Going beyond the status quo?
A roadmap to innovate responsibly

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KI-SIGS Workshop – 04 February 2022

Agenda

- Background
  - Technology Assessment (TA)
  - Responsible Research and Innovation (RRI)
  - Responsible Innovation (RI)

- How to implement RRI in practice?
  - The PRISMA Project
  - Responsibility-by-Design: a new pre-standard

- Relevance of RRI

Background: TA

- **Development of TA**
  - 1950s: Emergence of think tanks in the USA (e.g. Rand Corporation - scenario technique / thinking in alternatives)
  - 1966: Concept of TA in a U.S. Congressional Record
  - 1972: Foundation of the Office of Technology Assessment in Washington (OTA)
  - 1980s: Emergence of parliamentary TA in Europe
    - 1990 - Office of Technology Assessment at the German Bundestag (TAB)
    - 1990s - European Parliamentary Technology Assessment Network (EPTA)
  - 1995: Closure of the OTA
  - 2004: Foundation of the TA Network (*Netzwerk TA*)
  - 2005: European Technology Assessment Group (ETAG)
  - 2010 → : broader recognition of the term "Technology Assessment" (e.g.) acatech - National Academy of Science and Engineering

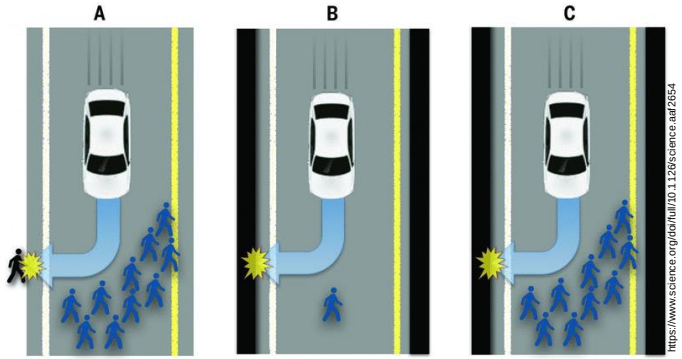
- **TA community today**
  - TA network (German-speaking area): approx. 300 personal and approx. 50 institutional members
  - EPTA - 25 members
  - Consultation of the European Parliament – ETAG (8 members)
  - Foundation of a "Global TA" network in 2019 (31 members)

Background: TA

- **Origin and motivation of Technology Assessment (TA)**
  - Social conflicts regarding technology
  - Decision-makers are overwhelmed by complexity and conflicting experts and reports

https://voxeurop.eu/en/anti-nuke-movement-mustnt-go-ballistic/

➢ Needs orientation of TA from the beginning



Background: TA

- **Main objectives of TA:**
  - Provide prospective knowledge about (possible/probable …) consequences of technologies
  - Take into account non-intended impacts
  - Assess risks and chances as early as possible and help balancing
  - Contribute to solving conflicts on technologies constructively
  - Help shaping technology for societal goals, e.g. for sustainable development
  - Involve stakeholders and civil society, and support public debate by participation and communication

➢ Related notions: impact assessment, technology foresight, technology futures assessment, ELSI studies (ethical, legal, social implications), RRI (responsible research and innovation), ….

Background: Conceptual dimensions of TA

Approaches

- Technology development is addressed in ***constructive TA (CTA)***, an approach for bringing feedback of TA activities into the actual construction of technology, but also in ***Participatory TA (pTA)*****,** which involves diverse social actors from academia, business, law, education, etc. It calls first and foremost for the engagement and involvement of users and social actors (citizens) in its procedures.

- **Demand pull** vs technology push

  - **Anticipation** ➔ gain knowledge about possible, plausible or probable developments in connection with new technologies → ELSI
    ➔ addresses the dimension of time: enhancing reflexivity over time (foresight, scenarios, consequentialist mode of operation, hermeneutic extension)

  - **Inclusion** of different perspectives ➔ increase the **social legitimacy** of the outcomes (User-/Human centred design (design value) / Participatory Design)
    ➔ Enhancing **reflexivity** over relevance (dimensions of consequences to be considered, perspectives to be included …)

Background: From TA to RRI

Different orientations towards **responsibility**
Different approaches to **innovation**

» A new attempt for science-society integration:

Need to take a broader, more complex approach to responsibility, not centered on the management of technological innovations per se (valued in accordance with “objectivity”), but rather on the “**whole innovation process**”.

Background: RRI

- Responsible Research and Innovation (RRI)
  - Policy-driven discourse that emerged from the European Commission (EC)
  - At a high level it aims to foster the design of inclusive and sustainable research and innovation, with an emphasis on co-creation and co-production with society ('science with and for society').
  - Strives to align research and innovation to the values, needs and expectations of society.

*"**RRI** is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process."* (von Schomberg, EC: 2011)

Required:
- Stakeholder commitment to socially desirable objectives

Background: RRI

- A normative framework for RRI

RRI KEYS

ETHICS
Ensuring research integrity, and science & society

GENDER EQUALITY
Promoting human resources in research for attaining gender balance

GOVERNANCE
Providing instruments to foster shared responsibility in R&I practices

OPEN ACCESS
Guaranteeing access to scientific knowledge to boost R&I

PUBLIC ENGAGEMENT
Fostering collaborative and multi-actor processes in R&I

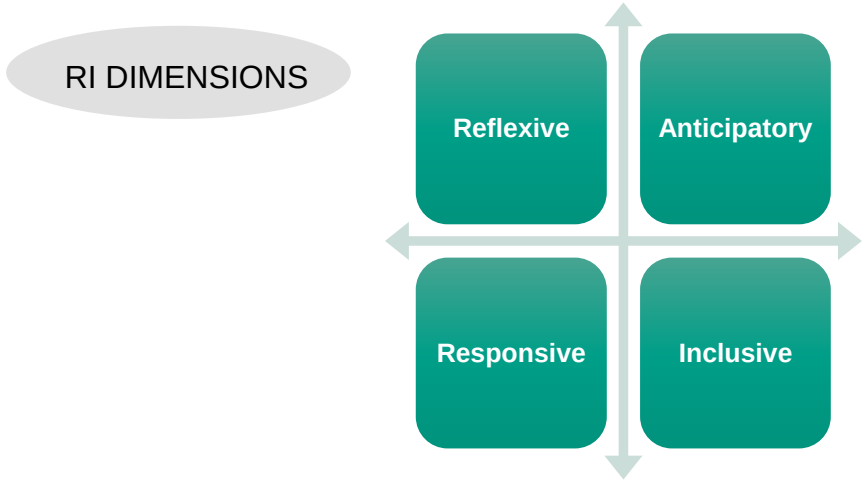
SCIENCE EDUCATION
Increasing the knowledge and skills of citizens in order to promote scientific vocations and participation

