AN INTRODUCTION TO RESPONSIBLE RESEARCH & INNOVATION

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Catalyst Editorial

UKRIO subscriber webinar
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CATALYST EDITORIAL

About Jane Alfred

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Defining what we are talking about

Research

- The systematic pursuit of knowledge.
- Detailed study to uncover new information or to add to body of knowledge.

Innovation

- New or significantly improved products (goods or services) or process, or new marketing/ organizational business methods. Provides advances that are incremental or transformative, beneficial or detrimental, economic & societal value.
- Important for addressing global challenges and UN SDGs.

Social responsibility

- Producing goods and services in a way that is not harmful to society nor the environment, and that maximises benefits to society and environment.
- Key objective is to contribute to sustainable development.

Responsible innovation

- Careful consideration of, and action to address, potential impacts of introducing a new product, service, process or business model.

TAS: https://tas.ac.uk/responsible-research-innovation/what-is-responsible-research-and-innovation-rri/
PAS 440: https://pages.bsigroup.com/l/35972/2020-03-17/2cgcnc1
ISO26000: https://www.bsigroup.com/en-GB/products-and-services/standards/iso-26000-guidance-on-social-responsibility/

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Origins of RRI


RESEARCH ARTICLE Open Access

Adapt or perish? Assessing the recent shift in the European research funding arena from 'ELSA' to 'RRI'

Hub Zwart*, Laurens Landeweerd and Arjan van Rooij


RESPONSIBLE RESEARCH AND INNOVATION IN H2020: CURRENT STATUS AND STEPS FORWARD

Policy Brief #1

NEW HORRIZON

POLICY BRIEF #1 | MAY 2018

RESPONSIBLE RESEARCH AND INNOVATION IN H2020: CURRENT STATUS AND STEPS FORWARD

European Commission RRI report (2012)
Set out how society should address key global challenges, such as energy, climate action, transport, food security, and health and well being.

https://data.europa.eu/doi/10.2777/11739

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Six core facets of RRI in EC framework

Engagement	Gender equality	Ethics	Training & Education	Governance	Open access
Researchers, industry, policymakers & civil society jointly participate in R&I process.	Address under-representation of women. Integrate gender dimension into R&I process.	Respect fundamental rights & attain high ethical standards. Ethics is not a constraint but a way of ensuring high quality results.	Equip future researchers, public & other societal actors with knowledge & tools to participate in & be responsible for R&I.	Policymakers have a responsibility to prevent harmful or unethical developments in R&I.	Provide free online access to results of publicly funded research to boost innovation & increase use of research by all societal actors.

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Research & innovation

Research & innovation can advance our understanding and knowledge, help to tackle global challenges, and create value (economic & social).

But R&I can also lead to:

- Unintended consequences
- Unforeseen impacts
- Ethical dilemmas
- Social transformations

Source: https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/responsible-innovation/

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‘**Responsible research and innovation** is a process that seeks to promote creativity and opportunities for science and innovation that are socially desirable and undertaken in the public interest.’

UKRI

RRI recognises that innovation:

- can raise questions and dilemmas;
- is often ambiguous in terms of purpose and motivations;
- and unpredictable in terms of impacts, beneficial or otherwise.

Source: https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/responsible-innovation/

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RRI seeks to ensure that:

- unintended negative impacts of innovative research are avoided (or mitigated), including to the environment;
- barriers to the dissemination, adoption and diffusion of research and innovation are reduced;
- and the positive societal and economic benefits of research and innovation are fully realised;
- research is conducted in ways that are more open, transparent and inclusive.

Source: https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/responsible-innovation/

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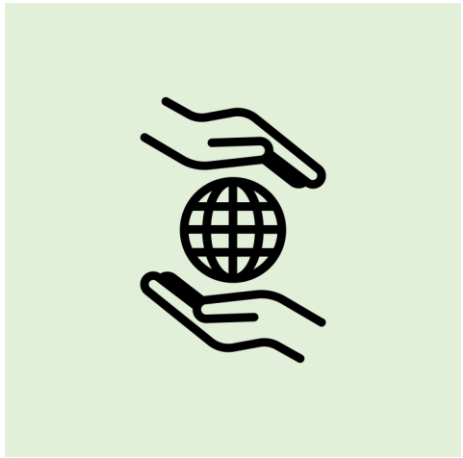
RRI is a process of research and development that considers innovative research in a wider context — wider society and the natural environment.



RRI aims to innovate in the public interest.

Social responsibility sits at the core of RRI

Source: https://rri-tools.eu/en/-/rri-tools-a-practical-guide-to-responsible-research-and-innovation-key-lessons-from-rri-tools-
Image credit: Noun project Justin Blake

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Responsible research and innovation is a collective responsibility (this means that research funders, universities & research institutes, researchers, companies, policymakers, regulators, civil society actors and the public all have key roles to play).

RRI includes, but goes beyond, considerations of risk and regulation.

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PAS 440

Is relevant to all those taking new products, services or processes to market, and to a company's wider stakeholders including:

- the public and customers,
- investors and suppliers,
- current and prospective employees,
- *scientists, collaborators and innovators*,
- *regulators and policy makers*.

Source: https://pages.bsigroup.com/l/35972/2020-03-17/2cgcnc1

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PAS 440 explains two key principles relevant to innovators, policy makers and regulators:

- **The precautionary principle**
- **The innovation principle**

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The precautionary principle

'The **Precautionary Principle** is widely invoked in situations where there is uncertainty about future benefits and risks of an innovation, particularly potential impacts on human health and well-being or the environment.'

It should be applied, for example, where there are potentially dangerous effects in the absence of "sufficient certainty" about the impacts of an innovation.

Source: https://pages.bsigroup.com/l/35972/2020-03-17/2cgcnc1

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PAS 440: The Innovation principle

- The Innovation Principle was developed to ensure the precautionary principle is implemented in a proportionate manner.
- Focuses on innovation as a driver for jobs and growth and its contribution to meeting important societal needs.
- It states that whenever policy is developed, the impact on innovation should be fully assessed and that the choice and design of regulatory tools should consider the benefits of innovation among other considerations

Source: https://pages.bsigroup.com/l/35972/2020-03-17/2cgcnc1

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Precaution and Innovation

The principles of precaution and innovation and RRI together aim to help all involved in innovation to get a difficult balancing act right between…

Innovation

Social responsibility

Source: https://pages.bsigroup.com/l/35972/2020-03-17/2cgcnc1

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So how can all of the stakeholders involved in research & innovation navigate this difficult balancing act?

