**Teacher’s guide - Power point presentation “Introduction to RRI”**

**To present the concept of RRI to the students, the teacher can use the power point presentation “Introduction to RRI”. Depending on the profile of the students, the reality of the place where the formation takes place, or the educational level of the classroom, the teacher can use and adapt the presentation as deemed more convenient.**

**Bellow we offer some tips and supplementary materials that can help with the presentation. For each slide, there is a minimum content that should be explained to maintain and follow the information thread (basic explanation). In some cases, more and precise information is provided about the texts or documents references in the slide (tips or supplementary information).**

SLIDE 2

BASIC EXPLANATION:

Science and technology provide with knowledge, generate well-being and contribute to overall development. But they also set out ethical dilemmas, lead to unwanted effects and pose new challenges.

TIPS OR SUPPLEMENTARY INFORMATION:

**Quote 3-4 examples** that students in the classroom are familiar with. They can either be world-wide know examples (like the ones proposed hereunder) or rather local cases, related to the specific field of study.

HELP: Some broadly known examples (**related to the images on the slide**):

* For example, the invention of plastic materials and their application in infinite spheres (domestic, industrial, medical, etc.) has solved many problems linked to other, more traditional, materials. Plastic materials are elastic, flexible, adaptable and versatile; their production is relatively easy and economical, and since they don’t weigh much, their transport consumes fewer energy resources. All this reasons have made plastic a huge success; so much, that its excessive and uncontrolled use has posed new problems and challenges for society. Just to mention one of them, the environmental consequences of the accumulation of plastic residues. To face this challenge, we will need a more responsible production and consumption, greater sensitivity of reuse and recycle, and an intensification of the search for similar materials with less of an environmental impact.
* The engine and the motorised means of transport have allowed humans to go across great distances and carry goods wherever needed. At the same time, however, they have created pollution problems and have had a very big impact on landscape and urban architecture.
* Medicines have reduced mortality caused by many diseases, but they are not exempt from side effects and complication.
* Telecommunications have made information and interaction barriers disappear, but at the same time, they have caused social challenges like the digital-gap inequalities or new pathologies linked to their excessive use.
* Robotics and Artificial Intelligence can improve life standards, but they also pose security risks and impacts on nowadays jobs, among other challenges.
* Gene editing, neuroenhancement, drones, biosecurity technology, assistive reproduction techniques, etc. The list goes on!

Another option is to **also** **ask students** about discoveries, inventions and applications that have had positive and negative effects. Examples can be real (from the past) or from emerging technologies that might have both kinds of effects in the future.

SLIDE 3

BASIC EXPLANATION:

Can we prevent negative impacts of science and technology, while at the same time we increase its positive or beneficial effects? How and when to act? Who should be in charge: researchers, politicians, industry, consumers, all of them?

There are worth-mentioning reflections about consequences of technology and who should take responsibility or make decisions on its regards in the 2016 book “The Ethics of Invention: Technology and the Human Future” from Prof. Sheila Jasanoff. Some fallacies and myths highlighted by this professor from Harvard Kennedy School have been included in the slide.

When presenting the fallacies and myths, the professor should complement the slide with this more detailed explanation:

* **The Determinism Fallacy**: The technology, once invented, possesses an unstoppable momentum, reshaping society to fit its insatiable demands.
* **The Myth of Technocracy**. Re-formulating the idea that modern life is too complicated to be managed by ordinary people, the idea of “technocracy” recognizes that technological inventions are managed and controlled by human actors, but presumes that only those with specialist knowledge and skills can rise to the task.
* ***Unintended* Consequences**. It is well known that technologies fail, but it is less obvious who should be blamed for failures and under what circumstances.

TIPS OR SUPPLEMENTARY INFORMATION:

The professor can offer to those students willing to learn more on the topic an outside-of-class screening of Professor Sheila Jasanoff’s speech (about an hour long). In her speech, she analyses in detail several issues of the ethics of inventions and comments on who is responsible of the decisions made. The hyperlink to her speech is found on the slide and here: <https://www.youtube.com/watch?v=aT1djsHSxMY>

SLIDE 4

BASIC EXPLANATION:

Nowadays, several sectors ask for researchers and innovators to be more reflexive, to ponder the consequences (positive and negative) of their profession, and to work closer to society, particularly, to the different groups of actors that can be affected by or interested in their research fields.

The images in the slides are extracted from two prestigious journals among the scientific community (Nature and Science), and show examples of these demands.

SLIDE 5

BASIC EXPLANATION:

Throughout the whole R+D+i process, multiple **decisions** must be made. Some of them affect the **WHAT** and **WHEN** (that is, the scientific agenda).

In the slide, some examples of these kind of questions and decisions to be made are shown.

SLIDE 6

BASIC EXPLANATION:

Other **decisions** affect the **HOW**.

In the slide, some examples of these kind of questions and decisions to be made are shown. The “S&T system” refers to the “Science and Technology System”.