From RRI Tools Webiste

Background: RI

- Responsible Innovation (RI)
  - Emerged largely from academic roots
  - Critics EC policy keys by considering them as representing isolated themes rather than a coherent discourse. In addition, do not substantively engage with innovation, or innovation systems.
  - Strives for innovation, that is more anticipatory, more reflexive, more inclusive, deliberative, open and, in total, more responsive.

*"**RI** means taking care of the future through collective stewardship of science and innovation in the present".*
(Stilgoe 2013)



Background: RI

- The process dimensions in depth – added value

Diversity and Inclusion means **early involvement** of a wide range of of actors and publics in R&I practice, deliberation, and decision-making **to yield more useful and higher quality knowledge**.

Strengthens democracy and broadens sources of expertise, disciplines and perspectives.

Anticipation and Reflection means to **envision impacts** and **reflect on the underlying assumptions**, values, and purposes **to better understand how R&I shapes the future**.

Produces valuable insights and increases our capacity to act on what we know.

Openness and Transparency means **to communicate** in a balanced, meaningful way methods, results, conclusions, and implications **to enable public scrutiny and dialogue**.

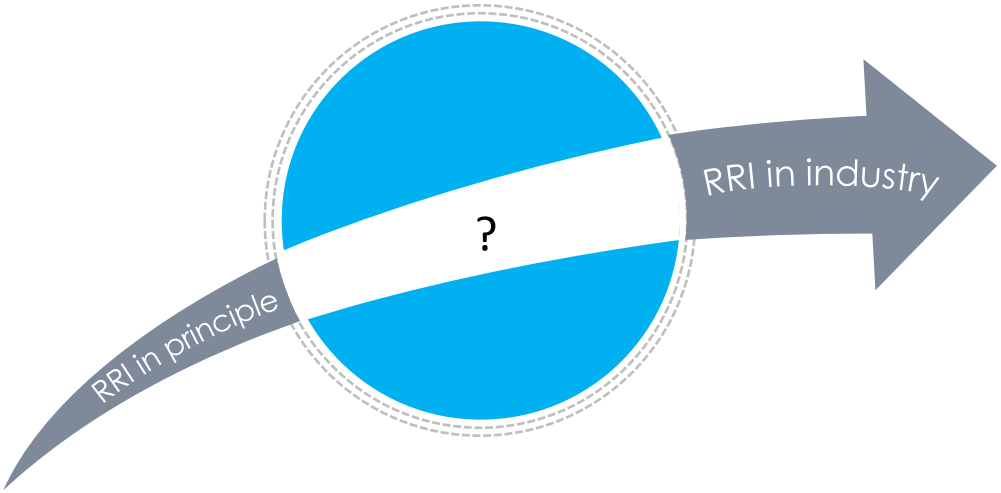
Benefits the visibility and understanding of R&I.

Responsiveness and Adaptive Change means to be able to **modify modes of thought and behaviour**, overarching organizational structures, **in response to changing circumstances**, knowledge, and perspectives.

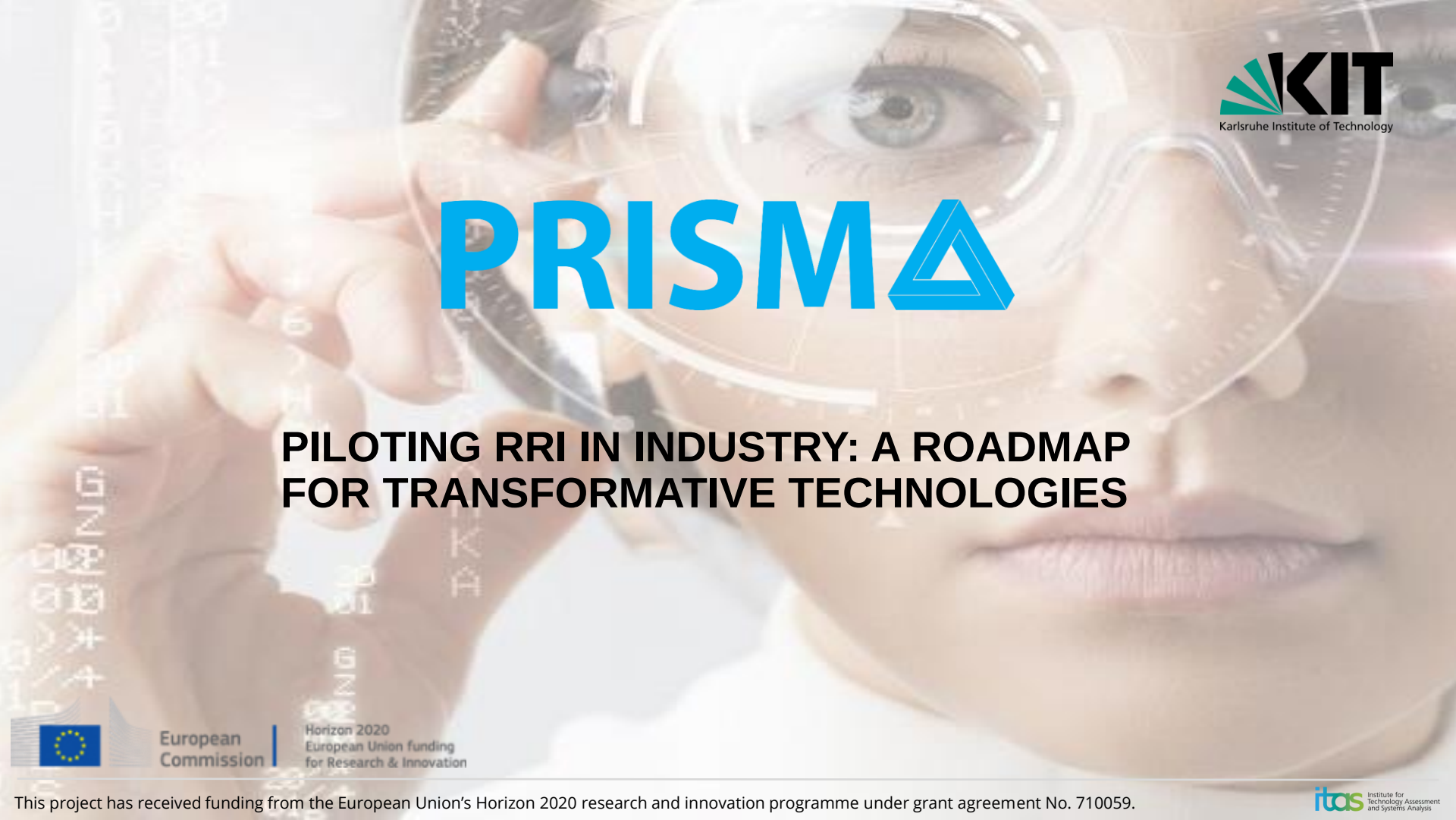
Aligns action with the needs expressed by stakeholders and publics.