Innovation

Responsible research and innovation

Social responsibility

Source: https://pages.bsigroup.com/l/35972/2020-03-17/2cgcnc1

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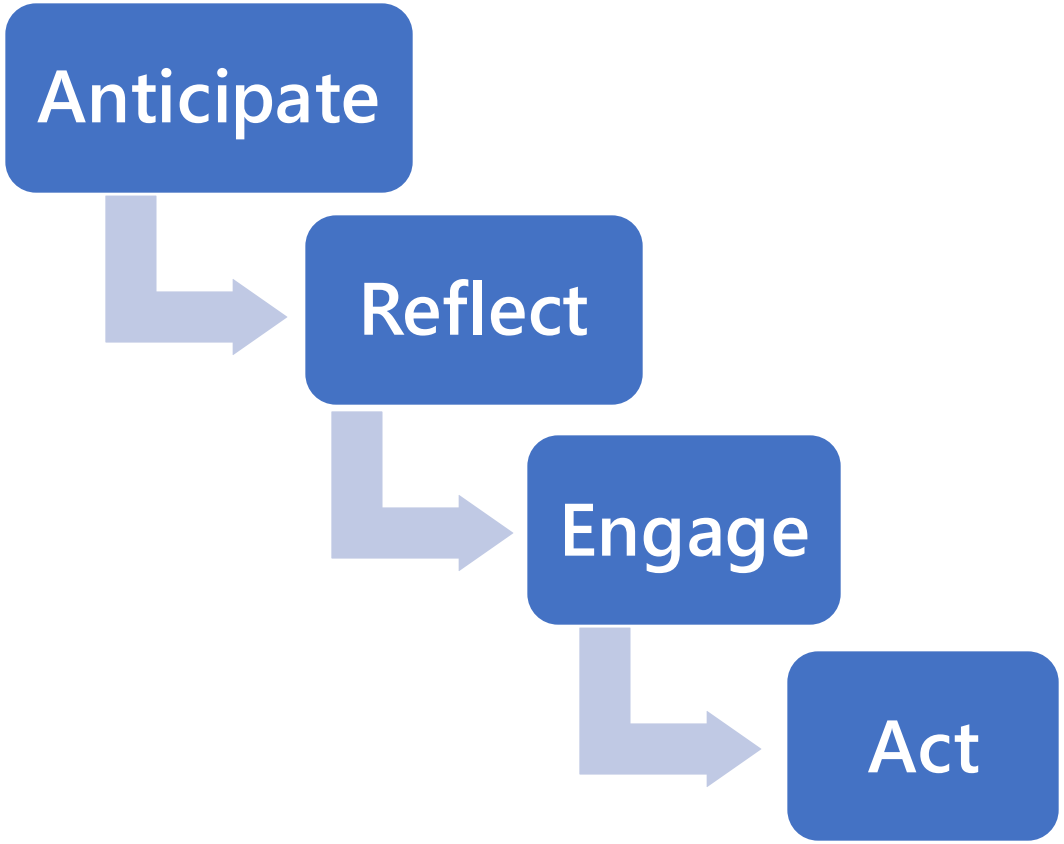
The AREA Framework

AREA is a key framework developed by the EPSRC used to consider responsible research & innovation in the UK



EPSRC acknowledges the support & advice of all those involved in creating AREA, particularly Richard Owen, Phil Macnaghten & Jack Stilgoe, and co-funding & support from the ESRC.

Source: https://www.ukri.org/about-us/epsrc/our-policies-and-standards/framework-for-responsible-innovation/

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The AREA Framework

Anticipate

Forward looking stage:

- Aim is for researchers to consider the known potential impacts of their planned research, intended or otherwise (e.g. economic, social, environmental).
- And the possible implications that might otherwise remain uncovered or not discussed, and the dilemmas & social transformations their proposed research may bring.
- To consider their own assumptions & areas of ignorance.

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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Anticipate

What specific questions might ANTICIPATE raise for researchers?

- Why should this research be undertaken? Is it controversial? Is it socially desirable?
- Is the planned research process and methodology appropriate and acceptable?
- Is the research environmentally sustainable?
- What benefits does it bring (or not)? And who will benefit (or not)? Who are the stakeholders with an interest?
- Who/what will it affect (directly/ indirectly)?
- What do we need to better understand concerning its implications (+/-)?

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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The AREA Framework

Reflect

Reflect stage:

- Encourages researchers to **explore in greater depth** the potential issues, questions, impacts, dilemmas, and social transformations identified in the anticipate stage.
- As well as their own motivations, framings and assumptions.
- Goal is to use stage to refine a project, to avoid wasting time and resources, or risking public trust.

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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What specific questions might REFLECT raise for researchers?

- What assumptions do we bring to this project, what are our motivations for doing it?
- Is our planned research likely to harm something, someone or the environment? Is it controversial, unethical or socially transformative?
- How do we know what all of the consequences of our planned research will be and whether it raises ethical dilemmas? What don't we know?
- How do we know who/what will benefit, or not, or be harmed?
- Who has an interest, who are the stakeholders?
- Can the research be done differently? What are the alternatives, what mitigations are needed?
- How does this guide who we need to engage with and how do we ensure EDI in our research and in our engagement activities?
- Do we have sufficient expertise in our research team?

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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RRI reflective use case: Creative Conversations for Responsible Innovation toolkit

Toolkit covers 6 themes:

- Your Perspective
- Future Thinking
- Diversity
- the Environment
- Wellbeing
- Your Research

Toolkit created by University of Bristol in collaboration with Kilter theatre
https://www.bristol.ac.uk/media-library/sites/public-engagement/documents/new/Creative%20Conversations_toolkit.pdf

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Toolkit to explore Your Perspective

‘Who we are affects what questions we ask, what we perceive as problems and solutions, how interested we are in tackling them, and the approaches we take to doing so.’

https://www.bristol.ac.uk/media-library/sites/public-engagement/documents/new/Creative%20Conversations_toolkit.pdf

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Creative Conversations on the Your Perspective

Why do you think reflecting on our own perspective of the world is important for good research practice?

Supporting exercise:
Explore & discuss research metaphors

To expose implicit, often unacknowledged, assumptions within disciplines and/or research cultures embedded within the language used to describe research outputs.

https://www.bristol.ac.uk/media-library/sites/public-engagement/documents/new/Creative%20Conversations_toolkit.pdf

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The AREA Framework

Engagement stage:

- The **anticipate** and **reflect** stages should inform researchers whether they need to engage with stakeholders and also who their stakeholders are.
- Stakeholder engagement aims to open up a project to wider deliberation and dialogue, and to explore its impacts on stakeholders, society, and/or the environment.

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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What specific questions might ENGAGE raise for researchers?

- Who do we need to engage with and why?
- How will we make contact with those we need to engage with?
- How can we ensure engagement is inclusive and reaches under-represented groups?
- What types and methods of engagement should we use, and how can we evaluate our engagement process?
- Do we have sufficient expertise in our research team? Do we know what good practice in public engagement consists of? Do we need training, advice, and/or to partner with others?