SLIDE 7

BASIC EXPLANATION:

In the slide, the current situation about **who** is responsible to make decisions regarding R+D+i is explained.

SLIDE 8

BASIC EXPLANATION:

The slide explains **which are the most commonly considered criteria** nowadays when making decisions regarding R+D+I.

When presenting the Criteria, the teacher should complement the slide with this more detailed explanation:

* Contribution to knowledge
* Need to solve big challenges (health, well-being, climate, food, security, etc.)
* Possibilities of success in the market and of individual or business economic benefit
* Contribution to economic development (of a city, region, country or group of countries)
* “Scientific excellence” criteria (fundamentally the impact on the scientific community in bibliometric terms)
* Specific strategic criteria: Politicians, etc.

SLIDE 9

BASIC EXPLANATION:

The slide shows some problems derived from making decisions in response only to the market.

When presenting this Decisions, the teacher should complement the slide with this more detailed explanation:

* Decisions that are solely (or fundamentally) based on the market response or on economic development models
  + **Ethical dilemmas.** They can suggest ethical dilemmas (such as the production or increase of inequality in access to knowledge or technology, etc.)
  + **Waste of opportunities.** If the potential users are not consulted during the R&D&I process it is difficult to know what they want, what they expect from the technology and research, what real need they have, etc. If decisions are made for them and they are simply offered different innovations and technologies, it is possible that some of them have a good reception in the market, but it is probable that business opportunities are being missed.
  + **Unwanted effects.** If end users and other stakeholders are not consulted, instead just waiting to see the market’s response, sometimes unexpected situations arise: rejection of a technology once it reaches the market (after considerable investment), unexpected success with displacement of other technologies, unexpected uses, etc.

SLIDE 10

BASIC EXPLANATION:

The slide shows why the concept of “excellent science” in its most common use (i.e., related to bibliometric criteria) is insufficient as the only criteria to consider when making R+D+i decisions. Specially, when the aim of the decisions is to have a positive impact on society.

The teacher should complement the slide with:

* “Scientific excellence” tends to be based on bibliometric criteria (such as the number of articles published by a researcher, the number of references received or the Impact Factor of the journals in which they have published)
  + These criteria do not measure the impact of the research on society, but the impact and visibility of the scientific community as such
  + It cannot be affirmed that the most referenced articles are really those that have contributed the most to knowledge, advancement of science or to solve the big problems of humanity
  + Publishing cannot become a goal *per se* of research (not even in the high impact journals)
  + Bibliometric indicators have a significant weight in scientific decisions, but the level of ignorance and misuse is high.

SLIDE 11

BASIC EXPLANATION:

The slide presents the case of Genetically Modified Foods (GMF) as a technology whose advancement was originally based on scientific and economic criteria, but that has faced many problems due to the public rejection in some regions (like Europe). This rejection is not only visible through the actions of some activist groups, but is also clear through public perception surveys (such as the one shown in the slide).

TIPS OR SUPPLEMENTARY INFORMATION:

Regarding GMF, confronted explanations are usually encountered:

* VISION A: *Society members reject GMF because they don’t understand them, they don’t have a good enough judgement and are unjustifiably alarmed by the information that activist groups spread.*
* VISION B: *GMF research is biased, scientific and political decisions depend hugely on the industry and power groups.*

In any case, it appears evident that it is not a good idea to wait until a technology is in the market to find out what the public thinks about it. It is a good practise to get to know the needs and values of different stakeholders from the beginning of the research process, and foster platforms for dialogue and participation.

SLIDE 12

BASIC EXPLANATION:

The slide shows a real example of how the uneven distribution of sanitary resources (among which R+D+i is included) increases social inequalities.

The example highlights the importance of considering ethical and social criteria when making decisions about R+D+I, and not only taking into account market criteria.

SLIDE 13

BASIC EXPLANATION:

The slide presents an example showing how current bibliometric indicators (especially the ones based on the Impact Factor of journals) are not good enough criteria (on their own) to make decisions regarding R+D+i. The idea of “excellent science” based solely on these aspects is also questioned.

SLIDE 14

BASIC EXPLANATION:

This sentence should help students reflect on their own role to help make a better research and innovation.

SLIDES 15

BASIC EXPLANATION:

Parting from the previous reflections and the question set out by this slide, the concept of RRI and how it originated can be explained, together with its meaning and how to implement it.

SLIDE 16-19

BASIC EXPLANATION:

These 4 slides explain the phrase “On one hand, RRI arises from a bottom-up process”, and in particular, the most influential disciplines, practices and movements for the rise of RRI are commented.