From RRI Tools Webiste

How to implement RRI in practice?



Responsibility by Design: a new pre-standard



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PRISMA

PILOTING RRI IN INDUSTRY: A ROADMAP FOR TRANSFORMATIVE TECHNOLOGIES

European Commission

Horizon 2020
European Union funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 710059.

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PRISMA 2016-2019

Funded by
the European Union

Call: ‘How the RRI approach, in particular the opening up of the innovation process to social actors, can improve the development process and the quality of the final outcomes of research.’

Main Objectives:

- **Integration of RRI in the CSR policies** of 8 companies in the field of transformative technologies;
- **Providing evidence** on how the RRI approach and attention for the gender dimension can improve the innovation process and its outcomes;
- The **development and testing of a roadmap** that helps industries to implement RRI in their innovation processes as part of their CSR policy in order to deal with uncertain and sometimes partly unknown risks and public and ethical concerns of transformative technologies;
- Broad uptake of this roadmap by companies through, industry associations, CSR and branch organizations as well as governments and CSOs.

Funded by the European Union

HOW?

- 8 **RRI pilots** - demonstrate how industry and societal actors can work productively together according to an RRI approach - practical evidence of the benefits for industry to follow up on similar paths.

- Different actors: industry, research and civil society → test out – evaluate – improve

- Starting from current Corporate Social Responsibility (CSR) initiatives in industry → broaden these with stakeholder engagement

- Disseminate a roadmap for implementing RRI in industry.

Funded by the European Union

PRISMA PILOTS

HUB OF ALL THINGS (HAT)

BISIGODOS

COLOROBBIA

ARCHA SRL & TECHA SRL

RDM GROUP

SPECTRO BV

EVOLVA

AERIALTRONICS

Technology	Pilot companies
Nanotechnology	2 Companies (Italy)
Synthetic biology	3 Companies (Belgium, UK, US)
Automated vehicles	2 Companies (UK, Netherlands)
Internet of Things	1 Company (UK)

Funded by
the European Union

Standardization happens at different levels

National

European

International

A European Standard is...

- A technical document **adopted by a recognized standardisation body** for repeated or continuous application
- Produced by **all interested parties (stakeholders!)** through a transparent, open and **consensus-based process ....**
- **Voluntary** in use
- **Market driven tool for** competitiveness of **European companies** and for the benefit of **society**
- A tool to underpin **EU legislation** and **EU policy**

What is a CWA?

- The **CEN Workshop Agreement** (**CWA**) is a **technical agreement**, developed by a Workshop, which reflects the agreement of registered workshop participants responsible for its content
- Document designed to meet an **immediate need**
- Developed in accordance with CEN rules and practices
  - Used for:
    - Emerging or rapidly-changing technologies
    - **Output of Research Projects**
    - As try-out before the development of ENs

CWA 17796: Responsability-by-design

Scope: provides **guidelines to develop long-term strategies (roadmaps) for innovating responsibly**, thereby helping organizations to achieve socially desirable outcomes from their innovation processes. These roadmaps encourage a "responsibility-by-design" approach that integrates considerations of technical, ethical, social, environmental, and economic aspects all along the research, development, and design process leading to an innovation.

Target: addressed to **all organisations/agents involved in planning and performing research and innovation and technological development**. The focus is on transformative/enabling technologies

(note: this in principle might even go beyond industry)