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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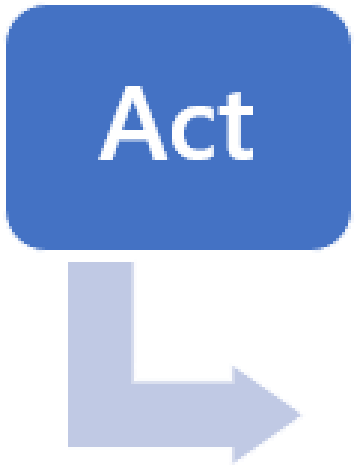
The AREA Framework



- Researchers use the key information and inputs they have gathered from the anticipate, reflect and engage stages.
- To revise, shape and influence the aims, design, process, outputs and products of their research and how they will be shared/distributed, and with whom.

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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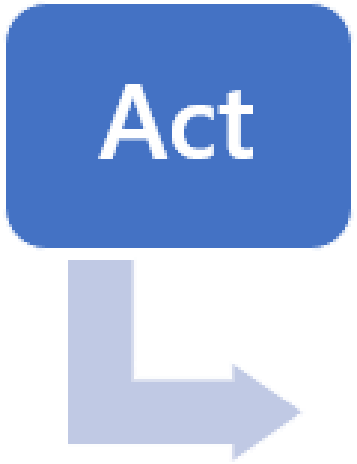

What specific questions might ACT raise for researchers?

- What do we need to do or change to ensure that our research remains socially desirable and/or environmentally sustainable?
- Do we need to modify the vision/purpose/motivations of our project, in light of stakeholder input? If so, how?
- How should we modify our research process, and/or research outcomes or products to respond to stakeholder views/ unanticipated risks/impacts?
- Are there any other potential ethical or environmental issues or stakeholder impacts to consider?
- Who needs to be notified about potential risks, impacts, regulatory requirements arising from our research?
- What new guidelines/ policies/ regulation are required? What training and/or infrastructure (people and things) is required?

Sources:
https://www.ukri.org/about-us/epsrc/our-policies-and-standards/ framework-for-responsible-innovation/
https://www.orbit-rri.org/about/area4pframework/

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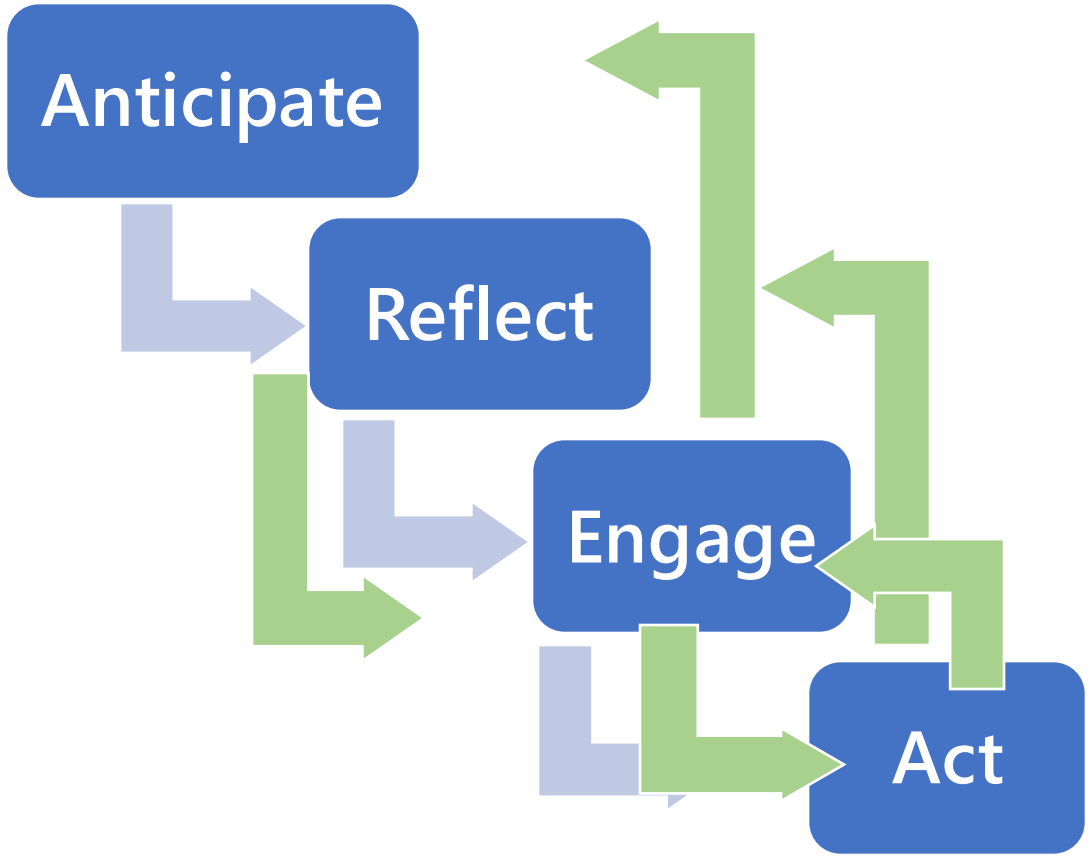
AREA is an iterative process



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Human brain project
putting AREA into practice

10 year, EU-funded multidisciplinary initiative to create a research infrastructure for academic & industry researchers to advance knowledge in neuroscience, computing, and brain-related medicine.

- Research undertaken raises many ethical, social, and regulatory issues.
- Goal: Integrate & embed RRI into projects from the outset.
- Used the AREA framework achieve this aim.

Human Brain Project

Source: https://www.tandfonline.com/doi/full/10.1080/23299460.2021.1955613/

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Human brain project

Anticipate

Created HBP Foresight labs: social scientist research groups, who evaluated the potential social, ethical, legal, and economic consequences of new knowledge and technologies produced by HBP projects.
Their work involved horizon scanning, modelling and scenario planning; stakeholder engagement; and monitoring of impacts (fed back into models).

Source: https://www.sciencedirect.com/science/article/pii/S0016328717301064#fn0030
Example at https://www.kcl.ac.uk/research/the-human-brain-project-the-foresight-lab

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Human brain project

Reflect

Brought together philosophers & ethicists with neuro- and computational scientists to identify and assess relevant ethical, philosophical, legal and societal issues and to carry out self-critical analysis.

Source: https://www.tandfonline.com/doi/full/10.1080/23299460.2021.1955613/

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Human brain project

Projects engaged with over 3300 EU citizens through a variety of events, in person and online.

Source: https://www.tandfonline.com/doi/full/10.1080/23299460.2021.1955613/

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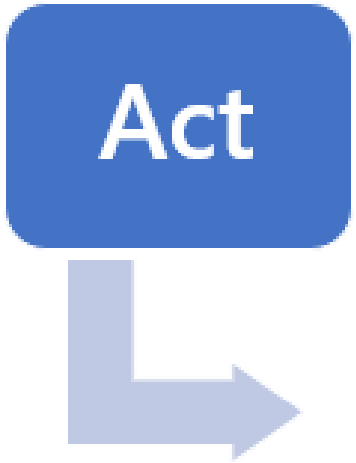
Human brain project



Ethics rapporteurs created, who anticipated and addressed ethical and social issues of each subproject and summarized them in one page summaries, to help the HBP to gain an ethics overview across the whole project.

