



FoTRRIS

Fostering a Transition towards Responsible Research and Innovation Systems

Policy recommendations for co-RRI Deliverable D4.3

Anett Ruszanov¹

Nele D'Haese²

¹European Regions Research and Innovation Network, 3 rue du Luxembourg, B-1000 Brussels

²VITO, Boeretang 200, B-2400 Mol

<http://www.fotrris-h2020.eu>



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About the FoTRRIS project

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

FoTRRIS stresses that RRI is a collaborative activity from the very beginning. Therefore FoTRRIS 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, FoTRRIS focuses on global challenges, i.e. local or regional manifestations of global challenges and on local opportunities for addressing them.

FoTRRIS 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, FoTRRIS experiments the implementation of new governance practices in five member states. These five experiments are evaluated, validated and constitute the basis for FoTRRIS 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>

Coordinator contact:

Dr. Nele D'Haese / Unit Sustainable Materials Management / VIT NV / Boeretang 200, 2400 MOL, Belgium.

t: +32/14 33 58 46 | e: nele.dhaese@vito.be | w: <http://www.vito.be/english>

Executive summary of the FoTRRIS policy recommendations

The **European recommendations** highlight the necessity of implementing the following policy measures:

- Take **resilient societies** as the **ultimate goal** of the European and global research agenda to be achieved by 2030.
- Structurally anchor a science-society dialogue, based on equality, in research and innovation systems by providing specific requirements towards the implementation of **transdisciplinary and co-creative approaches** in research trajectories.
- Invest in the development of **innovative ‘excellence indicators’ for science and innovation**, based on the insights gained from RRI so far, that allow to assess the societal impact of the outcomes of research and innovation trajectories.
- Invest in **capacity building** and training on RRI.

In the **regional and national policy recommendations** the following common points of interest are found:

Capacity building was mentioned by Austria, Flanders, Italy and Spain. Currently, the major lock-in is a lack of systemic thinking. The vision of partners around making RRI part of formal and/or informal education and life-long learning is that it should be quite free and open. Only the baseline, a common understanding of the essentials of co-RRI should prevail. The format and content of learning trajectories, however, can take many forms. The common end goals should entail behavioural change and the development of skills that enable actors to co-create and think systemically.

Support/funding for transdisciplinary and co-creation tracks in research and innovation was mentioned by Austria, Flanders, Hungary and Italy. (1) Long-term agenda setting (for instance the Flanders 2050 strategy), (2) institutionalisation (such as embedding competence cells in organisational structures), (3) making transdisciplinary research and co-creation tracks part of the selection criteria of publicly funded projects, (4) acknowledgement (such as labels or special titles for institutions) and (5) motivation schemes (for individuals) were proposed as actions that can incentivise this support.

Other areas that the national/regional-level policy recommendations cover:

- Organisational space for co-RRI
- Visibility and rewards for co-RRI
- Knowledge currency to value transdisciplinary cooperation in and between the pillars of the quadruple helix
- RRI as an underlying principle in national policy making
- Co-creation in R&I activities
- Citizen participation in the form of community building but also political/democratic participation
- Gender equality
- Sustainable tourism
- Support for niche innovators

These policy recommendations were written during the FoTRRIS project and presented in this report in the following way: one set of European recommendations (4 recommendations) and five sets of regional and national recommendations (altogether 17), which were defined by each of the project's partners carrying out a transition experiment (see also D3.1 and D3.2). These policy recommendations do not relate to each other and should be read per country or region, while taking into account their political, social, environmental and economic context.

While the European Policy Recommendations are addressing European institutions, more particularly the European Research and Innovation Directorate General (DG RTD) and the European Parliament, and were disseminated among European multiplier networks representing stakeholders in the quadruple helix model, the five partners' policy recommendations have been, and will be further, disseminated to relevant policy makers operating at regional, national and European level.

1. Introduction to the policy recommendations

In order to facilitate the reader's understanding of the structure and the content of these policy recommendations, a short explanatory text is provided below about the evidence they derive from, their validation process, their practical application and the territorial dimension inherent to research and innovation. In addition to this, the next chapter gives more information about the concept of co-RRRI, which is the main subject of these policy recommendations.

1.1. Input for the policy recommendations

The FoTTRIS policy recommendations address policy makers at various levels: regional, national and European. The regional and national recommendations build further upon the outcomes of the transition experiences and outreach workshops of the partners, while the European recommendations are based on the input from the back-casting exercise held in Paris in September 2017 (see also D4.5).

In all cases, the draft policy recommendations have been discussed and validated by a larger group of stakeholders. The partners' recommendations have been discussed with stakeholders who attended their outreach workshops and, in some cases, also with actors relevant to research and innovation policy issues who did not participate in the project transition experiments. The European policy recommendations, on the other hand, have been sent for comments to the European Commission Directorate General Research and Innovation, the Science with and for Society unit and to Science Europe, as was advised by the FoTTRIS Advisory Board's members.

1.2. Dissemination of the policy recommendations

To create real impact with their work, all partners will translate the policy recommendations into their national language(s) and will widely disseminate them among relevant stakeholders in the policy and decision making cycle. As most of them have several years of experience in lobbying and advocacy work, they can make use for this of already existing networks and contacts.

The same applies for the European recommendations. These recommendations will be sent to the European Commission, the European Parliament, the Committee of the Regions and multiplier European networks.

1.3. Territorial dimension of the FoTRRIS policy recommendations

In the next chapter, covering the core principles of co-RRI, we explain that co-RRI addresses local manifestations of grand societal challenges, also called ‘glocal challenges’. The reason underlying this concept is that each locality is characterised by its own specific combination of cultural, social, infrastructural, geographical, economic and environmental elements and that, therefore, the local manifestations of global sustainability problems, such as climate change or an increasing demand for clean, drinkable water and sustainable energy, will be contextualised and unique.

As a consequence, approaches to effectively tackle glocal problems should take this unique context into account. A significant part of relevant, local knowledge and expertise, however, lies (silently) embedded within local communities, which means that the involvement of these communities is a prerequisite for research and innovation to come to meaningful outputs. This implies that local communities should be empowered to create their own sustainable futures, based on their own response to local circumstances and local history. Co-RRI stands for a way of innovating that recognizes and emphasizes the key role played by the science community in this process of empowerment. It therefore stresses the importance of approaches that aim for solving glocal environmental and social challenges while respecting planetary boundaries, yet not without involving a diversity of non-traditional local knowledge actors in a transdisciplinary and co-creative way.

Co-RRI thus presupposes that for local (science) communities to flourish they should be given a certain degree of freedom: the freedom to act in such a way as to participate fully in this kind of transdisciplinary and co-creative local innovation processes. Public authorities are therefore responsible, in our point of view, to develop the necessary frameworks that allow for conditions under which this kind of ‘full participation’ can take place. As the policy recommendations presented in this deliverable will clarify, we stress the importance in this regard of changes within the fields of education, financing, evaluation of projects, gender equality, etc.

Given this position on the role of public authorities to facilitate responsible research and innovation, co-RRI aligns with the subsidiarity principle, which is rooted deep into the history of European political discourses. Also the subsidiarity principle presupposes that human flourishing requires freedom. Central to this principle is the idea that responsibilities should not be assigned to higher levels of social organisation when lower levels are better equipped for it. But it also presupposes, on the other hand, that higher forms of social organisation, such as the state, are needed in situations where lower levels cannot achieve their ends by themselves.¹

Co-RRI therefore also asks for governments concerning themselves with the common good. They should not only be actors enabling lower levels to perform better, and hence to contribute to the common good of all, but they must also be actors watching, directing and restraining communities in their activities when these are not in line with the overall goal of sustainable development, that is societal development respecting social and planetary boundaries.

The way the policy recommendations are formulated in this deliverable reflect these convictions. As already mentioned, they address various political levels, namely the European, national and regional level. These levels correspond with the issues each of the partners has identified and has chosen to further work on during the project. These levels also reflect the public administration and political system in each of the partner countries. Belgium, for instance, is a federal country, where the regions (Flanders) have the full responsibility over important competences, while Hungary and Austria are rather centralised states.

¹ Carozza, P.G. (2003): Subsidiarity as a structural principle of international human rights law, Scholarly Works, Paper 564.

2. Co-RRI : co-created responsible research and innovation

Political and societal support for research and innovation depend upon a silent contract between ‘science’ and ‘society’. In line with dominating ideas on the role and responsibilities of research and innovation systems, a certain return is expected for public and private funding. So are research and innovation increasingly expected to contribute to the economy by improving countries’ and regions’ competitiveness in a global knowledge economy. In the Europe2020 strategy², for instance, research and innovation are seen as instruments to achieve the ultimate goal of growth and job creation. Science is also expected to enrich and legitimise policy processes through evidence-based policy advice. The scientific world is still perceived by many, including the scientific community itself, as being ‘independent’ and ‘objective’ and is, therefore, considered to be an essential source of reliable knowledge. Not only for policymakers, though, but also for a broader public, which presses for researchers’ active role in public debates; and that science education and the communication of scientific results are increasingly used as tools to foster a broader culture of reason and reflexivity³.

With sustainability gaining terrain and coming into the forefront of European objectives, this movement towards an understanding of research and innovation processes having multiple dimensions has been placed in yet another perspective during the past decades. Though knowledge economies have access to vast amounts of scientific knowledge and technological know-how, the sustainability performance of knowledge economies leaves much to be desired. We currently lack the necessary knowledge to create a thorough understanding at the level of individuals and institutions of the sustainability challenges we are globally facing, although these changes will be so vast, so pervasive, and so influential that they require immediate policy and management interventions. The research and innovation system is therefore asked to reflect upon its role and position in society and to re-examine their course and goals.

Currently, we record an emerging paradigm, in which a successful interaction of science, technology and society depends on the cross-fertilisation of values, norms, experiences and expertise among all actors engaged with ecologically sustainable and socially just societal change, and hence on the ability to transcend disciplines, established research cultures and practices, and categorisations such as public–private and academic–non-academic. This redefinition of the relationship between the research and innovation system and society is relying, amongst others, on an increase of the share of highly-educated citizens and the emergence of new ‘spaces’ for non-traditional knowledge actors to engage with science and technology. Examples of the latter are the growing number of activities that could fall under the term ‘citizen science’ or ‘DIY science’ (makerspaces, fablabs, etc.) and the opportunities created by social media for previously disparate groups of engaged individuals to connect. The long-term benefit would be that public dialogues are becoming part of the science

² EC (2010): EUROPE 2020. A strategy for smart, sustainable and inclusive growth. COM(2010) 2020, Communication from the Commission, Brussels, 3.3.2010. <http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf>

³ Mejlgaard, N. (2018): Science’s disparate responsibilities: Patterns across European countries, *Public Understanding of Science*, 27(3), pp.262-275.

governance landscape at different levels and that knowledge generation is increasingly seen as the result of co-creating practices.

'Responsible research and innovation' (RRI) was introduced as a new way to conceptualise this science-society relationship. According to the European Commission RRI means that *'societal actors work together during the whole research and innovation process in order to better align both the process and its outcomes, with the values, needs and expectations of European society.'*⁴ In a broader sense, RRI is *'taking care of the future through collective stewardship of science and innovation in the present.'*⁵

RRI provides principles to facilitate the transformation of research and innovation systems. According to the European Commission, inclusive engagement, commitment to gender equality, more science education, ethics defined as shared values reflecting fundamental rights, open access to data and developing new models of governance open up and democratise the current research and innovation establishments.⁶ Related scientific arguments stress the importance of anticipation, reflexivity, inclusion and responsiveness as most fundamental RRI principles.⁷

These definitions and principles, however, leave room for various interpretations and practical implementations; ranging from views and practices that strive for the radical transformation of the current R&I systems to views and practices that hardly challenge current structures. While RRI is a normative concept, with values such as ecological sustainability and social inclusion in its core, its normative anchor points are blurred. This again leads to a diversity of RRI approaches concerning their ethical and political positions, their understanding of responsibility and their transformative potential.