The CWA 17796 management system for responsible innovation in industry

Easier to be integrated with existing procedures

Principles and terminology already known by companies

Involving specific company functions

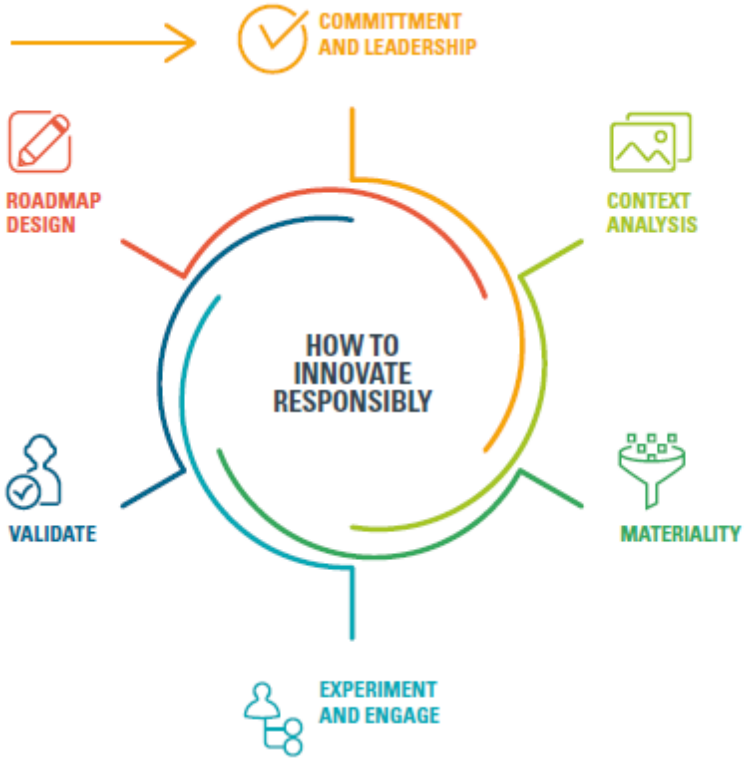
- Aligned with the **ISO High Level Structure** for management systems (e.g. ISO 9001 and ISO 56000)
- Built on experiences on **social responsibility, risk** (ISO26000, ISO 31000)
- Potentially to be integrated into the CEN and UNI work **innovation management**
- Looking at the whole **R&I value chain**

Principles for implementing RRI

Reflection & Anticipation	Integrate analysis of ethical, legal, and social impacts (ELSI) from the earliest stages of product conception and product development
Inclusion	Promote stakeholder engagement and involve stakeholders from the quadruple helix to inform all phases of product development and ensure that research and innovation activities are societally relevant and desirable
Responsiveness	Integrate monitoring, learning, and adaptive mechanisms to address public and social values and normative principles in product development

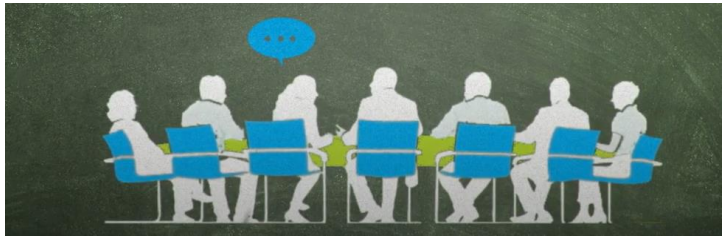
These actions are considered by the CWA as
minimum requirements for RRI uptake at company level

CWA 17796 - Overall approach and steps leading to the defining of an RRI roadmap

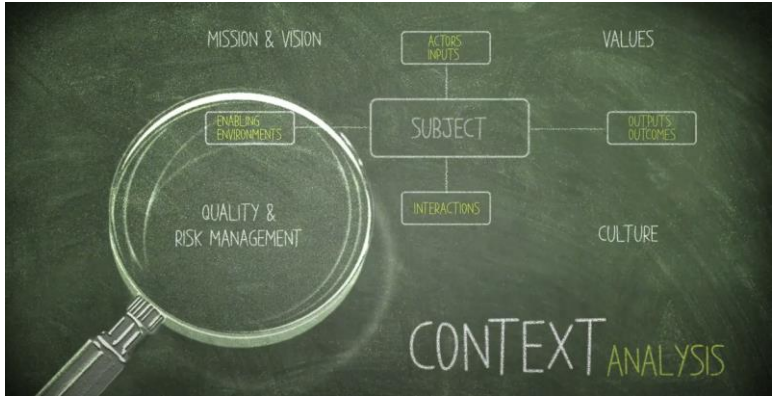


The CWA 17796 proposes a case by case, company specific and expert-driven approach to RRI uptake, to deal with differences in sectors, companies, and tech

- **Ensure endorsement of the organization moving towards RRI values and approach**
  - Top management commitment is necessary but not sufficient to achieve RRI's intended outcomes, as the **top-down approach** should be integrated with a **bottom-up approach**, involving other roles providing leadership.
  - Ensuring that an RRI roadmap, related actions, objectives, and vision are established and are **compatible with the organization's** values, identity, and stakeholders
  - Ensuring that the **resources** needed for both the roadmap design and its future implementation are available (including in the long term)



- **Analyse the organization and the R&I product(s) and technologies.**



Box 2: Model of a questionnaire to compile information for the context analysis

Facts and figures:

- Field of activity
- Company ownership
- Organization size
- Date established
- Trade organization membership

Type of organization:

- Organizational structure
- Business model
- Organizational culture
- Gender balance and gender/diversity policy (focus on R&I)

R&D and innovation function:

- Size
- Relevance for the organization
- Type of research activity
- Diversity of personnel (e.g., age, education, gender, home country)
- R&I role compared to the organization's CSR strategy
- Innovation management model

Experience with CSR and RRI:

- CSR, sustainability, risk, and quality strategies
- Responsibilities within the organization
- Experience with stakeholder engagement

Case description:

- Project description
- Technologies
- Regulatory regimes
- Type of R&I activities
- Type of business
- Time to market

MATERIALITY

- Identify and prioritize drivers and challenges for RRI, risks and barriers to overcome, stakeholders to work with, significant RRI actions to pursue

- Identify ethical, social, and legal impacts of the product and stakeholders of the product innovation ecosystem