Source: https://www.tandfonline.com/doi/full/10.1080/23299460.2021.1955613/

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USE CASE: SYNBIOCHEM operationalizing AREA

develops faster, more predictable, reliable and "greener" routes to chemicals production.

Its interdisciplinary RRI group:

- initiates RRI dialogue early in & throughout research process;
- provides expertise, guidance & training;
- fosters public engagement.

Source: https://synbiochem.co.uk/responsible-research-and-innovation /rri-group/

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USE CASE: SYNBIOCHEM operationalizing AREA

Use RRI expertise & AREA framework to *anticipate* and *engage* in dialogue about benefits & risks of products early in their innovation & during project lifecycle.

Feed outputs of dialogue into *decision-making* e.g. to ensure products & production processes are environmentally sustainable & societally useful.

Source: https://synbiochem.co.uk/responsible-research-and-innovation/ rri-group/

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RRI: helps us to navigate inter-related research frameworks & agendas

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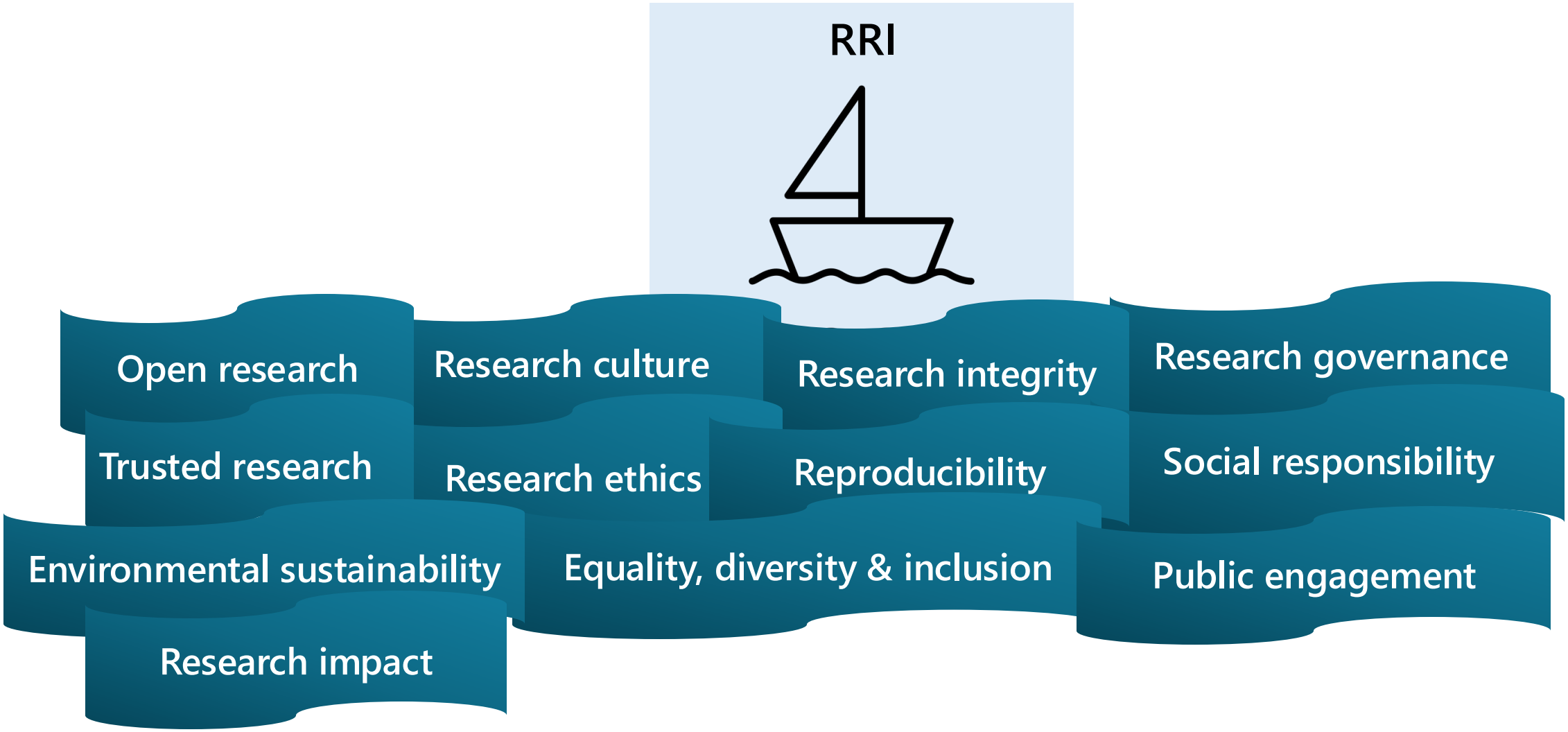

Image credits: Noun project

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Research ethics

Moral principles, laws & processes governing how researchers undertake research involving or impacting humans, animals and the environment.

Open research

Research culture

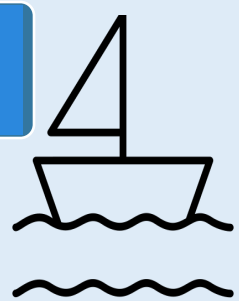
The behaviours, values, expectations, attitudes and norms of research communities.

Ethics

EDI/gender

RRI

Training



Governance

Research governance

Regulations, principles and standards of good practice to produce high quality research.

Environmental sustainability

Meeting the needs of the present without damaging the environment and compromising the ability of future generations to meet their own needs.

Engagement

Open access

Research integrity

Policies, processes, values and behaviours that ensure that research is carried out in a way that is trustworthy, ethical, and responsible.

Trusted research

Protecting UK's intellectual property, sensitive research, people & infrastructure from potential theft, manipulation and exploitation, including as a result of interference by hostile actors.