Therefore, FoTRRIS introduces **co-created responsible research and innovation (co-RRI)**. This is a concept that does not substitute former definitions and principles of RRI. It attempts to supplement them in order to clarify our normative position and our understanding of RRI principles. Co-RRI is characterised by its normative assumptions, content, its approach and its process.

⁴ EC (2012): Responsible Research and Innovation. Europe's Ability to Respond to Societal Challenges. European Commission, Brussels.

⁵ Stilgoe, J.; Owen, R. & Macnaghten, P. (2013): Developing a framework for responsible innovation, *Research Policy*, 42, pp.1568-1580.

⁶ EC (2012): Responsible Research and Innovation. Europe's Ability to Respond to Societal Challenges. European Commission, Brussels.

⁷ Owen, R.; Macnaghten, P. & Stilgoe, J. (2012): Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy*, 39, pp. 751-760.

Schomberg, von R. (2013): A vision of responsible research and innovation. In Owen, R. - Bessant, J. - Heintz, M. (ed): *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*. John Wiley & Sons, pp. 51-75.

Stilgoe, J.; Owen, R. & Macnaghten, P. (2013): Developing a framework for responsible innovation, *Research Policy*, 42, pp.1568-1580.

2.1. Normative assumptions

FoTRRIS acknowledges that research and innovation processes are embedded in societal and political discourses and institutional structures. In the current context, the overarching political framework regarding sustainable development is provided by the United Nations' Sustainable Development Goals (SDGs). However, the political context may change over time. Yet, the basic values of co-RRI will still press for our **joint responsibility in creating knowledge and taking actions for solving grand environmental and social challenges while respecting planetary boundaries.**

The **underlying values** co-RRI is committed to, therefore, are: **ecological sustainability, acknowledgement of different forms of knowing and social inclusion.**

Given the role of the research and innovation system to create, collect, structure and distribute new knowledge, and its tradition in exploring less-known paths and discovering new horizons, we consider traditional knowledge actors to be appropriate partners to initiate and to sustain the search for answers to global challenges. They are well placed to organise and actively contribute to actions contributing to long-term transformative change, such as raising awareness, creating niches to experiment and collaborate, broadening and connecting networks of frontrunners, and creating tools to deal with the uncertainty surrounding policy and management actions for transformative change. We believe that a lack of complete scientific understanding never justifies a lack of action. Researchers and other knowledge actors should, therefore, in our opinion, follow in this respect the precautionary principle, which we understand as a call for taking action and being pro-active.

Moreover, we believe that problem-solving, in the spirit of the precautionary principle, cannot be based on the exclusivity of scientific knowledge production. The entanglement of the research and innovation community with industry and government easily runs counter to researchers' critical distance from dominant beliefs and practices.⁸ Besides, each scientific discipline and paradigm is characterized by its boundaries, hence limiting researchers in their understanding of multifaceted societal problems. The necessary knowledge to understand the complex societal problems of today, therefore, lies scattered among a diversity of stakeholders and various forms of local knowledge. This makes that transdisciplinarity is a key characteristic of co-RRI.

We recognise, however, that not all stakeholders invited to participate in this kind of transdisciplinary learning processes can start on an equal footing. While co-RRI invites stakeholders to engage in a joint (consensus-oriented) problem-solving process, it acknowledges that opportunities for participating, influencing the outcomes or taking steps in the real world vary among stakeholders. The implementation of co-RRI inevitably involves controversies, conflicts, and power issues. As a result, co-RRI is inextricably linked with **making choices with ethical and political implications**, such as giving a voice to marginalised and silent social groups. Beyond being aware of the ethical and political nature of co-RRI, responsibility therefore asks for being reflexive upon the choices made, as well as their implications.

⁸ Deblonde, M. (2015): Responsible research and innovation: building knowledge arenas for global sustainability research, *Journal of Responsible Innovation*, 2(1), pp.20-38.

2.2. Content

Co-RRI addresses local manifestations of grand societal challenges (**glocal challenges**). As each locality is characterised by its own specific combination of cultural, social, infrastructural, geographical, economic and environmental elements, the actual problems, as well as the answers, are contextualised and unique. A precondition for research and innovation systems to become more responsible therefore is that local needs, values and opportunities are taken as a starting point to consider which combinations of traditional and non-traditional (local) knowledge are appropriate to effectively respond to the glocal problems they want to tackle. A next step is then to check whether their normative content complies with global ethical principles on strong sustainability. This implies that co-RRI frames economic growth as a means to realize social justice, prosperity and ecological sustainability as long as planetary boundaries are respected.

Local communities, however, never develop in solitude, but are attuned to changes in their environment in a co-evolutionary way. Co-RRI trajectories will therefore inevitably involve processes of critical reflection on their own functioning, also about this environment. We believe that this kind of **reflexive monitoring** should be structurally embedded in research and innovation processes and that it should be used to better align co-creation processes at the local level with broader societal developments. Accordingly, co-RRI trajectories touch upon a variety of possible options for addressing glocal challenges and should be understood as long-term processes involving lasting relationships between traditional and non-traditional knowledge actors and engagements transcending project-based knowledge creation.

2.3. Approach

Addressing grand societal challenges and, currently, pursuing SDGs implies complex and non-linear processes. SDGs and, in general, grand societal challenges cannot be solved in isolation, but they have to be looked at in interaction with each other, and as parts of one global agenda. The SDGs are dealing with **wicked problems**, which are deeply entrenched in contemporary societal, political, and economic structures and characterised by a hardly reducible structural uncertainty. These kinds of problems are very difficult to manage, given the variety of interests involved and the difficulties to interpret and structure them. Wicked problems 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.⁹

Therefore, co-RRI adopts a **complex systems** perspective. This means that we conceptualize societal systems as complex systems that can be described in the following, non-exhaustive way. First of all, complex systems are constantly evolving, open systems that contain a multitude of elements interacting with each other and with elements in the system's environment. These interactions are

⁹ Rotmans, J. & Loorbach, D. (2010): Towards a better understanding of transitions and their governance: A systemic and reflexive approach. In Grin, J. – Rotmans, J. – Schot, J. (ed): Transitions to sustainable development: New directions in the study of long-term transformative change. Routledge, pp. 105-113.

often unpredictable, in the sense that they are non-linear and determined by feedback loops. A small stimulus may, therefore, cause a larger effect than expected, or no effect at all, and vice versa. Secondly, complex societal systems are nested systems, which means that different organisational levels can be discerned in this kind of systems. Higher level structures emerge out of the interactions between elements at lower levels. So can co-RRI be placed in line with a Polanyian way of thinking in which the economic system is seen as nested within the social system which, on its turn, is nested within the ecological system. This implies that the institutionalised logic of economic activities is supposed to serve the social and, subsequently, the ecological system, and not the other way around. Moreover, the history of complex systems is believed to affect their present state, which in turn influences future states. This creates a certain degree of path dependency and makes that, in retrospect, there can always be found characteristics connecting distinct developmental states of a societal system. Furthermore, it questions 'one-size-fits-all solutions' for global problems, as this kind of solutions often lack connections with past states and are therefore less effective.

As a consequence, the complexity of societal systems emerges from the interactions between its composing elements. One of the elements can therefore never contain the whole or, said otherwise, one person, or even a group of people, can never have a complete view on the functioning of a whole societal system, such as the energy system, food system or health care system. Co-RRI, therefore, shares the opinion of those who say that when we understand that the world we live in is complex, we also have to acknowledge that there are limitations to our understanding of this world. An important consequence in this respect is the fact that it is difficult to describe the functioning of a societal system. Any description will be limited by the observer's needs, knowledge, interests and possibilities, which makes that there will be as many different ways to decompose and describe a societal system as there are observers.

In practical terms, this means that co-RRI follows the point of view that the knowledge gained through any description should always be placed relative to the perspective from which the description was made.¹⁰ It necessitates, in our perspective, the involvement of a diverse array of actors to come to a broad understanding of the causes of global problems, as well as a broad range of thinking about possible alternative solutions. Co-RRI can therefore never be understood as just an add-on to 'research and innovation as usual.' Citizen and stakeholder engagement for RRI requires the **co-creation of relevant knowledge and solutions for complex problems**, and not just involving citizens and stakeholders in the final phases of an R&I project with the aim of 'educating' them into acceptance of the outcomes (the 'box-ticking' exercise). Co-RRI is a much more solid, thorough, and systemic concept for tackling complex problems in non-linear contexts. "RRI is not about first promoting new solutions and then implementing them into society afterwards, but about first deciding what the real values and needs in society are. Once we have a clear picture of those, we have to look for a good combination of experiential, scientific and technological knowledge to respond to those values and needs."¹¹ As a result, co-RRI invites actors from at least four societal subgroups representing the four

¹⁰ Cilliers, P. (2005): Complexity, deconstruction and relativism, *Theory, Culture & Society*, 22, pp.255-267.

¹¹ Mariann Deblonde <https://www.youtube.com/watch?v=arXQf7uQpeY>

sectors of the quadruple helix of innovation, that is science, policy, business and civil society. The co-RRI process, in a **trans-disciplinary** spirit, provides space for dialogue among diverse types of knowledge-holders, and it creates room for guided reflections on the inherent values and norms of the research and innovation (R&I) system.

2.4. Process

Co-RRI processes go along with **transparency**, which grants access to information about the process as well as the (intermediary) results of ongoing activities, and therefore goes hand in hand with the **accessibility** of data and other information. On the one hand, this openness will allow stakeholders and other community members to reflect on the outcomes and to form their own opinions about the societal relevance of co-RRI trajectories. On the other hand, transparency and accessibility of data break down barriers and facilitate capacity building among actors engaged to participate in co-RRI processes.

Transparency, hence, enables another process characteristic of co-RRI, that is **reflexivity**. It concerns an iterative action during which the participants of a co-RRI process take account of the (intermediary) results relative to the choices that have been made as well as external changes. Reflexivity therefore creates awareness about the fact that making choices with ethical and political implications is inevitable – which addresses again the normative character of co-RRI processes mentioned previously. Furthermore, the reflexive character of co-RRI builds in a certain responsiveness to the emerging needs of the actors engaged to the process. It allows for research and innovation processes that unfold as ongoing, open and long-term processes carried by a continuously developing network of actors that channel in new problems on a regular basis.

Yet, this openness appears to have its limits. While for some co-RRI activities it is essential to implement a fully open and inclusive way of actor engagement, in other cases it makes sense to build upon invited participation. Particularly in highly contested fields, it is difficult to reconcile diverging interests. Thus, the way co-RRI processes deal with **inclusiveness** and actor selection are to be carefully chosen depending on the particular context in which they take place so that a productive and constructive working atmosphere can be fostered.

3. FoTRRIS policy recommendations

As mentioned before, six sets of recommendations are listed below. These are in alphabetical order:

- Austrian (4)
- European (4)
- Flemish (3)
- Hungarian (3)
- Italian (2)
- Spanish (5)



3.1. Austrian policy recommendations

FoTRRIS recommendations for fostering more co-RRI-ness in the Austrian R&I landscape

Institutional and financial support for reflections on the relevance and potential benefits of co-created Responsible Research and Innovation (co-RRI)

Co-RRI requires thorough commitment from all actors engaged, which only can be generated if its need is recognized. Reflections about the societal relevance of concrete R&I activities, especially those that reveal possible hidden societal implications, will help to highlight the need for co-RRI practices. Institutional and financial support measures, such as tailored funding, support structures and acknowledgement within hosting organizations, will be helpful to enhance actors' motivation to engage in early and continuous reflections on the societal relevance of R&I, and to explore the (potential) benefits of new ways of carrying out R&I.

Actions

As the relevance of co-RRI and its meaning may vary across research topics, not all research and innovation activities would need to consider co-RRI to the same extent. Thus, an important first step towards more co-RRI-ness is to explore its relevance regarding concrete R&I activities in terms of its societal relevance. If so, what additional value might co-RRI add compared to conventional R&I approaches? Some potential groups that will benefit include: The R&I community, as well as societal subgroups and stakeholders. If actors, who were expected to engage in co-RRI do not see the relevance and value of it, co-RRI might stay a top-down policy. This potential indicates the risk that if not implemented thoroughly, fostering co-RRI-ness may be a futile exercise that would not bring about any serious cultural change.

