value know how and skills. As open, decentralized, and self-organizing value network, it co-designs solution with stakeholders

- **Eligibility criteria:** the compensation/ number of tokens received depends usually on the value of the participant contribution. Other logic (egalitarian) may also be implemented;
- **Valorisation:** even if the platform enables the cooperation of the participants, the project management team supervises the work;
- **Validity conditions:** the token received may lose its value over time;

Evaluation of the solution

- **Effectiveness:** the use of a such platform may be a catalyst that contributes to the rise of participatory project. The setting-up of reward systems that support the knowledge economy can be a source of motivation for participants;
- **Easiness of implementation:** it could represent an important effort for the institution/research centre that decide to develop its own system;
- **Advantages:**
 - It enables the contribution from participants all around the world
 - Some tools specifically targets people who cares about local development
 - It may interest people who already use complementary currency or people who are in the knowledge economy environment;
- **Drawbacks/risks:**
 - It may not be fitted for every kind of participation
 - It may be difficult to recruit a large number of participants (only participants that have skills to publish may be interested)

Figure 20: strategy to match compensation with the “value” contributed: blockchains & Sensorica

5.2.14 **Focus on knowledge currencies**

5.2.14.1 **Insights from Muntuit**

In the Belgium transition experiment, VITO sub-contracted Muntuit, an organisation specialised in the implementation of complementary currencies. Muntuit supported VITO to experiment with a knowledge voucher. At the end of the Transition Experiment, Muntuit produced a report, explaining the concept & approach that have framed the development of the knowledge voucher pilot. The report contains also a description of the pilot and provides reflections and recommendations as conclusion. The concept and approach, as well as examples of other knowledge currencies, are presented below, while the knowledge voucher pilot is described in the transition experiments section. The following text is therefore pasted from Muntuit's report (Wanner & van Parijs, 2018).

Money a social construct: window of opportunities

Any money – conventional or complementary - according to the definition of Bernard Lietaer, is an agreement within a community to use something as a means of exchange or payment¹³. This agreement is not a natural fact; it exists within an institutional framework of organisations, rules, actors and habits. Also, the conventional money that we use every day, like the Euro, comes with its own game board, players and set of rules. Related to the discussion above, conventional money is, simply stated, 'scarce by design' and 'interest-driven'¹⁴. It urges members of the Euro community to compete for monetary resources, instead of fostering collaboration and exchange.

This kind of monetary systems are indeed the dominant ones in our society. Although many other 'monetary' systems exist. They vary in scope and range from elaborated, often more commercial and formalized systems, operated by large organisations, to tiny local and more informal systems. The container concept to regroup them is '**complementary currencies**'.

Examples of the biggest systems are the air miles or '**frequent flyer miles**'. 'Miles' can be used for many transactions in the sphere of traveling and tourism but are not convertible in dollars or euros. Loyalty points in supermarkets are a similar application of a complementary currency. In the business to business sphere the barter schemes and business exchange schemes are the best-known applications using their own currency.¹⁵ All these systems have in common that they predominantly serve commercial goals and promote business to customer relations.

At the other side of the spectrum there are local schemes of which Lets (Local exchange and trading system) groups and Timebanks are most common. Local groups ranging from tens to hundreds of people create and agree on their own currency that will serve specific goals in their local group or community: improve social relations, stimulate ecologically friendly behaviour, stimulate elderly care, reinforce the social fabric, and so on. Flanders counts some 50 Lets groups, and in the UK and US several hundreds of time banks and lets schemes are operational.¹⁶

Between these two poles we define **community currencies as those complementary currencies that integrate social, environmental and economic goals**. They are open systems operated mostly by not-for-profit organizations or local authorities. Their field of operation varies from a local neighbourhood to a city

¹³ Lietaer, B. (2001). *The Future of Money: Creating New Wealth, Work and a Wiser World*, London: Random House.

¹⁴ Snick, A. & Wanner, H. (2015). *Monetaire transitie als sleutelelement van een ecologische economie*. In Oikos – tijdschrift voor sociaal-ecologische verandering, nr 75.

¹⁵ IRTA ([International Reciprocal Trade Association](https://www.irta.com/)) <https://www.irta.com/> is the International Network for Barter companies. WIR <https://www.wir.ch/> is the oldest network based in Switzerland. RES <https://res.be/> is a system based in Belgium.

¹⁶ Lets Vlaanderen <https://www.letsvlaanderen.be/> is the umbrella organisation in Flanders. For UK visit <http://www.timebanking.org/> and <http://www.justaddspice.org/> and <http://www.letslinkuk.net/> For US visit <https://timebanks.org/> and <http://www.mutualaidnetwork.org/>

or region. For over the last three decades over 4.500 complementary currency, community credit and alternative finance systems have been set up worldwide, around values like reciprocity, redistribution, sharing and solidarity¹⁷. Famous examples are the Bristol Pound, Brixton Pound, Chiemgauer, Sardex, Japan's Fureai Kippu and so on¹⁸. Remarkable examples in Belgium are the Torekes in Ghent and the Limbu in Limburg. Torekes is a currency scheme to revive the social fabric in a deprived neighbourhood and to valorise inhabitants for their contribution and co-creation in the public sphere.¹⁹ In the province of Limburg the system called E-wallet²⁰ promotes ecological behaviour. Today it will be enlarged to 'Limbu', a scheme serving a wider scope including environmental, communal and economic goals²¹. Typical for these currencies is the fact that they are co-governed by their users. Since the communities themselves decide on the rules that apply, they enjoy a wide support among their members²². The techniques used to operate such currencies are diverse. It can be simple paper notes or a web application or sophisticated ICT using common payment systems like bank cards and apps.²³ These community currencies have in common that they are aiming for a 'generative' instead of 'extractive' economic model.

The concept of a knowledge voucher

Based on the previously mentioned definition of money **we argue that a learning currency is a type of money (1) agreed upon within a knowledge community (2) for the purpose of exchanging skills, experience and intelligence** among the members of that community.

The potential benefits of such currencies can best be illustrated with some remarkable examples. Some projects in the complementary currency field have a clear learning objective like the Wispo in Ghent, the SIF in Flanders and the Saber in Brazil. A less outspoken example is the Buckaroo in the USA. While Vosj'innove in France is clearly a system to stimulate knowledge exchange, however it does not (yet) take shape in the form of a currency.

In the next paragraphs we briefly describe these examples. We draw specific attention to how they define their community, what their higher purposes and practical aims are, which monetary mechanisms they evoke to pursue these aims and what challenges they face. Last but not least, we highlight the relevant features of these examples with regards to the potential development of a knowledge voucher for RRI in Flanders.

¹⁷ Place, C. & Bindewald, L. (2015) Validating and improving the Impact of Complementary Currency Systems through impact assessment frameworks. International Journal of Community Currency Research.

¹⁸ See: <https://bristolpound.org>, <http://brixtonpound.org>, <http://www.chiemgauer.info>, <https://www.sardex.net>, https://en.wikipedia.org/wiki/Fureai_kippu, <http://communitycurrenciesinaction.eu/>

¹⁹ <http://www.torekes.be>

²⁰ E-wallet see <https://mijn.limburg.net/e-portemonnee>

²¹ <https://www.limbu.be/>

²² For Belgium see following manuals: 'Maak je buurt uitmuntend! Handboek gemeenschapsmunten voor lokale besturen en organisaties' (Dutch) http://muntuit.be/handboek/_text_1/Handboek_Gemeenschapsmunt_2014.pdf and 'Guide pratique des monnaies complémentaires' (French) https://www.financite.be/sites/default/files/guide_pratique_des_monnaies_complementaires_0.pdf

²³ Do not confound with a recent phenomenon known as 'crypto currencies'. These are on the one hand a new software technology called 'blockchain' and currencies that use this technology on the other hand. Best known is the case of Bitcoin, a currency most famous for its speculative use. However also community currencies could make use of these new technologies. But we consider them as 'work in progress' (see <http://www.muntuit.be/blog/blockchain-en-gemeenschapsmunten>, in Dutch).

Inspiring examples

Wispo (Ghent, Belgium)²⁴

The Wispo is a currency project at a high school (Atheneum Wispelberg) in Ghent. It was started up when the school recognised that a substantial group of students suffered from learning deficiency. The ultimate goal: increasing the learning abilities of their students and the exchange of knowledge among them (peer learning). In addition to this, they also wanted to provide their students with a tool to take their educational career in their own hands. The currency project is based on insights from the 'learning pyramid' (see also further Saber)²⁵. This concept argues that the best way to gain and train your expertise is by educating others. The Wispo is a very small project since its community is defined by the students within the high school. The scheme is promoted and supported by the institutional framework of the school and by teachers and members from the school management dedicated to the program.

How is this currency conceptualised? Through educational games students earn tokens, called 'Wispes'. Each game is set up around a specific topic, e.g. mathematics or linguistics. Mixed groups of students play against each other. The stakes of the game are the tokens, which can be earned by a group of players; hence the stronger students on each topic are motivated to help the weaker ones within their group. The Wispes are spendable in an end game at the school in which the students can win a surprise packet that relates to their social environment: the more Wispes the more information the team could gather to win the game. In fact, all the games are co-designed by the students to foster their intrinsic motivation. As a result of the circulation of the token, the exchange of knowledge is increased. The social capital within the school grew and the school witnessed a decrease in learning deficiency.

Of course, the Wispo programme also faces some challenges. As project advisors, Muntuit noticed that the development of the games required a substantial investment. This was made possible because of a onetime subsidy for this pilot. The organizational context of a secondary school also raised a lot of obstacles to be tackled when introducing a new instrument like this. However, after the first year the currency was continued in cooperation with a neighbouring school – without any additional support. **The currency seemed to be successful. Although a series of highly practical hurdles remained at the organizational level (related to time schedules, school procedures and facilities), the pupils had, on average, better marks after the Wispo programme. Yet, scientific proof that this improvement was solely due to the programme is not available.**

One of the main strengths of this case, is the collaborative and user-oriented design of the currency scheme. This way, the programme managers take the 'intrinsic' motivations of the target group into account. As we will see also for the knowledge voucher, this approach might provide an important lever to build support among its stakeholders.

SIF (Flanders, Belgium)²⁶

The SIF is a currency started and organized by the Sociale Innovatie Fabriek²⁷ (SIFA), a Flemish not-for-profit organization dedicated to social innovation and Corporate Social Responsibility. The aim of the currency is to support the exchange of expertise among their community of social entrepreneurs. SIFA plays an active role in matching supply and demand for these exchanges.

²⁴ Information based on own observations and internal document analysis. See also final report by Netwerk Vlaanderen (2011) to the City of Ghent.

²⁵ Blandin, B., & Lietaer, B. (2013). Mutual learning: a systemic increase in learning efficiency to prepare for the challenges of the twenty-first century. *AI & society*, 28(3), 329-338.

²⁶ Information based on personal interview (11 October 2017) and internal document analysis.

²⁷ Sociale Innovatiefabriek vzw is one of the showcases in the EU supported project that produced the 'Practical guide to responsible research and innovation'.

How does it work? Every member earns SIFs from SIFA when supplying a service to the community, for example when guiding a workshop. One session is typically rewarded with 8 SIFs, which as a unit of measurement correspond to 400 euro (excl. VAT). However, SIFs cannot be bought nor exchanged for euros. Members can only use their amount of SIFs for receiving services back from the community. Every member is allowed to go below zero on its SIF account, yet is expected to go back to a positive balance after one year. This means that the SIF currency provides a micro form of interest-free community lending.

Motivating and assuring that members keep on exchanging their knowledge and skills within the network, is the main task of the SIFA team; hence matchmaking between the capacities and needs of people and organisations is an essential part of their job. As a result of the SIF currency, various social entrepreneurs exchange knowledge and expertise among their peers. They do this in an atmosphere of reciprocity and mutual benefit. While they build and strengthen both their personal and their organizational networks, the meetings and workshops provide a starting point for new initiatives inspired by these peer exchanges.

However, SIFA decided in 2017 to continue the project in a different format. They noticed that managing the currency was a real time consuming and administrative burden from an accountancy point of view. Some taxation issues in particular caused problems, as some of their members are taxable while others are not. As a consequence, some can deduct VAT from their books and others cannot. At the same time, the deduction of VAT implies a strict time constraint (related to the financial year). This resulted in organizational complexity and a structural imbalance of the SIF balance sheet, which had to be solved in euros by SIFA. Although the SIF system was discussed with the tax authorities, no solution was found to organize the exchange of services in their network in compliance with the actual legal frameworks.

We need to consider this element too when proceeding any experiments with a knowledge voucher in Flanders in the future.

Yet, the biggest lesson learned from the SIF, is that the dynamics within the community are the most important factor for the success of such a programme. This motivated SIFA to continue its activity as a matchmaker. They will keep striving for an optimal balance between supply and demand within their community. However, the concept of the currency and the plight to balance out supply and demand under a strict time constraint will be abandoned.

From this case we learn that a knowledge voucher might serve as a handy means for matchmaking, yet the mere circulation of a currency itself is not sufficient to make the desired exchanges happen.

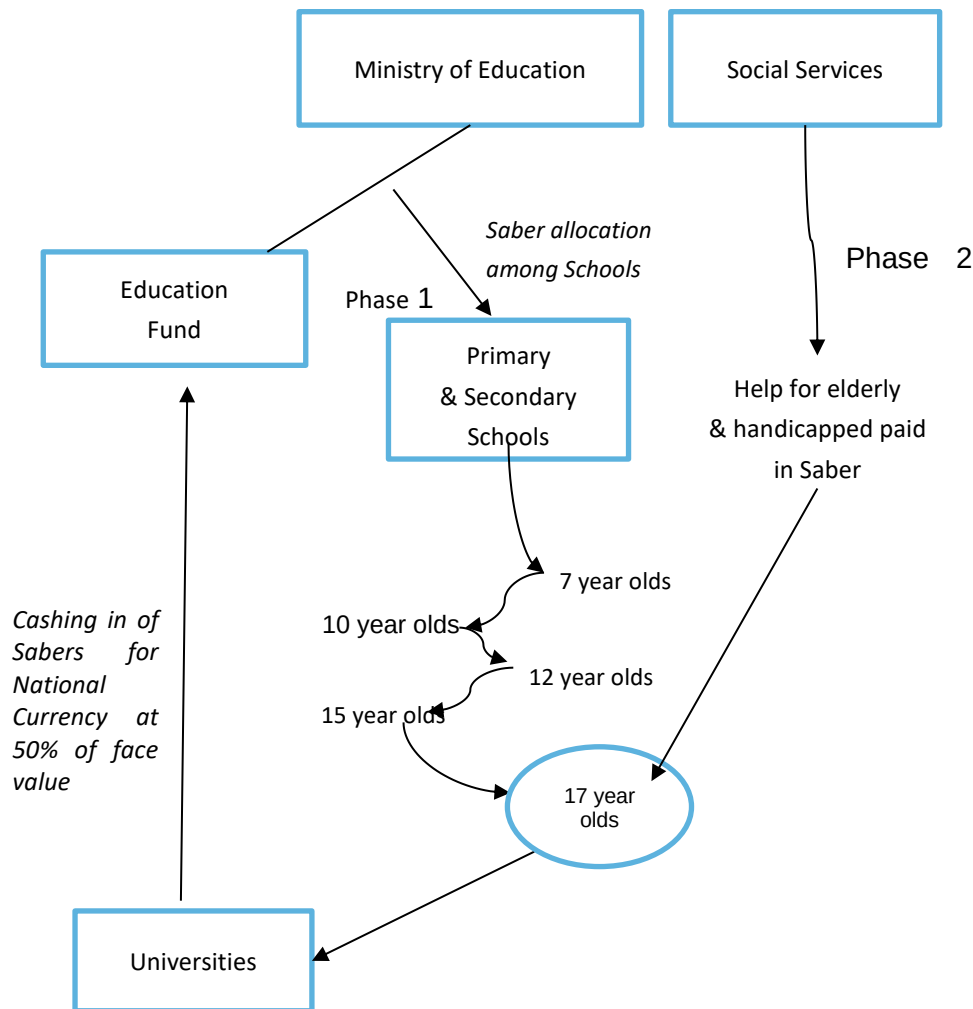
Saber (conceptual, Brazil)²⁸

The concept of the Saber educational currency for Brazil has been developed by Bernard Lietaer. Despite the fact that the currency was never put into practice, it remains an inspiring example of a learning currency. The reasoning behind the scheme is based on the theory behind the 'Learning pyramid'. Pedagogic studies have revealed that attending ex cathedra courses has the lowest impact on learning efficiency. Whereas teaching a subject has the highest impact on mastering the content of a course. The aim of the Saber (Portuguese for 'to know') therefore is to initiate this learning dynamic in order to tackle learning deficiency in Brazil. Lietaer argued that one needs to evoke a learning multiplier effect²⁹, whereby the circulation of a token would encourage students to exchange their skills and knowledge with other students. Hence students become teachers too. As a result, the total amount of exchanges would significantly increase with the same number of students (a multiplier effect).

²⁸ Lietaer, B. (2006). A proposal for a brazilian education complementary currency. *International Journal of Community Currency Research*, 10, 18-23.

²⁹ Blandin, B., & Lietaer, B. (2013). Mutual learning: a systemic increase in learning efficiency to prepare for the challenges of the twenty-first century. *AI & society*, 28(3), 329-338.

How would this currency have worked? The value of the currency lies in the final backing of the token by a foundation willing to support high-school students with a scholarship to attend university. The traditional approach for these scholarships is to invite and visit students in their last year of high school with a proposal for a scholarship. However, with the learning pyramid in mind, a different concept was formulated. Scholars of the first degree would have been given an amount of Saber, the knowledge currency. This currency could then only be used to pay for tuition by students of the second degree. Students of the second degree would have been able to use these Sabers to pay a student of the third degree, and so on till the last year. Students of the last year would then have collected a number of Sabers entitling them to subscribe at the university, or in monetary terms: the Saber could have been exchanged for the conventional money (Brazilian Reals) by the foundation to pay the tuition fee.



NB: 1 Saber is equivalent to 1 National currency unit redeemable for higher education expenses

Figure 21: 'Saber' Complementary Currency System = Learning Multiplier. Graph based on original work by Bernard Lietaer³⁰.

This system would have created a completely different dynamic at the secondary school. Pupils would have been more motivated to support and teach each other. There would still have been a kind of competition to go for better results, but in addition an atmosphere of cooperation could have grown. So the funding made available by the foundation could have resulted in a multiplier effect. Ideally, for each Saber earned by a last year student, ten others would have participated in a peer to peer learning process.

³⁰ Lietaer B. (2006) *ibid*.

While the concept of the Saber has never been literally put into practice, it has been a prime source of inspiration for other smaller projects, such as the Wispo currency in Ghent. Two lessons can be learned from both this concept of Saber and the practice of Wispo.

First, the activity of teaching, or helping others in understanding or learning, is a method to improve and master your own competences. For the Wispo this is clearly its first objective. Yet, also for the knowledge voucher this can provide an extra benefit. Specifically, if exchanges of knowledge take place in transdisciplinary settings, the knowledge vouchers may create a stimulus to overcome the challenges confronted with when transferring and translating knowledge from one field of expertise to another, and hence to do extra efforts in explaining cases. One can expect this when going beyond the classical client relation: the vouchers are introduced to stimulate relations with new types of partners from outside someone's traditional field of work.

Second, the same token can serve to trigger a series of transactions and, as such, function as a multiplier for the initial value invested. In the Saber case, this was the objective of the project. And also in the Wispo experiment every token served both in the games, initiating the learning process, and in the end game. Also for the knowledge voucher it might be interesting to work on this multiplier effect. Key points of action will be then, on the one hand, to improve the acceptance of the knowledge vouchers, and, on the other hand, to stimulate multiple exchanges before ending up with the final exchange and redemption of the voucher (see further).

Vosj'innove: échange de savoir (Vosges, France)³¹

Vosj'innove is an initiative by a group of entrepreneurs in the Vosges region in eastern France. Actual membership accounts for some 20 small and medium enterprises (SME), a university, an investment bank and a few individual entrepreneurs. The mission of Vosj'innove is 'to be a resource center at the service of the economic development in the region'³². Any local economic initiative can ask for support and advice, but the focus is on start-ups and innovative products and services. This way the community is composed of those actors who share the values of Vosj'innove, at the core of which is the principle attitude of sharing competences with each other. The idea is to create on the long run a local currency to mediate these exchanges between local partners.

To achieve this, a secretariat is set up and an inventory of the actual needs and available competences was made up. The needs were well-known through the experience of the SME members themselves. But the competences and expertise were not documented at all. There was a firm belief that competences were already present, but there was only a vague awareness of where to find precisely what was needed. So the first activity of the secretariat was to make this inventory, which turned out to be an intensive but very interesting task. With this information collected in a database the real work could then start: matching supply and demand for knowledge, expertise and competences.

1. The service as developed by Vosj'innove runs through 4 phases:
2. First meeting with the secretariat: intake of a request for support. A judgement is made to see if the project complies with the values and abilities of the service provider.
3. A group of some 3 persons will accompany the project and, in this stage, challenge the initiative to articulate with more precision the real needs.
4. Specific support and advice by the most competent person(s). This service is free as far as only advice is needed. If material (e.g. for production) is needed, this will be paid for by the project.
5. Further professional guidance and support will be charged for (now in euro, eventually in local currency?).

³¹ Based on personal interviewing (6 September 2017), field visit (1 August 2017) and public documents at website <https://www.vosjinnove.fr>

³² Interview with Patrick Féger, treasurer of Vosj'innove

This service proves to be very successful with over 20 support cases in its first year of existence (2016-2017) and several very inspiring stories. Lessons learnt until now are:

- **The function of the matchmaker is crucial to the success:** the database is a treasure of valuable information.
- Besides the specific competences, **the network(s) of the service provider proves to be key for the young projects.**
- **Entrepreneurs are willing to offer their services ‘for free’, since they feel an intrinsic motivation to do so.** Besides, it adds to their status in the organization.
- **In this stage the reciprocity of the services provided is still limited:** new projects cannot yet contribute much to others.

Vosj’innove are considering the development of a currency to support and expand their actions, but don’t run a currency yet. However, their undertaking gives valuable information for the FoTERRIS experiment. Firstly about the crucial role of matchmaking. In a similar way this is true for the practice of barter systems. And secondly on the importance of ‘intrinsic’ motivation of community members to intervene and offer their services.

Buckaroo (Missouri USA)³³

In the United States, there is a growing movement on college campuses to increase student involvement in their communities, particularly through what is known as ‘service-learning’, in which students participate in community service activities organized by local community groups.

The University of Missouri—Kansas City (UMKC) designed a program as a ‘monetary’ system, creating paper notes, called ‘Buckaroos’ (after the UMKC mascot, a kangaroo), with the inscription ‘this note represents one hour of community service by a UMKC student’, and denominated as ‘one Roo hour’ = 1 note. Each student is required to pay 25 notes in ‘taxes’ to the UMKC ‘Treasury’ each semester. Approved community service providers, that is state and local government offices, university offices, public school districts, and not-for profit agencies, submit bids for student service hours to the UMKC Treasury, which ‘awards’ special drawing rights to the providers. The providers then draw on their rights as needed and get the notes to pay students 1 note per hour worked. Students then pay their taxes with buckaroos, retiring Treasury liabilities.

This program serves a double purpose. First, Buckaroo introduces a mechanism to reward students and involve them in work that normally is not included in the curriculum. Students are engaged in community work and link their academic training with practically and socially useful work. It is part of the vision of the UMKC that student involvement in society should be stimulated. It opens the opportunity to focus the whole university (research, teaching and training) towards a responsible agenda. Second, especially for economics students, a set of presumptions of economic theory are tested in this setting, notably questions about taxation. Using this experimental currency, the students learn by doing how the tax system really works and how it relates to (full) employment³⁴.