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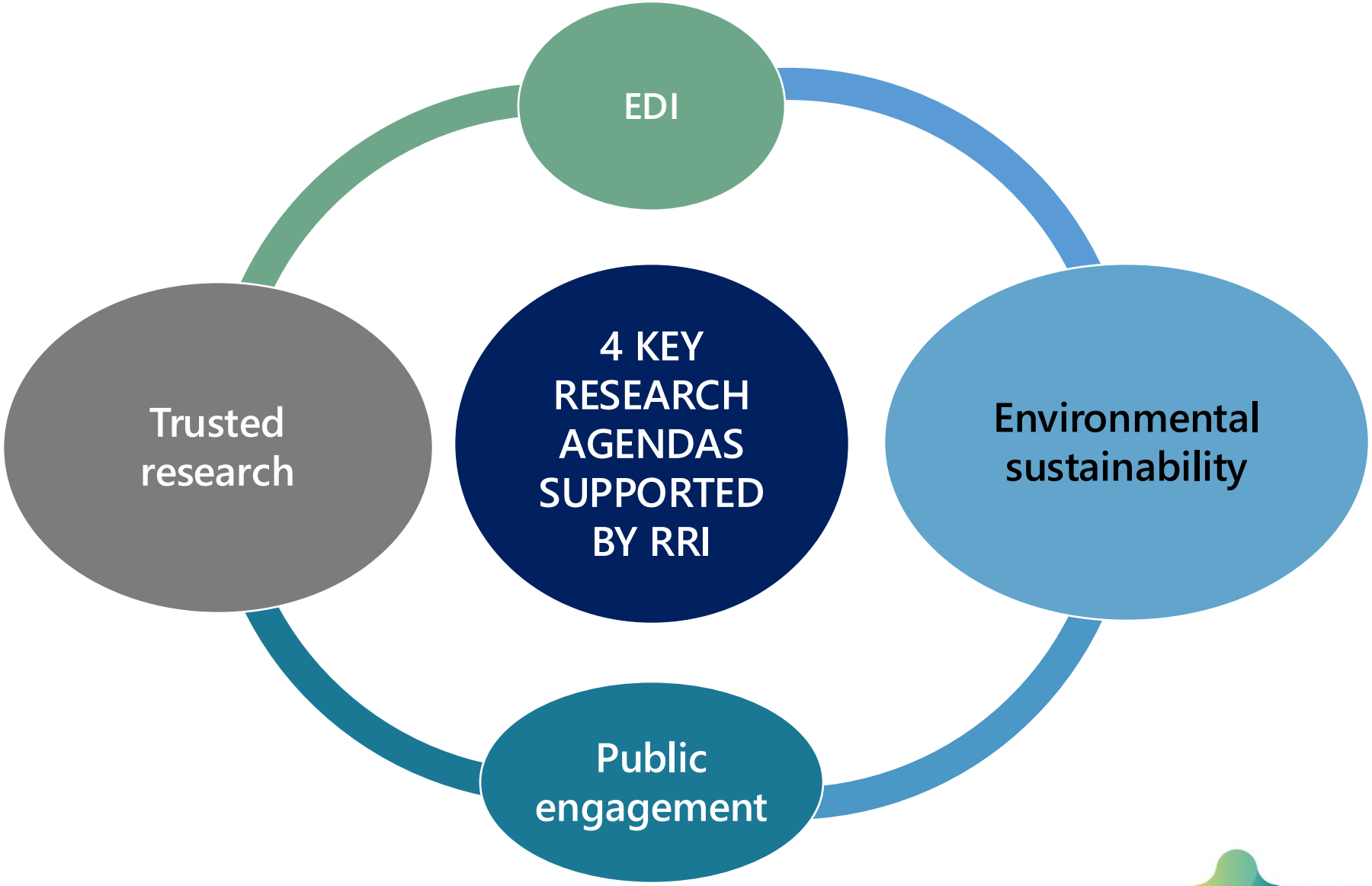

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PE (in the context of RRI) means research that is done **in consultation with the public**, not 'to', 'for' or 'about' them.

It means that stakeholders with relevant experience or interests in the research contribute to how research is designed, conducted and disseminated

High quality PE supports socially responsible research, & is an important enabler for RRI and EDI.

PUBLIC ENGAGEMENT

High quality PE can make research more *accessible, relevant, and responsive* to the needs & insights of society.

Should be a two-way process, involving *interaction, listening & dialogue with the public*, with the goal of generating mutual benefit.

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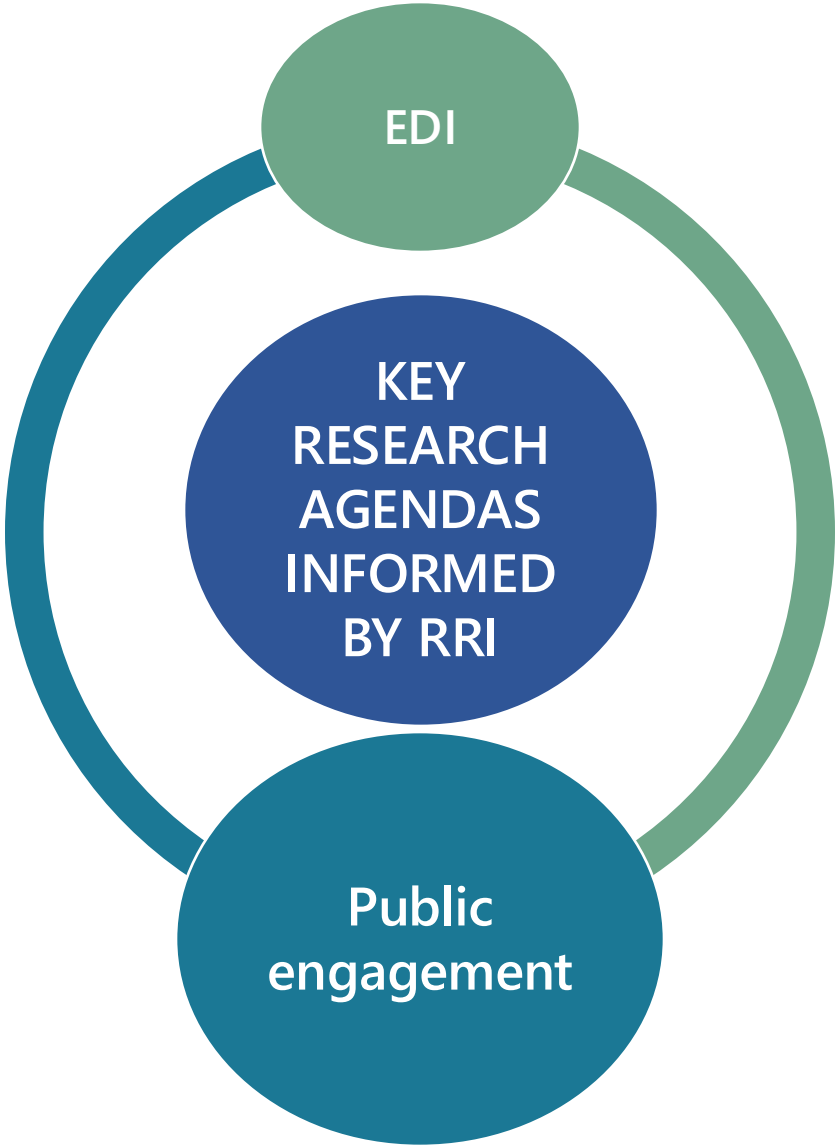

- Inclusive, high quality public engagement helps to embed EDI into the research process.
- Ensures that research isn't conducted that might inadvertently affect or negatively impact specific communities, groups, localities.

