PRISMA



PRISMA Pilots: RRI Roadmaps

The PRISMA Roadmap to integrate Responsible Research and Innovation in industrial strategies

CASE STUDIES

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The PRISMA Roadmap to integrate Responsible Research and Innovation in industrial strategies

CASE STUDIES

PRISMA

PRISMA

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INTRODUCTION

The overarching goal of the PRISMA project was to help companies implement Responsible Research and Innovation (RRI) in their innovation and social responsibility strategies, and to provide evidence on how RRI can improve their innovation processes and products and help companies to gain trust from society and build resilience, thus strengthening their position on the market.

The PRISMA project worked for two years with eight pilot companies, exploring and experimenting RRI methods, tools and actions in specific Research and Innovation (R&I) projects on transformative technologies, including in particular nanotechnologies, biotechnologies, the Internet of Things and autonomous vehicles.

The companies involved were active in different technologies and sectors, and included small and medium companies, public-private partnerships and a cooperative R&I project.

During the pilot, the PRISMA partners have supported the companies in implementing RRI actions adopting two different strategies. By providing external advice and consultancy to the company during the design of its specific RRI roadmap and by having an embedded ethicist within the company co-operating with the different organization's functions. Cornerstones of this action were:

- Performing ethical analysis, to reflect on Ethical, Legal, Societal implications (ELSI) of the R&I project
- Realizing awareness-raising and training initiatives for R&I personnel
- Design for values, value scenarios to inform R&I products design
- Advising on implementation of RRI and CSR tools and methodologies
- Organizing dialogues and co-creation initiatives with stakeholders
- Engaging with business partners to address RRI aspects

Based on this experience, eight "RRI roadmaps" have been developed, aiming to help these companies to implement RRI in their innovation processes, in order to deal with uncertain and sometimes partly unknown risks (anticipate), inform product development by dialogue with stakeholders (inclusion and reflection), and address public and ethical concerns of transformative technologies (responsiveness).

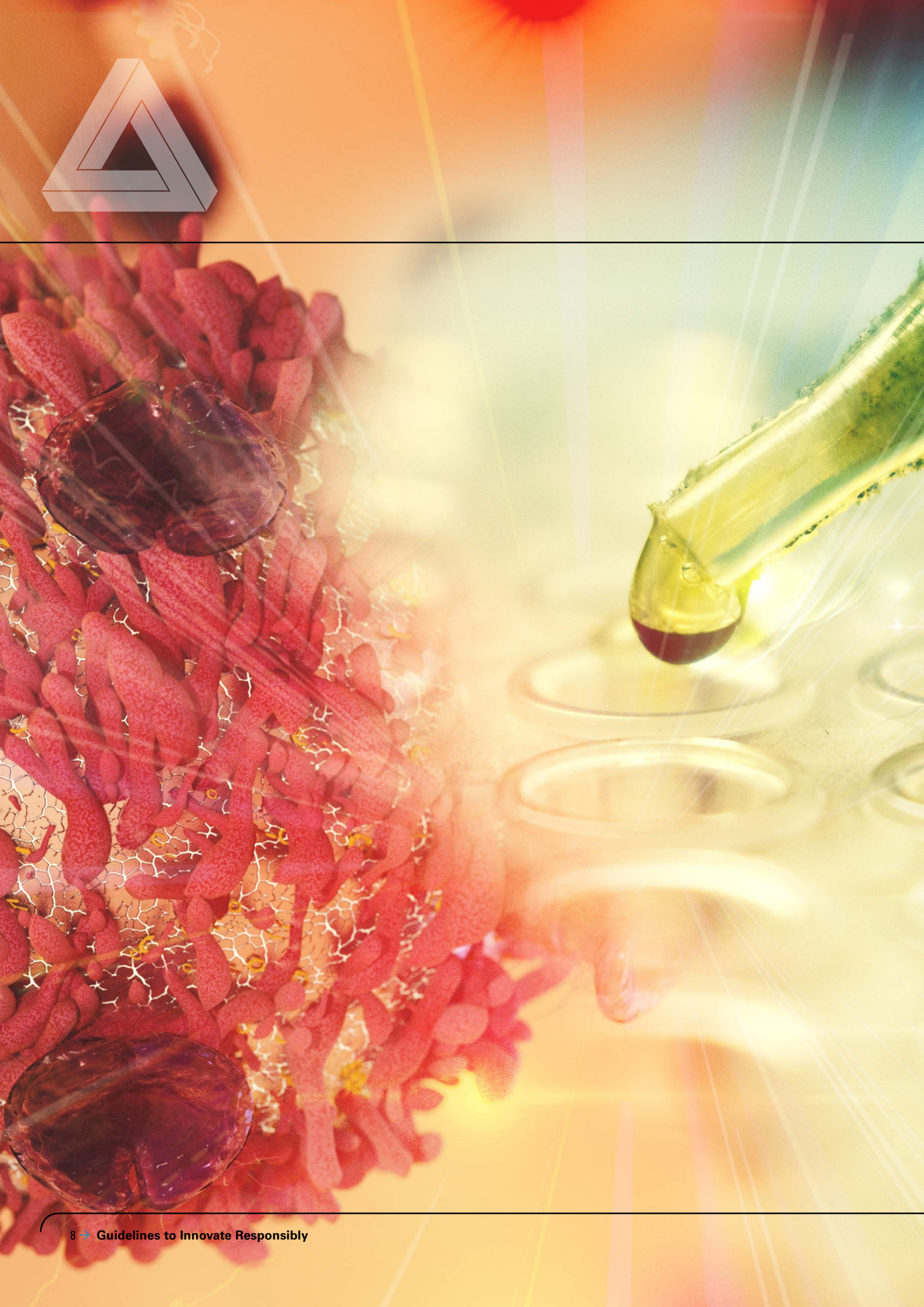
Further details on the methodology used to compile the roadmaps are available in the PRISMA deliverable 5.2, and the summary of D5.2, the report PRISMA Executive Brief: Guidelines to Innovate Responsibly.





Case Studies

PRISMA



COLOROBBIA CONSULTING

↘ CASE DESCRIPTION

Gruppo Colorobbia is specialised in the production and distribution of raw materials, semi-finished products and chemicals for the ceramics and glass industry.
Colorobbia Consulting S.r.l. is the technology service company of Gruppo Colorobbia, with activities on research, chemical and chemical-physical analysis, compliance with environmazental and safety regulations, IT and process plant engineering. Its mission is the research and development, prototyping and production of nano-based products to be used in the industrial sectors of pharmaceutics, nanomedicine, coatings and environmental protection.
The core values of the company include: quality and excellence in R&I; attention to environmental health and safety (EHS) issues in the R&D and production processes; respect of ethical standards in R&I; development of innovative solutions to tackle societal challenges. These values guide the overall business model of the company.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by one of the Executive Managers and the R&D manager
- Motivation for RRI: Better understanding (anticipating) potential ethical, legal and social risks and benefits, addressing uncertainties in existing and future developments in norms and standards, and exploring ways to ensure societal acceptability of the final products of the NanoMed project.

CONTEXT ANALYSIS

- Type of pilot organization: SME
- Country: Italy
- R&I project selected: NanoMed: Advanced nano-based theranostic platform for cancer and nervous system diseases.
- Technology: nanotechnologies
- Regulatory regimes relevant for NanoMed: nanomaterials, Advanced Therapy Medicinal Products (ATMP), medical devices
- Type of R&I activities: in-house and cooperative research
- Type of business: business to business
- Time to Market (indicative): 5-10 years
- CSR policies: in-house corporate sustainability policy
- Gender balance and gender policy in R&D: similar composition of R&D personnel in terms of men and women, no relevance of gender & diversity in recruitment criteria and selection of R&D personnel
- RRI Maturity Level: Strategic



MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: company (R&D, Quality and Management), R&D partners (research centres and academia, hospitals), business partners (public and private investors, suppliers), market clients and end-users (hospitals, healthcare professionals, patients associations, patients, advocacy groups), policy makers and regulators (healthcare sector), society (media and the public)
- Key ethical, legal and social issues: product efficacy, safety (use of nanomaterials in particular), excellence in R&D, ethics (respect of patients' rights), patient-centric procedures for both clinical trials and cure; respect of the principles of precaution, beneficence, dignity, informed consent, data protection and data ownership
- RRI actions selected for the PRISMA pilots[1]: RRI Training, ethical and social analysis, stakeholder dialogue



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on NanoMed products are[2]:
  - *Scientific & Technological:* Inspire technological innovation
  - *Ethical & Societal*: Product safety, Effect on quality of life and health of customers, Product related services and guidance (e.g. ethical protocols)
  - *Strategic*: Transparency on product qualities; Fulfil ethical and social requirements
  - *Organizational*: Address regulatory barriers, Risk management;
  - *Economic*: Time to market, Human Resources (use of)



RRI ROADMAP DESIGN

RRI Vision

Realize a personalized, patient-centric and point of care therapy, for a highly effective, accessible and affordable treatments of severe diseases.

R&I Technologies and products

NanoMed, is a large research project based on in-house resources from the company and funding by different cooperative projects. Its aim is the development of a technology platform providing an integrated and modular system, for the diagnosis and treatment (theranostic) of cancer and nervous system diseases. It is a nanotechnology-based system, using a combination of targeted and controlled drug delivery, hyperther-

[1] Further information in PRISMA deliverable D2.4: Responsible innovation in practice: experiences from industry

[2] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly

mia and radiofrequency treatment and laser imaging methods.
The technology platform will lead to different products, including a contrast agent, a formulation (drug), a cell therapy system and a portable and integrated medical device to produce the cell therapy system.

Drivers

- Demand for better diagnosis and increased efficacy in therapies for cancer and nervous systems diseases
- Entry into new markets, diversify company product portfolio

Challenges

- Personalized and precise diagnosis and treatments, significantly increasing patient survival and life quality
- Ensure accessibility (point of care), equity and affordability of treatments
- Patient-centric procedures, for both clinical trials and cure
- Need for long term research investments

Risks and barriers

- Regulatory uncertainties
- Ethical and social concerns, addressing patient's rights (precaution, safety, beneficence, dignity, informed consent, data ownership, transparency)
- Risks (potential/perceived) of use of nanomaterials into the body
- Safety of nanomaterials along the product life cycle
- Long-term efficacy and reliability of the therapy (in particular in relation with the use of nanomaterials)
- Societal acceptability, lack of trust in the product (in particular by professionals and patients)
- Mismatch of personalized therapy approach with the existing healthcare system
- Complex business eco-system
- Resources and competences for RRI actions

RRI actions



Reflection & Anticipation

- Ethical and social impact analysis, to pursue key social values and increase social impact of NanoMed products. Activities within PRISMA, including training and reflection on RRI with company staff facilitated by RRI experts (project partners), helped the company to reflect on RRI aspects of the product. These included issues related to product efficacy, safety of the product, excellence in R&D, ethics (respect of patients' rights) and patient-centric procedures for both clinical trials and cure; transparency about the ways of production and use nanomaterials in the product; issues of risk-benefit of personalised therapies, affordability, accessibility of the treatment



Inclusiveness

- Stakeholder dialogue: a dialogue event with most of the key stakeholders identified in the materiality analysis has been organized to shape the contents of the NanoMed roadmap
- Co-design and cooperation with authorities (cell therapy) and with

patients (e.g. for clinical trials): regulatory monitoring in the areas of ATMP, medical devices and nanomaterials; early cooperation with EU and national authorities on medicinal products, ATMP and nanomaterials; dialogue on ethical and social impacts with actors along the value chain of the R&I project; cooperation with national and local authorities and ethical committees on issues related to animal testing (and alternative methods to animal testing); plan and design protocols to ensure respect of patients' rights, including appropriate procedure for the data management and the informed consent related to data collected during clinical trials and therapy; consider novel approaches to design clinical trials, taking into account the peculiar aspects of personalized medicine; consider gender aspects in the definition of clinical trials; Implement a long-term risk management plan in the post-marketing phase, in order to oversee medium and long term impacts of the therapy on patients

- Early Assessment and dialogue on business models/costs/benefits with investors and the healthcare system: early analysis of cost-benefit impacts of the new therapies, regular screening of potential business models for personalized therapies, also based on assessment of benchmark products; early cooperation with Research Contract Organizations to analyse socio-economic impacts and potential (responsible) business models; dialogue and cooperation with potential public and private investors, including the health-care system (e.g. local authorities and hospitals).
- Create a communication and dialogue strategy toward professionals, patients and society: design an informed consent protocol together with health-care professionals, patients associations, and ethical committees; create informative events targeted to health-care professionals & patients; identify appropriate communication means and channels to inform the wider public on NanoMed technologies and products; favour the principle of "return on investment" of all stakeholders engaged in the NanoMed project.