Although the Buckaroo is a complex undertaking with multiple purposes, **it can be considered to be the low hanging fruit: it is organized within the framework of a university and serves the purposes of courses and internships.** The previous example of SIFA shows that operating ‘outside’, that is in the sphere of

³³ Randall Wray, L. (2009). How to Implement True, Full Employment. On <http://neweconomicperspectives.org/2009/08/how-to-implement-true-full-employment.html>
 Warren Mosler, W. (2011). The UMKC Buckaroo: A Currency Model for World Prosperity. On <https://www.huffingtonpost.com/warren-mosler/the-umkc-buckaroo-a-curre b 970447.html>

Carney, J. (2012). The Buckaroo and the Demand for Money. On <https://www.cnn.com/id/46314208>

³⁴ Wray, L. Randall. 1998. *Understanding Modern Money: the key to full employment and price stability*, Cheltenham: Edward Elgar.

economic transactions, implies more challenges. For the knowledge voucher as well, this will urge for a thorough preparation on practical and legal issues. Yet the Buckaroo shows just as Saber how it can be beneficial to seek the opportunities within a system, e.g. playing on existing institutional incentives (tuition fees, grants...), to launch a complementary currency.

5.2.14.2 Witcoin

As an illustration on the previous section, Witcoin consists in an alternative money that support transactions in the knowledge economy.

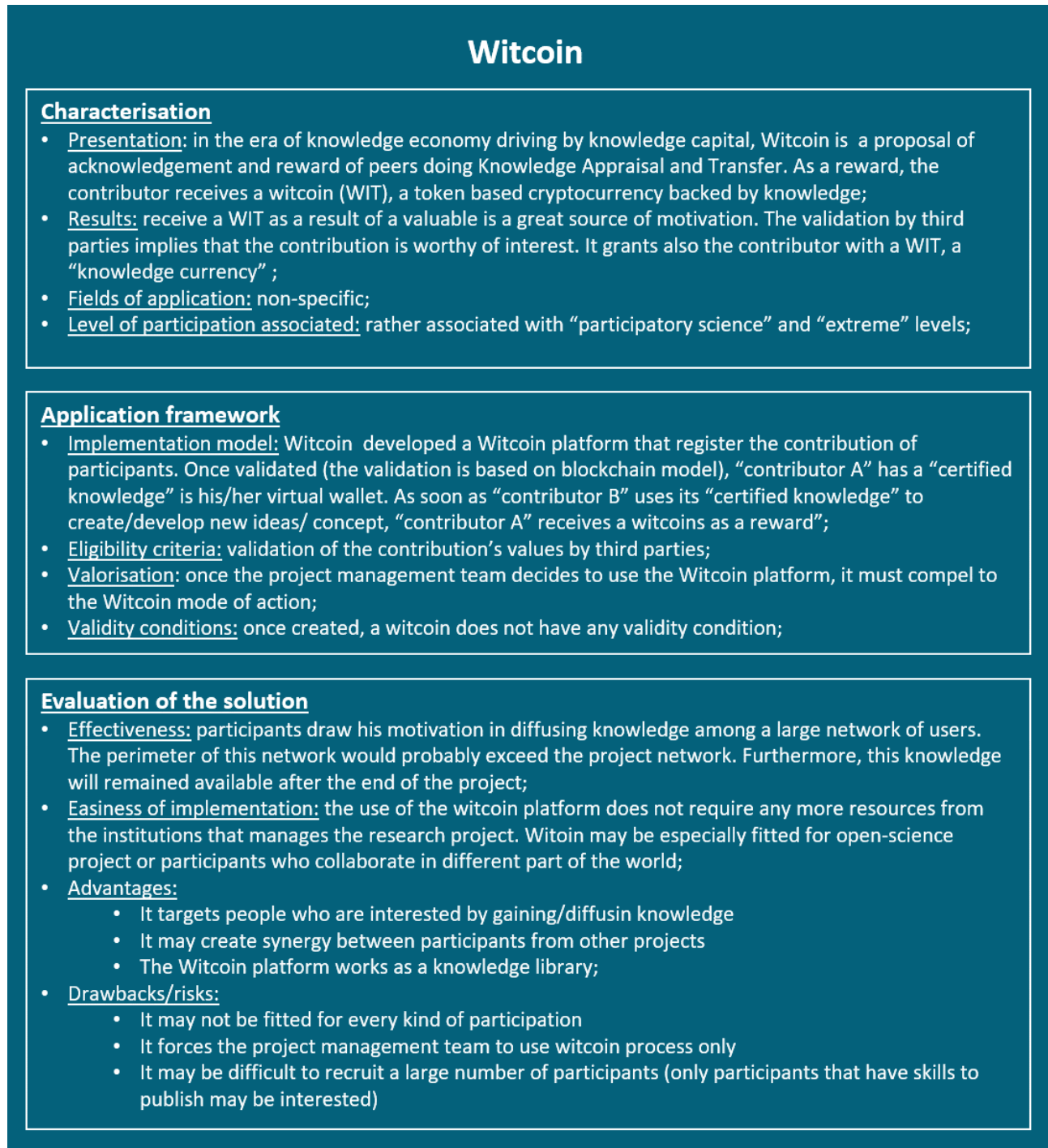


Figure 22: Witcoin R&C strategy

5.3 Presentation of the R&I strategies implemented in FoTERRIS

5.3.1 Austrian Transition Experiment (IFZ)

IFZ Strategy

Characterisation

- Typology: remuneration (market/reimbursement models)
- Presentation: participants received a monetary compensation of 200€ /day of workshop participation plus compensation of the travel costs. Beyond this compensation, the contributions of participants were acknowledged in various events and through different communication channels. One participant was even invited in a conference to talk about the project;
- Fields of application: sustainable food production;
- Level of participation associated: “participatory science” even “extreme level” levels of participation;

Application framework

- Implementation model: the monetary compensation was possible because of the FoTERRIS budget;
- Eligibility criteria: initially the compensation was only dedicated to people who must take a day off to assist the workshops. Ultimately, all participants who assisted the workshops asked for the compensation. All TE participants received the same amount of money, which was linked to the time they were present at the workshops;
- Valorisation: this solution was selected because of different reasons:
 - It created stable commitments for a continuous engagement
 - A line in the FoTERRIS budget was dedicated for compensation;
- Validity conditions: none;

Evaluation of the solution

- Effectiveness: even if the participants were happy with this form of compensation, alternative compensation (e.g. vouchers or gifts, e.g. sustainably produced food) could have had the benefit of emphasizing on the FoTERRIS ideology, which was driving the discussions around our TE-topic;
- Easiness of implementation: the reimbursement was linked to a simple administrative procedure: participants needed to fill in IFZ remuneration forms (standardised forms in line with institute’s rules and the Austrian law, which indicate the project and the purpose of the payment), which were checked and verified by the project manager. Taxes needed to be declared by the TE participants. So there were neither administrative nor legal problems with that simple procedure;
- Advantages:
 - This form of compensation was easy to implement
 - It cost zero to IFZ;
- Drawbacks/risks:
 - It was not context-specific
 - The compensation is not very in line with FoTERRIS ideology;

Figure 23: IFZ R&C strategy

In the Austrian experiment, the strategy was to remunerate the participants. It appeared that it was the **easiest way to create stable commitments for a continuous engagement and equal opportunities to participate**. Indeed, for those who could not participate in the scope of their “usual” work, investing time in the experiments would have implied a loss of earnings (e.g. for farmers, business people).

Retrospectively, for the Austrian partners, **alternative compensation (e.g. vouchers or gifts, e.g. sustainably produced food) could have had the benefit of emphasizing on the co-RRl values**, which was driving the discussions around the TEs. A disadvantage of this remuneration model was that it was not not fully fair, as supposedly, some participants actually participated during their paid working time.

5.3.2 ***Spanish Transition Experiment (UCM)***

In the Spanish TE, participants did not receive any monetary compensation, because **the financial services of the University did not accept to incur the costs (deemed as non-eligible)**. Therefore, the participants have collaborated in a volunteer basis. However, because the TEs have addressed relevant problems of inclusiveness, such as refugees and women with disabilities, they have really appreciated the interest on their subject, and this has been a good motivation to continue their participation in successive workshops of the TEs. Indeed, **the fact of being heard is very important for them**. The spread of their message is very relevant for marginalized communities. To have the possibility to draw the lines for research and innovation projects that can contribute to improve their lives was a very valuable opportunity.

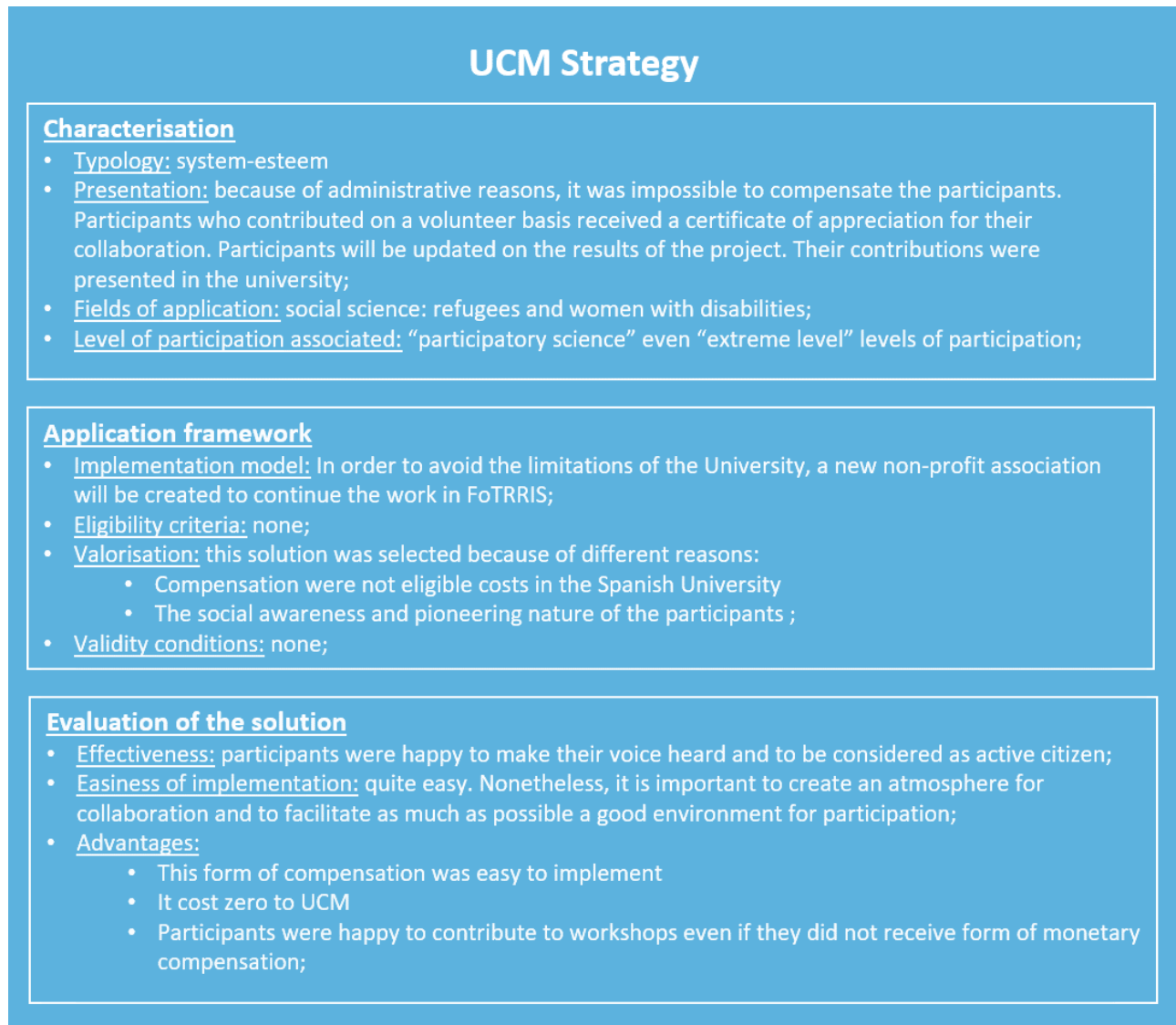


Figure 24: UCM R&C strategy

5.3.3 ***Italian Transition Experiment (CESIE)***

In Italy, participants received a solar backpack (a backpack with mini solar panel for electricity generation). This method was chosen for several reasons: the local community involved in the transition experiment was a very strong local and well-organised community, which had already built clear actions for its energy sustainability. For the Italian partners, the biggest advantage of working with such strong communities is that they do not call for monetary compensation, as **there are morally responsible for their territory and can invest time and efforts in making it better**. They considered that it would have been wrong to compensate the natural enthusiasm of the participants with monetary tools, so they looked for a strategy that could support their cause (energy sustainability), while promoting them as pioneers and increasing their moral satisfaction. Another reason for not using a monetary strategy was to not resort to competitive solutions (from the market economy) but to **promote solutions relying on common goods**: solar energy.

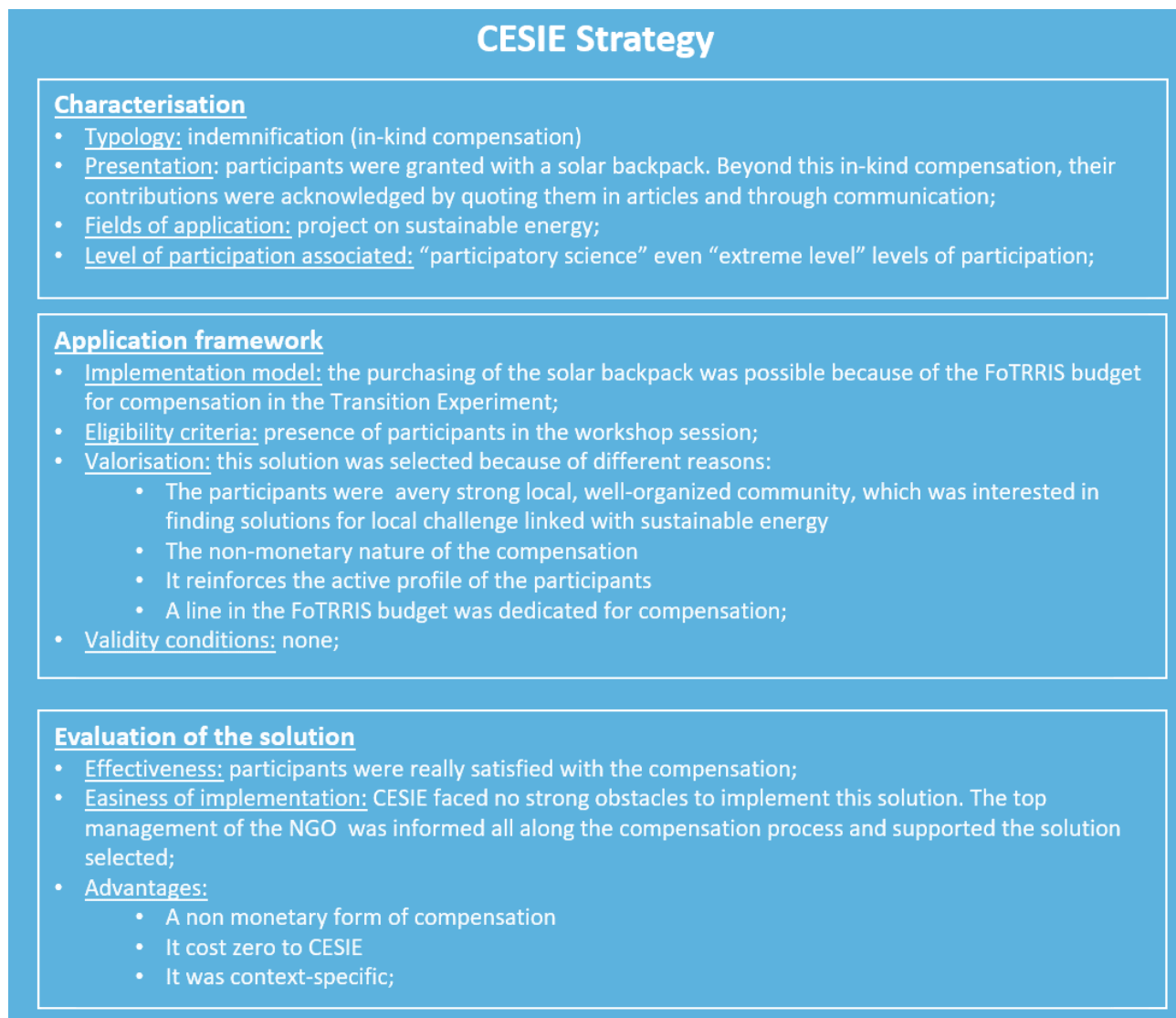


Figure 25: CESIE R&C strategy

5.3.4 ***Hungarian Transition Experiment (ESSRG)***

The topic of the Hungarian experiment was local economic development. **It seemed straightforward to provide an R&C strategy that reflected this topic.** Since there was an initiative developed by a local resident/activist providing with a local “customer’s card” to be used for shopping locally, a **voucher** (in exchange for participating at TE workshops) was created through this existing scheme. **The compensation scheme was thus embedded in an existing local system and habits of shopping, while, at the same time, sending the message of the importance of strengthening the local economy from a sustainability perspective.** Competence cell members were recruited, beyond researchers working for ESSRG (partner in FoTERRIS), for possessing special knowledge of TE topic³⁵. **As the competence cell members were not local residents, it seemed more suitable to provide them with monetary compensation,** instead of the voucher locally used.

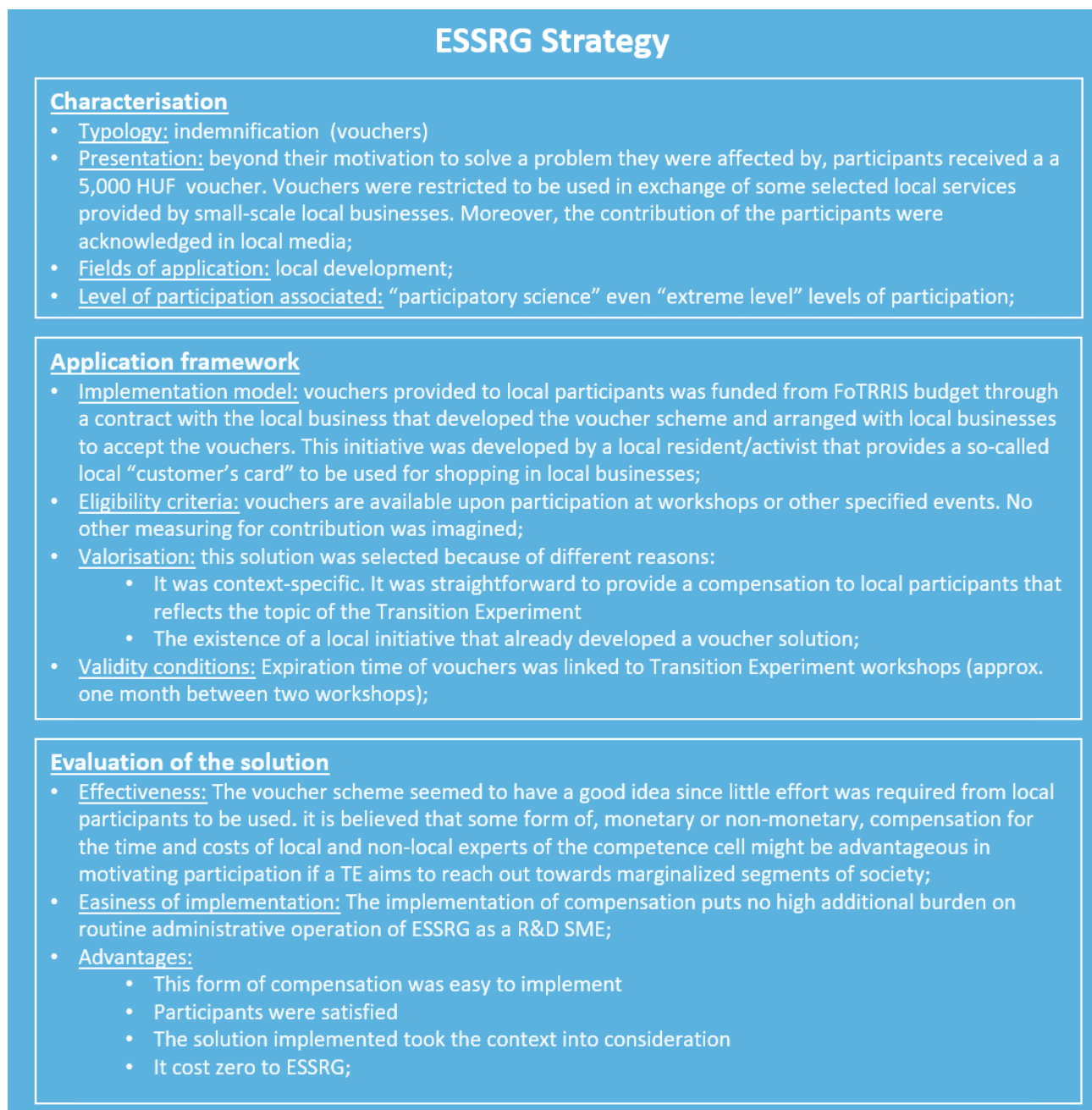


Figure 26: ESSRG R&C strategy

³⁵ In this transition experiment, the members of the competence cell (those in charge of running the experiment) were not only FoTERRIS partners but also invited stakeholders.

5.3.5 Belgium Transition Experiment (VITO)

As explained in section 5.2.14 Focus on knowledge currencies, the rewarding & compensation solution implemented in the Belgian transition experiment was a knowledge voucher, implemented with the support of Muntuit. Follows the Muntuit's report on the knowledge voucher pilot setting and its results (Wanner & van Parijs, 2018).

The pilot knowledge voucher

During the FoTERRIS project we explored the benefits and thresholds for the application of a knowledge voucher for the RRI-community in Flanders. To obtain relevant and interesting data we have chosen a particular method of action research. Instead of simply sending a survey to stakeholders, we involved participants of the FoTERRIS workshops in our research by issuing a knowledge voucher on a limited scale within a test environment³⁶. The thoughts, remarks, observations the participants had on this voucher, have then been used as the starting point for questionnaires and follow-up interviews.

When developing this experiment, we started with defining the main features of the knowledge voucher.

Two questions then automatically popped up from our general definition of money (see before). First: How is the community defined? Who are its members? Which actors are 'knowledgeable'? And second: What is the higher purpose? What change does the community aim at? Why does this community want to exchange skills, experience and intelligence?

The FoTERRIS project answers these questions from the perspective of the RRI-framework. Initiatives within this frame are defined by the European Commission as involving 'multi-actor and public engagement in research and innovation, enabling easier access to scientific results, the take up of gender and ethics in the research and innovation content and process, and formal and informal science education'³⁷. **The knowledge community is therefore understood as a broad social coalition consisting of, among others, traditional knowledge institutions, governments, enterprises, (non-profit) organisations and citizen groups.** The higher purpose is defined as: '**all the members of the community should increase the exchange of knowledge and expertise within and between their organisations for the benefit of the whole society**'. As indicated in the introduction, **this higher purpose should be in compliance with the SDG's. More specifically, this exchange should be 'generative' as opposed to 'extractive'** (see before), hence providing the members of the community with an encouraging environment for mutual exchange of information. Our pilot currency scheme had to embody this set of values.

As a consequence, the pilot knowledge voucher had following aims:

- the participation of non-traditional knowledge actors within innovative projects should be stimulated
- the financial, juridical and practical thresholds to ask for knowledge from third parties should be lowered or diminished
- each exchange should be (equally) valued regardless of the background of the knowledge provider

Method and data collection

The focus group or community of the currency consisted of some 20 people, i.e. the people participating in the 'Transition Experiment' consisting of three workshops organized by the FoTERRIS team (see table below). Yet in theory the community was much bigger since users were allowed to exchange their vouchers with third parties.