Rather, the need for co-RRI should proceed bottom-up based on the recognition of need. However, it is important to create incentives by means of providing an environment that encourages organisations and actors to reflect on what benefit a co-RRI approach might bring, regarding making a specific R&I activity more 'co-responsible'.

While for certain R&I activities the potential value of co-RRI is self-evident (e.g. research explicitly addressing the grand challenges or ethically sensitive topics), for others it is not. The challenge is to uncover possibly hidden societal implications, to identify societal actors potentially affected to jointly reflect on the potential relevance of co-RRI, and to define what 'responsibility' would mean in the specific R&I context.

In general, such reflections could take place during, on top of, or in parallel to already ongoing R&I activities, but for co-RRI we suggest a bottom-up processes. In line with this, FoTRRIS recommends that such reflections within multi-actor groups should be institutionalised as part of the conceptualisation of a project from the planning phase. This could be stimulated by funding rules.

Although a growing number of research funding programmes already ask for justifications about the societal relevance and the envisaged impacts of proposed R&I projects, it is the case that little attention paid to how the arguments to legitimise R&I plans are generated. In many

cases the arguments are built solely by the research community based on academic discourses.

In contrary, taking a co-RRI approach serious would mean including perspectives beyond the narrow disciplinary academic community when arguing for R&I's legitimacy. This should embrace the engagement of scholars from other disciplines as well as actors from other realms of society, such as relevant stakeholders.

However, related processes of reflection are hardly supported yet. In order to foster more co-RRI-ness already in the project planning in terms of ex ante reflections, and project conceptualisations in multi-actor groups, FoTRRIS recommends that funding programmes, as well as R&I hosting organisations, provide explicit support to convey such activities.

Funding programmes could grant financial support by means of personnel costs, financial compensations for participating non-R&I actors, other costs necessary for e.g. the implementation of multi-actor workshops, and honorariums for facilitators or other experts to be subcontracted to support reflection. In order to institutionalise such facilitated reflections, funding should also be granted to set up and run support structures.

In the case that co-RRI is considered relevant for the further project development, tailored funds supporting the joint elaboration of project concepts and proposals in multi-actor groups should also be provided.

R&I hosting organisations could support ex-ante reflections as a first step towards more co-RRI-ness by dedicating a certain percentage of their basic resources to such reflection activities. Moreover, they could institutionalise support by setting up in-house support structures. Such 'competence cells' would design and facilitate reflection processes from the very beginning and offer support for various other co-RRI related activities at a later stage of the implementation of co-RRI projects. Finally the acknowledgement from organisations' high level management will encourage actors to engage in innovative social experiments in the context of R&I.

FoTTRIS recommendations for fostering more co-RRI-ness in the Austrian R&I landscape

Providing appropriate organisational space for the implementation of co-RRI

A transition towards more co-RRI cannot take place without creating niches for experiments, within various settings and with different methods, to realize transdisciplinary multi-actor co-creation processes within the R&I landscape. Such kinds of 'social experiments' are not standardized, but highly context specific, and they need at this point in time an appreciative environment, extra time and resources, in order to finally evolve into a social innovation within the R&I landscape.

Actions

Co-RRI builds on processes, which are transdisciplinary and co-creative by engaging multiple actors in R&I. The overarching aim is to jointly elaborate on solutions for pressing societal challenges, which motivate societal change towards ecological sustainability, greater economic viability, and consideration of social justice. As societal change always touches upon values, needs, interests, and expectations of various societal subgroups, co-RRI builds on the engagement of diverse types of stakeholders and citizens. All of them hold relevant knowledge and bring in diverse perspectives about the problems at stake as well as possible ways to address them. This opens up a way towards more 'knowledge democracy', but it also involves controversies, conflicts, and power issues. Difficulties with handling certain tensions between pluralism and consensus make the implementation of a co-RRI process challenging.

Co-RRI is always context specific. It goes along with new constellations of stakeholders, and varying roles for the actors involved, which go beyond conventional roles. It also differs regarding its reflexive potential. Co-RRI does not only imply discussions about the societal challenge to be tackled, but it also entails reflections about the envisaged contributions of R&I in addressing also hidden societal relevant issues. Including its embeddedness into specific social, political, and economic contexts, and inherent values and norms. Even if there are discourses about the relationship of science, economy, and society, in general critical reflections on R&I processes within R&I systems are restricted to few occasions or they are 'professionalised', e.g. by ethics committees or by scholars from Science and Technology Studies. Thus, this reflexivity within co-RRI is quite unique in research funding.

Each co-RRI activity needs to be seen as a unique social experiment, which necessitates certain flexibility. Such experiments are likely to entail unexpected results, which could generate very innovative outcomes, but they also imply a certain risk to fail. This challenges their legitimacy and acceptance within the conventional R&I landscape. Consequently niches, by means of protected spaces, need to be provided, which offer an enabling environment and specific support for the implementation of co-RRI.

Specific spaces could be created by means of setting up intermediary centres, which initiate, coordinate and facilitate the implementation of co-RRI (see e.g. FoTTRIS 'competence cell' activity models D2.5). Such centres could be either located within the formal R&I system, e.g. hosted

by Universities, they could be community driven, or independent private organisational entities. Their mission would be to transcend borders between disciplines, between institutions and actors within the R&I community, as well as to establish links with various stakeholders.

Currently there are comparably few research fields and R&I organisations (e.g. innovation communities), which appreciate co-RRI like approaches. Therefore a broader cultural change in research communities as well as in organisations and individuals will be necessary in order to initiate a transition towards more co-RRI-ness.

Co-RRI activities might remain a marginalised niche practice in the near future, as transition takes time. However, these non-mainstream experiments are still important to show how co-RRI can work, what additional benefits might occur, and to build up expertise. It will be important to offer long-term support for a thorough development and improvement of co-RRI practices, because they build on long-term co-operations, which go beyond single projects. Furthermore, this is relevant for the successful implementation of single co-RRI activities, as well as for community building and cultural change.

Support for up-scaling is also essential for a transition. This could be achieved by additional single co-RRI experiments, but also through community building supported by platforms (e.g. Austrian RRI-Plattform), where co-RRI actors can network, exchange experiences, share resources, and join forces.

A very efficient way to drive the co-RRI development is the provision of resources by means of tailored funding instruments. Currently the resource mobilisation is still limited, although there are already some funding programmes in place, which support co-RRI like approaches. Thus FoTTRIS recommends to set up more of those programmes, which finance co-RRI activities as well as related support structures. They should consider the specific needs related to co-RRI, such as allowing for flexibility in terms of project processes and outcomes, or support for long-term cooperation between various knowledge actors (e.g. multi-actor research and innovation networks). However, as support structures might not be able to rely on long-term funding, they should develop long term self-sustaining strategies.

FoTRRIS recommendations for fostering more co-RRI-ness in the Austrian R&I landscape

Creation of visibility, acknowledgement, and rewards for co-RRI

In the current academic reward regime there is still little recognition for co-RRI inspired research approaches. Thus, a transition towards more co-RRI like approaches requires new academic reward schemes that offer R&I organizations, as well as single researchers, appropriate recognition and rewards for their efforts in engaging in co-RRI activities. There is also a lack of remuneration for informal actors contributing to research and innovation activities. In order to ensure genuine transdisciplinary co-creation processes, as foreseen in co-RRI, adequate remuneration and compensation needs to be granted to all actors engaged.

Actions

Engagement in processes beyond 'business as usual' practices not only entails additional efforts, but it may even imply disadvantages for actors from academia with regards to institutional rankings or personal academic career development. Within a highly competitive academic working culture, which operates under time pressure and limited financial resources, researchers face a strong pressure to publish in high ranking peer reviewed scientific journals and to produce outputs, such as patents or marketable products. Such circumstances make the engagement in transdisciplinary, co-creative R&I efforts, such as co-RRI unattractive.

As the aims of co-RRI are to produce outcomes that co-create societally relevant solutions to pressing challenges, it is often unclear if results would be relevant for an academic publication. Thus, scholars often find it difficult to determine where to publish their work. As there are only very few (not highly ranked) journals, which appreciate publications resulting from non-mainstream R&I activities, co-RRI is perceived as hindrance to individual careers.

Against this background, FoTRRIS recommends supporting the launch of additional journals that are open for publishing co-RRI-like work so as to help efforts to publish transdisciplinary work and to increase the visibility of non-mainstream approaches. It would also assist overcoming structural biases from the current system of peer review, which still favours conventional R&I approaches. Likewise, R&I organisations are also reluctant to institutionalise innovative non-mainstream approaches, if they are not valued by the evaluation system. Although there are some attempts to also capture societal criteria in performance records, which co-RRI could considerably contribute to, this remains of low or no relevance to R&I organisations.

Thus, FoTRRIS recommends enhancing the recognition of co-RRI in the current academic system by including co-RRI meaningfully in the performance indicator system (knowledge databases, evaluation, etc.). Moreover universities should be rewarded for their co-RRI activities in the negotiation processes for basic funding with the Ministry. For this purpose, co-RRI related performance indicators would need to be developed. They could be

adapted from existing evaluation and monitoring frameworks, such as e.g. the one elaborated within the MoRRI project. However, Co-RRI must not become another administrative task within an already administrative-heavy university regime. Thus, indicator based assessments must not become a standardised tick-box exercise, and the framework for evaluating co-RRI will need to be elaborated very thoughtfully, e.g. by including dynamic indicators.

In order to enhance the prestige of co-RRI within R&I organisations, it could be launched as a topic for a professorship, like innovation research or science, and technology studies. This could quickly promote the institutionalisation, also via teaching curricula, but it also might imply a certain risk that co-RRI would only become the subject of theoretical research.

Via 'competence cells' in universities, support could be institutionalised (like already existing gender equality offices or research support offices). Thereby co-RRI would add 'responsibility' to the 'third mission' of universities.

There is not only a lack of recognition of societal relevance in evaluation practices, but also in prevailing funding. Existing research evaluation procedures do not sufficiently acknowledge the value of co-RRI and related expertise, nor do they particularly support the type of open, mutual and adaptive learning processes required for the implementation of co-RRI.

Finally, the engagement in co-RRI does not only cause additional efforts for actors from the R&I community, but also for knowledge actors. As the benefit for non-R&I actors is often not immediately visible, appropriate compensation and remuneration needs to be provided to value their engagement. Particularly for CSOs, it is often essential to also get their personnel costs covered in order to be able to engage. Thus, funds should allow for an appropriate remuneration or other forms of compensation (see e.g. FoTRRIS D2.4) of non-R&I community participants. Co-RRI implementing organisations need to introduce related administrative procedures, which allow for an easy processing of remunerations.

FoTRRIS recommendations for fostering more co-RRI-ness in the Austrian R&I landscape

Education, training, and capacity building to co-create research and innovation in a responsible way

A transition towards more responsible research and innovation cannot take place without people having the necessary skills to implement co-RRI processes. Therefore education and training for researchers, innovators, and informal actors will be essential in order to build up capacities and expertise. Particularly to address the younger generation, which is not strongly socialized within mainstream working cultures yet, it is essential to foster a transition towards more co-RRI-ness.

Actions

There are various ways in which co-RRI activities could be implemented in practice (see e.g. FoTRRIS 'Cook Book'), depending on the specific context, the actors engaged, and the topic at stake. There is no one-serves-all recipe, and each co-RRI activity needs to be tailored according to its purpose in line with the participants' needs. Building competencies for co-RRI is very much about experiences gained through learning by doing. Still, education to create a basic understanding for co-RRI is needed as well as specific trainings for those, who practice co-RRI.