Responsiveness

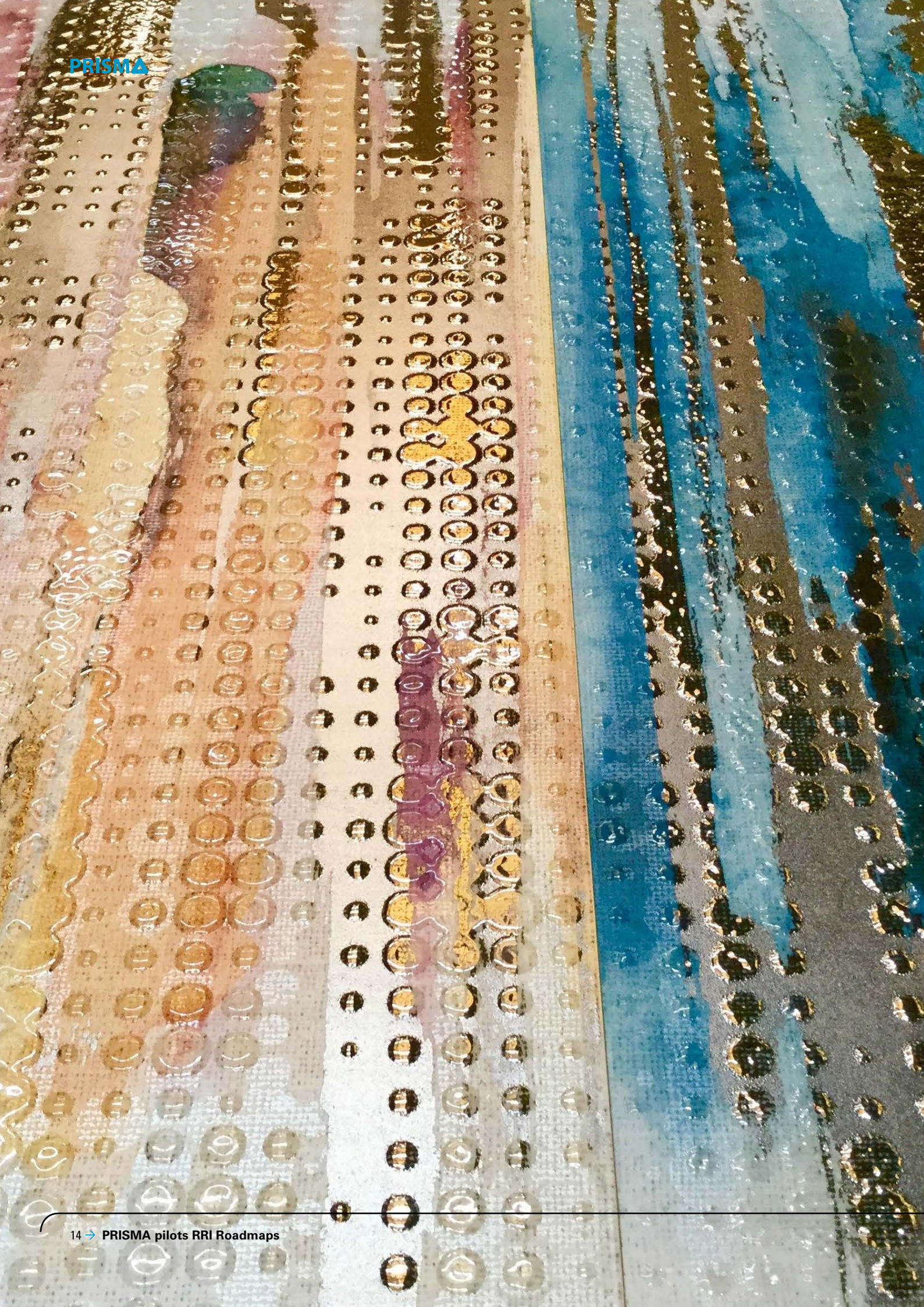
- Early use (research) of qualified standards and quality procedures all along the R&D and production process
- Strict safe by design approach for NM in product development
- Research & modelling of the mechanism of action (long-term efficacy) of the therapy to ensure system reliability
- Establishment of an ethical and social monitoring board to oversee project activities: Engage a multi-disciplinary panel of independent experts and end-users in order to assist the project in strategic choices on ethical, legal and social aspects (e.g. risk-benefit evaluation, ...) taking into account also technical developments (e.g. safety of nanomaterials) and socio-economical aspects

Final RRI Roadmap

The aspects relevant for the RRI uptake by the company, covering all the period until the commercialization and use of the product, have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 1).

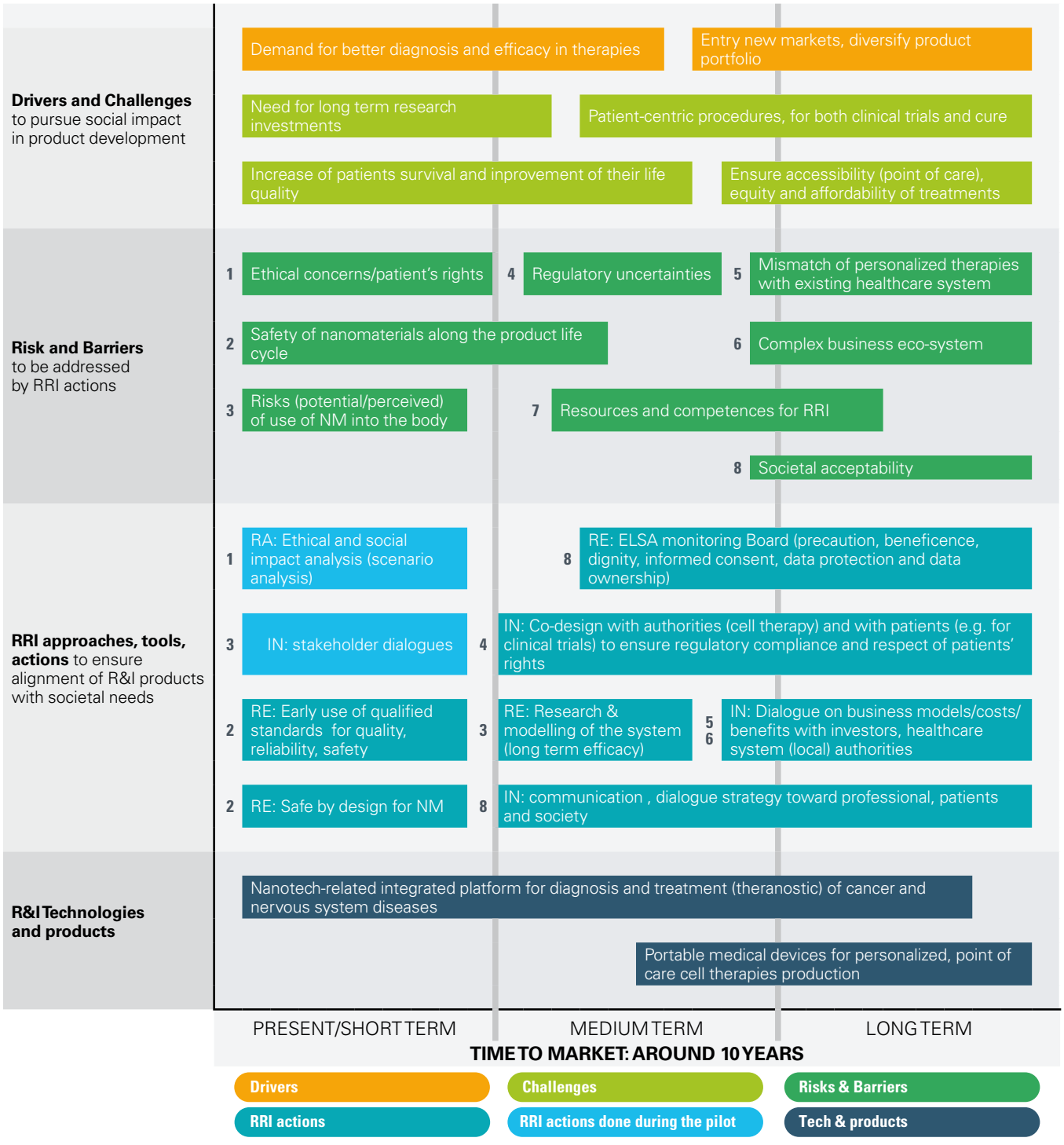
The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake, being suitable for implementation in the context of the overall development strategy of the NanoMed project. Some short-term actions were already planned by the company, other have been implemented thanks to the cooperation with PRISMA.

A barrier to RRI implementation is the human and financial resources needed to implement the roadmap. However, the overall balance is positive, an RRI approach is vital to improve functionalities, quality and reliability, acceptability, of the NanoMed technologies and products.



COLOROBBIA CONSULTING - NANOMED PROJECT

RRI Vision: realize a nano-based platform for personalized and point of care therapy, for a highly effective, accessible and affordable treatment of severe diseases



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions



LABORATORI ARCHA

↘ CASE DESCRIPTION

Laboratori Archa S.r.L (Archa) is a small-to-medium size enterprise (SME), with the mission to provide assistance, technological innovation and know-how to companies to enable them to produce while respecting the human health and the environment, preventing risk and complying with moral and ethical principles. The support spans over all the stages of the innovation process: outlining/definition of the idea, the research and development phases, prototyping, start-up and industrialization.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by the Executive management, and the R&D and quality managers
- Motivation for RRI: address risk and risk perception related to use of nanomaterials all along the life cycle of the product, strengthen product acceptability, address normative and regulatory compliance

CONTEXT ANALYSIS

- Type of pilot organization: SME
- Country: Italy
- R&I project selected: NanoCube
- Technology: nanotechnologies
- Regulatory regimes relevant for NanoCube: nanomaterials, cosmetics, medical devices
- Type of R&I activities: cooperative research
- Type of business: business to business
- Time to Market (indicative): 3-5 years
- CSR policies: Archa is certified OHSAS 18001 (Occupational Health and Safety Assessment), SA8000 (Social Accountability), UNI EN ISO 14001 (environmental management), UNI EN ISO 9001 (quality management).
- Gender balance and gender policy in R&D: similar composition of R&D personnel in terms of men and women, no relevance of gender & diversity in recruitment criteria and selection of R&D personnel
- RRI Maturity Level: Strategic

MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: NanoCube research partners, technology developers, nanomaterials producers, dermo-cosmetic and medical devices manufacturers, hospitals, retailers, certification bodies, consumers
- Key ethical, legal and social issues: product efficacy, safety and safe production, risk perception and user acceptability (in particular for nanomaterials), improved quality, affordability, compliance with sustainability norms (workers' rights,

supplying of raw materials, reduced environmental impact in processing and production)
- RRI actions selected for the PRISMA pilots[3]: RRI Training, ethical and social analysis, stakeholder dialogue



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the NanoCube products are[4]:
  - *Scientific & Technological:* Inspire technological innovation
  - *Ethical & Societal*: Product acceptability, Product safety
  - *Strategic*: Transparency on product qualities, Customer satisfaction, meeting new consumers' needs or requests, Building legitimacy and gain consumer loyalty on the product
  - *Organizational*: Safety at the workplace, Risk management
  - *Economic*: Human Resources (use of)

[3] Further information available in PRISMA deliverable D2.4: Responsible innovation in practice: experiences from industry

[4] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly



RRI ROADMAP DESIGN

RRI Vision

Create nano-based dermo-cosmetic products, based on ethically acceptable and sustainable production methods and on a safe and more effective use of natural and organic ingredients.