The main goal of these workshops was to develop a project concept contributing to a more sustainable use of scarce materials based on an RRI approach. The participants were rewarded for their active contribution

³⁶ This way of working is inspired by the insights on qualitative research by Flyvbjerg among others. See e.g. Flyvbjerg, B. (2002). Making Social Science Matter: Why Social Inquiry fails and how it can succeed again.

³⁷ Snick, A. (2017) *ibid*.

with the knowledge voucher. For this experimental setting we opted for a straightforward and simple paper voucher backed by the FoTTRIS partner VITO, a research and technology organization based in Flanders. Each voucher was denominated – to express an exchange value - in ‘hours of scientific service by VITO in the field of sustainable materials management’. By conceptualizing our ‘currency’ as such, we remained within the Belgian legal framework.

At the end of all the sessions, the participants had a wallet with 1 to 3 vouchers counting for 4 to 12 hours of knowledge exchange, depending on their attendance. They could exchange the vouchers with other knowledge institutions and other knowledgeable partners. At the same time, they were guaranteed that the vouchers could ultimately be spend at VITO until the end of 2018, after which the voucher would be taken out of circulation.

In accordance with the timing of the FoTTRIS project, the participants were given some weeks to consider how to use the vouchers, after which a questionnaire was sent out as preparation for a telephone inquiry (see also Annex 3). These interviews were done by the FoTTRIS team, as the members of this team were familiar with the subject, the participants of the workshops and the background of the organizations they represented. This led to a sufficient response rate: 13 out of 20 participants provided meaningful information.

Could the voucher encourage the exchange of knowledge in a transdisciplinary setting involving non-formal knowledge actors? Could it open the focus of the participating organisations to include different perspectives on the challenge (materials scarcity) at hand? Could the stakeholders define and value the return of these exchanges in other than financial terms? However interesting, these questions were less important than the ultimate ambition of the experiment, namely exploring the potential of a knowledge voucher by simulating the use of it.

The interviews made clear that so far none of the participants had already used its knowledge vouchers. The participants explained that the period before the inquiry had been too short and mainly coinciding with the holidays. Yet a first transaction took place shortly after the interviews and probably more transactions are about to come.

In spite of the short time available for this experiment, **the vouchers succeeded in their prime aim. The participants started to reflect on how to use the knowledge vouchers, talked about it with colleagues in their organization and were ready to give valuable feedback on its possible use.** Although there was no room in this experiment to analyse real transactions, the interviews resulted in a series of interesting observations. Several insights and remarks about the possibilities and potential limitations of the system were formulated by the participants. A whole set of questions explored the ‘possible’ uses and resulted into suggestions to elaborate on further.

Table 12: Table listing the respondents to the survey per sector

	Academic	Government	Non-profit	Company
Invited to workshop	8	12	6	9
Attended workshop(s)	4	7	4	5
Participated in the survey	2	4	3	4

Experiment results

Overall, we can observe meaningful differences, but also some similarities, between the answers provided by the four types of sectors involved in RRI: universities, public institutions, not-for-profit organizations and companies. Based on the input from the interviews (see also Annex 3), four main conclusions can be made:

- There is a positive attitude towards the vouchers among most participants
- The act of ‘matching’ is considered crucial for its success
- The vouchers acknowledge exchange and creation that are more informal
- The vouchers can be an instrument to broaden networks and to relate with a societal mission

We elaborate on these conclusions in the next paragraphs.

Positive attitude towards the vouchers among most participants

Most respondents were positive or neutral towards a possible use of the voucher. No one expressed a negative attitude. People perceive it as ‘innovative’, ‘sympathetic’, ‘spontaneous’ and ‘inspiring’. Some argued it is beneficial not to think in Euros, but to valorise according to time contributions. A few respondents were even suggesting they would give their vouchers to parties who are more in need for additional expertise, hence underpinning the idea to understand these knowledge exchanges from a ‘generative’ economic perspective. This general positive perception by the participants forms a very interesting observation since it shows the feasibility of a ‘real’ knowledge voucher.

Even though the experiment with the vouchers was temporary, the participants formulated proposals on how to improve the system. They argued on the weak points and saw opportunities for their organization if such system would be continued. These proposals and suggestions are another indication that there is a positive attitude towards this experiment.

Despite this uncertainty about possible uses of the vouchers, most respondents came with specific suggestions on their potential usefulness for their own organization. Some respondents asked whether the experiment with the knowledge vouchers would be evaluated and what steps would follow afterwards. One organization even expressed its willingness to cooperate if further development of the knowledge vouchers is planned.

The act of ‘matching’ is considered crucial for its success

Although no one used the voucher yet, the participants to this experiment had their thought on how to use them. For most of them the use of the voucher seemed to be rather straightforward: they could exchange their vouchers for VITO expertise.

The organizations who knew VITO and its activities already, had some clear ideas, but were, on the other hand, not sure whether the voucher could be used for that specific service they were looking for.

For others this was under discussion, mostly because they had to find out the possibilities of the voucher: what services can be obtained from what organization? Not every participant could use this specific type of services and support from VITO. Moreover, not all of them did understand that the vouchers could be used in exchange for knowledge from third parties (as long as these third parties were interested in using the knowledge vouchers). But even when they understood this, it was not clear to most respondents what other services could be provided and by whom.

Some expressed this ‘need’ in different wordings. They made clear that some sort of digitalized system would be useful, e.g. an online database giving an overview of all available services. Another suggestion was to specify the best contact person, especially in larger organizations, and a detailed description of the available knowledge, competences and expertise. In addition to this, also a matchmaking intermediate actor was proposed. Companies suggested that they would like to try out partners, that is to judge the quality of the services provided. As a consequence, the quality of the services based on an appreciation by

the client could also be incorporated in the database. Other issues that were mentioned, which could be taken into account when feeding the database, relate to intellectual property (e.g. on open source or public copyright licenses) and taxation issues.

To facilitate the flow of exchanges, a system of brokerage could be helpful; the function of the broker being to prevent 'hoarding' and observing the continuity of transactions for a proper circulation. The suggestion was made that this role might be part of the proposed competence cell, one of the objectives of the FoTTRIS project. This cell would then be a meeting point for persons and capacities and function as a facilitator.

Knowledge vouchers as an acknowledgement of informal knowledge exchange and creation

Most respondents see the knowledge vouchers as a supplement to the more formal structure of the traditional (money) system. This explains why the denomination of hours on the voucher (in contrast to a backing in Euros) feels like a logical choice and is in line with the spontaneous character of exchanges. Partners feel free to offer what suits them. In most cases this concerns minor assignments that are not being rewarded traditionally: giving a lecture, attending a workshop, helping with proposals, participating in expert groups, and other kinds of actions that occur in an informal setting. For NGOs that don't have the means for it, the voucher is a stepping stone to ask advice from larger organizations, which otherwise would not happen.

Within the limited time frame of the FoTTRIS project, this innovative system of the knowledge vouchers, in parallel with the euro system, is thought to be too limited for larger assignments. This is quite logical since the actual maximum each participant could obtain and spend represents maximum 12 hours of qualified support. It was also often mentioned that the knowledge vouchers should not interfere with traditional research tasks (especially mentioned by consultants and companies who are concerned about legal consequences, intellectual property rights, income, fraudulent competition, ...).

Knowledge vouchers as an instrument to broaden networks and to relate to a societal mission

Respondents mention that the knowledge vouchers could be linked to the following two big opportunities for the research and innovation system in Flanders. It concerns activities wherefore traditional knowledge actors are nowadays hardly valorised.

- The vouchers can facilitate networking and collaboration activities among different types of actors, such as academic researchers and people working for NGOs, for public administrations and companies.
- The vouchers lower the hurdles for start-ups, NGO's and small organizations to go to large knowledge institutes with their questions and knowledge needs. The vouchers stimulate relations that can increase capacity building within these smaller organizations. It opens opportunities for SME's and NGO's to get some support in a less formal way as opposed to the complexity of subsidy regulations and traditional procedures.

To further expand these opportunities questions were raised on the possibility to use the voucher for 'other' services, namely hiring meeting rooms and equipment. Another interesting proposal, albeit beyond the scope of the experiment, was the suggestion to steer private consumers behaviour, e.g. in the field of energy efficiency, reusing, repairing... Consumers could be rewarded for attending a specific course or training on energy saving, after which they might use the voucher to pay for an energy screening of their premises.

These and other suggestions were not elaborated on in this report but demonstrate the creativity and willingness of participants to envision the voucher as an instrument to promote social change. In this sense, the vouchers would support innovative initiatives and desired behaviour for which no budgets are available yet.

Overall, the reactions to this explorative study were positive and provide useful feedback with regard to the potential use of the knowledge vouchers. While further research is definitely needed, the results allow us to conclude that the circulation of a complementary currency like a knowledge voucher can be valuable for the research and innovation landscape in Flanders. It provides opportunities for the co-creation and sharing of knowledge among all four types of actors (academic, government, non-profit and business) involved in RRI.

5.3.6 Continuation of the rewarding & compensation strategies after the transition experiments

All FoTERRIS partners have updated participants on the future developments of the experiments' outputs.

This has occurred through different channels: personal email, newsletter, social media, etc. Their contributions were also highlighted in media and websites where the co-creation, co-production nature of the process was emphasised. As an additional mark of esteem, UCM has indicated to be open to involve participants in future projects. It is also interesting to note that some of the participants of the Italian TE were invited to participate in a further project. Nonetheless, except for one partner who invited a participant in a conference, no special reward was attributed. Several TE's participants have taken part in the FoTERRIS Final Conference, their costs being reimbursed by the project.

In the future, FoTERRIS competence cells will continue to implement R&C strategies when possible (meaning, when resources are available – via a dedicated budget or partners' resources). They will rely mostly on R&C strategies that are based on intrinsic motivation and will choose a strategy according to the project-context and co-RRI values. FoTERRIS partners consider that the main source of motivation remains the gain of knowledge and the possibility to see personal issues solved. For them, it is important that the R&C strategies do not constitute a simple monetary exchange. The Flemish competence cell will continue to develop a knowledge vouchers for knowledge exchange in Flanders.

5.4 Feedbacks from the transition experiments

5.4.1 From the knowledge voucher experiment (MUNTUIT-VITO)

At the end of their report, Wanner & van Parijs (Muntuit) provide four reflections and recommendations for further implementation of a knowledge voucher in Flanders. They are presented below (Wanner & van Parijs, 2018).

The feedback given by the participants in the FoTERRIS project is a good starting point to continue the experiment. In case this experiment would be continued, the following recommendations can be valuable:

Be aware of the importance of the (co-creative) design of the currency model

It is not because transactions in the context of RRI are mediated with a complementary currency that knowledge vouchers are a guaranteed tool for the required change. Several complementary currencies remain congruent with the current financial and economic framework and don't pursue or serve in any way the objectives of the RRI agenda³⁸. We therefore stress the importance of a proper design of the currency.

³⁸ At the time of writing the Bitcoin is one such example that hits the headlines because of its rocketing value increase, not because of its contribution to our society. The ICT that backs this currency however could serve very meaningful applications for a more sustainable financial design. **Note from LGI:** That is the case of applications such as [Witcoin](#) (presented in section 5.2.14.2) , and [Colony](#), [Back-feed](#), [D-cent](#) (presented in section 5.2.135.2.13).

Central to an appropriate design, **is the goal of the system it serves and the establishment of a good governance to observe and manage the functioning of the currency**. For this reason, the community should be clearly defined: who is running and using the currency and for what purpose? In the case of RRI, actors of the four mentioned types of stakeholders should be involved to observe the purpose of knowledge exchange, increased interaction between different stakeholders and sharing of information between different disciplines. **Attention should be given to what control mechanisms are installed and how the currency scheme can be adapted whenever desirable**. The survey revealed that organizations have their own dynamic and have different sensibilities. It is normal that companies are more sensitive for 'profitability and 'competition', while NGO's tend to be 'value driven'. Governmental organizations have 'bureaucratic' or more 'static' attitudes, and universities are more focused on 'theory' and 'specialization'. Taken all this together, this governance group will probably have quite some internal discussions, but this may create a good basis with balancing feedback loops to make sure the system remains oriented towards its goal: responsible research and innovation. This way all participants get ownership of the system, which will increase its acceptance and will lead to a better use.

Seek the windows of opportunities within the system

The knowledge voucher can be a viable alternative for conventional money to settle supply and demand within the research and innovation system in Flanders. It is especially useful to valorise the ongoing commitment of much demanded actors within the community, as members of steering bodies, advisory boards, committees, etc. **We think that, even during the early stages of a project, actors could use the voucher to recognise and valorise the efforts of other partners**.

Moreover, **there is room to experiment further on how to utilise the full potential of non-traditional knowledge actors**. Can civil society take part and be valorised for its contribution in these knowledge exchanges? If a large group (crowd) of people participate in (online) meetings to share information, for instance, this might lead to better documented and more supported results compared to a setting where only a limited number of very specific experts addresses a sustainability issue.

We see some potential rewards for actors participating in the knowledge network. The most obvious one is the expansion and sustaining of personal and organizational networks. The vouchers will open opportunities leading to suppliers, clients and potential partners. Also, public exposure of what one has to offer to society is a valuable asset: if the development of knowledge vouchers is continued, the organization behind them should focus on making the efforts of all partners visible. In addition to this, this organization should also report widely on the hours of exchange realized, the distributions of exchanges by different sectors, remarkable transactions, good examples on networking, ...

Lastly, we raise the question whether it would be interesting to involve the public sector and government further on the promotion of knowledge vouchers. They have a privileged position with regards to institutional incentives like public grants, conditions on public procurements, proof of social services, etc.

"Matchmaking" as a key for success

Matching supply and demand is of key importance. Both the managers of the SIF and Vosj'innove excel in this task. Their efforts add to the success of the programmes in many ways. Firstly, they directly facilitate exchanges among members, contributing to the daily relevance of their practice. As a consequence, they further develop their networks by connecting several organizations and people. At the same time this activity helps to control the use of the voucher in relation to its goals.

With regard to the knowledge voucher, **the focus should remain on exchanges between different types of knowledge actors, while the content of the transaction should relate to the SDG's and RRI**. However, **the various intrinsic motivations of all different participants should never be disregarded**. For the vouchers to resort further effect, they should be accepted widely in the scene of knowledge institutions. To reach this,

many now rather traditional organizations should be seduced to participate. This way the voucher becomes more widely known to researchers and, last but not least students, who are the researchers and social and economic entrepreneurs of the future. One interesting path to explore is, hence, **the role the knowledge vouchers could fulfil in the educational programme or curriculum of these institutions.**

Mind legal frameworks

Several juridical and other questions may arise. **We recommend designing prototypes of possible exchanges that can be tested for their compliance with Belgian legislation.**

A choice has to be made between central emission or mutual credit. The actual voucher was ‘backed’ by VITO and service time to be spent. This gave extra credibility to the currency. As is the case now with the vouchers, that is having no euro convertibility, the concept does comply with regulations by the National Bank of Belgium. However, as seen before in mutual credit systems, such as the model used by SIFA, this could result in a slower development of the exchange relations. Following the SIFA model, the practical hurdles related to VAT have to be studied in greater detail too. Another possibility to boost credibility and acceptance could be to cooperate with a financial partner who shares the same values, such as a bank with ethical standards and supportive of RRI.

5.4.2 From IFZ, ESSRG, CESIE and UCM transition experiments

5.4.2.1 Relevance of rewarding and compensation in co-RRI

According to FoTERRIS partners, the implementation of R&C strategies **may create a gap between those who reward/compensate and those who are rewarded/compensated.** If participation is truly equalitarian like in some TE, all stakeholders should be equally treated as partners, co-creators and knowledge actors. In this condition, the implementation of R&C strategies makes little sense.

Another argument expressed by FoTERRIS partners concerns the relevance of reward as an extrinsic form of motivation. Considering the nature of the problem targeted by the TE, **the motivation should be mainly intrinsic.** Participants will benefit from the project itself as it addresses their concerns. **Consequently, R&C strategies are not always necessary and could even be counterproductive.**

However, any form of compensation can be advantageous if an experiment aims **to reach out towards marginalised segments of society.**

The “respect of ownership” strategy is not relevant when too focused on traditional IP rights

Certain FoTERRIS’s partners considered that no ownership scheme was needed for protecting the ideas developed during the transition experiments. Several reasons were given.

The first being that the ideas developed were not fully mature.

Another was that co-RRI projects are co-created projects in which the general interest takes precedence over the individual interest and thus no individual ownership is relevant. One could even see **a clear tension between the usual logic of IP protection and co-RRI principles.**

A co-RRI process attempts to be inclusive to all voices and views and **work for the common good.** It is a paradigm of the commons, not of the market. In a commons’ paradigm, all can find their private benefits embedded in the common good. The I and the We cannot be separated. One flourishes within its community, inseparably from one’s community’s flourishing. Therefore, there is no reason to use the logic of intellectual property rights since it is a logic of market privatisation, in opposition to public benefit, free access and sharing.

Related to the transition experiments, everybody is expected to participate voluntarily, to bring in whatever s/he wants and does not bring in whatever s/he does not want. All outputs are shared, available to all participants and even beyond participants, to the public in general.

It is up to each idea holder/owner to decide whom to work with and how after the experiment. During the experiment, all were given the opportunity to bring in ideas and gain the support to develop it without any ownership claimed by the experiment process itself.

5.4.2.2 Implementation of the strategies

Resources and management

The transition experiments participants were compensated by the European Commission, a specific budget line had been dedicated to that during the project preparation phase. This eased a lot the setting of the strategies.

FoTERRIS partners have reported that setting the strategies was not difficult, nor a heavy process. However, different obstacles can still slow down the process as what happened in the Spanish experiment.

Consequently, **FoTERRIS partners recommend including top management at the beginning of the process.**

Choice of the R&C strategies

It is interesting to note the **great diversity of R&C implemented** by the FoTERRIS partners in their respective TE. None of them selected the same strategy: to be effective and in line with the core value of Co-RRI, **the R&C strategy implemented should not be generalised or universalised but adapted to the specific context of the co-RRI activities**. Contextual elements such as the local regulations, the administrative rules of the institutions, the profile of participants, the topic selected, etc. are important factors to determine the right R&C strategy for the TE. For instance, it makes no sense to reward participants with local vouchers if they are not from the same area. The same logic should be applied to decide whether the R&C strategy is a success or not. As shown in the Hungarian and Italian experiments, **linking the topic of the experiment/co-RRI process to the rewarding & compensation strategy is effective.**

Although it is usually a strong source of motivation, **most FoTERRIS partners do not recommend monetary compensation**. According to them, monetary compensation is not aligned with the co-RRI spirit and may lead to crowding out/destroying internal motivation. The philosophy of co-creation is based on non-limited empowerment and interactive relationships which can be altered by the social representation associated with money. However, in one transition experiment, **monetary compensation was seen as necessary, to make sure that participation in co-RRI projects was accessible to all that wished it.**

On the contrary, FoTERRIS partners recommend **alternative forms of compensation such as vouchers that could have had the benefit of emphasising co-RRI values and principles. It is also important to develop a “multiform” compensation strategy that integrates with existing mechanisms**. As an illustration, PhD students could receive European Credit Transfer Scale (ECTS) for their participation in co-RRI activities.

According to FoTERRIS partners, **certain forms of compensation have the power to lower barriers against transitioning towards RRI**. Knowledge voucher and in-kind compensations are in line the co-RRI spirit. **These R&C strategies can be valuable catalysts for the research and innovation landscape in a region. Such R&C strategies provide opportunities for the co-creation and sharing of knowledge among all types of actors** (academic, government, non-profit and business) involved in RRI.

Partners insist also on the recognition of participants. The involvement of local government officials and media contributes to increase the visibility of the participatory process and its value. This mark of esteem reinforces the image of participants as pioneers in the field in their communities.

In a nutshell, **the ideal is to create win-win situations in which everyone gains from participating**. An ideal R&C strategy would create an equal opportunity for everyone to engage in a TE which rewards participants through its results. Participants should enter the co-RRI activities process as partners / co-creators. It is important to remain flexible during the course of the process to accommodate emerging needs. Facilitators are guardians of a respectful and appreciative atmosphere towards all participants. When hosting the co-RRI process, a good hosting can also be seen as a valuing mark. Nice settings and catering show appreciation for the participants' contribution.

On the negative side the FoTERRIS partners warn that **it can be difficult to integrate such new cooperative approach in a conventional project framework**.

Distinguishing participants from competence cell's staff

FoTERRIS's partners distinguish participants' compensation and competence cell members' compensation: **Local participants can be rewarded with vouchers or in-kind compensations while experts can receive monetary compensation as part as their salary**.

Conditioning the allocation of the reward/compensation

Conditioning the allocation of the reward/compensation to an evaluation is most likely to have a negative impact on participation. Participants could fear being judged by others, and rather say nothing. Furthermore, this evaluation logic does not seem compatible with the inherent goodwill associated with the commons' spirit.

Control and transparency

With regards to the allocation of the reward/compensation, in certain cases, **it might be hard to distinguish to whom it is a precondition for participating**: some participants do not claim any reward/compensation even though they are eligible for it, while some others claim it whereas they are already paid by their job.

On the ownership of the idea, despite the commons' spirit can really be respected by all participants, it is not always the case, and that can make it difficult to control to what extent a single participant could further develop an idea without informing the others, when the ownership scheme is not formalised.

Therefore, if no ownership scheme is not completely formalised, at least **full transparency** is essential. For example, it can be agreed that all participants that have indicated their interest to further elaborate on one of the ideas, would inform each other in case they pick up on it, and then participants could either join the co-creation of a project application or opt out. The more elaborated project proposal then would be owned by those who actually worked on it. Still that does not prevent shortcomings, as the agreement on keeping each other updated might not be taken 100% seriously.

In the end, if no ownership scheme is formalised, there is no mechanism of control to make sure that some activities might be further developed by single participants without informing others about it.

5.4.2.3 Impact

All participants were satisfied with the reward/compensation received. It is to be noted that the reward/compensation was not a motivational driver. They were rather motivated by the possibility to gain knowledge, access to a network and the interest in the topic targeted by the TE.

5.4.3 ***Final thoughts***

Although there are quite many critics against rewarding and compensating external participants in traditional R&I projects, these critics are not really relevant for co-RRI projects. For example, the fact that, like in clinical trials, participants can be more at risk when rewarded/ compensated (professional guinea pigs), does not exist in co-RRI projects. Arguments around data quality exist but in a different way: participants can come with fake news. The issue would be to distinguish the true from the false. Even, one could imagine that such participatory process could be subject of shadow lobbying.

Even though this deliverable asks for a development of such approaches, some risks might arise from a systematisation of R&C and should therefore be minded. Especially, the **instrumentalization of the R&C strategies**. For example, in certain cases, participants could be motivated to take part in a specific project, via great rewards/compensation, but their participation, knowledge and resources could be used as a legitimacy tool and/or without giving much back to them in return. Also, while the DOA was rather written from a top-down/unequal approach (traditional R&I performers 'invite' external participants to contribute), there is a **conceptual change at the end of this research**: now we can see that the relationship between the traditional and external actors should **be more equal and should give birth to new social relations**. Thus, if one wants to follow a truly commons' approach to co-RRI, reward/compensation strategies might not be needed, and could even be counterproductive, or even detrimental. This is to be evaluated on a case-by-case basis as there are also pro arguments for rewarding & compensation strategies for co-RRI activities.