To put it roughly, co-RRI builds on experimental, reflexive, transdisciplinary, co-creative bottom-up processes, which engage a broad variety of knowledgeable actors, such as academic researchers from different disciplines, actors from policy, civil society, and the business sector. These actors interact throughout the whole lifecycle of a co-RRI project (at best even beyond), beginning in the project conceptualisation phase, in order to address complex wicked societal challenges. The joint activities go beyond the usual steps in R&I projects. They imply exchanging viewpoints on the problem(s) to be tackled and their root causes, discussions about what a more sustainable future might look like, different ways as to how to get there, and how the planned R&I activities could contribute. Such multi-actor constellations inevitably imply imbalanced power relations and different viewpoints. This requires openness (to disagreement) and willingness for mutual learning from actors engaging in co-RRI.

The implementation of co-RRI is definitely a challenging enterprise and requires specific competencies and skills including: general process competencies, such as didactics and facilitation; specific expertise in various participatory research methods; and capabilities to cooperate in interdisciplinary and multi-actor groups. Moreover, knowledge about the respective research field and related actors of relevance is necessary. This goes beyond what most of the curricula in Higher Education in Austria currently offers, as the curricula are still widely oriented towards disciplines and strongly specialised. RRI competencies often go along with what is called 'soft skills', which the education system occasionally offers, often by means of extra-curricular and optional add-on courses.

However, as the working conditions for researchers are already demanding, co-RRI must not put too much extra burden on researchers. Thus, it is important to set up support units ('competence cells') with skilled personnel, who hold necessary expertise to guide and facilitate co-RRI processes. This is of particular relevance in contexts where no or not much experience with participatory transdisciplinary or co-creative practices is given.

To prevent a complete outsourcing of co-RRI related expertise to specialised personnel or professional organisations, FoTRRIS recommends the integration of at least one basic obligatory course on co-RRI in higher education curricula. As the younger generation is most likely not to be deadlocked into a mainstream approach, we consider them promising actors for change. Thus, not only educational measures, but also the engagement of students in projects could help co-RRI to get a broader basis. However, there is also a risk that co-RRI related tasks might be framed as inferior work required of students, who hold least hierarchical power within the R&I system.

Teaching and trainings should also be offered in the context of continuing education programmes to senior researchers, as well as to staff of competent administrations and management units in order to create a better understanding for co-RRI approaches.

Since the portfolio of expertise necessary to implement a sophisticated co-RRI process is not likely to be held by a single person, it makes sense to build on complementary skills within transdisciplinary teams by also co-creating the process design. Therefore, trainings should not only be offered to actors from the R&I community, but also to other societal actors. Co-RRI trainings, engaging different stakeholder in multi-actor learning activities (e.g. RRI-Tools Multi-actor workshop concept), are particularly relevant to build up capacity for inter- and transdisciplinary cooperation, which is essential for the implementation of co-RRI.

Finally, support for community building between co-RRI actors, and for the exchange of experiences and good practices, will considerably contribute to capacity building.

3.2. Flemish policy recommendations

The FoTRRIS project recommends to Flemish Policy Makers:

Make strong sustainability an explicit goal of all publicly funded research and innovation

Publicly funded research and innovation is an important instrument to direct research and innovation in Flanders towards strong sustainability, and hence to succeed in accomplishing its strategic outlook for 2050. We therefore recommend to make strong sustainability, that is sustainable development respecting planetary boundaries, the main leading principle for all publicly funded research and innovation. This implies the development of innovative funding schemes adapted to the needs of long-term, transdisciplinary and co-creative innovation trajectories, as well as for clear, long-term research and innovation agendas in line with Vision 2050.

Actions

Why?

Research and innovation are increasingly expected to contribute to the economy by improving countries' and regions' competitiveness in a global knowledge economy. Innovation is considered to increase profit by reducing costs, exploring new market opportunities or stimulating consumption. The 'externalities', such as a loss of jobs or the depletion of resources, are too often merely the object of separate, disciplinary research. The results are incremental corrections, not systemic solutions addressing the root causes. From a systemic perspective, this global competition is the driving force of a race to the bottom. Though, there is a growing awareness that for humanity to thrive we need to let go of this competitive drive, and have to turn towards cooperative models. In its strategic outlook for 2050¹, the Flemish government presents its ambition to go for "an inclusive, open, resilient and internationally connected region that creates prosperity and well-being for its citizens in a smart, innovative and sustainable manner". It acknowledges that this will require "radical innovations to the way we live, work and enjoy life", and that this kind of transformative change cannot be brought into action without "collaborative partnerships". Academia, but also experts from the business and policy world, as well as knowledgeable citizens and other civil society representatives will be key actors in these collaborative partnerships. However, they should all be on the same page if Flanders wants this transition to become reality. We believe that publicly funded research and innovation is an important instrument in this respect. It could help to direct the research and innovation system in Flanders towards strong sustainability, and hence to succeed in accomplishing the vision of 2050.

What?

The government should make of strong sustainability the main leading principle for all publicly funded research and innovation. Academia, strategic research centres and other knowledge institutes should be given stimuli to adapt to this

new goal. This way, the common interest of a sustainable society can weigh more on the agenda setting, execution and valorisation of research and innovation in Flanders. It will also increase societal support for research and innovation and strengthen its democratic character.

How?

In its vision of 2050, the Flemish government acknowledges that understanding and anticipating on societal transitions emerging from complex problems, such as climate change and the growing demand for water and energy, is a prerequisite for the long-term well-being and prosperity of its population. Research and innovation effectively addressing complex problems, however, asks for a problem-driven, co-creative and transdisciplinary approach based upon a holistic analysis of societal systems. This kind of research and innovation asks for new methodological frameworks, cooperative networks, as well as new infrastructures supporting these transdisciplinary trajectories, of which funding schemes adapted to the needs of transdisciplinary and co-creative research and innovation are an essential part. This means, among other things, the development of new sets of funding criteria, but also - and even more important - a shift towards more long-term funding of innovation trajectories, so that long-term societal change can become the main goal of innovators instead of the immediate output resulting from fragmented and short-term projects. We therefore ask to develop clear, long-term agendas for publicly funded research and innovation that are in line with the Flemish Vision 2050, and for the appointment of a coordinating entity ensuring a certain level of cohesion among different projects and initiatives, without however wanting to unify them.

¹Department of public governance and the chancellery (2016) Vision 2050

The FoTRRIS project recommends to Flemish Policy Makers:

Support responsible research and innovation with a knowledge currency

Flanders, like the rest of the world, is facing complex societal challenges. These require a long-term approach in research and innovation, lasting partnerships, cooperation, the sharing of knowledge and experiences, and time for reflection. To ensure research and innovation processes meeting these criteria, it's important to find a way to properly value knowledge and cooperation, without making scarce goods of it. A knowledge currency complementary to the euro, could function as a structural support for responsible research and innovation.

Actions

Why?

The fundamental problem with our current monetary system is that it is not sufficiently diverse, and as a result it dams and bottlenecks our creative energies, and keeps us trapped in a world of scarcity and suffering" (B. Lietaer). The adaptation of the Flemish economic system to the evolutions of today is a complex task requiring knowledge co-creation at a large scale. Not only among traditional knowledge actors, such as university researchers and professionals in R&D departments of businesses, but also with in-situ actors or, said otherwise, with people having terrain expertise of relevant needs and opportunities within specific innovation contexts and at different scales. Research reveals that this is impossible to realise with the current monetary system alone. Because the euro is designed as a scarce good, it limits economic transactions. As a result, 'time is money'. However, exchanging insights, learning, creating novelties, ... ask time. Research and innovation are therefore expensive. Too expensive even to allow for an appropriate and nuanced definition of the societal challenges at hand, or to include series of co-creative learning sessions to develop solution corridors, to consult the necessary experts or to update data on a timely basis. The complex challenges Flanders is facing, however, require a long-term approach, lasting partnerships, open cooperation, the sharing of knowledge and experiences, and time for reflection. To ensure research and innovation processes that meet these criteria, it's important we properly value knowledge and cooperation, without making them scarce goods. A knowledge currency complementary to the euro, could function as a structural support and lever for responsible research and innovation, as well as for Open Science and Open Innovation.

What?

The government should support the development of a knowledge currency as a leverage for transition. Knowledge is a generative good par excellence. When insights are shared with others, they do not diminish. On the contrary,

they get enriched with other perspectives thereby closing the gap to implementation. Regulating such generative transactions with the vested monetary system is counterproductive. The co-creation of knowledge requires a novel exchange system. Whenever knowledge actors cooperate for a given goal, 'value' (in the form of insights or ideas) is created. This value can be captured in a knowledge voucher, which can then be traded freely for other knowledge in the community. This currency can therefore stimulate co-creative learning processes as well as lifelong and life-wide learning among all Flemish citizens. It would also allow citizen collectives to access the Flemish knowledge infrastructure (universities, SOCs, ...) directly, in close connection to their needs. Moreover, a knowledge voucher allows to address the ethical and juridical caveats around citizen science. In case the government wants to actively involve citizens in research, a knowledge currency can valorise citizens' input, mobilize their expertise and experiences, and lower the thresholds (and costs) for lifelong learning.

How?

The government should launch a long-term experiment, and create the required regulation-free zones to develop and optimize a system of Flemish knowledge vouchers. Existing knowledge and experiences with community currencies should be used as much as possible. The Flemish RRI competence cell, of which a first cell was recently established within VITO, should receive a mandate to follow this experiment and to advise the government how it can optimally use this new instrument. It should do so in collaboration with the Social Innovation Factory and the new Knowledge Centre Citizen Science that will be established in 2018 in the RVO Society (imec). The Flemish RRI competence cell should also offer a context for dialogue on how knowledge institutions can be encouraged to work with these currencies and share their knowledge.

The FoTRRIS project recommends to Flemish Policy Makers:

Educate children, students and (young) professionals on the paradigms of the 21st century

Higher education in Flanders is strongly specialized. A specialist paradigm makes it hard for researchers to see systemic connections or to cooperate with other disciplines for redesigning complex societal systems. We therefore recommend the development of a basic training for children, students, doctoral students and young researchers on systems thinking, as well as other skills needed to understand the paradigms of the 21st century. Furthermore, we advise to provide on-the-job training for all professionals involved in R&I policy making so that they understand the concept of RRI and are able to judge it on its own merits.

Actions

Why?

"You cannot solve a problem with the same kind of thinking that created it" (A. Einstein) Higher Education (HE) in Flanders is strongly specialized. A specialist paradigm makes it hard for researchers to see systemic connections or to cooperate with people from other disciplines (social, natural, medical, economic, etc.) to redesign complex societal systems. This means that Open Science runs the risk to boil down to a merely formal procedural set-up, in spite of important investments in platforms for data exchange. Of the four principles of Open Science (Findable, Accessible, Interoperable, Reusable) especially the third one is problematic, for a shared and broadly applicable language for the representation of knowledge across disciplines is missing¹. The strong institutionalisation of disciplines makes this problem especially persistent. A FoTRRIS consultation revealed that the mindset among researchers is the biggest obstacle for a transition of the R&I-system towards responsible research and innovation. The most effective strategy therefore is to instil in the younger generation (students, doctoral students and young academics) the knowledge, values and skills for RRI. It concerns skills such as systems thinking, futures planning, generative design, thermodynamics and transdisciplinary methodologies². In the next decades this generation can then mainstream this new mindset into research and education. Furthermore, services involved in R&I policies need to receive on-the-job training in order to be able to understand RRI and to judge it on its own merits. Only then administrations dedicated to this subject will be able to effectively follow and support this evolution within the Flemish science and innovation landscape.

What?

The Flemish government should stimulate the development of a basic training for students, doctoral students and young

researchers on systems thinking, as well as other skills needed to understand the paradigms of the 21st century. This should happen in cooperation with other initiatives that introduce this kind of courses at other levels of education³ or with educational institutions that already integrate some of these basic skills in their courses.

Administrations (at various policy levels) that deal with education, research and innovation or big societal challenges should receive appropriate training to allow them to judge transdisciplinary approaches aiming at systemic intervention on their own merits, and to replace traditional 'mental maps' by more adapted models.⁴

How?