R&I Technologies and products

The NanoCube project, coordinated by Archa and Techa (Tuscany region funds POR FESR 2014-2020) develops innovative technologies aimed at producing nanocapsules and nanosystems providing controlled release of bioactive agents for cosmetic and biomedical applications. A key research challenge is the exclusive use of natural ingredients, including the nanocapsules, and processing steps avoiding the use of chemical (synthetic) solvents. The final dermo-cosmetic product is expected to fulfil specific voluntary international certifications for organic and natural cosmetics.

Final products of NanoCube include: a dermo-cosmetic product based on controlled released of bioactive agents, that might be further developed in a medical device (class I) for anti-inflammatory dermal treatments; an electrospinning device/process for nano-capsule production; a medical device for lesion care (class II medical device) using nanowires produced by electrospinning.

Drivers

- Demand for more eco-friendly and organic based dermal products
- More efficient use of natural substances

- Reduce use of antibiotics
- Reduce risks for workers in handling active substances

Challenges

- Transparency and open communication to consumers
- Ensure workers' and consumers' rights all along the supply chain and product life cycle
- Efficacy, reliability and quality vs. conventional detergents

Risks and barriers

- Regulatory uncertainties (e.g. regarding NanoMaterials classification)
- Upscale of production system for nano-capsules
- Risks of use of NM into the body
- Risk perception on nanotech of professional users and, in particular consumers of green and natural cosmetics

RRI actions



Reflection & Anticipation

- Ethical and social impact analysis (stakeholder and value inventory, design for values approaches)



Inclusiveness

- Organize regular dialogue (co-creation) events on product development with stakeholders in particular developers, producers, certification bodies, distributors of cosmetic products for sharing values, creating positive ethical networks, and improving acceptability of the final product:
  - A first stakeholder dialogue has been held during the Prisma project to shape the contents of this roadmap; others should be organized continue all along the product development phases.
- Dialogue and cooperation with authorities to anticipate potential risks and monitor regulatory development, in particular for the nano-capsule production system and the medical device product
- Developing of a communication strategy, based on scientific evidence, to ensure transparency and quality and credibility of product claim. Particular attention to the use of nanomaterials. Specific criteria for the strategy include:
  - Distinguishing between natural substances and synthetic substances
  - highlighting improvements in durability and efficacy of the product, and possibility to avoid/ reduce the use of conservatives in the cosmetics
  - Providing indication on the safe use of nanomaterials during production, use and disposal (complementing normative requests of cosmetic regulation, requiring including nanomaterials in product labelling)
  - further emphasise in project communication aspects of gender balance in R&I as one of the strengths of the project and the company



Responsiveness

- Implementation of risk management

systems for nanomaterials, including use of state-of-the-art practices and standards for characterization, measurement and safety testing of nanomaterials (e.g. OECD test guidelines). Full assessment of potential exposure to nanomaterials during the production of nano-capsules, and regarding the end of life of the product

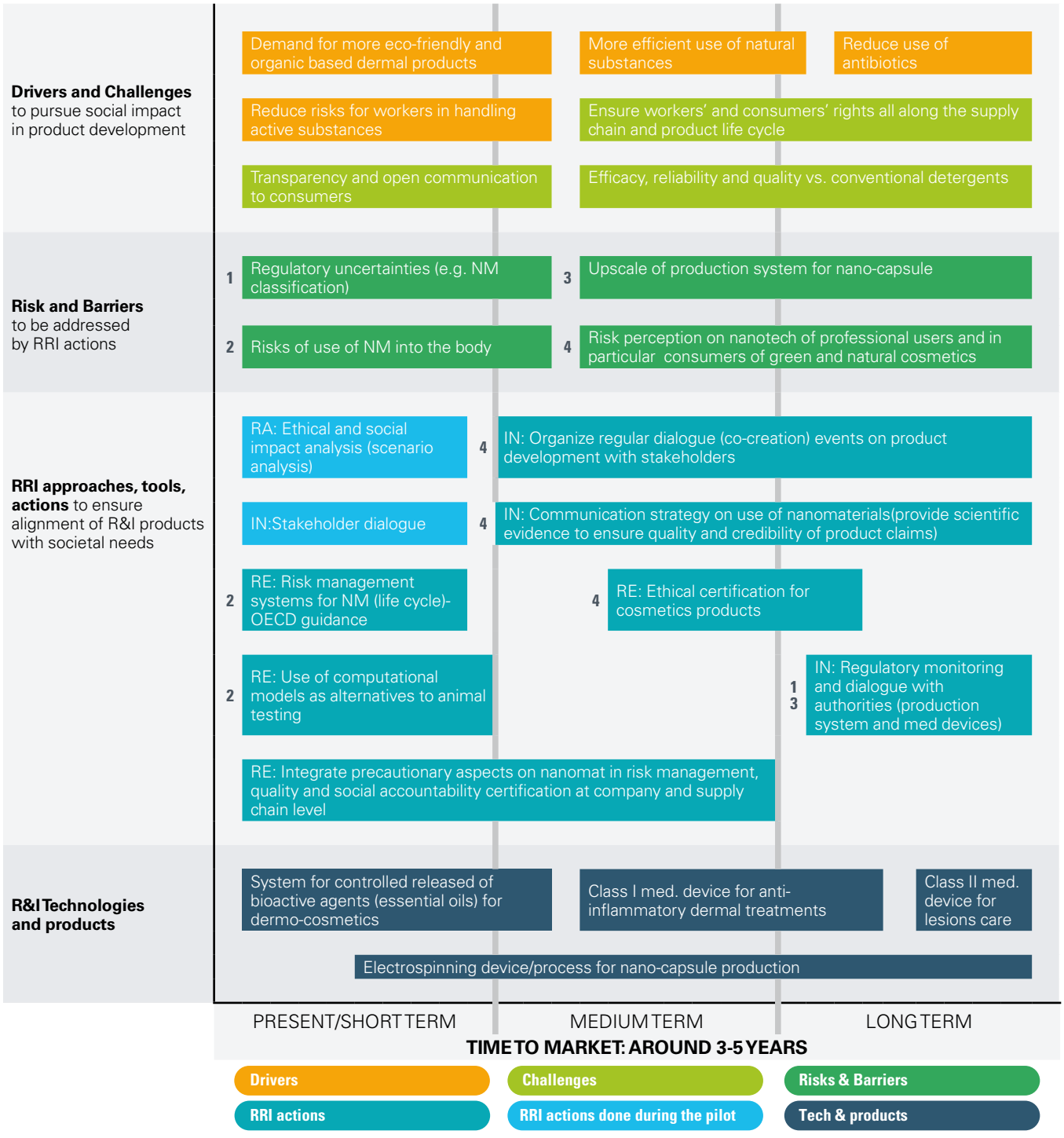
- Implementation of computational models, pre-screening techniques and in-vitro approaches for safety assessment of the product (in the case of medical devices, as alternatives to animal testing).
- Certification at process and product level to promote safety, ethical acceptability and societal desirability of products:
  - Fulfill requirements of ethical certification for the dermo-cosmetic products (e.g. COSMOS certification for organic and natural cosmetics products in Europe) and certifications concerning biological farming for production of raw materials (production of the active substance of the dermo-cosmetic)
  - Integrate in existing risk management, quality and social accountability certification at company and supply chain level, best practices for safe handling of nanomaterials in the workplace (e.g. control banding tools), and for end of life management of nano-related products

Final RRI Roadmap

The aspects relevant for RRI uptake by the company, covering all the period until the commercialization and use of the product, have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 2).
The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake, being suitable for implementation in the context of the NanoCube project.
Some short-term actions were already planned by the company, other have been implemented thanks to the cooperation with PRISMA. Some of the RRI tools and approaches emerged by the work of PRISMA will be integrated in usual practices of the company on several R&D projects.
Participation in PRISMA, helped the company to better understood the relevance of societal values to improve the R&D process, and the need of a transparent communication and of cooperation with stakeholders to align R&D products to their needs, expectations and requirements.

LABORATORI ARCHA - NANOCUBE PROJECT

RRI Vision: Create nano-based dermo-cosmetics products , based on ethically acceptable and sustainable production methods and safe and more effective use of natural and organic ingredients



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions



EVOLVA

↘ CASE DESCRIPTION

Evolva was created in 2004, as one of the first biotech firms in the world. It is a Swiss based company producing innovative, high-value, sustainable ingredients with an emphasis on the health, wellness and nutrition sectors. Evolva leverages modern biotechnology, including synthetic biology, to produce what are called yeast "strains," which are then brewed like beer in the traditional fermentation process. The purified end product contains no recombinant material. These end-products are molecularly identical to those traditionally extracted from plants, animals and petrochemicals. Many of the substances produced by Evolva are ingredients found in the natural world that come with supply chain issues, such as originating from a rare plant or animal. These ingredients are not available at the right quality or price in a sustainable manner. Sustainability, being one of Evolva's core values, drives Evolva to focus on a re-production of these types of ingredients by combining modern genetics with traditional brewing.

Evolva's products include substances such as Resveratrol, Nookatone and Valencene. Resveratrol is an example of a product with plenty of benefits (such as its potential to slow the rate of aging of neuromuscular junctions or lungs) but rare or difficult to be extracted from wine or grapes.

Evolva has experienced resistance from some environmental organisations in the past with some of their innovations such as fermentation-produced vanillin. The company is committed to Responsible Innovation, however, so far this has not prevented resistance from some societal actors.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by the public relations Manager. Endorsement from the executive management has been intermittent, due to restructuring of the company and change of managements during the period of the pilot
- Motivation for RRI: showcase and further strengthen responsibility and sustainability efforts of the company

CONTEXT ANALYSIS

- Type of pilot organization: SME (100 employees)
- Country: Switzerland (headquarters)
- R&I project selected: Agarwood
- Technology: synthetic biology
- Relevant regulatory regimes: Genetically Modified Organisms (GMOs) legislation
- Type of R&I activities: in-house and cooperative research
- Type of business: business to business
- Time to Market (indicative): not available (project was stopped during

the pilot because of company the restructuration)
- CSR policies: Sustainability strategy, based on the UN Convention on Biological Diversity. Responsible Research and Innovation and sustainability are part of the core values of the company
- RRI Maturity Level: Defensive



MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: research partners, NGOs, industry observers, farmers and local communities, the media and the general public
- Key ethical, legal and social issues:
  - safety of genetically modified organisms: the potential threat to biological diversity if they escape to the environment
  - value chain/benefit sharing and impact on farming at local territories: risk of biotech and fermentation-derived products replacing those from small, independent farms in vulnerable communities and developing countries
  - Environmental sustainability of fermentation products: most common feedstock used for yeast is sugar, the production of which may lead to deforestation
  - information to consumers (labelling): Synthetic biology are generally not allowed to be labelled as "natural". This applies also to Evolva products, though they are chemically identical to the product that was extracted from animals or plants, and contain no trace of the genetically modified yeast used in production.
- RRI actions performed during the pilot: ethical and social analysis, work with business and social actors sharing values and create positive ethical networks



VALIDATE

- The most relevant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the Agarwood project are[5]
  - *Scientific & Technological:* Feasibility of the technology solution
  - *Ethical & Societal*: Product acceptability
  - *Strategic*: Building legitimacy and gain consumer loyalty on the product
  - *Organizational*: Address regulatory barriers
  - *Economic*: Market penetration
  - *Direct costs* to perform the RRI action



RRI ROADMAP DESIGN

RRI Vision

To create a mutual understanding of a

[5] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly

desirable innovation pathway that can benefit both the synthetic biotechnology value chain as well as other stakeholders.

R&I Technologies and products

The goal of the Agarwood project is the development of natural compounds using Evolva's yeast fermentation production platform. The goal is to create a new paradigm in the sustainable production of Malaysia's high value indigenous natural products, starting with agarwood fragrances.

Agarwood of the Aquilaria and Gyrinops variety has been used since a long time by incense and perfume makers, and traditional medicine practitioners. Despite conservation measures and concerted efforts to grow Aquilaria and Gyrinops in tree nurseries and organic tree farms, these trees are rapidly vanishing from forests due to high demand. Agarwood has been designated as an endangered species by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The production of a range of agarwood products by fermentation could complement the existing traditional approaches and allow a significant widening of their use without increasing the pressure on the endangered trees.

The project got underway in 2014 and been in an exploratory phase until 2018 and has been currently suspended.