One insightful finding of this work on rewarding and compensation is that the **role of researchers could change**. Researchers could support local communities that try to solve grand societal challenge locally. Research projects could be initiated in a bottom-up way, where the researchers go to (local) communities to see what could be researched/innovated instead of arriving in the community with specific ideas of technology, products, services. **Such kind of relations between researchers/innovators and local communities/sustainable entrepreneurs can be fostered by vouchers, and especially knowledge vouchers**.

Another possibility of collaboration between these worlds is represented by solutions such as Colony, Backfeed, or D-Cent (see 5.2.13). Such solutions are really innovative and propose comprehensive new ways to collaborate and trust each other.

Although the **IP** topic is quite controversial in such open approaches, and in the co-RRI concept, **it should be given further reflection**, as open organisations such as Sensorica (hardware peer to peer production) think about it (see section 5.2.13). For example, it could be **wise to sign a preliminary agreement between participants**, even if not as formal as usual IP schemes.

6 Final recommendations and conclusion

6.1 Recommendations on how to implement the co-RRI solutions proposed

As the analysis of European R&I systems has shown, these systems are completely locked-in in a certain vision, far away from the vision embodied in the co-RRI concept. Therefore, huge efforts are needed to make them change, and the **current efforts for RRI are way too insufficient**. It is not by funding R&I project like the FoTERRIS project that these changes can happen. Indeed, these projects are too small, and a R&I project does not have the legal tools to institutionalise its findings, so they rely on the good will of top-down institutions to see their findings considered.

Change is a difficult process, it can only happen by hard constraint or by intrinsic motivation. At the moment, none of these two conditions are fulfilled. What is most needed is **then to build this intrinsic motivation** to adopt the co-RRI concept in the actors of the R&I system (in quadruple helix actors, not only the main structural organisations), and to **change the institutional settings** so that the co-RRI concept can be put into practice.

As we have seen in section 4.4, we recommend that a **hybrid working group starts to clear the ground for a co-RRI policy at system level**. This policy could consider all the recommendations given in this report, and in other FoTERRIS reports (especially D4.3 on policy recommendations). This working group should be constituted early in order to not loose time and have the possibility **to shape the elaboration of the next framework programme**. However, the constitution of this working group should not prevent other actions to start implementing and institutionalising the basic content of these recommendations. But, we remind that collaboration with the quadruple helix is key, and that it is the best way to increase the legitimacy, efficacy and resilience of the future changes for co-RRI. Another key principle is that this working group is given the power to **self-organise** and is given sufficient resources to function correctly.

This working group would have **to create a sense of urgency to adopt co-RRI values, launch a collaborative and inclusive process to define a vision of a co-RRI system, and communicate this vision, while in parallel, working on the co-RRI policy** (its form, content, instruments, timing, priority etc.). **The co-RRI policy could be based on a deep and thorough understanding of R&I systems and why they do not behave as co-RRI systems**, to inform its content.

This working group is likely to encounter internal resistance, one solution could be to use a **change management** approach, led by a neutral third party, and to base the instruments on the capacity of R&I performing organisations to adapt to policy changes, as seen in section 3.1.2.5.6.

The science of transition management could inform this policy and any other policy and institutional development. The co-RRI policy could be designed accordingly, with **complementary top-down, bottom-up, institutionalisation and phase-out mechanisms**. Inclusivity, diversity, synergy, adaptability and strategy, reflexivity, system analysis, resilience could be used to define the co-RRI policy and any other co-RRI related action.

To set co-RRI solutions and related policy instruments, **plenty of experiments should be launched, instead of institutionalising fixed solutions that have not been tested and only developed in the ivory towers of top-down institutions**.

A co-RRI policy (whatever it is) will not be possible if top-down actors do not implement this policy themselves. **We therefore recommend that the EU institutions and national governments embody the co-RRI concept and develop their instruments accordingly**.

In any cases, we recommend that EU and national governmental bodies rely on actors that are willing to implement a co-RRI system/co-RRI activities. As we have seen in this deliverable, there are many that are willing to see a change in the R&I system, have developed propositions accordingly, and there are many bigger initiatives that go in this direction. **They should be invited to collaborate with governments.**

The role of top-down institutions should therefore shift to one of support to the co-RRI policy working group and to these motivated individuals, groups and organisations. **What is truly necessary, is that governmental bodies empower these actors.** Thus, self-organisation and collective learning should be supported, and their findings institutionalised.

6.2 Propositions for developing Rewarding and Compensation strategies

The work done for the R&C topic shows that not much exist to compensate/reward external participants to R&I projects in a formal way, apart from the case of clinical trials. There however exist different initiatives but most of the time they remain rather experimental, unformal, marginal. **There is no official treatment of this topic.**

The section on R&C has shown that it is possible to design such strategies, and that many ways to do so exist, although it has received little top-down attention so far.

To support the implementation of such R&C strategies, we have found that ideally it should coincide with a change of the academic rewarding system.

A first political measure could be to **include specific budget lines for R&C** of external stakeholders in R&I projects budget. This budget could be used to develop the appropriate rewarding and compensation strategies, which, as we have seen, can be multiform, and not necessarily based on direct monetary compensation.

Policy measures in favour of **alternative currencies and the recognition of knowledge vouchers** should be launched. As the VITO experiment showed it, there are many legal barriers that prevent the development of alternative currencies and knowledge vouchers (tax rules, type of currency, etc.).

This encouragement to engage external stakeholders in R&I projects could be strengthened **by a change of the legal framework in order to let universities, RPOs reward/compensate external actors** (which was not possible at UCM). The revision of universities rules concerns also the education programs. Students should be encouraged to participate in co-RRI projects in exchange for ECTS credits. It is even possible to go a step further by including participation in co-RRI projects as a professional training for non-R&I employees.

These policy measures should be part of the co-RRI policy mentioned above. Specific hybrid working groups could be engaged to further implement rewarding and compensation strategies at system level, based on the findings of this deliverable.

6.3 Conclusion

In this deliverable we have proposed an analysis of a generic R&I system, a presentation of the current EU R&I policy, a presentation of the gap between current systems and an ideal co-RRI system, and inspirational initiatives that go in the direction of a co-RRI system, including a whole section on possible rewarding and compensation strategies and how to set them. We also have elaborated solutions to current practices to help a co-RRI system takes shape, based on transition management insights, other FoTERRIS deliverables, and questionnaires to FoTERRIS partners and external actors. Lastly, we have made propositions to implement these solutions.

The main insights that we have learned from this task T2.4 is that there are many individuals and groups that are willing to see a change in the co-RRI system and have developed initiatives and change-based propositions accordingly. As transition management science shows, these individuals and groups should be empowered to continue their action and shape the development of future R&I policy. The role of top-down bodies should therefore to provide this empowerment, support their self-organisation, and institutionalise the findings of these initiatives.

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Abbreviations

CESAER: Conference of European Schools for Advanced Engineering, Education and Research

CIP: Competitiveness and Innovation framework Programme

Co-RRl: Co-created Responsible Research and Innovation

COSME: Programme for the Competitiveness of Enterprises and SMEs

DG: Directorate – General

EARTO: European Association of Research and Technology Organisations

EC: European Commission

ECTS: European Credit Transfer Scale

EIB: European Investment Bank

EIC: European Innovation Council

EIP: European Innovation Partnerships

EIT: European Institute of Innovation and Technology

EPSC: European Political Strategy Centre

ERA: European Research Area

ERAC: European Research Area Innovation Committee

ERC: European Research Council

ESF: European Social Fund

ESIF: European Structural and Innovation Funds

ETP: European Technology Platforms

EU: European Union

EUA: European Universities Association

FP7: Framework Programme n#7

FP9: Framework Programme n#9

GBARD: Government Budget Allocation for Research and Development

GDP: Gross Domestic Product

H2020: Framework Programme for Horizon 2020

HEI: Higher – Education Institution

HR: Human Resources

ICT: Information and Communication Technology

IP: Intellectual Property

IPR: Intellectual Property Rights

IRI: Independent Research Institutes

JPI: Joint Programming Initiatives

JRC: Joint Research Centre

KET: Key Enabling Technology

KIC: Knowledge and Innovation Community

MNHN: French National Museum of Natural History

MOC: Mission-Oriented Centres

MS: Member State

NABS: Nomenclature for the Analysis of Scientific programmes and Budgets

NGO: Non-Governmental Association

LERU: League of European Research Universities

OECD: Organisation for Economic Co-operation and Development

PBRF: Performance-Based Research Funding

PCP: Pre-Commercial Procurement

PPI: Public Procurement of Innovation

PRC: Public Research Centres and Councils

PRO: Public Research Organisation

R&C: Rewarding and Compensation

R&D: Research and Development

REA: Research Executive Agency

RFO: Research Funding Organisation

R&I: Research and Innovation

RO: Research Organisation

RRI: Responsible Research and Innovation

RTD: Directorate – General for Research and Innovation

RTO: Research Technology Organisations

SD: Service Department

SDG: Sustainable Development Goals

SET: Strategy Energy Technology plan

SiS: Science in Society

SME: Small and Medium Enterprise

S&T: Science and Technology

Swafs: Science With And For Society

TE: Transition Experiment

TEU: Treaty on European Union

TFEU: Treaty on the Functioning of the European Union

UN: United Nation

UPRO: Umbrella Public Research Organisation

US: United States of America

1. Annex 1: Characterisation of EU R&I systems

Overview of a generic R&I system

Definitions and classifications

The R&I system comprises of research, education, development and innovation activities. The term R&I is relatively new, for before, the term R&D prevailed. We present here some defining elements of the research, development and innovation terms since FoTERRIS little investigated education issues. For R&D, the source is the **Frascati Manual** (OECD, 2015) which is the international standard for statistics on R&D activities at national level.

Definition of R&D

Research & experimental development (R&D) comprise creative and systematic work undertaken in order to **increase the stock of knowledge** – including knowledge of humankind, culture and society – and to devise **new applications of available knowledge** (OECD, 2015).

R&D activities (OECD, 2015):

- Are carried out by **different performers**
- May be aimed at achieving either specific or general objectives
- Are always aimed at **new findings**, based on original concepts (and their interpretation) or hypotheses
- Are largely **uncertain about their final outcome** (or at least about the quantity of time and resources needed to achieve it),
- **Are planned for and budgeted** (even when carried out by individuals),
- Are aimed at results that could be either **freely transferred or traded in a market place** (OECD, 2015)

Three types of R&D can be distinguished (OECD, 2015):

- **Basic research**: experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view
 - **Pure basic research** is carried out for the advancement of knowledge, without seeking economic or social benefits or making an active effort to apply the results to practical problems or to transfer the results to sectors responsible for their application
 - **Oriented basic research** is carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to recognised or expected current or future problems or possibilities
- **Applied research**: original investigation undertaken to acquire new knowledge. It is directed primarily towards a specific, practical aim or objective.
- **Experimental development**: systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

The Frascati manual proposes **five criteria to distinguish what is and what is not an R&D activity** (OECD, 2015):

- novel,
- creative,

- uncertain,
- systematic,
- transferable and/or reproducible

The following activities **are not counted as R&D** in the Frascati manual:

- scientific and technical information services,
- testing & standardisation,
- feasibility studies,
- specialised health care,
- policy-related studies,
- programmatic evaluations,
- purely R&D-financing activities,
- indirect supporting activities

Definition of innovation

According to the European Political Strategy Centre, innovation is a **new idea** in relation to something that is established. This idea must find its way **from theory to practice**. Innovation does not only relate to **technical or scientific novelties, but may also pertain to processes and organisational change** across sectors (European Political Strategy Centre, 2016).

Classifications

Several nomenclatures exist to classify R&D&I activities. There are statistical and non-statistical classifications:

- Statistical classifications (Lepori, 2017):
 - The **Nomenclature for the Analysis and Comparison of Scientific programmes and Budgets** (NABS) is the one used in the Frascati manual to classify public research funding according to its specific **policy intentions**
 - The **NACE** is the classification of R&D activities as **economic activities by sectors of activity**
- Non-statistical classifications (Lepori, 2017):
 - The **Key Enabling Technologies (KETs)** classification distinguishes technologies that are knowledge intensive, multidisciplinary, of systemic relevance since cutting across many technology areas with a trend towards convergence and integration. They are associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment.

Characterisation of a R&I system

Analysis framework

In this section we present what a generic R&I system is, covering both national and EU levels. We define a R&I system as all artefacts (practices, technologies, policies, employment, etc.) which ultimately result in, in whatever sectors:

- Knowledge
- New or better products and services, technologies, methods, processes
- Other outcomes that built on these latter, such as:
 - Research and innovation excellence
 - Productivity and growth
 - Education
 - Sustainable development

Our analysis framework consists in detailing the following artefacts of the system:

- Inputs
- Motivations
- Framework
- Actors
- Functional organisation

Framework overview

Inputs

By inputs we mean all the resources that are needed to carry out the activities that will ultimately result in the outputs and outcomes described above. We consider the following inputs:

- Capital
- Knowledge and information
- Workforce
- Infrastructure

Motivations

We thought it interesting to present the motivations of the main actors that undertake R&I activities. We have distinguished between public, private and individual motivations.

Framework

The framework consists of all artefacts that have an influence on the R&I system. We have distinguished the following influential categories:

- Mindsets
- R&I and related policies
 - Policies as such
 - Policy instruments
 - Supply-side measures
 - Demand-side measures
 - Integrated measures
- External structure, that is all the structural elements of other sectors and systems that frame the way the R&I system behave.

Actors

We present the main public, public-private and private actors that undertake R&I activities and distinguish them according to their role (governance, funders, performers, demand, etc.).

Functional organisation

This last unit of analysis serves to present important R&I activities, and who initiate and carry them out. We have selected the following activities as important ones:

- Political game
- Policy-making
- Appointment of missions
- Allocation of public and financing budgets
- Elaboration of project-funding programmes
- Management of structural organisations
- Policy-based evaluation of the R&I system
- Informal evaluation of HEIs
- Core activities
- Validation of research results
- Valorisation of outputs

Detailed analysis

Inputs

Capital

R&I and education activities require capital for paying the workforce and scientific infrastructures. Furthermore, basic research and education activities do not generate money, while the return on investment for applied research and innovation is all but predictable. Two types of capital stream can be distinguished:

- **Public streams:** public funds can be seen as policy instruments, so they are presented in the section on policy instruments
- **Private streams:** private funding is more important than public funding. It serves to finance private but also public organisations.

Knowledge and information

Science, R&I and education activities are a continuous construction on existing knowledge. Access to existing knowledge is therefore **crucial**. Furthermore, as innovation is linked to economic competitiveness, information can be seen as a **competitive weapon**.

Workforce

Two categories of workforce can be distinguished: **private and public workforces**. The public workforce must abide by the current policy framework and follows what is traditionally called an academic career, which is well formalised (PhD, Postdoc, Lecturer, Professor, Dean, etc). The private workforce is more adapted to the necessity of private organisations: engineers are most found in for-profit companies, while less traditional profiles can be found in independent research centres, NGOs, or not – for profit organisations.

Infrastructures

As already said, access to knowledge and information is crucial for R&I and education activities. Therefore, a lot of (infra) structures exist to provide this access:

- **Publishing system**
- **Libraries**
- **Databases**
- **Conferences & events**
- **Etc.**

Accordingly, **ICT infrastructures** are as important and allow a variety of other activities such as national statistics, online courses, etc.

Hard sciences such as physics, maths, IT, biology, chemistry require many **infrastructures** (labs, materials, scientific instruments, ...) and for some, lots of **energy** to run (e.g. the Large Hadron Collider).

Motivations

Here as well it is possible to categorise two types of motivation. The motivation of public bodies is to provide **education**, to increase **economic growth and competitiveness**, to gain **international prestige** (through national statistics, including numbers of Nobel prizes, etc.), and to **comply with EU R&I policy**. In the private side, **for-profit companies** usually think of R&I as a means to increase their competitiveness on existing markets and access new ones. Certain non-profit organisations rely on R&I to **improve and change**

what presently exists in various domains. While individuals, who choose to have professional or side activities related to R&I, are most of the time driven by **curiosity**, a taste for **intellectually challenging** activities, or the **prestige** associated with scientific discovery and entrepreneurship.

Framework

Mindsets

As any activity, R&I and education activities are framed by **individual and collective mindsets**. Current R&I policies in Europe are shaped by a certain idea of progress, which assumes that progress and thus well-being results **from economic growth and competitiveness, as well as from technological innovation**. Innovation is thought as their prerequisite.

Due to the recent, in an historical perspective, successes of the scientific method (starting with the Enlightenment, followed by the industrial revolution, and present major innovations (artificial Intelligence, spatial exploration, genetics, etc.)), Science, R&I and education activities have long been considered as prestigious and **fixed mindsets on what constitutes good and bad science** have developed, based on the type of science that led to these successes. However, nowadays, the problems R&I is confronted to are not the same as in the past. **When the first aim of past scientific inquiry was to understand the world, we now face the challenge of ensuring a sustainable living for all Earth's inhabitants**, which means that the main subject of R&I has switched from natural to human and natural sciences. This shift asks to overcome the fragmentation of Science and R&I in areas of expertise and types of activities and to develop new types of knowledge.

However, as all the prestige is associated to the past type of science, it is extremely difficult to shift mindsets. But **new mindsets emerge**, leading to concepts such as co-RRRI, citizen sciences, etc., and the reorientation of R&I activities towards sustainability and the use of different, usually more inclusive, approaches and methods.

R&I and related policies

Even though R&I activities are naturally human activities and would exist whatsoever, it is important to remember that most of them are part of national and European political strategies. Despite the supposed objectivity of Science, **R&I activities are framed by politics**, since deciding what to research and invest on with public capabilities, is a political act. We present here the main policy elements that frame R&I and education activities.

Policies

All the following policies go hand in hand and influence R&I and related activities:

- Education
- Science
- R&D& Innovation, including specific policies on key technologies
- Economy
- Industry

Policy instruments

To enforce policies, there exist a variety of policy instruments, which can be classified according to whether they serve the supply or the demand side. We present here a brief classification of these instruments, that we elaborated from (Edler & Georgiou, 2007; Empirica et al., 2013).

Supply – side measures

Management

Some instruments serve to manage the R&I system, by providing institutional support to R&I performers. Some R&I public organisations have for mandate to provide this support (for e.g. Umbrella Public Research Organisations). Some other instruments serve to optimise organisational performance (internal rules for reporting, allocating funds, etc.).

Optimisation of activities

Some instruments aim at ensuring that R&I activities are carried out in an optimised way. These instruments cover:

- Intellectual Property (IP) regulation: protection of academic outputs, licensing contracts, ...
- Links between the research and innovation worlds and technology transfer policies
 - Instruments to bridge institutions (businesses and research), and strengthen linkages within innovation systems such as the creation of infrastructure and opportunities for scientists and business people/engineers to meet, communicate, and collaborate (Empirica et al., 2013)
 - Strategic programmes for industry
 - Including intermediary results of tech transfer, such as patent applications or granted patents in academic appraisal procedures

Inputs

These instruments focus on providing the necessary inputs to R&I activities.

Knowledge and information

The following instruments aim to improve the access to information:

- Open access policy and related instruments (rules to publish under the open science model all publicly funded research, ...)
- Provision of public services such as:
 - Contact databases
 - Brokerage events
 - Advisory services
 - International technology watch
 - Patent databases
 - Benchmarking
 - Etc.

Workforce

Policy instruments here aim to form the minds to the scientific (mainstream) methods, improve capabilities, and attract the best researchers and entrepreneurs:

- Education methods
- Tailored innovation courses for firms
- Entrepreneurship training
- Industrial research studentships
- Mobility grants
- Etc.

Capital: public funding and financing instruments

Public funding and financing instruments are specific mechanisms to allocate public budgets to (groups of) performers (Lepori, 2017). They can directly fund or finance R&I activities, or support investments in R&I activities. The variety of such public instruments is considerable (Heinze, 2008) and they can be classified according to (based on (Empirica et al., 2013; Lepori, 2017; OECD, 2015):

Their purpose / thematic

Whether they focus on:

- Education and capabilities, examples include:
 - Subsidised secondments
 - Support for recruitment of scientists
 - Training and mobility
- Career development: personal grants can be provided to individuals for their career development
- Basic research
- Applied research
- Experimental development
- Innovation
- Key technologies
- Other policies and priorities such as grand societal challenges, economic innovation, etc.
- Cooperation between performers (academic – private, quadruple helix, etc.)

Whom they benefit

- Individuals (researchers, entrepreneurs, ...)
- Organisations (public, private, public-private; large companies, SMEs, NGOs, etc.)
- Mixed groups (intra or inter organisation consortia)

Their content

- Positive (meaning it is directly received by the beneficiary)
 - Money or capital
 - Vouchers
 - Underwriting loss: governments may underwrite some of the risk incurred by 3rd parties providing innovation financing
 - Guarantees for R&D&I loans
- Negative (meaning that the instrument will diminish due expenses)

The transaction's nature whether it is a funding (funds are contracted or transferred without compensation) or a financing instrument (funds are transferred against compensation – dividend, etc.).

The transaction's modalities

If it is a positive funding transaction, there are two modalities:

- Exchange: a service is delivered against funds
 - Contract: contract – based project-funding with specific objectives and milestones (Reale, 2017).
 - Payments for R&D services: procurement of R&D services, typically described as contracts for R&D services, or R&D procurement.
- Transfer: funds or other (assets, guarantee) go from one organisation to another without compensation. Examples include:
 - Awards and prizes
 - Endowed positions
 - Grants
 - Provision of infrastructure / materials

If it is a negative funding transaction, the instruments can be:

- Tax relief for volume or increment in R&D&I
- Reductions in employer's payroll tax and social contributions
- Personal tax incentives for R&D&I workers
- Etc.

If it is a financing transaction, the instruments can be:

- Equity
- Venture capital: public, mixed or subsidised
- Loans

Grants: institutional and project-based instruments

We focus here on institutional and project-based instruments, as they are the two main grants for R&I.

Institutional funding is funding attributed to public R&D&I performing organisations for their running activities and, usually, for an unlimited period (the yearly amount might vary). Institutional funding is usually not earmarked to specific activities and to organisational subunits: the internal allocation is left to the performing parent organisation. Institutional funding can be performance-based or not, and there exist different bases for calculating the amount that will be transferred. The transfer can be lump-sum or according to a budget-line, depending on the level of autonomy granted to the organisation ((Jongbloed & Vossensteyn, 2001) in (Reale, 2017)).

Project funding is defined as money attributed to a group or an individual to perform a research activity limited in scope, budget and time. It can be identified and distinguished from institutional funding based on three main characteristics: i) funds are attributed directly to groups and not to a whole organisation, ii) they have a limited activity scope and duration and iii) they are attributed by a research funding organisation outside the performing organisation to which the beneficiary belongs (Reale, 2017).

Demand-side measures

Systemic policies

Some policies have a more systemic focus, to improve the functioning of existing and new markets, such as cluster and supply chain policies.

Regulation

Regulations are developed to set standards and innovation targets, to create technology platforms coordinating key technologies development, among others.

Support of private demand

Some instruments aim to support the private demand of R&D&I outputs, such as:

- Demand subsidies and tax incentives
- Articulation of private demand
- Awareness on the benefits of innovation and training to use innovative products, services
- Catalytic procurement

Integrated measures, concerning both the supply and demand sides

Public-private partnerships

Public-private partnerships can be created to coordinate the supply and demand sides in a particular domain. Examples include: the European Technology Platforms and the European Innovation Partnerships, among others.

Public procurement

Public procurement instruments serve to support R&D&I providers, by opening a sale channel towards demanding public organisations.

Awareness measures

Awareness measures are developed to inform the wider audience about the benefits of the national and European R&I and related policies.

External structure

The external structure refers to the structure of non-R&I sectors that **influence the R&I system**. Such structural influences include:

- Other strategies, policies and regulations such as environmental and social policies
- Functioning of markets and finance, influencing innovation investments capacity
- Commercial strategy of large companies
- Quality of available infrastructures
- Standards

Actors

While we present here mostly single organisations, it is important to note that they also form networks, which have even more weight.