With ICT and online platforms, in combination with transdisciplinary workshops focusing on big societal challenges, it is possible to offer administrative personnel, students and researchers at the start of their higher education or (academic) career a basic package of insights and skills for the 21st century, thus avoiding the long delay implied in a curriculum reform. The format in which these basic courses are to be offered (e.g. workshops, summer schools, MOOCs combined with Peer Learning, eco-literacy, gamification, etc.) has to be decided on by higher education institutes. In addition to this, also teachers in nursery, primary and secondary schools should be instructed on how to integrate systems thinking in their lessons. The Flemish RRI competence cell, of which a first cell was recently established within VITO, can offer a platform for the exchange of lessons learned (e.g. on the integration of systems thinking in STEM education or on the impact and educational value of introducing a student portfolio for participation in sustainable projects⁵). For the training of personnel of administrations the RRI-Transition arena should collaborate with the concerned public services.

1. Communication at the EWI and Young Academy Focus on 'Open Science', Brussels November 08/11/17.

2. See e.g. the Ecocampus Inspiration book for sustainable HE: <https://www.vvs.ac/sites/default/files/inspiratieboek-web.pdf>.

3. e.g. Djapo vzw introduces systems thinking at preschool level; Ecocampus distributes materials for higher education.

4. Compare this with the initiative of the EC to offer staff of all DGs a compulsory gender training.

5. This idea was launched by participants of an inspiration session on RRI at HoGent university college on 23/10/17.

3.3. European policy recommendations

The FoTRRIS project recommends to European Policy Makers

Make resilient societies and sustainable development the ultimate goals of the long-term European strategy, to be implemented by the new Research and Innovation Framework programme as a financial instrument.

Enhanced resilience would enable our current societies to successfully cope with natural, climate, social, political and financial crises and with this knowledge deliver sustainable development in the future.

Actions

Co-RRI addressing complex societal challenges in an inclusive, reflective, transparent, responsive, transdisciplinary and co-created way is destined to be in the service of the sustainability goals. The implementation of SDGs as a complex system of interdependent goals will require transdisciplinary research and co-creation with societal actors. This is in line with the Lamy report¹ which calls for the mobilisation and involvement of citizens in research and innovation. This co-creation process can be best managed at local, regional level, where the stakeholders know and trust each other, are willing to put efforts towards a very concrete, common goal while working side by side. Regions have already built **innovation ecosystems** and are in the constant process of mobilizing these ecosystems for implementing their **smart specialisation strategies**². These ecosystems can offer the framework and context for co-creation and engagement among the stakeholders in the spirit of trust and confidence.

At the European level, these innovation ecosystems, embodying the territorial dimension of research and innovation, should be reinforced as building blocks of research and innovation in a co-RRI way. **Cities and regions can be drivers of finding successful solutions to the new mission-based challenges**³. They can develop and test solutions, can be validation hubs for innovations at local scales (depending on the societal challenge). Resilient societies have to be built bottom-up. The role of European level supporting programmes is to create, strengthen, encourage, internationalise these innovation ecosystems and facilitate their cooperation to further upscale the innovations (services, products, innovative models).

All actors of the quadruple helix are responsible for their own internal changes. Only this joint effort will make the paradigm change happen.

Public authorities and funding bodies at all levels should show a high commitment to Responsible Research and Innovation in their strategies. Creating a favourable policy environment to accommodate and drive this co-creational process forward is crucial.

Universities and institutions of Higher Education should consider engagement with society and societal issues (or SDGs) a priority over theoretical publications on research that does not aim at impacting society (see policy recommendation on Impact). Their generative knowledge has the capacity to multiply the creativity and know-how the global challenges require, as is advocated by Open science⁴.

Civil society and citizens should be encouraged to take part in the process. The better their resilience and innovative capacities are recognised, the more they will be empowered. The same applies to practitioners who as co-experts can co-create knowledge with researchers through transdisciplinary processes.

Companies should receive the necessary incentives to pursue societal benefits (while contributing to SDG 10: Reduced inequalities); only generative companies aiming at societal benefits (rather than at increasing their private profit) will have access to public funds for R&I.

Once RRI has become accepted as the new norm for all R&I, the next step will be to embed this paradigm shift in the culture and everyday practices of institutions, universities, associations and companies.

¹ LAB-FAB-APP
https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlq_2017_report.pdf

² <http://s3platform.jrc.ec.europa.eu/>

³ See Mazzucato report:
<https://publications.europa.eu/en/publication-detail/->

[/publication/5b2811d1-16be-11e8-9253-01aa75ed71a1/language-en](https://ec.europa.eu/programmes/horizon2020/en/h2020-section/open-science-open-access)

⁴ <http://ec.europa.eu/programmes/horizon2020/en/h2020-section/open-science-open-access>

The FoTRRIS project recommends to European Policy Makers

Foster co-created Responsible Research and Innovation (co-RRI) in the European Research and Innovation Framework Programme and in all initiatives launched at European level.

Co-RRI implies not only the integration of different disciplines but also the engagement of societal stakeholders in the design phase and throughout the whole research production process. The successful implementation of SDGs will depend on large scale investment in transdisciplinary research¹.

Actions

While it is true that not all research has to be transdisciplinary, and in some cases excellent research can more efficiently be achieved if it remains in only one discipline, it does not allow us to address the wicked global problems of today. This type of research should be complementary to and integrated in wider transdisciplinary research projects. Research and innovation programmes, be they public or public-private, can deliver bigger impact if the calls are shaped to describe “real life situations”, aim at addressing real challenges in society and require the collaboration among different disciplines. Although the integration of social sciences and humanities into Horizon2020 projects is already happening with more or less success², it could definitely be enhanced if calls made the **engagement of societal stakeholders' mandatory**. Consequently, **the evaluation should also be carried out by an interdisciplinary team**.

FoTRRIS recommends that R&I programmes should make transdisciplinary research – co-creating knowledge and innovation with all societal actors who aim at a more sustainable world – **a funding criteria**. This instrument could bring important results within a relatively short period of time.

Transdisciplinary research requires more than the cooperation among researchers of various disciplines only. In order for R&I to address the current challenges, public authorities- at European level, the various European Commission Directorate Generals (DGs) - should collaborate to bring about the **complex system change** that is needed to achieve the SDGs. FoTRRIS recommends that missions in the new research and innovation framework programme, FP9 (replacing the current societal challenges pillar of Horizon2020) should incentivise this kind of collaboration across DGs to define the mission themes³. An example is the aim of creating a fully circular economy which involves DG Environment, DG Energy, DG Climate Action, DG Transport and Mobility, DG Maritime Affairs and Fisheries, DG Research and Innovation, etc.

As the global challenges manifest themselves in various ways at the local level, **responsible research and innovation is necessarily place-based**, bringing together in-situ knowledge actors who are familiar with the local situation with ex-situ researchers who can connect the local solutions with higher level (regional and global) indicators⁴. Integration of universities into the territory they are anchored to, and making them an organic part of the learning community surrounding them is not a new concept. Civic universities respond to those criteria⁵. FoTRRIS recommends **adding engagement with society and pursuing outreach activities into the main evaluation criteria for higher education institutions**, rather than their contribution to the production of privatised knowledge (in terms of e.g. patents and non-open access publications). As transdisciplinary research transcends the culture, skills and knowledge of any specialist discipline, encouraging knowledge institutions to **set up a unit dedicated to and supporting research for societal engagement is recommended**. Presence of such a unit is recommended to consider as one of the evaluation criteria. Knowledge brokers are to be the intermediaries between societal innovators and research performers.

In line with the Rome Declaration⁶ **informal creative spaces** can encourage RRI and transdisciplinary discussions to kick-off, can stimulate and facilitate the cooperation between the research community and other societal actors aiming at sustainability. Skilled and trusted facilitators are also needed to convene the stakeholders and manage their discussion and co-creation process. This requires investment in human capital – boundary spanners and ‘blended professionals’. Various institutions can host such co-creation processes, always embedded in the local context and integrating already existing spaces for social innovation and co-creation. FoTRRIS recommends that the European Commission encourages the Member States and the sub-national levels to identify and support these trusted institutions and facilitators.

¹ INGSA Manifesto for 2030. Scientific Advice for the Global Goals

² According to the mid-term evaluation results SSH integration into H2020 calls is still quite low.

³ See See Mazzucato report: <https://publications.europa.eu/en/publication-detail/-/publication/5b2811d1-16be-11e8-9253-01aa75ed71a1/language-en>

⁴ Sterling Eleanor J. et al (2017) Biocultural approaches to well-being and sustainability indicators across scales. Nature, ecology & evolution <https://doi.org/10.1038/s41559-017-0349-6>

⁵ See John Goddard Civic University concept: <http://www.ncl.ac.uk/about/vision/civic/>

https://www.nesta.org.uk/sites/default/files/reinventing_the_civic_university.pdf

⁶ https://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf

The FoTRRIS project recommends to European Policy Makers

Define more broadly the desired impact of research and innovation

Research and innovation projects in Horizon2020 are evaluated in terms of their impact. Lamy report¹ calls for greater impact to be achieved in the next programming period. FoTRRIS agrees that although research outcomes are of paramount importance, it is even more vital that research and innovation funded by public resources contribute (directly or indirectly) to solving societal challenges. A lot of excellent research has been done in Europe. Now Europe needs to actually unlock the R&I potential to bring breakthrough results to society in terms of sustainability and a more responsible way of using planetary resources for the well-being of all.

Actions

SDGs provide a framework for what FoTRRIS conceptualised as co-RRI². SDGs cannot be addressed one by one in isolation, but have to be looked upon as part of a global agenda. R&I for the SDGs is not a linear process, but depends on changes to be effected in a complex and non-linear context, in which societal and ecological systems interact. As co-RRI tackles these complex issues, FoTRRIS recommends that it is recognized as an **iterative process** with continuous monitoring and **feed-back loops** at local as well as at global scales³. If research or innovation is not beneficial for society, if it negatively impacts society or if its risks and benefits cannot be demonstrated with relevant parameters⁴, it would need to be immediately adjusted back to the original goal.

FoTRRIS advocates that research and innovation has demonstrable societal impact – although it might take longer to actually measure the change. Accordingly, the **indicator system** will have to be adapted to be able to **make the societal impact visible**⁵. At least, the potential negative impacts should be immediately noted and corrected.

FoTRRIS recommends assessing the positive (regenerative) economic and societal impact of all new research or innovation projects - bearing in mind the precautionary principle - before they are launched and the results are disseminated. This can avoid consequences that will cause real catastrophes to mankind in the long-term (e.g. antibiotics resistance, acidification of oceans, climate change, entropy of scarce materials, social inequality). By integrating technological with social, economic and legal innovation, any (transdisciplinary) research project will be able to indicate what its (positive or maybe negative) impact will be on all of the SDGs.

As the goals are complex and depend on non-linear contexts, therefore broader outcomes have to be examined for evaluating projects. **Failures can offer useful**

insights in the process of developing and validating new models, new ideas or exploring out new socioeconomic practices. Learning from failure and understanding what caused it can actually lead to success later on if this feed-back loop is well connected and if the (iterative) R&I process allows for re-visiting the starting point and/or the process.

If project consortia had more time, they could better explore and map the impact their work may have; this is to be done by co-creative processes with all types of stakeholders (citizens, public services and economic actors pursuing regenerative economics). The interim evaluations should put more emphasis on the impact than on checking if the Description of Action is implemented literally.

More attention to the development of **Society Readiness Levels (SRL)** where projects self-assess the immediacy and importance of impact on society. The more immediate and important the societal impact is, the higher the SRL would be. To achieve high SRL, more thought needs to go into firstly communication and dissemination strategies that directly engage citizens but also consortia partners would bar responsibility to establish strong contacts with relevant end-users.

In research and innovation actions, the 'work in progress' can reveal unexpected results that deviate from the original plan, yet can bring very positive impact to society.