Drivers

- Finding replacements for the use of natural ingredients in health, wellness and nutrition products related to critical supply chains or originating from a rare plant or animal
- Ingredients for health and food that respect sustainability, availability of animal welfare issues

Challenges

- Innovation trajectory and innovation eco-system internationally dispersed
- Lack of company resources for RRI due to volatile market

Risks and barriers

- Prospective costumers are not primarily driven by sustainability, and by mechanisms such as LCA analysis. For example, most food and beverage producers focus on price and taste. They rarely pay suppliers a premium for ingredients that come with LCA data. There is no green premium.
- Societal debates about 'naturalness' and 'economic justice', and around synbio are highly polarized
- Some societal actors, such as some critical NGOs, are not open to exchange and collaboration
- It is difficult to establish sustainability of a product while developing the innovation, this is also due to the fact that different actors will use different criteria to establish sustainability

RRI Actions

Reflection & anticipation

- Ethical analysis, through foresight, scenario analysis, and other approaches, in order to develop a "socially ideal" business case for the R&I project (e.g. Agar Wood) .
- Further explore the opportunity to implement Life Cycle Assessment (LCA) and Social-LCA

Inclusiveness

- In the early stages of the R&I process, work with stakeholders to develop robust ethical and social framework (sharing values and create positive ethical networks, building user-based communities of practice), for selecting the 'problematic' ingredient which deserves to be replaced by a synthetic alternative. This includes exploring how to determine what fair and equitable benefit sharing implies for stakeholders.
- Share and communicate the ethical and social framework with stakeholders and the civil society, in a societally robust and transparent way

Responsiveness

- Implement adaptive risk, quality and sustainability management approaches, in order to: develop and continously update ways to demostrate whether Evolva's products are indeed more sustainable then the existing ingredients; and to re-evaluate metrics used for analysis and reporting of sustainability performances (e.g. parameters to perform LCA), to adapt them to production and product development and optimization.
- Further participate in sustainability, social accountability, quality certification schemes surrounding the 'problematic' ingredient, at both company and supply chain level
- Support and invest in sustainable supply chains for the feedstock supply of the engineered yeast
- Realize capacity building initiatives with vulnerable actors in the value chain, creating opportunities for vulnerable farmers in new value chains

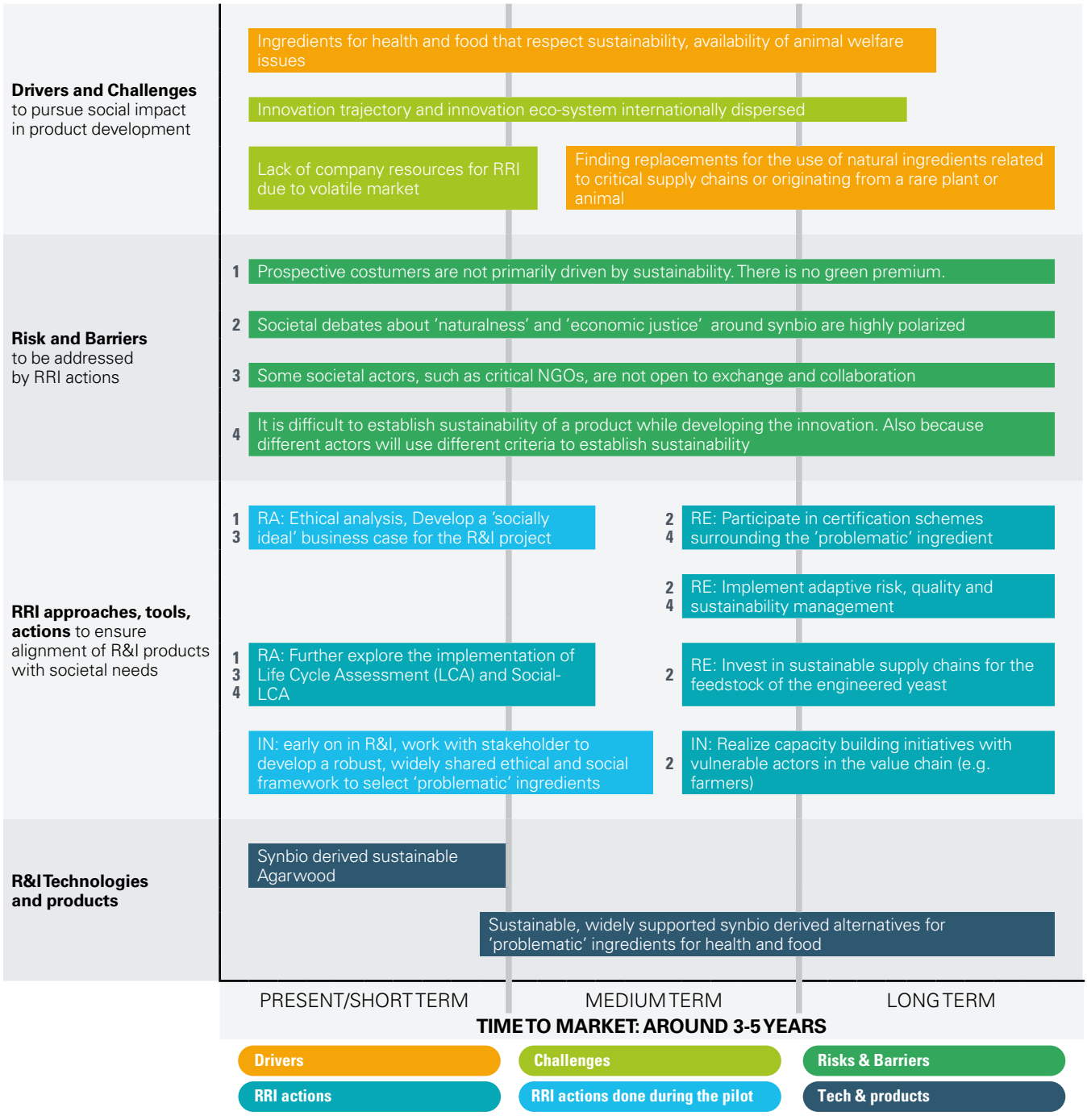
Final RRI Roadmap

The aspects relevant for the RRI uptake by the company have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 3).

The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake. If the above-mentioned issues are answered in a collaborative practice with a wide range of constructive actors, Evolva could move from a *defensive* kind of RRI to a more pro-active, confident kind of RRI. Defensive RRI is geared towards damage control and risk-management. Confident kind of RRI is geared towards the development of a robust rationale underlying and motivating all steps in the innovation chain. Such a rationale will allow for a more confident engagement with critical NGOs and concerned consumers.

EVOLVA ROADMAP

RRI Vision: create a mutual understanding of a desirable innovation pathway for synthetic biotechnology derived alternatives, that can benefit the value and supply chains as well as other stakeholders



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions


ecodos
Kitchen Cleaner
1
STOP
ecodos
Degreaser
2
STOP
ecodos
Disinfectant
3
STOP

SPECTRO

↘ CASE DESCRIPTION

Spectro is a Dutch manufacturer of cleaning agents for professional use. It is a family-owned company with about fifty employees and a small R&D department. The company has an active Corporate Social Responsibility (CSR) policy, with a focus in particular on sustainability. The mission is 'to decrease the total environmental impact of its products as well as decrease the cost of cleaning', and the company has the ambition to become a European player in the area of sustainable cleaning agents. Spectro also successfully implemented the A.I.S.E. Charter for Sustainable Cleaning (update 2010) in 2011 throughout the company. The 'Charter' is the quality system of the European Sector Association A.I.S.E. which has many overlaps with other quality systems such as ISO 9001, ISO 14001, OHSAS 18001 and EMAS.

The company develops highly concentrated ecological cleaning agents that are combined with smart dosing systems. A main example is the brand Ecodos, a system that takes care of the exact dosage of cleaning agents, so that overdosing becomes impossible. The rationale behind this is that life cycle analyses show that a large part of the environmental impact of cleaning detergents is in the use phase. Reducing detergent use, thus, has a positive environmental impact. Moreover, it reduces costs of cleaning. The Ecodos Easy system also has a small solar panel so that it can function independently from the electricity grid. The system stores data about its use.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by both the CEO and the R&D manager
- Motivation for RRI: respecting public values and avoiding ethical problems, ensuring acceptance of innovation by stakeholders, increasing market share though adding societal value

CONTEXT ANALYSIS

- Type of pilot organization: SME
- Country: The Netherlands
- R&I project selected: development of EcoDos in a cleaning devices system for sharing of data
- Technology: cleaning technology and Internet of Things
- Relevant regulatory regimes: cleaning detergents, General Data Protection Regulation
- Type of R&I activities: in-house and outsourcing
- Type of business: business to business
- Time to Market (indicative): 3-5 years
- CSR policies: in-house CSR and sustainability policy. Spectro also supports customers in achieving their CSR targets.
- RRI Maturity Level: Strategic



MATERIALITY, EXPERIMENT & ENGAGE

- 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
- Key ethical, legal and social issues: public/patient health and hygiene, sustainability, privacy, security, transparency (of data collection), autonomy (of cleaning personnel), reliability and trust
- RRI actions selected for the PRISMA pilots:
  - Literature study about hygiene issues in hospitals and the potential for better cleaning solutions
  - Stakeholder and value inventory and value scenarios (design for values): identification of values hierarchy, conflicting values and potential ways to deal with them



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the Ecodos project are[6]
  - *Scientific & Technological:* Inspire technological innovation
  - *Ethical & Societal*: Product safety, Product environmental sustainability, Address user's needs and rights' (e.g. privacy, data ownership, etc.)
  - *Strategic*: Competitive advantage, Customer satisfaction, meeting new consumers' needs or requests
  - *Organizational*: Risk management
  - *Economic*: Product cost, Market penetration

[6] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly



RRI ROADMAP DESIGN

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.

RRI technologies and products

A main technological development for Spectro is the Internet of Things (IoT). This will allow making cleaning devices connected and the collection and exchange of data. Some larger multinational companies are already developing and advertising new cleaning applications using IoT. Spectro is embarking on this development and is developing a number of IoT-based applications. Such applications will allow better maintenance and servicing (e.g. refilling in time). They also allow the collection of data about cleaning which can contribute to better or more efficient cleaning.

(T1) New version of Ecodos that can

exchange information trough internet

(T2) Share data with customers: this development was based on (A5). Spectro has developed an app to more actively share data with its customers so that they can take responsibility for the frequency and quality of cleaning.

(T3) Use data for prevention (e.g. warning of potential lack of cleaning): this is the long-term perspective that might help to attain D3

Drivers

(D1) Increased use of IoT in cleaning

(D2) Strong commitment of the company to CSR and public values

(D3) Adding societal value (public hygiene) may offer new business opportunities for the company: One of the potential markets that was explored for new clever dosing systems using IoT is that of cleaning in hospitals. This market is interesting for Spectro because the company is still a smaller player in that market but would like to expand. It was found – through a literature study – that healthcare-associated infections (HAI) are a main concern in hospitals.

(D4) The company is developing from a product provider (cleaning agents) to a technology/service provider

Challenges

(C1) Building new relationship with customers

(C2) Acquiring expertise on IoT and ICT

(C3) Increase RRI expertise

Risks and barriers

(R1) Privacy and security concerns raised by new applications that share data

(R2) Extensive stakeholder engagement is too costly for a small company like Spectro

(R3) Cleaning contracts are awarded through tenders in which often much emphasis is on costs of cleaning and with little attention for other values (including public hygiene)

(R4) Social acceptance of innovation: actors in value change do not necessarily see the need for improvement of current cleaning practices

(R5) Company has only a small role in a long value chain: The value chain contains many parties (the distributor, the user organization (e.g. hospital), parties within the user organization, the cleaning company etc). It is questionable whether it is feasible and desirable to aim at vertical integration along the value chain.

RRI approaches, tools, actions



Reflection & Anticipation

(A1) Stakeholder and value inventory: a first inventory was made and then enriched on basis of A2 and A3.

(A2) Literature study about hygiene issues in hospitals and the potential for better cleaning solutions.

(A3) Development of value scenarios: these are short hypothetical stories about (unexpected) use that help to reveal relevant values

and potential value conflicts.