Public and public-private actors

Political actors

Public political actors, that is, those who have an influence on the existing policy include **European institutions and national institutions** impacted by the R&I policy (impact on their budget, scope of action, etc.).

Policy and governance actors

At European level, these actors are the **European Commission** and the related organisations that it has created to enforce the European R&I policy (ERA, ERC, Structural funds, etc.).

At national level, **ministerial bodies and affiliates** are in charge of developing the R&I and related policies, while **specific institutions** have been created to support the implementation of policies, monitor and regulate R&I activities.

Structural supply organisations – those organisations that are public or semi-public and are the vital players of the policy

National funding and financing organisations

Research Funding Organisations (RFO) are organisational entities which **distribute public funding** for R&D on behalf of the State (Lepori, 2017). They cover both independent agencies such as research councils, and ministries and offices. Most of the time RFOs allocate project funding but in certain cases, they can also allocate institutional funding (Lepori, 2017).

Other organisations distribute different funds and financing (awards, prizes, negative funding in form of tax reductions, guarantees, public venture capital etc.), and are **more oriented towards innovation**.

National Umbrella Public Research Organisations (UPROs)

UPROs are national-level organisations which mission is to **organise research activities in a specific field** of national research policy (Lepori, 2017). They usually have a dual function: hosting and managing research laboratories distributed over the national area (managing laboratories and researchers' careers) on the one hand, and to provide project-funding on the other (Lepori, 2017).

National Higher Education Institutions (HEIs)

HEIs are organisations whose main mission is to **offer education** at the tertiary level as well as to **perform R&D activities** (Lepori, 2017). They are generally funded through a core institutional allocation (Lepori, 2017).

National Public Research Organisations (PROs)

PROs are public-sector organisations, which **perform R&D activities** as their core mission. PROs can also perform a variety of other roles (Sanz-Menendez et al., 2011):

- Policy support
- Training
- Knowledge and technology transfer
- Service provision
- Research funding
- Technological facilities
- Standardisation & certification

There exist different types of PROs (Sanz-Menendez et al., 2011):

- **Mission-Oriented Centres (MOCs)** are owned and sometimes run by government departments or ministries at the national and sub-national levels; they undertake research in specific topics or sectors to provide knowledge and technological capabilities to support policy-making.
 - Example: CIEMAT (Investigation Centre for Energy, Environment and Technology) in Spain
- **Public Research Centres and councils (PRCs)** perform and sometimes fund basic and applied research in several fields; they tend to be of considerable size in certain countries
 - Example: CNRS (National Centre for Scientific Research) in France
- **Research Technology Organisations (RTOs)**, or industrial research institutes, are dedicated to the development and transfer of science and technology to the private sector and society; although some of them are owned by government, usually their links with the government tend to be looser than the rest. They operate in the semi-public sphere and in the non-profit sector.
 - Example: Tecnalia in Spain
- **Independent Research Institutes (IRIs)** perform both basic and applied research focused on ‘issues’ or ‘problems’ rather than just fields. Most IRIs may be termed as ‘semi-public’ as they are founded under different legal forms and work at the boundaries between public and private but develop their activities with substantial public support and/or participation of public representatives in their governance.
 - CNIO (National Cancer Research Centre) in Spain

Supranational and international funding / financing organisations

Other organisations, at EU level, or joint between MSs, can provide funding to national or international organisations (to project consortia, or even RFOs). Example include the [European Research Council](#) and [Interreg](#).

R&I Performers

Those who really produce R&I are **R&I units and groups**. They either belong entirely to one HEI, UPRO, PRO, or are joint units between the latter. The units that belong only to one organisation are not autonomous and, in most cases, are funded through a combination of institutional resources from their parent organisations and from external third-party funds (Lepori, 2017) (project-funding in most cases). Joint units are usually autonomous and funded by government allocations.

Innovation and technology-oriented organisations

Specific public organisations are created to **support innovation and technology developments** such as techno parks, technology transfer and innovation centres, incubators.

Demand

Public demand can be **policy-oriented or public-service oriented**. In case it is policy-oriented, it includes all ministerial and other institutional units which command R&I activities to **orientate their policy-making** according to their outputs. In case it is public service-oriented, it includes the public bodies such as cities that directly deliver public services. They command R&I activities and buy innovative outputs to **improve their delivery**.

Private actors

Political actors

Apart from lobbies, mostly from performers organisations (network of national and international HEIs, high-tech and large companies, etc.), **R&I is little discussed** by private political actors such as political parties and by citizens in the public debate. To be noted, new organisations promote new kinds of Science and R&I (this includes RRI and citizen-science oriented organisations).

Funders and financiers

Private funders and financiers include:

- Philanthropic organisations
- Companies, which can fund public R&I by commanding R&I activities, and their own R&D&I departments
- Banks, both mainstream and ethical banks
- Business angels and investors
- Crowdfunding and crowdsourcing platforms

Performers

Private actors that perform R&I activities are:

- For profit organisations
 - Large companies with R&D&I departments
 - Innovation driven joint ventures
 - Innovation driven SMEs
 - Start-ups
 - Independent R&I organisations
 - Certain for-profit fablabs
- Not for profit and NGOs organisations, including fablabs, science shops, makerspaces
- Communities and individuals that innovate for solving a problem they directly encounter, or that participate in citizen science projects.

Support organisations

As for the public section, there exist private organisations for supporting innovation: techno parks, incubators, accelerators, science shops, mentoring organisations etc., but there exist also different organisations which aim at supporting the side activities of R&I such as: publishers, altmetrics providers, conference organisers, etc.

Demand

R&I activities benefit society as a whole (citizens, companies, public organisations, etc.). However, certain categories are more in need such as patients or certain communities.

Functional organisation

We present here some further insights on specific activities in the R&I system and by whom they are carried out/initiated. While these activities occur both at national and European levels, we here present the national ones, for they are the most common. The European activities follow more or less the same scheme.

Political game

The political game is hardly democratic. R&I and education policies are not the main subject of any political campaign. The political game takes place at the European and ministerial levels, between the government in power (both EU and national government) and lobbies.

Policy – making

Policy-making include two types of activities: policy-making at such, which is the resort of ministries and affiliates, and preparation of policy-making, which consist of, among others:

- (Technology) forecasting & long-term visions
- Benchmarking of industrial sectors
- Elaboration of evidence for policy-making

These latter activities are carried out by governmental organisations or dedicated R&I performers such as MOCs or IRIs.

Appointment of missions

R&I policy is translated into missions, mandated to the various structural organisations: RFOs and innovation funding organisations, HEIs, PROs, UPROs, knowledge transfer and innovation centres, platforms, etc. This is the resort of ministerial and affiliates bodies.

Allocation of public and financing budgets

Specific funding lines inside the whole public budgets (national or regional) are intended to be spent for R&I and related purposes. The Government Budget Allocations for R&D (GBARD) accounts for all public money spent for R&D (Lepori, 2017). These budget lines are then allocated to the various R&I organisations. We present here the allocation of institutional and project-funding, for there are the most important and common ways to allocate public funds.

Allocation of institutional funding

Institutional funding is allocated by the government or supra- and international agencies to UPROs, HEIs, PROs, and joint units, and by UPROs, HEIs, PROs to their internal units.

Allocation of institutional funding can be **performance-based, or not**. Recently, there has been a clear trend towards inserting performance or quality-based funding, to **enhance the accountability of organisations, provide incentives for improving research performance, and to concentrate resources** in the best performing organisations in order to increase the probability of a return on investment (Jonkers & Zacharewicz, 2016; Reale, 2017). A Performance – Based Research Funding (PBRF) system usually implies to assess research on an ex-post basis, to evaluate the outputs and/or impacts of research, and to base the allocation of funds on the outcome of the assessment (Jonkers & Zacharewicz, 2016).

The usual criteria for allocating institutional funding in a non-performance-based way are:

- **Education metrics**
 - Inputs: number of students enrolled, personnel's costs, ...
 - Outputs: number of BSCs, MCSs graduates, PhD awarded, ...
- **Historic indicators**: allocation is partially or fully based on the allocation distributed in the preceding years
- **Budget negotiations**

Common performance-based criteria include:

- **Bibliometric:** counts of publications, impact factor, citation analysis, ...
- **Performance indicators:** academic quality, topicality to national R&D policy, ...
- **Other formula elements:** number of patents, number of international research projects, external funding, diversity measures (gender, internationalisation), ...

Institutional funding can also be allocated according to a mix of these criteria.

Allocation of project funding

Project-funding is allocated by UPROs, RFOs and innovation funding organisations (national, supra- or international) and **has increased substantially** in a number of countries in the past decade (Reale, 2017). The allocation is usually based on a **competitive process**, among several applications submitted in response to calls for tenders issued by the funding organisation (Reale, 2017). For selecting the 'best' applications, several types of peer-review process exist (Reale, 2017). Project funding can also be contract- based, with specific objectives and milestones (Reale, 2017). In project-funding, the evaluation is therefore ex-ante, and the criteria can be:

- Performance indicator (academic quality, efficiency of the implementation, ...)
- Topicality to calls
- Potential for economic innovation and public/private cooperation
- Who the applicants are (HEIs, Government, NGOs, etc.)

The decision-making body responsible for the allocation of both institutional and project-funding can be composed of (Lepori, 2017):

- Academic (university professors and/or other public-sector researchers)
- Experts (experts from policy, society and economy)
- Policy and administration
- Mixed (at least two of the above categories)
- No committee, in case decision is based on some automatism

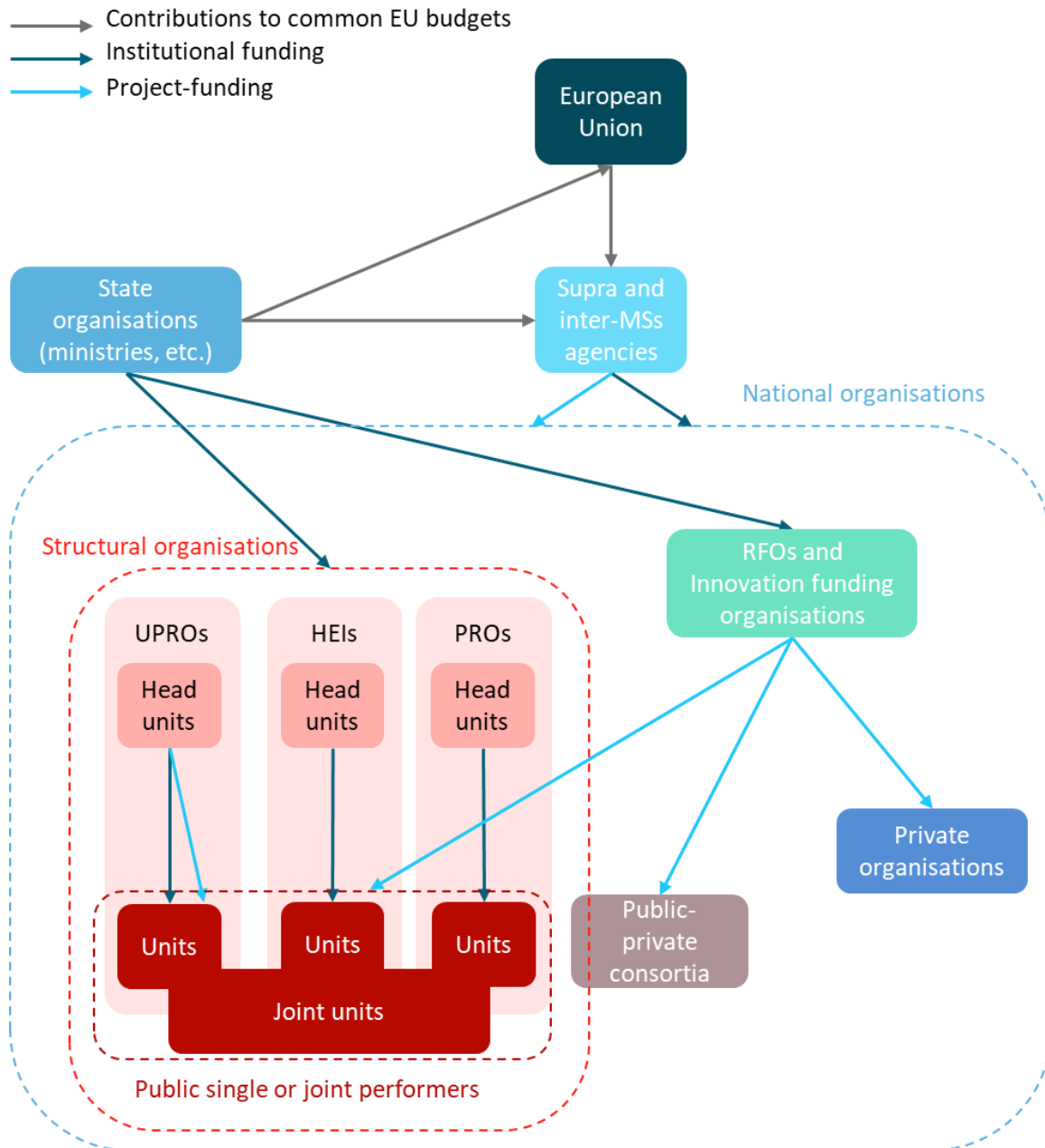


Figure 27: Overview of budget and funding flows, based on (Lepori, 2017; Reale et al., 2013)

Elaboration of project-funding programmes by funding organisations

RPOs and innovation funding organisations receive a certain budget from the government, which they allocate as project-funding to R&I performers. However, they do not allocate the funding randomly, but on the basis of funding programmes designed according to their attributed missions. After receiving their budget, they (Reale et al., 2013):

- identify scientific priorities and define type and mode of research and innovation expected
- define procedures and rules for submitting proposals
- define procedures and criteria for proposals evaluation and selection
- define procedures for contract management

Management of structural organisations

The head units of UPROs, HEIs, and RFOs, and innovation funding organisations have to ensure that they carry out the **missions that they have been attributed**. Especially, UPROs have the capacity to supervise a whole R&I field.

With regards to **PROs, their autonomy is usually more important**, so they can select their role in a certain extent. The two dimensions that affect the capacity of PROs to select and perform their roles are (Sanz-Menendez et al., 2011):

- Their autonomy against the political system in place, based on their power in the negotiation processes with regards to their budget, employment and structure. The autonomy scale, starting where autonomy is maximum, is: IRIs, RTOs, PRCs, MOCs
- Their internal distribution of authority: in systems where such distribution is decentralised and researchers very autonomous, PROs may find it harder to develop strategic approaches towards role selection. The overall profile of the PRO will tend to be the aggregate of the individual preferences and orientations of the researchers.

PROs remain however subject to policy change, their **ability to respond to such changes** is determined by:

- Their specific institutional arrangement and organisational structure (autonomy degree in budget allocation, employment structure, internal distribution of authority)
- Their researchers' adaptive behaviour, goals and incentive structures.

Policy-based evaluation of the R&I system

To ensure that the R&I system will deliver according to the R&I and related policies, it is regularly evaluated, at different levels.

Evaluation of the R&I system as a whole

Several organisations monitor the R&I systems: countries themselves, the EU, Eurostat, the OECD, etc. The main indicators are:

- R&D&I budgets and expenses: private, public; to the private, to the public sectors; within the national territory, externally; at country level, at regional level, etc.
- Workforce: by sector, by gender, by educational degree, by ages, by type of organisation, career's evolution, mobility paths, etc.
- IP: numbers of patents, trademarks, etc.
- Bibliometrics and citation metrics
- Infrastructure's quality
- Investments
- Cooperation
- Employment
- Market value generated

Evaluation of performing organisations

Performing organisations are usually evaluated through **case studies, bibliometrics, peer review, patents analysis, user surveys, and cost-benefit analysis** by specifically mandated organisation (national or international, independent, etc.).

Evaluation and valorisation of researchers and units

Researchers, academics and R&I units are evaluated by their parent organisation, as most usual employees are. However, in the public sector, evaluation is intrinsically linked with **peer esteem**, as shown below.

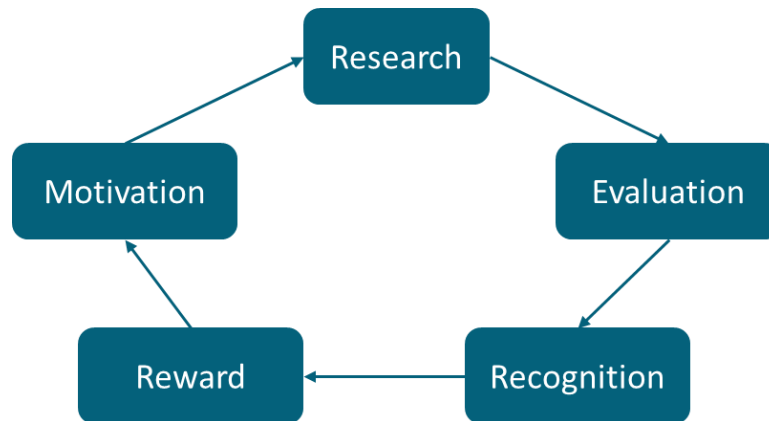


Figure 28: Research reward cycle (O'Carroll et al., 2017)

If the evaluation is successful, then one gets recognised and can receive a reward, which can increase his/her motivation to continue his/her R&I activities.

Researchers and academics can be evaluated thanks to 'business as usual' criteria and **altmetrics**. The 'business as usual' criteria are as follows:

- **Research quality:**
 - Academic record
 - Amount of publications
 - Amount of citations
 - Quality of the publications used as publishing channels for the research
 - Research relevance
 - Valorisation (patents, economic fallout, ...)
 - Etc.
- **Network and peer esteem:**
 - Invitations to give lectures at conferences and publications in proceedings
 - Participation in international research projects
 - Participation in doctoral committees
 - Reviews for scientific journals
 - Capacity to competitively attract funding
 - Prize, awards
 - Recommendations
 - Etc.

Several tools and indicators support the evaluation process. The **journal impact factor** is used to evaluate academic journals. Publications in high-impact factor journals are then better noted. The **h-index** is used to measure the publishing activity (number of articles published) of researchers and their scientific influence (number of citations). The **g-index** is a variant of the h-index and emphasises on the articles that have a great number of citations.

Many publishers have an **online platform** that allow evaluators to determine how often a researcher has been cited, such as [Web of Science](#), [Scopus](#), [Google Scholar](#), [the Publish or Perish application](#). **Top lists** give directly the most cited researchers per year in a given field. Examples of top lists are: [Highly Cited Researchers](#), [CiteSeerX](#).

When evaluating a **research team/group**, the criteria are roughly the same, but indicators are not directly available from online databases.

Almetrics are alternative metrics that complement ‘business as usual’ metrics and are based on recent **digital technologies**. They are meant to emphasise the informal dissemination of research outputs (articles, papers, etc.) through online platforms such as Twitter, Facebook, blogs, Wikipedia, and specific science-based platforms such as [Mendeley](#), [ResearchGate](#), [Academia.edu](#) etc. (Vuorikari et al., 2015). Aggregators for, or enablers of, such informal dissemination have been created to track all citations of a given researcher, such as [Altmetric.com](#), [Kudos](#), [Orcid](#). These new altmetrics platforms can be seen as **emerging reputational mechanisms** (Vuorikari et al., 2015). They allow to share knowledge and information, disseminate one’s research outputs, receive feedbacks, and to measure, demonstrate, compare, and rate outputs in a public way. At the end, they allow to build, promote and measure one’s reputation. A report on altmetrics platforms indicate that their large majority of services serve traditional research activities, and that activities such as teaching attract little notice (Vuorikari et al., 2015).

It is to be noted that the purpose of the **evaluation is not the same depending on the parent organisation**. For example, intra-organisational evaluations in PRCs and IRIs would relate to the research outcomes of individual researchers. Outcomes such as publication impact and success in competitive block funding would inform the decision related to the allocation of rewards. In the contrary, MOCs would have different evaluations, where the evaluation variables and resulting managerial decisions may be more ‘political’ than ‘scientific’ (Sanz-Menendez et al., 2011).

Based on formal evaluation and altmetrics, a researcher can receive the **following rewards**:

- Award of a new degree
- Appointment or extension of a contract
- Salary promotion
- Funding for further research
- Travel or post-doctoral fellowship
- Scientific support
- Material and / or institutional support
- Prizes and awards (the most known being the Nobel Prize)

Advancing one’s career

To advance one’s career, a researcher must perform well according to the evaluation criteria, must access the most renowned HEIs, UPROs, or PROs, and must publish in journals of a high impact factor. Ultimately, given the nature of the evaluation system, a good researcher is a researcher that publishes a lot, according to the famous ‘**Publish or Perish**’ quote. This means that the **researchers must conform to the political criteria of what good or bad research and innovation is**. As seen in section 3.1.2.3.1 Mindsets, these criteria depend predominantly on the past successes of natural sciences and expectations towards technological progress and economic growth.

Informal evaluation of HEIs

Informal evaluations of HEIs exist, which aim at informing the wider audience on which HEIs perform better. One of the three most known informal evaluations of HEIs is the **QS World University Rankings**³⁹ (the other being the Times and the Shanghai rankings). It is an annual, worldwide, ranking of universities. It ranks universities according to six metrics:

- Academic reputation for 40% of the grade
- Faculty/student ratio for 20% (to assess the number of teachers, lecturers, tutors, etc. per student)
- Citations per faculty for 20%
- Employer reputation for 10% (reputation of the university according to their students’ employers)

³⁹ <https://www.topuniversities.com/qs-world-university-rankings/methodology>

- International faculty ratio for 5% (percentage of international employees, researchers, etc.)
- International student ratio for 5% (percentage of international students)

Core activities

In order to get further insights on the R&I system, rather than just looking at the traditional public system which consists mainly of public organisations and large companies, we mapped more than 140 R&I organisations to see what types of activities they undertake. This list of organisations is presented in Annex 6. From this mapping we have distinguished the following activities:

R&I in the strict sense of the term

- Basic research
- Applied research
- Scientific studies
- Studies to gain contextualised knowledge
- Experimental development and innovation
- Implementation of innovative outputs (products, services, methods, etc.)
- Production of innovative outputs

Academic activities

- Education and teaching
- Writing proposals
- Peer-reviewing
- Writing articles and disseminating one's outputs, including valorising one's outputs (through transfer and academic-business cooperation)
- Looking for funding

Supporting academic activities

Many markets and organisations have developed at the side of academic activities such as publishers; altmetrics and big data providers; patents, markets and technology watch providers; support software providers (Zotero, Mendeley), etc.

Financing and funding

As already seen, funds and finance are the sinews of R&D&I. So, many organisations and platforms have developed accordingly. New organisations such as ethical banking and investment, crowdfinance and crowdfunding have emerged specifically for the R&I sector.

Empowering

Especially for innovation in the field of the social and circular economies, and for citizenship-related R&I activities, many organisations have emerged to ignite, inspire, incubate, accelerate and empower new initiatives, and motivated individuals and groups.

Labelling

Certain organisations have developed a label to distinguish certain types of innovation, R&I projects or organisations. For example, it is the case in France with the development of a label for innovative and green projects that have been crowdfunded.

Sharing information and thoughts

Other organisations aim at feeding the political arena and increasing awareness for certain R&I themes. This can be the case of citizen science organisations.

Influencing

As in any sector, lobbies and advocacy represent vested interests, some mainstream and some other alternatives.

Collaborative approaches

While all the activities presented above are often carried out by single individuals and organisations, collaborative approaches have started to develop such as co-production of knowledge, co-innovation, etc. Accordingly, organisations have developed to foster these kinds of collaborative approaches and coordinate the collaborating organisations.