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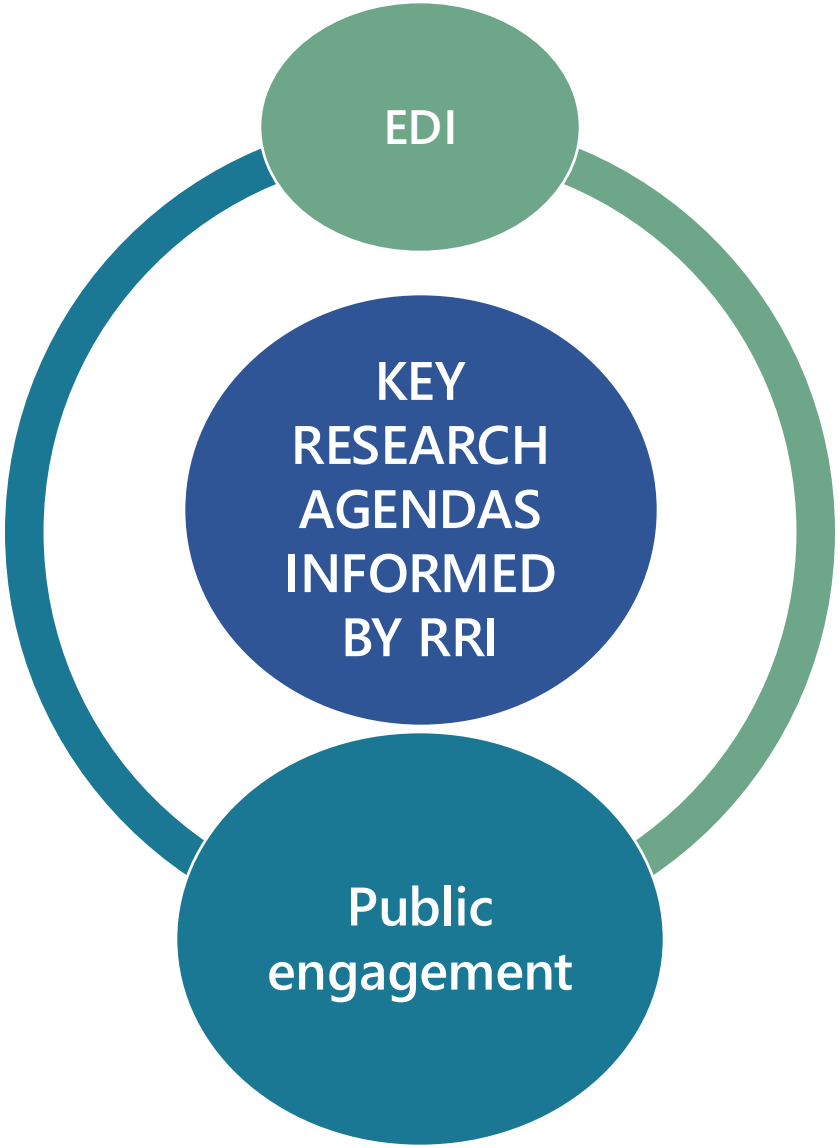

AREA supports EDI through engagement as it encourages researchers to consider:

- Whether a wide variety of stakeholders are involved in a public engagement process.
- Whether the planned stakeholders adequately represent *diverse values, knowledge, genders, socio-economic status, place-based communities, ethnicities & disabilities.*
- And whether all under-represented groups are reached and engaged with, all voices listened to, using dialogue that is inclusive.
- Whether research teams themselves are diverse.

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Resources on public engagement

National Co-ordinating Centre for Public Engagement (NCCPE) resources

- https://www.publicengagement.ac.uk/resources

NHS Health Research Authority (NHRA) guidance on public involvement in research

- https://www.hra.nhs.uk/planning-and-improving-research/best-practice/public-involvement/

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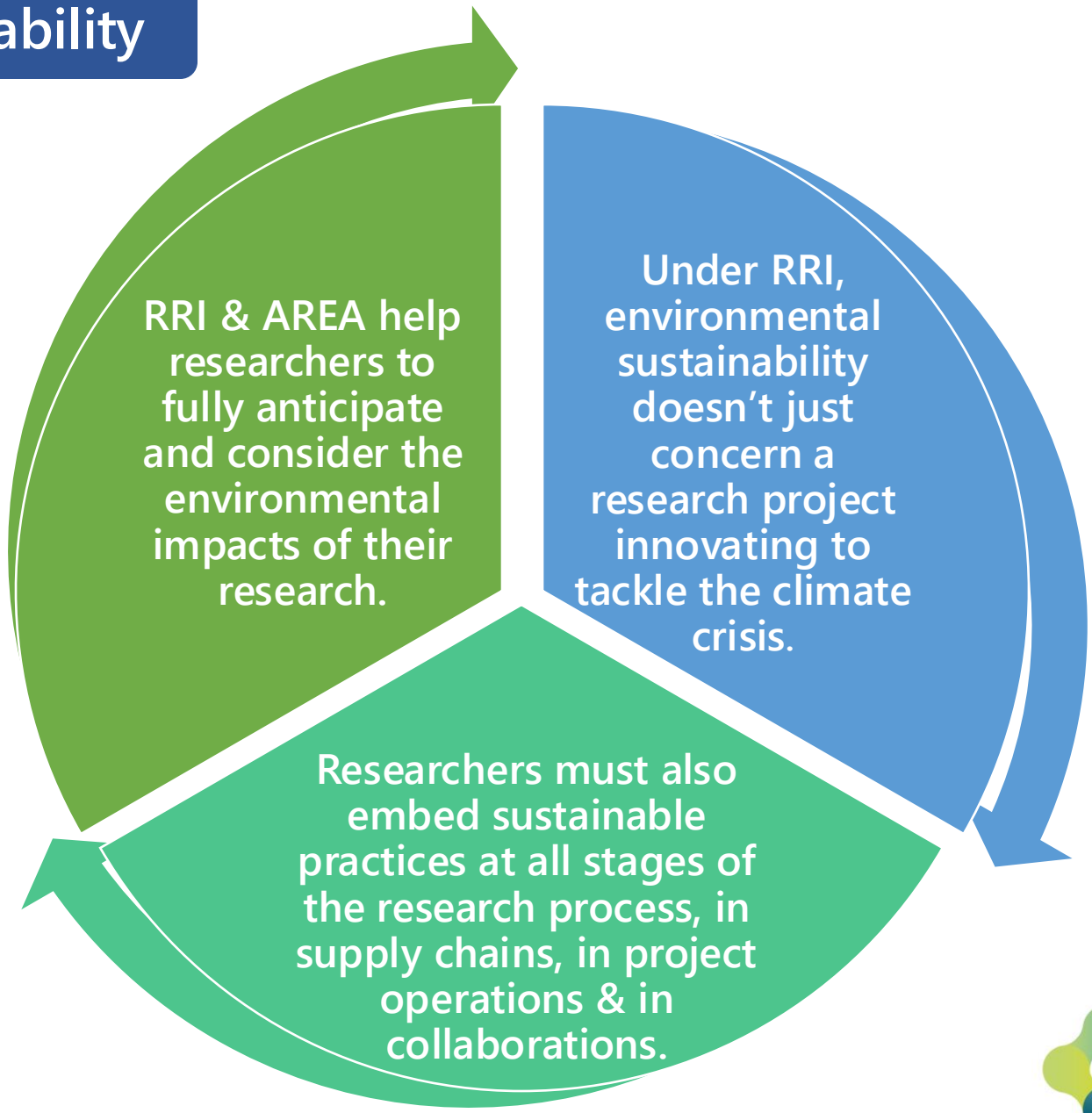
Environmental sustainability