(A4) Inventory of conflicting values and ways to handle them: these were based on A2 and A3 and put in a diagram to show the values that reinforce each other and that might be at tension in the development of the new product.



Inclusiveness

(A5) Better inform customers about collection of data: based on the value scenarios (A3) it was decided that better informing customers would help to prevent some potential ethical issues. This resulted in T2.

(A6) Stakeholder dialogue at the branch level: a stakeholder dialogue at the branch level is chosen to overcome barrier R2.

(A7) Pilot study at a hospital.



Responsiveness

(A8) Investigate implications of GDPR: The data that are currently collected are most likely not personal data in the sense of the GDPR (General Data Protection Regulation) of the EU because they cannot be traced back to individuals. Nevertheless, it would be wise for Spectro to develop a policy about privacy collection and sharing that explicitly addresses privacy issues, in particular because future technological innovations may involve the collection of data that can be traced to persons.

(A9) Broaden CSR reporting to include ethics and values in innovation as well

Final RRI Roadmap

The aspects relevant for the RRI uptake by the company have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 4).

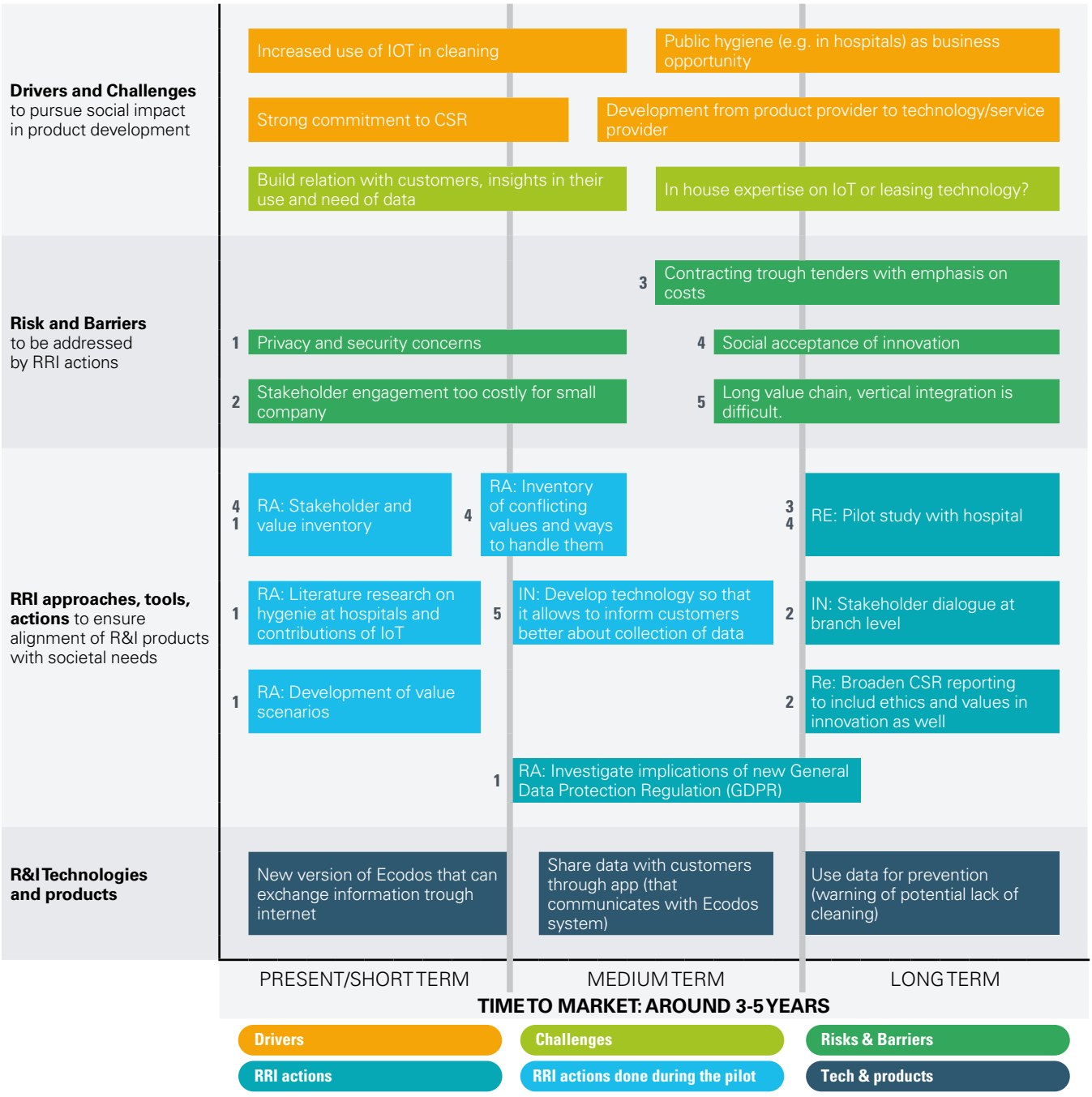
The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake.

The company's CEO has indicated that participation in the PRISMA project was particularly useful for him because it made him think about issues he would not normally think of. Spectro now aims at more actively sharing data with its customers so that they can take responsibility for the frequency and quality of cleaning. The CEO also found out that many of his customers are not aware of the data being collected and of the potential value of this data. He now sees it as the company's responsibility to make its customers more aware.

Increased collection and sharing of data may also potentially raise privacy issues. The data that are currently collected are most likely not personal data because they cannot be traced back to individuals. Nevertheless, it would be wise for Spectro to develop a policy about privacy collection and sharing that explicitly addresses privacy issues, in particular because future technological innovations may involve the collection of data that can be traced to persons.

SPECTRO ROADMAP

RRI Vision: develop new IoT-based cleaning technologies that contribute to public health and hygiene (and respect other relevant values) and offer the possibility to increase market share



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions



AERIALTRONICS

↘ CASE DESCRIPTION

Aerialtronics develops autonomous Unmanned Aerial Vehicles (UAVs). UAVs, also known as drones, are large vehicles that can operate either autonomously or in a swarm. The company focuses on specific technologies that allow the drone to operate more independently from an operator and aims to sell the drones for professional and commercial tasks, such as monitoring and small maintenance tasks carried out for instance by police, fire departments or industrial inspection and maintenance companies. In the Autumn of 2017, the company was acquired by Drone Volt, a French manufacturer of commercial drones. With the acquisition of the knowledge base of Aerialtronics, Drone Volt can further develop the drone technology and include specific technologies, in particular in the field of security. Central to the UAVs is the development of technologies allowing these vehicles to operate safely in an urbanized environment. Currently, existing legislation prevents these activities and as such the commercial value of the technology.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by the head of legal council and regulatory affairs
- Motivation for RRI: learn about new methods and approaches to identify the risks and uncertainties with respect to potential future ethical, legal and social impacts when developing and implementing commercial and professional drones. In the past, the company has faced serious pitfalls in the drone development as a result of ethical, legal and social issues which led to longer lead times, higher costs and endangered competitive position.

CONTEXT ANALYSIS

- Type of pilot organization: SME
- Country: The Netherlands
- R&I project selected: PENSAR
- Technology: autonomous vehicles
- Relevant regulatory regimes: safety, security legislation, General Data Protection Regulation
- Type of R&I activities: in-house
- Type of business: business to business
- Time to Market (indicative): 1-3 years
- CSR policies: in-house corporate sustainability, privacy and dual-use ethical policy
- Gender policies in R&I: the company has no explicit policy in this respect, but given the field of operations it is relatively more men as compared to women who work in aerospace and electronics
- RRI Maturity Level: Tactical



MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: users and bystanders, authorities (e.g. police), civil aviation roads authorities, national Civil Aviation Authority, local municipalities, market clients and end-users such and inspection companies for off-shore and wind-turbines.
- Key ethical, legal and social issues: safety, security, privacy, data protection, data ownership (use of data and images that are produced by camera's), respect to the use of and the criteria for type of public and commercial drone operators
- RRI actions selected for the PRISMA pilots: stakeholder dialogue, ethical and social analysis



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the PENSAR project are[7]
  - *Scientific & Technological:* Product quality, Product reliability
  - *Ethical & Societal*: Product acceptability, Address user's needs and rights' (e.g. privacy, data ownership, etc.), Trust with/ avoid conflicts with business partners, suppliers and end-users
  - *Strategic*: Building legitimacy and gain consumer loyalty on the product
  - *Organizational*: Address regulatory barriers, Avoid irresponsible behaviour
  - *Economic*: (favoured) access to financial support
  - *Direct costs* to perform the RRI action

[7] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly



RRI ROADMAP DESIGN

RRI Vision

Develop drones with innovative active visual monitoring systems for application in public emergency and security, and industrial applications, ensuring safety, and safeguarding users' rights, including privacy and fair use of data.

RRI technologies and products

Aerialtronics has developed professional drones that are equipped with technology to monitor and survey by drawing on artificial intelligence and big data analytics. The main technology is the Altura Zenith surveillance system which can be extended by data capture modules (audio, video, physical parameters, etc.) and software for the processing and analysis of the data collected.

The technology we focus on in the PRISMA pilot is the PENSAR. The PENSAR is a dual spectrum computer vision platform that is mounted to a drone and operates with the Altura Zenith. The PENSAR can capture images and data and analyse it real-time by making use of

reading text or thermal vision. This helps the operator of the drone, for instance to recognize characteristics, read license plates of cars or serial numbers of equipment immediately in the course of performing monitoring tasks.
PENSAR is equipped with a special privacy masking tool. This tool automatically and instantly blurs the details of sensitive data such as the privacy of bystanders.
We decided to focus on the PENSAR technology, because it is being sold and has a potential high intrusion on people's private life.

Drivers

- Possible areas of application for drones are continuously increasing
- Entry into new markets, such as urban areas

Challenges

- Industry fragmentation, absence of industry standards in technology
- Regulation needs evidence, public and media are receptive to the issues with drones
- Regulation for emerging and novel, autonomous, AI data driven drone technologies
- High level discussions and international regulation authorities are difficult to access for SMEs

Risks and barriers

- Small companies do not see their relevance in the ethical discussion and acceptance of drones
- Lack of space to conduct experiments no living labs for aerial drones, no evidence
- Regulatory compliance burden and costs for companies, in particular SMEs
- Limited applications leading to an elimination of potential clients. Applications suitable only for those with certificate to fly
- Limited product acceptability, reluctance to autonomous aerial drones due to privacy and safety

RRI approaches, tools, actions



Reflection & Anticipation

- Privacy and social impact analysis: to ensure that the drones and the camera systems are used wisely by commercial operators, the technology is equipped with smart camera's that automatically blur faces of people and protect the disclosure of other private information. This technology is not fully certified and needs to be included in compliance and regulatory protocols. Within the pilot it has discussed within the company and with stakeholders how to generate data and evidence in order to build a case for regulatory authorities to accept the technology and allow operators to use it in their operations.



Inclusiveness

- Building legitimacy, connecting stakeholders and industry partners. Individual companies do need to see they have a role in the development of regulation. By building a community of producers and users of drones, bringing together their knowledge and concerns, the company tries to develop a playing field for discussion, and strengthen

the legitimacy of the overall sector
- User based and stakeholder inclusive approaches to experimental sites/ living labs. The development of living labs and test fields with stakeholders can help to conduct experiments and provide evidence that the new technology does respect ethical, legal and social issues.
- Engage collaborations within industry to develop common interest, set standards. To ensure the industry is committed to hold to the guidelines it necessitates the inclusion of various industry and policy experts and have them jointly collaborate by warranting their ownership and commitment.



Responsiveness

- Development of design guidelines for regulatory compliance (safety and ethical requirements), in cooperation with regulators and authorities. The aim is to provide a framework for companies in the drone industry to organise and have a common approach for drone development and operations which can also be easily checked and monitored by local and regional authorities.

Final RRI Roadmap

The aspects relevant for the RRI uptake by the company have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 5).