Validation of research results

A research project produces outputs, which normally have first to be **reviewed by peers** before being validated and joining the existing corpus of knowledge. This process starts when the results are proposed to a publisher. Most publishers have peer-reviewers, but certain just publish what they receive, on the basis of simple reading or automated review. This has led to many invalid papers and articles. Even if the results are published after a peer review, they still can be contested, for they will be read by many more researchers, which increases the chances of identifying methodological flaws and incoherent results.

Valorisation of outputs

Outputs of R&I activities can be valorised in different ways:

- In academic conferences, papers, books and in new R&I projects, even in opening new R&I fields
- If produced by academic or public research units, they can be transferred to commercial organisations
- Providing evidence for policy – making
- Commercial exploitation
- Direct implementation without commercial exploitation

Commercial valorisation of public results requires **HEIs and PROs to interact with commercial organisations**. These interactions take place at three levels (Sanz-Menendez et al., 2011):

- Bottom-up interactions at the researcher/ research unit level
- Interactions promoted by policy-makers and funding agencies
- Strategic interactions in which PROs leadership engage themselves

These interactions are fostered by current policies and the greater emphasis on patents and technological innovation in PROs' evaluations, rather than being initiated by PROs themselves (Sanz-Menendez et al., 2011). As a result the number of patents filed and licensed by PROs and the number of spin-off companies in which their research findings are commercialised have grown (European Commission, 2009) in (Sanz-Menendez et al., 2011). One-one relationship can establish between HEIs, PROs and commercial organisations, but also multiple relationships, with the establishment of **hybrid organisations** in which more than one type of organisation participate. Some PRCs have a long history in the set-up of hybrid (sub-) organisations with HEIs. PRCs, MOCs, and RTOs have also engaged in establishing hybrid organisations in which the R&D laboratories of private firms take part (Sanz-Menendez et al., 2011).

Overview of the EU R&I policy

In this section we present the main developments of the European policy on Research and Innovation since 2010 in order to understand and characterise the current state of the European R&I system.

Europe 2020 and the Innovation Union

Europe 2020 or ‘**Europe 2020**, a European strategy for smart, sustainable and inclusive growth’ (European Commission, 2010a), adopted in 2010, is the EU’s strategy for growth and jobs for the decade 2010 – 2020. The reason why we include it here, is that one of its flagship initiatives was the creation of the **Innovation Union**, which has several consequences for the European R&I system.

The Innovation Union

The Innovation Union is the EU strategy to **re-focus R&D&I policy on the challenges**⁴⁰ facing the European society, such as climate change, energy and resource efficiency, health and demographic change (European Commission, 2010a).

In the same time, it aims to create an innovation-friendly environment that makes it easier for **great ideas to be turned into products and services** (European Commission, n.d.-x).

The Innovation Union includes over 30 action points coinciding towards 3 main objectives (European Commission, n.d.-c):

- Making Europe into a **world-class science performer**
- **Removing obstacles to innovation** – like expensive patenting, market fragmentation, slow standard-setting and skills shortages – which currently prevent ideas getting quickly to market
- **Revolutionising the way public and private sectors work together**, notably through Innovation Partnerships between the European institutions, national and regional authorities and business

An overview of the 30 actions points (European Commission, n.d.-d) is here presented:

Promoting excellence in education and skills development:

- Gender equality to be reinforced
- Supporting an **independent multi-dimensional international ranking system**
- Supporting **business-academia collaborations** through the creation of ‘Knowledge alliances’ for bridging innovation skills gaps

Delivering the European Research Area (ERA):

- Framework for a **European Research Area**: developing a strategic research agenda focused on challenges such as energy security, transport, climate change and resource efficiency, health and ageing, environmentally-friendly production methods and land management, and to enhance joint programming with Member States and regions (European Commission, 2010a). It is to be noted that Art. 179 (1) of the Treaty on the Functioning of the European Union (TFEU) sets the task of achieving a European Research Area by strengthening the scientific and technological bases of the MSs
- By 2015, MSs should have completed or launched the construction of 60% of the priority **European research infrastructures**

Focusing EU funding instruments on Innovation Union priorities:

- Future programmes to focus more on **societal challenges** and simplified funding instruments
- Strengthening the role of the **European Research Council (ERC) and industry driven priorities**
- Simpler access and stronger involvement of SMEs, in particular those with a **high growth potential**

⁴⁰ In H2020, and in many other documents, these challenges are called ‘the grand societal challenges’

- Strengthening the **science base for policy making** through the Joint Research Centre (JRC) and the creation of a “European Forum on Forward Looking Activities”

Promoting the European Institute of Innovation and Technology (EIT) as a model of innovation governance in Europe:

- **Expanding the activities of the EIT** as a showcase and introduction of the “EIT” degree
- Creation of new **Knowledge and Innovation Communities (KICs)** for close links with the private sector

Enhancing **access to finance for innovative companies** to close the market gaps in investing in R&I

Creating a single innovation market:

- Adopting the proposal on the **EU patent**
- Improving the rules to provide sufficient and continuous incentives to drive innovation, especially linked with **eco-innovation** and the European Innovation Partnerships
- Fostering standardisation, in order to speed up and modernise standard-setting to **enable interoperability and foster innovation in fast-moving global markets**
- Member States (MSs) and regions should set aside **dedicated budgets for pre-commercial procurements and public procurements** of innovative products and services for improving the efficiency and quality of public services, while addressing the major societal challenges
- Implementing joint (cross-border) procurements between contracting entities

Promoting openness and capitalising on Europe's creative potential:

- Promoting open access to the results of publicly funded research and making **open access to publications the general principle** for projects funded by the EU research Framework Programmes
- **Facilitating effective collaborative research and knowledge transfer** within the research Framework Programmes and beyond
- Developing a **European knowledge market for patents and licensing** for breathing new life into neglected Intellectual Property (IP)

Spreading the benefits of innovation across the Union:

- Member States should considerably improve their use of existing **Structural Funds for research & innovation projects**, and should improve the performance of their national systems and **implement smart specialisation strategies and trans-national projects**

Increasing social benefits:

- Launching a **European Social Innovation pilot** which will provide expertise and a networked 'virtual hub' for social entrepreneurs and the public and third sectors. Social innovation should become a mainstream focus in the next generation of European Social Fund programmes.
- Piloting a **European Public Sector Innovation Scoreboard** to benchmark public sector innovation
- Consulting the social partners **to examine how the knowledge economy can be spread** to all occupational levels and all sectors

Pooling forces to achieve breakthroughs: European Innovation Partnerships (EIP):

- The EIPs are established between the EU and national levels to **speed up the development and deployment of the technologies needed to meet the challenges identified**.
- **The Council, Parliament, Member States, industry and other stakeholders** are invited to support the innovation partnership concept and to indicate the specific commitments they will undertake to make the concept work

Reforming research and innovation systems:

- Member States are invited to carry out self-assessments and identify key challenges and critical reforms as part of their **National Reform Programmes**

Measuring Progress:

- Developing a new indicator measuring the share of fast-growing innovative companies in the economy.
- Monitoring overall progress on innovation performance using the **Research and Innovation Union scoreboard**

EU's view on Responsible Research and Innovation (RRI)

The concept of Responsible Research and Innovation (RRI) is integrated within the activities of the EC that aim at bridging the gap between the scientific community and society at large (European Commission, n.d.-b), and that have developed since 2001.

These activities were gathered, at the start, under the 'Science and Society' programme (2001), entitled 'Science in Society' (SiS) in 2007. Since 2013, RRI activities are integrated in the 'Science With and for Society' (Swafs) programme of H2020.

On the website of the EC (European Commission, 2016b), dedicated to Swafs it is indicated that the EC understands RRI as an approach to R&I in **which all societal actors** (researchers, citizens, policy makers, businesses, civil society organisations, etc.) work **together** during the whole R&I process, with the aim to **better align research and innovation outcomes with societal values, needs and aspirations**. A document of the EC about RRI indicates that RRI is a way to find the right answers to the grand societal challenges since the only way to face them is by involving as many stakeholders as possible in the R&I process (European Commission, 2012), to co-construct innovative solutions, products and services.

A framework for RRI has been developed, which consists of 6 keys (European Commission, 2012):

- **Engagement of all societal actors**, as a sound framework for excellence entails that the challenges are framed on the basis of widely representative social, economic and ethical concerns and common principles, and for mutual learning and joint solutions
- **Gender equality** to overcome the under-representation of women in R&I
- **Science education** to equip future researchers and other societal actors to fully participate and take responsibility in the R&I process
- **Open access** by giving free online access to the results of publicly-funded research
- **Ethics** to respect fundamental rights and the highest ethical standards, to ensure increased societal relevance and acceptability of R&I outcomes
- **Governance** as an umbrella term for the 5 others and to develop harmonious models for RRI

The website also indicates that, for the longer term, it is essential to realise societally robust science and innovation policy generally, in particular also in the context of the European Research Area (ERA) and Innovation Union. It seems that ERA stakeholders themselves have indicated an interest in complementing ERA with RRI oriented actions, for example with regard to public engagement and ethics (European Commission, 2016b).

EU strategy for R&I since 2015

Open innovation, open science and open to the world are the 3 main policy goals for EU R&I set by Commissioner Moedas in 2015 (European Commission, n.d.-r) which still drives the EU's R&I strategy.

A book, entitled "Open innovation, open science, open to the world – a Vision for Europe" (European Commission, 2016a) explains in detail the thinking behind these policy goals and how they will be achieved (European Commission, n.d.-r). We present briefly here the concepts behind these 3 Os.

Open innovation, open science, open to the world – a vision for Europe (European Commission, 2016a)

R&I is conceptualised as a key component of the EU's overall policy and strategy, for its capacity to create investment opportunities for new and better products and services, and therefore increase

competitiveness and employment. ‘Open innovation’, ‘open science’ and ‘open to the world’ represent three new concepts of R&I that are being developed and implemented, which imply new ways of doing R&I, and will change the R&I system.

Open innovation is defined relying on Henry Chesbrough definition as ‘the use of purposive inflows and outflows of knowledge to **accelerate internal innovation**’ (Chesbrough, 2006). The idea is to open up the innovative process to all active players so that knowledge can circulate more freely and be transformed into products and services.

Open science is conceptualised as a new approach to the scientific process based on **cooperative work and new ways of diffusing knowledge**. It entails the ongoing transitions in the way research is performed, researchers collaborate, knowledge is shared, and science is organised. It is expected that Open Science can transform science into ‘better’ science, which means making science:

- **Good**: by making science more credible and replicable
- **Efficient**: by avoiding duplication of resources and optimising the re-usability of data
- **Open**: by improving the accessibility of data and knowledge at all stages of the research cycle. On this particular topic, the EC sees Open Access not as an end in itself but as a tool to facilitate and improve the transparency and circulation of scientific information and ultimately, to produce even more high-quality science and contribute to better policy making

Open Science means also making Science **more inclusive** (this covers the concept of citizen science) of non-institutional participants.

Open to the world means striving to face challenges at global level, making Europe competitive and having access to knowledge developed elsewhere and a leading voice in global debates.

Towards an Innovation Principle Endorsed by Better Regulation

The EC has an in-house think tank, the European Political Strategy Centre (EPSC) mandated to engage in foresight and anticipatory governance, spearheading the EC’s involvement in the EU inter-institutional collaboration that aims to build preparedness for upcoming challenges and opportunities⁴¹. The EPSC has written an insightful document about the role of Innovation in the EU, entitled ‘Towards an Innovation Principle Endorsed by Better Regulation’ (European Political Strategy Centre, 2016). We present here its main insights.

An innovation principle

This document sees **innovation** as an essential element of the internal market, a **precondition of ‘sustainable and job-creating growth’** because innovation is seen as leading to higher productivity and competitiveness while yielding social and environmental benefits. It recalls that Art. 3 (3) of the Treaty on European Union (TEU) **does not permit**, when innovating, **to focus one-sidedly on economic benefits and higher growth**.

With regards to the role of MSs and the EC, this document implies that legal and regulatory requirements must aim at optimising outcomes in all policy fields and have to demand a high level of environmental, health and consumer protection, in accordance with Art. 114 (2) of the TFEU. The EU and the MSs must also ensure that the **conditions necessary for the competitiveness of the Community’s enterprises exist**.

After showing that innovation is a core principle of the EU, and that, public bodies (MSs and EC) must ensure that it leads to sustainable and job-creating growth, the document further argues that it is possible to deduct an innovation principle from key EU legal texts:

⁴¹ European Political Strategy Centre: https://ec.europa.eu/epsc/about_en

'the guarantees embodied in the EU charter of Fundamental Rights are important for deducing an implicit innovation principle' (European Political Strategy Centre, 2016).

An innovation principle means ensuring that, **whenever a policy is developed, the impact on innovation is fully assessed**. The principle provides guidance to ensure that the choice, design and regulatory tools foster innovation, rather than hamper it (European Political Strategy Centre, 2016).

Another facet of this innovation principle, is the **fundamental right to innovate**. This right implies certain limits on the regulatory capacity of MSs, as shown below:

'Under the rule of law (Art. 2 TEU) fundamental rights [to innovate] imply a duty to respect freedom for state authorities. In their subjective dimension they serve as a benchmark for the assessment of all public action interfering with individual freedom.

'Any action taken by state authorities is considered as an intervention in individual freedom and, as such, faces the pressure of legitimisation. If state authorities want to interfere in the scope of protection of a fundamental right, they are obliged to legitimise their action. The burden of proof lies with public authorities wishing to regulate. They must prove their 'better right' to regulate' (European Political Strategy Centre, 2016).

However, there are other principles stated by the European treaties, that have to be balanced with the Innovation principle, such as the integration principle, and the precautionary principle, among others.

In the end, the EPSC implies that, to respect all these principles, it is important to find the right regulatory mix, which explains the EC's 'better regulation' agenda. For that, regulation should find the right balance between information, flexibility, and stringency, and should distinguish between general regulation, innovation-specific rules and sector-specific regulation (European Political Strategy Centre, 2016).

The document goes on by describing the tools to enforce and respect the innovation principle (*Ibid.*):

- **The Better Regulation agenda**, which aims to support innovation
- **Mutual recognition and country-of-origin principles**, which were initially developed by the European Court of Justice to tackle barriers to the freedom of goods and services
- **Standard setting**
- **Test of alternatives**, which requires applicants for regulatory approval to consider potential alternatives, and to justify why their chosen solution is the optimal way to meet the policy goals underlying regulation (European Commission, 2017a). For e.g., the REACH regulation provides that very hazardous chemicals, which cause considerable risks to human health or the environment, can obtain an authorisation only under the condition that there are no suitable alternative substances or technologies.
- **Flexibility with regards to binding objectives**: binding objectives set a target and possibly the criteria to be followed to achieve compliance, instead of prescribing the exact mechanisms by which compliance is obtained
- **Right to challenge**: allows public organisations, local governments and possibly even Member States to apply for an exemption from an existing rule or regulation by showing how they would be better able to deliver improved public outcomes. Companies could be granted the right to challenge regulatory requirements, if they can demonstrate that they can surpass a regulatory target, or that they can comply in the same way.
- **Benchmarking and best practice**
- **Innovation deals**, are meant to involve the EC, the relevant MS authorities as well as stakeholders in finding ways to avoid potential barriers to innovation
- **Sunset clauses**, to react to rapidly changing market conditions by setting temporary legal or regulatory provisions

- **Innovation action plans** aiming at implementing policy goals by providing a range of regulatory tools, often combined with funding programmes.

Framework Programme n#9: likely possibilities

The next framework programme to succeed to H2020 is Framework Programme n#9 (FP9). One of its likely key features is to be designed around **Missions**, such as the ‘Man to the moon’ (Apollo) mission, to solve the grand societal challenges. Carlos Moedas has invited Mariana Mazzucato to provide her recommendations on the design of these missions. She elaborated on the topic in her publication ‘*Mission-oriented R&I in the European Union, a problem-solving approach to fuel innovation-led growth*’ (Mazzucato, 2018). We provide below her main messages.

Rationale for missions:

Although the H2020 programme introduced seven Societal Challenges and cross-cutting Focus Areas such as the circular economy, its **broad societal impact remains limited**. It may be the consequence of the erroneous definition of the programme’s objectives. According to her, Societal Challenges and Focus Areas, such as the SDGs, on the one hand, are useful to focus, but remain too broad to be actionable. On the other, most of R&I projects that deal with very concrete problematic achieve only isolated impacts. In FP9, Missions should be designed to make the most of a collaboration between fundamental and applied research and should be based upon the consideration that **grand societal challenges cannot be solved by scientific and technological solutions only**.

Framing missions:

Definition:

Missions should allow problems to be framed and reflected upon by a combination of **different understandings**. Their objective is to activate innovation across sectors and disciplines to develop **systemic solutions** to solve these problems.

Mission design:

Missions are imagined as a portfolio of research and innovation projects and supportive measures. Contrary to the H2020 logic, which focused on sectors or technologies, **the starting point of FP9 Missions should be the grand societal challenges themselves**. Using SDGs example, Figure 29 gives a first insight about how FP9 could operate.

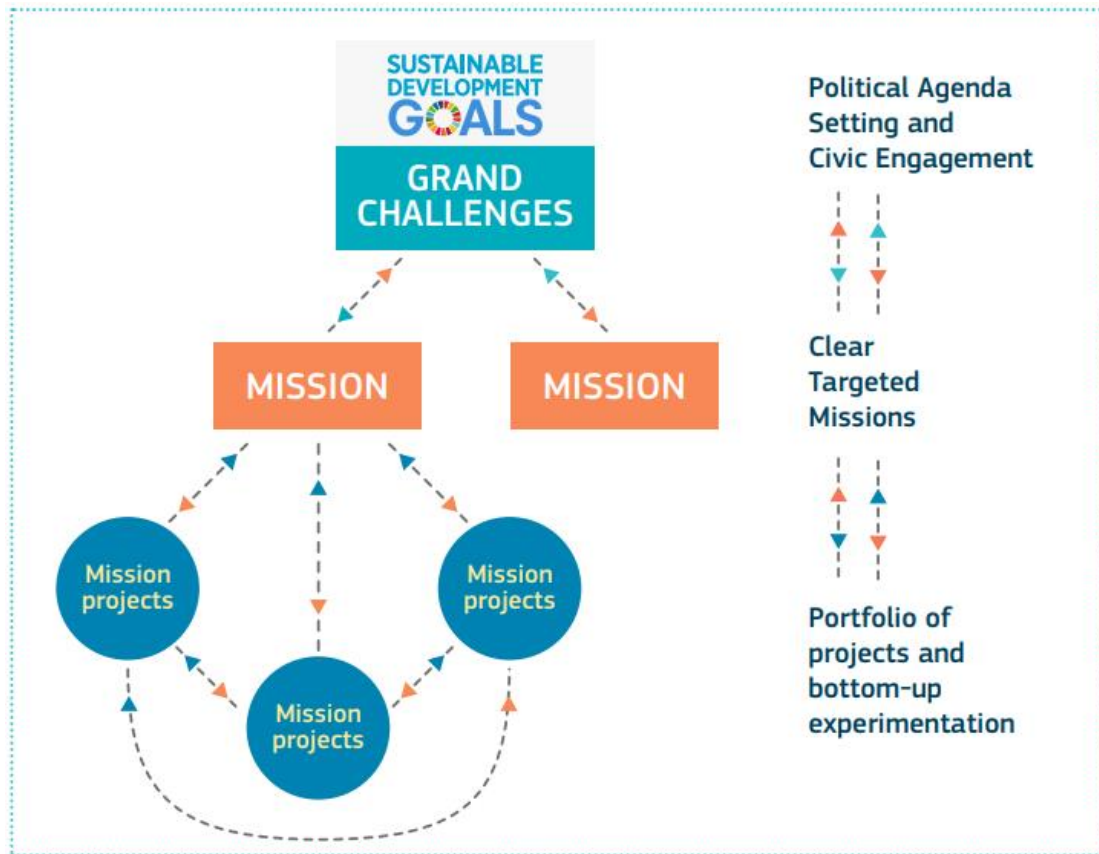


Figure 29: FP9 Missions focus on societal challenges (Mazzucato, 2018)

The selection of the Missions' topics should be the result of a participatory process and should be based on five criteria:

- **Bold, inspirational with wide societal relevance**
 - Missions should engage the public and outline exciting opportunities for bold innovation, while being connected to debates in society about what the key challenges are. Ultimately, they should improve people's daily lives.
- A clear direction: **targeted, measurable and time-bound**
 - Missions should have a clear timeframe which needs to be long enough to allow the R&I process to grow, for actors to build relationships and interact, while at the same time being time-limited.
- **Ambitious but realistic**
- **Cross-disciplinary, cross-sectoral and cross-actor innovation**
 - Missions should take a problem focussed lens and not a sectoral lens, to enlarge the scope of possible solutions (rather than focussing on technological solutions only)
 - Missions should connect all relevant actors through new forms of partnerships of co-design and co-creation
- **Multiple, bottom-up solutions**

Flexibility is to be a watchword of FP9 to create impact with utmost societal relevance. Even if Missions set clear and ambitious objectives, it impossible to define one canvas on 'what a mission should be and how it should be structured'. Missions set only a direction for potential solutions and do not specify how to solve a challenge. On the contrary, **the Missions' approach is to stimulate the development of a range of different solutions through multiple forms of cross-actor collaborations**. Research projects under FP9 should gather all the interested stakeholders, from fundamental research to applied research and cutting-edge

innovations to develop different type of solutions and achieve measurable success. **Bottom up and ‘outside of the box’ solutions should be encouraged through incentives.**

The missions should also focus on supporting R&I developments that otherwise would not be undertaken by private actors, providing the justification and legitimacy for public intervention. Overall, the Missions’ approach is the opportunity to review the role of the public sector by **escaping the narrow market failure framework and shifting towards a more active market ‘co-creation’ framework.**

Implementation:

Missions should be understood as an innovative frame that requires:

- **Engagement of diverse national and regional stakeholders**
 - A broader political commitment to align policy objectives at both the EU and MS level will be critical to ensure the coherence of the programme.
 - The nature of this alignment is also budgetary. It demands a complementarity between the public investments from European, national or regional programmes, and additional private investments. It is only under this condition that it is possible to create a catalysing effect on the chances for success.
- Definition of goals and milestones to **measure the success** of Missions
- **A portfolio of instruments to foster bottom-up solutions**
 - Missions should be funded with multiple instruments, from grants, to prizes, to new forms of procurement, and financial instruments with a concern of avoiding duplication
 - Contrary to the H2020 management which assessed projects in isolation and according to project specific objectives, the system of portfolio stimulates interaction, experimentation and cross-learning.
- **Flexibility, pro-active management and building in-house capabilities**
 - Extra investment should be facilitated to reach Missions’ objectives.
 - Such pro-active management should be based on metrics and the orchestration between ‘the need for some form of ex-ante dynamic risk assessment and the danger of writing off potentially viable missions at an early stage because ex-ante impact assessments cannot predict the kind of unexpected spill-overs the mission approach can cause’
 - The methodology of R&I projects evaluation should be reviewed. It should take into account the project proposals as much as the portfolio of projects. If individual projects seem not to be contributing to the mission objective, it should be possible to redirect funding to other projects
 - To ensure the maximum contribution of activities to the mission objective, funding should be distributed on a ‘stage-gate’ principle, where successive tranches of funding are only allocated based on reaching an intermediate milestone
 - While some outsourcing is fine, it is also crucial to build dynamic capabilities inside public institutions that are responsible for engaging with technological and scientific priorities
 - The curricula for public administration as well as key quality and performance management tools and metrics widely employed in public organisations should be rethought. Public institutions in charge of mission-oriented policies must be willing to experiment novel forms of collaboration with third-sector organisations to pool and share expert knowledge.
- **Public engagement**
 - ‘A mission will not inspire people unless they are part of it. Public participation in the selection process must be followed by public inclusion in the implementation’

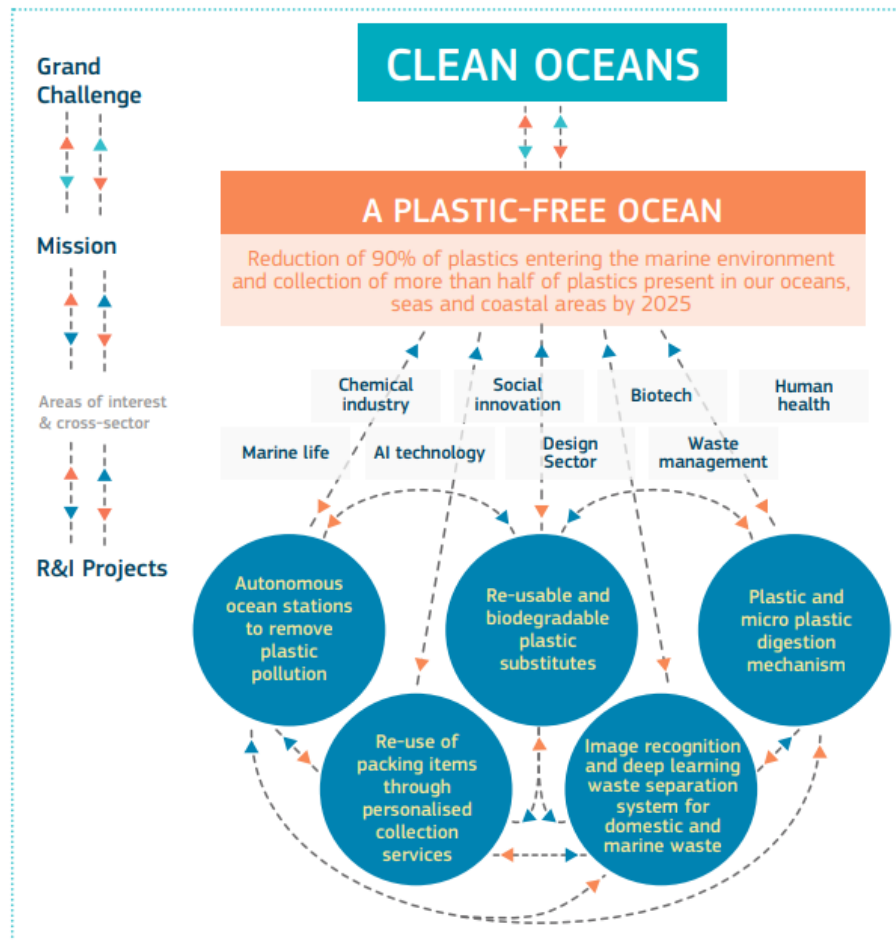


Figure 30: Example of the proposed Mission ‘A plastic-free ocean’ (Mazzucato, 2018)

Functional organisation and policy instruments of the EU level

This section deals with the organisation of the EU governance system and with EU’s policy instruments for R&I.