The non-descriptive calls that the Lamy-report proposes could be a useful instrument to focus more on the expected impact rather than on the details of the call that a successful proposal has to comply with in order to receive the funds.

¹ LAB-FAB-APP https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf

² See D4.5

³ Sterling Eleanor J. et al (2017) Biocultural approaches to well-being and sustainability indicators across scales. *Nature, ecology & evolution* <https://doi.org/10.1038/s41559-017-0349-6>

⁴ Krop, H. et al (2016). NanoDiode. Developing Innovative Outreach and Dialogue on responsible nanotechnologies in EU civil society. Regulatory research for effective risk assessment.

⁵ Sterling Eleanor J. et al (2017) Biocultural approaches to well-being and sustainability indicators across scales. *Nature, ecology & evolution* <https://doi.org/10.1038/s41559-017-0349-6>

The FoTRRIS project recommends to European Policy Makers

Invest in capacity building of current societal actors & researchers and in education of the next generations to co-create research and innovation in a responsible way

A transition towards more responsible research and innovation can only take place with people learning what co-RRI exactly means and having the necessary skills to implement it. This implies training the practitioners who already finished their education but also forming a co-RRI-minded new generation of citizens.

Actions

“The click in the mind” takes time and requires structural investments. A group of niche actors, ‘system breakers’ or ‘frontrunners’ already advocate the need for change within the currently dominant research and innovation practices. With adequate support, this core group has the capacity to increase the visibility of this long-lasting process and as crucial actors to upscale the practice of co-RRI. Giving these ‘system breakers’ more opportunities at EU level to showcase breakthrough co-RRI projects and giving them more means to initiate new research and innovation trajectories, for instance, can facilitate the process of upscaling co-RRI at local, regional, national and international level. However, these kinds of measures will achieve optimal results only if they are complemented with structural interventions at the basis, that is at the level of education. It is important that students learn to approach their research subjects systemically and are encouraged to leave trodden disciplinary paths.

From this point of view, European programmes, like Erasmus+ and Marie Curie Actions could become key for co-RRI researchers. FoTRRIS recommends specifically **orienting these programmes towards increasing the capacities for co-creative transdisciplinary research and innovation for a sustainable future.** Equivalent programmes are available for civil society organisations such as Programmes for Employment and Social Innovation (EaSI)¹ and Rights, Equality and Citizenship (REC)² also support this kind of capacity building. Community-led initiatives on climate change and sustainability are known to be crucial innovators³. Their work and commitment could flourish with more easily accessible funds and with researchers encouraged to partner with them to monitor progress⁴.

FoTRRIS also recommends making co-RRI a **mandatory part of higher-education and PhD curricula**⁵. All students should be inspired to contribute to solving societal

challenges by means of inclusive, reflective, transparent, responsive, transdisciplinary and co-created research and innovation. **Curiosity** is a driver to inspire learning about our planetary ecosystems, their boundaries, and about global justice. Developing **critical thinking** is crucial to be able to differentiate between scientific facts vs emotion-based intuitions and to see the interlinkages between disciplines and societal domains. The system goal, building resilient societies, is attainable only if students are trained to become responsible policy makers, company owners and researchers who will make the change. As the Lamy report says, “there will likely be no excellent research and innovation without excellent education”⁶.

FoTRRIS welcomes the European Commission’s vision to create a European Education Area by 2025⁷ in which, amongst several other actions, enhanced cooperation between the Member States is called for in order to develop curricula equipping new generations with skills and knowledge to cope with the societal challenges Europe faces. FoTRRIS recommends taking programmes such as ‘Learning for Sustainability’, which is a priority of the Scottish Government, as a model for these curricula. Learning for Sustainability is defined in this programme as “learning to live within the environmental limits of our planet and to build a just, equitable and peaceful society. It is essential for the well-being of all and is an international priority”⁸. Curricula that are embedded in the territory of the school, recognizing their place-based dimension have the advantage that they are co-designed with local business actors, public administrations and civil society organisations. This process of co-designing curricula could have a two-way mutual benefit: to enrich and tailor education programmes to the local needs, and by the process of development, to shape the mind of these organisations to the common goals.

¹ <http://ec.europa.eu/social/main.jsp?langId=en&catId=1081>

² http://ec.europa.eu/justice/grants1/programmes-2014-2020/rec/index_en.htm

³ [The EU-funded TESS project \(2017\) recently concluded that: ‘If just five per cent of EU citizens were to engage in effective community-led climate mitigation initiatives, the carbon savings would be sufficient for nearly 85 percent of EU-28 countries to achieve their 2020 emissions reduction targets.’](https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf)

⁴ Weaver, P. M., et al. (2017) [Resourcing, monitoring and evaluation : scaling challenges and pathways \(TRANSIT Brief : 5\)](https://www.gtics.org.uk/professional-standards/learning-for-sustainability.aspx). TRANSIT: EU SHH.2013.3.2-1 Grant agreement no: 613169.

⁵ <http://heirri.eu/> project has produced material

⁶ LAB-FAB-APP

https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf

⁷ https://ec.europa.eu/commission/sites/beta-political/files/communication-strengthening-european-identity-education-culture_en.pdf

⁸ <http://www.gtics.org.uk/professional-standards/learning-for-sustainability.aspx>

3.4. Hungarian policy recommendations

The FoTRRIS project recommends to Hungarian Policy Makers

Responsible research and innovation as an overarching principle in national policy making

Responsible research and innovation (RRI) is not solely a new field for funding. RRI should be considered as an overarching principle relevant in all fields of research, development and innovation policies.

Actions

Research and development policies focus on several objectives we have a good reason to support, such as excellence, cooperation, sustainability, competitiveness or social impact.¹ However, in many cases, the pursuit of these different objectives create tensions and incoherencies in policies; different support and funding schemes may weaken each other's effects and create contradictions.

The FoTRRIS project recommends that the 'science with and for society' (SWAFS) principle, which is stressed by the European Union's Framework Programme on Research and Innovation (Horizon 2020); and more specifically, responsible research and innovation (RRI) should serve as a guiding principle that is considered in all fields of research, development and innovation policy making and strategy building:

(1) The search for systemic answers for global environmental and social challenges, inter- and trans-disciplinarity, the social (and not purely market) relevance and impact of research and cooperation with stakeholders and citizens should become guiding principles in research, development and innovation policies.

(2) The abovementioned principles should serve as a basis for evaluating the different policy objectives. This way it becomes visible whether the diverse objectives pursued by R&D and innovation policies create synergies or weaken each other's effects.

We suggest this recommendation to be adopted by the Ministry for National Economy and the National Research, Development and Innovation Office during the creation and revision of the National Research, Development and Innovation Strategy and the formulation of the National Position Paper on the next EU framework programme for research and innovation (FP9).

The objective of the FoTRRIS (Fostering a Transition towards Responsible Research and Innovation Systems) H2020 project is to foster the institutionalization of responsible research and innovation (RRI) in the systems of research and innovation. The project emphasizes that global environmental and social challenges necessitate systemic answers that should be moulded through collective efforts with stakeholders and citizens.

We formulate the Hungarian national policy recommendations on the basis of the concept of 'co-created RRI' (co-RRI), which is argued for in the FoTRRIS project; interviews with various actors of the Hungarian national innovation system and the lessons learnt from the co-RRI transition experiment conducted in Wekerletelep, Budapest together with various local actors.

¹ EC (2010): Europe 2020. A strategy for smart, sustainable and inclusive growth. European Commission, Brussels. <http://ec.europa.eu/eu2020/pdf/COMPLETE%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf>

NRDIO (2017): Position Paper of Hungary on the next EU Framework Programme for Research and Innovation. National Research, Development and Innovation Office, Budapest.

The FoTRRIS project recommends to Hungarian Policy Makers

Responsible research and innovation as a criterion of supporting research and development activities

The principles of responsible research and innovation (RRI) should serve as criteria in all kinds of research and development evaluation, funding and support schemes.

Actions

RRI-related principles, such as inter-disciplinarity, social relevance or cooperation with users often appear in R&D and innovation policy documents.¹ However, they remain fragmented, their relative importance is often low and they need to be supplemented.

The FoTRRIS project recommends that the principles of responsible research and innovation should serve as criteria in all kinds of research and development evaluation, funding and support schemes:

(1) The search for systemic answers for global environmental and social challenges, inter- and trans-disciplinarity, the social (and not purely market) relevance and impact of research, and cooperation with stakeholders and citizens should become requirements in the calls for funding and should become criteria for the evaluation of project proposals.

(2) The abovementioned principles should appear in the evaluation and funding schemes of publicly funded research and higher education institutions, as well as in the individual performance evaluation and motivation schemes of their researchers.

We suggest this recommendation to be adopted by the Ministry for National Economy; the Ministry of Human Capacities; the National Research, Development and Innovation Office (NRDIO); the Hungarian Academy of Sciences (HAS) and the decision makers of the Hungarian higher education institutions and academic research institutions. We suggest these bodies should adopt this recommendation with regard to the priority setting and the evaluation criteria for the funding schemes supervised by the NRDIO and the HAS; with regard to the funding and the accreditation criteria of the Hungarian higher education institutions; and with regard to the organizational strategies and individual performance assessment schemes of the higher education institutions and the research institutes of the HAS.

The objective of the FoTRRIS (Fostering a Transition towards Responsible Research and Innovation Systems)

¹ NRDIO (2017): Position Paper of Hungary on the next EU Framework Programme for Research and Innovation. National Research, Development and Innovation Office, Budapest.

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The FoTRRIS project recommends to Hungarian Policy Makers

Increased importance of cooperation and co-creation with stakeholders and citizens in research and development activities

Stakeholders and citizens should be considered as key actors in research, development and innovation activities. Cooperation and co-creation with stakeholders and citizens should become standard requirement and evaluation criteria in research funding and support schemes.

Actions

Finding solutions to grand societal and environmental challenges¹ cannot happen in isolation from societal actors. Therefore, cooperation and co-creation with various (academic, business, civil society, and policy) actors is in the core of RRI as proposed by FoTRRIS.

The FoTRRIS project recommends that cooperation and co-creation with stakeholders and citizens should gain an increased importance in research funding and support schemes:

(1) Publicly funded research institutes and projects should open up for new groups of stakeholders. Civil society actors, local communities and various marginalized groups are just as important as business and policy actors in finding solutions for grand societal and environmental challenges.

(2) Providing equal access to knowledge and research aiming to improve the situation of marginalized groups should gain higher importance and priority.

(3) Research, development and innovation policies should foster the institutionalization of research activities that co-create research questions, process design, and outputs/outcomes with stakeholders in a trans-disciplinary spirit (see, e.g., citizen science, DIY science, science shop, community-based research and participatory action research).

We suggest this recommendation to be adopted by the Ministry for National Economy; the Ministry of Human Capacities; the National Research, Development and Innovation Office (NRDIO); the Hungarian Academy of Sciences (HAS) and the decision makers of the Hungarian higher education institutions and academic research institutions. We suggest these bodies should adopt this recommendation with regard to the priority setting and the evaluation criteria for the funding schemes supervised by the NRDIO and the HAS; with regard to the funding and the accreditation criteria of the Hungarian higher education institutions; and with regard to the organizational strategies and individual performance assessment schemes of the higher education institutions and the research institutes of the HAS.

The objective of the FoTRRIS (Fostering a Transition towards Responsible Research and Innovation Systems) H2020 project is to foster the institutionalization of responsible research and innovation (RRI) in the systems of research and innovation. The project emphasizes that global environmental and social challenges necessitate systemic answers that should be moulded through collective efforts with stakeholders and citizens.

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¹ <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges>

3.5. Italian policy recommendations

FoTRRIS recommendations for fostering RRI in Italy

Education for sustainability and entrepreneurship

A transition towards more responsible research and innovation system which targets sustainability goals is not possible without education of people. People should have necessary skills, knowledge, and practical approach in support and application of actions for sustainability. Providing an education, which support development of such skills and knowledge, creates conditions which stimulates local development and wellbeing.