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Wellcome report on environmental impact of research

Biosciences lab research consumes a lot of energy (estimated @ 3x that of a similarly sized office) & produces A LOT of plastic waste.

Identified that different types of research affect the environment in different ways.

Computational research uses lots of energy to store data and train models, both linked to significant carbon emissions.

Research hardware production linked to unsustainable mining practices & to e-waste disposal - both impact the environment throughout the research lifecycle.

Clinical trial research consumes energy & produces high carbon emissions (coordinating centres, trial-related travel, material distributions & fieldwork).

https://wellcome.org/reports/advancing-environmentally-sustainable-health-research

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Planning (Anticipate & Reflect)

Does the research address a global challenge/ SDG?	Environmental impacts?	Specific communities /ecosystems affected?	Does it produce harmful waste?	Are supply chains sustainable?	What don't we know?

Planning & study design (Reflect)

Can eco-friendly materials be sourced & energy consumption reduced?	Can waste materials be reduced, reused or recycled?	Are operational activities sustainable?	Are research team aware and skilled in reducing env impacts?

Planning, engagement & execution (Engage)

Can research be co-designed/co-produced to maximize benefits & reduce impacts?	Will stakeholders experiencing env impacts be included in engagement?	Will engagement work be planned and conducted sustainably?

Research products and outputs (Act)

What env regulations apply to the planned research/ products?	Who needs to be informed about any environmental risks/impacts?	Will research outputs be disseminated & openly shared to maximise value/reduce duplication?

Sustainability use case: Archer 2 supercomputer

Archer 2 team at Uni of Edinburgh were asked to measure their environmental impacts & consider environmentally sustainable policies by their funder, EPSRC

In response the Archer 2 team:

- Used green energy sources to power Archer2.
- Optimised the computer for low-power processing and cooling.
- From Nov ‘21 – May ‘23: Reduced Archer2’s power draw by 20% = very significant for a supercomputer of this size.

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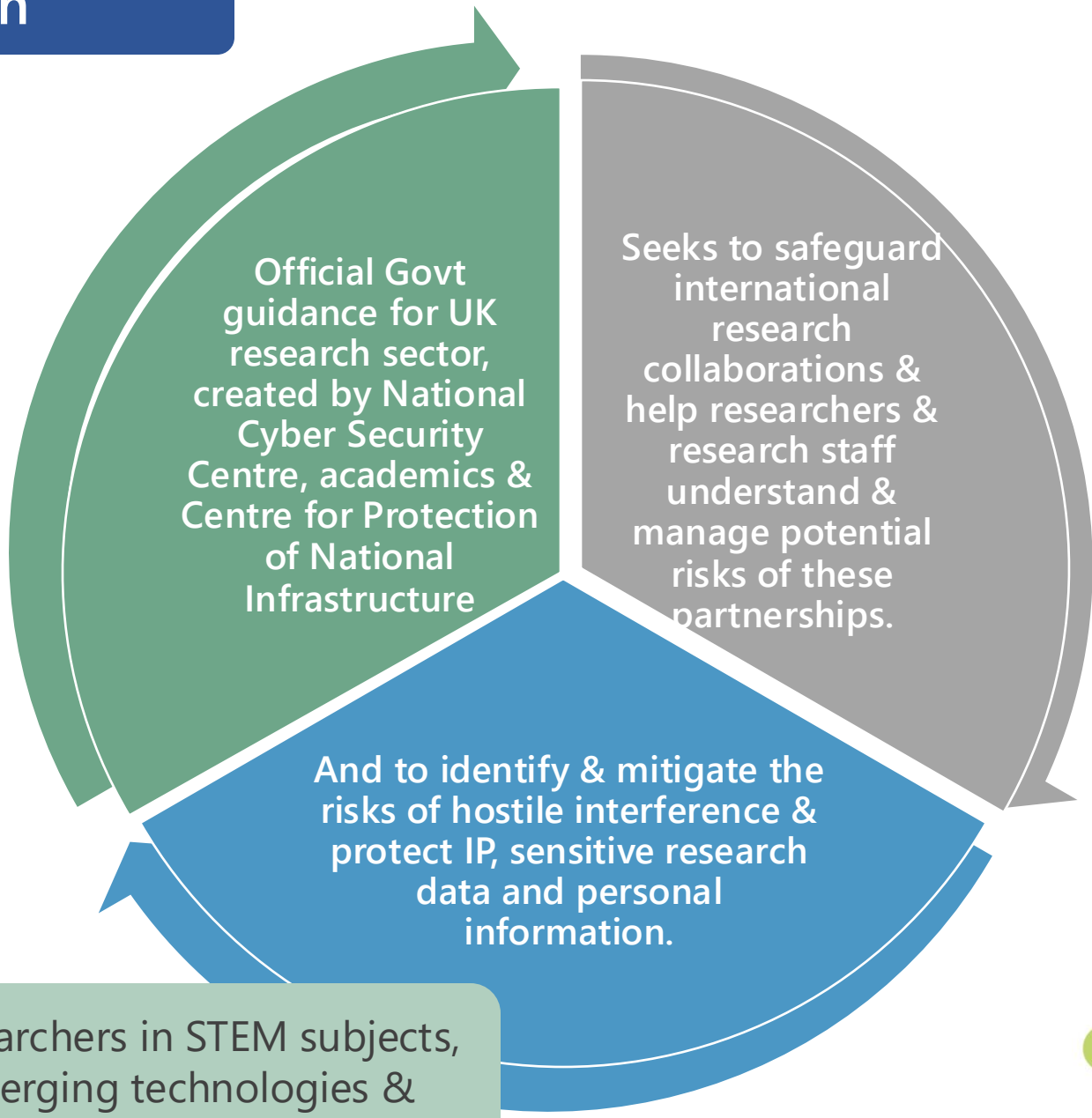
Trusted research



Particularly relevant to: researchers in STEM subjects, dual-use technologies, emerging technologies & commercially sensitive research areas.