Organisation

The European Commission is organised into policy departments, known as Directorate – Generals (DG), which develop, implement and manage EU policy, law, and funding programmes. Services Departments (SD) deal with administrative issues while Executive Agencies (EA) manage programmes set up by the Commission.

For R&I, the relevant EU’s organisations are the following:

Directorate – Generals:

- Research and Innovation (RTD)
- Joint-Research Centre (JRC), which is the Commission’s science and knowledge service. The JRC employs scientists to carry out research to provide independent scientific advice and support to EU policy

Executive agencies:

- European Research Council (ERC)
- Research Executive Agency (REA)

Service departments:

- European Political Strategy Centre (EPSC)

Expert groups:

- Scientific Advice Mechanism
- The European Group on Ethics in Science and New Technologies
- High-level group on maximising the impact of EU research and innovation programmes
- Research, innovation and science policy experts group
- Strategic forum for international science and technology cooperation
- Expert group on the economic and societal impact of research and innovation

Other relevant R&I organisations and groups

Not directly part of the European bodies, other organisations and groups have nonetheless an important role in the EU's R&I strategy.

Smart Specialisation Platform (European Commission, n.d.-s)

The smart specialisation platform proposes advice to MSs and regions for the design and implementation of their **Smart Specialisation Strategy**. This strategy aims to boost growth and jobs in Europe, by enabling each region to identify and develop its own competitive advantages (European Commission, n.d.-aa). Through its partnership and bottom-up approach, smart specialisation brings together local authorities, academia, business spheres and the civil society, working for the implementation of long-term growth strategies supported by EU funds (*Ibid.*).

European Institute of Innovation & Technology (EIT)

The EIT is an independent body of the European Union to spur innovation and entrepreneurship across Europe. It brings together leading higher education institutions, research labs and companies to form dynamic cross-border partnerships – **Knowledge and Innovation Communities (KIC)** - that develop innovative products and services, start new companies, and train a new generation of entrepreneurs. The innovation communities are also tasked with overcoming some of the greatest challenges our society faces, including climate change, the use of raw materials, energy and active ageing (eit, n.d.).

European Technology Platforms (ETPs)

ETPs are independent industry-led stakeholder recognised by the European Commission as **key actors in driving innovation, knowledge transfer and European competitiveness** (European Commission, n.d.-n). They develop research and innovation agendas and roadmaps for action at EU and national level and mobilise stakeholders to deliver on agreed priorities (*Ibid.*).

European Innovation Council (EIC) and the high-level group of innovators

The EIC pilot aims to **support top-class innovators, entrepreneurs, small companies, and researchers with bright ideas and the ambition to scale-up internationally**. It focuses on funding and opportunities for innovators, start-ups and companies with ideas and innovations which are radically different from existing products, services, or business model, and are highly risky (European Commission, n.d.-a).

The high-level group of innovators supports the EC in developing the EIC. Their last set of recommendations is intitled 'Funding – Awareness – Scale – Talent (FAST)', and advocates to (European Commission, 2018):

Funding: Current investment opportunities are too low and not adapted to breakthrough innovations.

- Simplify current schemes into a small set of 'EIC Awards' (grants and other forms of funding) supporting the emergence and the scaling up of breakthrough market-creating innovation

- Enable grants, loans and equity investments to be awarded in combination
- Change evaluation, selection and management to enable risk taking and flexibility

Awareness: Europe needs a flagship initiative on breakthrough innovation that can attract the best innovators and connect local and sectorial ecosystems

- Set up comprehensive monitoring and information systems that combine data from EIC with other sources
- Communicate success stories

Scale: Europe needs continental scale to compete at global level. European start-ups should not be forced to relocate to the US to access larger financing rounds.

- Help EIC awardees access high-quality partnerships and networks across Europe
- Partner and share practice with other innovation agencies and programmes
- Help EIC awardees overcome regulatory barriers and improve the early identification of regulatory barriers for emerging technologies

Talent: Europe needs role models and champions. Its funding needs to empower people, create a culture of risk-taking and stimulate entrepreneurship rather than encouraging risk avoidance and paper shuffling.

- Introduce prestigious 'EIC fellowship' to recognise leading innovators
- Pair up EIC awardees with experienced peers

Start-up Europe

Startup Europe is an initiative of the European Commission designed **to connect startups, investors, accelerators, entrepreneurs, corporate networks, universities and the media** through an array of networks. Furthermore, it intends to connect local startup ecosystems around Europe and enhance their capacity to invest in other markets such as Silicon Valley or India. Not less important, it celebrates the European entrepreneurs' success, making it visible and rewarding for instance through the **Startup Europe Awards** (European Commission, n.d.-ab). The One Stop Shop platform⁴² enable startups and ecosystem builders to easily access all the support and funding services offered at EU level.

EU's policy instruments

EU's instruments for R&I are numerous. We provide here an overview of the main ones.

Funding and financing instruments

The EU has several different funding programmes, split in two types: **direct and indirect funding** (European Commission, n.d.-g). Direct funding comprises of grants, other financing instruments and contracts, while indirect funding is managed by national and regional authorities and comprises nearly 80% of the EU budget, mainly through five big funds that come under the umbrella of the European Structural and Investment Funds (ESIF) (European Commission, n.d.-g). These five big funds are:

- the **European Regional Development Fund** for regional and urban development,
- the **European Social Fund** for social inclusion and good governance,
- the **Cohesion Fund** for economic convergence by less-developed regions,
- the **European Agricultural Fund for Rural Development**,
- the **European Maritime and Fisheries Fund**

The direct funds are:

- **Horizon 2020**, the main EU's funds for R&I (European Commission, n.d.-q)

⁴² <http://startupeuropeclub.eu/>

- *RRI activities* are funded (462,2M€) in the Swafs' calls of Horizon 2020 (European Commission, n.d.-b)
- **LIFE programme**, the EU's funding instrument for environment and climate action, which proposes grants for projects, NGOs, and financial instruments (European Commission, n.d.-q)
- **Research fund for Coal and Steel** (European Commission, n.d.-q)
- Fellowships and individual research grants (European Commission, n.d.-o)
 - *ERC grants* for frontier research
 - *Marie Skłodowska-Curie actions – Research Fellowship Programme*
- **ERC Proof of Concept** (ERC, 2017) : made available only to those who already have an ERC award to establish proof of concept of an idea that was generated in the course of their ERC-funded projects. The funding cover activities at the very early stage of turning research outputs into a commercial or socially valuable proposition.
- **InnovFIN schemes** (eib, n.d.), financing tools and advisory services offered by the European Investment Bank Group. Different types of funding & financing, in terms of instruments, innovators, and themes.
- **European Fund for Strategic Investments** (European Commission, n.d.-i): mobilises private funding for strategic investments to increase the level of investment in Europe
- **Pan-European Venture Capital Fund-of-Funds programme** (eif, n.d.): help increase the scale of venture capital funds in Europe and attract private investors
- **EU programme for the Competitiveness of Enterprises and SMEs (COSME)** supports access to finance and markets for small and medium businesses via (European Commission, n.d.-e):
 - The Loan Guarantee Facility
 - The Equity Facility for Growth
- **EIC funding for innovators** (European Commission, n.d.-a) - €2.7 billion in funding for the period 2018-2020 via the following funds and services:
 - *SME instrument*: for SME with a radical innovation that can disrupt established value networks and markets.
 - *Fast-track to Innovation*: for relatively mature ground-breaking technologies, concepts and business models which are close to the market
 - *Future and Emerging Technologies (FET) Open*: promote collaborative inter-disciplinary research and innovation on future and emerging technologies.
 - Opportunities for networking, mentoring and coaching
 - Strategic advice to upgrade the innovation ecosystem in Europe
- **Innovation procurement support** (European Assistance for Innovation Procurement⁴³): Pre-Commercial Procurement (PCP) and Public Procurement of Innovation solutions (PPI) are underutilised in Europe (European Commission, n.d.-w). In order to increase the use of innovation procurement in Europe, the EC is taking several actions: a better policy framework, and EU co-financing.
- **ICT Innovation Vouchers** (European Commission, n.d.-u): ICT Innovation Vouchers are available for small businesses in any field to develop their ICT capabilities. The vouchers are administered by regional authorities and can be used to pay for various services including web design, training staff in digital skills, or developing new ICT-based business models.
- **Prizes and contests** (European Commission, n.d.-p)
 - *Horizon prizes*: aiming at delivering breakthrough solutions to specific issues, it is a reward to whoever can most effectively meet a defined challenge
 - *The European Capital of Innovation Award*, for cities designing innovation solutions to societal challenges
 - *EU Prize for Women Innovators* for the most innovative women entrepreneurs
 - *EIC Horizon Prizes*, similar to the Horizon Prizes, without describing how a challenge could be solved, and delivered by the EIC
 - *EU contest for Young Scientists*

⁴³ <http://eafip.eu/>

- **Annual Innovation radar prizes:** identifies project innovations that have big potential in H2020

Support services for innovators:

- **European innovation partnerships:** they represent a new approach to EU research & innovation, are challenge-driven, focused on societal benefits and a rapid modernisation of the associated sectors and markets. They bring together all relevant actors at EU, national and regional levels to set-up research and development efforts, coordinate investments in demonstration and pilots, anticipate and fast-track any necessary regulation and standards, and mobilise the demand side (European Commission, n.d.-j). The existing partnerships are:
 - EIP Active & Healthy Ageing
 - EIP Agricultural Sustainability and Productivity
 - Smart Cities and Communities
 - Water
 - Raw Materials
- **Knowledge and innovation communities** (eit, n.d.): partnerships between businesses, research centres and universities that develop new services, and can start new companies
- **The Seal of Excellence** (European Commission, n.d.-p) is a quality label awarded to projects submitted to H2020 which were deemed to deserve funding but did not receive it due to budget limits. It recognizes the value of the proposal and supports the search for alternative funding.
- **Enterprise Europe Network** (European Commission, n.d.-f) has 600 members including national chambers of commerce and development agencies. It helps businesses innovate and grow on an international scale.

The European Research Area – ERA

The ERA is the EU's programme to unify MSs' efforts on R&I, to create a unified area in which scientific knowledge, technology and researchers can circulate freely (ERA, n.d.-b). It operates around the following priorities:

- **More effective national research systems** (European Commission, n.d.-l): it is thought that national-level competition is crucial to deriving maximum value from public money invested in research. So MSs are invited to:
 - Introduce or enhance competitive funding through calls for proposals and institutional assessments as the main modes of allocating public funds to R&I
 - Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review (panels of leading independent domestic and non-domestic experts)
- **Optimal transnational co-operation and competition** (European Commission, n.d.-m) to coherently achieve the scale of effort and impact needed to address grand challenges with the limited public research fund available. MSs are invited to:
 - Set-up efforts to implement joint research agendas addressing grand challenges
 - Remove legal and other barriers to the cross-border interoperability of national programmes to permit joint financing of actions.

Current **Joint Programming Initiatives (JPI)** include:

- Alzheimer and other Neurodegenerative Diseases
- Agriculture, Food Security and Climate Change
- A Healthy Diet for a Healthy Life
- Cultural Heritage and Global Change: A New Challenge for Europe
- Urban Europe - Global Urban Challenges, Joint European Solutions
- Connecting Climate Knowledge for Europe

- Antimicrobial Resistance- The Microbial Challenge - An Emerging Threat to Human Health
- Water Challenges for a Changing World
- Healthy and Productive Seas and Oceans

In 2016, an evaluation of the Joint Programming Initiatives was made. The main conclusions were the following (Hunter, Hernani, Giry, Danielsen, & Antoniou, 2016):

- Nearly two-third of the investment was from just seven countries
 - Many stakeholders were concerned about the lack of industrial players and societal challenge owners
 - The overall level of ambition to really support them was disappointing
 - The commitment of MSs was quite variable. There are the leaders, selective players, and the marginal players. Most countries were unwilling or unable to co-invest in the central executive resource that is needed to effectively implement the strategic agendas of the JPIs
 - With regards to the national structures for coordination, funding and management of JPIs: the situation was rather mixed. Some had mirror groups, or demonstrated high level commitment but too many had not really made any progress
 - Operational bureaucracy: there was a high degree of operational inertia that was affecting the progress and potential impact of the JPIs.
- **An open labour market for researchers**
 - **Gender equality and gender mainstreaming in research**
 - **Optimal circulation, access to and transfer of scientific knowledge**
 - **International cooperation**

To complete the ERA, the Commission reinforces the partnerships with MSs and research stakeholder organisations. The **European Research Area and Innovation Committee** (ERAC) is a strategic policy advisory committee that advises the Council, the Commission and MSs on the full spectrum of R&I issues in the framework of the ERA's governance. It includes **partnerships** with the following stakeholder organisations (ERA, n.d.-a):

- European Association of Research and Technological Organisations (EARTO)
- European University Association (EUA)
- League of European Research Universities (LERU)
- NordForsk, which provides funding for Nordic research cooperation
- Science Europe, an association of major European Research Funding and Research Performing Organisations
- The Conference of European Schools for Advanced Engineering Education and Research (CESAER)

Better regulation agenda

Innovation is the spearhead of the EU's strategy for growth. However, the regulatory environment may constitute **enabling factors or perceived or real regulatory bottlenecks** to innovation (European Commission & DG R&I, 2016). Furthermore, the importance of a high quality and cost-effective regulatory framework has been confirmed for fast growing firms as well as for the innovation behaviour of traditional firms (European Commission & DG R&I, 2016).

That is why the European Commission has proposed the 'Better regulation agenda' to create innovation-friendly regulatory frameworks in the EU. The agenda proposes to:

- Further improve the design of existing and future regulations about their impact on innovation
- Achieve an optimal balance between predictability of the regulatory environment and adaptability to technological and scientific progresses

- Ensure an overall approach to the assessment of the combined impacts of regulations that impact multi-technology and multi-domain innovations
- Check implementation issues that can affect outcomes, including at national, regional and local levels of administration

The 'Better regulation agenda' rests upon the **innovation principle** which means ensuring that whenever policy is developed, the impact on innovation is fully assessed (European Political Strategy Centre, 2016).

An instrument of the 'Better regulation agenda' is the **Innovation Deals**, which help innovators who face regulatory obstacles by setting up agreements with stakeholders and public authorities (European Commission, n.d.-v).

Support to R&I MSs policies

The **Horizon 2020 Policy Support Facility** is a new instrument that gives Member States practical support to design, implement and evaluate reforms that enhance the quality of their R&I investments, policies and systems. It comprises peer reviews, mutual learning exercises, and specific support (European Commission, n.d.-z).

EU-based evaluation of R&I

Evaluation of national and regional R&I systems

Under the Europe 2020 strategy, the Innovation Union priority sets several tools for measuring and evaluating how the EU, and each MS, perform in terms of R&I. These tools are:

- **The self-assessment tool of national and regional R&I systems** (European Commission, 2010b) which shows what the features of well performing national and regional research and innovation systems are, as follow:
 - Promoting R&I is considered as a key policy instrument to enhance competitiveness and job creation, address major societal challenges and improve quality of life and is communicated as such to the public
 - Design and implementation of R&I is steered at the highest political level. Policies and instruments are targeted at exploiting current or emerging national/regional strengths within an EU context (Smart specialisation)
 - Innovation policy is pursued in a broad sense going beyond technological research and its applications
 - There is adequate and predictable public investment in R&I focused in particular on stimulating private investment
 - Excellence is a key criterion for research and education policy
 - Education and training systems provide the right mix of skills
 - Partnerships between high education institutes, research centres and businesses, at regional, national and international levels are actively promoted
 - Framework conditions promote business investment in R&D, entrepreneurship and innovation
 - Public support to R&I in businesses is simple, easy to access, and high quality
 - The public sector itself is a driver of innovation
- **The European Innovation Scoreboard** (European Commission, n.d.-k) provides a comparative analysis of innovation performance in MSs and other countries and regions. It assesses relative strengths and weaknesses of national innovation systems. The **Regional Innovation Scoreboard** is a regional extension of the European Innovation Scoreboard, based on the same list of criteria but with less criteria, for regional data is not always available. In 2017, the criteria for the national scoreboard were (European Commission, 2017b):
 - **Framework conditions**

- **Human resources:** New doctorate graduates, Population aged 25-34 with tertiary education, Lifelong learning
 - **Attractive research system:** International scientific co-publications, top 10% most cited publications, Foreign doctorate students
 - **Innovation-friendly environment:** Broadband penetration, opportunity-driven entrepreneurship
 - **Investments**
 - **Finance and support:** R&D expenditure in the public sector, venture capital expenditures
 - **Firm investments:** R&D expenditure in the business sector, non-R&D innovation expenditures, Enterprises providing training to develop or upgrade ICT skills of their personnel
 - **Innovation activities**
 - **Innovators:** SMEs with product or process innovations, SMEs with marketing or organisational innovations, SMEs innovating in-house
 - **Linkages:** Innovative SMEs collaborating with others, Public-private co-publications, Private co-funding of public R&D expenditures
 - **Intellectual assets:** PCT patent applications, Trademark applications, Design applications
 - **Impacts**
 - **Employment impacts:** employment in knowledge-intensive activities, employment fast-growing enterprises of innovative sectors
 - **Sales impacts:** Medium and high-tech product exports, knowledge-intensive service exports, sales of new-to-market and new-to-firm product innovations
- **Key indicators, selected by the Research and Innovation Observatory – Horizon 2020 Policy Support Facility.** They cover the following four innovation dimensions (European Commission, n.d.-y):
 - **Inputs – Investments and Human Resources (HR):**
 - **HR in Science and Technology:** HR in science and technology by sub-groups, new doctoral graduates per thousand population aged 25-34, number of researchers (male, female) by sector (public and private), scientists and engineers as % of active population
 - **Investment – sectors of performance:** Business enterprise R&D expenditure by source of funds, private enterprise expenditure on R&D, public R&D expenditure as % of GDP, and other indicators...
 - **Investment – source of funding:** Business enterprise R&D expenditure financed by public funds, government budget appropriations or outlays for R&D, ...
 - **Framework conditions**
 - **Collaboration and knowledge flows:** international co-patenting, share of enterprises cooperation with academia, ...
 - **Digital economy:** households having access to the internet
 - **Education and skills:** new graduates from tertiary education, students in tertiary education by gender, ...
 - **Entrepreneurship:** Innovative enterprises as % of total enterprises, venture capital investments, ...
 - **Foreign Direct Investment and trade:** High-tech exports
 - **Innovation outputs**
 - **Bibliometrics:** highly cited publications
 - **Innovation Output:** innovation output indicator, turnover from innovation
 - **Patents**
 - **Impacts**
 - **Economic structure:** value added for knowledge-intensive services and high-tech and medium-high-tech industries as % of total value added, ...

- **Employment:** Employment in knowledge intensive activities as % of total employment, gender breakdown of employment in knowledge intensive business industries, ...

H2020 funding programme: evaluation and selection procedure

R&I projects submitted to H2020 funding instruments are evaluated on three dimensions: **Excellence, Impact and Quality and efficiency of the implementation**. For each of these three dimensions, there is a general set of criteria applicable to all funding instruments, and specific criteria for each instrument. The specific criteria however have been designed in the same kind of spirit than the general ones. The general set of criteria comprises of (European Commission, n.d.-t):

- For the Excellence dimension:
 - Clarity and pertinence of the objectives
 - Soundness of the concept
 - Credibility of the proposed methodology
- For the Impact dimension:
 - The extent to which the outputs of the project would contribute to each of the expected impacts mentioned in the work programme
- For the Implementation dimension:
 - Quality and effectiveness of the work plan
 - Appropriateness of the management structures and procedures
 - Complementarity of the participants and extent to which the consortium as whole brings together the necessary expertise
 - Appropriateness of the allocation of tasks

A **threshold is set**, and proposals which mark is below are discarded. Above the threshold, only a certain number of proposals is selected, by order of mark, and according to the total funding available.

2. Annex 2: Partners' questionnaire on the R&C strategies implemented in their TE

Purpose

The overall aim of D2.4 “financing, rewarding, and compensation strategy” is to define generic models for financing/funding RRI, and rewarding and compensating each actor contributing to a RRI proposal/project.

More specifically, about rewarding and compensation, the DOA says:

“[...] in order to reward each stakeholder participating in co-RRI projects”

“FoTERRIS will elaborate a rewarding strategy that will suggest ways to make the respective contributions of the various stakeholders visible and to value their efforts”

“the R&C strategy is meant a) to evaluate, acknowledge and make visible the societal value of knowledge actors' contributions and b) to compensate knowledge participants for the time and other resources they invested in a co-RRI project. The rewarding strategy can function as a basis to measure the ‘innovation excellence’ of respective contributions. It can be used to base a knowledge actor's career opportunities on the co-RRI quality of his or her innovation activities, or in other words, on the knowledge actor's co-RRI reputation”.