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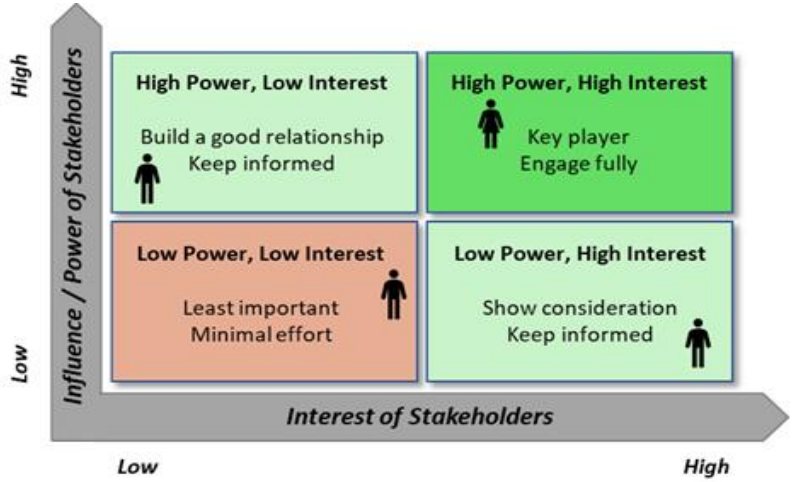
REFLECTION & ANTICIPATION actions for integrating analysis of ethical, legal, and social impacts (ELSI) throughout all stages of product development

Include RRI principles in company's mission and vision, include reflection on creating shared value
Set specific targets in R&I strategies in order to provide solutions for sustainable development goals
Conduct ethical analysis and ethics impact assessment through foresight, scenario analysis, social phenomena, trends evaluation, etc.
Design for values; stakeholder and value inventories/scenarios (values hierarchy, conflicting values, etc.)
Hold internal meetings with R&D personnel to reflect on ethical issues and promote internal knowledge transfer

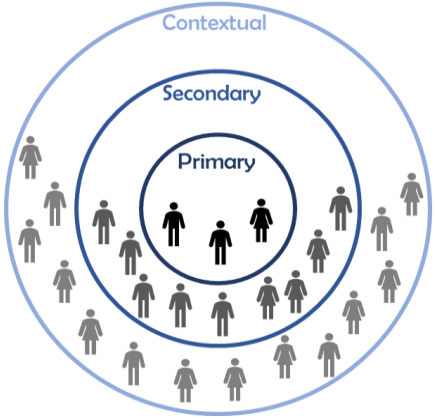
INCLUSION actions for stakeholder engagement that inform all phases of product development

Set and implement a communication and dialogue strategy on ELSI
Set and implement an internal platform that promotes a culture of internal knowledge exchange (including reflection on company values)
Work with business and social actors (e.g., civil society organizations, NGOs, and citizens) sharing values and creating positive ethical networks
Co-design product through dialogue with policy actors, authorities, and normative bodies (EU, regional, and local)
Organize public dialogues, build/use public platforms for expressing needs and concerns

- Perform exploratory/pilot RRI actions, engaging with stakeholders to inform the RRI roadmap

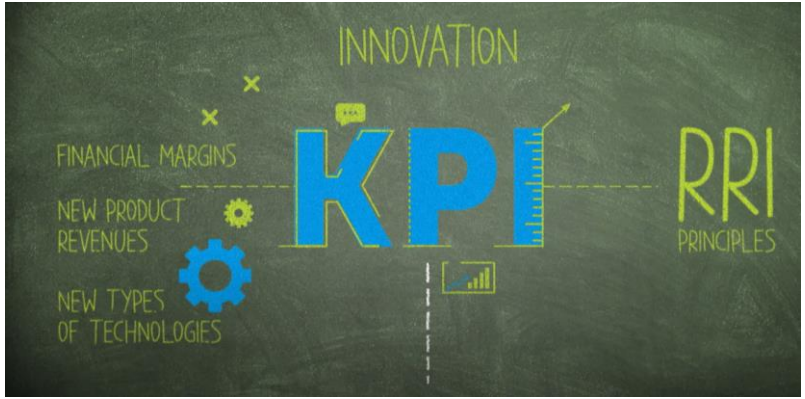


Example of the Interest/Influence grid



The ring stakeholder map

- Evaluate impact on both the product development and the organization (key performance indicators)



- develop tailor-made indicators for both the organization or business side and for RRI:

The benefit of monitoring KPIs is that different projects within the company can compare.

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Key Performance Indicators – Impact on the organization (Examples)

1. Awareness of public and social values
2. Awareness of ethical issues of innovations
3. Integration of public and social values into company innovations
4. Anticipation of social effects in the company innovations
5. Stakeholder engagement
6. Diversity and gender equality
7. Transparency and accountability about RRI-relevant choices
8. Learning mechanisms to address public and social values in product development
9. Capacity to align to societal goals
10. Active monitoring of RRI impacts
11. Outcome-focused measures (backward- and forward-looking)

	Item	RRI KPIs	Examples of quantitative parameters to measure KPIs
Anticipation & Reflection	1	Awareness of moral values	- Nr. of training sessions/meetings per year to learn and reflect on moral values connected to innovation strategy and core business
	2	Awareness of ethical issues of innovations	- Nr. of training sessions/meetings per year aiming to reflect on integration of social and ethical values into specific R&I/R&D projects
	3	Does the company embed moral values in its innovations?	- RRI principles formally integrated into the company's mission and vision (e.g. ethical code of conduct)
			- Nr. of R&I/R&D projects per year where moral values are actively and included into innovation strategies and technological design
	4	Does the company (actively) anticipate social effects of its innovations?	- Nr. of R&I/R&D projects per year where internal/external stakeholders were involved from the early stages in product development
			- Nr. of consultancy initiatives with other innovators and external advisors to discuss and identify social impacts of R&I/R&D projects
Inclusiveness	5	Stakeholder engagement	- Nr. of stakeholder engagement initiatives organized per year by the company
			- Nr. of R&I/R&D projects per year where active stakeholder engagement is foreseen into R&I/R&D plans
			- Nr. of R&I/R&D projects per year where engagement with end-users has been performed
	6	Gender Diversity	- Percentage of men and women involved in R&I/R&D function/teams in the company
Responsiveness	7	Transparency and accountability about RRI-relevant choices	- Formal communication strategy established at company level to ensure most relevant RRI choices are explained in key company documents and/or the website
			- Nr. of patents per year aiming to integrate non-financial values
			- Nr. of open access publications
			- Nr. of events or webpages or channels in social media (or similar) disseminating project results to the general public
	8	Learning mechanisms to address public and social values in product development	- Nr. of user-centered approaches per year formally integrated into the company innovation model (e.g. user-centered design, co-creation)
			- Nr. of user experience tools per year carried-out to respond (new) societal demands and developments
	9	Capacity to align to societal goals	- Nr. of R&I/R&D projects per year addressing socially/ethically-oriented products/services
	10	Active monitoring of RRI impacts	- Percentage of R&I/R&D projects per year that apply impact analysis strategies (e.g. risk management, ethical/social impact analysis, etc.)
			- Formal external auditing procedures (at least yearly basis) in place to monitor non-financial values of the company