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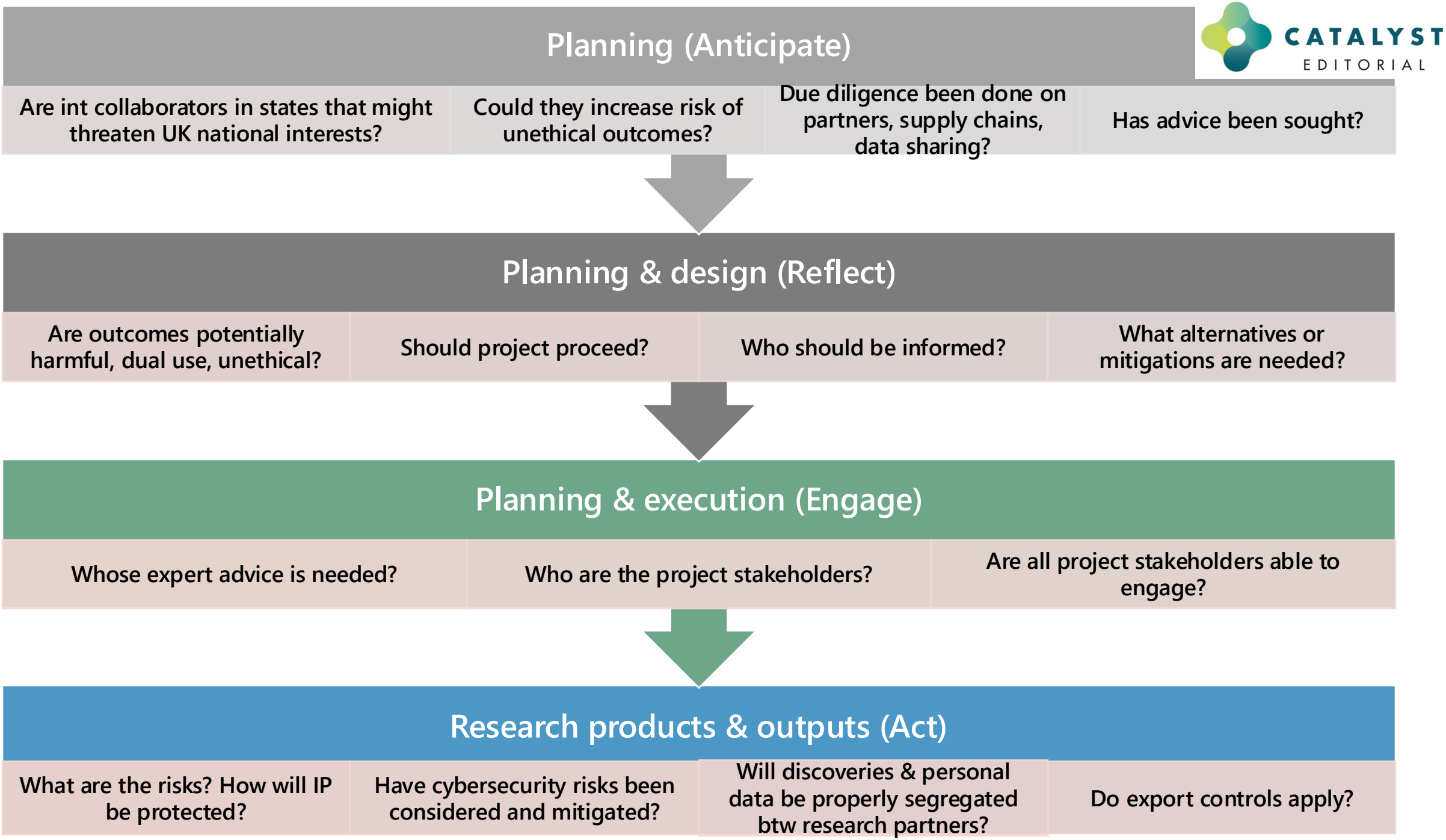
Planning (Anticipate)
Are int collaborators in states that might threaten UK national interests?
Could they increase risk of unethical outcomes?
Due diligence been done on partners, supply chains, data sharing?
Has advice been sought?
Planning & design (Reflect)
Are outcomes potentially harmful, dual use, unethical?
Should project proceed?
Who should be informed?
What alternatives or mitigations are needed?
Planning & execution (Engage)
Whose expert advice is needed?
Who are the project stakeholders?
Are all project stakeholders able to engage?
Research products & outputs (Act)
What are the risks? How will IP be protected?
Have cybersecurity risks been considered and mitigated?
Will discoveries & personal data be properly segregated btw research partners?
Do export controls apply?

The benefits of RRI

RRI helps to produce higher quality research of societal value

- By anticipating potential harms of innovative research
- By emphasizing importance of social responsibility
- By refining research question, motivations and process through dialogue

RRI builds public trust in innovative research

- By anticipating & avoiding/mitigating harms & impacts
- By including the public in the research process
- Thru focus on social responsibility & environmental sustainability

RRI improves the research process

- By encouraging interdisciplinary collaboration and knowledge exchange
- By refining research question and process through engagement
- By enabling a range of core frameworks to be addressed

RRI strengthens researchers' skills and reputation

- For conducting innovative, socially responsible research
- By being inclusive & co-producing research
- By expanding skills, network of collaborators & via knowledge exchange

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‘**Exploring Responsible Innovation can sometimes be tricky: it may not always be immediately obvious how your individual research relates to the different dimensions of Responsible Innovation;**

- some of the conclusions may be uncomfortable, and
- the open and anticipatory approach to thinking about your research can be daunting in its complexity and magnitude.

However, these challenges are precisely what helps to improve your research; it initiates an on-going process of reflection that helps you to do work that is more ethical, meaningful and relevant to the ‘real world’.’

Mari-Rose Kennedy, Research Associate, Centre for Ethics in Medicine, Bristol Medical School, University of Bristol
https://www.bristol.ac.uk/media-library/sites/public-engagement/documents/new/Creative%20Conversations_toolkit.pdf

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RRI provides us with a means by which to find an appropriate balance between innovation and precaution. It enables us to plan and conduct innovative research that meets the needs society, in the best interests of society, in ways that are ethical, sustainable, inclusive and rigorous.
At its core, it uses reflection and engagement to inform decisions and actions.

Blog post: https://catalyst-editorial.co.uk/blog/9qpsjze8zahp7yg24ir53ksztk8q23

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Where to find additional RRI resources

Alan Turing Institute video on RRI
https://alan-turing-institute.github.io/turing-commons/skills-tracks/rri/
RRI Tools: https://rri-tools.eu/
RRI-related training resources from ORBiT (Observatory for Responsible Research and Innovation in ICT):
https://www.orbit.org

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Thank you for joining today's webinar

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Any questions?

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