In order to work on this issue about rewarding and compensation, we have translated the DOA's requirements as follows:

- Compensation: each participant receives a compensation for the resources invested in a CO-RRI project. This is related to the concept of exchange “A gives a to B, so B gives back to A”. We define it as a **material** compensation, of two kinds:
 - Remuneration: participants receive a monetary compensation for the resources invested, equivalent to a *salary*
 - Compensation: participants do not receive the equivalent of a salary, but can receive a smaller amount of money, alternative currencies, in-kind compensations (training offered, etc.), ...
- Contribution ownership: each participant “owns” the value he/she contributed to the project, and has rights over this ownership. This has to do with the fact that if value is created, then it should be given back to those who created this value. There should be a “paternity” link between value created and the creator. For example, if a paper is written thanks to the contribution of participants, then they should be quoted as co-authors. A further example would be the redistribution of monetary benefits, resulting from the contribution of participants.
- System-esteem: the R&I system should recognise & value the contributions of non-formal actors to R&I. We have assumed that the DOA criticises the fact that, broadly speaking, the R&I system does not recognise sufficiently the value that non-formal actors bring to R&I. So, what FoTERRIS proposes, is a change of mind-set about the benefits of participatory science. A way to do so, at the level of the participatory project, is to communicate to participants about the results gained thanks to their participation. Another way is to inform participants on their capability to produce consistent data/knowledge.
- Visibility: the fact that participants contributed to a given project is communicated, to hierarchy; to usual audience; This relates to the previous point: the change of mind-set cannot be achieved without communicating about the benefits of participatory science. So, it is the responsibility of those who trigger participatory projects to communicate about their results, and their added-value, compared to non-participatory science.
- Acknowledgement / reward: certain participants receive a reward, that is, an additional gratification, which goes beyond mere compensation. A reward is a way to celebrate extra-ordinary

achievement; an acknowledgement, a way to thank someone warmly. For e.g., the most motivated participants can get a special acknowledgement; motivations of some participants can be highlighted in a newsletter; an original contribution can be highlighted; participants can get a certificate of participation, etc.

To nourish the section on rewarding & compensation, we ask you to report on this issue, based on what happened in your TE.

The aim of this reporting is twofold, first it aims at **describing** the “rewarding and compensation strategies” implemented in your transition experiments; second it aims at **assessing** whether these strategies have the capacity to actually **lower barriers** against the transitioning towards a responsible R&I system.

We have assumed that you, as competence cell members, are not the only ones able to provide such Rewarding & Compensation strategies (R&C). That is the reason why we ask you to describe which other actors have participated in implementing these R&C strategies, and which R&C strategies they have chosen.

For example, the Research Performing Organisation (VITO, IFZ, CESIE, ESSRG, UCM) in which you work may have decided to valorise the contributions made by the hubs participants. Or mother organisations of your participants may have decided so....

You may not need to answer all questions since some will not be relevant to your experiment.

Reporting template

Compensation strategies

Compensation: each participant receives a compensation for the resources invested in a CO-RRRI project. This is related to the concept of exchange “A gives a to B, so B gives back b to A”. We define it as a material compensation, of two kinds:

Remuneration: actors receive a monetary compensation for the resources invested, equivalent to a salary

Compensation: actors do not receive the equivalent of a salary, but can receive a smaller amount of money, alternative currencies, in-kind compensations (training offered, etc.), ...

1. Who are the actors that have compensated/will compensate the TE’s participants?

You as the competence cell, your Research Performing Organisation, others, ...

2. If you, as a competence cell, have not/will not compensated your participants, please explain why?

3. If there is no compensation at all (none from you, none from any other actor), can you explain why?

4. In case other actors compensate, from which information sources can they do so?

Reading reports from the competence cell, participating in the workshops, discussing with participants, with you...

5. Which compensation(s) is offered by each actor? Explain what the participants gain from each compensation.

Remuneration, in-kind contribution, alternative currencies, vouchers, etc., lost-salary compensation; access to goods otherwise inaccessible, etc.

6. **Compensation goes hand in hand with evaluation. Which criteria does each actor use for compensating?** e.g. time & “energy” invested, contribution’s economic potential, contribution’s scientific quality...
7. **Which value is given to each criterion? Meaning, what is the weight between the criteria: what will be compensated most and least? Why?**
8. **For each compensation, justify (if possible, in case compensation is offered by other actors, you might not be able to answer this question) why it was chosen.**
9. **Highlight the factors & conditions that influenced the choice (organisational, economic, political, regulatory, contextual, Intellectual Property etc.); distinguish between positive factors/conditions (levers) and negative ones (barriers).**
10. **Please estimate the resources (time, budget, competences, authorisation, others?) you (as the competence cell) need for compensating. Is it “easy” to get these resources? By whom are they provided (FoTERRIS’ budget, your organisation’s budget, etc.)?**
11. **Implementation & management of each compensation: how is it implemented and managed in terms of time, location, legal framework, organisation, etc.?**
Expiration time of vouchers; vouchers/other currencies exchange management; ...
12. **What is the impact of each compensation in terms of satisfying participants? What feedbacks did you get from them?**
13. **What is the impact of each compensation in terms of lowering barriers against transitioning towards RRI?**
14. **Which compensation(s) do you consider a success? (do not consider only the compensation offered by your competence cell, but others as well, if any) Justify.**
15. **For each compensation that you consider a success, is there any context-dependent conditions that would limit its replication in another context?**

Recognising contribution’s ownership

Each participant “owns” the value he/she contributed to the project, and has rights over this ownership. This has to do with the fact that if value is created, then it should be given back to those who created this value. There should be a “paternity” link between value created and the creator. For example, if a paper is written thanks to the contribution of participants, then they should be quoted as co-authors. A further example would be the retribution of monetary benefits, resulting from the contribution of participants.

1. **How will you, as a researcher, recognise the contribution’s ownership of each participant?** E.g. by quoting the name of each participant in an academic paper resulting from the TE, invitation to a conference as a speaker etc.

2. In case benefits (monetary, or of another kind) arise from the TE, how will they be traced back to the participants? How will the gains be distributed?
3. Is there any kind of ownership scheme to ensure the protection of the output(s) of the TE, respecting the fact that it is a shared output (to limit an unfair appropriation of results, maybe creative commons licenses)? Please describe it.
4. In case there is not, was it discussed? If it was not discussed, please explain why?

System –esteem

System-esteem: the R&I system should recognise & value the contributions of non-formal actors to R&I. We have assumed that the DOA criticises the fact that, broadly speaking, the R&I system does not recognise sufficiently the value that non-formal actors bring to R&I. So, what FoTERRIS proposes, is a change of mind-set about the benefits of participatory science.

A way to do so, at the level of the participatory project, is to communicate to participants about the results gained thanks to their participation. Another way is to inform participants on their capability to produce consistent data/knowledge.

1. How do you show esteem for your participants? For e.g. by keeping them informed, after their participation, on the use of their contributions; by giving them feedback on the quality and usefulness of their participation.
2. Has someone else shown esteem for the participants? If yes, how?
3. What is the impact of this sign(s) of esteem in terms of satisfying participants?

Visibility

Visibility: the fact that participants contributed to a given project is communicated, to hierarchy; to usual audience; This relates to the previous point: the change of mind-set cannot be achieved without communicating about the benefits of participatory science. So, it is the responsibility of those who trigger participatory projects to communicate about their results, and their added-value, compared to non-participatory science.

1. In case you have communicated about the TE, how have you highlighted the participants' role?
2. To whom have you communicated? Have you communicated it to your organisation/to your hierarchy?
3. Does your organisation communicate about other participatory experiences hosted in your organisation/co-organised?

Acknowledgement / Reward

Acknowledgement / reward: certain participants receive a reward, that is, an additional gratification, which goes beyond mere compensation. A reward is a way to celebrate extra-ordinary achievement; an acknowledgement, a way to thank someone warmly. For e.g., the most motivated participants can get a special acknowledgement; motivations of some participants can be highlighted in a newsletter; an original contribution can be highlighted; participants can get a certificate of participation, etc.

- 1. Will there be any kind of acknowledgement / reward, rewarding one or several TE's participants?**
- 2. In case yes, can you describe this acknowledgement / reward:**
 - a. Who rewards and why?**
 - b. What is the reward?**
 - c. What is rewarded? And how (evaluation: on which basis)?**
- 3. What is the impact of this acknowledgement / reward in terms of satisfying participants?**
- 4. What is the impact of each acknowledgement / reward in terms of lowering barriers against transitioning towards RRI?**
- 5. Are you aware of any acknowledgement / reward scheme that could be used to reward participatory processes like the TEs?**

3. Annex 3: Overview of the results of the MUNTUIT's survey

Answers on the questions sorted by type of knowledge actor. The full questions are written out beneath the table.

	Academic	Government	Nonprofit	Company
Q5 Future use	Obtain data from VITO for specific courses Visiting lector by VITO	Obtain support from VITO Transfer voucher to client	Help with subsidy file Specific data for own program	Specific info for own production or R&D
Q6 Where to spend	Open for exchange with different knowledge groups Input linked to own research project Input for courses e.g. guest teachers, lecture... Valorization of participating (advisory boards, PhD juries, project coordinator...)	Spend with VITO Reward organizations if they participate in e.g. steering groups, advisory boards...	Need matchmaker to pick the right organization Expand own knowledge	Try out other knowledge institutes Get legal advice (government)
Q7 Knowledge you provide	Research Research proposals Feasibility studies Small consulting questions Lectures Valorize others (e.g. project coordinator) Voucher is an extra	Offer service, even without voucher.	Speakers Advice Consulting Vouchers welcome as payment	Advice Voucher is more useful for bigger tasks
Q8 Internal feedback	Original Inspiring Instrument to reward people	Enthusiast Cheaper service with VITO	Positive Cheaper service Lower threshold to ask for services	Original

Q9 Conditions to accept	Informal system Spontaneous Legal issues (IP, ...) Creative commons	Realistic planning Nonprofit oriented Exclude abuse	Honest partnership Stick to core mission Realistic planning	Feasibility issues Realistic planning No market distortion Legal issues (IP, ...)
Q10 Choice of value	Time is logical choice	Time based is OK	Time based is OK	Time is logical choice Market distortion? Legal issues?
Q11 Guidance	More info needed	More info needed (even internally)	More info needed Guidelines useful	More info needed Guidelines useful
Q12 Contribution to knowledge needs of the organisation	Reward people Valorize guest speaker, students Eye opener for hierarchy	Learn to know other organizations. Broaden network	Threshold reducing to go to knowledge institutes Broaden network	Broaden network Capacity building Legal issues?
Q13 Contribution to other ambitions of the organisation	Networking Lower thresholds Informal reward Visibility for knowledge exchange Monitor efficiency on third pillar 'societal impact of research' Indicator for time spent PhD candidates Trustworthiness	Broaden network Valorize people Less bureaucratic	Fits with own core mission Trigger others	Networking New customers New suppliers Between paid and free

Full questions:

- Q5: How do you intend to use the voucher in the near future?
- Q6: The voucher can be used till end 2018 with VITO. Before that it can be used for other exchanges of knowledge. Do you consider using the voucher with following partners: Academic, Government, Nonprofit, Company? And what kind of return do you expect?
- Q7: Your organization can also accept vouchers. Which (form of) knowledge would you offer to other organizations: Academic, Government, Nonprofit, Company?
- Q8: How was the voucher received within your organization? What responses did you get?
- Q9: Under what conditions can your organization accept vouchers from other actors?

- Q10: Is the value indication in time (hours / days) practical enough? Do you have other suggestions?
- Q11: If your organization is struggling with a knowledge question, is it then sufficiently clear where you can go for advice?
- Q12: How can the voucher contribute to your organization's knowledge needs?
- Q13: The knowledge vouchers aim to achieve more exchanges of knowledge and expertise within and between knowledge institutions, governments, companies, NGOs and other (non-traditional) knowledge organizations. How can the voucher also contribute to your organization's ambitions?

4. Annex 4: Overview of external interviews

CETAF – Consortium of European Taxonomic Facilities	
Country	Belgium
Interviewer	CESIE
Organisation's activities related to RRI	For about two years the CETAF European Initiatives Advisory Group has been developing an innovative framework for Responsible Research and Innovation (RRI) for CETAF members to implement in their everyday activities
PUSH	
Country	Italy
Interviewer	CESIE
Organisation's activities related to RRI	The goal of the MUV project is to reshape and improve the liveability of neighbourhoods and cities thanks to citizens direct contributions, intrinsic motivations and personal commitment. More specifically, the project fosters citizens to build new greener and healthier daily mobility behaviours, helps local businesses owners to improve their marketing campaigns and city planners to design more effective urban policies
Main insights	It is important to take into account the different cultural barriers to involve effectively the stakeholders
Vigie- Nature	
Country	France
Interviewer	LGI
Organisation's activities related to RRI	Vigie-Nature is a participatory science programs open to stakeholders (citizen, NGO, etc.) interested in nature.
Main insights	Acquisition of knowledge and know-how is the first driver of citizens (neophytes and enthusiasts) interested in Vigie-Nature's projects. An anthropologist's study of the nature of the participants' motivations revealed that many people involved in these projects were ready to change their behaviour towards nature. Generally, effective participation requires a clear identification of roles between researchers and participants. External stakeholders only participate in projects/programmes within they could bring an added-value to researchers.
EPSRC – Engineering and Physical Sciences Research Council	

Country	UK
Interviewer	LGI
Organisation's activities related to RRI	EPSRC is committed to develop and promote Responsible Innovation through different actions: • Promote reflection, understanding and training about Responsible Innovation approaches within the wider research community, encouraging broader interactions with other disciplines and spheres of expertise in order to develop capacity for responsible innovation. • Welcome funding requests within EPSRC research grant proposals that seek to explore aspects of Responsible Innovation as an integral part of that research endeavour. • Be vigilant to potential social, environmental, ethical and regulatory challenges which arise from new research at the limits of our knowledge, and to broaden debate at an early stage. • Ensure that Responsible Innovation is prominent in our strategic thinking and funding plans, including proposal assessment. • Alert policy makers in Government and regulators to emerging issues and opportunities associated with new research areas as soon as they become apparent.
Main insights	Interdisciplinarity and co-creation are key to build solutions to today's world challenges. The Orbit model could inspire FoTERRIS' competence cells.
Institutions for Collective Actions	
Country	Netherlands
Interviewer	LGI
Organisation's activities related to RRI	Institutions for Collective Action is a research group that studies institutional arrangements that are formed by groups of people in order to overcome certain common problems over an extended period of time by setting certain rules regarding access to the group (membership), use of the resources and services the group owns collectively, and management of these resources and services.
Main insights	The focus on Collective Action and the numerous 'citizen science' projects implemented can serve as inputs/guidelines for the FoTERRIS Competence Cell, especially since they have some

	experiences with rewarding and compensation strategies.
SENSORICA	
Country	USA
Interviewer	LGI
Organisation's activities related to RRI	Sensorica is a commons-based peer production network operating as an Open Value Network. Designed as an open, horizontal and decentralized organisation, its role is to facilitate large-scale co-creation and exchange of value between different kinds of stakeholders
Main insights	Sensorica succeeded in implementing alternatives to traditional R&I processes which incorporates some of the RRI values. It could serve as a living example from which FoTERRIS can learn. Especially with their new project "Le Voice" which a transition initiative, and their original business/activity model.
SoScience	
Country	France
Interviewer	LGI
Organisation's activities related to RRI	So Science's ambition is to modify the research system. According to them, the research system is composed of fundamental research, which aims to produce knowledge, and applied research, which aims to produce economic value. Therefore, no research is aimed at delivering social / environmental value. Therefore, So Science's ambition is to increase the social and environmental values of science.
Main insights	According to So Science, being responsible is not only about Corporate Social Responsibility engagement and reducing negative impacts. Being responsible should be embedded in one's core activities/mode of action.
The Oslo Research Group on Responsible Innovation	
Country	Norway
Interviewer	LGI
Organisation's activities related to RRI	The Oslo Research Group on Responsible Innovation aims to contribute to responsible innovation by engaging in research and development projects with clear sustainability and democratic objectives. They believe that society should be a driver for innovation, and not only a passive recipient. They are convinced that technological innovation must be carried out in dialogue with key users, stakeholders, affected parties and the society at large, -

	from the start of the innovation processes (e.g. setting research priorities) until the products are commercialised and needs regulation or other governance measures.
Main insights	Despite some progress toward a RRI system, some conditions are missing: • Incentive systems • Culture • The lack Societal expectation According to the interviewee, it is important to implement RRI requirement for funding and to push the political sphere to change the system

5. Annex 5: Interview of a director of Vigie-Nature Programmes

Vigie-Nature is a participatory science program open to stakeholders (citizen, NGO, etc.) interested in nature. Developed by the Museum of Natural History (an institution under mandate of the Ministry of Research and Environment), Vigie Nature is led by associations and implemented through networks of volunteer observers. Based on simple and rigorous protocols, these programmes offer everyone the opportunity to contribute to research by discovering the biodiversity and measure its health.

The first program set up by Vigie-Nature was developed in 2001. It relied on a network of birdwatchers who observed the evolution of certain bird species. This network included 800 passionate amateurs who participated in the Vigie-Nature program as part of their hobbies. The work of observation and data reporting corresponded to 5% of the time they gave overall to this leisure. The data collected was of high quality, which is probably due to the nature of the activities carried out. They were very similar to the observation activity that ornithologists practice classically even if the paradigm (a deterministic approach integrating a probabilistic vision, observation objective related to the assessment of the health status of biodiversity) in which these observations were made was very different. Ownership of this paradigm is vital to sustaining participant motivation.

From 2006, there is a diversification of observation programs to other areas: naturalists, botanists, etc. The results of these programs are more nuanced because observation protocols are moving away from the way botanists and naturalists practice their hobbies.

Alongside these programs dedicated to an informed public, other participatory programs such as "Butterfly in my garden" were developed for larger audiences. "Butterfly in my garden" is specifically about the observation of butterflies in participants' gardens. Neophytes who follow a simplified observatory protocol (observation + monthly reporting) learn by watching contrary to an informed public who already have knowledge.

Whatever the type of stakeholders involved, mutual trust among participants and researchers is required. However, statistical control of the data is possible to detect anomalies. Therefore, it is almost impossible to distort the data and the results transmitted to the researchers.

Acquisition of knowledge and know-how is the first driver of neophytes and enthusiasts for Vigie-Nature's projects. An anthropologist's study of the nature of the participants' motivations revealed that many people involved in these projects were ready to change their behaviour towards nature after watching butterflies.

Furthermore, the idea of belonging to a community is beneficial. It strengthens the motivation of participants. Moreover, foster interactions between participants is also key to increase participation and improve the quality of participation.

The only form of reward received by participants is the knowledge acquired during observations. This effect is multiplied by the share of information between participants. In some rare cases, some participants arrive at a certain reputation level in the community because of the quality of the observations made (data that are used for thesis). Regarding compensation, it seems that the public is usually not interested in financial rewards or participation in the results.

Generally, effective participation requires a clear identification of roles between researchers and participants. External stakeholders only participate in projects/programmes within they could bring an added-value to researchers. Stakeholders will not be motivated without feeling invested by the project. If there is no added value to citizen participation or if "others can do the work", it will be a failure. It is important to use citizen participation only when necessary.

The field of participatory sciences is evolving today notably thanks to researchers who are already engaged in participatory science. "It's like going into religion." Although participatory science remains marginal, this type of project is increasing in very different sectors (social, medical and technical sciences). The "ostracization" of the scientific community is less strong than in the past. It's no longer "pseudo-science". The result is a sense of pride among participatory science researchers who consider this approach as an additional motivation lever. Participatory science, "it's something more modern than something in fashion" concluded our interviewee.

6. Annex 6: Mapping of 140+ R&I organisations

ArcInnovation	MakeSense
Community Exchange System	Living knowledge - the international science shop network
Atemis	Matters
Collective Action and Property Rights in Agriculture (CAPRI)	La NEF
Consultative Group on International Agricultural Research (CGIAR)	Nesta
Community Animation and Social Innovation Centre (CASIC)	Open knowledge international
Center for citizen science	OuiShare
Citizen cyberlab	P2P foundation
Civic Techno	Vlaanderen Circular
Club for Functional Economy and Sustainable Development	Product life institute
Collaborative Economy Research Network	ACDD network (network for critical approaches of sustainable development)
Collaborative economy	Rethinkeconomics
Commons Transition	René von Schomberg
Commons Sense	Citizen Sciences
Connecting women	SoScience
Creative commons	Institute for Social Renewal
Center for Research and Interdisciplinarity	Social Science Research Park
DIST (Center for Design, Innovation, and Sustainable Transition)	The Future of Waste (FOW)
ECIU (European Consortium of Innovative Universities)	ELabEurope
Economy for the Common Good	Transitions2
Ecsite	RRI Tools Community
European Foundation Centre Research Forum	UpMouvement
Europe Tomorrow	Joint Programming
European Citizen Science Association	Institutions for Open Societies at Utrecht University
European Crowdfunding Network	Berlin Workshop in Institutional Analysis of Social-Ecological Systems (WINS)
FING	Y Lab
CERRI (Fraunhofer Center for RRI)	Accorderie
Great Transition Initiative	MoviLab
SOS Group	Third-places
International Association for the Study of the Commons	Social Innovation Exchange (SIX)
European Institute of Economy of Functionality and Cooperation	Covenant of mayors for climate and energy
Institutions for Collective Action	Future Earth

Intelligence for urban areas	International Council for Science
IRI Thesys	Politics for tomorrow
Knowledge network for system innovations and transitions (KSI)	The Oslo Research Group on Responsible Innovation
La Caixa Foundation	The virtual institute for Responsible Innovation (VIRI)
Laboratory for the governance of the city as a commons (Labgov)	Mistra Urban Futures
Equality lab	Academic Torrent
Ladyss (Social dynamics and areas' restructuration)	Sensecub
Social economy lab	Medea
National Research Alliances on Environment (ALLENVI) & Human & Social Sciences (ATHENA)	Design for Social Innovation and Sustainability network (DESIS)
Citizenscience.gov	Institute For Research and Innovation in Society (IFRIS)
InMediats	National network for the Houses of Human Sciences
Research and Evaluation of Innovative and Social Solutions (RESOLIS)	Mission for interdisciplinary (Within National Center for Scientific Research - CNRS)
Social Value Exchange	Crowd.Science
FairCoop	Independent Social research foundation
Enspiral	Ashoka
OECD's "Science, technology and innovation" directorate	The Cultural Capital Exchange
National co-ordinating centre for Public Engagement (NCCPE)	International conference on sustainability science
C40 Cities	Platform RRI Autriche
Synchronicity Earth	Hungarian Responsible Innovation Association (RRI.Hu)
ALLISS	Witcoin
International association for technicians, experts and researchers (AITEC)	Crowdfunding France
Participatory Action Research & Citizen Sciences Research Group (GDR PARCS)	Backfeed
Engineers without borders	Synereo
TETRIS	Colony
National Association of Research and Technology (ANRT)	Institute for Social-Ecological Research (ISOE)
World Business Council for Sustainable Development (WBCSD)	ORBIT
Euro Science	Greener Acres Value Network (Gavnet)
SCOOL	Sustainability Transitions Research Network (STRN)
Institut Godin	Transition Research Network
Senior scientists & patients association (ScienSAs')	Ecolise
Coexistencence	Sensorica
Hab Fab	FabFoundation

Chaire Bernard Maris (UNESCO)	Repair Cafés
National collective for participatory sciences in biodiversity	Imagine for People
B Corp	French Impact
Convergences	Verdun project
Deuxième labo	La Fabrique des mobilités
Sciencewise	European Academies Science Advisory Council (EASAC)
Science Europe	Responsible Innovation Research Programme (NWO-MVI)
Science in transition	Drift
Fondazione Giannino Bassetti	Local Governments for Sustainability (ICLEI)