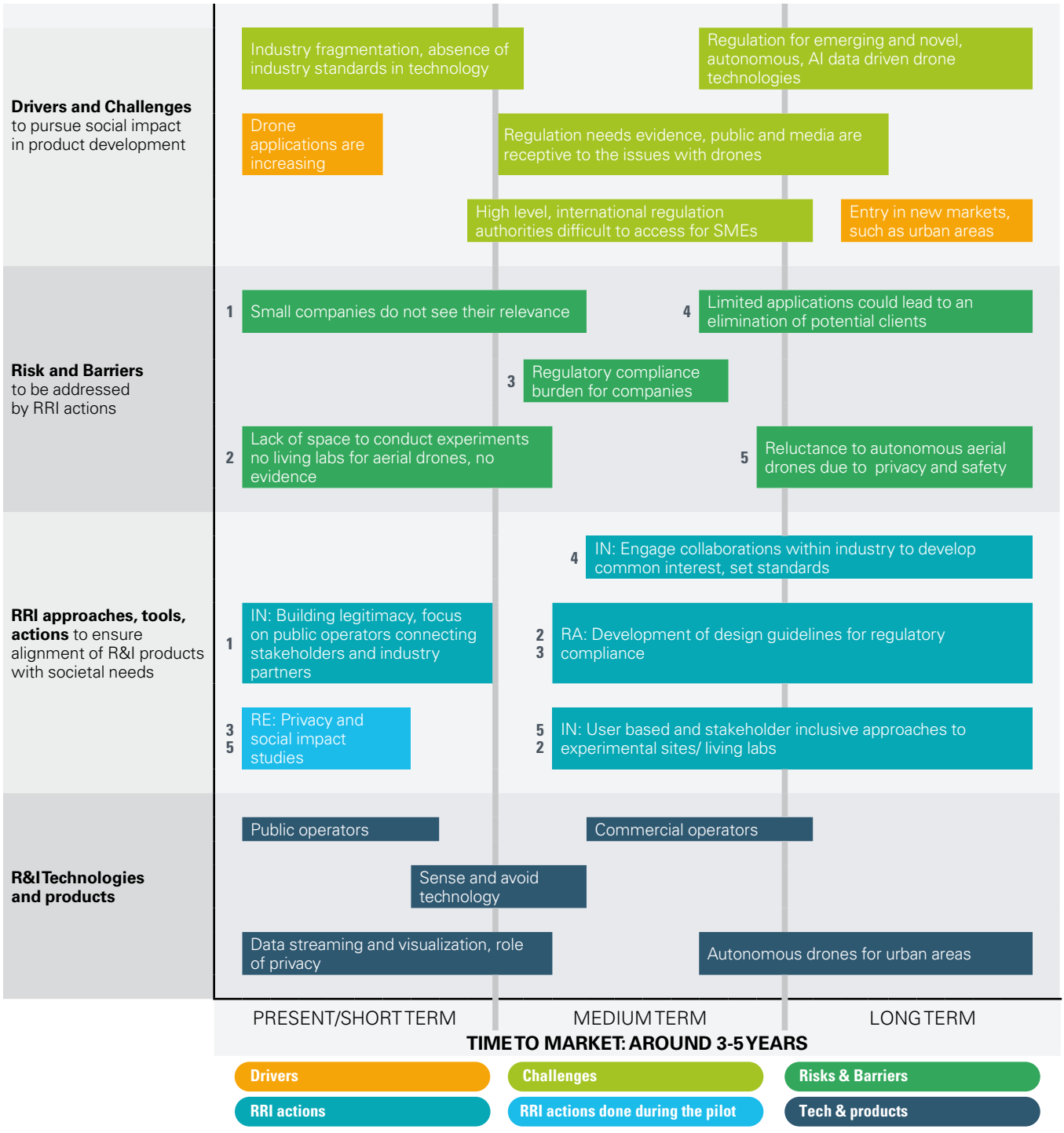
The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake for Aerialtronics. It could be as well helpful for other companies in the field developing specific add-on technologies for drone applications, such as smart camera systems.

Aerialtronics is very active in the short-term activities, developing a framework of reference for drone design and development. The effect of these guidelines is aimed at the longer term to ensure acceptance between commercial drone operators and the governmental authorities.

The smallness of the company in terms of resources and representativeness, puts pressure on the extent the company can live up to meeting the steps as outlined in the roadmap. Yet the drone sector is characterised as an emerging one with many small players and Aerialtronics is, despite its small size, among the major leaders in the sector, and has a strong position in the stakeholder dialogues with governments at EU level to promote further regulation in the field.

AERIALTRONICS ROADMAP

RRI Vision: Develop drones with innovative active visual monitoring systems for application in public emergency and security, and industrial applications, ensuring safety, and safeguarding users' rights, including privacy and fair use of data



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions



HUB OF ALL THINGS

↘ CASE DESCRIPTION

The HAT ecosystem is the first-ever personal data exchange ecosystem that enables individuals and organisations to exchange data directly between individuals and organisations without third party involvement.

The HAT is therefore a personal data platform for firms to offer individuals services for their data in a scalable way, yet allowing individuals to control the data rights given to firms. Importantly, the HAT and its transformed data is owned by the individual. For firms, the HAT opens opportunities for exchanges and use of personal data in a way that is privacy preserving, real time and on demand. The enterprise grows out of a series of university-based research projects. The HAT project as a whole has received several grants from the RCUK/EPSRC/digital economy fund.

Alongside the UK Government funded research projects, there are two central private organisations: the HAT Community Foundation (HCF) Ltd., a not for profit company governed by its membership on behalf of the whole HAT community and the HAT Data Exchange Ltd (Hatdex), a private limited company with share capital, with a mission as a social enterprise.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by both the founder and the Commercial Director of HAT
- Motivation for RRI: Better understanding of the ethical, legal and social impacts and uncertainties related to technology development, exploring ways to ensure societal acceptability of the final product.

CONTEXT ANALYSIS

- Type of pilot organization: SME
- Country: UK
- R&I project selected: Hub of All Things
- Technology: Internet of Things
- Relevant regulatory regimes: General Data Protection Regulation
- Type of R&I activities: in-house and cooperative research, based on public -private partnership
- Type of business: business to business and business to consumers
- Time to Market (indicative): 1-3 years
- CSR policies: the work of HAT is sustained by the non-profit HAT Community Foundation, which represents HAT members, and defines ethical requirements that regulates the HAT personal data exchange ecosystem
- RRI Maturity Level: Strategic

MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: technology developers, certification bodies,

consumers, companies, R&D partners (research centres and academia, business partners), public and private investors, market clients, society (media and the public)
- Key ethical, legal and social issues: information privacy, data ownership, commercial use of private data, respect of users' rights, transparency (of data collection), security
- RRI actions selected for the PRISMA pilots: embedded ethicist



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the HAT are[8]

– *Scientific & Technological:* Inspire technological innovation, Product reliability
– *Ethical & Societal*: Product acceptability, Product related services and guidance, Address user's needs and rights'
– *Strategic*: Customer satisfaction, meeting new consumers' needs or requests, Building legitimacy and gain consumer loyalty on the product
– *Organizational*: Address regulatory barriers
– *Economic*: Market penetration, (favoured) access to financial support

[8] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly



RRI ROADMAP DESIGN

RRI Vision

Develop distributed data platform as a mechanism for increased personal control of data

R&I Technologies and products

The 'Hub of All Things' is a secure internet platform for storing, donating, personal data, but without aggregating it. The HAT entails the HAT micro-server, which is a new technology that confers intellectual property rights of personal data to individuals through their ownership of a database, wrapped with containerised microservices. Firms can (1) build smart devices that individuals can control and acquire the data on the device onto their HAT; (2) build smart applications for individuals to make use of their data; or (3) help individuals exchange their data for better buying decisions, personalisation and recommendation (4) not need to hoard data as firms can request for data in real time and on demand whenever needed and only while the user is using the service.

Drivers

- Stricter regulation on privacy and data protection
- Demand for secure, safe and privacy preserving exchange of data across individuals and companies
- Need for global operating standards for personal data exchange
- Growing public reaction against non-distribution to account holders of value of their data: there is a widespread complaint in public

discourse concerning the unfair extraction of the value of personal data or the use of personal data without obtaining proper consent
- More and more hacking of commercial and public sector and personal data. Large data sets held by organisations of any size are vulnerable to the increasingly sophisticated methods deployed by hackers.

Challenges

- Internet providers charging for use of internet services in exchange for loss of right to harvest and analyse data. Widespread abandonment of the data-in-exchange-for-services model of the online economy and instead the use of straightforward paid models without the imperative to exploit personal datasets.

Risks and barriers

- Scaling up use by individuals incentivizing firms with non-distributed data sets to set up new accounts on HAT, get existing users to migrate to HAT. The HAT is only useful if it has a wide uptake; it is only likely to have a wide uptake if it is useful. The challenge that the organisation is working on is how to create a snowball effect that would lead to widespread uptake.
- Identifying the Data controller: is it the HAT management, or commercial users of HAT who recruit customers via a HAT platform. There remains a legal issue of who is to be assigned the status of Data Controller, and in particular whether the HAT organisation is to be assigned this status individual HAT users are their own Data Controllers. If one of the HAT organisations itself has this status, then there is a diminishment of its claims merely to be acting to facilitate people owning their own data
- Converting HAT to a Data sale platform: Sales by individuals to aggregators, researchers. The long -term goal is to create a platform that enables individuals to obtain the economic value of their personal data in accordance with their own preferences for privacy
- Data protection legislation may create confusion over the adoptability of HAT as a response to hacking threats. The HAT depends in part on the legal idea that an individual can own a database (even if individuals cannot own pieces of data). It remains to be seen in the context of evolving data protection legislation how that legal idea plays out.

RRI actions



Reflection & Anticipation

- Ethical design of data auctions. Technologists might reflect upon the various possible pricing models for how personal data is valued on exchange platform



Inclusiveness

- Create understanding among users about informed data donations in the HAT and learning form the community which are the needs and users' requirements about data protection or use. E.g. through user-

centered design and stakeholder dialogues.



Responsiveness

- Embedded ethicist: translation of existing practices into RRI-terms
- Privacy by design approach in HAT: in order to make people sure that their data will be handled in the right way, incentivizing mass take up of the HAT by individuals
- Consider adoption of sustainability, and business ethics certification schemes to formally recognize RRI principles implemented by HAT, and as well showcase HAT as a social enterprise

Final RRI Roadmap

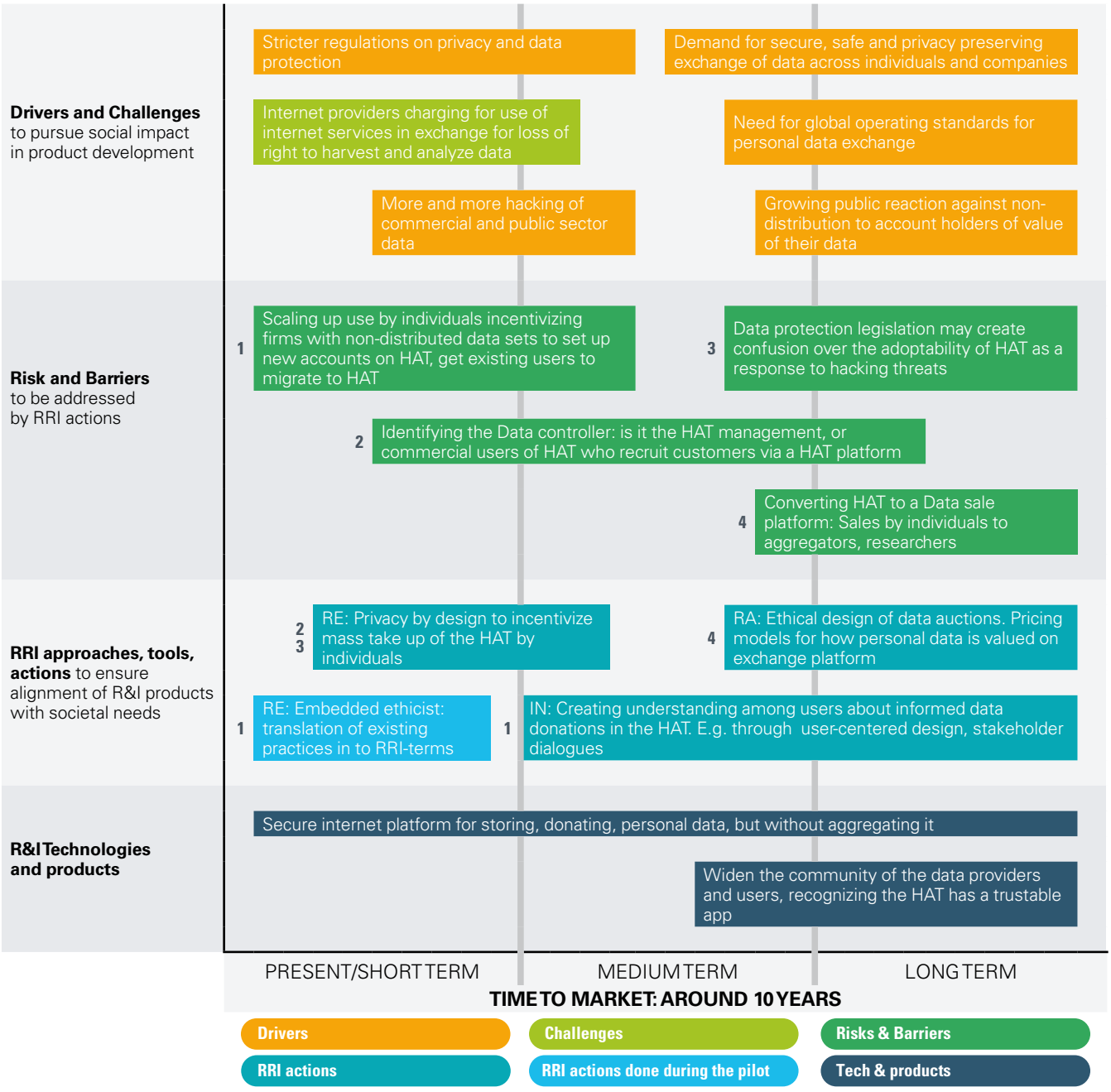
The aspects relevant for the uptake of RRI by the company have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 6).

The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake. Implementation of RRI could help HAT to engage with the community of stakeholders, and make the people aware about the moral motivation of HAT project, in order to inform the development of the technology, and ensure HAT is representing as much as possible consumers and their interest, and thus gain their trust.

HAT is convinced that the digital economy is going to shift from a centralized to an individual model of control of personal data. In this scenario, an ethical approach toward personal data economy will be an essential factor to be a trustworthy business that engages with the consumer, and to gain a competitive advantage in the field. RRI is the way to explore and found solutions toward this scenario.

HAT ROADMAP

RRI Vision: develop distributed data platform for increased personal control of data



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions


RDM
AUTONOMOUS
VEHICLES
pod
001
RDM
AUTONOMOUS
OPEN
CAUTION!

RDM

↘ CASE DESCRIPTION

The RDM Group, produces small low-speed self-driving pods. These are envisioned as being deployed for the 'last mile' of a journey, such as between a railway station and the final destination. They also might be used in shopping malls, university campuses, airports, or for parcel delivery.

The company RDM is part of several consortia receiving funding from Innovate UK, a body that distributes government funds for research. Amongst the project members are also Jaguar Land Rover and Milton Keynes Council. Furthermore, RDM has been involved in UK research council funded projects on automated cars managed by Warwick Manufacturing Group, Warwick University, including the projects INTACT, SWARM, and SMARTER.

CONTEXT ANALYSIS

- Type of pilot organization: SME
- Country: UK
- R&I project selected: self-driving pods
- Technology: Autonomous vehicles
- Relevant regulatory regimes: General Data Protection Regulation, safety, security, mobility and environmental regulation
- Type of R&I activities: in-house and cooperative research (public -private partnership)
- Type of business: business to business, business to consumer
- Time to Market (indicative): 3-5 years
- CSR policies: none explicit
- RRI Maturity Level: Tactical

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by the Chief Technical Officer
- Motivation for RRI: exploring ways to ensure societal acceptability of the final product: involve a diversity of stakeholders to discuss about how vehicles should be conducted, how the data collected should be used in order to respect people's rights and how autonomous vehicles could affect or improve the public spaces, urban planning or commerce.

MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: universities and other research partners, suppliers, commercial partners, local governments funders, local communities, and end-users of the pods (both private citizens and businesses), media and the general public
- Key ethical, legal and social issues: information privacy, commercial use of private data, and urban planning, safety of trials on public roads

- RRI actions selected for the PRISMA pilots: embedded ethicist



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the self-driving pods project are[9]

– *Scientific & Technological:* Feasibility of the technology solution, Product reliability
– *Ethical & Societal*: Product acceptability, Product safety
– *Strategic*: Customer satisfaction, meeting new consumers' needs or requests, Fulfil ethical and social requirements
– *Organizational*: Address regulatory barriers, Risk management, Avoid irresponsible behaviour
– *Economic*: Market penetration



RRI ROADMAP DESIGN

RRI Vision

Developing automated and personalized public transport to reduce traffic, pollution and parking land use in urban areas. The vision is to develop this technology in a way that is:

- carried out in consort with all involved, especially its end users and those who live in the spaces in which it will be deployed
- both safe and inconspicuous, and tested rigorously
- proactively open, transparent and fair about its use of people's personal data
- demonstrably an improvement in sustainability terms

R&I Technologies and products

Electric Automated Cars for Public Transport: The core deployment of the technology is the automated vehicle for the purposes of public transport in a city.
Market for Retailers in Routes: Among the possible revenue models for the technology is the creation of a market among retailers for advertisements or even offers of different destinations to customers.
Smart sensors of real time traffic densities, transport demand: The technology includes a set of different sensors that can detect, predict, and avoid traffic congestion, with a set of driverless pods acting as an aggregated group.
Electric commercial vehicles for urban deliveries: Alongside the passenger carrying function is the possibility of deploying the vehicles for delivery of goods.
Urban pods as data collectors and transmitters: The pods must collect a great deal of data in order to function, and this is likely only to increase as data collection technology in general improves and gets cheaper.

Drivers

- Fixed business hours making for peaks and troughs in demand:

[9] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly

Transport in cities is subject to rush hours and quiet periods; in rush hours the infrastructure will be heavily stretched and there will therefore be great value in finding ways to reduce the demands upon it, for instance through the creation of the kind of park and ride scheme proposed by the RDM driverless technology.

- Multiplication of delivery technologies by large internet retailers: The various proposed uses of the driverless pod include their use as a delivery channel for internet retail products. This is one of the several potentially lucrative uses of the technology.

Challenges

- Difficulties of automated transport off motorways: It is challenging to deploy automated vehicles – even slow-moving ones – in complex residential environments that include cyclists, pedestrians, and larger vehicles. Success will depend on robust technological solutions to the various problems raised.
- Oversight about data collection: RDM projects is designed on the model of "service in exchange of data" – raising revenue by brokering the data provided by users – so users need transparent information about the data collected and used, in order to provide informed consent. Transparency also avoids a possible uses of users' data beyond the individual's expectations.
- Transparency in communication with users: road-users need to be informed about the behavior of autonomous vehicles

Risks and barriers

- Public misapprehensions about safety and risks: alongside technological robustness, in order to succeed it will be necessary to take the correct path being with regard to popular attitudes towards the technology
- Crowding of pedestrian spaces by delivery vehicles: If the vehicles are perceived as crowding pedestrian spaces, especially where they are in a delivery function, then public uptake will be diminished
- Resistance to vehicle sharing: In order for the efficiency with regards to reducing congestion, it will be necessary for the vehicles to operate with a ridesharing function. It remains to be seen how far there is a market for this product that sits in between public transport, on one hand, and private cars and taxis on the other.
- Protocols for data exchange with authorities

RRI approaches, tools, actions



Reflection & Anticipation

- Advanced Simulation and Testing of Speeds, environments, also based on stakeholder engagement: in order to anticipate and characterize possible risks or conflictual situations. This will improve the risk management and safety procedures and will highlight the conflicts in order to solve them.



Inclusiveness

- Co-creation with retailers, urban transport authorities, local residents in order to involve who has a stake in

the definition of the urban planning and to improve the positive social impacts of the project. The users could be interested in a service providing them information about places, to find shops with specific characteristics, or receive advertising based on their preferences.



Responsiveness

- Embedded ethicist: translation of existing practices into RRI-terms
- Environmental impact studies: in order to select the best options for the development of autonomous electric vehicles usage and for environmental impact reduction (e.g. aiming at the maximum traffic reduction)
- Oversight and transparency about data collection, including use of specific ethical protocols to guarantee respect of users' rights

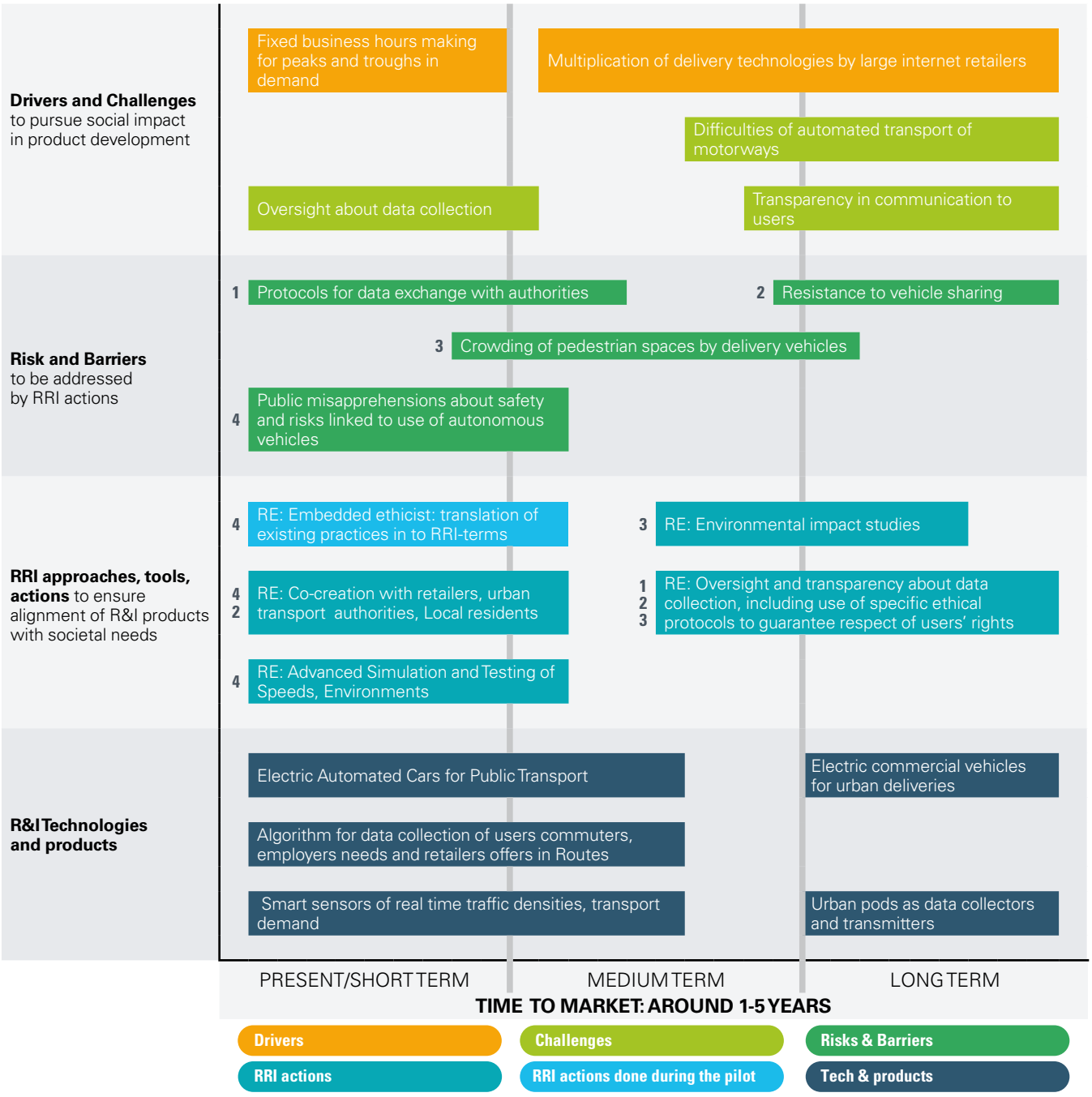
Final RRI Roadmap

The aspects relevant for the uptake of RRI by the company have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 7).

The RRI roadmap developed in PRISMA is a useful starting point for RRI uptake. The PRISMA experience has been really informative for RDM, it allowed a small family business –with limited formal education in ethics or responsible innovation – to benchmark itself against the rest of the innovation world, have a better understanding of the values, needs and concerns of its customers, finally improving the product.

RDM ROADMAP

RRI Vision: Developing automated and personalized public transport to reduce traffic, pollution and parking land use in urban areas



Notes:
RA: Reflection & Anticipation actions; IN: Inclusiveness actions; RE: Responsiveness actions.
Numbers provide indication of links between each of the risks and barriers and each of the RRI actions



BISIGODOS

↘ CASE DESCRIPTION

The EU project BISIGODOS aimed to identify ways to use algae as a feedstock in order to produce valuable chemicals, amino acids and high added-value bio-resins that would normally be produced using petrochemicals. The algae biomass can be fed directly with CO_2 from industrial emissions (cement, steel factory, thermal power plants, etc.) as a raw material that is cost-effective and renewable. The process is assisted by solar radiation, nutrients and sea water microalgae. The consortium brought together expertise and resources within the areas of: microalgae and photo-bioreactors production and optimization, manufacture of amino acids for food products, production of conductive polymer coatings, bio-resin development for water-based inks, bio-surfactants production and bio-PU adhesives manufacturing, and end-users in the food, flexible packaging, hair care, metal industry and paints products.

This PRISMA pilot has a different approach compared to the other pilots. The work has been retrospective, looking and analyzing from an RRI perspective activities and results of the EU project BISIGODOS. The work will be informative for the development of future initiatives of partners, and as well as setting research calls in this field, especially within the EU science funding context.

MANAGEMENT COMMITMENT

- The RRI PRISMA pilot has been endorsed by the project coordinator and the project partners
- Motivation for RRI: better understanding of the ethical, social and legal issues and stakeholder expectations the technology faces; and better alignment for future bids for research funding

CONTEXT ANALYSIS

- Type of pilot organization: public-private partnership (EU funded research project)
- Country: UK
- R&I project selected:
- Technology: industrial biotechnologies
- Regulatory regimes relevant for the R&I project: IPR protection frameworks
- Type of R&I activities: cooperative research
- Type of business: business to business
- Time to Market (indicative): not applicable
- RRI Maturity Level: Defensive



MATERIALITY, EXPERIMENT & ENGAGE

- Key stakeholders: research organizations, companies involved in chemicals, adhesives, coatings, ink, surfactants, food, consumer groups, other industry actors, investors, policy makers, media and the public, companies involved in the end-of-waste and recycling sector
- Key ethical, legal and social issues: profit and short/long term research vs improvement of environmental and social and economic impact, issues of cooperation amongst partners, Intellectual property rights aspects, transparency
- RRI actions selected for the PRISMA pilots: embedded ethicist



VALIDATE

- The most significant criteria identified with the company to analysis and monitor over time the impacts (in terms of costs & benefits) of the RRI actions on the Bisigodos project are[10]
  - *Scientific & Technological:* Feasibility of the technology solution, Product quality
  - *Ethical & Societal*: Product environmental sustainability, Trust with/avoid conflicts with business partners, suppliers and end-users
  - *Strategic*: Fulfil ethical and social requirements (e.g. for access to funding)
  - *Organizational*: Team cooperation and motivation for product development, Address regulatory barrier
  - *Economic*: Product cost, Time to market
  - *Direct costs* to perform the RRI action

[10] For more details on the criteria for impact analysis, see PRISMA Executive Brief: Guidelines to Innovate Responsibly



RRI ROADMAP DESIGN

RRI Vision

Developing bio-based (algae) feedstock to replace petrol-chemicals feedstocks, based on RRI-aware Life Cycle Analysis and funding calls more specific on RRI demands: the vision is to ensure future projects on developing algal oil products would carry out richer Life Cycle Assessments that draw more widely on the range of LCA methods that are available, including greater input from external stakeholders.
Furthermore, it is envisaged that funding calls in this area will provide guidance for applicants on the RRI tools that they are expected to deploy, or attainments that they are expected to achieve.

R&I Technologies and products

The five products developed on the project using algal oil were: adhesives, coatings, ink, surfactants, food. In the future, the project partners would aim at the general replacement of petrochemical feedstock with algae feedstock for consumer and industrial products

Drivers

- Consumer products produced without using petrochemicals, Lower resource usage, absorption of Co2. The project aimed at developing ways to use algae in order to produce materials that would normally have a petrochemical basis. Aside from the advantages of moving away from petrochemical feedstocks in terms of sustainability and geopolitics, the methods developed in the project ultimately sought ways of making products that not only had a lower resource impact themselves but also would absorb the carbon dioxide emissions of other industries.
- High-value consumer products. The project focused on creating products that have high economic value such as life-style foodstuffs and toiletries. Such a focus is more likely drive the technology in the future, since the possibility of a profit is more likely to become real.

Challenges

- Experimental nature of project. Not all of the products were possible to make as expected; the technology remains at a relatively early stage. It is therefore greatly aided by the university setting and the investment of outside funds.

Risks and barriers

- Early stage technology cannot achieve economies of scale. As with any new technology development, the relatively small-scale production that took place in the project was unlikely to show economic viability in comparison to existing industrial methods. The life cycle and economic assessments carried out at the end of the project confirmed this.
- Uncertainty about market or viability. Since the pure resource case for the products can't be made at this stage, those developing them must depend on the analysis changing in the future. This may be through inherent improvements in the techniques themselves, newly discovered economies of scale (perhaps in the production of algae), or in changes in the petrochemical markets, perhaps due limitations on the supply of crude oil or new governance structures favouring non-petrochemical methods.
- Commercial imperative of partners. The specifications for the products to be produced were made and controlled by the commercial partners on the project. While this had the advantage of ensuring that the project focused on producing products that may ultimately go to market, it had the disadvantage that only a relatively narrow range of stakeholders were involved at the coal face of deciding what the focus of production would be.

RRI ACTIONS



Reflection & Anticipation

- (Retrospectively) embedded ethicist: The embedded ethicist approach was applied retrospectively in order to identify and analyse the ethical issues that arose, trying to extrapolate lessons for future similar projects. Such projects would benefit from the direct deployment of the embedded

ethicist approach.

- Implement Life Cycle Assessment, value assessment and social LCA: The project involved a Life Cycle Assessment and a Value Assessment. From an RRI perspective this might be improved through making assessments that are anticipatory rather than merely retrospective, are stakeholder engaged, open access, and have explicitly socially-led goals and scope. Moreover, the assessment was carried out on the assumption that each product (surfactants, coatings, and so on) would be separately produced; it would be worthwhile also to see such assessments on the wider assumption that algal oils replaced petrochemical feedstocks in the economy more broadly.
- Anticipatory' assessments of technology, to take into account economic or social value and indeed to draw out the values that are implicit in those carrying out the research



Inclusiveness

- Stakeholder engagement: work with research, business and social actors sharing values and create positive ethical networks. Involve both internal stakeholders (e.g. corporate partners in project) and those outside of the technology with expertise on possible economic effects of deployment.



Responsiveness

- Implement user-centered design, user innovation, flexible and adaptive design, co-creation approaches, involvement from the outset a wide range of stakeholders
- Performing LCA and S-LCA starting from the very early stages of design, considering the large part of environmental impact is locked in the design stage.

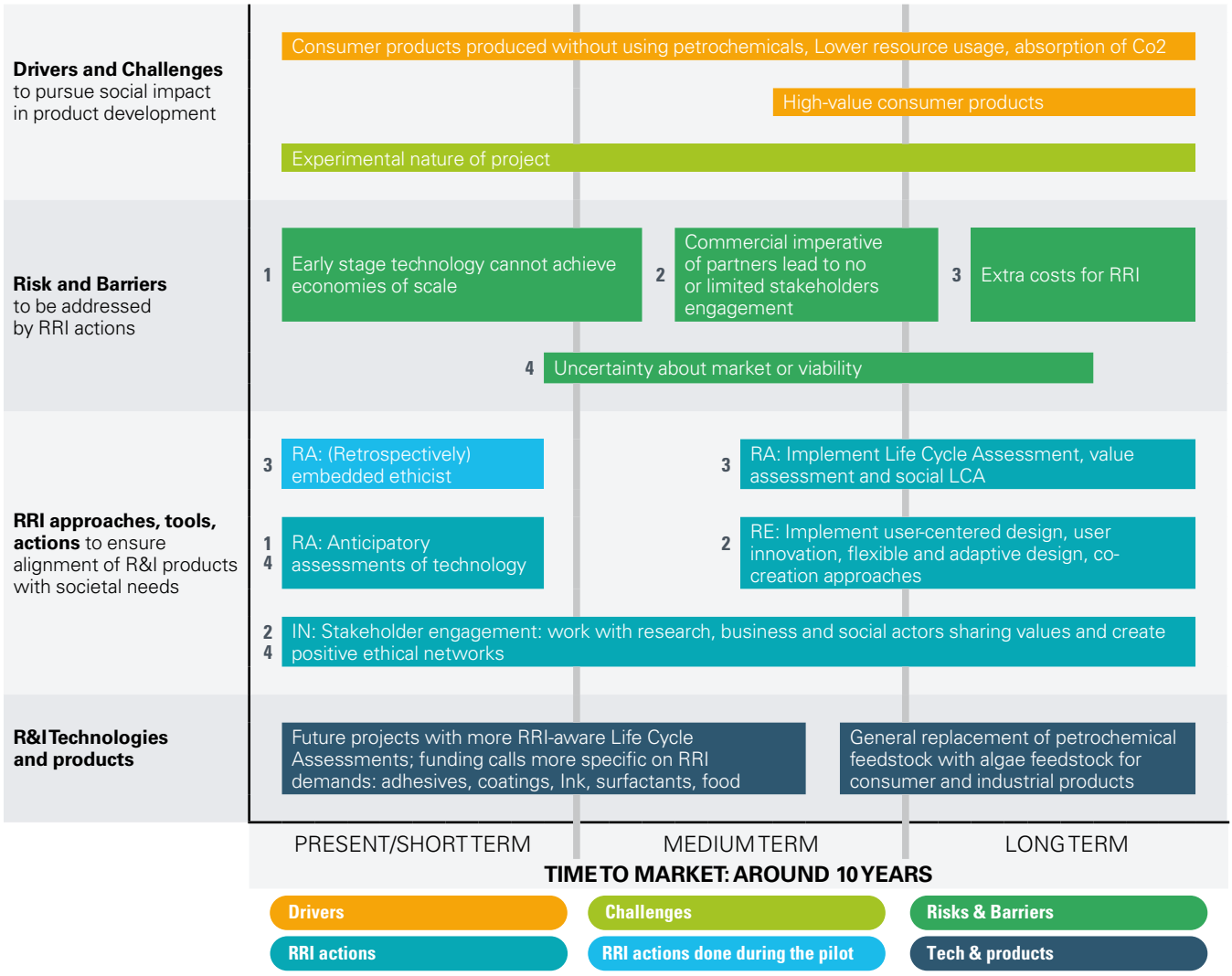
Final RRI Roadmap

The aspects relevant for the uptake of RRI by the company have been synthetized in an overall diagram, following the visual approach described in the PRISMA Guidelines to Innovate Responsibly (Figure 8).

The BISIGODOS pilot in PRISMA has been retrospective, looking at a project already finished. The recommendations and actions included in the roadmap could help to shape future calls in the field or could help research actors to find the best ways to implement RRI aspects in future projects. The roadmap helps in understanding the value that RRI implementation could bring into product development. In future calls and projects, it will be essential to be more explicit about the actions needed to meet societal needs and expectations, in terms of stakeholder engagement, assessment of social, environmental, economic benefits or other aspects. And this is exactly what the action plan of the roadmap allows to do. However, RRI implementation requires extra costs in product development, and therefore it is really important that addressing RRI aspects will become a requirement in future calls. This is the only way to ensure RRI implementation.

BISOGODOS ROADMAP

RRI Vision: develop projects on bio-based (algae) feedstock to replace petrol-chemicals feedstocks, based on RRI-aware Life Cycle Analysis demands



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