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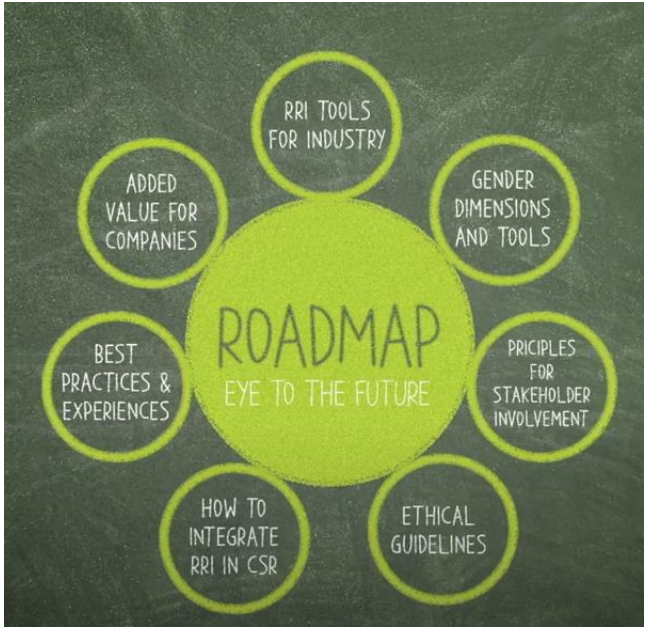
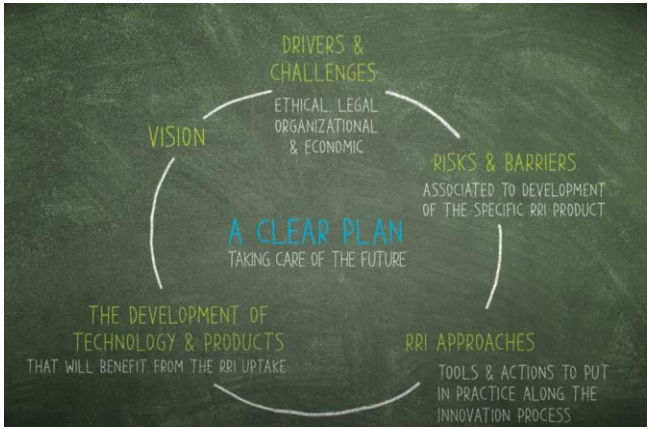
ROADMAP DESIGN

- Consolidate and visualize the long-term RRI strategy, covering the entire R&I value chain (time to market) and product life cycle