Actions

In the FoTRRIS project local development was an integrated part of Transition experiments. Such experiments were implemented by local communities. This helped to understand values and needs of the communities and reflection on processes and elements, which foster community development. One of the most important outcomes was a list of priorities which orient the community to implement national strategy in international areas the areas set by the sustainability goals. Education of citizens plays a key role in this list. Formal education at kindergartens, schools, higher education institutions is still limited by different factors: strong application of disciplinarity, structural non flexibility, poor learning environment.

Local governance and communities are interested in innovative techniques and tools, which can contribute to achievement of their sustainability goals. In primary, secondary and high school there is an essential need for education of future citizen, who will contribute to creation of strong, safe and prosperous community. Therefore, educational changes need to be implemented targeting, for example, changes in curricula for more openness and cooperation with external stakeholders, who bring real case studies into curricula, transdisciplinary, empowerment and responsibility for common future. An educational environment should be based on equity and quality, creativity through the non-formal and informal education, entrepreneurial mind sets and interaction with the local authorities.

The recent research of the OECD regarding Adult Skills, says that Italy's population is under-skilled compared to the OECD average, this correlates with unemployment. Young people of all education and skill levels have difficulties in finding a job (Source: OECD¹). Meantime, "entrepreneurship development means to respond to new economic challenges, to create jobs and to fight social and financial exclusion", states OECD (Source OECD²). In our opinion, entrepreneurship has stronger links not with the economic challenges, but with social challenges. It is linked with the individual capacities to recognise potential for

innovations and implement them using specific knowledge of the area, with impact for a specific group of people and contributing to society. However, since individual capabilities are defined and might be limited by social and educational environments, implementing change in these environments is essential for both entrepreneurship and sustainability. We believe that, the future of local community is not possible without merging these two important actions: education for sustainability and entrepreneurship. Empowerment for entrepreneurship should be based not on the reality "it is difficult to find a job", but on the capability to recognise development potential in the local community. Why? Only responsible citizen can understand real problematics of the territory, know resources and potential of growth, reuse local network for margining initiatives. Responsible citizen can be described as citizen who has social and moral obligations to the territory and shared values with a society.

Project recommends to:

- 1) integrate courses on sustainability goals in educational curricula to contribute to the development of critical thinking, problem solving, advocacy skills. Putting focus on the process of how the subject is learned and in what type of environment it is learned in, who assists in the learning process (CSOs, other citizens, policy makers, etc.)
- 2) integrate courses on responsible research and innovation in the higher education and research system, providing continuing training for teachers and professors/researchers in this field and encouraging them to use approaches based on transdisciplinary teaching. In a long term perspective this could also encourage creation of "networks for changes" with new capacities and experiences. Such education will focus on support of bottom-up processes and stimulate local growth, and as a result – will foster employability and sustainability.

¹ OECD. Better policies for better lives. Education Policy Outlook, Italy. February 2017. Available on internet: <http://www.oecd.org/education/policyoutlook.htm>

² OECD. Better policies for better lives. Supporting Youth Entrepreneurship in Italy. A review of policies and programmes. 2016. Available on internet: <https://www.oecd.org/employment/leed/Italy-Youth-Entrepreneurship-Report-FINAL.pdf>

FoTRRIS recommendations for fostering RRI in Italy

Openness of R&I funding for co-creation and transdisciplinarity

Italian research and innovation system is influenced by changes implemented in 2001¹: delegation of authority from national to regional levels and allocation of some roles to regions. Italian regions distribute their own research funds and develop regional innovation strategies, manage EU funds. In such system it is not easy to link different knowledge actors: to evaluate their contribution into R&I, to assess the added value of new knowledge, skills, networks; collect relevant data about actors' impact on R&I agenda. R&I openness for more formal involvement of transdisciplinary and co-creation of knowledge actors in the list of criteria for R&I funding would contribute to capitalization of R&I knowledge and their active reuse for sustainable and inclusive territorial growth.

Actions

According to different reports, Italian Research and Innovation system faces various obstacles, which limit fast and proactive R&I development at national and EU level. One of such factors lies in the fact that it is the regions that play a strategic role in R&I development through the decision making process, preparation of R&I strategies and allocation of funds. Even though an agreement² to develop policy recommendations to promote Responsible Research and Innovation in Italy was signed between the Italian Association for Industrial Research (AIRI) and the National Research Council of Italy (CNR) in February 2015 and a number of specific actions were planned, it is still noticeable that the key role in R&I process is still concentrated in arms of the research performing organisations and universities. Moreover, some national R&I programmes (for example: PRIN) favour cooperation among researchers of different national universities. All this data confirms that non-academic knowledge actors still have limited interaction with and access to R&I organisations.

At the same time, an increasingly active interest towards cooperation between knowledge actors is noticeable on the national level. Some indications of this trend are: active growth of social innovations; impact of RRI projects; strategies supporting industrial and social players to develop new approaches to tackle global challenges, support of bottom up approaches as a research pillar, support for transdisciplinary research³, etc. These changes are influenced by different policy agendas, for example: United Nations Agenda "Transforming our world: the 2030 Agenda for Sustainable Development"⁴. Such goals cannot

be reached by R&I institutions alone, universities and research institutions cannot ensure a more sustainable future on their own. Other local actors should be involved in this process, therefore R&I process should be more democratised and open for informal knowledge actors.

These goals promote closer cooperation between knowledge actors and creation of new knowledge and practises, their circulation and application for the benefit of society.

Such cooperation fosters transition in Research and Innovation systems and created collaborative Research and Innovation systems; it increases relevance of research and validity of its results, additionally reorienting R&I policies towards those research actions that deliver socially and economically relevant results.

Based on this, the project team recommends, to change R&I budgeting on local, national and regional levels according to these new partnerships and results of such R&I processes. Transdisciplinarity and co-creation should be set as one of the criteria, during the application process for R&I funding. In addition participation of informal knowledge actors with different profiles in R&I activities should not be limited by funding rules, since results make direct impact on citizens. Such initiative should be welcomed and supported though funding policies, since a linear approach cannot be used to find solutions to complex problems

¹ Legge costituzionale 18 ottobre 2001, n. 3. "Modifiche al titolo V della parte seconda della Costituzione". Available on internet: <http://www.parlamento.it/parlam/leggi/01003lc.htm>

² Report on Responsible Research and Innovation in Italy. Executive summary 2015. Available on internet: http://www.nanotec.it/public/wp-content/uploads/2016/03/Executive_Summary.pdf

³ APRE. APRE's position on the next Framework Programme. February 2018. Available on internet: http://www.obiettivo.fp9.it/wp-content/uploads/2018/02/APRE_PP_FP9.pdf

⁴ Transforming our world: the 2030 Agenda for Sustainable Development. Available on internet: <https://sustainabledevelopment.un.org/post2015/transformingourworld>

3.6. Spanish policy recommendations

The FoTRRIS project recommends to Spanish Policy Makers

Investing in broad participation of citizens under equal conditions

A transition towards more responsible research and innovation will require changes in the mindset of people, in order to allow a higher "social"-awareness. This kind of thought can be acquired more easily through education, providing settings and activities where students can realize of its need and benefits.

Actions

Nowadays, the Spanish legal regime applicable to citizen participation can be explained by examining the different normative levels: state, autonomous and local. In addition, citizen participation is analysed from different points of view: the role of the local administration in this area, the ways of participation and the reality of it in Spain. Finally, the present and future of citizen participation is studied, trying to clarify the latest citizens behaviour in relation to democratic participation, as well as the role that ICTs can play in the incorporation of e-democracy and, finally, the measures proposed to modernize and strengthen the role of citizen participation in Spain.

Different forms of participation can be distinguished: social-community, citizen and political. The concepts of political, social and citizen participation are interrelated, although they are clearly differentiable. On the one hand, political participation is enshrined in modern constitutions as the political right of citizens whose main purpose is that of active and passive suffrage, a fundamental principle of participatory democracies. Social and community participation are those movements or social initiatives in which a group of people try to influence the decision making of a community. Finally, the concept of citizen participation at the beginning of the 21st century is the one associated with the right of citizens to participate actively in the elaboration of public policies, as a complement to political participation.

Focusing on citizen participation, this concept is intimately related to participatory democracy. The objective of this is the integration of all sectors of society (territorial entities, citizens, organizations and entities, experts...) in the decision-making processes. It is based on the ideas, principles and values of democracy as participation, considering that it gives added value to politics by contributing to good governance.

In Spain there is a space of public participation in normative projects, both for the previous public consultation, as well as for the process of audience and public information in the process of elaboration of norms of the General Administration of the State.

The Spanish Constitution of 1978 incorporated the ideas of citizen participation in public affairs. In concrete, its article 9.2 states the obligation of public authorities to promote conditions and facilitate the participation of all citizens in political, economic, cultural and social life. Also, it is worth mentioning article 129.1, which indicates that "the law will establish the forms of participation of those interested in the activity of public bodies whose function directly affects the quality of life or social welfare."

The broad participation of citizens under equal conditions is the goal in order to adapt to the new context and embrace co-RRI as the "new normal" (paradigm).

There is a periodic National Plan for R&I, which is currently very aligned with the European programme (currently, with H2020). The definition of this plan is driven by the administration with collaboration of experts from academia and industry. However, citizens participation is not sufficiently addressed, and should be promoted through new channels. One proposal would be to create a web application to facilitate a broad participation, at least in a first level. Then some commissions by areas should include representatives of civil society. At the level of regions in Spain, there are also specific plans. The elaboration of their R&I agendas should also consider the inclusion of social actors. A way to arrive to this situation is the movements for greater participation of civil society in decision making at local level (e.g., in town hall).

The FoTRRIS project recommends to Spanish Policy Makers

Engendering 2030

A transition towards a system of research and innovation with a closer relation to the society challenges need to be more inclusive with all the actors in society. In particular, this implies that a gender perspective should permeate all its activities in order to get a balanced influence of different genders. Given the current unbalanced situation, measures on these aspects need to be considered.

Actions

The issue of women's participation in the scientific-technological fields is an important aspect in the 2030 Agenda. However, achieving gender equality in the academic and educational fields is a challenge in which all societal actors must be involved. In Spain, it is such a crucial issue that, only if we understand the importance of everything that is pending, we will be able to propose short-term and medium-term solutions. The main goal, as it is established by RRI, should be achieving women's participation in all the stages of the research and innovation process, as well as in all the levels of R&I governance. This egalitarian participation is not guaranteed in the Spanish society. Reality keeps on evincing that gender differences are still present in higher education. Even if there is a bigger presence of female students, the percentage reverses as the degree of responsibility increases. According to the ranking that was published in the Spanish newspaper *El Mundo* (9/27/2018), only 3 of the 50 public universities exceed the 25% of women full professors: the University of Valencia (26.4%), Rovira i Virgili University (28.8%), and the University of Burgos (33.3%). Some of the most relevant researches related to gender inequality demonstrates its perpetuation: Susana Alpino and Pilar Pérez studied the inequalities of the university public system in the Basque Country (2003). Other examples are the studies of Ana Guil, who analyzed the situation of women in the Spanish public universities (2004), and María Jesús Izquierdo, who reported the sexism in the Autonomous University of Barcelona (2004). Furthermore, in the scientific field, several publications can be consulted, such as *La situación de las mujeres en el sistema educativo de Ciencia y Tecnología en España y su contexto internacional* (Eulalia Pérez et al., 2003), *Mujeres investigadoras* (CSIC, 2003), and *Mujer y Ciencia: la situación de las mujeres investigadoras en el sistema español de ciencia y tecnología* (FECYT, 2005). FoTRRIS ast December was carried out the engendering 6th international conference "Más allá del ODS#5: El género en la Agenda 2030 de Desarrollo Sostenible," in Madrid (Spain)¹.