Slide 16 should be complemented by the following explanation:

* On one hand, RRI arises from a bottom up process:
  + The concept of RRI has issued both from the confluence of various academic disciplines and from initiatives and movements of different natures lead by academics, representatives of civil society and the industrial sector, science communicators, etc. So, it can be said that RRI parts from a Bottom-Up force

Slide 17 should be complemented by this information:

* Reflection on R&D&I, its processes, results and impacts on society and the environment, and how to improve them, are not new.
  + Various disciplines, initiatives and movements address this topic (completely or partially):
    - Some of these disciplines are decades or centuries old (like ethics), and some are much more recent
    - Each one of these disciplines has their own theoretical base, methodologies and tools; even so, it is easy for them to overlap and intersect

Slide 18 should be complemented with:

* Some of these disciplines are focused on the need to include society and various stakeholders in the deliberative processes; others on science’s social compromise; others on respecting the shared principles and values of society. Others focus on the anticipative analysis of impacts and adaptation processes (responsiveness). Some focus on more specific aspects: gender, open access, sustainability, etc.

Slide 19 explains some practical ways of public engagement, varying the level of participation of the public. Both society and the various stakeholder groups for each action are understood here as “public”.

TIPS OR SUPPLEMENTARY INFORMATION:

In slide 19, the ladder type representation takes as referent the metaphor used by Arnstein to describe the different levels of citizen participation – In that case, he did not exclusively refer to scientific decisions, but to political decisions in general (Arnstein, Sherry R. "A Ladder of Citizen Participation," JAIP, Vol. 35, No. 4, July 1969, pp. 216-224.)

SLIDE 20 - 21

BASIC EXPLANATION:

These two slides develop the phrase “On the other hand, RRI is also determined by a top-down process”.

Slide 20 should be complemented with this more detailed explanation:

* On the other hand, the definition and dissemination of RRI is determined by a Top-Down process
  + Some large organizations (noticeably the EU, but also other government entities, establishments etc.) are playing a crucial role in the definition of the concept of RRI and its dissemination and integration (in professional practices, teaching, etc.). So there is also a **Top-Down** force that impulses RRI.

SLIDE 22

BASIC EXPLANATION:

Considering slides 16-21, slide 22 highlights that RRI is an emerging principle, both political and “philosophical” (in quotation marks to indicate that the term is used generically to include different academic disciplines).

SLIDE 23 - 29

BASIC EXPLANATION:

These 7 slides summarise the most influential definitions of RRI, including those that have moved from the academic to the political area, and those that have move the opposite way (once political, now academic).

Slide 24 should be complemented with:

* The most referenced definition of RRI, both in academic literature as in the more political speech of the EU/EC, is probably that of René Von Schomberg, an expert in this field who also works in the European Commission as such.

TIPS OR SUPPLEMENTARY INFORMATION:

The professor should become acquainted with the definitions shown in the slides, as they are the foundations of RRI. To do that, it is necessary that the professor studies the articles and references indicated in the slides.

It would be advisable that students read, outside the classroom, some of the articles and documents where these definitions have been published.

SLIDE 30-34

BASIC EXPLANATION:

Given the profusion of visions and definitions of RRI, these four slides show what aspects do all of them have in common.

Slide 31 should be complemented by this more detailed information:

* Recent perspectives on RRI agree on several elements: **the five ingredients for RRI** (similar to the 4 dimensions by Stilgoe et al. 2013).

1. **Anticipation**
2. **Transparency**
3. **Responsiveness**
4. The capacity of a system to adapt and to change during its course of development can be identified as its **reflexive stance**.
5. The **inclusion of stakeholders** should help
   1. defining and revealing what are the actors’ values and the ends and purposes they assign to science and technology,
   2. co-establishing norms from these values,
   3. shaping the design of innovation and research processes and outputs.

SLIDE 34

BASIC EXPLANATION:

In this slide, basic examples of RRI practices are listed. This aims at providing real-life exercises so that students can see a practical translation of the RRI definitions described in previous slides. More examples can be commented in class.

SLIDE 35

BASIC EXPLANATION:

These Final Remarks are important for students, as they show RRI’s transformative mission and at the same time, state that the definition of RRI is not closed yet. This way, students are encouraged to pick the important messages of RRI, and not just focus on the superficial aspects.

The Final Remarks should be complemented with this more detailed explanation:

* Responsible Research and Innovation (RRI) represents a movement for change of the current science and technology system
* Even though it is relatively new, and its definition is probably not closed yet, the concept of RRI does not arise from nothing, it has been built upon the intersections of various movements and disciplines, some of them of long standing tradition.
* Even though RRI represents a revolutionary movement in some ways, it is also receiving strong institutional support, both from international (especially EU/EC) and national organizations. These institutions are supporting the diffusion of the concept, its integration into professional routines and in the higher education of future scientists, engineers and other professionals that are implicated, affected by or interested in R&D&I

TIPS OR SUPPLEMENTARY INFORMATION:

It is advised to leave some extra time in this slide to ensure that all concepts are properly understood. Now it can be a good time for questions or to encourage an open dialogue between the professor and the students, before moving to the next activity.