ROADMAP DESIGN



Box 5: Template of documented information to be provided on the RRI roadmap

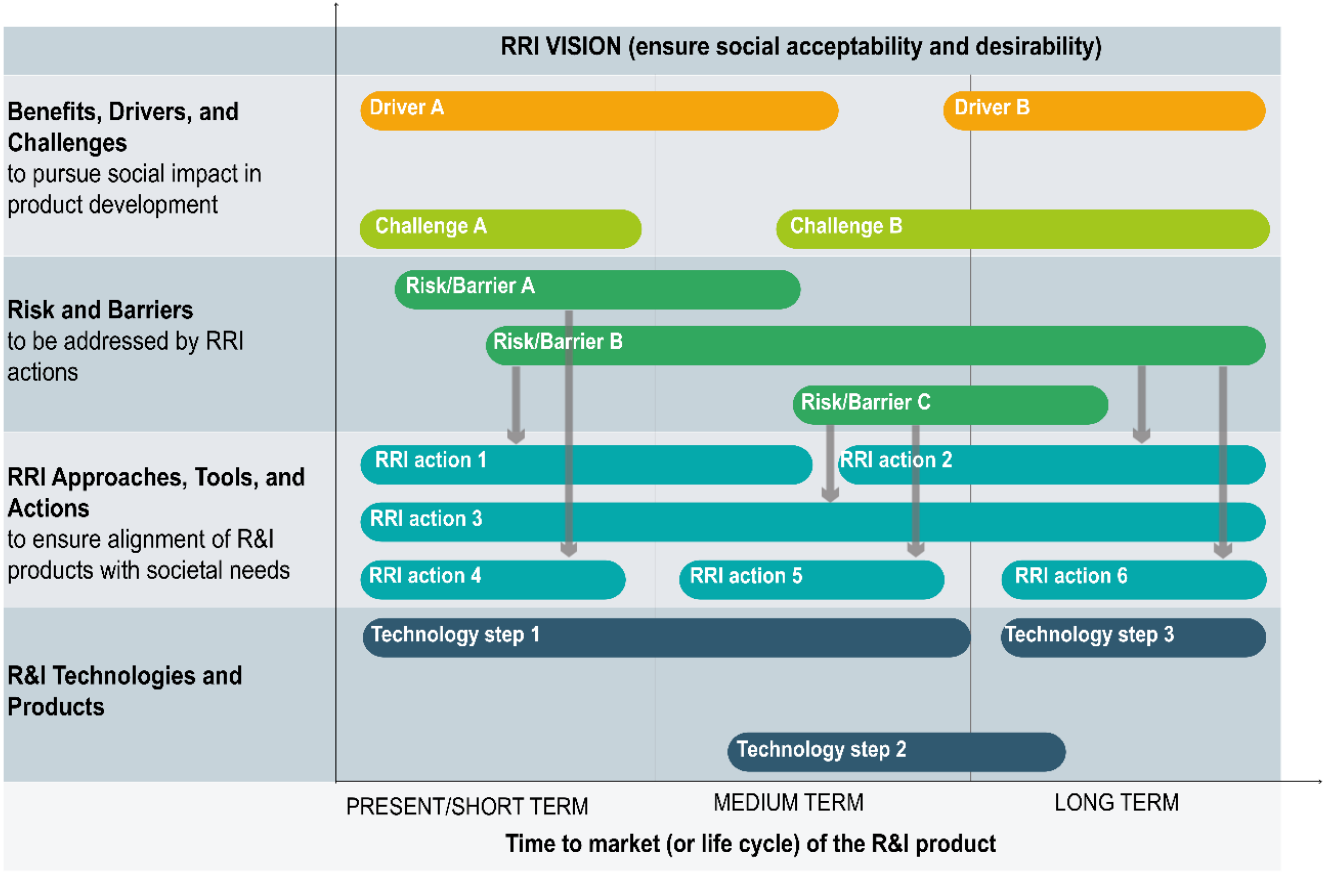
Case description

- The company
- RRI commitment
  - Functions of the organization endorsing the roadmap
  - Motivation to implement the roadmap
- Context
  - Size and ownership of the organization
  - Date of establishment, country
  - RRI product selected
  - Technologies
  - Regulatory regimes relevant for the RRI product (both current and emerging/future)
  - Type of R&I activities
  - Type of business
  - Time to market
  - CSR policies
  - Gender and diversity (of societal and behavioural roles) in R&D/R&I
  - RRI maturity level
- Materiality & experimentation
  - Significant stakeholders
  - Significant ethical, social, and legal impacts
- Validation aspects
  - Criteria to evaluate impact of RRI actions on the RRI product
  - Key performance indicators to monitor RRI aspects within the organization

RRI roadmap

- RRI vision
- R&I technologies and products
- Benefits, drivers, and challenges for RRI
- Risks and barriers to be addressed by RRI actions
- RRI actions
- Roadmap design

ROADMAP DESIGN



Spectro – company

- Manufacturer of cleaning detergents for professional use
- Dutch company
- Family-owned, since 1986
- SME with about 50 employees
- R&D department: 4 people and one trainee
- Pilot was endorsed by by both the CEO and the R&D manager
- Lot of attention for CSR, in particular sustainability
- Spectro's ambition is to become an European player in the area of sustainable cleaning agents

Spectro – Pilot

Super concentrated cleaning agents in combination with the very first intelligent and energy neutral dispenser for detergents in the world.

- Entrepreneurial challenge
  - Spectro is not yet a big player in hospital cleaning
  - Market is not easy to enter
  - How to win trust and acceptance

Spectro – Pilot

- Transformation to producer of cleaning technology:
  - A broader range of ethical and social issues than sustainability becomes important, in particular privacy and security
  - More attention for innovation process: RRI
  - Increased need for stakeholder involvement
    - Will clients and other stakeholders accept innovation?
    - Is market and society ready for it? Is it a desirable development?

Motivation for RRI: respecting public values and avoiding ethical problems, ensuring acceptance of innovation by stakeholders, increasing market share though adding societal value

Spectro – Pilot: RRI activities

Materiality and experimentation

- Inventory of key stakeholders
  - cleaning products distributors; cleaning personnel; healthcare personnel; patients (and relatives); hospitals cleaning departments, purchase units, logistics departments, directions, expert infection prevention; health inspection; ministry of health
- Identification of ethical, legal and social issues
  - public/patient health and hygiene, sustainability, privacy, security, transparency (of data collection), autonomy (of cleaning personnel), reliability and trust
- Development of value scenarios
  - short hypothetical stories about (unexpected) use that help to reveal relevant values and potential value conflicts

Scenario 1

The new soap dispenser is taken into use in hospital X.

The staff of cleaning company Y finds out that data is being stored from the soap dispenser. The story among the cleaning staff is that the system stores how well they do their job. It is speculated that if people do not perform well, this is told to their supervisors and that even dismissal can follow.

A few weeks later, an employee of company Y is fired for unclear reasons. Soon the stories are summed up and the staff tries to destroy the soap dispensers.

Spectro – Pilot: RRI activities

Potential value conflicts

- Hygiene may conflict with autonomy of cleaning personnel:
  - Better hygiene may require a change in cleaning habits
  - Data collection and sharing may improve cleaning but feel as a loss of autonomy for cleaning personnel
- Hygiene may conflict with trust:
  - Of clients (hospitals): if data is shared for example with health inspection
  - Of cleaning personnel: if they feel data is used to control them and is shared beyond their control
- Hygiene may conflict with privacy:
  - Data collection and analysis can contribute to hygiene but may also lead to a loss of privacy

Spectro – Pilot: RRI activities

Validation aspects (key performance indicators)

- 6 most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions
  - Q1.1: Inspire technological innovation
  - Q2.2: Product safety
  - Q2.3: Product environmental sustainability
  - Q2.6: Address user's needs and rights' (e.g. privacy, data ownership, etc.)
  - Q3.1: Competitive advantage
  - Q3.4: Customer satisfaction, meeting new consumers' needs or requests
  - Q4.5: Risk management
  - Q5.1: Product cost
  - Q5.3: Market penetration

Spectro – Pilot: RRI activities

RRI Roadmap

- RRI VISION:
  - To develop new cleaning technologies that contribute to public health and hygiene (and respect other relevant values) and offers Spectro the possibility to increase market share.