It was the sixth edition of the series of congresses Engendering initiated in 2013 within the framework of the network COST European genderSTE (Gender, Science, Technology and Environment). In previous editions held in Rome, Lisbon, Istanbul, Madrid and Crete, various aspects on how to promote the presence and participation of

women in scientific and technological fields, through structural change organizations were addressed. He also actively contributed to the process of drafting the New Urban Agenda, particularly through a Position Paper that was the result of the Madrid Congress in 2016. This new edition was the first to be held after the adoption of the New Agenda Urbana. It planned to address the issue of gender in the Agenda 2030 Sustainable Development, in particular through its location in the territory, considering the New Agenda Urbana as the privileged instrument of international policy in this direction. To do so, they had the presence of the Presidents respectively of Women's Groups and Academia and Research of the General Assembly of Members of the New Agenda Urbana UN-Habitat to talk about the gender dimensions in these international agendas and the role of universities and research in the implementation and monitoring; They featured representatives of local administrations to speak Spanish from practical experience in municipal management; Finally, they had the vision from international cooperation programs. To achieve women's participation in all the stages of the research and innovation process and in all the levels of governance, it is necessary to include gender perspective as a cross-cutting in all organizations, because international law, individual efforts, the conducted studies and the held conferences are not enough to solve this structural problem. This inclusion of gender perspective must be supported by those who are responsible for implementing those measures, but also by all the members of the educational and research community, because sometimes they are not aware of this inequality and they perpetuate the same discriminatory mechanisms. Related to this point, the Spanish Advisory Board coincides with the Competence Cell in considering training programs in gender equality for scholars as a key measure.

¹ <http://engendering6.gendersteunescochair.com/>

The FoTRRIS project recommends to Spanish Policy Makers

Investing in Sustainable Tourism for all

A responsible research and innovation includes a higher commitment with the future, regarding people, but also our planet. In this context, economic activity needs to change from just considering the immediate benefit to be also responsible for their impact over time. Sustainability means adding this dimension. In the case of Spain, tourism is a key economical sector, where sustainability will have a high impact and a tractor changing effect for the rest of the economy.

Actions

Sustainable tourism, as defined by the World Tourism Organization (UNWTO), has the aim of protecting natural, social and cultural resources to ensure that these resources can meet the needs of all kind of residents and tourist. Sustainable tourism ideas and practices emerging around the globe are aligned with the principles of RRI, and an extensive and broad application of co-RRI to travel industry planning strategies has the potential of contributing to a more inclusive tourism and to reducing its negative impact on planet. Several efforts have been made to assess the environmental and social impacts (both positive and negative) of tourism on destinations. This study¹ focuses on developing sustainability indicators for established coastal destinations in Spain, using a method which could be applied to resorts in other countries. Sustainability indicators can be used to track changes by selecting key measures that summarize the state of the environment. These indicators are useful to evaluate tourist destinations and to help planners design suitable policies based on diversity, quality and sustainability. They allow comparisons of complex issues and can identify emerging environmental trends. The system of indicators developed by the researchers shows the links between tourism and the impacts of this industry on social and natural environments. In addition, the indicators can rank destinations in terms of sustainability and relevant stakeholders can use changes in rankings to inform sustainability planning. Key indicators supply basic information, such as tourism intensity, effects of tourism on the local community and management of waste. There are also indicators specific to each coastal and beach destination. In all, 32 indicators integrate the social, economic and environmental aspects of sustainable tourism, including how tourist activities affect the total provision of services, the economic benefits from tourist activities, and the intensity of beach use, management of water resources and the degree of protection for natural resources.

In addition, a composite indicator was calculated for each destination including three broad dimensions of sustainability: social, economic and environmental. Higher positive values for indicators suggest improvements and greater negative values suggest the sustainability of these dimensions has deteriorated, making it easier to compare different destinations. Spain participates in several

international schemes to promote sustainable tourism. The Sustainability and Tourism Forum, FITUR Green, which is held in our country, is evidence of this. The organizers of this event include the Hotel Technology Institute, a Spanish organization which promotes the efficiency and sustainability of companies linked to the hotel and tourism industry. With this objective, it invests in various Research, Development and Innovation (RDI) projects. The result is that Spanish tourism enterprises are beginning to gain a notably ecological and sustainable profile. The researchers calculated an overall global indicator for each destination, composed of the social, economic and environmental indicators. These global indicators suggest that the best destinations combine high sustainability conditions in waste and water management, safe beaches and lower ratios of peak season tourists to local residents because the tourist season is spread throughout the year. The Spanish competence cell also suggest that the further development of sustainability indicators is required so that they can integrate a larger number of social variables, among other those related with human diversity and equal opportunities to travel for all (among other for persons with disabilities, old age, etc.). Collaboratively designed travel package designs that include citizens in their processes, such as the initiatives of a Bilbao based travel agency (Travel for All) are examples of co-RRI applications in the field of sustainable tourism. In this sense, focusing not only in the reception, but also in the emission of tourism flows (conditions of those who travel) can broaden the social perspective of RRI in the field of tourism.

¹ <http://www.unep.fr/shared/publications/pdf/dtix0592xpa-tourismpolicyen.pdf>

The FoTRRIS project recommends to Spanish Policy Makers

Fostering a transversal vision of co-RRI in Education: promote inclusiveness

Responsible research and innovation needs being aware of the multiple impacts and effects of different decisions and activities. This implies a multi perspective and disciplinary approach to problems. However, research and education institutions have fallen to very specialized niches. Policy makers have to promote a change to create also more transversal institutions able to carry out the king of transversal studies required.

Actions

Innovation for big challenges requires diverse, often contradictory perspectives to be taken into account simultaneously. In such a context R&I becomes extremely complex. Recent research shows that the current R&I system is not sufficiently prepared for this new agenda. That is why the EC launched Responsible R&I (or RRI), a transversal theme aimed at enabling the R&I-system to (learn to) work in ethical and socially relevant ways. Open Innovation and Open Science are initiatives that share this ambition. To address complex problems and increase the societal support for transitions, cocreation with diverse actors is needed. So RRI is therefore always co-RRI, "co" standing for collaborative or/and co-creation.

Spanish research institutions are known for their strong specialization in various disciplines. Systematic solutions, however, depend on the capacity to transcend specialist perspectives so as to understand the complex interactions between subsystems and to influence system behavior at its very root causes. This means that in Spain a transition of the R&I-systems is needed.

Given the importance of RRI in the fields of academy and culture, among others, RRI promoting and dissemination actions are currently taken place in Spain. In order to promote a more sustainable cultural sector and aligned with the Sustainable Development Goals of the UN, the University of Valencia hosts, on 25 and 26 January 2018, the second Conference on Sustainability and Cultural Institutions¹. National and international experts from the field of culture will participate, during two days, in a seminar in which the role of cultural institutions and art to achieve sustainable development will be discussed.

Another initiative is the guidelines "Getting started with the SDGs in universities"² which provides a set of recommendations for higher education institutions to accelerate their contributions to the Sustainable Development Goals (SDGs). The Guidelines highlights the important role universities have in implementing the SDGs through their teaching, research, operations and leadership, and provides practical guidance and examples to inspire further action.

Education in Spain is promoting inclusiveness of the different collectives of the society: people with disability,

elderly people, refugees, etc. It is a paradigm which needs connections and cooperation inter disciplines in order to redesign the current systems.

This means that in this specific domain RRI initiatives are needed. Strategies of co-RRI are instill from the children at the schools, younger people at the university, and elderly people in their daily life to everyone in the society. The new perspective requires skills to carry out activities with transdisciplinary methodologies. In the next decades this generation can then mainstream the new mindset into a broader sphere of research and education system. Moreover, this is only possible if co-RRI is understand in order to able to follow and support this evolution.

Promoting inclusiveness in the Spanish education is been stimulated some years ago. Different collectives work to define an education system for all. In addition, the government should promote the development of a general basic education for every one student, creating new regulations and budgets. It is important to consider other initiatives and working in a cooperative way to introduce this inclusiveness at all levels of education and with educational institutions that already integrate some of these basic skills in some of their courses.

Furthermore, including hands-on RRI courses in under graduate of post-graduate syllabus fosters co-RRI becoming the "new normal" in Education. For the further education of administrations the RRI-Transition arena should collaborate with the concerned public services. Media dissemination of RRI practices and examples of "success cases" can create public awareness about the discipline contribute to its uptake in Education institutions. The FoTRRIS project recommends to Spanish Policy Makers.

¹ http://www.fundaciouv.es/cursos/ver_curso.asp?idioma=cas&id=6751

² <http://ap-unsdsn.org/regional-initiatives/universities-sdgs/university-sdg-guide/>

The FoTRRIS project recommends to Spanish Policy Makers

Niche-innovators: Online platforms to R&I systems Investing

Most of funding for research and economical initiatives is today focused on traditional activities. Early adopters of responsible research and innovation face difficulties to compete for funding and aids when they are evaluated under usual metrics, paying attention to high immediate impacts. Changing that will widen the landscape of proposals, because it would allow an effective comparison of proposals from different perspectives.

Actions

In Spain, there are Citizen Science initiatives that experiment with new social learning a research platforms and technologies. These platforms follow two main goals. First, increase citizen awareness on their capabilities to participate in science and the relevance that such implication can have. Second, create local solutions in response to global challenges. Some of the main obstacles to the higher involvement of citizens in research is their perception that this is something "boring", only for "professionals", and that there are not real opportunities for participation. With the focus of European Commission in citizen science over the last years, there is a growing number of initiatives aimed at removing these obstacles. For instance, the CSIC (Spanish "Centro Superior de Investigaciones Científicas") participated in the FP7 Societize project (grant RI-312902, 2014) to increase the visibility of this approach, MediaLab Prado¹ is a reference for number of projects and promotion, and BCNLab² also works actively on promotion. The Observatory of Citizen Science in Spain (Spanish "Observatorio de la Ciencia Ciudadana en España")³ keeps updated a list and map of initiatives of citizen science in Spain.

The involvement of citizen in research has a clear impact in the immediate impact and orientation of initiatives. Though the awareness of global challenges continues, there is also an increased presence of the local challenges. This can be an enabler of a more social-oriented research towards sustainable goals. Literature reveals that global competition reduces national governments' capacities to realise sustainable goals. In the global financial economy, companies are very mobile. If a national or regional government aims at limiting the externalities of the extractive economy, they can move to countries where no such restrictions prevail. With this power imbalance, the push of emerging initiatives focused on social wellness and sustainability offers a very powerful leverage for the SDGs. They abandon the premise of competitiveness as the main economic driver, and explore a generative model based on

cooperative principles. Those initiatives come from every actor in society, from citizens but also from governments (mainly local and regional) and companies. Citizens that want to set up a sustainable initiative seek support in specific networks of actors with similar interests. These sustainable communities succeed in creating more local wellbeing with fewer resources. All this shows that in-situ actors (citizens, companies and governments) are successfully innovating for more sustainability outside the established R&I system.

In order to achieve a broader citizen participation, the Spanish government has to valorize these niches-innovators as key leverages, and embed them in the R&I and education system. In spite of their crucial contribution to a more circular and inclusive economy, government policies still impair these niches with important limitations. These are, in general, common issues of countries in the European Union, as pointed out in the Societize white paper. While this kind of limitations had not been addressed, the potential for this approach will remain underused.

Generative niche initiatives are relevant for all transition arenas and therefore must be supported across policy departments. Their small scale, project-based approach should be complemented with a more structural, long-term support, potentially reinforced by the broad application of knowledge currencies. The co-RRI transition arena has to investigate what mechanisms today hinder the cooperation of established R&I institutions with these niches and propose alternative regulations. Local governments too have to be stimulated to cocreate solutions for local problems with generative niches. Also, cultural changes must be promoted. The early adoption of such approaches should be an objective in all education levels. Later, the government should facilitate the bottom-up and top-down appearance of these initiatives through incubators for citizen science.

¹ <http://medialab-prado.es>

² <http://www.ub.edu/opensystems/es/projectes/oficina-de-ciencia-ciudadana-del-bcnlab/>

³ <http://ciencia-ciudadana.es/>