D3.1: Diagnosis: RRI in Industrial Leadership

Grant Agreement No.	**741402**
Project Start Date	May 1st, 2017
Duration of project	48 months
Version	1.1
Authors	Peter Novitzky (WUR) Vincent Blok (WUR) Job Timmermans (WUR) Jana Dvořáčková (TACR) Vladimír Kebo (TACR) Lukáš Macenauer (TACR) Zbyněk Machát (TACR) Filip Vostál (TACR)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 741402.The opinions expressed in this document reflect only the author's view and in no way reflect the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.

Contents

List of Figures

List of Tables

1 Executive Summary

The European Commission (EC) supports research and innovation (R&I) to expand the scientific and technological base of the European economy and industry, fostering broader benefits for society and tackling pressing societal challenges, while also upholding European values of inclusiveness and democratic politics (EC 2010; EC 2013a). As part of its R&I strategy, the EC is in the process of funding its eighth framework programme, Horizon 2020, for €77 billion from 2013–2020, with plans for the ninth framework programme rapidly taking shape. Within H2020, approximately one-third of programming is carried out under the Excellent Science priority, focusing, "On the next generation of science, technology, researchers and innovations and providing support for emerging talent from across the Union and associated countries, as well as worldwide" (EC 2013a, L347/123).

The goal of the whole Industrial Leadership pillar is to make Europe a more attractive location to invest in research and innovation ventures. This includes the promotion of activities where businesses set the agenda. Industrial Leadership aims at providing major investments in key industrial technologies, while maximising the growth potential of European companies by providing them with adequate levels of finance as well as helping innovative SMEs to grow into world-leading companies. Industrial Leadership as a Horizon 2020 pillar thus comprises Leadership in Enabling and Industrial Technologies, Access to Risk Finance, and Innovation in SMEs.

The synthesis presented in this document is summarized from individual "Diagnosis Reports," presented in full in four annexes. We find that Industrial Leadership pillar was successful in implementing some of the RRI themes and keys, however, this implementation is not always systematic and complete given the full list of RRI-related keys. There is a high variability in requirement, evaluation, and successful implementation of RRI keys throughout the pillar. It can be concluded that the implementation of RRI keys is one step ahead in bigger businesses, while smaller SMEs are exposed to the greater vulnerabilities and challenges of market conditions posed on competitiveness.

The demanded steps and recommendations from the involved stakeholders suggest that further training in relation to RRI keys is required, with the involvement of dedicated specialists for societal challenges. Greater awareness of socio-ethical issues in relation to responsible research and innovation is required.

2 Introduction

2.1 Responsible Research and Innovation, Horizon 2020, and the NewHoRRIzon Project

2.1.1 Responsible Research and Innovation in European Research and Innovation

Research and innovation (R&I) contribute directly and indirectly to many beneficial advances in how we live and how we support our societies. Indeed, R&I feature centrally in the European strategy for smart, sustainable, and inclusive growth (EC 2010). At the same time, scientific and technological developments resulting from R&I contribute to undesirable or unsustainable impacts in our lives,

societies, and the environment. Evidence of unequal benefits and burdens of R&I are visible in many spheres of our daily lives, from transportation systems, to agriculture, from the built environment, to health care, water and energy systems.

The European Commission (EC) supports R&I to expand the scientific and technological base of the European economy and industry, fostering broader benefits for society and tackling pressing societal challenges, while also upholding European values of inclusiveness and democratic politics (EC 2013a). One of the tactics taken by the EC to create and disseminate socially and economically beneficial knowledge and drive prosperity has been to include cross-cutting requirements into its multi-year, large-scale research framework programmes—most recently the €77 billion Horizon 2020 (H2020; the eigth framework programme, running form 2013–2020) (EC 2013a).

One of these cross-cutting requirements includes the concept of Responsible Research and Innovation (RRI) (EC 2013a). RRI activities try to create a more open, accountable and democratic scientific culture and process, strengthening the ways groups of people think about and respond to new opportunities in R&I. In practice, this means drawing on more diverse ways of understanding and addressing problems, sharing knowledge, and empowering people to learn and work together. A central aspiration of RRI is to contribute to excellent science and innovation for socially desirable, economically vibrant, and sustainable societies (EC 2014d). For the Commission, this means, in particular, focusing on:

- **Gender equality**, including gender balance of R&I teams, and accounting for gender dimensions of R&I projects;
- **Public engagement**, envisioned as a two-way communication and learning process to include in R&I industry and SME, policymakers, non-governmental organisations (NGOs), civil society organisations (CSOs), and citizens who would not normally interact with each other on matters of science and technology;
- **Science education and science literacy**, to nurture modes of scientific inquiry, curiosity, and creativity;
- **Open access and Open Science**, to make data and results of research more accessible, earlier to improve R&I;
- **Ethics**, going beyond legal compliance and researcher integrity to include also reflection on questions of how R&I do and do not relate or respond to societal interests;
- **Governance**, to ensure effective, inclusive, and sustainable ways of co-designing agendas and activities to achieve the above and broader objectives of European R&I.

More recently, the Commission has made additional commitments to Open Science, Open Innovation, and Open to the World (EC 2016a) as part of its continued prioritization of fostering alignment among science and society in R&I. The EC Open Agenda includes three dimensions:

- **Open Innovation** — “co-creation” that unfolds across innovation ecosystems and requires knowledge exchange and innovation capacity of all actors involved, be they financial institutions, public authorities or citizens, businesses, or academia (EC 2016a, p.12).

- **Open Science** — a concept of transformed scientific practice, wherein the foci of researcher activity shifts from “publishing as fast as possible” to “sharing knowledge as early as possible,” in manners that are accessible to as many parts of the innovation ecosystem as possible (EC 2016a, p. 34).

- **Open to the World** — "Fostering international cooperation in research and innovation” to enable access to “the latest knowledge and the best talent worldwide, tackle global societal challenges more effectively, create business opportunities in new and emerging markets, and use science diplomacy as an influential instrument of external policy” (EC 2016a, p. 59).

The EU contributes to the tackling of the so-called societal challenges. The importance of tackling societal challenges increased with the adoption of the Sustainable Development Goals1 defined by the UN, as well as the Paris Climate Change Agreement. Horizon 2020 allocates the highest share of its budget to tackling societal challenges (EUR 29.7 billion, i.e. 37.8% of Horizon 2020 budget; EC 2017j p51). The expressed conviction is that big opportunities exist that can turn the societal challenges into business opportunities of tomorrow, hence the focus on radical technological breakthrough that would be quickly marketable for Horizon 2020 (EC 2017j p51). For example, in tackling the societal challenges the EU supports key enablers to innovation and to growth, that might have a strong replication potential and impact upon the whole EU (EC 2017l p819).

The project NewHoRRIzon seeks to promote a strong integration of RRI into Horizon 2020 and national research and innovation funding. Its objectives are to:

- Bring together different stakeholders to co-create social experiments that foster the uptake of RRI;

- Develop narratives and storylines on how to implement RRI;

- Provide recommendations on how to better integrate RRI into the next European Framework Programme and beyond;

- Raise awareness, mainstream best practices and share NewHoRRIzon results;

- Develop and disseminate a concept of Societal Readiness Levels (SRL) of technology; and create a sustainable RRI Network and RRI Ambassador Programme.

To achieve its objectives NewHoRRIzon organizes 19 Social Labs — one for each Horizon 2020 programme line (see Figure 1). Social Labs build on a tradition of participatory action research to bring together people with common interests in solving complex problems related to technology and society. Inviting people with a range of expertise from all across society, the labs will be creative, engaging spaces for collaborative experimentation. Every Social Lab hosts three workshops and a series of smaller additional activities and meeting formats. Participants have the opportunity to co-

create, prototype, and test pilot actions and activities to support RRI. The three workshops held in each of the 19 Social Labs are planned. In addition, selected participants of each Social Lab are invited to cross-sectional exchange workshops after the second and third series of Social Lab workshops.

These societal challenges are defined as follows (EC 2017j p160):

- **SC1** – Health, demographic change and well-being: improve the lifelong health and well-being of all
- **SC2** – Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy: secure sufficient supplies of safe, healthy and high quality food & other bio-based products
- **SC3** – Secure, clean and efficient energy: make the transition to a reliable, affordable, publicly accepted, sustainable and competitive energy system, aiming at reducing fossil fuel dependency
- **SC4** – Smart, green and integrated transport: achieve a European transport system that is resource-efficient, climate- and environmentally-friendly, safe and seamless for the benefit of all citizens, the economy and society
- **SC5** – Climate action, environment, resource efficiency and raw materials: achieve a resource- and water-efficient and climate change resilient economy and society, protection and sustainable management of natural resources and ecosystems and a sustainable supply and use of raw materials
- **SC6** – Europe in a changing world – inclusive, innovative and reflective societies: foster a greater understanding of Europe, providing solutions and supporting inclusive, innovative and reflective European societies
- **SC7** – Secure societies – protecting freedom and security of Europe and its citizens: secure European societies, while strengthening the European culture of freedom and justice

2.1.2 The NewHoRRIzon Project

The NewHoRRIzon project (European Commission Grant Agreement No 741402) seeks to promote integration of RRI and Open Agenda approaches into national and international R&I management. To do so, the project engages a wide-ranging group of R&I stakeholders from across Horizon 2020 programming in order to co-create tailor-made “pilot actions” supporting RRI and Open Agenda aspirations. Through such engagement, pilot actions can be based on key needs of European and national research and innovation funding programmes. NewHoRRIzon’s specific objectives include:

- bring together different stakeholders to co-create social experiments that foster the uptake of RRI;
- develop narratives and storylines on how to implement RRI;

- provide recommendations on how to better integrate RRI into the next European Framework Programme and beyond;
- raise awareness, mainstream best practices and share NewHoRRIzon results;
- develop and disseminate a concept of Societal Readiness Levels (SRL) of technology; and
- create a sustainable RRI Network and RRI Ambassador Programme.

To achieve these objectives, NewHoRRIzon has organized 19 Social Labs, where interventions will be co-created for pilot co-created for pilot implementation, evaluation and cross-sector learning, one for each Horizon 2020 programme line (see Figure 1). Social Labs build on a tradition of participatory action research to bring together people with common interests in solving complex problems related to technology and society. Inviting people with a range of expertise from all across society, the labs will be creative, engaging spaces for collaborative experimentation. Every Social Lab hosts three workshops and a series of smaller additional activities and meeting formats. Participants have the opportunity to co-create, prototype and test pilot actions and activities to support RRI. In addition, selected participants of each Social Lab are invited to cross-sectional exchange events after the second and third Social Lab workshops.

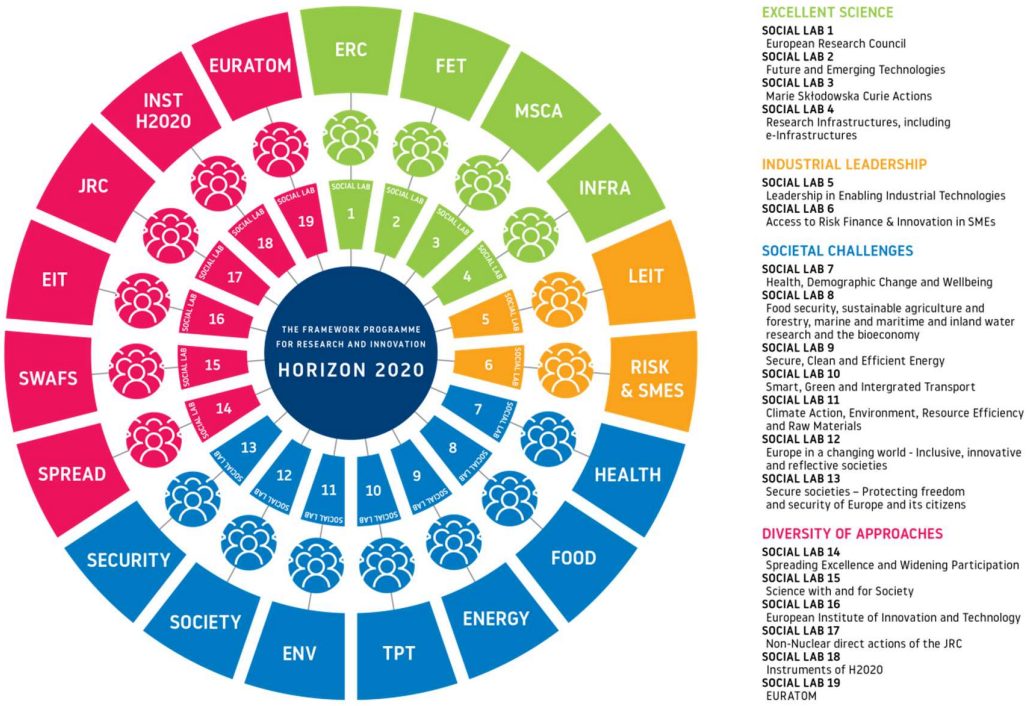

Figure 1 - NewHoRRIzon Social Labs

2.1.3 NewHoRRIzon Deliverable 3.1

Deliverable 3.1 presents, summarizes and analyses the results of Diagnosis reports about current practices of RRI in the NewHoRRIzon Social Lab cluster "Industrial Leadership." This cluster includes the following NewHoRRIzon Social Labs:

- Social Lab 5: Leadership in Enabling and Industrial Technologies
- Social Lab 6: Access to Risk Finance and Innovation in SMEs program lines

The diagnosis phase is part of the Social Lab process and had two intertwined tasks:

1. to identify and recruit "Social Lab participants (H2020 stakeholders) and
2. "starting to analyse the specifics of the current use and practices of RRI within the respective programme line" (GA Part B: 16 ff).

Diagnosis should provide first information for the Social labs about the "concepts of RRI, current experiences with RRI in this part of H2020, potentials, visions, benefits, costs, barriers, instruments, RRI relevant practices in R&I and funding (including various instruments), innovation culture, good practices of RRI" (GA Annex 1: 14)

This report presents, compares and analyzes the following Diagnosis reports (see Annex):

- NewHoRRIzon Diagnosis Report Social Lab Nr. 5. Leadership in Enabling and Industrial Technologies. (Novitzky et al 2018).
- NewHoRRIzon Diagnosis Report Social Lab Nr. 6. Access to Risk Finance and Innovation in SMEs program lines (Dvořáčková et al 2018).

Material presented in Deliverable 3.1 is synthesized from the above reports. Each report draws information, evidence, examples, and experiences from a range of document sources and interviews, the methodologies of which are presented in each Annex. The diagnosis thus consisted of 2-steps: a *a) desktop research*, which included the review of programme papers, articles about the structure of European Research Council (ERC), evaluations of the ERC review process, calls, policy documents of the European Commission for the Horizon 2020 Framework Programme in order to get an in-depth overview of the programme and its aspirations, interim evaluation documents, project documents, etc.; *b) interviews with relevant stakeholders* from the respective fields. In total 30 stakeholders have been interviewed (14 for LEIT, 16 for Access to Risk Finance), using the template listed in *8.1 Interview Template*. The statistics and/or overview of participants is under section *4.8 Interview findings* in Table 20 of Annex 1 for LEIT, and section *0 Relevant stakeholders* of Annex 2 for Access to Risk Finance. Please note that due to the General Data Protection Regulation (2018) and maintaining the trust with participants from private corporations the list of LEIT interviewees was anonymised.

2.2 Overview of the Industrial Leadership Pillar

The overall structure of the Industrial Leadership theme of Horizon 2020 programme is depicted in Figure 2.

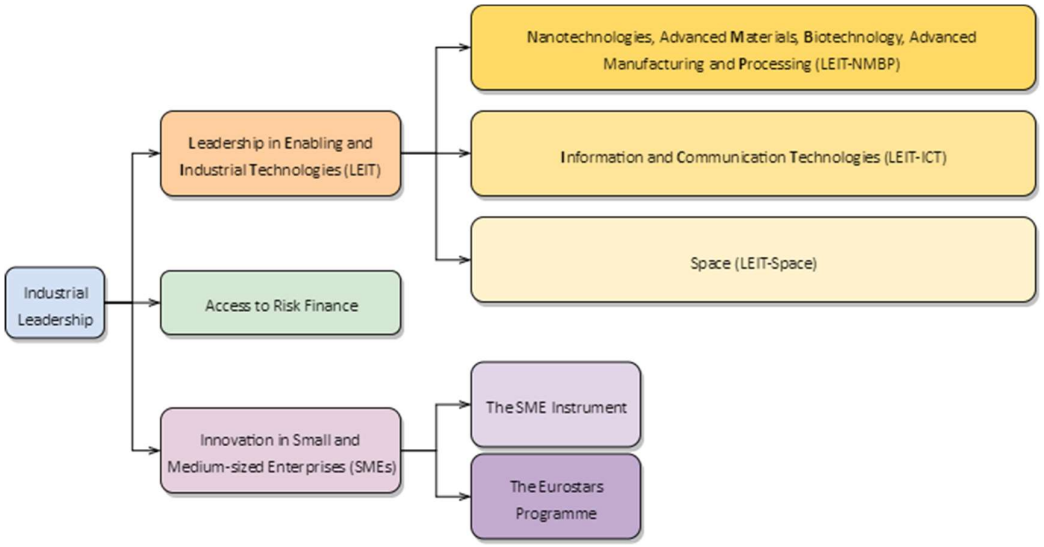

Figure 2 – Organizational Structure of Industrial Leadership

Table 1 shows the three main programme parts of the LEIT subtheme. In contrast with LEIT-ICT and LEIT-Space, the LEIT-NMBP programme part has four further underlying programme parts, namely Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology, which each receive specific attention in the funding calls. Table 1 also lists the priorities of the respective LEIT subthemes.

	LEIT-NMBP	LEIT-ICT	LEIT-Space
Programme Parts	• Nanotechnologies • Advanced Materials • Advanced Manufacturing and Processing • Biotechnology	• Information and Communication Technologies	• Space
Priorities	• Stimulate growth and jobs • Integration & deployment of enabling technologies by European industry • Stimulate private sector involvement • Enhance product competitiveness and impact • Foster cross-cutting KET activities • Technology validation in an industrial environment • New opportunities to tackle societal challenges	• A new generation of components and systems • Advanced Computing • Future Internet • Content technologies and information management • Robotics • Micro- and Nano-electronic technologies, Photonics	• European Global Navigation Satellite System (EGNSS) & Earth Observation flagships • Space infrastructure & Space Surveillance and Tracking system (SST) • Industry's competitiveness and value-chain • Exploitation of space infrastructure & support space science; • Enhancing international partnerships.

Table 1 – Programme Parts and Priorities per LEIT Theme

Table 2 provides an ovierview of the remaining parts of the Industrial Leadership programme, together with their priorities.

	Access to Risk Finance	Innovation in SMEs
Programme Parts	• InnovFin – EU Finance for Innovators	• The Eurostars Programme
Priorities	• Support and facilitate access to sources of debt and equity financing • support for innovative SMEs (microenterprises, startups)	• Optimise the Research, Development & Innovation environment for SMEs • Establishment and facilitation of a range of support services • Strengthening the innovation capacity of SMEs

		• Creating value on the market and/or into society • Underpinning the Europe2020 strategy for smart, inclusive and sustainable growth

Table 2 - Programme Parts and Prioritios of the Industrial Leadership Themes (except LEIT)

The goal of the whole Industrial Leadership pillar is to make Europe a more attractive location to invest in research and innovation ventures. This includes the promotion of activities where businesses set the agenda. Industrial Leadership aims at providing major investments in key industrial technologies, while maximising the growth potential of European companies by providing them with adequate levels of finance as well as helping innovative SMEs to grow into world-leading companies.[1]

LEIT together with SMEs are expected to have a wider impact on all of the societal challenges defined by the European Commission within the Horizon 2020 programme. The biggest impact is expected in the case of LEIT-NMBP on Climate actions, resource efficiency and raw materials (SC5), followed by Secure, clean and efficient energy (SC3) and Health, demographic change and wellbeing (SC1). LEIT-ICT is expected to have the biggest impact on Europe in a changing world: inclusive, innovative and reflective societies (SC6), followed by SC1 and Secure societies – protecting freedom and security of Europe and its citizens (SC7). LEIT-Space is expected to have the biggest impact on Smart, green and integrated transport (SC4), closely followed by SC7 and SC5. The impact of Innovation in SMEs is consistent throughout the societal challenges, gaining a stable influence in their addressing. For a more detailed overview see Table 3.

Horizon 2020 Programme Part	SC1	SC2	SC3	SC4	SC5	SC6	SC7
LEIT-NMBP (n=96)	42,4%	29%	52,6%	23,2%	61,9%	18%	14,6%
LEIT-ICT (n=77)	52%	21,5%	32,2%	34,5%	30%	55,8%	38,5%
LEIT-SPACE (n=6)	28,2%	31,4%	33,1%	52,3%	44%	29%	50,6%
Innovation in SMEs (n=30)	24.4%	24.3%	26.8%	19.9%	19.9%	26.0%	21.5%

Table 3 – Expected wider impact on SCs in next 10 years (EC 2017j p163)

Table 4 presents the overview of expenditures within the subthemes of LEIT together with Access to Risk Finance and Innovation in SMEs, broken down into funds for sustainable development and climate change. The highest percentage of expenditures on sustainable development was spent on LEIT-NMBP, and specifically on biotechnology. The biggest contribution for climate change was spent again on LEIT-NMBP, specifically on advanced manufacturing. The total budget of Access to Risk Finance and Innovation in SMEs are considerable smaller compared with the overall LEIT subtheme. Nevertheless, nearly 50% of the whole SMEs' expenditure was spent on sustainable development goals, while a quarter of the Access to Risk Finance was spent on the sustbainable development goals.

Horizon 2020 Programme Part	Total budget in EUR	CC in EUR	CC In %	SD in EUR	SD in %
Nanotechnology	364.913.028	14.413.667	4%	209.014.778	57%
Advanced materials	355.548.010	142.271.539	40%	248.521.298	70%
Biotechnology	145.591.736	30.809.110	21%	136.064.144	93%
Adv. Manufacturing	642.456.139	304.039.088	47%	498.846.983	78%
LEIT-NMBP total	1.508.508.913	491.533.404	33%	1.092.447.203	72%

1 Cf. http://ec.europa.eu/programmes/horizon2020/en/h2020-section/industrial-leadership

LEIT-ICT	2.600.625.571	169.750.563	7%	782.674.517	30%
LEIT-Space	344.897.303	59.355.382	17%	145.797.628	42%
LEIT overall	4.454.031.787	720.639.349	16%	2.020.919.348	45%
Access to Risk Finance	7.471.875	48.000	0,64%	1.871.430	25,05%
Innovation in SMEs	63.698.824	10.686.098	16,78%	29.436.265	46,21%

Table 4 – Expenditure to Sustainable Development (SD) and Climate Change (CC), 2014–2015 (EC 2017k p208)

3 Current situation of RRI in Industrial Leadership pillar

3.1 RRI as reflected by official policy documents

In LEIT subtheme the most frequently referred RRI-related concepts are public engagement, gender equality, and open access. All these terms are referred to and elaborated substantially throughout the reviewed policy documentation extensively.

The least attention is given to Science education and science literacy, ethics, and governance. These keys are present in the documentation, however, they are not elaborated, explained, or applied in a substantive way. They are mostly used as a reference point with implicit implications.

Within Access to risk finance, there is only implicit reference to the RRI-keys through societal challenges (e.g. science education and science literacy; secure, clean, and efficient energy; public awareness). Similarly, Innovation in SMEs refer to societal challenges, while demonstrating only limited and implicit awareness of RRI-related keys.

An explicit reference is being made to a novel aspect of the Horizon 2020 programme in the form of Open Research Data Pilots – and as such, to open science.

3.2 RRI-oriented assessment of the pillar

3.2.1 Role of RRI on different levels

Scoping Document Level

From the perspective of LEIT, the biggest attention from the scoping level documents have been provided to topics such as public engagement, science education and science literacy, as well as open access. Limited in-depth awareness has been provided to ethics, gender equality, and governance RRI keys. Surprisingly, all three aspect of open innovation, open science, and open to the world have been referred to.

Access to risk finance's reference in the scoping documentation is mostly of economic nature, specifically increasing competitiveness within Europe and globally. In addition, coordination is highlighted, which can be broadly interpreted as an element of open innovation aspect.

Work Programme Level

LEIT's main focus in the work programme level documentation is on gender equality, open access. Other RRI-related keys of public engagement, science education and science literacy, ethics, as well as governance receive a limited in-depth elaboration. From the three Os, open innovation and openness

to the world receive some attention, again, with greater focus to open access and thus also open science. Inclusivity is much more elaborated compared with the previous levels of documentation.

Access to risk finance's documentation refers implicitly again to societal challenges, having the main focus on economic aspects of the programme in terms of access to finances. Similarly, Innovation in SMEs main focus is also economic competitiveness on the work programme level, with occasional references to collaborative research projects and analysis of current SME practices (open science).

Call Level

In LEIT the main emphasis of the documentation is on science education and science literacy, with some reference points to gender equality and governance aspects, with strong emphasis on inclusiveness. Open innovation also receives some attention within the documentation.

Access to risk finance similarly has its main emphasis on science education and science literacy and fulfilling economic and competitive goals within businesses. This is in contrast with Innovation in SMEs, where the emphasis is much broader, including topics of open disruptive innovation schemes, sustainability, resource-efficient and green innovations (societal challenges). References to open access and openness to the world are also noteworthy in the call level.

Project Level

For project level implementation of RRI-key please refer to section 3.4.

In general, it can be stated that only a minority of projects have explicit references to RRI keys. Most of the LEIT, Access to risk financing, and Innovation in SME projects at best has some implicit references to RRI keys and societal challenges, if they refer to these at all.

Proposal Template Level

The proposal templates focus mostly on keys related to public engagement, governance, and ethics (as it is required during the application procedure). Surprisingly, reference to gender equality were not found, nor references to science education and science literacy. Openness to the world was also present in the proposal template level.

Evaluation Level

LEIT's evaluation level documentation consisted of KPIs for RRI and KPIs for gender equality and public engagement.

Access to risk finance and Innovation in SMEs evaluation documentation focused implicitly on societal challenges, as well as other related topics, such as effectiveness, efficiency, coherence, EU added value. The last can be interpreted with hesitation as an element of the open to the world aspect (in relation to the aspirations of becoming a global actor).

3.2.2 General use of RRI

For the area of LEIT, Responsible Research and Innovation is traceable through the requirement of addressing societal challenges throughout the Horizon 2020 programme. Only a single (RIA) call makes *explicit* reference to RRI as a method, by stating "[l]egal, policy making and Responsible Research and

Innovation aspects should be integrated in the proposal" (NMBP-15-2019: Safe by design, from science to regulation: metrics and main sectors; EC 2017h p27).

Most of the societal challenges refer to one or multiple keys. However, these references are often gaining a circular argument: a societal challenge can be addressed by instrumental implementation of one of the keys, which would contribute to boosting and renewing Europe's industrial capacities, to maintain or become a world-leading innovation power. In this regard it is not the technology that is providing the fix but rather the RRI concept as such. Implementing more keys from responsible innovation are not considered as values in themselves, they are rather considered as concepts required during the application or evaluation of a project. Few LEIT-related projects consider RRI keys as something more than a tick box exercise, however, they still do not implement all the keys. The situation with concepts such as the need to increase public engagement, gender equality, open innovation, or open access is slightly better, where these concept are reflected in the documents in an overall positive and valuable manner.

Very few theoretical considerations were present in the official EC documents. The reason for this might be due to the format and possible audience of these reports, the purpose and goals of which is not defined to provide a theoretical overview of Responsible Research and Innovation as such. Theoretical considerations related to RRI are prevalent mostly in academic publications, the documentation for the pillar of Industrial Leadership do not refer to RRI's theoretical ramifications, while RRI's importance is considered somewhat implicit.

As noted above, some of the RRI-related keys are referred to as valuable endeavours, e.g. greater public engagement, open access, open innovation. The reference to economic benefits, greater global competitive advantage, and ethical/societal issues are mentioned more often and in a meaningful way. Other keys are not as much conceptually developed in the reviewed documentation.

The requirement of ethical evaluation during the submission of a project can be interpreted as a substantial influence in requiring the implementation of RRI in a proposal. Similarly, some of the RRI-related keys are also having clear (and sometimes quantifiable) evaluation criteria, while others don't. Overall, the reference to RRI is traceable throughout the tackling and addressing of societal challenges, especially in the mid-term interim evaluation documents. Therefore, the answer to this question is yes.

Throughout the reviewed documentation, the following (explicit or implicit) references were made to the RRI-related keys, O's, Societal Challenges, or other RRI-related concepts (cf.section 4.3).

In Access to Risk finance and Innovation for SMEs the RRI is not traceable as a clear vision in any of the programme lines. The desktop analysis highlighted that RRI is not reflected in the challenges to be addressed in any of the programme lines. Both programme lines are heavily based on mainstream economic-theory assumptions, while RRI is not present as a tick-box exercise nor as a more substantial concept. RRI is not substantially influencing the way R&I in the program lines is carried out.

Keys, O's and other RRI related concepts are rarely used in the documents of the program lines. They are not being addressed specifically in working program documents, calls, proposals, project

descriptions, project evaluations, etc. They are used in policy documents and then in the last step during the overall evaluation of the program.

3.2.3 RRI beyond the keys

RRI is understood in the LEIT-related documentation mostly mediated through the societal challenges, therefore, as a process of tackling overarching grand-challenges of communities. Therefore, RRI is used mostly as a source of motivation and/or justification for a particular research or innovation project, with aspirations towards providing some solutions to these.

Gap analysis is occasionally performed through the Horizon 2020 scoping period which concluded that all priorities have already been addressed at least once in the two first work programmes. Better integration of activities in all parts of the programme is needed to achieve the maximum impact. Decentralisation in one of the LEIT-ICT project can be considered as one of the RRI beyond the key themes. The exchange of skills of artists and creative people with entrepreneurs and technologists should be promoted.

Besides the aforementioned implicit references to RRI-related topics, keys, and themes there is very little explicit reference to RRI in general within the LEIT theme.

The role of RRI-related topics beyond the keys for Access to Risk finance and Innovation in SMEs is, based on the desktop research, not applicable, as very little awareness of RRI, keys, and O's have been found in the aforementioned areas.

3.2.4 Conceptual underpinnings of Research and Innovation in the 7 programme lines

The conceptual underpinnings of Research and Innovation stems from the comparison of FP7 and Horizon 2020 (EC 2017j p26), presented in Table 5.

Recommendations from FP7 ex-post evaluation	Horizon 2020
Focus on critical challenges and opportunities in the global context	• Focuses on society's major challenges • Boosts private-sector participation, including SMEs • Maximizes synergies between different areas of R&I and new digital technologies
Align research and innovation instruments and agendas in Europe	• Seeks to support the alignment of national research strategies • Better coordinates with EU regional funding • Helps EU countries reform their R&I strategies • Identifies obstacles to R&I • Ensures that research proposals support innovation
Integrate different sections of research funding programmes more effectively	• Focuses on better consistency across the funding programme • Ensures cross-cutting issues are considered • Simplifies access to R&I funding • Applies single set of rules consistently • Coordinates effectively across the commission in managing funding
Bring science closer to citizens	• Better communicates to the general public on science issues in general and on Horizon 2020 in particular • Strengthens open access to research publications and data • Involves citizens in research strategy and topics
Establish strategic programme monitoring and evaluation	• Better monitors and evaluates funding and socio-economic impacts • Improves feedback loop from project results to policymaking

Table 5 - From FP7 to Horizon 2020

The notion of responsible innovation has been adopted by the Horizon 2020 and thus by the European Commission based on the definition as 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 and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)" (von Schomberg 2013 p19)

However, from the theoretical framework underling the innovation process as reflected in the H2020 program line the research and innovation processes are interpreted in practice in multiple ways (especially within the LEIT theme). As described by the research conducted by Blok & Lemmens (2015), in much of the responsible innovation literature, the input of responsible innovation processes is not present in a form of clear-cut and isolated problems. Instead, they are listed under the 'grand challenges' or our time category. Into these grand challenges belong climate change (e.g. global warming), resource depletion (e.g. sustainable development), poverty alleviation, ageing. Horizon 2020 documents therefore prioritizes research and innovation that promises to tackle the aforementioned grand challenges of our times (and societies; Blok & Lemmens 2015).

Regarding responsible research and innovation, various stakeholders have different ideas about it both as a problem and what might be its solution. This related also to a more general societal and ethical aspects which have to be taken into account during the innovation process in particular. Due to these overarching differences amongst multiple stakeholders, Blok & Lemmens (2015) note that their involvement into the innovation processes are thus prone to failure. This failure occurs due to multiple reasons:

- Naivety stemming from the reduction of the issue of information assymetries in relation to mutual responsiveness among stakeholders;
- The unrealistic nature of mutual responsiveness and collective responsibility which brings abut blurring of tasks and responsibilities;
- The Collingridge dilemma (dilemma of control), which combines the information problem (i.e. unpredictability of negative consequences of technologies at early stages of R&I) with the power problem (i.e. difficulties related to amendments of a technology at later stages of R&I).

All these aspects may therefore contribute to the low adoption of responsible research and innovation in the LEIT theme of the Horizon 2020 programme.

Research further investigated the issues related with responsible innovation and stakeholder engagement. Blok et al (2015) identified multiple critical issues related to stakeholder engagement in responsible innovation in relation with transparency, interaction, responsiveness, and co-responsibility. Many of these issues have been confirmed also during the interviews with LEIT-stakeholders (see section 4.8), such as negative impact on competitive advantage, lack of control, fear of knowledge-leakage, power imbalances, or time loads. Other critical issues, listed by Blok et al (2015) are uncertainty regarding product launch, collaboration of stakeholders with other companies,

different visions, goals, motives, sectors, and values as well as the burden of investment for becoming a responsible investor is carried by the invertor alone.

These critical, and often conflicting, issues all feed into the conflicting framings that are essential on the one hand for running businesses, and being ethical on the other hand. The interpretation of the findings of Blok et al (2015), as well as the analysis of interviews (see section 4.8) suggests that the resulting lack of the ethics-related topics within LEIT might be due to the inherent and dominant business-logic present in the overall LEIT programme.

Similarly, Lubberink et al (2017) confirm the findings, supported by extensive literature review, that businesses are already engaging in systems-thinking for innovation. Businesses engage in understanding the needs of target beneficiaries (i.e. consuers), and often contribute to the discussion with the stakeholders regarding the values of their innovation in respect to the stakeholders' needs. This confirms the relatively high-level responsiveness of businesses. On the other hand, however, the critical examination of desirable or possible negative implications of innovations (i.e. ethics-related reflexiveness) are scarce (Lubberink et al 2017).

A recent proposal attempts to align RRI and open innovation. Although open innovation and RRI are relatively well aligned in respect of openness of open innovation towards the criteria defined by responsible innovation. However, this openness towards socio-ethical factors are dependent on the extent the innovators willingness to adopt these (Long & Blok 2018). While open innovation enables the embedding of socio-ethical aspects into the innovation programme, the proposed Open Innovation 2.0 extends this by requiring the adaption towards socio-ethical factors (Long & Blok 2018).

Regarding *Access to Risk Finance* and *Innovation in SMEs*, the analysis concluded that there is very little awareness of RRI, keys, and O's in the aforementioned parts of the subtheme. While the former does make references to topics of LEIT (e.g. ICT, NMBP, Space) and Societal Challenges (e.g. food security, energy challenge, smart and green integrated transport), the latter specifically refers to the addressing of Horizon 2020 areas of Excellent Science, Spread of excellence and widening of participation, as well as Strengthening social and political support for science and technology. In Innovation in SMEs explicit references to RRI, RRI-related keys, and O's have been made.

3.2.5 Overall assessment if RRI in Industrial Leadership pillar

Category	Value	Description
A	High awareness **LEIT** • Open Science • Open innovation • Other RRI-related issues (mostly socio-ethical issues) • Social Challenges **Access to Risk Funding** • N/A **Innovation in SMEs** • N/A	• RRI as concept is (implicitly or explicitly) present in most documents on all levels; • RRI keys and O's are used and referred to in several documents; • Governance structures reflect societal embeddedness; • Upstream/Downstream engagement is present on multiple levels
B	Some awareness	• RRI as concept is (implicitly or explicitly) present in some documents; • Some RRI keys and O's are used and referred to in any document;

	LEIT • Gender equality • Ethics • Science and literacy education **Access to Risk Funding** • **Innovation in SMEs** • Effectiveness • Efficiency • Coherence • EU Added Value • O's	• There is some process of better social embeddedness through governance or engagement
C	Limited awareness **LEIT** • RRI as a concept • Public engagement • Governance **Access to Risk Funding** • Reference to SCs, only implicit reference to RRI keys • Reference to RRI use is rare, used mostly in policy documents and overall evaluation of the programme • RRI is not substancially influencing the way R&I is carried out in the programme line **Innovation in SMEs** • User involvement • Competitiveness and sustainability	• Responsibility or ethical awareness is referred to in any document • Any RRI key is mentioned; • There is reference to the need for social embeddedness of the research at hand.
D	No awareness **LEIT** • Open to the World • RIAA **Access to Risk Funding** • N/A **Innovation in SMEs** • N/A	• RRI as concept is not present in any document; • No RRI key is mentioned implicitly or explicitly; • There is no reference to societal embeddedness or civic engagement;

3.3 Findings from the stakeholder interviews

3.3.1 Understandings of RRI

Most of the **Social Lab 5** participants expressed a good understanding and extensive familiarity with the term, theory, and implementation of Responsible Research and Innovation (n=10). Only few of the interviewees admitted little or some familiarity with the term, although they were aware of its existence (n=2). One interviewee had never come across the term of RRI before. Another interviewee expressed familiarity with the term, although could not recollect an exact definition of RRI.

The respondents admitted the importance of ethics and responsibility within research, either through the societal challenges (that are part of the LEIT-NMBP programme), or through their requirement in every research proposal within Horizon 2020. They were aware of the other keys (e.g. gender equality, public engagement), while referring to the importance of inclusiveness in research, incorporating a bigger role for social sciences and humanities in the research process. They referred also to actual regulation standards and other requirements for compliance (e.g. privacy, safety, data protection, GDPR). Some interviewees referred to ideas such as circular economy, competitive disadvantages RRI (especially open access and open science) and ethical standards might pose to businesses and their commercial interests, research ethics, necessity to control exports by not collaborating with adversary countries, discrimination and biases, job security (in relation to robotic technologies), sustainability. Ultimately, these views were considered as approaches to incorporate safety, aiming at societal relevance and impact, as well as methods towards effective governance. Some expressed views that societal challenges can be understood as businesses cases for industry, as a part of generic drive behind funded technologies. Without this additional incentive research, for example, into sustainable technologies would be considered too costly for businesses, which would remain unexplored without these additional incentives. The ultimate goal is to create trust with citizens and become engaged in research and innovation projects and policies.

Overall, the recognition of societal challenges and the motives to tackle them is in accordance with the economical rationale to provide solutions for these. Therefore, all the technological, legal, ethical, and economic reasons are in accordance with the formulation of societal issues, as people for whom these solutions are being developed are also the customers of businesses. Some interviewees see the efforts of the European Commission towards RRI and greater ethical compliance extremely beneficial, as without these incentives a lot more projects would fail in the area of research integrity. Ethical and societal issues are honestly and carefully addressed at least in EU projects, due to the ethical review processes present in funding applications. At the same time, some expressed the view that RRI is unknown beyond the policy level and the level of EU projects, despite the fact that some de-facto RRI solutions are to be found in industry and university research.

Although collaboration between industry partners and other related stakeholders is not without competitive issues, such collaboration is often conducted in pre-competitive stage. Furthermore, challenges of open science and open innovation for competitiveness and commercial interests are ‘addressed’ through patenting, where these are considered crucial in fulfilling the requirement of open innovation. Patents thus, according to the interviewee, helps to open-up for businesses. At the same time open access and open data is a ‘deal breaker’ for businesses if it is mandatory, usually opting-out from open access clauses.

Other stakeholder identified the prevention of discrimination and biases in development of algorithmic solutions for data mining technologies as a boundary issue, as the research teams ‘do not operate on actual human subjects’ (only the scientists themselves as sources of data), which legitimized the little (and ‘last minute’) involvement of ethics in the WPs. On a similar note, a different interviewee pointed out the predominant focus on technological and engineering solutions, and the lack of attention on discrimination, gender equality, and biases in topics such as serious video game development.

It is a general experience in businesses that RRI-related works are not top priorities in companies. Some participants acknowledged that there are currently many EU projects related to RRI. However, according to various interviewees, social and ethical issues are still generally underestimated by industries as well as policy actors. Legislation is not aligned with RRI-type aspirations of companies. However, a company's reputation (and hence competitiveness) may depend on RRI-type activities. Business competitiveness and social reputation go hand-in-hand. By some, RRI is understood more as a political term that is used by the EC within EU-funded projects and is less prevalent as a concept in industries or university research institutes. This coins RRI as a concept that is pushed top-down to stakeholders, while another interviewee confirmed that RRI is not known beyond EC policy documents and projects dedicated to RRI. An example might be RRI in the field of Artificial Intelligence (AI) and robotics, where its relevance is warranted also by public concerns and questions, and last EC calls on robotics were revised by RRI and ethics experts ensuring compliance with RRI keys. However, industries' as well as academia's vested interests may stand in a way of implementing RRI. These interests are difficult to reshuffle; however, it is desirable by the interviewees that it would be addressed on the EC-policy level.

Interviewees highlighted the lack of public knowledge about RRI and its keys, which ultimately hampers ***engagement*** with RRI. Public engagement in terms of communicating the results to the public is already required within EC-funded research projects, and the quality of its outputs is increasing. More involvement of main stakeholders in research projects with industry, media, societal and scientific partners is needed across Europe. This claim has been repeated to all RRI-related projects within the LEIT-NMBP theme. The topic of public engagement is one of the most recurring keys throughout the interviews. However, aside from development, user-testing, and clients there is not much going on in this regard in companies. A view has been expressed that in non-technical projects there is more room for public engagement and vice versa. There is a lack of specialists who have the competencies in both technology and social engagement, which then results in difficulties communicating the interested citizens. Creating awareness and dialogue at different levels of societies about the technology itself (e.g. nanotechnology) or politics of technology (e.g. privacy policies) are much needed. For companies, the requirements to engage with citizens should be streamlined and actively supported, for example by simplifying procedures and possibilities of such engagement. This engagement should incorporate also technologies, so that the role of technologies could be socially interpreted and understood. Some companies directly aim at being open and transparent about their conduct and activities, stating that citizens should be able to check these activities. Some interviewees admitted they expected engagement with citizens to be easier than it really was. It has been recommended that, in relation to public engagement, focusing on specific topics and particular application (area) of a technology is more fruitful compared with engagement activities focusing on technology as such. Examples for such engagement: the user engagement of one of our interviewee's project regarding the programme line of energy-efficient buildings; engagement through emphasizing societal adaptation (e.g. interface design for particular user-groups) rather than technology development. Civil Society Organizations (CSOs) are not discussing certain technologies (e.g. nanotechnology), and this is considered a barrier towards engagement with the public by the business. Furthermore, civil society is not motivated to engage in such activities, as they feel they are not heard, and if they are, their viewpoints are not taken into consideration. NGOs and governmental

actors should be included into the public engagement according to an interviewee. An issue might be also no interest in industrial technologies by a general public and NGOs, which makes then public engagement difficult to perform. It is also unclear, who everybody should participate in the engagement process, and what role the public should have in policy-monitoring and -making. Engagement with local NGOs and (local) politicians should also be encouraged for researchers/scientists. Researchers, on the other hand, slowly start to understand that public outreach is required from them to justify the spending on research from public money, and they start to take responsibility for it.

Another often highlighted key is ***gender equality*** and social discrimination. According to one of the interviewee companies in general have gender balance at higher level, ICT is lacking behind in women-education. Research and innovation projects are aware of its importance, which means that gender equality related goals are included in the project descriptions. However, within research and innovation itself gender is not often an issue. One of the respondents highlighted that the absence of interest in issues of women and minority communities may further translate into negative representation of Middle-Eastern characters, racism, sexism, homophobia, ageism, and transphobia in software development (e.g. video games). Although in theory gender-related issues are incorporated and seemingly considered, in practical life it has been admitted that it trickles down to a bare minimum of actions required – a practice paramount in other areas, therefore, not an urgent issue. In academia, researchers feel that focusing on issues like gender equality is another topic that keeps researchers away from research as such. The requirement of gender equality is viewed as box-ticking, and it should be enforced more by funding requirements or by the need to rearrange operational structures. Technical and cultural/social perspectives need to be mixed in outreach activities (e.g. public engagement) to research and innovation communities to get across the social message. In this regard social sciences play an entry point for RRI, where a better understanding of cultural and societal values can be initiated. Other interviewees confirmed the lack of reflection regarding gender- and diversity-related issues in businesses. A creation of mutual language between scientists between various disciplines (technology-related and social and political scientists), stakeholders, and actors involved in a project is needed. Some businesses representatives confirmed that the gender equality policy has been already adopted company-wide. Hence, meeting gender-related requirements of funding calls is not a problem for them. In addition, their clearly defined goal is to have balanced number of high-level managers from all genders.

The key related to ***science literacy and education*** is requested by the EC in the dissemination and exploitation activities. Some companies do have some outreach. Nevertheless, it often is delegated to persons already working in these areas, and the involvement and inclusion of the public is somehow lacking behind. Science centres are considered as drivers of engagement and education. The dialogue regarding technologies should be broadened beyond topics such as safety and risks. Regarding gender equality, it is not sufficient to educate the greater public about these issues but involve project partners with multidisciplinary backgrounds (e.g. interaction designers, industry, academia, etc., to mediate between partners) to personally motivate software developers to address gender and/or minority issues in their work. Addressing cultural diversity-related issues need to be done very carefully in order to avoid defensive attitudes from the stakeholders. Again, social sciences and humanities play a crucial role in this part. The lack of educational resources for people with natural

sciences background has been reported. NGOs and other stakeholders need capacities and training in establishing modes of participation. Such resources would support interdisciplinary collaboration. There is also a lack of time for cross-disciplinary education (social sciences vs natural sciences). The experienced lack of openness of social scientists towards the insights of engineers should be addressed and discouraged (and possibly tackled by increasing their technical knowledge), as well as more dedicated projects should be funded for science literacy and education. Some industry players reported successes in science education initiatives during public outings of companies (multiple personnel are also part-time professors). It has been expressed that the provision of a guidance how to deal with negative public perception with certain technologies (e.g. robotics), including, for example, the inclusion of public into the problem definition would be extremely helpful for stakeholders. A view that researchers are developing technologies in pure isolation from societies has been challenged by an interviewee, researchers are working on empowering humans instead of making their lives burdensome. An interviewee could not identify an EU-funded robotics-related research proposal which is funded for the sake of robotic research, rather robotic-research is funded for the sake of tackling societal challenges defined by the EC. In this regard, more education is needed, for example, in the theme of robotics for the public, who are often misled by depictions of robots in movies. The explanation and presentation of the beneficence of novel technologies (e.g. robots) for the public is lacking behind. Citizen science has been identified as a means of dealing with educational challenges in general.

The ***open access and open science*** keys are discussed on the national and EU level, however, it's reception is skeptical in Brussels as it is interpreted as contradictory with the competitive edge of businesses. Commercial interests limit the requirement towards open data and open science. Companies prioritize intellectual property, open data and open innovation are unspecific terms, without the obvious practical benefit for the companies as such. Some companies were successful in fulfilling the open science and open innovation requirements by establishing open campuses where the participation and engagement of other (start-up) companies as well as citizens are welcomed to use their facilities. Open access and open data should not harm the business ventures, according to one of the interviewee a demonstrated goodwill of sharing information will result in the eventual reception of goodwill in the future. Stakeholders involved in EC-funded research projects are usually listing most of the deliverables as open access, which practice also demonstrate the different attitudes of academia and companies regarding open data.

The ***ethical*** requirements of RRI according to the interviewees refer mainly to research ethics. Various ethical issues emerge throughout multiple projects the interviewees were and are involved: security, sustainability, trust, politics, anonymization, privacy-by-design, best practices. Companies are interested in ethical guidance, however, in an informal and reflexive way, within companies, 'on the work floor' – which has been put into contrast with regulatory guidance (suggesting that companies are not interested in more regulatory prescriptions, rather they are interested in dealing with conflicts between values). For developers, technologies (e.g. software) are gaining political importance, as it is not value-neutral, the conflicting values need to be acknowledged and addressed. GDPR is mentioned as an example that forced many companies into good practice. Companies are interested in avoiding 'incidents,' nevertheless it is usually the CEO of a company who brings in the drive to become more ethical in a business. Ethical considerations are present at the lower levels within a company, however,

they often stay there, suggesting that the ethical practice in companies occurs in top-down initiatives. Ethics is seen in companies as an aside, people who are linked with ethics-related tasks are considered hindering the engineers' and developers' work. An explanation in this regard is given, which describes the nature of private sector companies, that highlights the focus on employees with specialized (hierarchical, affordance-based) competencies. Such employees, in contrast with higher-level managers, lack the overview of the project and its broader societal impacts. An interviewee's company tries to actively abstain from unethical activities, as being a sustainable company is important part of their overall reputation. Companies are involved in value-sensitive innovation and are actively engaging other companies to be accredited as ethical companies with a degree of transparency, corporate integrity, and ethics procedures and boards. On the EC-level, according to an interviewee, ethical and social issues are honestly and carefully addressed in Europe, where ethical review is extremely beneficial. Repeated ethical review process is also mentioned as beneficial. Another interviewee admitted, ethics-related WPs of a EC-research project were added last-minute and were not regarded as overly relevant and operational for the research project (although the project related to big data research, but with 'no actual human subjects'). The interviewee disclosed that the ethical WP felt as artificially added, and there was a reason why it was initially absent in the big data-related research project. Another interviewee claimed that even if requirements of research integrity are merely tick-boxes, they do assure some level of addressing societal challenges in general. In this regard an annual re-training would be beneficial to adhere to compliance requirements However, the lengthy procedure of obtaining ethical approvals and being compliant to EU regulation is burdensome and, in the interviewee's view, holds back innovation (e.g. individual subjects reluctant to participate in projects due to stringent data-related ethical requirements). Ethical and legal compliance may be extremely burdensome especially for small companies and projects, for which the EC should provide additional support.

The key related to ***governance*** is the least reflected by most of the interviewees. Interviewees expressed difficulties in adapting (pre-conceived) EU framework programme project plans to newly identified societal/ethical insights during the duration of the project itself. This translates into a specific lack of responsiveness, which might be also occurring due to loss of valuable time, energy, or a simple lack of competence from the project consortium members. Furthermore, the relation of businesses with EC-funded research project officers is somewhat ambiguous, as besides their professional roles as officers/controllers, throughout multiple earlier research projects, they became also the researchers' friends. Therefore, the researchers do not want to bother the officer with multiple difficult queries. Moreover, every time the consortium partners have something to discuss with the project officer, the officers do not have a detailed recollection of the previous engagements with the project. This means that the discussions need to be initiated from scratch and it is a waste of time and energy. It has been highlighted that, for example, nanotechnology is not discussed currently on a governance-level. On the policy-makers level it has been noted that, for example, the issue of gender equality can be addressed by specifically requiring greater diversity from the project-proposing stakeholders.

From the analysis of the interviews it can be concluded that the most important keys of RRI are engagement with the public, scientific literacy and education, ethics, and gender equality. The much less prevalent keys were open science and access (with open innovation), together with governance.

Most of the interviewees (except one) operationalize RRI keys in their work, either explicitly referring, or by application of one of the keys without being familiar with the theoretical framework behind the RRI. Few companies and institutions have already codes of conduct and regulation in place (they also have formal reflection processes in place). Others do this either due to the personal convictions of higher managers towards corporate responsibility practices, or due to some feeling of responsibility towards the wellbeing of citizens or societies. Ethical issues are prevalent in relation to industrial applications of technologies, mostly in the areas of ICT, AI, privacy or big data.

Successes are partial or fragmental, but this is not considered as an issue due to the underlying contradiction between RRI keys and business competitiveness. Overall, the very fact that RRI keys are slowly appearing on the table of businesses is considered a positive thing. The role of the European Commission in requiring these in call applications and throughout research projects is considered an important boost into the right direction. Only one of the 14 interviewees did not consider the keys of RRI important, but the interviewee have never heard about the concept of RRI before either.

The level of awareness among interviewed stakeholders of **Social Lab 6** about the Horizon 2020 depends on the institution membership and held positions. RRI-awareness is generally very low. The interviewees seem not to comprehend these concepts and they do not consider them very important. However, the issue of ethics is very important for all types of stakeholders from the academy up to business:

- Ethical issues are connected to cyber-security and privacy protection within ICT
- They organize workshops to obtain feedback on company plans and activities
- Open discussions with feedback in different groups and final, directed, brainstorming
- Companies, institutions, and the general public are not engaged in activities that would reflect the issues of RRI

In general, the six keys related to RRI are not very well-known among the interviewees. They seem to use a different discourse when speaking about their activities. Thus, there is no need of prioritization among the keys in general.

- They do not reflect upon societal and ethical challenges. The support of SMEs and innovation is not referring to the RRI keys. The pressing challenge is rather global competitiveness of SMEs. They are trying to share the knowledge from abroad and develop the predictive model of SMEs' performance
- Gender equality is part of everyone's life. Naturally, there are different roles in society and within the family. The question of what equality is remains still relevant. Equality means to provide everybody the same opportunities – for example to gain education or the same job. For SMEs it is similar in relation to starting positions as well as support-provision

The SL6 interviewees interpret *governance* as a very important aspect of RRI. However, they do not perceive it clearly, instead they interpret it in an implicit and non-direct way. This means that they expect some stability in the innovation ecosystem, the existence of clear and long-term rules, which will not change every year.

Some positive examples from interviews:

- Open advantage – necessary for growth of SME from former EE, sharing of knowledge creates new knowledge for the future

- Positive influence of Horizon 2020 SME Instrument – Seal of Excellence – synergy to national TACR program. For innovation in SMEs the synergy with strong government support is necessary

- Strategy as an enabler – this topic depends on the conditions. Hungary is a small EU country and researchers are not forced to think about general questions (RRI). People should do their job the best way they can do, not think about how to measure somebody else. Setting of the rules should be done from the position of maximal economic performance of the country. The next generation should be much more successful

Operationalization of RRI is not direct and reflected (with the exception of the interviewee from academia). Some respondents used the concept of CSR (interviewee from banking industry), some have educational programmes that cover selected topics, which could be connected to RRI concepts (this includes interviewees form Innovation Centres and startup-funds), but they do it in a non-systematic way.

Interviewees do not feel the need to have RRI mainstreamed, which is caused mainly by very low awareness and low knowledge of the concept as such. Some examples of perception of RRI within the discussions:

- One side is the scientific excellence – the other side is the business excellence – that is the most important for competitiveness. Business excellence – the need is for real innovative companies to conduct the applied / goal-oriented R&D for real business. Support tools that are really good for companies – responsibility

- Barriers in the innovation processes – cultural barriers, to have excellent universities and institutions is not enough. The goal is not to be excellent in science – how to find shorter ways to prosperity. Risk finance – need for excellent products, services – innovations, SMEs that are able to produce globally competitive results – to be fit for market. Conducting scientific/engineering work “for nothing” [i.e. without real applicability] – without real innovation/product is worthless

It can be concluded that there are stark differences between LEIT-related and SME-focused participants of the two related social labs. While LEIT-related participants had a relatively high understanding of societal and ethical challenges through their work, interviewees were not demonstrating high level of understanding of societal and ethical challenges.

This is then reflected in the importance of priorities related to RRI keys. Bigger companies do consider topics such as public engagement and gender equality as emerging and rather important issues. Societal and ethical imperatives are gaining momentum in their everyday conduct and activities, nevertheless it is often brought into conflict with business competitiveness. In contrast, SMEs do not have the 'luxury' to invest into knowledge-gaining and reflection upon RRI-related topics in SMEs strive of everyday business – their main worries relate to business competitiveness and their obligation to do (financially) successful businesses.

3.3.2 Understandings of societal impacts and embeddedness of R&I

Interviewees of **Social Lab 5** considered the inclusion of partners with special **expertise** to tackle societal challenges, ethical issues, or RRI keys important, as such experts are not widely spread in the LEIT theme, with the exception of few projects. A pool of experts dedicated to responsible societal challenge solutions is desired, who would take further informal reflection within companies and act upon it. Unfortunately, technologists in projects are only interested and motivated in social sciences in relation to increase the selling rates of a product (better marketing). Their interests expand seldom beyond this motivation, which should be changed by training and other incentives.

Interviewees expressed a desire to intensify the **media attention** about new technologies and their societal impacts, as well as the funding bodies. Firstly, there is a deeply embedded mismatch between what policy seems to represent regarding technological solutions, and how such technologies are perceived by their private and professional users, as well as developers. Secondly, such attention needs to begin early, as research and innovation on higher technological readiness levels (TLR) is more difficult to link with societal impact and relevance. There is a lack of awareness and understanding of RRI within industry. Also, the European funding bodies and framework programmes need better PR, as citizens do not really know what Horizon 2020 or RRI are, neither are they familiar with the ongoing innovations and opportunities. There is also a lack of time, interest, and overall knowledge from the public to care about citizens' interests in everyday technology use. Often citizens are not even aware that they can become one of the stakeholder groups, or that they can be represented in projects. Therefore, public engagements should have a specific agenda for the dialogue that drives the engagement into greater success. In addition, it has been noted that developers are not familiar with academic publications, so this way of public outreach is not that effective, requesting alternative methods of gaining attention.

Increased **incentives** should be provided to fund RRI-related works throughout academic careers and funding opportunities by the EC. This would encourage individuals to implement RRI-related societal engagement on project-level, which is generally a difficult task, despite political will on national and European level for conducting these. According to an interviewee, academics are not enough encouraged to conduct research and publicly engage in activities with good ethical impact during their careers. Funding-related issues regarding RRI is noticed but on a more systemic level by other interviewees. Another interviewee disclosed that there is a lot of RRI-related practice present in industry already, however, these stakeholders belong to the already responsible circle of partners. There is an overall lack of resources to do RRI-related works beyond the legal requirements in (small) companies. Therefore, RRI-related work does not reach top priority in companies. Similarly, to small companies, municipalities also lack financial and information resources in order to comply with (data,

privacy) regulations, which ultimately puts them at the disposal of private sector players and market forces.

There is a lack of **training** regarding RRI-related issues for people from technology development and industries.

Tensions between commercial and research activities can be evaded by conducting research in pre-competitive stages. Vested interests between various (academic and industry) stakeholders form obstacles in the way of implementing RRI. Therefore, according to the interviewee, project funders should have a role in countering the conflicting vested interest and directing them towards the implementation of RRI. Also, biases between disciplines often hamper collaborations, therefore they should be actively identified and addressed. Specialists from social sciences should also exhibit greater sense of creativity (instead of putting everything into boxes) in research and innovation projects in order to understand and be helpful within the consortium of partners. On the other hand, many companies do not consider RRI burdensome, as many keys represent already a part of their particular technological approach.

Regarding the **next funding programme** (i.e. Horizon Europe), unlike in the Horizon 2020 framework programme, it has been recommended to further deepen the notion of responsibility between technologies and the pillars of the framework programme for addressing societal challenges. Other interviewees noticed unwillingness of policymakers to engage with RRI-type projects during conferences and in face-to-face meetings, they do not attend meetings they have been invited for. Policymakers often have a specific focus, which disregards deeper understanding of social values (e.g. happiness, social benefit, relationships) that are beyond economic value. Furthermore, many technology developers are actively acknowledged by policymakers for their motivation to address societal issues. An interviewee with technical background noted that social sciences seem to be underrepresented in Horizon 2020 programme funding calls. For research project consortium partners RRI also means maintaining good relationship with EC project officers (i.e. not bothering her/him with small things, keep the PO enthusiastic, be proactive). Companies should be encouraged to develop compliance with ethical principles (CSR), as well as national and international legislation, or human rights standards. In the next funding programme the development of silos should be further eradicated, through simplifying the size and complexity of themes and the framework programme itself. RRI-related themes should be essential part of the next framework programme (they are according to interviewees still underrepresented in Horizon 2020), as even if research integrity in calls is merely represented as tick-boxes, they contribute to the understanding of societal challenges overall. However, the difference and/or overlap between RRI keys such as open science, societal challenges within SwafS and RRI projects is unclear within the EU policy. A related that needs to be addressed is the lack of clear boundaries between programmes: for example, citizen science was not included in SwafS, while one would expect to be included in it. On the other hand, gender equality is a cross-cutting key in Horizon 2020, covering the pillars and programmes, while it is also embedded within SwafS. The next framework programme should make RRI really cross-cutting at all levels (i.e. support, policy, calls, projects), and should also exhibit much greater sensitivity towards the diverse societal challenges on a regional level compared with the high-level Horizon 2020 programme perspective. Although societal challenges are relatively well covered throughout Horizon 2020, there

is no systematic incentive to address RRI keys throughout calls due to unstructured programme, lacking a logical meaning, and inflexibility. The term of SwafS is quite broad, however, its scope is quite narrow. For NGOs to be an advisor for an EU project costs money, as they have to travel to the meetings. These travels are often covered from their own budget, as NGOs do not want to be strain on the taxpayers' money.

The **Social Lab 6** interviewees' level of awareness expressed during the lab work were around the need for a better social embeddedness of R&I and science, which is currently very low. They stress the necessity to increase the awareness of innovation and more support the activities that would promote higher levels of technology readiness.

- The SMEs' understanding of societal challenges translate into the acceptance of some common values:
    - To give before you get
    - To work as a team
    - To be innovative – try new things
- Multiple topics and challenges have been expressed:
    - Social control and transparency
    - Higher involvement of SMEs in the innovation environment
    - Human-technology boundary in the domain of ethics
    - Long-term impact and investments
    - Digital – ethical problems – level of considering the consequences, including sustainability
    - Science education - changes within the entire education system that distributes the education goals along the innovation chain (TRL level) – this should occur through synergy and interaction

The need of social embeddedness was mentioned during our the SL6 interviews very rarely. These rare references were occasionally related to the issues of Ethics and Gender. For example:

- The necessity to hold discussions regarding the challenges and relevant RRI topic. The problem of climate change and political responsibility could serve as an example – governance has been neglecting it for a long time. Pleasure to decrease the CO_2 production – ethical aspects. There has been a book published on this topic in Slovakia: "Technology and Humanity". In order to change the view of the future needs, global solution of ethical problems is needed – with strong voices

- Strategies are defined and offered in a top-down manner – from political level to executive level. For example, for the innovation agency SIEA, RRI is a new issue, agency has to follow the basic rules and guidelines for financing

It can be concluded that both groups of larger businesses as well as SMEs are interested in greater uptake of RRI-related practices, responsible and sustainable business models. While larger businesses demand specialist and experts in relation to RRI-related keys, SMEs are interested in closer cooperation with other stakeholders in innovation environments. Both groups are relatively aware of ethical and societal issues, especially in connection with ICT innovations. However, innovative businesses demand a larger share of media attention at responsible conducts and innovative solutions, as there is a lack of awareness and understanding of RRI within industry. This lack of awareness has been apparently confirmed with SMEs, where social embeddedness of innovations is currently low. While SMEs are still interested in TLRs, larger businesses struggle linking TRLs to societal challenges while implementing RRI-related keys.

Businesses also require a more holistic and long-term system of incentives, supported by legal frameworks that would provide stability for business ventures but also workers in the required fields of responsible research and innovation. Such a long-term thinking might significantly contribute to sustainability goals.

Both social labs confirmed a need for trainings and education of RRI.

Although businesses face tensions between the RRI-related goals and business goals, the merge of which can contribute into decreased competitiveness, however, businesses at the same time recognise the importance of societal responsibilities. Therefore, they do not consider the requirements of responsible research and innovation as burdensome.

Larger businesses provided an extensive list of recommendations for the next HorizonEurope framework programme (see above).

3.3.3 RRI-oriented assessment of the Industrial Leadership-related interviews

Overall, within the pillar of Industrial Leadership there is a stronger RRI uptake in LEIT-related areas than SMEs. In this regard, there is a high awareness of open science, open innovation, social challenges, and other RRI-related (mostly socio-ethical) issues in almost all the LEIT-related areas. SMEs in this regard are also sensitive, however, based on the analysis their difficulties are much more business-focused. This is understandable, since smaller businesses may face a higher level of competitiveness, while at the same their financial assets are constrained.

Most of the RRI-related keys are having some or limited level of awareness in both groups (LEIT and SME), as well as in both research areas (desktop research, interview research). Most of the RRI keys are implicitly expressed in interviews with professionals, while the desktop research confirmed higher level of explicit references to RRI-keys in policy- and evaluation-documents.

Only few of the RRI-related keys had no awareness (or were not mentioned) during the interviews.

Category	Value	Description
A	High Awareness **LEIT** • Public engagement • Science and literacy education **Access to Risk Funding** • N/A **Innovation in SMEs** • N/A	• RRI as concept well understood by all stakeholders; • RRI keys and O's are used and referred to by most stakeholders; • Operationalization of RRI already present
B	Some awareness **LEIT** • Gender equality • Ethics • RRI as a concept **Access to Risk Funding** • N/A **Innovation in SMEs** • N/A	• RRI as concept understood by some stakeholders; • Some RRI keys and O's are referred to by some stakeholders; • The need for mainstreaming through operationalization is referred to by some stakeholders
C	Limited awareness **LEIT** • Governance • Open access / Open science **Access to Risk Funding** • Public engagement • Governance • Open science **Innovation in SMEs** • Societal and ethical challenges • Open innovation • Ethics	• Vague awareness of RRI as concept by a few stakeholders • Any RRI key referred to by some stakeholders • Some ideas of operationalization of RRI present
D	No awareness **LEIT** • Concepts of RRI beyond the keys **Access to Risk Funding** • N/A **Innovation in SMEs** • N/A	• RRI as concept is not present • No RRI key is mentioned • No reference to or explicit refusal of societal embeddedness or civic engagement

3.4 Selected Industrial Leadership projects

3.4.1 SeeingNano Project (LEIT-NMBP)

SeeingNano (Project ID: 646141),[2] funded by the Horizon 2020 programme, run between December 2014 to November 2016. Its full title was "*Developing and Enabling Nanotechnology Awareness-*

2 https://cordis.europa.eu/project/rcn/194417_en.html

Building through the Creation and Exchange of enhanced Communication and Visualisation Tools and Guidance for 'Seeing at the Nanoscale'". Horizon 2020 contributed to the project 206.362,50 EUR.

SeeingNano aimed at creating Novel Visualisation Tools for Enhanced Nanotechnology Awareness through a coordinated collaborative approach conducted by leading experts in the relevant fields: the target audiences identified in the proposal were analyzed by the consortium's socio-economic sciences and humanities, who – in collaboration with the consortium's state-of-the-art information visualisation partners – were elaborated and agreed on the most appropriate tool to address the respective audiences.

The challenge of the project consisted of how to visualize a technology that is so small, one cannot see it? A single strand of hair is 80.000-100.000 nanometres wide, and it would take one thousand of the thickest nanomaterials (100 nanometres) to match this width. It is unsurprising then that understanding the principles of nanotechnology can be difficult. SeeingNano took on this challenge through unique visualization tools that allow one to 'see at the nanoscale.' The materials provide an understanding and awareness for the breadth of nanotechnologies, and the benefits, uncertainties and potential risks connected to them. It enables youngsters, non-scientific journalists, science teachers, adult museum visitors, and people in retirement to engage with this type of technology in an effortless and accessible way.[3]

Three families of tools were developed within this project:

- An application for both iPhone and Android users shows how nanotechnology is used in several applications including car engines. Users are able to slowly move closer and closer to the surface of an engine piston until they are 'seeing at the nanoscale'
- Exciting quizzes
- Group activities

The SeeingNano implicit RRI-related engagement is clearly in public engagement, which has been defined as along the question how to gauge the impact those tools have when used in real-world scenarios. The project established a number of strategic liaisons with individual stakeholders (such as large international companies, policy maker units, and the press office of the European Commission) and key stakeholder groups (such as industry associations, and technology networks) in order to properly address these stakeholders' needs from an early stage of the project. The project established also an Expert Working Group (EWG), consisting of Nanotechnologies Industry Association (NIA) Members that were themselves direct beneficiaries of the planned SeeingNano project outputs and who played a pivotal role in the multiplication of the project impact: these NIA Members engaged in the SeeingNano project through a Linked-3rd Party agreement, and were brought in at strategic points to[4]

3 http://nanotechia.org/seeingnano
4 Ibid.

a. provide concrete feedback on the project's planned work and progress through feedback templates

b. provide additional input (e.g. science content)

c. use, promote and disseminate the SeeingNano output and thus act as a multiplier to its impact

3.4.2 Gaming Horizons Project (LEIT-ICT)

Gaming Horizons (Project ID: 732332),[5] funded by the Horizon 2020 programme, run between December 2016 and January 2018. Horizon 2020 contributed to this project 226.443,75 EUR.

Gaming Horizons' ambition was to democratically open up new areas of public value for the games industry as a whole, beyond sectorial distinctions between 'leisure' and 'serious' games. As such, the project laid the groundwork for a balanced and research-informed dialogue about the use of games or game-derived elements for learning and critical reflection, benefiting a range of stakeholders in various sectors: education, ICT, game development, and policy.[6]

Gamin Horizons' was a direct response to the official recognition by the H2020 programme of work that multidisciplinary research can help to advance the integration between Responsible Research and Innovation (RRI) and the Social Sciences and the Humanities (SSH). The project's objective was to enable a higher uptake of socially responsible ICT-related research in relation to gaming. In this regard the RRI-uptake, as a part of LEIT-ICT, is explicit in this project, which helped identifying future directions at the intersection of ethics, social research, and both the digital entertainment and serious games industries.[7]

3.4.3 InvestHorizon (Access to Risk Finance)

InvestHorizons (Project IDs: multiple), funded by the Horizon 2020 programme, run between January 2014 to May 2017. Its full title was "*Boosting the Investment-Readiness of SMEs and Small Midcaps*". Horizon 2020 contributed to the project 2.319.201,25 EUR.

Number of institutions involved: 108

There are no references to RRI keys or O's in the documents accessible about the project on Cordis database (more than 50 documents). The project was strongly focused on "Open communication" and "Inclusiveness" as both a process and method: "We identify three principles – namely flat-hierarchy, open communication and inclusiveness – that can be found in all of the most innovative actors operating in the innovation space today."[9]

There is no reference to governance, ethics, gender, science education, public engagement or open access at all. However, *Educate* is a sub-principle of "Open Communication" and it means: "Actors that

5 https://cordis.europa.eu/project/rcn/206006_en.html
6 https://www.gaminghorizons.eu/about/
7 https://cordis.europa.eu/project/rcn/206006_en.html
8 http://investhorizon.eu/
9 "Opening the Black Box of Europe's Startup Ecosystem". Deliverable Nr.1.4. Report on "Better Practices for Strategies, Indicators, Schemes and Tools fostering Investment Readiness", p66–67.

are seriously engaged in sharing, educating and vocalising the ins-and-outs of the startup world (and the crucial thing is to paying it forward).“[10]

3.4.4 EEN Northern Netherlands: enhancing the innovation capacity of SME's (Innovation in SMEs)

EEN Northern Netherlands: enhancing the innovation capacity of SME's (Project ID: 674865),[11] funded by the Horizon 2020 programme, run between January 2014 to May 2017. Horizon 2020 contributed to the ad hoc project 82.750 EUR.

Number of institutions involved: 4

There are no references to RRI keys or O's in the documents which are accessible about the project at Cordis database (4 documents).

There is no reference to governance, ethics, gender, science education, public engagement or open access at all.[12]

4 Conclusions

The reviewed documents of the LEIT-related desktop research highlight high sensitivity towards social and ethical challenges. Concepts such as open science, open innovation, are represented in the documentation often and in a meaningful way. The main driver towards the fulfilment of RRI-related keys are the reference to social challenges in general.

The documentation also refers to keys such as gender equality, ethical requirements, and the increasing need of science education and literacy education.

During the interviews, the respondents also admitted the high importance of ethics and responsibility within research and innovation, in an expectable form through societal challenges (as a part of the LEIT-NMBP programme). Interviewees see the requirement for ethical compliance as a positive and important step during the application procedure and within the monitoring of projects during their duration. They were aware of the other keys (e.g. gender equality, public engagement), while referring to the importance of inclusiveness in research, incorporating a bigger role for social sciences and humanities in the research process. They referred also to actual regulation standards and other requirements for compliance (e.g. privacy, safety, data protection, GDPR). Some interviewees referred to ideas such as circular economy, competitive disadvantages RRI (especially open access and open science) and ethical standards might pose to businesses and their commercial interests, research ethics, necessity to control exports by not collaborating with adversary countries, discrimination and biases, job security (in relation to robotic technologies), sustainability. Ultimately, these views were considered as approaches to incorporate safety, aiming at societal relevance and impact, as well as methods towards effective governance.

10 Ibid, p75.
11 https://cordis.europa.eu/project/rcn/199080_en.html
12 http://een-north.nl/

However, during this desktop research it became obvious that the conceptual and more theoretical underpinnings of RRI are missing from the official documentation. This then has a negative consequence in terms of less thoroughly considered RRI keys in project proposals and evaluation documents. Some of the less represented RRI-related keys in the documentation were ethical compliance, public engagement, and gender equality. These underrepresented topics need to be developed further in the form of explanation of their relevance, and in the forms of key performance indicators that can endorse measurement of compliance.

According to the interviewees collaboration between industry partners and other related stakeholders is not without competitive issues. Nevertheless, such collaboration is often conducted in pre-competitive stage, which can prevent the emergence of hurdles and further issues. In addition, challenges of open science and open innovation for competitiveness and commercial interests are 'addressed' through patenting, where these are considered crucial in fulfilling the requirement of open innovation. Patents thus, according to the interviewee, helps to open-up for businesses. At the same time open access and open data is a 'deal breaker' for businesses if it is mandatory, usually opting-out from open access clauses.

Only a single interviewee in SL5 was not familiar with the concept of RRI as such, while s/he was the only one who did not consider the relevance of RRI-related keys and requirements at the project level. All the other respondents in SL5 highly valued the implementation and aims of RRI, they were very well aware of the societal and ethical challenges novel technologies (e.g. big data, robotics, nanotechnology) are introducing to the everyday life of affected societies.

Multiple larger companies tried to tackle the issue of gender balance, however, while some were rather successful in this regard, others were less. The latter would expect more incentives in this regard.

More incentives are requested towards the incorporation of RRI-related requirements into the everyday work of stakeholders, either through support or career-paths. Moreover, multiple interviewees explicitly referred to an increased number of stakeholders from humanities and social sciences in research and innovation projects involving more technical staff.

Few interviewees referred to concepts beyond RRI that might be considered as important principles in European projects, such as explicit reference to principles of human rights and beneficence in relation with international cooperation on a global scale as well as working with disruptive technologies. The concept of democratic decentralization also emerged in this context, which might refer to the requirement of subsidiarity on the EU-level.

As a goal for innovation SMEs demand the creation of an effective innovation ecosystem within Europe, without administrative and other additional barriers. Innovation barriers could be seen at the allocation of external/internal resources in the SMEs, when production does not provide enough finance for global ambitions of innovation. Open Access in this regard refers to the ability to be open appropriately to the conditions and share the experience and access to R&D infrastructure. The role

of the governments is to provide SMEs motivation and risk finance tools. Balance of appropriate money and innovation feedback would then eventually result in a larger impact for society.

Social engagement is extremely important as innovation is for society.

Ethical issues in R&D and responsibility – this discussion has been initiated many years ago with bio-technological research, and currently it becomes a commonly respected principle in all R&D areas and we can observe strengthening of the rules of research ethics. Dynamics of R&D are also becoming more important.

Gender is a very highly recognized issue, which has further cultural and religious connotations within the respective countries. There are limited opportunities for women especially in "Confucian societies" and these have to be addressed. However, policy actions have a limited impact, as it is nearly impossible to change a society overnight.

Institutions and programs helping innovation should be the enablers, but SMEs cannot rely on them fully to provide complex solutions. So far, there has been no systems, nevertheless there is a increased need for changes to take place very quickly and reflect the dynamics of society. Furthermore, it is very difficult to reach a consensus on important topics and societal questions. The main issue is the stability of society and the speed of change of the rules reflecting RRI. There are big differences in values of younger and older generations, hence no general rule could be implemented for the whole society.

The challenges for RRI in the area of SME's and access to risk finance stem from the inherent character of the business sector, where anything that is not directly and apparently related to the "bottom line" of the company or a project currently at hand is deliberately labelled as unimportant or even against the best interest of the organisation. This rigid mindset of people involved in running companies makes RRI difficult to introduce as a feasible prism for evaluating immediate reality, and future opportunities. Simply put, the processes which determine the dynamics of a business (even those relatively small, agile and innovative) remain relatively unchanged and limit the possibility of introducing new variables into the game.

There is also a somewhat cultural problem with the notions of equality or openness – such values are alien to the community that is all about competition, taking (unfair) advantage and reducing everything to numbers. Certain level of distrust is understandable here, judging the circumstances. However, RRI, as it is conceptualized in the NewHoRRIzon project is not essentially going against the interests of business, namely the innovative SMEs with a need for risk funding. Explaining this, nevertheless, remains one of the greatest challenges of our work in the program.

Last, but not least, the perception of RRI suffers from a number of misconceptions in the business community regarding various regulations, quotas, rules for subsidies that are (often mistakenly) attributed to the European Commission and the EU as a whole. It is very time-consuming and sensitive in terms of argumentation to make things clear before it is at all possible to move on to the agenda of RRI and its implications for the activities of people involved in SMEs development, risk funding and related areas. This kind of misconceptions has been also reported during interviews for POs within EC funded projects, where often the familiarity with a project diminished over time, and the discussion had to be initiated from scratch – a practice that is extremely time consuming for business partners.

Business leaders naturally tend to „do the right thing“ but that is not nearly as straightforward as it is described in a majority of business ethics literature. Most ethical dilemmas on the strategic level are much more complex than expected and require a change of perspective, accepting change and information as well as a certain level of personal bravery to bring up the topic in the day-to-day running of a company.

5 Literature, links, resources

Please use APA6 Citation. Use Annex 8.1 to check if your document meets the standard citation for NewHoRRIzon documents.

Blok, V., Hoffmans, L., & Wubben, E. F. M. (2015). Stakeholder engagement for responsible innovation in the private sector: critical issues and management practices. Journal on Chain and Network Science, 15, 147–164. https://doi.org/10.3920/jcns2015.x003

Blok, V., & Lemmens, P. (2015). The emerging concept of responsible innovation. Three reasons why it is questionable and calls for a radical transformation of the concept of innovation. In Responsible Innovation 2 (pp. 19–35). Springer, Cham. https://doi.org/10.1007/978-3-319-17308-5_2

EC (2010) Europe 2020: A strategy for smart, sustainable and inclusive growth. Brussels, COM(2010) 2020

European Commission (2013a) REGULATION (EU) No 1291/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC

EC (2017j). Interim Evaluation of Horizon 2020. Brussels: Directorate-General for Research and Innovation. https://doi.org/10.2777/220768

EC (2017l, May 29). Interim Evaluation of Horizon 2020. Annex 2. European Commission. Brussels.

Long, T. B., & Blok, V. (2018). Integrating the management of socio-ethical factors into industry innovation: towards a concept of Open Innovation 2.0, 21, 463–486. https://doi.org/10.22434/ifamr2017.0040

Lubberink, R., Blok, V., van Ophem, J., & Omta, O. (2017). Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices. Sustainability, 9(5), 721. https://doi.org/10.3390/su9050721

von Schomberg, R. (2013). A Vision of Responsible Research and Innovation. In R. Owen, J. Bessant, & M. Heintz, R. Owen, J. Bessant, & M. Heintz (Eds.), Responsible Innovation (pp. 51–74). https://doi.org/10.1002/9781118551424.ch3

Annex 1: NewHoRRIzon Diagnosis Report Social Lab Nr. 5

NewHoRRIzon Diagnosis Report

Social Lab Nr. 5

Grant Agreement No.	741402
Project Start Date	May 1st, 2017
Duration of project	48 months
Version	1.0
Author	Peter Novitzky (WUR) Vincent Blok (WUR) Job Timmermans (WUR)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 741402. The opinions expressed in this document reflect only the author's view and in no way reflect the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.

Contents

List of Figures

List of Tables

1 Executive Summary

This report provides information on an analysis of the state of Responsible Research and Innovation (RRI) in European Commission (EC) programming related to the pillar of Industrial Leadership – Leadership in Enabling and Industrial Technologies (LEIT). LEIT's specific emphasis is on strong industrial dimension where mastering new technological opportunities will enable and drive innovation within Europe. LEIT provides research, development, and demonstration support in a particular set of technologies: information and communication technology (ICT); nanotechnology; advanced materials; biotechnology; advanced manufacturing and processing; and space-related technologies. LEIT's emphasis is on interactions and convergence across and between different technologies, the marketability of these technologies, and their usefulness in relation of addressing societal challenges and user needs. Cross-cutting aspects through international cooperation and RRI are also incorporated. The aim of LEIT is to increase competitiveness of EU to become world-leading global player in the aforementioned areas of research and innovation. The overall LEIT budget is 10 bn EUR (officially 13 bn EUR) within the Horizon 2020 programme, including all the subthemes and SME participation.

The desktop research of LEIT-related RRI keys suggest that responsible research and innovation is traceable through the requirement of addressing societal challenges throughout the Horizon 2020 programme. Only a single (RIA) call makes explicit reference to RRI as a method. Most of the societal challenges refer to one or multiple RRI keys. Implementing more keys from responsible innovation are not considered as values in themselves, they are rather considered as concepts required during the application or evaluation of a project. Few LEIT-related projects consider RRI keys as something more than a tick box exercise, however, they still do not implement all the keys. The situation with concepts such as the need to increase public engagement, gender equality, open innovation, or open access became better throughout the duration of the Horizon 2020 programmer, where these concept are reflected in the documents in an overall positive and valuable manner. Theoretical considerations in the reviewed documentations are exceptional, which might be explained based on the specific (and different) purpose and nature of these documents, making the theoretical considerations prevalent mostly in academic publications. RRI-related keys are referred to as valuable endeavours, e.g. greater public engagement, open access, open innovation. The reference to economic benefits, greater global competitive advantage, and ethical/societal issues are mentioned more often and in a meaningful way. Other keys are not as much conceptually developed in the reviewed documentation.

During the interviews, participants expressed high awareness of RRI-related keys of public engagement and science and literacy education. Other RRI-related keys were represented with some or limited awareness. The familiarity with the theoretical ramifications of RRI was sporadic amongst the interviewees. The participants also provided valuable recommendations towards the framing of the next European funding programme, with the goal of further deepening the notion of responsibility between technologies and the pillars of the framework programme for addressing societal challenges. The role of humanities and social sciences in this process was explicitly demanded. Overall, the role of RRI was considered as a positive and distinguishing element of European research and innovation activities, which should be maintained and further developed in the future.

2 Scope of this document

This diagnosis report is not an official deliverable. It is for internal-use only and, unless otherwise indicated, for Social Lab 5, the leader of the NewHoRRIzon Work Package 3 on Industrial Leadership, or for members of the NewHoRRIzon Consortium carrying out duties related to the grant agreement (no. 741402) of the European Commission. The scope of the report is to provide necessary information for diagnosis (i.e. overview) of the state of Responsible Research and Innovation (RRI) in activities related to Leadership in Enabling and Industrial Technologies (LEIT). Research conducted to develop the diagnosis further served to support the development and initiation of Social Lab 5 in the project. By presenting research input and data collected in a systematic way, this document provides ground for comparison across Horizon 2020 Programmes within the Industrial Leadership pillar, and across other Horizon 2020 pillars, in addition to other levels of interest to project consortium members.

3 Methods

The diagnosis of the Leadership in Enabling and Industrial Technologies programme of the European Commission's Horizon 2020 programme consisted of two parts:

1. Desktop research
2. Interview research

The desktop research was conducted on the policy documents of the Horizon 2020 programme (EC 2017f; EC 2017g), work package documentation (EC 2017h; EC 2017i; EC 2017m), narrowed down to scoping documents (EC 2017a; EC 2017b; EC 2017c). Additional analysis has been conducted on the Horizon 2020 Interim Evaluation of Horizon 2020 (EC 2017j) with the two additional Annexes (EC 2017k; EC 2017l). All these documents have been reviewed from the viewpoint of relevance to the broader Industrial Leadership pillar, and especially from the perspective of relevance to the LEIT subtheme.

The documentation from the periods of 2014–2015 and 2016–2017 were screened in Annex 1 of the Interim Evaluation (EC 2017k p248) for RRI-related themes. As the screening was already conducted for the earlier periods, this diagnosis focuses on the work package documentation from the 2018–2020 period.

The analysis of how Responsible Research and Innovation is enacted in the LEIT subtheme, the aforementioned policy-, scoping-, and review-documents were reviewed for:

- Indications of research and innovation goals
- Research and innovation structures
- General funding levels
- Mentions and measures of responsible research and innovation, with indicators of RRI keys
    - Public engagement

- Open access/open science
- Gender equality
- Ethics
- Science education and science literacy
- Governance

responsible innovation denoted by procedural elements of

- Inclusion
- Anticipation
- Reflexivity
- Responsiveness

and reference to

- Open Innovation
- Open Science
- Open to the World (Open Agenda)

In addition to the desktop research, interview research has been conducted with a total of 14 recruited participants (5 females, 9 males) from multiple countries, with relevant expertise for the subtheme of LEIT (cf. Table 20). The interviews were 45–60 minutes long. These interviews were then transcribed and analysed in a similar way as the European policy documentation, with encoding using Atlas.ti software of the aforementioned criteria (RRI keys, procedural elements, O's, other RRI-relevant comments).

3.1 General scope of the program

The Industrial Leadership pillar of the Horizon 2020 programme aims to speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs to grow into world-leading companies. The goal is to make Europe an attractive investment area for research and innovation activities. These activities are promoted based on the agenda set by businesses themselves. It provides major investments in key industrial technologies, as well as it maximizes the growth potential of European companies by providing adequate means and levels of financing, assisting SMEs to expand into world-leading companies.[13]

13 https://ec.europa.eu/programmes/horizon2020/node/10

3.1.1 LEIT overall

The Industrial Leadership pillar is one of the three pillars (mutually reinforcing priorities) of the Horizon 2020 programme: Excellent science, Industrial leadership, and Societal challenges (EC 2017j). The goal of the **Industrial Leadership** pillar is

> 'to make Europe a more **attractive location to invest** in research and innovation (including eco-innovation), by promoting activities where businesses set the agenda. It will **provide major investment** in key industrial technologies, maximise the growth potential of European companies by providing them with adequate levels of finance and **help innovative SMEs to grow** into world-leading companies.'[14] [emphasis added]

'Leadership in enabling and industrial technologies' (LEIT) is one of the sub-themes of the Industrial Leadership pillar), the other two being 'Access to risk finance' and 'Innovation in SMEs' (which are covered by Social Lab 6, within NewHoRRIzon's WP3). The focus of this sub-theme is thus on supporting and promote Research & Innovation (R&I) in industry (businesses/companies of all sizes including SMEs) by improving the investment climate, provide investment itself, and support growth of businesses.

In LEIT specific emphasis is placed on:

> 'R&I with a strong **industrial dimension** and where **mastering new technological opportunities** will enable and drive innovation.'[15] [emphasis added]

It ties in closely with the EU Industrial policy goals, which have a strong technology focus. LEIT contributes to these goals by providing:

> 'dedicated support for **research, development and demonstration** and, where appropriate, for **standardisation and certification**'[16] [emphasis added]

LEIT in this regard refers to a particular set of technologies, namely:

> 'information and communications technology (ICT), nanotechnology, advanced materials, biotechnology, advanced manufacturing and processing and space.'[17]

These technologies are considered **world-leading enabling and industrial technologies** (hence the name LEIT of the subtheme), which will underpin tomorrow's businesses and growing SMEs. This is reflected in the three main lines of funding under the LEIT theme (each is discussed in detail below), are shared under Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing (NMBP), ICT, and Space as separate entities:

1) *LEIT-NMBP* – Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology

14 https://ec.europa.eu/programmes/horizon2020/en/h2020-section/industrial-leadership
15 Ibid.
16 Ibid.
17 Ibid.

2) *LEIT-ICT* – Information and Communications Technology

3) *LEIT-Space*

Furthermore, within LEIT the emphasis is placed

> 'on **interactions and convergence** across and between the different technologies and their relations to **societal challenges**. **User needs** will be taken into account in all these fields.'[18] [emphasis added]

LEIT is therefore closely linked with **Key Enabling Technologies** (KETs), which for the EC represent six technologies: micro- and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies. KETs have applications in multiple industries and help tackle societal challenges.[19] LEIT's role in and relation to KETs is the development of **industrial capabilities** in areas defined by NMBP.

Consequently, within the LEIT subtheme, connections between the different technologies are considered, for example, by including funding calls that include technologies of more than one line (e.g. ICT & KET, or KET & Space). Moreover, societal challenges (i.e. the seven Societal Challenges recognized in H2020[20]) are to be considered within LEIT, as well as the needs of the users of the different technologies.

In summary, emphasis of actions for LEIT is placed on:[21] [emphasis added]

- 'R&I to strengthen Europe's industrial capacities and business perspectives, including SMEs
- **Public-private partnerships** (PPPs)
- Cross-cutting KETs
- Seizing the ICT opportunities
- Contributions to solving Societal Challenges and to Focus Areas
- Cross-cutting aspects, like **international cooperation** and **responsible research and innovation**.'

Thus, within LEIT, alongside the promotion of collaboration between publicly-and-privately funded R&I, two cross-cutting aspects of the Horizon 2020 programme are also emphasized: international cooperation, and – of particular interest to this diagnosis – **Responsible Research and Innovation (RRI)**.

18 Ibid.
19 https://ec.europa.eu/growth/industry/policy/key-enabling-technologies_en
20 https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges
21 http://ec.europa.eu/programmes/horizon2020/en/h2020-section/leadership-enabling-and-industrial-technologies

3.1.2 LEIT-NMBP

The LEIT funding line has a 'strong focus on developing European industrial capabilities in Key Enabling Technologies (KETs)', comprising areas such as:[22]

- Nanotechnologies
- Advanced materials
- Advanced manufacturing and processing
- Biotechnology

Activities under this line

> 'address the **whole innovation chain** with **technology readiness levels** spanning the crucial range from **medium levels to high** levels preceding mass production, and helping to bridge the gaps ("valley of death") in this range.'[23] [emphasis added]

Furthermore, for the higher technology readiness levels (TRLs) the route towards marketability is further supported by providing 'dedicated support […] for **larger-scale pilot** lines and **demonstrator projects** to facilitate industrial take-up and commercialization.'[24] [emphasis added]

In line with the overall Industrial Leadership pillar of Horizon 2020 programme, this line aims at connecting public and private R&I. This goal is achieved, firstly, by establishing research agendas (**R&I priority setting**) involving research communities, industries, and businesses. Secondly, LEIT-NMBP's aims are achieved by strongly emphasizing '**leveraging private sector investment'** in these activities. To these ends, **Contractual Public-Private Partnerships** (CPPP) are to be used extensively for the implementation and deployment of KET.

Apart from meeting commercial aims, the KET funding line also puts

> 'a strong focus on the contribution of Key Enabling Technologies to **societal challenges**.'[25] [emphasis added]

Consequently, although KET refers to societal challenges, there is no mention of RRI or any of its keys on the general description on the respective H2020 portal page.

3.1.3 LEIT-ICT

The wide range of new solutions provided by ICTs are considered core to economic development of the EU as they

22 http://ec.europa.eu/programmes/horizon2020/en/h2020-section/nanotechnologies-advanced-materials-advanced-manufacturing-and-processing-and
23 Ibid.
24 Ibid.
25 Ibid.

> 'enable a wealth of new **business developments** in particular for SMEs, and will contribute to boosting **competitiveness**, creating **jobs** and supporting **growth**.'[26] [emphasis added]

To this end, funding in the LEIT-ICT line helps to:[27] [emphasis added]

1) to maintain a **strong expertise** in key technology **value chains**

2) to move quicker **from research excellence to the market**

Furthermore, like in the KET line, the activities in this line are complemented with support

> 'to innovation and **take-up**, **international cooperation** and a dedicated action for **SMEs** to propose bottom-up innovative ideas, using the SME instrument.'[28] [emphasis added]

ICT is supportive to existing innovations, as well as to novel breakthroughs. On the one hand, by supporting (existing) **industrial roadmaps**, it aims to provide continuity and stability. On the other hand, by encouraging **disruptive innovation** it will offer flexibility and openness with helping to develop dynamic eco-systems.[29]

To exploit and leverage new technologies, and to initiate and drive change, LEIT-ICT requires the **involvement of new actors**. Despite this requirement, which could be interpreted to align with the call for stakeholder inclusion, neither RRI or its keys are mentioned in the general description of the LEIT-ICT line on the H2020 portal.[30]

3.1.4 LEIT-Space

This funding line of LEIT aims at supporting the European space research community in developing

> 'innovative space technologies and operational concepts "from idea to demonstration in space," and to use space data for scientific, public, or commercial purposes.'[31]

LEIT-Space's focus is on developing and operationalizing technology, alongside the use of data output generated by space technology. Also, this line aims at releasing the potential for growth of the space sector. To this end, the Work Programme of this line has been structured to address the following challenges:[32] [emphasis added]

- Prioritizing the existing two EU Space flagships of **European Global Navigation Satellite System (EGNSS)** and **Earth Observation** reaping the benefits they can generate in the coming years and ensuring their state-of-the-art also in the future

26 http://ec.europa.eu/programmes/horizon2020/en/h2020-section/information-and-communication-technologies
27 Ibid.
28 Ibid.
29 Cf. Ibid.
30 Cf. Ibid.
31 http://ec.europa.eu/programmes/horizon2020/en/h2020-section/space
32 Ibid.

- Ensuring support for the third priority of the EU space policy: the **protection of space infrastructure**, and setting up of a **Space Surveillance and Tracking system (SST)** at European level

- Ensuring support to EU industry to meet the objectives defined in the Commission communication on Space Industrial Policy, notably to maintain and enhance **industry's competitiveness** and its **value-chain in the global market**

- Ensuring that Europe's investments made in space infrastructure are **exploited to the benefit of citizens**; as well as supporting European **space science**; and

- Enhancing Europe's standing as an attractive partner for **international partnerships** in space science and exploration

Funding under Space has a strong commercial dimension, aimed at competitiveness and reaping benefits, as was to be expected under the LEIT heading. Furthermore, it continues support to existing flagships and EU space policy. Also, in line with LEIT overall, it aims at international collaboration and generating societal benefits. Although 'benefit of citizens' could be interpreted to mean/include societal benefits, (e.g. the Airborne Tactical Observation & Surveillance [ATOS] system raises ethical issues and, thus, may contribute to sustainability goals & security), neither RRI nor Societal Challenges are explicitly mentioned in the general documentation offered by the H2020 portal.

3.2 What is your program about?

3.2.1 Objectives

The overall objective of LEIT is to contribute to 'boosting competitiveness, creating jobs and supporting growth'[33] by 'providing new opportunities for industrial leadership in Key Enabling Technologies (KETs), ICT and Space' (EC 2017f). It does this by funding R&I into new and breakthrough technologies in these three domains, which are

> *'areas of key industrial competences determining Europe's global **competitiveness**, and providing key components and systems needed for solutions to the **Societal Challenges**.' (*EC 2017f) [emphasis added]

The aims are foremost technology- and economy-driven. LEIT contribute to tackling Societal Challenges only indirectly: by 'providing key components and systems' (EC 2017f).

3.2.2 Addressees

LEIT targets 'R&I with a *strong industrial dimension* and where *mastering new technological opportunities will enable and drive innovation*.' (EC 2014) [emphasis added]. This specifically entails 3 technological domains:

- Key Enabling Technologies (KETs)

33 http://ec.europa.eu/programmes/horizon2020/en/h2020-section/leadership-enabling-and-industrial-technologies

- ICT and Space
- R&I actors in both the public and private domain (industry, businesses, SMEs)

3.2.3 Purpose

The overall purpose of LEIT to strengthen R&I to strengthen Europe's industrial capacities and business perspectives, including SMEs.

3.3 What is the size and structure of your program in terms of budget, applications and projects?

3.3.1 Structure

The overall structure of the Industrial Leadership theme of Horizon 2020 programme is depicted in Figure 2.

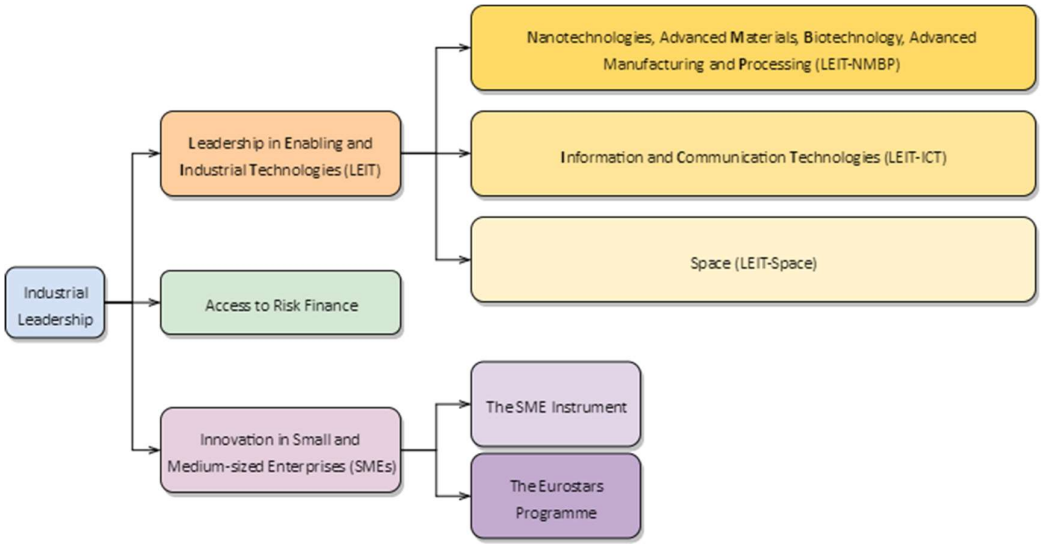

Figure 3 – Organizational Structure of Industrial Leadership

Table 1 shows the three main programme parts of the LEIT subtheme. In contrast with LEIT-ICT and LEIT-Space, the LEIT-NMBP programme part has four further underlying programme parts, namely Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology, which each receive specific attention in the funding calls. Table 1 also lists the priorities of the respective LEIT subthemes.

	LEIT-NMBP	LEIT-ICT	LEIT-Space
Programme Parts	• Nanotechnologies • Advanced Materials • Advanced Manufacturing and Processing • Biotechnology	• Information and Communication Technologies	• Space

Priorities	• Stimulate growth and jobs • Integration & deployment of enabling technologies by European industry • Stimulate private sector involvement • Enhance product competitiveness and impact • Foster cross-cutting KET activities • Technology validation in an industrial environment • New opportunities to tackle societal challenges	• A new generation of components and systems • Advanced Computing • Future Internet • Content technologies and information management • Robotics • Micro- and Nano-electronic technologies, Photonics	• European Global Navigation Satellite System (EGNSS) & Earth Observation flagships • Space infrastructure & Space Surveillance and Tracking system (SST) • Industry's competitiveness and value-chain • Exploitation of space infrastructure & support space science; • Enhancing international partnerships.

Table 6 – Programme Parts and Priorities per LEIT Theme

3.3.2 Budget, Calls, and Topics

Officially the total budget size is LEIT is 13.035 million EUR. However, an analysis of the all calls for FEIT under H2020 accounted for 10.936 million EUR (cf. Table 7). That leaves approx. 2.438 million EUR that is not accounted for in this analysis.

Programme Part	Calls	Topics	Budget
ICT	30	360	5.596.372.937,00 EUR
Biotechnology	1	5	76.740.000,00 EUR
Manufacturing	3	17	267.450.000,00 EUR
Nanotechnology	1	1	3.000.000,00 EUR
NMBP-mixed	5	100	1.596.840.000,00 EUR
(NMBP total)	10	123	1.944.030.000,00 EUR
NMBP/ICT	3	91	1.433.210.000,00 EUR
Space	14	82	959.425.239,00 EUR
SME	2	2	1.003.126.102,00 EUR
LEIT overall	59	658	10.936.164.278,00 EUR

Table 7 – Breakdown of Calls, Topics and Budget per Programme Part of LEIT (Based on Call-Data Extracted from Cordis Website, November 2017)

Topic Type	Topics
Research and Innovation Action (RIA)	298
Innovation Action (IA)	192
Coordination and Support Action (CSA)	137
Other	31
LEIT overall	658

Table 8 – Type of Topics Across LEIT

Most of the topics are of the Research and Innovation Actions (RIA), followed by Innovation Action (IA) and Coordination and Support Action (CSA, cf. Table 8). Other types of topics, such RCA, SME, Joint funding and prices accounted for 31 topics.

	NMBP	ICT	Space	LEIT overall
2014	517,49	765,06	167,79	1450,34
2015	513,70	844,03	182,20	1539,93

2016	516,37	762,55	167,06	1445,98
2017	571,25	831,90	183,85	1587
2018	533,80	806,02	182,43	1522,25
2019	544,67	932,82	205,23	1682,72
2020	571,6	955,32	228,05	1754,97
Total	3768,88	5897,70	1316,61	10983,19

Table 9 – Budget of LEIT Programme Parts in EUR Millions

Table 9 presents the breakdown of budget funding for the various subthemes within LEIT. The analysis demonstrates that the biggest funding has been granted to LEIT-ICT since 2014, and the granted amount is consistently rising. LEIT-NMBP received the second biggest funding that constantly rise between 2014–2017, with a significant drop in funding in 2018, while LEIT-NMBP is expected to receive roughly the same amount of funds in 2020 as it was receiving in 2017. LEIT-Space received the smallest portion of funding; however, its funding budget is also consistently rising.

3.3.3 Proposals, Projects, Beneficiaries, and Stakeholders

Almost two-thirds of the proposed LEIT-related research projects are submitted within the LEIT-ICT subtheme. The highest success after a single Cofund project in LEIT-ICT is CPCP with 38% of success and CSA actions with 28% of funding. NMBP-LEIT has lower Cofund proposal success rate (80%), followed by 45% of CSA action successfully receiving funding. LEIT-Space is successful in 50% of the CPCP funding and 38% in CSA action funding. Overall, the lowest successful funding proposals are in SME1 and SME2, while the overall success rate of the whole LEIT theme is around 9%. More detailed breakdown is presented in Table 10.

	ICT			**NMBP**			**Space**			**LEIT overall**		
	Funded	Success	Proposals	Funded	Success	Proposals	Funded	Success	Proposals	Funded	Success	Proposals
CPCP	3	38%	8	N/A			1	50%	2	4	40%	10
CSA	72	28%	257	39	45%	87	24	38%	63	135	33%	407
Cofund	1	100%	1	4	80%	5			N/A	5	83%	6
IA	176	18%	978	95	14%	685	45	20%	223	316	17%	1886
RIA	358	11%	3255	133	15%	903	75	15%	511	566	12%	4669
SME1	326	6%	5433	194	7%	2869	51	13%	388	571	7%	8690
SME2	104	5%	2080	49	4%	1091	15	10%	147	168	5%	3318
Total	1040	9%	12012	514	10%	5640	211	16%	1334	1765	9%	18986

Table 10 – Proposals and Projects per Programme Part (ICT & NMBP October 2016; Space January 2017, EC 2017l)

Organization type	**NMBP**	**ICT***	**Space**	**LEIT overall**
Higher Education	266	803	156	1225 (19%)
Private company	1342	1935	460	3737 (57%)
Public body	76	110	43	229 (3%)
Research Organization	282	657	136	1075 (16%)
Other	100	146	34	280 (4%)

Total	2066	3651	829	6546 (100%)

Table 11 – Number of Participants per Organization Type Space = January 2017; ICT & NMBP = October 2016 (EC 2017l); * ICT = Estimated Amounts Based on Percentage Participations

The largest portion of participants (57%) is coming within LEIT from private companies, where LEIT-ICT is the biggest group of participants followed by LEIT-NMBP. Participants from higher education represent the second largest group with contributing overall 19% of participants, closely followed by research organizations with 16%. Again, the biggest contributor is LEIT-ICT subtheme, followed by LEIT-NMBP in both cases. The smallest representation is by public bodies, which contributes only 3% of participants. to the overall LEIT theme. Detailed results are presented in Table 11.

Country	NMBP	ICT	Space	LEIT overall
Austria	95	90	21	206
Belgium	183	147	47	377
Bulgaria		5	3	8
Croatia		2	1	3
Cyprus	13	5	6	24
Czech Republic	28	10	14	52
Denmark	56	55	9	120
Estonia			5	5
Finland	73	70	9	152
France	273	300	96	669
Germany	526	475	87	1088
Greece	95	102	28	225
Hungary	11	9	4	24
Iceland	4		0	4
Ireland	51	60	9	120
Israel	35			35
Italy	381	220	103	704
Latvia		2	3	5
Lithuania		2	4	6
Luxembourg	17	7	3	27
Malta	0	0	2	2
Netherlands	173	180	34	387
Norway	53			53
Poland	56	30	20	106
Portugal	86	45	22	153
Romania	19	8	7	34
Slovakia		5	4	9
Slovenia	36	25	4	65
Spain	471	260	85	816
Sweden	105	75	17	197
Turkey	22			22
United Kingdom	306	325	86	717

Total	3168	2514	733	6415

Table 12 – Number of participants per country – Space = January 2017, ICT & NMBP = October 2016 (EC 2017l)

The highest number of participants is in the NMBP-related part, followed by ICT and Space. Within LEIT-NMBP, the highest number of participants was from German, followed by Spain and Italy. Close to the leading group of top 3 highest number of participants are also UK, France, and Belgium. The LEIT-ICT part has, again, the highest number of participants from Germany, followed by UK and France. The top 3 highest number of participants were followed by Spain, Italy, and the Netherlands. Within LEIT-Space the leading country in the number of participants was Italy, followed by France, Germany, UK, and Spain. Other countries in this part of LEIT were significantly lacking behind in the numbers of participants.

From the data it can be concluded that the **LEIT-ICT** subtheme is the most attractive for universities and higher and secondary institutions (HES) together with research organizations. LEIT-ICT is also the most attractive subtheme for SMEs and large enterprises, as well as public authorities and associations.

The **LEIT-NMBP** subtheme appears highly relevant to industry and SMEs, in helping them sustain and boost their leadership in KETs. The current participation rate of industry is 49,8%, a four points increase from 45% in FP7, at which time this participation rate was significantly above average. The participation of industry in cPPP projects has reached almost 60% in the first years of the Horizon 2020 programme. In budgetary terms, the share of industry rose by 8,5 points, from 36% in FP7 to 44,5% in Horizon 2020. The activities involve 54% of newcomers to the programme (compared to 33% of newcomers to the Horizon 2020 programme overall), of which 87% are from industry, and roughly half are SMEs. The SME participation rate is 36,2% of distinct participants. Within the contractual PPPs, 77% of project participants are not members of the corresponding industrial associations, showing the openness and relevance of this mechanism in addressing the needs of industry (EC 2017l p313).

Within **LEIT-Space** over 25% of participants involved are SMEs, start-ups or individual entrepreneurs representing 26% of the total EU contribution (EC 2017l p371). In the programming period of 2014-2017, 65% of the allocated to the LEIT-Space thematic shared budget has been applied to enable European competitiveness, non-dependence, and innovation of the European space sector to enable advances in space sector. 30% was allocated towards the enablement of exploitation of space data (incl. from EU space programmes). Finally, the remaining 5% was allocated for the enablement of European research in support of international space partnerships (i.e. space explorations; EC 2017l p366). The share of EU funding for the stakeholders in the thematic area of LEIT-Space was 17% for higher education and secondary institutions, 24% for research organizations, 32% for large enterprises, 22% for SMEs, 4% for public bodies, and 1% for other, of the total 314,82 million EUR budget allocated in the calls 2014/15 (EC 2017l p383).

Within the LEIT theme, being the part of the Industrial Leadership pillar, the focus is on technology-driven research and innovation. However, other elements also appear, besides new product development (covering 75% of LEIT-NMBP efforts), such as new process development (60%), new services development (24%), and organizational or business model innovation (4%; EC 2017j p152).

Special interest is provided to solutions that facilitate the integration of technology into industrial environments.

In important part of technological innovation is the submission of patent applications. The overall rationale for intervention by Horizon 2020 programme was to boost the EU-28 innovation gap. The declining patent applications in the EU demonstrated a relative lack of young companies striving to become world-leading innovation hubs in the emerging sectors. The EC therefore recognized in Horizon 2020 the importance of companies that bring about the necessary breakthroughs, and which produce market expanding innovations (EC 2017j p67). Horizon 2020, during its running, already generates large numbers of high-quality, commercially valuable patents and other intellectual property rights (in 2017 it was 153 patent applications and 39 patents already awarded; EC 2017j p131). It has been further recognized that EU funded research teams are around 40 % more likely to be granted patents or produce patent applications (25 % of respondents produced at least one IPR output in 2015) than nonfunded units (18 %). Data suggest that patents produced as a part of FP collaboration are of higher overall quality and more likely of commercial value than similar patents produced elsewhere (EC 2017j p133).

LEIT furthermore actively contributes to the tackling of the so-called **societal challenges**. The importance of tackling societal challenges increased with the adoption of the Sustainable Development Goals[34] defined by the UN, as well as the Paris Climate Change Agreement. Horizon 2020 allocates the highest share of its budget to tackling societal challenges (EUR 29.7 billion, i.e. 37.8% of Horizon 2020 budget; EC 2017j p51). The expressed conviction is that big opportunities exist that can turn the societal challenges into business opportunities of tomorrow, hence the focus on radical technological breakthrough that would be quickly marketable for Horizon 2020 (EC 2017j p51). For example, in tackling the societal challenges the EU supports key enablers to innovation and to growth, that might have a strong replication potential and impact upon the whole EU (EC 2017l p819).

LEIT has also a strong **economic and commercial focus**. For this reason, the involvement of privately funded partners is encouraged. In this regard, 70% of projects expect additional private funding for research and development (R&D; EC 2017j p143). As mentioned earlier, the LEIT theme is intently aimed at bringing technological solutions to market and towards business development (EC 2017j p152). For this reason, the LEIT theme in Horizon 2020 supports upscaling of industry and businesses. This is noticeable in relation with LEIT-Space, where industry participants indicated positive progress in access to new markets (EC 2017j p132); commercialization or diffusion of innovation in economy throughout the overall LEIT theme (EC 2017j p140); involving demonstrators, pilots, and advancement on the TLR scale with the aim of bringing about clear market results (EC 2017j p150). This positive progress materializes in PPP projects (n=32; EC 2017j p144); collaboration with developers and end-users (especially in LEIT-ITC; EC 2017j p132); as well as bridging the gap between research and innovation and markets.

34 http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Finally, LEIT has also strong **academic focus**, as scientific publications are considered as an important type of research output. 15% of peer-reviewed publications in the Horizon 2020 programme derive from industry focused on LEIT-related projects (EC 2017j p114), of which 70% derive from LEIT-ICT.

4 Current situation of RRI in the programme

4.1 RRI in brief

In the official introduction of LEIT both addressing societal challenges as well as RRI are mentioned as having emphasis. Based on previous engagement with emerging technologies especially in the field of ICT (e.g. ETICA project[35]), innovative technologies are understood to have immense societal (even disruptive) impacts, especially in areas such as sustainability, privacy, health. However, innovative technologies also hold promise in solving some of the most pressing societal issues of our time. Against this backdrop it is reasonable to expect that some of the EU keys and de-facto RRI would be present all over the calls and proposals of the LEIT theme. However, LEIT has a very strong focus on industry. There is not much evidence of RRI being taken up beyond academia. In addition, LEIT appears to have a strong business focus, so its goals are further narrowed down by aiming at creating primarily economic value rather than broader societal values.

4.2 Desktop findings

4.2.1 Societal Challenges

LEIT is expected to have a wider impact on all of the societal challenges defined by the European Commission within the Horizon 2020 programme. The biggest impact is expected in the case of LEIT-NMBP on Climate actions, resource efficiency and raw materials (SC5), followed by Secure, clean and efficient energy (SC3) and Health, demographic change and wellbeing (SC1). LEIT-ICT is expected to have the biggest impact on Europe in a changing world: inclusive, innovative and reflective societies (SC6), followed by SC1 and Secure societies – protecting freedom and security of Europe and its citizens (SC7). LEIT-Space is expected to have the biggest impact on Smart, green and integrated transport (SC4), closely followed by SC7 and SC5. For a more detailed overview see Table 3.

Horizon 2020 Programme Part	SC1	SC2	SC3	SC4	SC5	SC6	SC7
LEIT-NMBP (n=96)	42,4%	29%	52,6%	23,2%	61,9%	18%	14,6%
LEIT-ICT (n=77)	52%	21,5%	32,2%	34,5%	30%	55,8%	38,5%
LEIT-SPACE (n=6)	28,2%	31,4%	33,1%	52,3%	44%	29%	50,6%

Table 13 – Expected wider impact on SCs in next 10 years (EC 2017j p163)

Table 4 presents the overview of expenditures within the subthemes of LEIT, broken down into funds for sustainable development and climate change. The highest percentage of expenditures on sustainable development was spent on LEIT-NMBP, and specifically on biotechnology. The biggest contribution for climate change was spent again on LEIT-NMBP, specifically on advanced manufacturing.

35 http://www.etica-project.eu/

Horizon 2020 Programme Part	Total budget in EUR	CC in EUR	CC In %	SD in EUR	SD in %
Nanotechnology	364.913.028	14.413.667	4%	209.014.778	57%
Advanced materials	355.548.010	142.271.539	40%	248.521.298	70%
Biotechnology	145.591.736	30.809.110	21%	136.064.144	93%
Adv. Manufacturing	642.456.139	304.039.088	47%	498.846.983	78%
LEIT-NMBP total	1.508.508.913	491.533.404	33%	1.092.447.203	72%
LEIT-ICT	2.600.625.571	169.750.563	7%	782.674.517	30%
LEIT-Space	344.897.303	59.355.382	17%	145.797.628	42%
LEIT overall	4.454.031.787	720.639.349	16%	2.020.919.348	45%

Table 14 – Expenditure to Sustainable Development (SD) and Climate Change (CC), 2014–2015 (EC 2017k p208)

4.2.2 Focus Areas

Compared with the previous Framework Programme 7 (FP7) that focused at thematic programmes, the integration of research and innovation into a single programme within Horizon 2020 (structured around three pillars and a set of challenges) improved the overall coherence. The three pillars were: the excellence-driven *Excellent Science*; the technology-driven *Industrial Leadership*; and the challenge-driven *Societal Challenges* (EC 2017j p187). All three pillars consisted of top-down approaches, as well as bottom-up approached (with the exception of the Societal Challenges).

The main target groups for Excellent Science were the scientific community, while in the case of Industrial Leadership it was businesses and industry, and in Societal Challenges all the both of the aforementioned communities (EC 2017j p187).

The contribution to LEIT-related programmes increased between the WP years of 2014–2015 and 2016–2017 significantly. The main drivers in this regard were the new WP with the title Industry 2020 in the Circular Economy, with the overall budget of 669,5 million EUR followed by Smart and Sustainable Cities and Internet of Things (each with 114 million EUR budget). The comparison of the LEIT-specific focus areas regarding their funding is presented in Table 15.

WP Part	Focus Area(s)	
	WP 2014-2015	**WP 2016-2017**
LEIT-NMBP	• Waste: a resource to recycle, reuse, and recover raw materials (5 million EUR)	• Blue Growth: unlocking the potential of seas and oceans (2 million EUR) • Industry 2020 in Circular Economy (396 million EUR)
LEIT-ICT	N/A	• Digital Security (42 million EUR) • IoT (114 million EUR) • Smart & sustainable cities (114 million EUR) • Industry 2020 in Circular Economy (116 million EUR)
LEIT-Space	N/A	N/A

Table 15 – Focus Areas per WP part (EC 2017j p188)

As of January 2017, 13,7% of the RRI-flagged EC contribution goes to LEIT, whereas the average across Horizon 2020 is 11%. This means that LEIT is above average (EC 2017l p247), but is still not very widely included as a cross-cutting issue, albeit LEIT is a new one, compared with climate change.

As of January 2017, CORDA data show that 11.0% of Horizon 2020 projects, for which data are available (i.e. not missing), are RRI-relevant. The EC's contribution to these flagged projects is EUR 2,7 billion equating to 13.95% of the Horizon 2020 budget. Excluding *ad hoc* calls and joint undertakings, more than two-thirds of the RRI-flagged EC contribution goes to MSCA (30.4%), SC1 – Health (14.8%), Industrial Leadership – LEIT (13.7%), and SC5 – Climate (12.4%). (EC 2017l p247)

4.3 Role of RRI on

Policy document level

No	
Yes	Keys: <u>Public engagement:</u> • Public engagement is specifically mentioned in relation with LEIT-ICT, where "the main keywords mentioned are the participation of citizens and communities, usability, trust, networking, empowering and co-design. Keywords appearing in some ICT projects under excellent science relate to citizen participation, citizen engagement and co-design." (EC 2017j p171). • It has been noted that "LEIT-ICT has been successful in attracting more industrial participants in the programme" (EC 2017l p268 and again p271). • "New SMEs represent a high share of the industry participants in LEIT-ICT, throughout all areas. The involvement of SMEs in 'Horizon 2020 ICT' has been to date quite successful. The survey results indicate that SMEs recognise the efforts made to simplify the application procedures but that further improvements are needed. The main barriers identified for their participation were: limited awareness of existing support schemes; difficulties in drafting convincing proposals; difficulties in creating international consortium; and limited financial access to complement EU funds" (EC 2017l p271). • In general, LEIT-ICT is more successful in engaging with SMEs and to a lower extent large companies "that are brought in the consortia to undertake specific tasks in line with their experience and knowhow" (EC 2017j p271). • Previous Horizon 2020 Programme participants highlighted that during the introduction of innovations to the market "issues of exploitation and customer engagement were insufficiently addressed during the [duration of the] project" (EC 2017l p322).

- In relation to LEIT-NMBP, CSA actions are recognized as a means to speeding up the exploitation of project results in cPPPs through communication and societal engagement (EC 2017l p341). For example, the MARINA project (2016-2019) aims to create an all-inclusive knowledge sharing platform that, amongst others, through online platforms catalyses and organizes the convergence of already existing networks, communities, while also facilitates direct engagement of researchers, CSOs, citizens, industry, and others to improve RRI (EC 2017l p1156).

- The EGNSS service and Earth Observation thematic areas play an important role in LEIT-Space to engage with non-space actors (EC 2017l p386).

<u>Gender equality:</u>

- Gender equality is one of the priorities of a "Reinforced European Research Area Partnership for Excellence and Growth" (ERA). Consequently, the European Council invited the European Commission to continue to strengthen the implementation, monitoring, and evaluation of all Horizon 2020 objectives related to gender equality (EC 2017l p899).

- The post-FP7 evaluation showed that gender equality in R&I is advancing very slowly. Therefore, major changes were introduced on several levels in Horizon 2020 compared to FP7 in the way gender equality is mainstreamed as a cross-cutting issue (EC 2017k pp251-252).

    - Gender balance in research teams
    - Gender balance in decision-making
    - Gender dimension in the content of research and innovation

- KPI for Gender equality monitoring:

    - Percentage of women participants in Horizon 2020 projects (total workforce)

WP part	Percentage of women participants
LEIT-NMBP	31%
LEIT-ICT	24%

	LEIT-Space 28%

Table 16 – Share of women in total workforce by Horizon 2020 programme parts (LEIT; EC 2017k p253)

- Percentage of women project coordinators in Horizon 2020 projects

WP part	Percentage of women coordinators
LEIT-NMBP	27,5 %
LEIT-ICT	21,6 %
LEIT-Space	17,3 %

Table 17 – Share of women coordinators by Horizon 2020 parts (LEIT; EC 2017k p254)

- Percentage of women in EC advisory groups, evaluation panels, expert groups, individual experts, etc.

  According to the graph in EC 2017k p255, both LEIT-NMBP and LEIT-Space (no LEIT-ICT data available) are close to the ratio of 1:1 between women and men advisory group members, with a slight prevalence of men (the data were collected by the EC and last updated in December 2016).

- Percentage of projects taking into account the gender dimension in R&I content

WP part	Gender dimension integration
LEIT-NMBP	**34,3 %**
LEIT-ICT	**27,6 %**
LEIT-Space	**43,5 %**

Table 18 – Integration of the Gender Dimension in funded projects – Industrial Leadership (EC 2017k p257)

- An analysis, both qualitative and quantitative, of a sub-set of 111 projects out of the 263 funded projects that correspond to 35 gender-flagged topics, from the seven Societal Challenges, LEIT-ICT, LEIT-NMBP and SwafS. (EC 2017k p252)

<u>Open Access:</u>

	• Due to new socio-technical developments, such as digitization and the new role of consumers, there is an explosion of data driven science, diving scientists in many disciplines interoperable access to research data of a hitherto-unimagined scale and diversity. In relation to these new developments, the industry has become more service focused, by the increasingly blurred product-service boundaries, forced to use advanced technologies in their products and digital and data-based services. Few projects in LEIT-NMBP have yet to reflect the importance of these developments (EC 2017j p56). • "Some stakeholder position papers, including academia, research organisations, public authorities and NGOs, commented on the transnational and multi-sector collaborative approach for excellent R&I, perceiving it as an "attractive" and "successful" method and "the backbone" of Horizon 2020. However, one SME was particularly critical noting there is already enough emphasis on interdisciplinarity and that insisting on it makes research lose its focus.should fund the extra costs that comes with keeping data open (for example for the ICT tools)" (EC 2017j p63). • "LEIT-ICT assessment highlights that there is not enough room for openness in the calls for topics and ideas from the research community, creating the risk that quality research is not funded because it does not fit the calls or their timelines" (EC 2017j p63). • "For LEIT-Space, a risk has been identified regarding the focus in the programme design on the specific needs of each segment, thereby lacking the integrated approach needed for the longer-term creation of competitiveness by fostering the inclusion and strengthened position of European SMEs in the global supply chains." For this reason it has been recommended that "call themes should not be pre-defined but rather should be more open and bottom-up" (EC 2017j p63). • Horizon 2020 is expected to make EU R&I funding simpler to access, not only for established players but also for newcomers, by cutting back administrative costs drastically and significantly improve accessibility (EC 2017j p70). • "Some stakeholders, in particular NGOs, research organisations and academia, welcome the Open Data initiative and call for greater transparency and open access. Yet others, including representatives of businesses and industry as well as academia, pinpoint that an open access to data requires strict conditions to be met, such as the waterproof Intellectual Property protection system which must be put

	in place. Open access should be voluntary and evaluated by the beneficiary on a case-by-case basis – opting out should remain a possibility, a sustainable model should be ensured, involving all relevant stakeholders in the transition, and governments should fund the extra costs that come with keeping data open (for example, for ICT tools)" (EC 2017j p114). • A survey performed for Horizon 2020 programme reported "[a] relatively high proportion of ICT project participants also foresee a high impact from their project in terms of access to international technological/scientific networks (over 80% of participants perceived a high or fair impact in this area). Collaboration with both developers and end-users are important areas where the ICT projects are perceived as having an impact by over 40% of participants." (EC 2017j p132). • cPPPs' priorities are highly attractive to a vast range of stakeholders: "In many industrial sectors and cPPPs, the associations work closely with related ETPs to develop their strategies and roadmaps. These platforms are also open to new members and do not require a financial commitment, thereby opening up participation in particular to SMEs. SME participation varies across cPPPs and ranges from 11% to 35%" (EC 2017j p136). Overall, Joint Undertakings (JU) and cPPPs demonstrate openness, while the former requires open access policy towards membership (EC 2017j p136). • "Particularly relevant are demonstrators on technology integration in an industrial environment, for example those from the dedicated Pilot Lines call, which also include open access pilot lines for SMEs. A total of 77 pilot lines have been developed so far" (EC 2017j p152). • "a large number of stakeholders consider that important gaps still exist in EU support for disruptive, market-creating innovation and other forms of support for young innovative companies … [they think] a genuinely bottom-up approach should be introduced to allow projects from any sector(s) to apply for funding" (EC 2017j p154) that is easy to access. • "LEIT-ICT and application oriented parts innovation embedded more strongly than previously, even taking on board some of the principles of open innovation. … [Overall in Horizon 2020] 82% of project coordinators responded that open science principles were being applied in their project, with open science defined as doing science in

	an open and collaborative way, sharing research results as much as possible" (EC 2017l pp244-254). • 2,150 publications have been generated by LEIT ICT projects, of which 400 publications in peer-reviewed journals. The number of open-access articles published in peer-reviewed journals is 285 (71%) (EC 2017l p253) • Projects funded under LEIT ICT have applied for 33 patents, of which 4 have been awarded. 10 trademark applications have been made and awarded (EC 2017l p253). Science Education and Science Literacy: *Nothing different than what other H2020 Programmes are supposed to implement* Ethics: *Nothing different than what other H2020 Programmes are supposed to implement* Governance: • "LEIT-NMBP funds scientific and regulatory research in the area of nanosafety, contributing to EU regulations and to international standards in the OECD context. The NanoSafety cluster addresses policy and risk governance issues related to the use of nanotechnology. The targeted results include predictive models and harmonised standard operating procedures for nanotechnology." (EC 2017j p177) O's: Open Innovation: *See Open Access above.* Open Science: *See Open Access above.* Open to the world: *See Public Engagement above.*

	Implicit: Reflexive: *Nothing different than what other H2020 Programmes are supposed to implement* Inclusive: • The QUINNE project "investigates how job quality and innovation mutually impact each other at the organisation level, and what employment outcomes result from this interaction – i.e. how more and better jobs are created" (EC 2017j p171). • "The Europe 2020 strategy focusses on smart, sustainable and inclusive growth, highlighting the role of research and innovation as key drivers. Horizon 2020 puts a specific focus on innovation under its second and third pillars (Industrial Leadership and Societal Challenges)" (EC 2017k p191). • In a survey "[f]or SC6 (Europe in a changing world - Inclusive, innovative and reflective societies), Research Infrastructures, LEIT NMPB and LEIT ICT, respectively 53.5%, 52%, 42,5% and 52% of respondents expected their project to have a wider impact on SC1 in the next 10 years" (EC 2017l p640). • Cross-cutting actions targeting the field of interaction between humans and technology were implemented. In particular the Topic Boosting inclusiveness of 'ICT-enabled research and innovation' requires synergies with the LEIT-ICT topics 'ICT35-2016: Enabling responsible ICT-related innovation'. As take-up of LEIT-ICT result, projects were funded to demonstrate how emerging technologies can be applied in the public sector (EURO-6) in order to highlight the role of public administrations in bringing innovation to the market and thereby contributing to growth" (EC 2017l p984). Anticipatory: *Nothing different than what other H2020 Programmes are supposed to implement* Responsive: *See Governance above.*

Explanation	The reviewed policy documents provide a relatively concise, although often limited reference to the RRI keys. For example, the public engagement is a rather elaborated and often cited RRI key, the involvement of citizens and citizen science does not appear in the reviewed documents (at least not as much as one would expect given the number of the phrase of public engagement). The specificity of socio-ethical issues is also underdeveloped, despite the fact that the reference to these issues is high. This is especially striking given the challenges and opportunities in areas of LEIT-ICT.

Scoping level

No	
Yes	Keys: <u>Public engagement:</u> • Digital innovation hubs are "proposed to address hubs in the respective programme sections with possible groupings around thematic areas and to set up appropriate coordination mechanisms to ensure coherence in implementation and building of synergies between hubs" (EC 2017b p5). • The reinforcement of EU in the standardization scene should occur "mainly through a standardisation observatory and a facility supporting the participation of key European specialists (especially from SMES and Academia) in key international and global SDOs and consortia" (EC 2017b p12). • "The potential offered by the use of inducement prizes to reach innovators beyond traditional Horizon 2020 participants and communicate on R&I towards general public should be further exploited in 2018–20" (EC 2017b p12). • Regarding LEIT-Space the engagement with the public can occur through the Off-The-Shelf (COTS) components (EC 2017a p3). • LEIT-Space encourages the promotion of "synergies between space and non-space activities of Horizon 2020 notably in the areas of technologies and societal challenges" (EC 2017a p3). <u>Gender equality:</u> *Nothing different than what other H2020 Programmes are supposed to implement*

	Open Access: • "Horizon 2020 [LEIT-]Space will support open access to research data, results and publications unless prevented for imperative reasons of security or EU industrial competitiveness." (EC 2017a p4) • Furthermore, the exploitation of space data should result in a higher-level data products in "openly available data archives including software tools for using" (EC 2017a p6). • The link of LEIT-Space to other parts of the work programme will be strengthened with "cross-references, guidance and explanation in the corresponding work programme parts and visibility in the participant portal" (EC 2017a p7). • In LEIT-ICT, the European Commission since 2014 highlighted the importance of "cross-sector re-use of data assets" (EC 2017b p4), "re-use and integration of data assets across sectors" (EC 2017b p9), and publicly accessible "open source repositories" (EC 2017b p6). Science Education and Science Literacy: • The exploitation of space science data in LEIT-Space should include the training for the next generation of space and data scientists (EC 2017a p6). • "Communication and outreach activities should highlight, for European citizens, the benefits of space-based applications in all aspects of life in our modern society. They should support education in science and technology and inspire the young generation to explore the Universe and to better understand our planet Earth." (EC 2017a p6). • For LEIT-ICT the development of innovation ecosystems centred on innovations in human machine interaction and data usage should, amongst others, address the needs of education (EC 2017b p9). Ethics: *Nothing different than what other H2020 Programmes are supposed to implement*

	Governance: *Nothing different than what other H2020 Programmes are supposed to implement* O's: Open Innovation: • The activities of LEIT-Space "should build upon technological and scientific expertise across the European Union and encourage co-development, spin-in or spin-out between space and non-space actors" (EC 2017a p6). • LEIT-ICT expect from Digital Innovation Hubs "easy access to the latest digital innovations and experimentation facilities" (EC 2017b p2). • The objective of the Next Generation Internet initiative of LEIT-ICT is to "find new ways to support mid- to long-term research and development on essential architectural and services building blocks of a next generation Internet, strengthening its open character and opening new opportunities to European Internet industry" (EC 2017b p6). This can occur, for example, through "open service platforms" (EC 2017b p7). • In leveraging innovative cloud technology solutions LEIT-ICT seeks "partnerships with industry and the public sector" (EC 2017b p8). • LEIT-ICT's Big Data cPPP tries to provide "secure environments for experiments incubating novel business ideas based on the reuse of data supported by functioning data markets" (EC 2017b p9). • In relation with research on interactive technologies (e.g. augmented- and virtual-reality) LEIT-ICT tries to provide "the industries with a full content value chain from authoring to application" (EC 2017b p10). • LEIT-NMBP's "overall approach is to serve open innovation in industry to achieve global industrial leadership" (EC 2017c p2). • In this regard, LEIT-NMBP's "[o]pen innovation will be strengthened by a step-change in societal engagement, to demonstrate the benefits of the technologies, and consider the human factor and societal needs" (EC 2017c p2).

	• For LEIT-NMBP open innovation makes the researchers' and industries' interaction (with the support of the public) this whole "eco-system more effective by extending it to users and society and to the financial sector" (EC 2017c p3). • "The aim is to enhance public confidence, societal engagement and encourage the uptake of new technologies (especially by SMEs) in an open innovation eco-system" (EC 2017c p4). <u>Open Science:</u> • For LEIT-ICT open science principles foster value creation through "re-use and integration of data assets across sectors" (EC 2017b p9). • LEIT-NMBP focuses on advanced and disruptive technologies, which, through the use of open scientific data, increases the innovation potential by creating new markets (EC 2017c p2). <u>Open to the world:</u> • LEIT-ICT supports the data standards and improves "technology transfer and entrepreneurial support" (EC 2017b p9). • LEIT-ICT's overall aim is to promote "skilled and inclusive society by digitally empowering all European citizens and businesses" (EC 2017b p10). • For LEIT-NMBP open to the world represents Europe's global leadership in key enabling technologies, as well as their "application to factories of the future and sustainability" (EC 2017c p2). Implicit: <u>Reflexive:</u> *Nothing different than what other H2020 Programmes are supposed to implement.* <u>Inclusive:</u> *See the Open Science and Open to the world sections.*

	Anticipatory: *Nothing different than what other H2020 Programmes are supposed to implement.* Responsive: *Nothing different than what other H2020 Programmes are supposed to implement.*
Explanation	Although the scoping documentation provides a very limited and time-specific version of the final Work Programme drafting procedure, it is also evident that the support for entrepreneurships and development of specific business-related skills is highlighted since the early drafts. This narrative, together with the overall enablement of European business-competitiveness is the leitmotiv of the consecutive documents. The exploitation of achievement, mostly in the economic sense, is prevalent since the initial drafts.

Work program level

No	
Yes	Keys: Public engagement: *Nothing different than what other H2020 Programmes are supposed to implement* Gender equality: • For LEIT-NMBP: "[w]here relevant, research and innovation activities should explore, analyse, and respond to possible sex and gender differences and take into account biological characteristics as well as the evolving social and cultural features of women and men, and other relevant factors of diversity (e.g. age, weight, user/consumer preferences and needs) in a given context. Responding to the gender dimension in technology development and use can lead to better designs and improve the marketability of products. Proposals should also pay due attention to the gender dimension of research and innovation in the proposed actions" (EC 2017h p6). • For both, LEIT-NMBP as well as for LEIT-ICT proposals and validations should take sex, gender specificities (aspects) into account (EC 2017h p55; EC 2017m p16) wherever it is important. • LEIT-ICT uses even a stronger phrasing, in a form that gender issues "must be addressed" (EC 2017m p17).

	Open Access: • Projects of LEIT-ICT has been participating in Open Access through the Pilot on Open Research Data in Horizon 2020 since 2014–2015 (EC 2014 p2). • There were also open access pilot lines for LEIT-NMBP for cost-effective nanocomposites (EC 2014 p7). • LEIT-NMBP proposals must ensure the accessibility, reliability, and reusability of data produced in the course of project(s) (EC 2017h pp15,25) and should comply with Open Access and Open Data Access policies (EC 2017h p24). • Within LEIT-ICT "Specific attention needs to be put in involving SMEs and give them access to data and technology" (EC 2017m p31). • Beneficiaries "must deposit and take measures to make it possible for third parties to access, mine, exploit, reproduce and disseminate, free of charge for any user: (1) data needed to validate the results presented in scientific publications ('underlying data'); and (2) other data as specified by the beneficiaries in their Data Management Plan" (EC 2017h p6; EC 2017g p37). • In the case of LEIT-Space and LEIT-ICT participants may opt out of the Open Access and Open Data Access arrangements, both before and after the signature of the grant agreement (EC 2017i p5; EC2017m p7). Science Education and Science Literacy: *See the relevant section under Call level*. Ethics: *Nothing different than what other H2020 Programmes are supposed to implement* Governance: *See the relevant section under Call level.*

	O's: Open Innovation: • LEIT-NMBP declares that "[t]his Work Programme reflects [the need for greater outreach] by including 25 topics in 2018–19, which explicitly promote open innovation through cooperation with other projects; enhanced user involvement; and the accessibility to the results produced" (EC 2017h p7) • Furthermore, "Open innovation and open science will be served with Open Innovation Test Beds for upscaling, characterisation, modelling, and safety. These will provide the widest possible access and users' involvement, in one open innovation ecosystem. Open innovation will be further served through the inclusion of more companies that will use the technologies developed to produce breakthrough innovations in products and processes, and through extensive societal engagement" (EC 2017h p7). Open Science: *See the Open Access section above.* Open to the world: • Openness is one of the leading motives in the WP 2014–2015, described as "bottom up actions will offer flexibility and openness and will help develop dynamic eco-systems in which innovators can operate" (EC 2014 p9). • LEIT-NMBP's "[o]penness to the world will be reflected in three flagships: one in nanosafety; one on global health care; and one biotechnology for the environment. It will further be served by inviting multilateral cooperation in more topics, notably in the area of catalysis for the circular economy" (EC 2017h p7). Implicit: Reflexive: *Nothing different than what other H2020 Programmes are supposed to implement*

	Inclusive: • LEIT since 2014 recognizes the cross-cutting KET activities that "bring together and integrate different KETs and reflect the interdisciplinary nature of technological development" (EC 2014 p5). • For LEIT in general the involvement of industrial participants, SMEs in particular, is extremely important in order to maximize the expected impact of applications (EC 2016a p3). • "Relevant innovations in advanced materials and nanotechnologies that would contribute to address the energy challenges leverage existing R&D results and project clusters for reaching market deployment and activities will also contribute to implementation of the integrated roadmap with support of all relevant stakeholders, such as EMIRI" (EC 2016a p5). Anticipatory: *Nothing different than what other H2020 Programmes are supposed to implement* Responsive: *Nothing different than what other H2020 Programmes are supposed to implement*
Explanation	The Work Programme level documentation provides a much greater importance to gender-related issues, however, still in a rather generic terms. No practical recommendations are provided in this regard. Again, the outreach and implementation purposes all are mostly directed towards economic impacts, especially in the LEIT-NMBP subtheme.

Call level

No	
Yes	Keys: Public engagement: *See the Inclusive section below* Gender equality: • LEIT-ICT's expected outcomes in *ICT-30-2019-2020: An empowering, inclusive Next Generation Internet* is to endorse that "increase in the overall uptake of technology for personalised and inclusive learning

for all, regardless of their age, gender or other socioeconomic factors" (EC 2017m p64).

Open Access: *Nothing different than what other H2020 Programmes are supposed to implement*

Science Education and Science Literacy:

- Most of the LEIT-NMBP's expected impact in IA calls (e.g. *CE-SPIRE-02-2018*; *CE-SPIRE-03-2018*; etc.) is effective dissemination of major innovation outcomes to the current and the next generation of employees, through the development of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programs (EC 2017h pp64).

- LEIT-Space's main delivery of the *DT-SPACE-08-BIZ-2018: Space outreach and education* action is "an initiative capable of attracting the interest of a significant number of students towards space and space-related themes, while creating at the same time a relevant impact on their families and the general public in terms of news coverage, social-media interest, stakeholders' involvement. The action shall engage academia and educators involved in different education levels, targeting different demographics including young children and teenagers" (EC 2017i p25).

- Similarly, *ICT-05-2019: Application driven Photonics components* in LEIT-ICT endorses that "[a]ctions should reach out to STEM graduates/PhD students and young postdocs in order to encourage more of them to pursue a career in photonics. Actions should help make students more industry ready and should provide the appropriate training, encourage innovation and entrepreneurship" (EC 2017m p17).

- LEIT-ICT's *ICT-09-2019-2020: Robotics in Application Areas* emphasizes a "[g]reater public exposure to actual robotics capability" (EC 2017m p25) through robotics competitions.

- LEIT-ICT's CSA action *ICT-28-2018: Future Hyper-connected Sociality* expected impact is defined as "[s]ocietal change towards digital literacy and citizen participation" (EC 2017m p60).

	• The *Digital Opportunity pilot scheme* within LEIT-ICT defined its scope as "To fully exploit the potential of LEIT ICT and to overcome the lack of appropriately skilled workforce in these technologies, the action supports internships for higher education students and recent graduates in companies in ICT producing and using sectors" (EC 2017m p129). Ethics: *Nothing different than what other H2020 Programmes are supposed to implement.* Governance: • *NMBP-13-2018: Risk Governance of nanotechnology (RIA)* tries to address the specific challenge of transferring the knowledge of nanomaterials into marketable solutions, by developing "transdisciplinary risk governance […] based on a clear understanding of risk, its management practices and the societal risk perception by all stakeholders" (EC 2017h p25). • The expected impact of *NMBP-13-2018: Risk Governance of nanotechnology (RIA)* is the creation of "[g]overnance framework tools for managing possible nanotechnologies risks in regard to social, environmental and economic benefits" (EC 2017h p25). O's: Open Innovation: • LEIT-NMBP's *DT-FOF-05-2019: Open Innovation for collaborative production engineering (IA)* tries to "[e]stablish Open-Innovation networks for manufacturing that support customer-driven production all around Europe" (EC 2017h p38). • *DT-NMBP-20-2018: A digital 'plug and produce' online equipment platform for manufacturing (IA)* within LEIT-NMBP contributes to open innovation via "particular user interface aspects to encourage active customer feedback" (EC 2017h p46). Open Science: *Nothing different than what other H2020 Programmes are supposed to implement*

Open to the world: *Nothing different than what other H2020 Programmes are supposed to implement*

Implicit:

Reflexive:

- *In LEIT-NMBP the call DT-NMBP-20-2018: A digital 'plug and produce' online equipment platform for manufacturing (IA) tries to develop a platform based on "Transparency of product features, capabilities, resource use, associated add-on services and price" (EC 2017h p46).*

Inclusive: (*see also section Science Education and Science Literacy*)

- In LEIT-NMBP the action *DT-NMBP-03-2019: Open Innovation Test Beds for nano-enabled surfaces and membranes (IA)* the proposals submitted under this topic will be designed to facilitate "cooperation, across Europe, with other projects and existing Pilot Lines; to enhance user involvement" (EC 2017h p15).
- *DT-NMBP-07-2018: Open Innovation Test Beds for Characterisation (IA)* is interested in network-building with "relevant stakeholders across Europe for defining roadmaps, application of realtime methods, implementation of regulatory and safety requirements, training and management of information (including Materials Informatics) and development of new skills" (EC 2017h p17).
- Similarly, *DT-NMBP-12-2019: Sustainable Nano-Fabrication (CSA)* tries to "[e]stablish a network of EU stakeholders that will manage information and communication among its members" (EC 2017h p22)
- *DT-NMBP-07-2018: Open Innovation Test Beds for Characterisation (IA); DT-NMBP-08-2019: Real-time nano-characterisation technologies (RIA); DT-NMBP-09-2018: Accelerating the uptake of materials modelling software (IA)*; and *DT-NMBP-10-2019: Adopting materials modelling to challenges in manufacturing processes (RIA)* focus on enhancing user involvement within the action (EC 2017h pp17,19,20,21).
- *DT-NMBP-12-2019: Sustainable Nano-Fabrication (CSA)* promises to "Link and consolidate existing infrastructure, create a sustainable

	community of stakeholders managing information and communication within and outside the group and develop an EU wide research and innovation strategy" (EC 2017h p23). • *CE-BIOTEC-05-2019: Microorganism communities for plastics bio-degradation (RIA)* in LEIT-NMBP tries to involve non-EU stakeholders in order to "promote substantial coordinated and balanced research and Innovation cooperation between the EU and China" (EC 2017h p53). • LEIT-Space's *DT-SPACE-01-EO-2018-2020: Copernicus market uptake* claims that "business plan and evidence of user engagement shall be compulsory and shall be provided as part of the proposal, to demonstrate the user need and sustainability of the project" (EC 2017i p9). • *LC-SPACE-02-EO-2018: Copernicus evolution – Mission exploitation concepts* also emphasizes that "To advance a coordinated preparation of a mature European capacity there is a need to bring together the key European stakeholders and competent entities which are" (EC 2017i p11). • Similar engagement with relevant industry stakeholders, including SMEs, in the operation and provision of Innovation Actions is noticeable in LEIT-ICT (EC 2017m p24). • Proposals in *ICT-15-2019-2020: Cloud Computing* try to "[f]acilitate awareness of stakeholders in research and policy matters related to Cloud Computing" as well as "[c]oordinate stakeholders in Cloud Computing and act as support to R&D programmes/activities by disseminating project results and organising scientific and policy events, developing research and innovation roadmaps, and addressing pre-standardisation initiatives" (EC 2017m p35). • The creation of "sustainable European forum of stakeholders" is the goal of both *ICT-15-2019-2020: Cloud Computing* as well as *ICT-16-2018: Software Technologies*. • *ICT-24-2018-2019: Next Generation Internet - An Open Internet Initiative* provides a detailed approach towards inclusiveness by defining its scope as "[i]nvolving today's best Internet innovators to address technological opportunities arising from cross-links and advances in various research fields ranging from network infrastructures to platforms, from application domains to social innovation. Beyond research, the scope includes validation and

	testing of market traction with minimum viable products and services, of new economic, mobility and social models, and involves users and market actors at an early stage" (EC 2017m p50). • *ICT-28-2018: Future Hyper-connected Sociality* defines as one of its expected impact the "societal change towards digital literacy and citizen participation" (EC 2017m p60). • The specific challenge of *ICT-30-2019-2020: An empowering, inclusive Next Generation Internet* is that "[e]very citizen, from all walks of life, should be able to fully take part in the Digital Single Market. This means that the Next Generation Internet will have to empower users, including its most vulnerable or disabled one, to have access to the same digital learning opportunities, in forms that are accessible, perceivable and understandable by everybody" (EC 2017m p63). • International cooperation is highlighted in *ICT-31-2018-2019: EU-US collaboration on NGI* by stating "to establish a continuous dialogue among the key actors in the US and European programmes and to implement focused projects for joint developments" (EC 2017m p64). • Pilots in *ICT-32-2018: STARTS – The Arts stimulating innovation* "will engage industry, technology, end-users, and artists in a broad artistic exploration of technologies with the aim of creating novel products, processes and services that respond better to human needs" (EC 2017m p66). Anticipatory: *Nothing different than what other H2020 Programmes are supposed to implement* Responsive: *Nothing different than what other H2020 Programmes are supposed to implement*
Explanation	The inclusiveness and governance receive much greater influence in the Call level documentation. This is understandable given the application-orientedness of the documentation. On the other hand, the lack of ethics-related references in the Call level documentation is difficult to interpret.

Project level

No	

Yes	Keys: O's: Implicit:
Explanation	*Please refer to the section 4.9 Case briefs*

Proposal Template level

No	

Yes	Keys:
	
	<u>Public engagement:</u>
	
	• In WP2014–2015
	  ○ CSA-LS, COFUND, RIA, SME1, SME2
	  ▪ In impact creation, especially in communication and measurement of public/societal engagement on issues related to the project
	
	• In WP2016–2017
	  ○ CSA, PCP, COFUND, RIA, SME1, SME2
	  ▪ In impact creation, especially in communication and measurement of public/societal engagement on issues related to the project
	  ○ CSA, PCP, COFUND
	  ▪ Increase in market introduction of solutions towards the public
	
	• In WP2018–2020
	  ○ RIA, SME1, SME2
	  ▪ In impact creation, especially in communication and measurement of public/societal engagement on issues related to the project
	
	<u>Gender equality:</u> N/A

Open Access: *Nothing different than what other H2020 Programmes are supposed to implement*

Science Education and Science Literacy: N/A

Ethics: *Nothing different than what other H2020 Programmes are supposed to implement*

Governance:

- In WP2014–2015
    - PCP, PPI
        - organisational structure and decision-making mechanisms are appropriate to the complexity and scale of the project (e.g. related to governance, conflict resolution, quality management, potential changes in partners and/or reallocation of budget when needed, approving deliverables, decision making related to handling of any IPR related rights assigned to the buyers group
        - consortium agreement has to clarify these
- In WP2016–2017
    - PCP, PPI
        - organisational structure and decision-making mechanisms are appropriate to the complexity and scale of the project (e.g. related to governance, conflict resolution, quality management, potential changes in partners and/or reallocation of budget when needed, approving deliverables, decision making related to handling of any IPR related rights assigned to the buyers group
        - consortium agreement has to clarify these

- In WP2018–2020
    - PCP, PPI
        - Organisational structure and decision-making mechanisms are appropriate to the complexity and scale of the project (e.g. related to governance, conflict resolution, quality management, potential changes in partners and/or reallocation of budget when needed, approving deliverables, decision making related to handling of any IPR related rights assigned to the buyers group
        - Consortium agreement need to clarify these

O's:

<u>Open Innovation:</u> *Nothing different than what other H2020 Programmes are supposed to implement*

<u>Open Science:</u> *Nothing different than what other H2020 Programmes are supposed to implement*

<u>Open to the world:</u>

- In WP2014–2015
    - PCP, PPI
        - Description needs to be provided on the state-of-the art on the demand side: What are the most advanced solutions already adopted or under development by other public procurers or private sector customers on the EU Internal Market or in other parts of the world to address the same challenge as the one addressed by the PCP
- In WP2018–2020
    - PCP

	▪ Description needs to be provided regarding the consortium's planned methodology for the preparation stage of the PCP (in particular regarding open market consultation, the development of the details of the common specifications and common evaluation criteria) Implicit: <u>Reflexive:</u> N/A <u>Inclusive:</u> N/A <u>Anticipatory:</u> N/A <u>Responsive:</u> N/A
Explanation	Overall, the proposal templates demonstrate only little modifications throughout the Horizon 2020 programme. The requirement for ethical checklist can be interpreted towards the requirements of RRI.

Evaluation level

No	
Yes	General RRI: <u>KPI for RRI are</u> • "instances where citizens, Civil Society Organizations (CSOs) and other societal actors contribute to the co-creation of scientific agendas and scientific contents" (EC 2017l p234). • It is a proxy for actions across the five dimensions of RRI, though like most KPIs it imperfectly captures the concept. (EC 2017l p246) • "However, CSO involvement in Horizon 2020 is very low, and CSOs are generally "hangers on" in projects and rarely co-ordinate them." (EC 2017l p249)

Keys:

Public engagement:

- Public engagement in the evaluation occurs through public procurement of innovative solutions (PPI) actions, where the progress beyond the state-of-the-art of innovation degree needs to strengthen competitiveness and growth of companies by developing innovations meeting the needs of European and global procurement markets. These are measured on 2 levels (EC 2017g p30):
    - Exploiting and disseminating the project results and managing research data (where relevant)
    - Communicating project activities to different target audiences

Gender equality: *Please see the corresponding section under Policy document level*

Open Access: *Please refer to Work programme level – Open access section, the conditions are the same.*

Science Education and Science Literacy: N/A

Ethics: *N/A, except the application form, please refer to the Proposal Template level.*

Governance: N/A

O's:

Open Innovation: N/A

	Open Science: N/A Open to the world: N/A Implicit: Reflexive: N/A Inclusive: N/A Anticipatory: N/A Responsive: N/A
Explanation	Only few of the RRI keys, and RRI itself has defined evaluation criteria. It can be argued that the questionnaire regarding ethics fulfils this criterion as well.

4.4 General use of RRI

Responsible Research and Innovation is traceable through the requirement of addressing societal challenges throughout the Horizon 2020 programme. Only a single (RIA) call makes *explicit* reference to RRI as a method, by stating "[l]egal, policy making and Responsible Research and Innovation aspects should be integrated in the proposal" (NMBP-15-2019: Safe by design, from science to regulation: metrics and main sectors; EC 2017h p27).

Most of the societal challenges refer to one or multiple keys. However, these references are often gaining a circular argument: a societal challenge can be addressed by instrumental implementation of one of the keys, which would contribute to boosting and renewing Europe's industrial capacities, to maintain or become a world-leading innovation power. In this regard it is not the technology that is providing the fix but rather the RRI concept as such. Implementing more keys from responsible innovation are not considered as values in themselves, they are rather considered as concepts required during the application or evaluation of a project. Few LEIT-related projects consider RRI keys as something more than a tick box exercise, however, they still do not implement all the keys. The situation with concepts such as the need to increase public engagement, gender equality, open innovation, or open access is slightly better, where these concept are reflected in the documents in an overall positive and valuable manner.

Very few theoretical considerations were present in the official EC documents. The reason for this might be due to the format and possible audience of these reports, the purpose and goals of which is not defined to provide a theoretical overview of Responsible Research and Innovation as such. Theoretical considerations related to RRI are prevalent mostly in academic publications, the documentation for the pillar of Industrial Leadership do not refer to RRI's theoretical ramifications, while RRI's importance is considered somewhat implicit.

As noted above, some of the RRI-related keys are referred to as valuable endeavours, e.g. greater public engagement, open access, open innovation. The reference to economic benefits, greater global competitive advantage, and ethical/societal issues are mentioned more often and in a meaningful way. Other keys are not as much conceptually developed in the reviewed documentation.

The requirement of ethical evaluation during the submission of a project can be interpreted as a substantial influence in requiring the implementation of RRI in a proposal. Similarly, some of the RRI-related keys are also having clear (and sometimes quantifiable) evaluation criteria, while others don't. Overall, the reference to RRI is traceable throughout the tackling and addressing of societal challenges, especially in the mid-term interim evaluation documents. Therefore, the answer to this question is yes.

Throughout the reviewed documentation, the following (explicit or implicit) references were made to the RRI-related keys, O's, Societal Challenges, or other RRI-related concepts (cf. Table 19). NB: the Interim evaluation of Horizon 2020 programme documents are not included due to the extensive reference to RRI-related terms throughout the document and size (+1000 pages) which fact would skew the data.

	Keys						O's			SCs							Other RRI-related concepts
	Public Engagement	Gender Equality	Open Science	Science Education and Science Literacy	Ethics	Governance	Open Innovation	Open Science	Open to the World	SC1	SC2	SC3	SC4	SC5	SC6	SC7	
EC 2014			2				1	1				5					
EC 2016a										2	1	1					7
EC 2016b																	
EC 2017a	2		3	2			1			1	2	4	2	5	1	5	2
EC 2017b	3		4	2			10	4	2	6	4		4		2	1	10
EC 2017c	1			2			7	1	1	7		8	2	8		2	1
EC 2017g		1	1					1									1
EC 2017h		2	20	6	1		9	1	1								16
EC 2017i			1	14						1		1		1			7
EC 2017m		3	3							1							37
Total	6	6	34	26	1	0	28	8	4	18	7	19	8	14	3	8	81

Table 19 - Overview of RRI keys, O's, SCs, and other RRI-related concepts within the reviewed LEIT-related documentation

4.5 RRI beyond the keys

RRI is understood in the documentation mostly mediated through the societal challenges, therefore, as a process of tackling overarching grand-challenges of communities. Therefore, RRI is used mostly as a source of motivation and/or justification for a particular research or innovation project, with aspirations towards providing some solutions to these.

Gap analysis is occasionally performed through the Horizon 2020 scoping period which concluded that all priorities have already been addressed at least once in the two first work programmes. Better integration of activities in all parts of the programme is needed to achieve the maximum impact. Decentralisation in one of the LEIT-ICT project can be considered as one of the RRI beyond the key themes. The exchange of skills of artists and creative people with entrepreneurs and technologists should be promoted.

Besides the aforementioned implicit references to RRI-related topics, keys, and themes there is very little explicit reference to RRI in general within the LEIT theme.

4.6 Theoretical framework of RRI applied in the program line

The notion of responsible innovation has been adopted by the Horizon 2020 and thus by the European Commission based on the definition as 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 and its marketable products (in order to

allow a proper embedding of scientific and technological advances in our society)." (von Schomberg 2013 p19)

However, from the theoretical framework underling the innovation process as reflected in the H2020 program line the research and innovation processes are interpreted in practice in multiple ways. As described by the research conducted by Blok & Lemmens (2015), in much of the responsible innovation literature, the input of responsible innovation processes is not present in a form of clear-cut and isolated problems. Instead, they are listed under the 'grand challenges' or our time category. Into these grand challenges belong climate change (e.g. global warming), resource depletion (e.g. sustainable development), poverty alleviation, ageing. Horizon 2020 documents therefore prioritizes research and innovation that promises to tackle the aforementioned grand challenges of our times (and societies; Blok & Lemmens 2015).

Regarding responsible research and innovation, various stakeholders have different ideas about it both as a problem and what might be its solution. This related also to a more general societal and ethical aspects which have to be taken into account during the innovation process in particular. Due to these overarching differences amongst multiple stakeholders, Blok & Lemmens (2015) note that their involvement into the innovation processes are thus prone to failure. This failure occurs due to multiple reasons:

- Naivety stemming from the reduction of the issue of information assymetries in relation to mutual responsiveness among stakeholders;
- The unrealistic nature of mutual responsiveness and collective responsibility which brings abut blurring of tasks and responsibilities;
- The Collingridge dilemma (dilemma of control), which combines the information problem (i.e. unpredictability of negative consequences of technologies at early stages of R&I) with the power problem (i.e. difficulties related to amendments of a technology at later stages of R&I).

All these aspects may therefore contribute to the low adoption of responsible research and innovation in the LEIT theme of the Horizon 2020 programme.

Research further investigated the issues related with responsible innovation and stakeholder engagement. Blok et al (2015) identified multiple critical issues related to stakeholder engagement in responsible innovation in relation with transparency, interaction, responsiveness, and co-responsibility. Many of these issues have been confirmed also during the interviews with LEIT-stakeholders (see section 4.8 *Interview findings*), such as negative impact on competitive advantage, lack of control, fear of knowledge-leakage, power imbalances, or time loads. Other critical issues, listed by Blok et al (2015) are uncertainty regarding product launch, collaboration of stakeholders with other companies, different visions, goals, motives, sectors, and values as well as the burden of investment for becoming a responsible investor is carried by the invertor alone.

These critical, and often conflicting, issues all feed into the conflicting framings that are essential on the one hand for running businesses, and being ethical on the other hand. The interpretation of the findings of Blok et al (2015), as well as the analysis of interviews (see section 4.8) suggests that the

resulting lack of the ethics-related topics within LEIT might be due to the inherent and dominant business-logic present in the overall LEIT programme.

Similarly, Lubberink et al (2017) confirm the findings, supported by extensive literature review, that businesses are already engaging in systems-thinking for innovation. Businesses engage in understanding the needs of target beneficiaries (i.e. consuers), and often contribute to the discussion with the stakeholders regarding the values of their innovation in respect to the stakeholders' needs. This confirms the relatively high-level responsiveness of businesses. On the other hand, however, the critical examination of desirable or possible negative implications of innovations (i.e. ethics-related reflexiveness) are scarce (Lubberink et al 2017).

A recent proposal attempts to align RRI and open innovation. Although open innovation and RRI are relatively well aligned in respect of openness of open innovation towards the criteria defined by responsible innovation. However, this openness towards socio-ethical factors are dependent on the extent the innovators willingness to adopt these (Long & Blok 2018). While open innovation enables the embedding of socio-ethical aspects into the innovation programme, the proposed Open Innovation 2.0 extends this by requiring the adaption towards socio-ethical factors (Long & Blok 2018).

4.7 Overall assessment of RRI in the program line (based on desktop research)

Category	Value	Description
A	High awareness • Open Science • Open innovation • Other RRI-related issues (mostly socio-ethical issues) • Social Challenges	• RRI as concept is (implicitly or explicitly) present in most documents on all levels; • RRI keys and O's are used and referred to in several documents; • Governance structures reflect societal embeddedness; • Upstream/Downstream engagement is present on multiple levels
B	Some awareness • Gender equality • Ethics • Science and literacy education	• RRI as concept is (implicitly or explicitly) present in some documents; • Some RRI keys and O's are used and referred to in any document; • There is some process of better social embeddedness through governance or engagement
C	Limited awareness • RRI as a concept • Public engagement • Governance	• Responsibility or ethical awareness is referred to in any document • Any RRI key is mentioned; • There is reference to the need for social embeddedness of the research at hand.
D	No awareness • Open to the World • RIAA	• RRI as concept is not present in any document; • No RRI key is mentioned implicitly or explicitly; • There is no reference to societal embeddedness or civic engagement;

4.8 Interview findings

The interviews were conducted between January and March 2018. The overview of the participants is demonstrated in Table 20. Fourteen people were interviewed, the biggest group of 7 from the Netherlands, followed by 2 from the United Kingdom and Portugal each, and one interviewees from Belgium, Hungary, and Luxemburg each. Five of the interviewees were women and nine were men. The areas of expertise were divergent, ranging from policy on the national and international level (EC), through education and research, to industry and non-profit/non-governmental institutions involved in LEIT-related topics.

No.	Country	Gender	Expertise
1	**BE**	F	Policy - EC

2	**HU**	F	Industry
3	**LX**	F	Policy - EC
4	**NL**	M	Research
5	**NL**	M	Policy
6	**NL**	M	Education
7	**NL**	M	Industry
8	**NL**	M	Industry
9	**NL**	M	Education
10	**NL**	M	Industry
11	**PT**	M	Research
12	**PT**	M	Education
13	**UK**	F	Industry
14	**UK**	F	Industry

Table 20 – Overview of Interview Participants for Social Lab 5 Diagnosis

4.8.1 Shared understanding of RRI

Most of the participants expressed a good understanding and extensive familiarity with the term, theory, and implementation of Responsible Research and Innovation (n=10). Only few of the interviewees admitted little or some familiarity with the term, although they were aware of its existence (n=2). One interviewee had never come across the term of RRI before. Another interviewee expressed familiarity with the term, although could not recollect an exact definition of RRI.

The respondents admitted the importance of ethics and responsibility within research, either through the societal challenges (that are part of the LEIT-NMBP programme), or through their requirement in every research proposal within Horizon 2020. They were aware of the other keys (e.g. gender equality, public engagement), while referring to the importance of inclusiveness in research, incorporating a bigger role for social sciences and humanities in the research process. They referred also to actual regulation standards and other requirements for compliance (e.g. privacy, safety, data protection, GDPR). Some interviewees referred to ideas such as circular economy, competitive disadvantages RRI (especially open access and open science) and ethical standards might pose to businesses and their commercial interests, research ethics, necessity to control exports by not collaborating with adversary countries, discrimination and biases, job security (in relation to robotic technologies), sustainability. Ultimately, these views were considered as approaches to incorporate safety, aiming at societal relevance and impact, as well as methods towards effective governance. Some expressed views that societal challenges can be understood as businesses cases for industry, as a part of generic drive behind funded technologies. Without this additional incentive research, for example, into sustainable technologies would be considered too costly for businesses, which would remain unexplored without these additional incentives. The ultimate goal is to create trust with citizens and become engaged in research and innovation projects and policies.

Overall, the recognition of societal challenges and the motives to tackle them is in accordance with the economical rationale to provide solutions for these. Therefore, all the technological, legal, ethical, and economic reasons are in accordance with the formulation of societal issues, as people for whom these solutions are being developed are also the customers of businesses. Some interviewees see the

efforts of the European Commission towards RRI and greater ethical compliance extremely beneficial, as without these incentives a lot more projects would fail in the area of research integrity. Ethical and societal issues are honestly and carefully addressed at least in EU projects, due to the ethical review processes present in funding applications. At the same time, some expressed the view that RRI is unknown beyond the policy level and the level of EU projects, despite the fact that some de-facto RRI solutions are to be found in industry and university research.

Although collaboration between industry partners and other related stakeholders is not without competitive issues, such collaboration is often conducted in pre-competitive stage. Furthermore, challenges of open science and open innovation for competitiveness and commercial interests are 'addressed' through patenting, where these are considered crucial in fulfilling the requirement of open innovation. Patents thus, according to the interviewee, helps to open-up for businesses. At the same time open access and open data is a 'deal breaker' for businesses if it is mandatory, usually opting-out from open access clauses.

Other stakeholder identified the prevention of discrimination and biases in development of algorithmic solutions for data mining technologies as a boundary issue, as the research teams 'do not operate on actual human subjects' (only the scientists themselves as sources of data), which legitimized the little (and 'last minute') involvement of ethics in the WPs. On a similar note, a different interviewee pointed out the predominant focus on technological and engineering solutions, and the lack of attention on discrimination, gender equality, and biases in topics such as serious video game development.

It is a general experience in businesses that RRI-related works are not top priorities in companies. Some participants acknowledged that there are currently many EU projects related to RRI. However, according to various interviewees, social and ethical issues are still generally underestimated by industries as well as policy actors. Legislation is not aligned with RRI-type aspirations of companies. However, a company's reputation (and hence competitiveness) may depend on RRI-type activities. Business competitiveness and social reputation go hand-in-hand. By some, RRI is understood more as a political term that is used by the EC within EU-funded projects and is less prevalent as a concept in industries or university research institutes. This coins RRI as a concept that is pushed top-down to stakeholders, while another interviewee confirmed that RRI is not known beyond EC policy documents and projects dedicated to RRI. An example might be RRI in the field of Artificial Intelligence (AI) and robotics, where its relevance is warranted also by public concerns and questions, and last EC calls on robotics were revised by RRI and ethics experts ensuring compliance with RRI keys. However, industries' as well as academia's vested interests may stand in a way of implementing RRI. These interests are difficult to reshuffle; however, it is desirable by the interviewees that it would be addressed on the EC-policy level.

Interviewees highlighted the lack of public knowledge about RRI and its keys, which ultimately hampers ***engagement*** with RRI. Public engagement in terms of communicating the results to the public is already required within EC-funded research projects, and the quality of its outputs is increasing. More involvement of main stakeholders in research projects with industry, media, societal and scientific partners is needed across Europe. This claim has been repeated to all RRI-related

projects within the LEIT-NMBP theme. The topic of public engagement is one of the most recurring keys throughout the interviews. However, aside from development, user-testing, and clients there is not much going on in this regard in companies. A view has been expressed that in non-technical projects there is more room for public engagement and vice versa. There is a lack of specialists who have the competencies in both technology and social engagement, which then results in difficulties communicating the interested citizens. Creating awareness and dialogue at different levels of societies about the technology itself (e.g. nanotechnology) or politics of technology (e.g. privacy policies) are much needed. For companies, the requirements to engage with citizens should be streamlined and actively supported, for example by simplifying procedures and possibilities of such engagement. This engagement should incorporate also technologies, so that the role of technologies could be socially interpreted and understood. Some companies directly aim at being open and transparent about their conduct and activities, stating that citizens should be able to check these activities. Some interviewees admitted they expected engagement with citizens to be easier than it really was. It has been recommended that, in relation to public engagement, focusing on specific topics and particular application (area) of a technology is more fruitful compared with engagement activities focusing on technology as such. Examples for such engagement: the user engagement of one of our interviewee's project regarding the programme line of energy-efficient buildings; engagement through emphasizing societal adaptation (e.g. interface design for particular user-groups) rather than technology development. Civil Society Organizations (CSOs) are not discussing certain technologies (e.g. nanotechnology), and this is considered a barrier towards engagement with the public by the business. Furthermore, civil society is not motivated to engage in such activities, as they feel they are not heard, and if they are, their viewpoints are not taken into consideration. NGOs and governmental actors should be included into the public engagement according to an interviewee. An issue might be also no interest in industrial technologies by a general public and NGOs, which makes then public engagement difficult to perform. It is also unclear, who everybody should participate in the engagement process, and what role the public should have in policy-monitoring and -making. Engagement with local NGOs and (local) politicians should also be encouraged for researchers/scientists. Researchers, on the other hand, slowly start to understand that public outreach is required from them to justify the spending on research from public money, and they start to take responsibility for it.

Another often highlighted key is ***gender equality*** and social discrimination. According to one of the interviewee companies in general have gender balance at higher level, ICT is lacking behind in women-education. Research and innovation projects are aware of its importance, which means that gender equality related goals are included in the project descriptions. However, within research and innovation itself gender is not often an issue. One of the respondents highlighted that the absence of interest in issues of women and minority communities may further translate into negative representation of Middle-Eastern characters, racism, sexism, homophobia, ageism, and transphobia in software development (e.g. video games). Although in theory gender-related issues are incorporated and seemingly considered, in practical life it has been admitted that it trickles down to a bare minimum of actions required – a practice paramount in other areas, therefore, not an urgent issue. In academia, researchers feel that focusing on issues like gender equality is another topic that keeps researchers away from research as such. The requirement of gender equality is viewed as box-

ticking, and it should be enforced more by funding requirements or by the need to rearrange operational structures. Technical and cultural/social perspectives need to be mixed in outreach activities (e.g. public engagement) to research and innovation communities to get across the social message. In this regard social sciences play an entry point for RRI, where a better understanding of cultural and societal values can be initiated. Other interviewees confirmed the lack of reflection regarding gender- and diversity-related issues in businesses. A creation of mutual language between scientists between various disciplines (technology-related and social and political scientists), stakeholders, and actors involved in a project is needed. Some businesses representatives confirmed that the gender equality policy has been already adopted company-wide. Hence, meeting gender-related requirements of funding calls is not a problem for them. In addition, their clearly defined goal is to have balanced number of high-level managers from all genders.

The key related to ***science literacy and education*** is requested by the EC in the dissemination and exploitation activities. Some companies do have some outreach. Nevertheless, it often is delegated to persons already working in these areas, and the involvement and inclusion of the public is somehow lacking behind. Science centres are considered as drivers of engagement and education. The dialogue regarding technologies should be broadened beyond topics such as safety and risks. Regarding gender equality, it is not sufficient to educate the greater public about these issues but involve project partners with multidisciplinary backgrounds (e.g. interaction designers, industry, academia, etc., to mediate between partners) to personally motivate software developers to address gender and/or minority issues in their work. Addressing cultural diversity-related issues need to be done very carefully in order to avoid defensive attitudes from the stakeholders. Again, social sciences and humanities play a crucial role in this part. The lack of educational resources for people with natural sciences background has been reported. NGOs and other stakeholders need capacities and training in establishing modes of participation. Such resources would support interdisciplinary collaboration. There is also a lack of time for cross-disciplinary education (social sciences vs natural sciences). The experienced lack of openness of social scientists towards the insights of engineers should be addressed and discouraged (and possibly tackled by increasing their technical knowledge), as well as more dedicated projects should be funded for science literacy and education. Some industry players reported successes in science education initiatives during public outings of companies (multiple personnel are also part-time professors). It has been expressed that the provision of a guidance how to deal with negative public perception with certain technologies (e.g. robotics), including, for example, the inclusion of public into the problem definition would be extremely helpful for stakeholders. A view that researchers are developing technologies in pure isolation from societies has been challenged by an interviewee, researchers are working on empowering humans instead of making their lives burdensome. An interviewee could not identify an EU-funded robotics-related research proposal which is funded for the sake of robotic research, rather robotic-research is funded for the sake of tackling societal challenges defined by the EC. In this regard, more education is needed, for example, in the theme of robotics for the public, who are often misled by depictions of robots in movies. The explanation and presentation of the beneficence of novel technologies (e.g. robots) for the public is lacking behind. Citizen science has been identified as a means of dealing with educational challenges in general.

The ***open access and open science*** keys are discussed on the national and EU level, however, it's reception is skeptical in Brussels as it is interpreted as contradictory with the competitive edge of businesses. Commercial interests limit the requirement towards open data and open science. Companies prioritize intellectual property, open data and open innovation are unspecific terms, without the obvious practical benefit for the companies as such. Some companies were successful in fulfilling the open science and open innovation requirements by establishing open campuses where the participation and engagement of other (start-up) companies as well as citizens are welcomed to use their facilities. Open access and open data should not harm the business ventures, according to one of the interviewee a demonstrated goodwill of sharing information will result in the eventual reception of goodwill in the future. Stakeholders involved in EC-funded research projects are usually listing most of the deliverables as open access, which practice also demonstrate the different attitudes of academia and companies regarding open data.

The ***ethical*** requirements of RRI according to the interviewees refer mainly to research ethics. Various ethical issues emerge throughout multiple projects the interviewees were and are involved: security, sustainability, trust, politics, anonymization, privacy-by-design, best practices. Companies are interested in ethical guidance, however, in an informal and reflexive way, within companies, 'on the work floor' – which has been put into contrast with regulatory guidance (suggesting that companies are not interested in more regulatory prescriptions, rather they are interested in dealing with conflicts between values). For developers, technologies (e.g. software) are gaining political importance, as it is not value-neutral, the conflicting values need to be acknowledged and addressed. GDPR is mentioned as an example that forced many companies into good practice. Companies are interested in avoiding 'incidents,' nevertheless it is usually the CEO of a company who brings in the drive to become more ethical in a business. Ethical considerations are present at the lower levels within a company, however, they often stay there, suggesting that the ethical practice in companies occurs in top-down initiatives. Ethics is seen in companies as an aside, people who are linked with ethics-related tasks are considered hindering the engineers' and developers' work. An explanation in this regard is given, which describes the nature of private sector companies, that highlights the focus on employees with specialized (hierarchical, affordance-based) competencies. Such employees, in contrast with higher-level managers, lack the overview of the project and its broader societal impacts. An interviewee's company tries to actively abstain from unethical activities, as being a sustainable company is important part of their overall reputation. Companies are involved in value-sensitive innovation and are actively engaging other companies to be accredited as ethical companies with a degree of transparency, corporate integrity, and ethics procedures and boards. On the EC-level, according to an interviewee, ethical and social issues are honestly and carefully addressed in Europe, where ethical review is extremely beneficial. Repeated ethical review process is also mentioned as beneficial. Another interviewee admitted, ethics-related WPs of a EC-research project were added last-minute and were not regarded as overly relevant and operational for the research project (although the project related to big data research, but with 'no actual human subjects'). The interviewee disclosed that the ethical WP felt as artificially added, and there was a reason why it was initially absent in the big data-related research project. Another interviewee claimed that even if requirements of research integrity are merely tick-boxes, they do assure some level of addressing societal challenges in general. In this regard an annual re-training would be beneficial to adhere to compliance requirements However, the lengthy

procedure of obtaining ethical approvals and being compliant to EU regulation is burdensome and, in the interviewee's view, holds back innovation (e.g. individual subjects reluctant to participate in projects due to stringent data-related ethical requirements). Ethical and legal compliance may be extremely burdensome especially for small companies and projects, for which the EC should provide additional support.

The key related to ***governance*** is the least reflected by most of the interviewees. Interviewees expressed difficulties in adapting (pre-conceived) EU framework programme project plans to newly identified societal/ethical insights during the duration of the project itself. This translates into a specific lack of responsiveness, which might be also occurring due to loss of valuable time, energy, or a simple lack of competence from the project consortium members. Furthermore, the relation of businesses with EC-funded research project officers is somewhat ambiguous, as besides their professional roles as officers/controllers, throughout multiple earlier research projects, they became also the researchers' friends. Therefore, the researchers do not want to bother the officer with multiple difficult queries. Moreover, every time the consortium partners have something to discuss with the project officer, the officers do not have a detailed recollection of the previous engagements with the project. This means that the discussions need to be initiated from scratch and it is a waste of time and energy. It has been highlighted that, for example, nanotechnology is not discussed currently on a governance-level. On the policy-makers level it has been noted that, for example, the issue of gender equality can be addressed by specifically requiring greater diversity from the project-proposing stakeholders.

From the analysis of the interviews it can be concluded that the most important keys of RRI are engagement with the public, scientific literacy and education, ethics, and gender equality. The much less prevalent keys were open science and access (with open innovation), together with governance. Most of the interviewees (except one) operationalize RRI keys in their work, either explicitly referring, or by application of one of the keys without being familiar with the theoretical framework behind the RRI. Few companies and institutions have already codes of conduct and regulation in place (they also have formal reflection processes in place). Others do this either due to the personal convictions of higher managers towards corporate responsibility practices, or due to some feeling of responsibility towards the wellbeing of citizens or societies. Ethical issues are prevalent in relation to industrial applications of technologies, mostly in the areas of ICT, AI, privacy or big data.

Successes are partial or fragmental, but this is not considered as an issue due to the underlying contradiction between RRI keys and business competitiveness. Overall, the very fact that RRI keys are slowly appearing on the table of businesses is considered a positive thing. The role of the European Commission in requiring these in call applications and throughout research projects is considered an important boost into the right direction. Only one of the 14 interviewees did not consider the keys of RRI important, but the interviewee have never heard about the concept of RRI before either.

4.8.2 Beyond RRI

Interviewees considered the inclusion of partners with special **expertise** to tackle societal challenges, ethical issues, or RRI keys important, as such experts are not widely spread in the LEIT theme, with the exception of few projects. A pool of experts dedicated to responsible societal challenge solutions is

desired, who would take further informal reflection within companies and act upon it. Unfortunately, technologists in projects are only interested and motivated in social sciences in relation to increase the selling rates of a product (better marketing). Their interests expand seldom beyond this motivation, which should be changed by training and other incentives.

Interviewees expressed a desire to intensify the **media attention** about new technologies and their societal impacts, as well as the funding bodies. Firstly, there is a deeply embedded mismatch between what policy seems to represent regarding technological solutions, and how such technologies are perceived by their private and professional users, as well as developers. Secondly, such attention needs to begin early, as research and innovation on higher technological readiness levels (TLR) is more difficult to link with societal impact and relevance. There is a lack of awareness and understanding of RRI within industry. Also, the European funding bodies and framework programmes need better PR, as citizens do not really know what Horizon 2020 or RRI are, neither are they familiar with the ongoing innovations and opportunities. There is also a lack of time, interest, and overall knowledge from the public to care about citizens' interests in everyday technology use. Often citizens are not even aware that they can become one of the stakeholder groups, or that they can be represented in projects. Therefore, public engagements should have a specific agenda for the dialogue that drives the engagement into greater success. In addition, it has been noted that developers are not familiar with academic publications, so this way of public outreach is not that effective, requesting alternative methods of gaining attention.

Increased **incentives** should be provided to fund RRI-related works throughout academic careers and funding opportunities by the EC. This would encourage individuals to implement RRI-related societal engagement on project-level, which is generally a difficult task, despite political will on national and European level for conducting these. According to an interviewee, academics are not enough encouraged to conduct research and publicly engage in activities with good ethical impact during their careers. Funding-related issues regarding RRI is noticed but on a more systemic level by other interviewees. Another interviewee disclosed that there is a lot of RRI-related practice present in industry already, however, these stakeholders belong to the already responsible circle of partners. There is an overall lack of resources to do RRI-related works beyond the legal requirements in (small) companies. Therefore, RRI-related work does not reach top priority in companies. Similarly, to small companies, municipalities also lack financial and information resources in order to comply with (data, privacy) regulations, which ultimately puts them at the disposal of private sector players and market forces.

There is a lack of **training** regarding RRI-related issues for people from technology development and industries.

Tensions between commercial and research activities can be evaded by conducting research in pre-competitive stages. Vested interests between various (academic and industry) stakeholders form obstacles in the way of implementing RRI. Therefore, according to the interviewee, project funders should have a role in countering the conflicting vested interest and directing them towards the implementation of RRI. Also, biases between disciplines often hamper collaborations, therefore they should be actively identified and addressed. Specialists from social sciences should also exhibit greater

sense of creativity (instead of putting everything into boxes) in research and innovation projects in order to understand and be helpful within the consortium of partners. On the other hand, many companies do not consider RRI burdensome, as many keys represent already a part of their particular technological approach.

Regarding the **next funding programme** (i.e. Horizon Europe), unlike in the Horizon 2020 framework programme, it has been recommended to further deepen the notion of responsibility between technologies and the pillars of the framework programme for addressing societal challenges. Other interviewees noticed unwillingness of policymakers to engage with RRI-type projects during conferences and in face-to-face meetings, they do not attend meetings they have been invited for. Policymakers often have a specific focus, which disregards deeper understanding of social values (e.g. happiness, social benefit, relationships) that are beyond economic value. Furthermore, many technology developers are actively acknowledged by policymakers for their motivation to address societal issues. An interviewee with technical background noted that social sciences seem to be underrepresented in Horizon 2020 programme funding calls. For research project consortium partners RRI also means maintaining good relationship with EC project officers (i.e. not bothering her/him with small things, keep the PO enthusiastic, be proactive). Companies should be encouraged to develop compliance with ethical principles (CSR), as well as national and international legislation, or human rights standards. In the next funding programme the development of silos should be further eradicated, through simplifying the size and complexity of themes and the framework programme itself. RRI-related themes should be essential part of the next framework programme (they are according to interviewees still underrepresented in Horizon 2020), as even if research integrity in calls is merely represented as tick-boxes, they contribute to the understanding of societal challenges overall. However, the difference and/or overlap between RRI keys such as open science, societal challenges within SwafS and RRI projects is unclear within the EU policy. A related that needs to be addressed is the lack of clear boundaries between programmes: for example, citizen science was not included in SwafS, while one would expect to be included in it. On the other hand, gender equality is a cross-cutting key in Horizon 2020, covering the pillars and programmes, while it is also embedded within SwafS. The next framework programme should make RRI really cross-cutting at all levels (i.e. support, policy, calls, projects), and should also exhibit much greater sensitivity towards the diverse societal challenges on a regional level compared with the high-level Horizon 2020 programme perspective. Although societal challenges are relatively well covered throughout Horizon 2020, there is no systematic incentive to address RRI keys throughout calls due to unstructured programme, lacking a logical meaning, and inflexibility. The term of SwafS is quite broad, however, its scope is quite narrow. For NGOs to be an advisor for an EU project costs money, as they have to travel to the meetings. These travels are often covered from their own budget, as NGOs do not want to be strain on the taxpayers' money.

4.8.3 Assessment of RRI based on interviews

Category	Value	Description
A	High Awareness • Public engagement • Science and literacy education	• RRI as concept well understood by all stakeholders; • RRI keys and O's are used and referred to by most stakeholders; • Operationalization of RRI already present
B	Some awareness • Gender equality	• RRI as concept understood by some stakeholders; • Some RRI keys and O's are referred to by some stakeholders;

	• Ethics • RRI as a concept	• The need for mainstreaming through operationalization is referred to by some stakeholders
C	Limited awareness • Governance • Open access / Open science	• Vague awareness of RRI as concept by a few stakeholders • Any RRI key referred to by some stakeholders • Some ideas of operationalization of RRI present
D	No awareness • Concepts of RRI beyond the keys	• RRI as concept is not present • No RRI key is mentioned • No reference to or explicit refusal of societal embeddedness or civic engagement

4.9 Case briefs

4.9.1 SeeingNano Project

SeeingNano (Project ID: 646141),[36] funded by the Horizon 2020 programme, run between December 2014 to November 2016. Its full title was "*Developing and Enabling Nanotechnology Awareness-Building through the Creation and Exchange of enhanced Communication and Visualisation Tools and Guidance for 'Seeing at the Nanoscale'*". Horizon 2020 contributed to the project 206.362,50 EUR.

SeeingNano aimed at creating Novel Visualisation Tools for Enhanced Nanotechnology Awareness through a coordinated collaborative approach conducted by leading experts in the relevant fields: the target audiences identified in the proposal were analyzed by the consortium's socio-economic sciences and humanities, who – in collaboration with the consortium's state-of-the-art information visualisation partners – were elaborated and agreed on the most appropriate tool to address the respective audiences.

The challenge of the project consisted of how to visualize a technology that is so small, one cannot see it? A single strand of hair is 80.000-100.000 nanometres wide, and it would take one thousand of the thickest nanomaterials (100 nanometres) to match this width. It is unsurprising then that understanding the principles of nanotechnology can be difficult. SeeingNano took on this challenge through unique visualization tools that allow one to 'see at the nanoscale.' The materials provide an understanding and awareness for the breadth of nanotechnologies, and the benefits, uncertainties and potential risks connected to them. It enables youngsters, non-scientific journalists, science teachers, adult museum visitors, and people in retirement to engage with this type of technology in an effortless and accessible way.[37]

Three families of tools were developed within this project:

- An application for both iPhone and Android users shows how nanotechnology is used in several applications including car engines. Users are able to slowly move closer and closer to the surface of an engine piston until they are 'seeing at the nanoscale'
- Exciting quizzes
- Group activities

The SeeingNano implicit RRI-related engagement is clearly in public engagement, which has been defined as along the question how to gauge the impact those tools have when used in real-world

36 https://cordis.europa.eu/project/rcn/194417_en.html
37 http://nanotechia.org/seeingnano

scenarios. The project established a number of strategic liaisons with individual stakeholders (such as large international companies, policy maker units, and the press office of the European Commission) and key stakeholder groups (such as industry associations, and technology networks) in order to properly address these stakeholders' needs from an early stage of the project. The project established also an Expert Working Group (EWG), consisting of Nanotechnologies Industry Association (NIA) Members that were themselves direct beneficiaries of the planned SeeingNano project outputs and who played a pivotal role in the multiplication of the project impact: these NIA Members engaged in the SeeingNano project through a Linked-3rd Party agreement, and were brought in at strategic points to[38]

d. provide concrete feedback on the project's planned work and progress through feedback templates

e. provide additional input (e.g. science content)

f. use, promote and disseminate the SeeingNano output and thus act as a multiplier to its impact

4.9.2 SavingFood Project

SavingFood (Project ID: 688221),[39] funded by the Horizon 2020 programme, run between January 2016 and December 2017. Its full title was "*An innovative solution to tackle food waste through the collaborative power of ICT networks*". Horizon 2020 contributed to the project 217.625 EUR.

SavingFood built on the collaborative power of ICT networks and created an online community of citizens (in 4 countries: Greece, Hungary, United Kingdom, Belgium), food waste stakeholders and policy makers that, through knowledge-creation and -sharing, they were empowered to take direct action and become part of the suggested food waste solution. Through the use of advanced open source tools connected to a social networking environment SavingFood facilitated the redistribution of surplus food to those in need, ensured that no food was wasted through lack of communication, supported the participation of people in organized as well as *ad hoc* events around food saving and encouraged wide debate. Leveraging on the collaborative power of social networks and by activating the collective intelligence of citizens SavingFood sought to create a social movement for tackling food waste and influenced lifestyles towards a more sustainable future.[40]

The aim of the project was to offer a socially and environmentally responsible solution to the food waste challenge by developing an online networked community of various stakeholders who through collective awareness, knowledge sharing, motivations and incentives, will facilitate the redistribution of surplus food and leftover crops for the benefit of vulnerable groups in our society.[41] In this regard the project implicitly referred to the public engagement and open innovation keys of RRI, as a part of LEIT-ICT subtheme.

38 Ibid.
39 https://cordis.europa.eu/project/rcn/199864_en.html
40 Ibid, for more information see https://savingfood.eu/
41 Cf. SavingFood Brochure: https://savingfood.eu/?file=repository/FortheWEB_SavingFood_EN.pdf

4.9.3 Gaming Horizons Project

Gaming Horizons (Project ID: 732332),[42] funded by the Horizon 2020 programme, run between December 2016 and January 2018. Horizon 2020 contributed to this project 226.443,75 EUR.

Gaming Horizons' ambition was to democratically open up new areas of public value for the games industry as a whole, beyond sectorial distinctions between 'leisure' and 'serious' games. As such, the project laid the groundwork for a balanced and research-informed dialogue about the use of games or game-derived elements for learning and critical reflection, benefiting a range of stakeholders in various sectors: education, ICT, game development, and policy.[43]

Gamin Horizons' was a direct response to the official recognition by the H2020 programme of work that multidisciplinary research can help to advance the integration between Responsible Research and Innovation (RRI) and the Social Sciences and the Humanities (SSH). The project's objective was to enable a higher uptake of socially responsible ICT-related research in relation to gaming. In this regard the RRI-uptake, as a part of LEIT-ICT, is explicit in this project, which helped identifying future directions at the intersection of ethics, social research, and both the digital entertainment and serious games industries.[44]

5 Conclusions

The conclusion section will list the bright spots and the challenges of the diagnosis process, covered by both desktop research as well as interview research. Regarding the conclusions, higher importance will be given to the feedback collected from the interviews, as these represent the actual materializations of the aspirations described in the policy documents. The summary is therefore collected in three consecutive sections, as the bright spots, the challenges, and the recommendations as a result of this analysis.

5.1 The Bright Spots

The reviewed documents of the desktop research highlight high sensitivity towards social and ethical challenges. Concepts such as open science, open innovation, are represented in the documentation often and in a meaningful way. The main driver towards the fulfilment of RRI-related keys are the reference to social challenges in general.

The documentation also refers to keys such as gender equality, ethical requirements, and the increasing need of science education and literacy education.

During the interviews, the respondents also admitted the high importance of ethics and responsibility within research and innovation, in an expectable form through societal challenges (as a part of the LEIT-NMBP programme). Interviewees see the requirement for ethical compliance as a positive and important step during the application procedure and within the monitoring of projects during their duration. They were aware of the other keys (e.g. gender equality, public engagement), while referring

42 https://cordis.europa.eu/project/rcn/206006_en.html
43 https://www.gaminghorizons.eu/about/
44 https://cordis.europa.eu/project/rcn/206006_en.html

to the importance of inclusiveness in research, incorporating a bigger role for social sciences and humanities in the research process. They referred also to actual regulation standards and other requirements for compliance (e.g. privacy, safety, data protection, GDPR). Some interviewees referred to ideas such as circular economy, competitive disadvantages RRI (especially open access and open science) and ethical standards might pose to businesses and their commercial interests, research ethics, necessity to control exports by not collaborating with adversary countries, discrimination and biases, job security (in relation to robotic technologies), sustainability. Ultimately, these views were considered as approaches to incorporate safety, aiming at societal relevance and impact, as well as methods towards effective governance.

5.2 The Challenges

During the desktop research it became obvious that the conceptual and more theoretical underpinnings of RRI are missing from the official documentation. This then has a negative consequence in terms of less thoroughly considered RRI keys in project proposals and evaluation documents. Some of the less represented RRI-related keys in the documentation were ethical compliance, public engagement and gender equality. These underrepresented topics need to be developed further in the form of explanation of their relevance, and in the forms of key performance indicators that can endorse measurement of compliance.

According to the interviewees collaboration between industry partners and other related stakeholders is not without competitive issues. Nevertheless, such collaboration is often conducted in pre-competitive stage, which can prevent the emergence of hurdles and further issues. In addition, challenges of open science and open innovation for competitiveness and commercial interests are 'addressed' through patenting, where these are considered crucial in fulfilling the requirement of open innovation. Patents thus, according to the interviewee, helps to open-up for businesses. At the same time open access and open data is a 'deal breaker' for businesses if it is mandatory, usually opting-out from open access clauses.

Only a single interviewee was not familiar with the concept of RRI as such, while s/he was the only one who did not consider the relevance of RRI-related keys and requirements at the project level. All the other respondents highly valued the implementation and aims of RRI, they were very well aware of the societal and ethical challenges novel technologies (e.g. big data, robotics, nanotechnology) are introducing to the everyday life of affected societies.

Multiple companies tried to tackle the issue of gender balance, however, while some were rather successful in this regard, others were less. The latter would expect more incentives in this regard.

More incentives are requested towards the incorporation of RRI-related requirements into the everyday work of stakeholders, either through support or career-paths. Moreover, multiple interviewees explicitly referred to an increased number of stakeholders from humanities and social sciences in research and innovation projects involving more technical staff.

Few interviewees referred to concepts beyond RRI that might be considered as important principles in European projects, such as explicit reference to principles of human rights and beneficence in relation with international cooperation on a global scale as well as working with disruptive

technologies. The concept of democratic decentralization also emerged in this context, which might refer to the requirement of subsidiarity on the EU-level.

5.3 Recommendations

The following recommendations were phrased during the diagnosis process:

- Thorough and consistent representation of the RRI-keys throughout the policy documentation.
- More consistent requirement of RRI-related keys in projects.
- More systematic development of key performance indicators for RRI-related keys, O's, RIAA. These should highlight as positive goals in themselves, and not as tick boxes. Thus, they need a deeper explanation in the documents for deepening the understanding of stakeholders in this regard.
- Greater support and incentives for gender equality compliance.
- Developing career paths that supports work on RRI-related concepts and applications.
- Involvement of scientists from humanities and social sciences.

6 Relevant stakeholders

6.1 Who are relevant applicants/actors/stakeholders?

Information withheld in compliance with GDPR. See methods section for general overview of interview participants. An anonymised list of interviewees for LEIT is in section *4.8 Interview findings* in Table 20 of Annex 1.

7 Timeline for Diagnosis

Month	Task(s)
4	Start of Diagnosis
4	Get to know the program line
5	Identify relevant stakeholders/experts for interviews
6–7	Interviews with experts (in total 14)
7–10	Transcribe interviews, analysis
10	Drafting of the Report
15	D3.1 due in M15 – ensure you send your reports to WP lead on time

8 Literature, links, resources

Blok, V., Hoffmans, L., & Wubben, E. F. M. (2015). Stakeholder engagement for responsible innovation in the private sector: critical issues and management practices. Journal on Chain and Network Science, 15, 147–164. https://doi.org/10.3920/jcns2015.x003

Blok, V., & Lemmens, P. (2015). The emerging concept of responsible innovation. Three reasons why it is questionable and calls for a radical transformation of the concept of innovation. In Responsible Innovation 2 (pp. 19–35). Springer, Cham. https://doi.org/10.1007/978-3-319-17308-5_2

EC (2014, July 22). Horizon 2020 - Work Programme 2014-2015. European Commission. 5. Leadership in enabling and industrial technologies – Introduction. C(2014)4995. Retrieved from https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-leit_en.pdf

EC (2015a, April 17). Horizon 2020 - Work Programme 2014-2015. European Commission. 5. Leadership in enabling and industrial technologies - i. Information and Communication Technologies. C(2015)2453. Retrieved from https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-leit-ict_en.pdf

EC (2015b, April 17). Horizon 2020 - Work Programme 2014-2015. European Commission. 5. Leadership in enabling and industrial technologies - ii. Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing. C(2015)2453. Retrieved from https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-leit-nmp_en.pdf

EC (2015c, April 17). Horizon 2020 - Work Programme 2014-2015. European Commission. 5. Leadership in enabling and industrial technologies - iii. Space. C(2015)2453. Retrieved from https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-leit-space_en.pdf

EC (2016a, July 25). Horizon 2020 - Work Programme 2016-2017. European Commission. 5. Leadership in enabling and industrial technologies – Introduction. C(2016)4614. Retrieved from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit_en.pdf

EC (2016b, July 25). Horizon 2020 - Work Programme 2016-2017. European Commission. 5 iii. Leadership in Enabling and Industrial Technologies – Space. C(2016)4614. Retrieved from https://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-space_en.pdf

EC (2017a). Horizon 2020 Work Programme 2018-2020. European Commission. Scoping Paper: Leadership in Enabling and Industrial Technologies – Space.

EC (2017b). Horizon 2020 Work Programme 2018-2020. European Commission. Scoping Paper: LEIT – Information and Communication Technologies.

EC (2017c). Horizon 2020 Work Programme 2018-2020. European Commission. Scoping Paper: Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing (NMBP).

EC (2017d, April 24). Horizon 2020 - Work Programme 2016-2017. European Commission. 5.i. Information and Communication Technologies. C(2017)2468. Retrieved from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-ict_en.pdf

EC (2017e, April 24). Horizon 2020 - Work Programme 2016-2017. European Commission. 5.ii. Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing. C(2017)2468. Retrieved from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-nmp_en.pdf

EC (2017f, October 27). Horizon 2020 - Work Programme 2018-2020. European Commission. 5. Leadership in enabling and industrial technologies – Introduction. C(2017)7124. Retrieved from https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/h2020-wp1820-leit_en.pdf

EC (2017g, October 27). Horizon 2020 - Work Programme 2018-2020. European Commission. 19. General Annexes. C(2017)7124. Retrieved from https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-ga_en.pdf

EC (2017h, October 27). Horizon 2020 - Work Programme 2018-2020. European Commission. 5.ii. Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing. C(2017)7124. Retrieved from

http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-leit-nmp_en.pdf

EC (2017i, October 27). Horizon 2020 - Work Programme 2018-2020. European Commission. 5.iii. Leadership in Enabling and Industrial Technologies – Space. C(2017)7124. Retrieved from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-leit-space_en.pdf

EC (2017j). Interim Evaluation of Horizon 2020. Brussels: Directorate-General for Research and Innovation. https://doi.org/10.2777/220768

EC (2017k, May 29). Interim Evaluation of Horizon 2020. Annex 1. European Commission. Brussels.

EC (2017l, May 29). Interim Evaluation of Horizon 2020. Annex 2. European Commission. Brussels.

EC (2017m, October 27). Horizon 2020 - Work Programme 2018-2020. European Commission. 5.i. Information and Communication Technologies. Retrieved from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-leit-ict_en.pdf

Long, T. B., & Blok, V. (2018). Integrating the management of socio-ethical factors into industry innovation: towards a concept of Open Innovation 2.0, 21, 463–486. https://doi.org/10.22434/ifamr2017.0040

Lubberink, R., Blok, V., van Ophem, J., & Omta, O. (2017). Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices. Sustainability, 9(5), 721. https://doi.org/10.3390/su9050721

von Schomberg, R. (2013). A Vision of Responsible Research and Innovation. In R. Owen, J. Bessant, & M. Heintz, R. Owen, J. Bessant, & M. Heintz (Eds.), Responsible Innovation (pp. 51–74). https://doi.org/10.1002/9781118551424.ch3

Anneces

8.1 Interview Template

Interview ID **Institution Type**

1. Challenges	**Min. 75 words**
- […]	
	Exemplary Quotations
- […]	
2. Current Practice	Min. 75 words
- […]	
	Exemplary Quotations
- […]	
3. Enablers	Min. 75 words
- […]	
	Exemplary Quotations
- […]	
4. Barriers	Min. 75 words
- […]	

Exemplary Quotations - […]

5. Application of RRI Keys

Key		Elaboration on how/where
K1-Public engagement	☐ No	☐Yes, …
K2-Gender equality	☐ No	☐Yes, …
K3-Science Literacy/Education	☐ No	☐Yes, …
K4-Open Access (open science)	☐ No	☐Yes, …
K5-Ethics	☐ No	☐Yes, …
K6-Governance	☐ No	☐Yes, …

6. Recommended Interviewees
- […]
Comments / reflection on and inferences from the interview
- […]

8.2 Checklist for proofreading

Element	Issue/Common Mistake(s)	OK

Document file	The document at hand is the latest version including all revisions and additions: no track changes pending, no further comments.	☒
Document file	After proofreading and finalisation: the file is labelled as “final” in some way and has a meaningful file name.	☒
Front Page/Cover	The cover page conforms to the standards of the project (cross-checked with project template).	☒
Front Page/Cover	All authors are listed; their order is agreed upon and correctly displayed.	☒
Front Page/Cover	The author names are correctly spelled.	☒
Front Page/Cover	Institutional affiliations of all authors are visible (name, logo) and correctly spelled.	☒
Front Page/Cover	Contracting entity/grant authority is visible (name, logo, grant-agreement number).	☒
Front Page/Cover	The name and acronym (including small/large caps) of the project are correctly spelled.	☒
Front Page/Cover	The cover does not break over pages.	☒
Table of Contents	There is a table of content, a table of figures, and a list of tables.	☒
Table of Contents	The table of contents is on an uneven page.	☒
Table of Contents	The table of contents, including page numbers and headings, is updated.	☒
Table of Contents	The table of contents comprises all relevant headings and subheadings (max. three levels).	☒
Table of Figures/Tables	The table of figures and the list of tables comprise all figures and tables.	☒
Header/Footer	The header and footer are in accordance with the main text (check: font, size, content, format).	☒
Header/Footer	If there is a front page/cover, there is no header/footer on that first page.	☒

Header/Footer	There are page numbers on every page of the main text and appendices (not on the cover or following blank pages).	☒
Main text	The main text starts at an uneven page.	☒
Main text	Suggestions of the automatic spelling and grammar check are reviewed and considered – if appropriate.	☒
Main text	The final text (after accepting track changes) has been proofread.	☒
Main text	Headings and subheadings use the same style throughout the text, check for example: size, font, bold/italics/underlined, colour, numbering (dot after the final number or not ("1.1." or "1.1")).	☒
Main text	Cross references are updated.	☒
Main text	All tables have meaningful captions and are continuously numbered (check for inconsistencies regarding numbering along chapters/continuous numbering without chapter number).	☒
Main text	Tables have the same formatting (font, font size, line spacing, etc.) – if reasonable.	☒
Main text	Tables do not break across pages – if possible.	☒
Main text	All figures have meaningful captions and are continuously numbered (check for inconsistencies regarding numbering along chapters/continuous numbering without chapter number).	☒
Main text	Figure captions have the same formatting (font, font size, line spacing, etc.) – if reasonable.	☒
Main text	Figures do not break across pages – if possible.	☒
Main text	Every reference has an entry in the reference list.	☒
Main text	Reference check: The name(s) and year of each reference match the reference entry in the reference list.	☒

Main text	The style of referencing within the text is consistent: • Separation of multiple entries: Is there a comma or a semicolon? • Separation of name and year: Is there a comma, a colon, a blank space? • Separation of two authors of the same entry: Is there a comma, a slash or an "and"? • Multiple authors: How is the "et al" formatted (in Italic/standard, is there a full stop behind it, etc.) • Page numbers: Choose between either "p." and number or numbers only. • Page numbers: Is there a comma or colon between the year and the page number?	☒ ☒ ☒ ☒ ☒ ☒
Main text	Abbreviated terms are written out the first time they are used, followed by their abbreviation (in brackets).	☒
Main text	Figures, tables and illustrations have an alternative text (right click → *Format Picture…* → *Alt Text*)	☒
Main text	Tab stops and blank characters are NOT used in order to format the text. Rather, other ways (e.g. invisible tables) are used.	☒
Main text	Please distinguish between hyphen and dash. Never put a hyphen (-) between to empty characters.	☒
Main text	Consistent use of British OR American English (e.g. "s" or "z" as in "organisation"/"organization") – set autocorrect accordingly.	☒
Main text	Consistent gender-neutral language.	☒
Main text	Bullet points are used in the same style throughout the text (e.g. bullets or dashes, size of the items, etc.). Please also check if the indent of the bullet points is the same in all lists.	☒
Reference list	There is a reference list.	☒

Reference list	Every entry in the reference list is mentioned/cited in the text at least once.	☒
Reference list	The reference list is in alphabetical order.	☒
Reference list	All entries in the reference list follow the same citation system/style. Check: • Format of names: Is the first name written out or abbreviated (initials)? • Title: How are title and subtitle separated (colon, full stop)? • Punctuation: Is there a comma, a semicolon, etc. between the names of multiple authors? Is there a full stop after every entry? • Typography: Are titles of books, articles, journals, etc. continuously written in italics or not? • Etc.	☒ ☒ ☒ ☒
List of Sources	Empirical paper: there is a list of sources (list of interviews, list of documents analysed, etc.).	☒
List of Sources	Interviewees are sufficiently anonymised.	☒
Whole document	Use the find-and-replace function of your text processing software to check and correct the following issues: • The project acronym is correct including the uppercase and lowercase characters. • Remove unnecessary blank characters (e.g. two blank characters after a word).	☒ ☒
Whole document	Check the use of dates, times, etc. in terms of style: Is it the same throughout the text (e.g. "November 1st 2016", "01/11/2016", "06:00h", "6:00h", etc.)?	☒
Final	After having checked the above issues, update the Table of Contents, List of Tables and List of Figures again (page numbers could have changed because of the review process).	☒

Final PDF Document	The PDF document conforms to the original document (same number of pages, same size).	☒

Annex 2: NewHoRRIzon Diagnosis Report Social Lab Nr. 6

NewHoRRIzon Diagnosis Report

Social Lab Nr. 6

Grant Agreement No.	741402
Project Start Date	May 1st, 2017
Duration of project	48 months
Version	1.0
Author ***(in alphabet order)***	Jana Dvořáčková Vladimír Kebo Lukáš Macenauer Zbyněk Machát Filip Vostál

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 741402.The opinions expressed in this document reflect only the author's view and in no way reflect the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.

Contents

1. Executive Summary

Horizon 2020 – Industrial Leadership is divided into three parts. We will only focus on *Access to risk Finance* and I*nnovations in SMEs* program lines. Both promised to help companies and other types of organizations engaged in research and innovation (R&I) to gain easier access, via financial instruments, to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance.

Current status of RRI is complicated. A concept such as RRI is not important for banking institutions, private investors and also for companies itself in a direct way. They focus on innovation with an expectation of future profitability of goods or services.

Main actors in our field are the European Investment Bank and European Investment Fund; European bank sector – banks (at national level), other providers of financial instruments – individual contractors, business angels, private investors, national innovation agencies, innovation and start up incubators, national start up and innovation funds.

Main practice, not surprisingly, focuses on business profit and risk reduction. Perspective on RRI – none or weak, discourse of RRI is very implicit, people interviewed during the research and people involved in the first Social Lab were not familiar with concepts of RRI or 3 Os, apart from the scholars from the academic field.

2. Scope of this document

The goal of the Diagnosis Report describes the field covered by Social Lab number 6. It is part of the Horizon 2020 – Industrial Leadership. The first part is focused on *Leadership in Enabling Industrial Technologies* (SL5), our SL6 part of Industrial Leadership is divided to ***Access to Risk Finance*** **and** ***Innovations in SMEs*** **program lines**.

Under *Access to Risk Finance*, Horizon 2020 will help companies and other types of organizations engaged in research and innovation (R&I) to gain easier access, via financial instruments, to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance. (HORIZON 2020; WORK PROGRAMME 2014–2015; 6. Access to Risk Finance Revised; page 3)

Under the *Industrial Leadership* pillar, this specific objective will help companies and other types of organizations engaged in research and innovation (R&I) to cultivate European innovation ecosystem, gain easier access, via financial instruments, to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance, which will now be most importantly boosted under the new Commission initiative VentureEU.

3. Methods

We used the following procedure for out area: at the beginning, we collected documents defining the field of activities of the EU – Strategy 2020, fundamental documents related to Horizon 2020, and other types of policies such as *Investment Plan for Europe*. We also paid attention to documents which were created during the last two internal evaluations of Horizon 2020. Then we collected documents at the *Working Program level* and lower.

Concurrently with the work on the desktop research, first interviews were taking place. These helped us to understand the logic of behaviour of the individual actors involved in the decision-making process. We succeeded in engaging respondents from the field of academia, banking industry, private investments, private startup funds, national centres of innovation support, national agencies for applied research, innovative SMEs or advisors for SMEs with a technological focus.

Bibliometric and statistical analyses were not used for the documents or the mass of supported projects in the two observed program lines. Documents were analyzed through desktop research and document analysis. In the case of supported projects, the project team did not have the capacity to conduct such analysis.

3.1 General scope of the program

Despite the fact that Horizon 2020 constitutes a small proportion of complex public research and development (R&D) spending in the European Union, macroeconomic models show significant socio-economic impact from the programme (of over EUR 400 billion gained by 2030). (Interim Evaluation of H2020, page 11).

Horizon 2020 is the eighth EU Framework Programme for Research and Innovation for the period 2014-2020 with a budget of nearly EUR 80 billion, bringing together EU-level R&I funding into a single programme, covering the scope of FP7, the innovation activities from the former Competitiveness and Innovation Framework Programme (CIP), as well as EU funding to the European Institute of Innovation and Technology. (Interim Evaluation of H2020, page 22)

When Horizon 2020 was adopted, this single framework integrating research, education and innovation was expected to deliver enhanced scientific, technological and innovation impacts which would translate into larger downstream economic, competiveness and social impacts as well as environmental and EU policy impacts. (Interim Evaluation of H2020, page 23)

Access to Risk Finance

(https://ec.europa.eu/programmes/horizon2020/en/h2020-section/access-risk-finance*)*

Under the 'Industrial Leadership' pillar, this specific objective will help companies and other types of organisation engaged in research and innovation (R&I) to gain easier access, via financial instruments, to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance, which will now be most importantly boosted under the new Commission initiative VentureEU.

The concrete goal is to support and facilitate access to sources of debt and equity financing by innovative companies of all sizes and also by research centres and universities, public-private partnerships, special-purpose companies or projects, and joint ventures.

Particular support is required for innovative SMEs (and in some sectors, microenterprises), especially in the start-up phase or after diversifying into new markets. The availability of early-stage and growth-stage equity finance for innovative firms is being improved thanks to **VentureEU**, which will help to provide better access to finance to support the concept and proof-of-concept stage of the innovation process, as well as the later stages of development where relevant. European and national innovation ecosystems that will motivate the innovation companies to act globally to become the “innovation gazelles” are very important.

Instruments

InnovFin – EU Finance for Innovators is the name under which the EU promotes a range of debt and equity products and advisory services in order to effectively give a boost to the availability of finance for research and innovation activities in Europe.

InnovFin - EU Finance for Innovators consists of a range of tailored products – from guarantees for intermediaries that lend to SMEs to direct loans to enterprises - helping support the smallest to the

largest R&I projects in the EU and countries associated to Horizon 2020, the new EU research programme for 2014-20.

The InnovFin products operates in conjunction with those of EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME).

Financial Institutions

The European Investment Bank and the European Investment Fund play an important role, as entrusted entities, in implementing each financial instrument facility on behalf of and in partnership with the European Commission.

The European Investment Bank provides loans to medium to larger companies, or guarantees to banks lending to them. It also provides a range of technical assistance and advisory services, in order to help project promoters to make research, development and innovation bankable.

In addition, two thematic finance products were launched in 2015, for the support of combating infectious diseases and high-risk energy demonstration projects. An additional product supporting the development of thematic finance platforms was added to the InnovFin product portfolio in 2017.

Also in 2017, a specific product supporting investment in research organizations, institutes or universities was launched, as well as a product specifically tailored to innovating entities based in countries that are qualified as emerging innovators according to the European Innovation Scoreboard.

Lastly, a product providing intermediated or direct quasi-equity type of financing to large R&I programmes and innovative mid-caps also drawing from funds provided by the EFSI was also put on the rails in 2017.

The European Investment Fund from its side provides guarantees to banks lending to small and medium-sized firms and small midcaps and invests in funds providing start-ups and fast-growing firms with equity, including through the new Venture EU initiative.

Accompanying measures

Apart from access to finance mainly through debt and equity instruments implemented by the EIB, Horizon 2020 also support in particular SMEs and start-ups to become more investment-ready via various capacity-building actions, directed at them and their national support organisations:

- InvestHorizon is a programme designed to increase investments made in Innovative European SMEs through Investment Readiness development and Investor sensitization. The project aims to defragment the SME investment market, helping both SMEs and investors to make better deals by increasing their knowledge about each other, on the crossroads of finance and innovation.
- Progres TT: **P**ublic **R**esearch **O**rganisation **GR**owing **E**urope through best practice **S**olution**S** for **T**echnology **T**ransfer (TT) is a three-year pilot initiative promoting good practice for the commercialisation of Intellectual Property. Supported TT Offices improve skills in targeted areas of the TT process, increase the Return on Investment and accelerate Technology Readiness Levels (TRLs) of the R&D projects they handle.
- ACCESS4SMEs is a 30-month coordination and support action directed at National Contact Points in the domains of access to risk finance and SMEs, fostering the use of financial

instruments (incl. through exchange of best practices) and including the establishment of a community of practice facilitating access to cross-border finance.

For examples of more accompanying measures, please consult the Work Programmes on Access to Risk Finance at the bottom of the page.

EFSI Boosts Innovations

The European Fund for Strategic Investments (EFSI) is widening the opportunities for finance for innovation support both under its Infrastructure & Innovation and SME windows. The products under EFSI will be implemented by the European Investment Bank group.

RDI is not only a priority sector under the EFSI Infrastructure and Innovation Window (IIW). It is a horizontal dimension, also present in other priority sectors of IIW (like Digital, Energy, Transport, etc.), as well as in the EFSI SME Window (SMEW) where debt and equity finance products are supporting the growth of RDI-driven / innovative SMEs and small mid-caps.

Innovations in SMEs

(https://ec.europa.eu/programmes/horizon2020/en/h2020-section/innovation-smes)

Horizon 2020 actively supports SMEs by providing both direct financial support, and indirect support to increase their innovation capacity. 'Innovation in SMEs' aims at creating a bridge between the core of the framework programme - support to research, development and innovation projects - and the creation of a favourable ecosystem for SME innovation and growth.

The objective of 'Innovation in SMEs' is to optimise the Research, Development & Innovation environment for SMEs, including through the establishment and facilitation of a range of support services, with the aim of strengthening the innovation capacity of SMEs and creating value on the market and/or into society, thus underpinning the Europe2020 strategy for smart, inclusive and sustainable growth.

'Innovation in SMEs' includes actions which provide mostly intermediated support to SMEs. These actions take the form of tailored services and projects (innovation management capacity building, IPR management, etc…), networking and mobilisation actions for innovation service providers and policymakers (i.e. exchange of experience between national innovation agencies); moreover, Horizon 2020 provides direct support to the Enterprise Europe Network, a key player in improving SMEs' access to funding opportunities, for instance by providing brokerage services to SMEs looking for a coach under the European Innovation Council pilot's SME instrument.

'Innovation in SMEs' funds additional activities intended to support entrepreneurship, internationalisation, and improving access to markets (through the COSME programme).

'Innovation in SMEs' provides a top-up to the budget of the second EUREKA/Eurostars Joint Programme Initiative (2014-2020), which helps market-oriented transnational collaborative R&D projects, spearheaded by R&D performing SMEs established in any of the 36 EUREKA Member-States that participate to Eurostars. Eurostars pools together national resources, with the aim of strengthening integration and synchronization of national research programmes contributing to the achievement of a European Research Area.

3.2 What is your program about?

Industrial Leadership

(https://ec.europa.eu/programmes/horizon2020/en/h2020-section/industrial-leadership)

This pillar aims to speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs to grow into world-leading companies.

It consists of three specific objectives:

- "Leadership in enabling and industrial technologies" will provide dedicated support for research, development and demonstration and, where appropriate, for standardisation and certification, on information and communications technology (ICT), nanotechnology, advanced materials, biotechnology, advanced manufacturing and processing and space. Emphasis will be placed on interactions and convergence across and between the different technologies and their relations to societal challenges. User needs will be taken into account in all these fields.
- "Access to risk finance" will aim to overcome deficits in the availability of debt and equity finance for R&D and innovation-driven companies and projects at all stages of development. Together with the equity instrument of the Programme for the Competitiveness of Enterprises and small and medium-sized enterprises (COSME) (2014-2020) it will support the development of Union-level venture capital.
- "Innovation in SMEs" will provide SME-tailored support to stimulate all forms of innovation in SMEs, targeting those with the potential to grow and internationalise across the single market and beyond.

The goal is to make Europe a more attractive location to invest in research and innovation (including eco-innovation), by promoting activities where businesses set the agenda. It will provide major investment in key industrial technologies, maximise the growth potential of European companies by providing them with adequate levels of finance and help innovative SMEs to grow into world-leading companies.

3.3 What is the size and structure of your program in terms of budget, applications and projects?

Access to Risk Finance

As at 31 December 2016, some EUR 7.42bn of **InnovFin** financial assistance had been committed to an estimated 5,780 final beneficiaries across the EU28 Member States and other eligible countries.47 This figure does not include any amounts that may have been committed to final beneficiaries under the MidCap Guarantees (the EIB's Operational Report only includes the amount committed to financial intermediaries). These estimates should be treated with caution since it is difficult to combine guarantee and loan data and because some firms may be a beneficiary of more than one InnovFin product. In particular, the total volume of funding already committed is inflated by a small number of high volume transactions under Large Projects. In case of the SMEG, the average size of a transaction to final beneficiaries is EUR 353,136. (Interim Evaluation of Horizon 2020's Financial Instruments Final Report, page 36)

It is difficult to compare the different InnovFin schemes in terms of the amount of finance provided to beneficiaries. In case of the SMEG, the maximum amount of newly originated beneficiary transactions rather than the EU budget allocation is included in guarantee agreements with intermediaries (EUR 6,874m). In case of InnovFin Equity, and the two thematic instruments, the overall budget figures are presented. In case of the other three EIB-managed financial instruments (MidCap Guarantee, MidCap Growth Finance and Large Projects) no overall data on the financial outlays for the 2014-20 period are available. Rather, an annual figure of EUR 2.7bn has been taken and multiplied by 2.5 years (i.e. the period between the launch of the schemes and the end of 2016) to arrive at a figure of EUR 6.75bn. (Interim Evaluation of Horizon 2020's Financial Instruments Final Report, page 36 – 37)

The InnovFin financial instrument with the highest take-up (based on the number of contracts signed with financial intermediaries) was the SME Guarantee (109 signatures). This has been far more popular than the MidCap Guarantee with only five signed intermediary agreements as at 31 December 2016.

In terms of the number of final beneficiaries, once again the SME Guarantee dominates by far with 5,682 firms benefitting, followed by MidCap Growth Finance (38 signatures with beneficiaries) and Large Projects (49 signatures with beneficiaries, out of which three cancelled after signature).

The investment duration varies from up to 5 or 7 years in case of the MidCap Growth Finance and Infectious Diseases schemes, to up to 15 years in case of the Energy Demo Projects. (Interim Evaluation of Horizon 2020's Financial Instruments Final Report, page 37)

So far, the geographical distribution of InnovFin finance is quite concentrated from a geographical perspective. Italy, leads by far, followed by Spain, France, Belgium, Germany, the UK and Sweden. Generally, investment is heavily concentrated in Western Europe. (Interim Evaluation of Horizon 2020's Financial Instruments Final Report, page 41)

As at 31 December 2016, no InnovFin finance had been committed in a total of seven countries to final beneficiaries under any of the financial instruments. These countries were: Latvia, Lithuania, Slovakia, Faroe Islands, Georgia, Montenegro, Norway, and Ukraine. However, of these countries, in case of Latvia, Lithuania, Slovakia and Ukraine, one intermediary each had signed up to the SMEG before 31 December 2016, meaning that investments could be expected in these countries shortly. We understand that the position has indeed changed since then. In case of the SMEG (as at mid-March), further operations have been signed, and countries newly covered since end of 2016 are Faroe Islands, Georgia and Norway. This leaves Montenegro as the only country that has not made any use so far of InnovFin to date. Since we do not have up-to-date information available to us for all the financial products, we have presented the position as at 31 December 2016 in the tables in this section. More up-to-date information is presented in the separate country reports. (Interim Evaluation of Horizon 2020's Financial Instruments Final Report, page 42)

4. Current situation of RRI in the program

4.1. RRI in brief

RRI could be relevant for financial sector because it is the concept, which could help our societies go behind the short-term profitability. If RRI would be more reflected throw the delivering process provided by EIB and EIF it could lead to more diversified portfolio of economic activities in the whole EU area. And more diversified European economic could vice versa fulfilled societal needs and give more answers in term of goods & services to problems which we are challenged.

The main challenge is how to "reconnect" Horizon Europe with investment activities which Horizon 2020 supported but without to be visible part of the whole process. People from financial institution don't see Horizon 2020 like key part of process, the story for them starts with EIB and EIF and their rules, terms and conditions.

4.2. Desktop findings:

4.2.1. Role of RRI in Access to Risk Finance and Innovation in SMEs

Policy document level: EU 2020 Strategy

No	
Yes	Keys: NO O's: NO Implicit: YES
Explanation	The EU 2020 strategy discourse shows interrelatedness of its targets: For instance, better educational levels help employability and progress in increasing the employment rate helps to reduce poverty. A greater capacity for research and development as well as innovation across all sectors of the economy, combined with increased resource efficiency will improve competitiveness and foster job creation. Investing in cleaner, low carbon technologies will help our environment, contribute to fighting climate change and create new business and employment opportunities. Meeting these targets should mobilise our collective attention.

	(EUROPE 2020)

Scoping level: The Investment plan for Europe

No	
Yes	Keys: NO O's: NO Implicit: None or very non direct
Explanation	The document is strongly focused on effort to: "continue to mobilise private sector financing in investments crucial for Europe's future job creation, growth and competitiveness with strengthened additionality." Implicit focused on issues which could be connect to RRI could show this formulation of one priorities: „The EFSI will continue to contribute to the development of the market for sustainable/green projects, by encouraging in particular the development of a green bond market in Europe and improved coordination of existing efforts." (The Investment plan for Europe)

Work program level H2020 6. Access to Risk Finance 2014-15

No European Commission Decision C (2015)8621 of 4 December 2015	
Yes ***Some awareness***	Keys: NO O's: NO Implicit: YES

Explanation	Under 'Access to Risk Finance', Horizon 2020 will help companies and other types of organisation engaged in research and innovation (R&I) to gain easier access, via financial instruments, to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance. Expected impact: This instrument will help address sub-optimal investment situations stemming from poor prospects within firms or other entities for the creation or commercialisation of products or services of societal importance (in the sense of Horizon 2020's Societal Challenges) or that constitute a public good.

Call level H2020-CBTT-2014

CBTT-1-2014: Capacity-Building in Technology Transfer	
Yes ***No awareness***	Keys: NO O's: NO Implicit: NO
Explanation	Type of action: Coordination and support actions. Expected impact: Sustainable, comprehensive strategy for building capacity in TT across Europe. Higher levels of TT expertise in Europe. Greater commercialisation of scientific knowledge in Europe. Increase in cross-border TT-related investments in Europe.

Call level H2020-BIR-1-2014

BIR-1-2014: Boosting the Investment-Readiness of SMEs and Small Midcaps	
Yes ***No awareness***	Keys: NO O's: NO Implicit: NO
Explanation	Type of action: Coordination and support actions. Expected impact: Better overview of the investment-readiness landscape in Europe. More entrepreneurs better prepared to negotiate effectively with potential investors. More investors with a better understanding of the commercialisation potential of technologies and applications developed through FP7 and Horizon 2020 projects. More investments made into early-stage firms. Greater commercialisation of scientific knowledge in Europe.

Project level

No Project ID: 643619 Boosting Investment Readiness of SMEs and Small Midcaps - InvestHorizon	
Yes	Keys: NO O's: NO Implicit: NO

Explanation	InvestHorizon was a programme designed to increase investments made in Innovative European SMEs through Investment Readiness development and Investor sensitization. Target groups included: • All SMEs from Proof-of-concept till Mid-cap companies • Equity and Private Investors • Intermediaries • Policy-Makers Project included 39 online courses within fields: • Bussiness & Management • Finance & Equity Investment • Industry & Technology • Early – Stage courses • Growth-stage courses None of the topics of courses was related to RRI or O's.

Proposal Template level – Nonidentified for years 2014 - 2015

No	
Yes	Keys: - O's: - Implicit: -
Explanation	Proposal template level wasn't identified in European databased:

	http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/master_calls.html

Evaluation level – Interim Evaluation of Horizon 2020's Financial Instruments

No	
Yes	Keys: YES O's: YES Implicit:
Explanation	As part of Horizon 2020's 'Access to Risk Finance' pillar, InnovFin can also be expected to contribute to achieving other Horizon 2020 objectives, namely: □ Excellent Science: reinforce and extend the EU's science base and consolidate the European Research Area; □ Industrial Leadership: accelerate development of technologies and innovations and help innovative European SMEs to grow into world-leading companies; □ Societal Challenges: stimulate research and innovation efforts in areas such as health, food security, secure and clean energy, etc.; □ Spread excellence and widen participation by addressing disparities across Europe in R&I performance; and □ Strengthen social and political support for science and technology. Moreover, the programme should at least be complementary with, and ideally [1]contribute to the European Commission's 10 political priorities. (Interim Evaluation of Horizon 2020's Financial Instruments, page 28)

Innovation in SMEs

Work program level H2020 Innovation in SMEs 2014-15

No European Commission Decision C (2015)8621 of 4 December 2015	
Yes ***Some awareness***	Keys: NO O's: YES Implicit: YES
Explanation	Horizon 2020 'innovation in SMEs' is a bridge between the core of the framework programme, the provision of support to research, development and innovation projects, and the creation of a favourable ecosystem for SME innovation and growth. It includes: • The SME instrument (for which budget is allocated in the Societal Challenges and Leadership in Enabling and Industrial Technologies) • The support to the EUREKA/Eurostars initiative (transnational collaborative projects of research-intensive SMEs) • Various actions that aim at developing and providing better innovation support services to SMEs • Analysis of current SME innovation activities and their future development The introductory parts of this document exhibit a limited awareness for RRI. The arguments they draw on are almost solely economic: SMEs with innovative potential should be supported, as they help to increase the economic growth and competitiveness.

	The document mentions that a novelty in Horizon 2020 is the Open Research Data Pilot (although certain work programme parts and areas have been explicitly identified as participating in the Pilot, individual actions can choose to participate on voluntary basis).

Call level Horizon 2020 dedicated SME Instrument

CALL LEVEL (2014 – 2015) a) Horizon 2020 dedicated SME Instrument	
Yes ***some awareness***	Keys: YES O's: YES Implicit: YES
Explanation	In 2014 and 2015 SMEs were invited to submit proposals under the SME instrument within all Societal Challenges and Leadership in Enabling and Industrial Technologies areas under the common call: Parts and topics (relevant from the RRI perspective) (p.5-6): 5. Leadership in enabling and industrial technologies 5i. Information and Communication Technologies • *Open Disruptive Innovation Scheme* (open innovations – 3 O's)

	5ii. Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing • *SME boosting biotechnology-based industrial processes driving competitiveness and sustainability* 9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy • Resource-efficient eco-innovative food production and processing • Supporting SMEs efforts for the development - deployment and market replication of innovative solutions for blue growth 10. Energy Challenge • Stimulating the innovation potential of SMEs for a low carbon and efficient energy system 11. Smart, green and integrated transport • Small business innovation research for Transport 12. Climate action, environment, resource efficiency and raw materials • Boosting the potential of small businesses for eco-innovation and a sustainable supply of raw materials 13. Europe in a changing world – inclusive, innovative and reflective Societies • Innovative mobile e-government applications by SMEs • SME business model innovation 14. Secure societies – Protecting freedom and security of Europe and its citizens

	• Protection of urban soft targets and urban critical infrastructures *Several call topics explicitly referred to responsible approach. In almost of all of them, responsibility took a form of ecological concerns.* The SME instrument consists of three separate phases and a coaching and mentoring service for beneficiaries. None of these phases seems to stimulate in SMEs responsible approach (in terms of its definitions by the EC). The activities and approaches that are supported by the programme consist in testing of economic or technological viability, risk assessment, market study, Intellectual Property management, innovation strategy development, partner search, prototyping or piloting. A small exception is a possibility of "user involvement" (= engagement). The aim is to increase profitability of the enterprise through innovation and the return in investment. Among the main expected impacts, also sustainability is listed ("market uptake and distribution of innovations tackling the specific challenges in a sustainable way"), but it is not linked to the SME instrument in a systematic way.

Call level Enhancing SME innovation capacity by providing better innovation support H2020

Enhancing SME innovation capacity by providing better innovation support H2020	
Yes	Keys: NO O's: NO

No awareness	Implicit: NO
Explanation	*While following of the 3 O's principles in the field of innovations in SMEs belong to central aims of the call and its topics, there are almost no mentions concerning the 6 keys of RRI.* The call and its topics strongly reflect the concept of "open innovations", as they emphasise the need to open up the innovation process to various actors in order to increase the circulation of knowledge and its transformation into products and services. They support, for example, collaboration among "public enterprises, SME intermediaries, direct and indirect customers, end-users, suppliers and enterprises with complementary skills" (p. 11), online collaboration, peer learning or dissemination of skills and expertise among SMEs. One of the schemes is focused on spin-in of technology. It supports SMEs to establish contacts between knowledge institutions and SMEs in order to make use of their technology and knowledge in SMEs´ practice. There is also a strong focus on international dimension of the above mentioned activities, transnational transfer of knowledge and technologies – openness to the world (especially at the European level). Also some elements of "open access" principle seem to be involved in this call. Under the topics "European Intellectual Property Rights Helpdesk" or "Increasing the quality of IP advisory services to SMEs" support is given to activities that aim to improve knowledge and capacity of SMEs to access, diffuse, use and manage IPR more efficiently. (The 3 Os, p.12 – Open Innovations Principles: "We should profit

	from others' use of our IP, and we should buy others' IP whenever it advances our own business model.") Apart from the 6 keys, there are several marginal mentions of ecological concerns (for example, in description of the topic Cluster facilitated projects for new industrial value chains, p. 11: "SMEs need help to generate, take up and better capitalise on all forms of knowledge, creativity, craftsmanship and innovation – including for the application of existing cross-cutting or emerging technologies, ICT, eco-innovative and resource-efficient solutions, new business models, service innovation and design).

Project level

No Project ID: 674865 EEN Northern Netherlands: enhancing the innovation capacity of SME's	
Yes	Keys: NO O's: NO Implicit: NO
Explanation	This specific Horizon 2020 activity within the EEN services therefore offered mentoring and coaching services to beneficiaries with the objective to increase and accelerate economic returns from innovation. The EEN Northern NL consortium addressed this specific challenge with two service packages: 1. Key account management services for H2020

	SME instrument beneficiaries: By offering key account management services to beneficiaries of the H2020 SME instrument it was possible to support these SME's in their innovation process and enhance their innovation capacity. 2. Services to enhance the innovation management capacities of SMEs: particularly promising SMEs were supported by the enhancement of their innovation management capacities. This was done by carry out a diagnostic audit of selected SMEs that are capable of growth and successful internationalization in order to develop and implement a tailored action plan to improve the SME's capacity to manage innovation processes.

Proposal Template level SME Instrument 2014 - 2015

No	
Yes	Keys: NO O's: NO Implicit: NO
Explanation	No mention about Keys or O's.

Evaluation level – Evaluation of the SME instrument and the activities under Horizon 2020 Work Programme Innovation in SMEs

No	
Yes	Keys: NO O's: NO Implicit: YES
Explanation	The evaluation is done around four key lines: Effectiveness Efficiency

	Coherence EU Added Value However: "The design of the SME Instrument is therefore fully focused on the close-to-market objectives of Horizon 2020. SME Instrument activities within the Societal Challenges priority are intended to cover the full range of research and innovation activities, including innovation-related activities such as piloting, demonstration, test-beds, and support for public procurement, pre-normative research and standard setting, and market uptake of innovations." (Evaluation of the SME instrument and the activities under Horizon 2020 Work Programme Innovation in SMEs, page 99)

4.2.2. General use of RRI

- ***Is RRI (in any form) traceable as a vision in the program line?***

RRI is not traceable as a clear vision in any of the programme lines.

- ***Is RRI reflected in the challenge to be addressed? (as opposed to looking for a "technology fix" to the challenge)?***

RRI is not reflected in the challenge to be addressed in any of the programme lines.

- ***Is RRI (or any other underlying principle thereof) reflected in the theoretical considerations of the work programme or the calls?]***

No, both programmes are heavily based on mainstream economic theory assumptions.

- ***Is RRI (via keys) present only as a tick-box exercise or is it more substantial? If yes, how?***

RRI is not present as a tick-box exercise or as a more substantial concept.

- ***Is RRI (keys, O's etc.) substantially influencing the way R&I in the program line carried out?***

RRI is not substantially influencing the way R&I in the program lines is carried out.

Keys, O's and other RRI related concepts are rarely used in the documents of the program lines. They are not being addressed specifically in working program documents, calls,

proposals, project descriptions, project evaluations, etc. They are used in policy documents and then in the last step during the overall evaluation of the program.

4.2.3. RRI beyond the keys

- RRI as approach; method or process
- General approach to address a challenge (please explain)
- Research method applied to address a challenge (please explain)
- Process (stakeholder engagement) applied to address a challenge (please explain)
- Other, please specify.
- RRI is explicitly not used in documents but other societal/ethical approaches (different from the keys and the O's) [e.g. explicit reference to ethical challenges or issues; request for stakeholder engagement; Please explain

Answers to the above mentioned points are not applicable as it was described above. There is very little awareness of RRI, keys, and O's.

4.2.4. Theoretical framework of RRI applied in the program line

In the first one, several of the call topics referred specifically to responsibility, and were related mostly to ecology. The call topics included:

- Leadership in enabling and industrial technologies
- Information and Communication Technologies
- Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy
- Energy Challenge
- Smart, green and integrated transport
- Climate action, environment, resource efficiency and raw materials
- Europe in a changing world – inclusive, innovative and reflective Societies
- Secure societies – Protecting freedom and security of Europe and its citizens

The other one did specifically address the Horizon 2020 objectives and stated that it is expected that it will contribute to achieving these:

- Excellent Science: reinforce and extend the EU's science base and consolidate the European Research Area;

- Industrial Leadership: accelerate development of technologies and innovations and help innovative European SMEs to grow into world-leading companies;
- Societal Challenges: stimulate research and innovation efforts in areas such as health, food security, secure and clean energy, etc.;
- Spread excellence and widen participation by addressing disparities across Europe in R&I performance; and
- Strengthen social and political support for science and technology. Moreover, the programme should at least be complementary with, and ideally contribute to the European Commission's 10 political priorities.

(Interim Evaluation of Horizon 2020's Financial Instruments, page 28)

Other documents and projects did contain only explicit references to RRI, keys, and O's and did not address these specifically.

4.2.5. Overall assessment of RRI in the program line (based on desktop research):

Access to Risk Funding:

Category	Value	Description
B	Some awareness	• RRI as concept is (implicitly or explicitly) present in some documents; • Some RRI keys and O's are used and referred to in any document; • There is some process of better social embeddedness through governance or engagement
C	Limited awareness	• Responsibility or ethical awareness is referred to in any document • Any RRI key is mentioned; • There is reference to the need for social embeddedness of the research at hand.

Innovation in SMEs:

Category	Value	Description
B	Some awareness	• RRI as concept is(implicitly or explicitly) present in some documents; • Some RRI keys and O's are used and referred to in any document; • There is some process of better social embeddedness through governance or engagement
C	Limited awareness	• Responsibility or ethical awareness is referred to in any document • Any RRI key is mentioned; • There is reference to the need for social embeddedness of the research at hand.

4.3. Interview findings

4.3.1. Shared understanding of RRI

- ***What is the level of awareness among the stakeholder interviewed? (e.g. are they aware of the concept; keys; other related ideas; what do they think of the relationship of technology and society; technology and ethics; science and ethics; is their awareness of ethics/responsibility beyond RE/RI)***

  The level of awareness among interviewed stakeholders about the H2020 differs according to the institution/position. It is generally very low. The respondents seem not to comprehend these concepts and they do not consider them very important. However, the issue of ethics is very sensitive for all types of stakeholders from the academy up to business:

  - Ethical issues are connected to cyber security and privacy protection in ICT. (Inter., VK4)
  - They organize workshops to obtain feedback on company plans and activities. (Inter., VK4)
  - Open discussions with feedback in different groups and final directed brainstorming.

- Companies, institutions, and public are not engaged in activities that would reflect the issue of RRI. (Inter., VK4)

- ***How are the keys understood (if at all) by interviewees? Is there a prioritization among the keys?***

  In general, the six keys are not very well-known among the respondents. They seem to use a completely different discourse when speaking about their activities. Thus, there is no need of prioritization among the keys in general.

  - They do not know the societal and ethical challenges. The support of SMEs and innovation is not touching the RRI keys. Challenge is global competitiveness of SMEs. They are trying to share the knowledge from abroad and develop the predictive model of SMEs performance. (Inter., VK3)
  - Gender equality is part of everyone's life. Naturally, there are different roles in society and family. The question of what is equality still remains relevant. Equality means to provide to everybody the same possibility – for example to gain education or the same job. For SMEs it is the same starting positions and support. (Inter., VK3)

- ***What aspect of RRI do they find the most important (Governance; Engagement; Communication & Education; Gender mainstreaming; Open Access, other)?***

  They find *Governance* to be a very important aspect of RRI. However, they do not perceive it clearly as the aspect of *Governance* but they express, in a non-direct way, that they expect some stability in the innovation ecosystem, the existence of clear and long-term rules, which will not change every year.

  Some positive examples from interviews:

  - Open advantage – necessary for growth of SME from former EE, Sharing of knowledge creates new knowledge for the future. (Inter. VK5)
  - Positive influence of H2020 SME Instrument – Seal of Excellence – synergy to national TACR program. For innovation in SMEs the synergy with the strong government support is necessary. (Inter. VK5)
  - Strategy as an enabler - Issue depends on the conditions. Hungary is a small country in the EU and researchers do not need to think about general questions (RRI). People should do their job the best way they can do not think about how to measure somebody else. Setting of the rules should be done from the position of maximal economic performance of the country. The next generation should be much more successful. (Inter. VK3)

- ***How do interviewees operationalize RRI (if at all)? (Do they reflect upon it in their work; do they include some reflection on the process level; Do they also evaluate success through social embeddedness etc.)***

  Operationalization of RRI is not direct and reflected (with the exception of the interview from the field of academia). Some respondents used the concept of CSR (interview from the banking industry), some have educational programmes that cover selected topics, which could be connected to RRI concepts (this includes interviewees form Innovation Centers and Start up fund), but they do it in a non-systematic way.

  Some examples from interviews:

  - Working with Talents - special talent management program, open the global challenges for the young researchers/university students, create the opportunity for TALENTS. (Inter. VK5)
  - Global cooperation – approach the best experts worldwide, the strong idea motivates them to cooperate. (Inter. VK4)
  - Choosing the right topic – the right slot for business and support. Example – Biotechnology x Waste management and in final Circular Economy. (Inter. VK5)
  - Global Marketing - crucial for global success is good prediction of future development for 2 – 3 years. (Inter. VK5)

  Some barriers and obstacles to RRI were mentioned:

  - Lack of self-confidence – very often at SMEs, they do not evaluate the real innovation potential of a new idea, historical context – companies from former Eastern Block are under-evaluated (so good that it cannot be true!) (Inter. VK5)
  - Lack of money – a key barrier for SMEs. (Inter. VK5)
  - There is a lot of support of R&D for TRL1-6, but almost no support for the TRL7-9, necessity of national Seed funds to go from prototype to real product. (Inter. VK5)
  - Time to cross the “Dead valley” - the survival time to cross the dead valley involves so much risk for small companies that they give up innovation. There are also administrative barriers. (Inter. VK5)

  However, there were also some enablers related to H2020 mentioned in the interviews:

  - Sharing research infrastructure - SME do not has resources to create own R&D infrastructure. To be excellent in innovation – necessity to rent/share resources including the knowledge of experts connected to the infrastructure. (Inter. VK5)
  - Risk Financing – not easy to attract investors for time lasting final technology development, about 5 years at biotechnology. In some countries there is no seed financing. (Inter. VK5)

- Consortium – sharing the excellence – be part of an excellent consortium is a great enabler – sharing of knowledge and skills at R&D. (Inter. VK5)

- Go global H2020 – special support for SME instrument – coaching by top experts, this opens the door to be globally competitive. (Inter. VK5)

- Enablers are based on funding and services. It is very effective to provide business experts to companies to make the activities more effective. Sharing of knowledge is a good practice that helps a lot. (Inter. VK5)

- Evangelisation of companies – to open eyes and mind to new impulses – challenges, to be open to the world. Example - use a local crisis to develop a new global business – cooperation with international partners. (Inter. VK4)

- ***How important interviewees consider it to have RRI mainstreamed in R&I in general and in H2020 in specific? Please explain why.***

  Interviewees do not consider it important to have RRI mainstreamed, which is caused mainly by very low awareness and knowledge of the concept of RRI itself. Some examples of perception of RRI within the discussions:

  - One side is the scientific excellence – other side is the business excellence – that is most important for competitiveness. Business excellence – the need for real innovative companies, do the applied / goal oriented R&D for real business. Support tools that are really good for companies - responsibility. (Inter. VK3)

  - Barriers in the innovation processes – cultural barriers, to have excellent universities and institutions is not enough. The goal is not to be excellent in science - how to find shorter ways to prosperity. Risk finance – need for excellent products, services – innovations, SMEs that are able to produce globally competitive results – to be market fit. Not to do scientific/engineering work for "nothing" – without real innovation/product. (Inter. VK3)

4.3.2. Beyond RRI

- ***What is the awareness of the need for a better social embeddedness of R&I and science?***

  The level of awareness among interviewed stakeholders about the need for a better social embeddedness of R&I and science is very low. They stress the necessity to increase the awareness of innovation and more support the activities with high level of technology readiness.

  - Societal challenges – they have/accept common values (Inter. VK4):

    1. Give before you get.

    2. Work as a team.

    3. Be innovative – try new things.

- There are several topics/challenges (Inter. VK6):

  1. Social control and transparency

  2. Higher involvement of SMEs in the innovation environment

  3. Human technology boundary in ethical area

  4. Long term impact and investments

- Digital – ethical problems – level of thinking in consequences - to understand the sustainability, (Inter. VK6)

- Science education - change the entire education system that separates the education along the innovation chain (TRL level) – this should be in synergy and interaction. (Inter. VK6)

- ***What do interviewees think about the further need of social embeddedness? How should it be achieved?]***

  The further need of social embeddedness was mentioned during our stakeholder interviews very rarely. It was sometimes related to the issues of Ethics and Gender.

  - Necessity to keep the discussions regarding the challenges and relevant RRI topic. The problem of climate change and political responsibility could serve as an example – governance has been neglecting it for a long time. Pleasure to decrease the CO2 production – ethical aspects. Book in Slovakia: "Technology and Humanity" To change the view of the future needs global solution of ethical problems – strong voice. (Inter. VK6)

  - Strategies are realized top-down – from political level to executive level, like an innovation agency SIEA, there the RRI is a new issue, agency has to follow the basic rules and guide lines for financing. (Inter. VK6)

4.3.3. Assessment of RRI based on interviews

Category	Value	Description
C	Limited awareness	• Vague awareness of RRI as concept by a few stakeholders; • Any RRI key referred to by some stakeholders;

		• Some ideas of operationalization of RRI present

4.4. Case briefs

Case brief 1: InvestHorizon

Webpage: http://investhorizon.eu/

Duration of the project: From January 12, 2014 to May 31, 2017

Funding amount: EUR 2 319 201,25

Number of institutions involved: 10

There are no references to RRI keys or O's in the documents which are accessible about the project on cordis database website (more than 50 documents). The project was strongly focused on "Open communication" and "Inclusiveness" as both a process and method: "We identify three principles - namely flat-hierarchy, open communication and inclusiveness - that can be found in all of the most innovative actors operating in the innovation space today."

"Opening the Black Box of Europe's Startup Ecosystem" Deliverable Nr.1.4. Report on "Better Practices for Strategies, Indicators, Schemes and Tools fostering Investment Readiness, page 66 – 67"

There is no reference to governance, ethics, gender, science education, public engagement or open access at all. However, *Educate* is a sub-principle of "Open Communication" and it means: "Actors that are seriously engaged in sharing, educating and vocalising the ins-and-outs of the startup world (and the crucial thing is to paying it forward)."

"Opening the Black Box of Europe's Startup Ecosystem" Deliverable Nr.1.4. Report on "Better Practices for Strategies, Indicators, Schemes and Tools fostering Investment Readiness, page 75"

Case brief 2: EEN Northern Netherlands: enhancing the innovation capacity of SME's

Webpage: http://een-north.nl/

Duration of the project: From January 12, 2014 to May 31, 2017

Funding amount: EUR 82 750

Number of institutions involved: 4

There are no references to RRI keys or O's in the documents which are accessible about the project on cordis database website (4 documents).

There is no reference to governance, ethics, gender, science education, public engagement or open access at all.

5. Conclusions

As a goal for innovation we should create an effective innovation ecosystem within Europe, without administrative and other barriers. Innovation barriers could be seen at the allocation of external/ internal resources in the SMEs, when production does not provide enough finance for global ambitions of innovation. Potential of HR and ambitions of SMEs – to be an innovation gazelle! OA – the ability to be open appropriate the conditions and share the experience and access to R&D infrastructure. The role of the government – governance, provide SMEs motivation and risk finance tools. Balance of appropriate money and innovation feedback – impact for society.

Social engagement is extremely important as innovation is for society.

Ethical issue in R&D and responsibility – the discussion started many years ago with bio-research, now it becomes a commonly respected principle in all R&D areas and we can observe strengthening of the rules of research ethics. Dynamics of R&D are also becoming more important.

Gender is a very serious issue depending on the culture and religion of the country. There are limited opportunities for women especially in "Confucius society" and these have to be changed. Policy actions have a limited impact, it is impossible to change the society overnight.

Institutions and programs helping innovation should be the enablers, but we cannot rely on them to provide complex solutions. So far, there has been no system but changes should take place very quickly and reflect the dynamics of society. It is very difficult to reach a consensus. The main issue is the stability of society and the speed of change of the rules reflecting RRI. There are big differences in values of younger and older generations, hence no general rule could be implemented for the whole society.

- ***What are the main challenges for RRI in your program? Why?***

The challenges for RRI in the area of SME's and access to risk finance stem from the inherent character of the business sector, where anything that is not directly and apparently related to the "bottom line" of the company or a project currently at hand is deliberately labelled as unimportant or even against the best interest of the organisation. This rigid mindset of people involved in running companies makes RRI difficult to introduce as a feasible prism for evaluating immediate reality, and future opportunities. Simply put, the processes which determine the dynamics of a business (even those relatively small, agile and innovative) remain relatively unchanged and limit the possibility of introducing new variables into the game.

There is also a somewhat cultural problem with the notions of equality or openness – such values are alien to the community that is all about competition, taking (unfair) advantage and reducing everything to numbers. Certain level of distrust is understandable here, judging the circumstances. However, RRI, as it is conceptualized in the New Horizon is not essentially going against the interests of business, namely the innovative SME's with a need for risk funding. Explaining this, nevertheless, remains one of the greatest challenges of our work in the program.

Last but not least, the perception of RRI suffers from a number of misconceptions in the business community regarding various regulations, quotas, rules for subsidies that are (often mistakenly)

attributed to the European Commission and the EU as a whole. It is very time-consuming and sensitive in terms of argumentation to make things clear before it is at all possible to mover on to the agenda of RRI and its implications for the activities of people involved in SMEs development, risk funding and related areas.

Business leaders naturally tend to „do the right thing“ but that is not nearly as straightforward as it is described in a majority of business ethics literature. Most ethical dilemmas on the strategic level are much more complex and require a change of perspective, accepting change and information as well as a certain level of personal bravery to bring up the topic in the day-to-day running of a company.

- ***Are there already particular solutions your social lab can build on?***

  There are some “real-life” examples of success driven by adopting attitudes consistent with RRI. These include success stories of SMEs which built identified and pursued opportunities found in the potential for improvement in areas such as gender equality, sustainability etc.

  One actual solution directly applicable in our field of interest is the RRI Toolkit (*https://blog.rri-tools.eu/home)* that provides very well developed explanations and argumentation regarding RRI as well as templates for action steps and examples of success stories.

- ***First preliminary story lines***

  - ***What might be possible futures if RRI would be fully integrated in the program line?***

There are several viable directions in which RRI integration can take the SMEs (and the ecosystem of risk finance supporting them) that appear to be actually attractive to them. These directions include:

1. Identification of opportunities for innovative businesses
2. Creating better conditions for people working in the sector, bringing up their productivity
3. Making research outcomes accessible that would serve as a source of competitive advantage

  - ***Are there already good stories and practices of RRI in the respective program line?***

Yes, there are several examples of SMEs and other players in the risk finance ecosystem behaving consistently within the intentions of RRI.

  - ***What would be the elements of the program line to promote RRI?]***

  Since we have identified several examples of RRI principles being applied in the successful development of SMEs business models, products lines and their funding these could serve as a vehicle for conveying the message to the SME community and the risk-finance ecosystem.

Relevant stakeholders

Who are relevant applicants/actors/stakeholders?

Name	Stakeholder Group	Organisation	Country	Awareness for RRI	Gender	Relevance to program line	Interview	Social lab team member	Social lab wider circle
Zuzana Brablikova	Banking Industry	Česká Spořitelna	Czech Republic	low	female	Expert in Risk Finance	Yes	Yes	Yes
Artur Bobovnicky	National Innovation Institution	SIEA	Slovak Republic	High	male	Expert in Innovation	Yes	NO	Yes
Pavel Danihelka	Academy	VŠB-TUO	Czech Republic	High	male	Expert in Risk Assesment	Yes	Yes	Yes

Luboš Dubovský	governance	Ministry of Finance	Czech Republic	Low	male	Expert in Financial Instruments	No	Yes	Yes
Joachim Haumann	expert	FGI	Austria	high	male	Expert in innovation	No	Yes	Yes
Adéla Hradilová	expert	MSIC	Czech Republic	low	female	Expert in innovation	Yes	Yes	Yes
Jachym Judl	Expert / governance	Finnisch Environmental Institut	Finland	high	male	Expert in circular economy	No	Yes	Yes

Vladimir Kebo	expert	VŠB-TUO / TACR	Czech Republic	high	male	Expert in innovation	No	Yes	Yes
Magda Kubicka	Regional Innovation Institution	Łódzka Specjalna Strefa Ekonomiczna	Poland	low	female	Expert in innovation	No	Yes	Yes
Milos Lukacka	Private Investment Fund	Pragecon Capital	Austria	None	male	Expert in Risk Finance	Yes	Yes	Yes
Lukáš Macenauer	Start-up	Virtubio	Czech Republic	low	male	Expert in start up scene	No	Yes	Yes

Lenka Mynářová	Bussiness	Nafigate – Hydal Corporation	Czech Republic	high	female	Expert in circular and innovative economy	Yes	Yes	Yes
Jan Petr Nekovář	Private Investment Fund	UP21	Czech Republic	none	male	Expert in Funding and start up scene	Yes	Yes	Yes
Mate Pecze							Yes	Yes	Yes
Heike Philp	Education, EdTech Innovation	Let's talk online sprl	Germany	none	female	Expert in innovation in education	Yes	Yes	Yes

Idar Ramberg	Consultancy	Nectar learning	Norway	none	male	SME development consultant, Tech innovation in Learning	Yes	Yes	Yes

	High	Low	None	Un-known
Level of knowledge about European research funding		X		
Knowledge about H2020/FP7		X		
Knowledge about the specific program line	X			
Project/Research experience Involvement in EU funded research as project partner Involvement in EU funded research as project manager	Participant	Other		
Impacted by EU funded research (assumed)		X		
Assumed Impact on EU funded research				X
Assumed Knowledge/awareness about RRI		X		
Experience with RRI		X		
Experience with social labs			X	

Timeline for Diagnosis

Month	Task(s)
4	Start of Diagnosis
4	Get to know the program line
5	Identify relevant stakeholders/experts for interviews
6-7	Interviews with experts (in total 15–20)
7-10	Transcribe interviews, analysis
10	Finalizing Report
15	DX.1 due in M15 – ensure you send your reports to WP lead on time

Literature, links, resources

Access to Risk Finance,
https://ec.europa.eu/programmes/horizon2020/en/h2020-section/access-risk-finance

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

Evaluation of the SME instrument and the activities under Horizon 2020 Work Programme Innovation in SMEs, Technopolis, 2017
https://publications.europa.eu/en/publication-detail/-/publication/d4c51dac-beb7-11e7-a7f8-01aa75ed71a1/language-en

Horizon 2020; Work Programme 2014–2015; 6. Access to Risk Finance Revised; European Commission Decision C (2015)8621 of 4 December 2015
http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-ga_en.pdf

Industrial Leadership
https://ec.europa.eu/programmes/horizon2020/en/h2020-section/industrial-leadership

Innovations in SMEs,
https://ec.europa.eu/programmes/horizon2020/en/h2020-section/innovation-smes

Interim Evaluation of H2020, Commission staff working document, Brussels, 2017,
https://ec.europa.eu/research/evaluations/pdf/book_interim_evaluation_horizon_2020.pdf#view=fit&pagemode=none

Interview no: VK3, april 2018, interim document of SL6 team

Interview no: VK4, april, 2018, interim document of SL6 team

Interview no: VK5, may, 2018, interim document of SL6 team

Interview no: VK6, april, 2018, interim document of SL6 team

Investment plan for Europe; Brussels, 2014,
https://ec.europa.eu/commission/sites/beta-political/files/investment_plan_booklet_en.pdf

Opening the Black Box of Europe's Startup Ecosystem, Deliverable Nr.1.4., Report on "Better Practices for Strategies, Indicators, Schemes and Tools fostering Investment Readiness",
https://cordis.europa.eu/project/rcn/194084_en.html#deliverable1

Interim Evaluation of Horizon 2020's Financial Instruments Final Report, The Centre for Strategy & Evaluation Services LLP (CSES), European Commission, July – 2017
https://ec.europa.eu/programmes/horizon2020/en/news/interim-evaluation-horizon-2020s-financial-instruments

RRI Toolkit
https://blog.rri-tools.eu/home

Checklist for proofreading

Element	Issue/Common Mistake(s)	OK
Document file	The document at hand is the latest version including all revisions and additions: no track changes pending, no further comments.	☒
Document file	After proofreading and finalisation: the file is labelled as “final” in some way and has a meaningful file name.	☒
Front Page/Cover	The cover page conforms to the standards of the project (cross-checked with project template).	☒
Front Page/Cover	All authors are listed; their order is agreed upon and correctly displayed.	☒
Front Page/Cover	The author names are correctly spelled.	☒
Front Page/Cover	Institutional affiliations of all authors are visible (name, logo) and correctly spelled.	☒
Front Page/Cover	Contracting entity/grant authority is visible (name, logo, grant-agreement number).	☒
Front Page/Cover	The name and acronym (including small/large caps) of the project are correctly spelled.	☒
Front Page/Cover	The cover does not break over pages.	☒
Table of Contents	There is a table of content, a table of figures, and a list of tables.	☒
Table of Contents	The table of contents is on an uneven page.	☒
Table of Contents	The table of contents, including page numbers and headings, is updated.	☒
Table of Contents	The table of contents comprises all relevant headings and subheadings (max. three levels).	☒
Table of Figures/Tables	The table of figures and the list of tables comprise all figures and tables.	☒
Header/Footer	The header and footer are in accordance with the main text (check: font, size, content, format).	☒

Header/Footer	If there is a front page/cover, there is no header/footer on that first page.	☒
Header/Footer	There are page numbers on every page of the main text and appendices (not on the cover or following blank pages).	☒
Main text	The main text starts at an uneven page.	☒
Main text	Suggestions of the automatic spelling and grammar check are reviewed and considered – if appropriate.	☒
Main text	The final text (after accepting track changes) has been proofread.	☒
Main text	Headings and subheadings use the same style throughout the text, check for example: size, font, bold/italics/underlined, colour, numbering (dot after the final number or not ("1.1." or "1.1")).	☒
Main text	Cross references are updated.	☒
Main text	All tables have meaningful captions and are continuously numbered (check for inconsistencies regarding numbering along chapters/continuous numbering without chapter number).	☒
Main text	Tables have the same formatting (font, font size, line spacing, etc.) – if reasonable.	☒
Main text	Tables do not break across pages – if possible.	☒
Main text	All figures have meaningful captions and are continuously numbered (check for inconsistencies regarding numbering along chapters/continuous numbering without chapter number).	☒
Main text	Figure captions have the same formatting (font, font size, line spacing, etc.) – if reasonable.	☒
Main text	Figures do not break across pages – if possible.	☒
Main text	Every reference has an entry in the reference list.	☒
Main text	Reference check: The name(s) and year of each reference match the reference entry in the reference list.	☒

Main text	The style of referencing within the text is consistent: • Separation of multiple entries: Is there a comma or a semicolon? • Separation of name and year: Is there a comma, a colon, a blank space? • Separation of two authors of the same entry: Is there a comma, a slash or an "and"? • Multiple authors: How is the "et al" formatted (in Italic/standard, is there a full stop behind it, etc.) • Page numbers: Choose between either "p." and number or numbers only. • Page numbers: Is there a comma or colon between the year and the page number?	☒ ☒ ☒ ☒ ☒ ☒
Main text	Abbreviated terms are written out the first time they are used, followed by their abbreviation (in brackets).	☒
Main text	Figures, tables and illustrations have an alternative text (right click → *Format Picture…* → *Alt Text*)	☒
Main text	Tab stops and blank characters are NOT used in order to format the text. Rather, other ways (e.g. invisible tables) are used.	☒
Main text	Please distinguish between hyphen and dash. Never put a hyphen (-) between to empty characters.	☒
Main text	Consistent use of British OR American English (e.g. "s" or "z" as in "organisation"/"organization") – set autocorrect accordingly.	☒
Main text	Consistent gender-neutral language.	☒
Main text	Bullet points are used in the same style throughout the text (e.g. bullets or dashes, size of the items, etc.). Please also check if the indent of the bullet points is the same in all lists.	☒
Reference list	There is a reference list.	☒
Reference list	Every entry in the reference list is mentioned/cited in the text at least once.	☒

Reference list	The reference list is in alphabetical order.	☒
Reference list	All entries in the reference list follow the same citation system/style. Check: • Format of names: Is the first name written out or abbreviated (initials)? • Title: How are title and subtitle separated (colon, full stop)? • Punctuation: Is there a comma, a semicolon, etc. between the names of multiple authors? Is there a full stop after every entry? • Typography: Are titles of books, articles, journals, etc. continuously written in italics or not? • Etc.	☒ ☒ ☒ ☒
List of Sources	Empirical paper: there is a list of sources (list of interviews, list of documents analysed, etc.).	☒
List of Sources	Interviewees are sufficiently anonymised.	☒
Whole document	Use the find-and-replace function of your text processing software to check and correct the following issues: • The project acronym is correct including the uppercase and lowercase characters. • Remove unnecessary blank characters (e.g. two blank characters after a word).	☒ ☒
Whole document	Check the use of dates, times, etc. in terms of style: Is it the same throughout the text (e.g. "November 1st 2016", "01/11/2016", "06:00h", "6:00h", etc.)?	☒
Final	After having checked the above issues, update the Table of Contents, List of Tables and List of Figures again (page numbers could have changed because of the review process).	☒
Final PDF Document	The PDF document conforms to the original document (same number of pages, same size).	☒