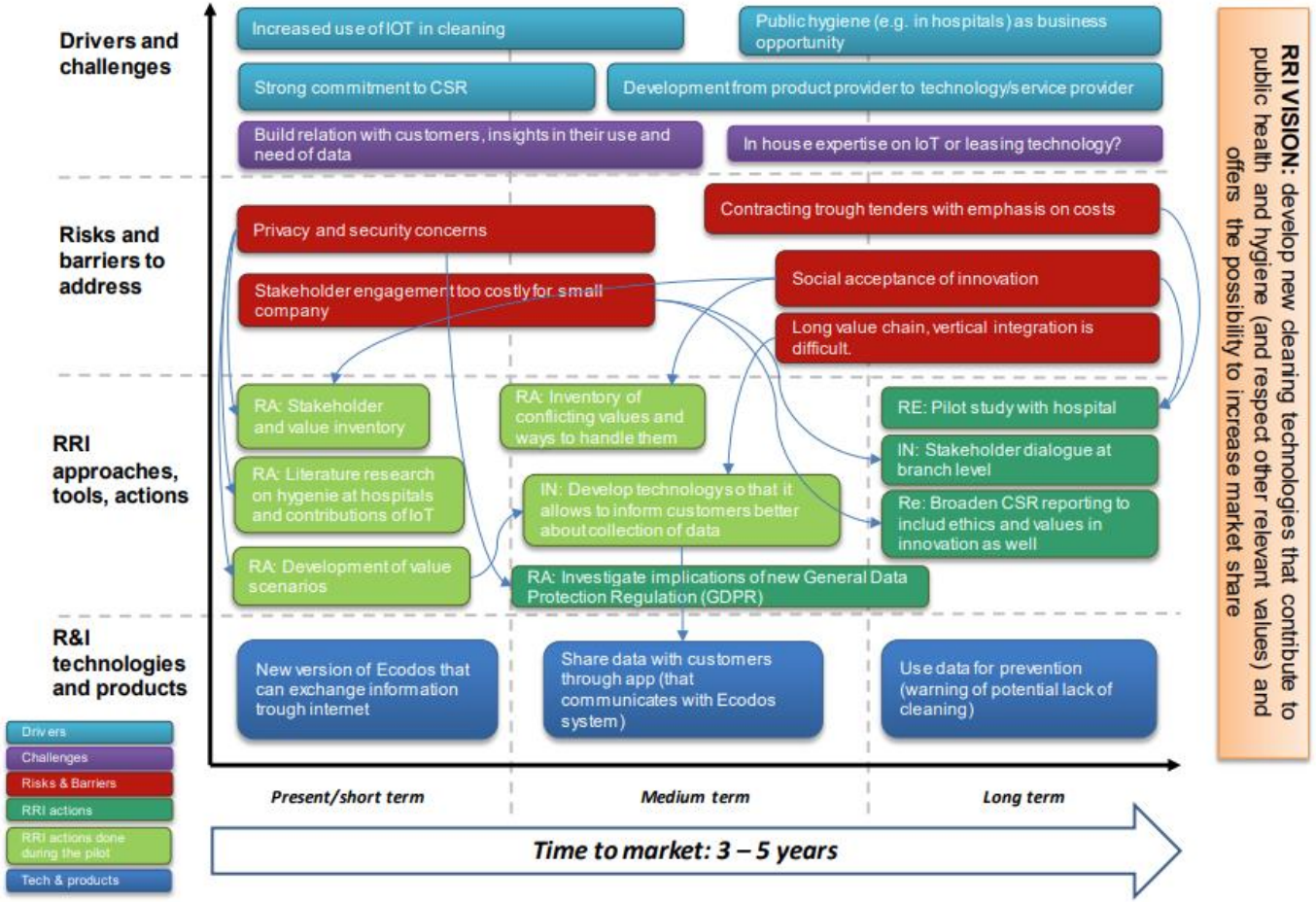


Figure 4 Spectro, PRISMA RRI roadmap

Relevance of RRI

	STRENGTHS	WEAKNESSES
Internal origin	• Create value • Motivate workers • Offer competitive advantage • Strengthen relations with all stakeholders • Increase trust among stakeholders • Increase the social value/impact of R&D • Strengthen quality of innovation at industrial level • Ensure compliance with qualified norms and standards • Identify new market needs • Potential to communicate benefits and risks of products • Increase transparency in product development	• Limited awareness and skills on the RRI concept • Additional bureaucratic burden, lack of resources (particularly for SMEs) • Low perception of tangible impact on product development • Lack of integration of RRI across the company functions • Internal boycott from some functions in the company • Difficulties in measuring associated costs • Adding excessive extra costs to product development • Intellectual Property Rights • Misuse of the concept (checkbox exercise)

Relevance of RRI

	OPPORTUNITIES	THREATS
External origin	• Improve product quality, desirability and acceptability • Improve product sustainability, safety and reliability • Increase customer satisfaction • Improve effect on quality of life and health of customers – by addressing existing social needs • Improve efficiency (e.g. use of resources, decision-making process) and cost reduction on a medium/long term • build corporate image and reputation • Improve market penetration, profit • Facilitate the access to financial support	• Difficulties in engaging with stakeholders • Possible slowdown or even premature stop of innovation • Few practical examples available from industry (case studies, applications) • Lack of engagement along the value and supply chain • Lack of endorsement by partners and suppliers • Seen by stakeholders as a "window dressing" exercise • Lack of incentives (at policy and regulatory level)

Final reflections

- RRI: *From science in and for society* ⟶ *to science* ***for and with society***
- **From ex-post to ex-ante approaches:** the RRI focus on impacts during the R&I process (*ex-ante*), could complement CSR/CSV initiatives
- RRI shares with risk & innovation management practices the need **to cope (and take advantage) of uncertainties**
- **Help to recognize "de facto" RRI actions** already integrated in several companies
- **Address need for context-sensitive** (sector, technology, type of company and business), **and long term planning approaches**, to deal with tangible and intangible, short and long-term impacts

A change in the culture of the organization and a strategic approach are needed

Thank you!

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PRISMA Project: