CO-CHANGE
CO-create CHANGE in Research Funding and Performing

D6.2 Comparative analysis of the Co-Change Labs: Insights emerging from the application of RRI performance monitoring

Version 1.0

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List of abbreviations

< RRI > < Responsible Research and Innovation >
< KPI > < Key Performance Indicators >
< AIRR > < Anticipation, Inclusion, Reflexivity, and Responsiveness >
< D > < Deliverable >

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Introduction

The aim of WP6 was:

1. To provide evidence of the added value of the implementation of the RRI approach in research performing and research funding organisations through an assessment of the Co-Change Labs;
2. and a comparative analysis of the Co-Change Labs to better understand the institutionalisation of RRI.

This Deliverable (D6.2) is a continuation of the work that has been reported in Deliverable (D6.1). D6.1 concerns the Co-Change's assessment of individual Co-Change Labs in terms of their RRI performance. These Co-Change Labs aim to institutionalise the concept of RRI and are located in a variety of European countries (See Table 1). This D6.2 Deliverable will proceed by comparing the performances of these labs, and by reflecting on the experiences of using RRI monitoring methods. As such, this deliverable puts forth valuable recommendations for practitioners who aim to institutionalise and monitor RRI in their organisation.
D6.2 is structured as follows, Chapter 1 briefly discusses the main work and findings of D6.1, and proceeds in Chapter 2 by presenting additional findings as a result of a reflection tool used by Co-Change Labs. It then briefly compares labs in Chapter 3 in terms of their performance. WP6 then reports insights that emerged from reflections on the use of RRI monitoring (Chapter 4). Lastly, D6.2 will put forth some key recommendations for practitioners in Chapter 5.

Table 1: Co-Change labs of consortium partners in Co-Change

Co-Change Lab acronym	Consortium partner	Type of organisation	Country
NEN	Delft University of Technology	Research Performing Organisation	The Netherlands
VTT lab (incl. RAAS)	Technical Research Centre of Finland (VTT)	Research Performing Organisation	Finland
SHAPELAB	Tecnalia	Research Performing Organisation	Spain
AIT AI Ethics Lab	Austrian Institute of Technology	Research Performing Organisation	Austria
RD	Delft University of Technology	Research Performing Organisation	The Netherlands
RRizing lab	Novi Sad, Faculty of Agriculture, (PFNS)	Research Performing Organisation	Serbia
CTR	Council of Tampere Region (CTR)	Research Funding Organisation	Finland
WWTF	Wiener Wissenschafts Forschungs und Technologiefonds (WWTF)	Research Funding Organisation	Austria

1. Short recapitulation of Deliverable D6.1

D6.1 was dedicated to determining RRI-related Key Performance Indicators (KPIs) for the Co-Change labs. It proceeded by monitoring the performance of these labs over time.

Methodology

The methodology of D6.1 consisted of several steps and drew inspiration from previous RRI-related studies and projects (e.g., PRISMA). First, a literature review was conducted to take stock of the RRI literature, and to include both product-oriented and process-oriented RRI dimensions that feed into the KPI creation. In order to find dimensions that help Co-Change Labs become more 'responsible', we first explored the literature of innovation management and responsible innovation. The focus shifted here to "upstream" and "midstream" phases of innovation in which the social desirability of innovation can still be governed before path-dependencies and ramifications have materialised (Fisher and Mahajan, 2006; Rogers-Hayden and Pidgeon, 2007).

RRI-related aspects were considered relevant when they related to the widely adopted AIRR dimensions (Stilgoe et al., 2013), six RRI keys, and the notion of Corporate Social Responsibility. This review resulted in 47 aspects that were translated to product-oriented and process-oriented KPIs. These have first been tested in an external setting (Yaghmaei et al., 2019). KPIs were formulated in such a way that individuals could agree/disagree with them to a certain extent on a 5-point Likert scale.

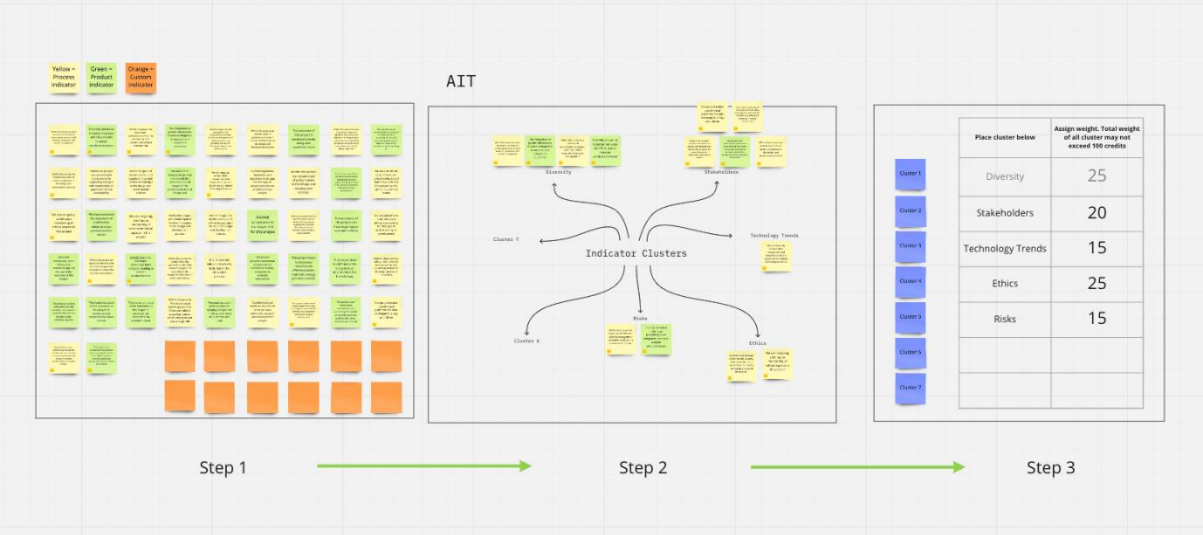

Figure 1: A screenshot of the MIRO board of one of the Co-Change Labs. Step 1 includes selecting and adding KPIs. Step 2 concerns the clustering phase. Step 3 relates to the weighting of clusters.

In the following step, WP6 organised an online workshop via MIRO (a digital collaborative platform) in which Co-Change Lab managers could select and add any KPIs that they deemed relevant to their organisation. To understand the relative importance of KPIs, we urged Co-Change Labs to cluster and weight the indicators.

All clusters should have a cumulative weight of 100 points that they could allocate among their clusters. For instance, a KPI cluster containing the weight of 20 is deemed twice as important as a cluster with the weight of 10.

Co-Change Labs were asked to score the performance of their KPIs at two moments in time, with 4 months in between these two moments. With this short time frame, WP6 aims to understand whether RRI-related institutional changes can be perceived in such a short period (See Chapter 4 for an in-depth discussion on this temporal aspect). Of course, the assessment was not considered the main goal. Rather, it served as a reflection that would stimulate Co-Change Lab managers to reflect on their 'responsibility performance'.

Results

Although Co-Change Labs selected very different KPIs, Labs tended to focus on process-oriented KPIs (N=76[1]). Product-oriented KPIs (N=34) and custom-made KPIs (N=11) were less chosen. The most frequently selected KPIs related to the dimensions of *diversity & inclusion* and *anticipation & reflection*. The specific RRI topics that Labs prioritised related to *engagement* (N=24), *(impact) assessment* (N=21), *diversity & gender equality* (N=17), and *open access & transparency* (N=16; Table 2). The least selected RRI topics were *environmental sustainability* (N=3), *intellectual property & confidentiality* (N=3), and *public & ethical issues* (N=1).

Table 2: Number of times (N.) a process or product-oriented KPI was chosen from a particular category by all Labs.

RRI cluster	RRI topic	N. process KPIs	N. product KPIs	N. Total
Diversity & inclusion	Diversity & Gender Equality	10	7	17
	Engagement	20	4	24
Anticipation & Reflection	Institutional Landscape	5	4	9
	(Impact) Assessment	15	6	21
	Public & Ethical issues	1	0	1
Responsiveness & Adaptive Change	Risk Identification & Mitigation	7	2	9
	Environmental Sustainability	1	2	3
	Social Sustainability	6	0	6
Openness & Transparency	Intellectual Property & Confidentiality	2	1	3
	Open Access & Transparency	9	7	16

[1] 'N' denotes the number of times a KPI or KPI category was selected by Labs.

When considering individual KPIs (See Appendix I), the most selected ones were “we continuously consult other researchers and research projects to signal new and future technological trends” (N=8) and “Societal values (privacy, safety, health, security, data ownership, etc.) are actively included in the design process of this project” (N=8). These two KPIs were followed by “within the project, we value and nourish diversity (in the broadest sense) in both research, innovation, and project management” (N=6); “Within the project, we adopt a learning approach to adapt the research programme according to the viewpoints and ideas of other stakeholders” (N=6); and “Research/innovation activities and results are actively and transparently communicated within the research network (stakeholders) during the project” (N=6).

Concluding remarks

D6.1 assisted Labs in selecting, adding, clustering, weighting, and scoring RRI-related KPIs that they subsequently used to monitor their RRI performance. In what follows, Chapter 2 presents additional findings from a reflection tool (the AIA Framework, explained in Chapter 3) that the Co-Change Labs used. In Chapter 3, we will further compare the Labs in both the KPI performances and reflection tools.

2. Results of reflection tool

Introduction and methodology

In addition to the monitoring of Co-Change Labs through their self-selected KPIs (see D6.1), WP6 additionally monitored the Co-Change Labs in terms of three RRI-aspects– hereafter referred to as the reflection tool. The three aspects are part of the so-called AIA Framework (Yaghmaei, 2018) and relate to their (1) *Awareness* of RRI, (2) *Implementation* of RRI, and (3) *Assessment* of RRI. WP6 respectively developed 3, 8, and 4 KPIs that related to these three RRI-aspects (Table 3). KPIs were designed in such a way, that managers could score these on a 5-point Likert-scale.

In similar vein, we additionally asked Labs (1) whether they raise *awareness* about their RRI activities, (2) whether they use particular tools/frameworks to *implement* RRI, and (3) whether there are any rules, laws, standards, and the like that they use to *assess* their compliance with RRI.

Co-Change Labs were urged to score their performance in terms of the first three AIA aspects on a 5-point Likert-scale, and answer the latter three questions through an online reflection tool (see table 3). This was done twice, once at the start of the Co-Change project (between M10 and M11), and towards the end of the project (between M30 and M32).

Table 3: The AIA framework consisting of RRI awareness, RRI implementation, and RRI assessment.

RRI dimensions	Item	RRI key performance indicators
RRI Awareness	1	Awareness of moral values
	2	Awareness of ethical issues raised by the lab's innovations
	3	Awareness of stakeholder views
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)
	5	Employee engagement level in the lab
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals
	7	(Reflexivity) does the lab embed moral values in its innovations?
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?
	10	Diversity and gender equality
	11	Does the lab learn mechanisms to address public and social values in product development?
RRI Assessment	12	Risk identification and risk management
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?
	14	Technology assessment (TA)
	15	Is the lab monitoring its RRI efforts and the consequences of these?

Results

This section describes the results of the analysis of the reflection tool per Co-Change Lab. If possible, some Co-Change Labs were scored by two persons to enhance the inter-rater reliability (see results per Lab). In those cases a Lab manager and an external expert chosen by the manager filled in the reflection tool. Per Lab, we first describe the AIA Framework results and then delineate the remaining three questions per Lab.

The Royal Netherlands Standardisation Institute (NEN)

NEN has seen a slight increase in its RRI awareness (Figure 2). The average score during Co-Change increased from 3,33 to 4,66. The RRI implementation increased from 3,38 to 3,75, while the scores for RRI assessment remained the same, being 3. The largest improvements seem to be made in the "awareness of moral values" (#1) and "mechanisms to address public and social values in product development" (#11). Although the Lab initially intended to use the Maturity Model as a framework to implement RRI, it changed course by focusing on an RRI KPI analysis tool that complements other RRI-related tools such as standards (i.e., CEN/WS 105, ISO26000, and ISO31000[2]) and an informal stage-gate model. Stage-gating refers to the deliberate choice of Labs – in this case NEN – to accept/refuse opportunities for innovation. NEN increasingly refuses to standardise innovations if they are deemed unethical. NEN also developed and adopted an AI-driven Stakeholder Analysis Tool and a safety-by-design protocol.

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	3	5
	2	Awareness of ethical issues raised by the lab's innovations	3	4
	3	Awareness of stakeholder views	4	5
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	5	4
	5	Employee engagement level in the lab	5	4
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	4	4
	7	(Reflexivity) does the lab embed moral values in its innovations?	3	4
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	2	3
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	3	3
	10	Diversity and gender equality	3	4
	11	Does the lab learn mechanisms to address public and social values in product development?	2	4
RRI Assessment	12	Risk identification and risk management	3	4
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	2	2
	14	Technology assessment (TA)	4	3
	15	Is the lab monitoring its RRI efforts and the consequences of these?	3	3

Figure 2: AIA Framework scores of NEN

VTT Lab (Incl. RAAS)

The scores of VTT Lab indicate that it has struggled to improve its RRI implementation, but that it succeeded in driving the *conditions* to implement RRI, i.e., driving the RRI

[2] CEN/WS 105: Responsibility-by-design – Guidelines to develop long-term strategies (roadmaps) to innovate responsibly. ISO26000: Guidance on social responsibility. ISO31000: Risk management – Guidelines.

awareness and RRI assessment (Figure 3). The focus of VTT's Lab has changed since the start, and it has 3 focus areas (1= VTT's internal responsibility work; 2= Autonomous tram case; 3= responsibility in manufacturing industry). The reflection has been filled from VTT's internal responsibility work's perspective (Focus 1).

Their RRI implementation stayed at an average score of 3,63 both before and after Co-Change. The RRI awareness of VTT Lab, however, has increased from an average of 3,33 to 4, while the RRI assessment score has significantly increased from 2,25 to 4,5. The greatest improvement has been made for "monitoring its RRI efforts and the consequences of these" (#15). Other exemplary indicators that have witnessed a substantial improvement are their "transparency about its RRI-relevant choices" (#9), "risk identification and risk management" (#12), "impact assessment" (#13), and "technology assessment (TA)" (#14). These have increased by 2 Likert-points.

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	3	4
	2	Awareness of ethical issues raised by the lab's innovations	3	4
	3	Awareness of stakeholder views	4	4
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	4	4
	5	Employee engagement level in the lab	4	3
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	4	4
	7	(Reflexivity) does the lab embed moral values in its innovations?	3	3
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	3	3
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	2	4
	10	Diversity and gender equality	5	4
	11	Does the lab learn mechanisms to address public and social values in product development?	4	4
RRI Assessment	12	Risk identification and risk management	2	4
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	3	5
	14	Technology assessment (TA)	2	4
	15	Is the lab monitoring its RRI efforts and the consequences of these?	2	5

Figure 3: AIA Framework scores of VTT Lab

Tecnalia (SHAPELAB)

The scores of SHAPELAB were given by three individuals prior to the start of Co-Change and were filled in by one Lab manager after the project (Figure 4). The scores indicate that minor improvements were made. The average score for RRI awareness increased from 2,6 to 3. RRI implementation rose from 2,7 to 3, while the RRI assessment grew from 2,6 to 3. Most improvements seem to be made in terms of "diversity and gender equality" (#10) and "awareness of ethical issues raised by the Lab's innovations" (#2).

The Lab indicates that it used ISO 31000 and the Societal Readiness Level Thinking Tool when the project started. Yet, throughout the project it adopted a broad variety of tools like the WEP United Nations tool for gender equality in firms, the COMPASS Self-Check Tool, the Gender Institutional Transformation, the SDG Impact: Assessment Tool, ISO26000, and the EDGE Tool.

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	2,7	3
	2	Awareness of ethical issues raised by the lab's innovations	2,3	3
	3	Awareness of stakeholder views	2,7	3
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	2,7	2
	5	Employee engagement level in the lab	3,3	3
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	3,0	3
	7	(Reflexivity) does the lab embed moral values in its innovations?	2,7	2
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	2,3	2
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	2,3	3
	10	Diversity and gender equality	3,0	4
	11	Does the lab learn mechanisms to address public and social values in product development?	3,0	3
RRI Assessment	12	Risk identification and risk management	2,7	3
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	2,7	3
	14	Technology assessment (TA)	2,7	2
	15	Is the lab monitoring its RRI efforts and the consequences of these?	2,3	2

Figure 4: AIA Framework scores of SHAPELAB

Austrian Institute of Technology (AIT AI Ethics Lab)

The scores of AIT AI Ethics Lab were given by two individuals prior to, and after, the start of Co-Change (Figure 5). AIT AI Ethics Lab has undergone great improvements in all three AIA dimensions. Its RRI awareness has increased at average from 2,3 to 2,8. The RRI implementation score rose from 2,1 to 3,1, while its RRI assessment scores moved from 1,8 to 2,5. More specifically, the Lab has witnessed great improvements in terms of their anticipatory capacity (#8) and their "transparency about RRI-relevant choices" (#9). It has also made improvements in terms of "Technology Assessment (TA)" (#14) and "monitoring its RRI efforts and the consequences of these" (#15).

The Lab initially used the Stage-gate model, ISO9001[3], and an internal code of conduct. Both the Lab manager and the expert expressed increased interest to WP6 for using other RRI-related tools in the future.

[3] ISO9001: Quality management systems - Requirements

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	3,0	3,0
	2	Awareness of ethical issues raised by the lab's innovations	2,0	3,0
	3	Awareness of stakeholder views	2,0	2,5
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	2,0	3,0
	5	Employee engagement level in the lab	2,0	3,0
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	2,0	3,0
	7	(Reflexivity) does the lab embed moral values in its innovations?	2,0	3,0
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	1,0	3,5
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	1,5	3,0
	10	Diversity and gender equality	3,0	3,0
	11	Does the lab learn mechanisms to address public and social values in product development?	3,0	3,0
RRI Assessment	12	Risk identification and risk management	3,0	2,5
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	2,0	2,5
	14	Technology assessment (TA)	1,0	2,5
	15	Is the lab monitoring its RRI efforts and the consequences of these?	1,0	2,5

Figure 5: AIA Framework scores of AIT AI Ethics Lab

Convergence Alliance: Resilient Delta (RD)

RD is distinctive from other Labs in the sense that it joined the Co-Change project nearly 2 years after the start of the project. As such, WP6 did not track the changes of this Lab over time as the timeframe was assumed to be too short. WP6 did urge the Lab to evaluate themselves by means of the AIA Framework when they joined the project (Figure 6). This allows us to estimate their current performance. The scores suggest that RD struggles to assess and implement RRI with an average score of 1,5 for RRI assessment and 1,9 for RRI implementation. However, with a score of 2,3, it scores better in terms of RRI awareness. Especially its anticipatory (#8, #13 & #14), responsive (#6), and equality (#10) capacities seem challenging considering the score of 1. The Lab's RRI-related strengths relate to their "awareness of moral values" (#1), "stakeholder engagement" (#4), and "employee engagement level in the lab" (#5).
The Lab has indicated interest in using the PRO-Ethics Framework. This is a stakeholder engagement guideline currently in development in the PRO-Ethics H2020 project.

RRI dimensions	Item	RRI key performance indicators	Score
RRI Awareness	1	Awareness of moral values	3
	2	Awareness of ethical issues raised by the lab's innovations	2
	3	Awareness of stakeholder views	2
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	3
	5	Employee engagement level in the lab	3
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	1
	7	(Reflexivity) does the lab embed moral values in its innovations?	2
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	1
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	2
	10	Diversity and gender equality	1
	11	Does the lab learn mechanisms to address public and social values in product development?	2
RRI Assessment	12	Risk identification and risk management	2
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	1
	14	Technology assessment (TA)	1
	15	Is the lab monitoring its RRI efforts and the consequences of these?	2

Figure 6: AIA Framework scores of RD

Novi Sad, Faculty of Agriculture, "PFNS" (RRizing Lab)

The scores of RRizing Lab were given by four individuals prior to, and after, the start of Co-Change (Figure 7). The Lab has made considerable improvements in terms of RRI awareness (2,4 to 3,3) and RRI implementation (2,4 to 3,5), but made a minor decline in terms of RRI assessment (2,2 to 1,9). The most substantial improvement was made in terms of Responsiveness (#6), Stakeholder engagement (#4), and "mechanisms to address public and social values in product development" (#11). RRizing Lab indicated that prior to the project they used the ORION open science self-assessment tool, COMPASS Self-Check Tool, Gender-NET IGAR Tool, and Gender Equality Diagnostic Tool. Despite the many tools, some Lab managers indicated that they had little experience with RRI. By the end of the Co-Change project, RRizing Lab did not adopt any new tools but showed an increased interest in new tools that they may use in the future.

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	2,7	3,8
	2	Awareness of ethical issues raised by the lab's innovations	2,5	3,0
	3	Awareness of stakeholder views	2,2	3,3
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	2,2	4,0
	5	Employee engagement level in the lab	2,3	4,0
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	2,2	4,8
	7	(Reflexivity) does the lab embed moral values in its innovations?	2,5	4,0
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	2,7	3,5
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	2,7	3,0
	10	Diversity and gender equality	2,7	4,5
	11	Does the lab learn mechanisms to address public and social values in product development?	2,3	4,0
RRI Assessment	12	Risk identification and risk management	2,2	3,0
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	2,5	1,8
	14	Technology assessment (TA)	1,7	1,3
	15	Is the lab monitoring its RRI efforts and the consequences of these?	2,3	1,5

Figure 7: AIA Framework scores of RRizing Lab

Council of Tampere Region (CTR)

The Lab manager of CTR filled in the scores of the reflection tool (Figure 8). It suggests that the Lab made improvements in all three AIA dimensions – especially in terms of RRI assessment. CTR was already performing relatively well in terms of RRI awareness. The RRI awareness score increased from 4,3 to 4,7. The RRI implementation rose from 3,0 to 3,3, and the RRI assessment improved from 1,8 to 3,0. The Lab especially improved in relation to its "employee engagement level in the lab" (#5), "capacity to align to societal goals" (#6), and its "risk identification and risk management" (#12). The Lab indicated a lot of interest in RRI-related tools prior to the start of the project, but did not adopt any particular approach during Co-Change.

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	3	4
	2	Awareness of ethical issues raised by the lab's innovations	5	5
	3	Awareness of stakeholder views	5	5
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	4	4
	5	Employee engagement level in the lab	2	4
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	2	4
	7	(Reflexivity) does the lab embed moral values in its innovations?	4	4
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	5	5
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	3	3
	10	Diversity and gender equality	2	2
	11	Does the lab learn mechanisms to address public and social values in product development?	2	2
RRI Assessment	12	Risk identification and risk management	1	3
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	2	3
	14	Technology assessment (TA)	2	3
	15	Is the lab monitoring its RRI efforts and the consequences of these?	2	3

Figure 8: AIA Framework scores of CTR

Wiener Wissenschafts Forschungs und Technologiefonds (WWTF)

One Lab manager of WWTF filled in the reflection tool for their Lab. Please note that two scores are missing for the after evaluation as the Lab manager was unable to score these indicators. WWTF has witnessed minor improvements for its average scores on RRI implementation (3,5 to 3,7) and RRI Assessment (3,3 to 3,5), while it slightly decreased its average performance for its RRI awareness (4,0 to 3,5). The greatest improvements were made for its "stakeholder engagement" (#4) while its performance decreased most for its "awareness of ethical issues raised by the lab's innovations" (#2) and its anticipatory performance (#8).
The Lab indicated that during the project it stopped using the GENDER-NET IGAR Tool and Gender Equality Diagnostic Tool, while it still uses the OECD Toolkit for Mainstreaming & Implementing Gender Equality.

RRI dimensions	Item	RRI key performance indicators	Score before	Score after
RRI Awareness	1	Awareness of moral values	4	N/A
	2	Awareness of ethical issues raised by the lab's innovations	5	3
	3	Awareness of stakeholder views	3	4
RRI Implementation	4	Stakeholder engagement (inclusion) - external stakeholders and third party networks (e.g. CSOs)	2	4
	5	Employee engagement level in the lab	4	5
	6	(Responsiveness) does the lab respond to (new) societal demands and developments? - Capacity to align to societal goals	3	3
	7	(Reflexivity) does the lab embed moral values in its innovations?	4	4
	8	(Anticipation) does the lab (actively) anticipate social effects of its innovations?	4	2
	9	Transparency and accountability about RRI-relevant choices: is the lab transparent about it RRI-relevant choices?	3	3
	10	Diversity and gender equality	5	5
	11	Does the lab learn mechanisms to address public and social values in product development?	3	N/A
RRI Assessment	12	Risk identification and risk management	3	2
	13	(Impact assessment) does the lab assess the environmental, social, governmental, ethical, and legal impacts of its innovations?	4	4
	14	Technology assessment (TA)	4	5
	15	Is the lab monitoring its RRI efforts and the consequences of these?	2	3

Figure 9: AIA Framework scores of WWTF

3. Comparing Co-Change Labs: KPIs and the reflection tool

This chapter briefly compares the Labs in terms of their self-selected KPIs (see also D6.1) and their reflection tool scores (Chapter 2). In both comparisons, first a general comparison is made between the Labs, followed by a comparison of Research Funding Organisations (RFOs) and Research Performing Organisations (RPOs).

Comparing self-selected KPI scores

As discussed, all Labs selected, clustered, weighted, and scored RRI-related KPIs (see also D6.1). These KPIs related to four distinct categories being *anticipation & reflexivity*, *diversity & inclusion*, *responsiveness & adaptive change*, and *openness & transparency* (See Table 2). Verlami et al. (2023) have collected and compared the KPI scores of the Labs. Within each category, this was done by multiplying the KPI performances with their weight (i.e. their importance). Subsequently, the average score of these weighted performances were taken as a Lab's categorical performance. In what follows, this section compares the categorical performances of the Labs. Occasionally, a Lab may have an N.A. score (See Figure 10, 11, 12, and 13) if the respective Lab did not choose any KPIs that fall within the category.

First, Labs generally performed the same in terms of anticipation & reflexivity (Figure 10). RFOs seem to have performed slightly worse. In terms of diversity & inclusion (Figure 11), we witness mixed results. Although this category was deemed most important to most Labs, we report that RPOs have, on average, only slightly improved while RFOs have decreased in terms of their KPI scores. When considering the category of responsiveness & adaptive change (Figure 12), an inverted result is found. RPOs perform slightly worse while RFOs have constant scores. This category was deemed least important by the Labs. Lastly, Labs already considered themselves relatively open & transparent (Figure 13), but saw minor changes in their performance – RPOs operated slightly better, while RFOs functioned slight worse.

Perhaps most striking is that these KPIs contradict the stories of Lab managers in which they explain that they have institutionalised various RRI-related changes. A possible explanation might be the short time period of these self-selected KPIs, i.e., 4 months. A more elaborate reflection of this can be found in Chapter 4.

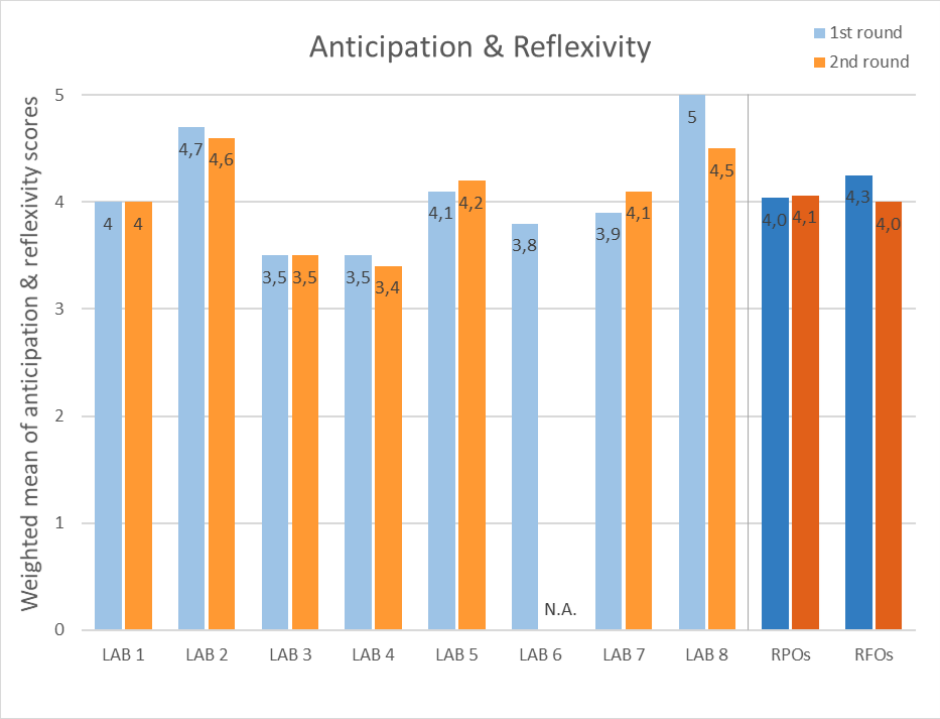

Figure 10: Weighted mean scores of self-selected KPIs per Lab in the category of Anticipation & Reflexivity

Figure 11: Weighted mean scores of self-selected KPIs per Lab in the category of Diversity & Inclusion

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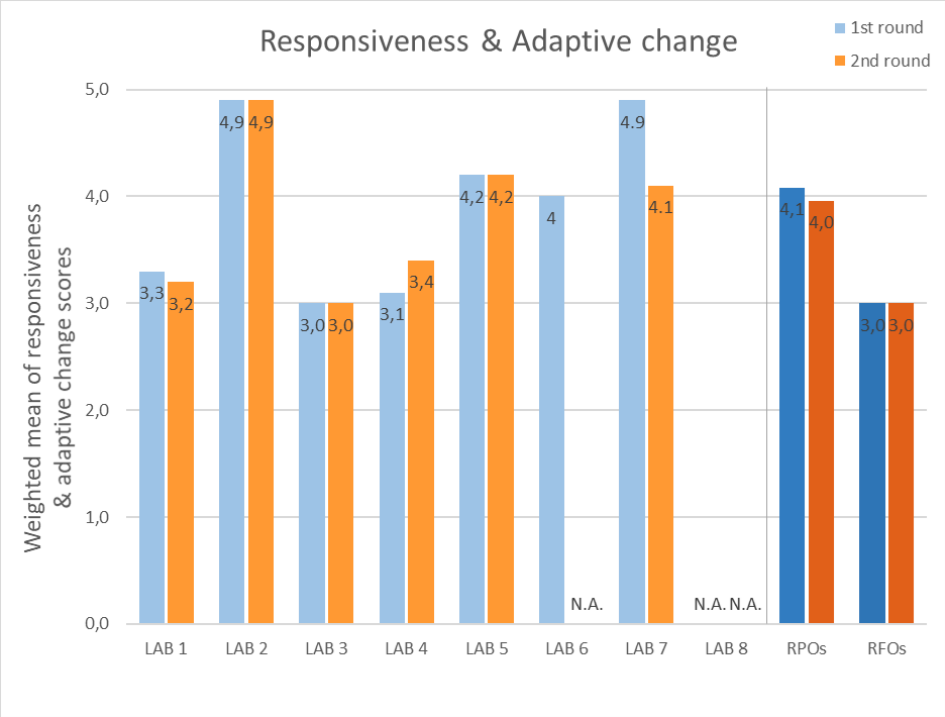

Figure 12: Weighted mean scores of self-selected KPIs per lab in the category of Responsiveness & Adaptive Change

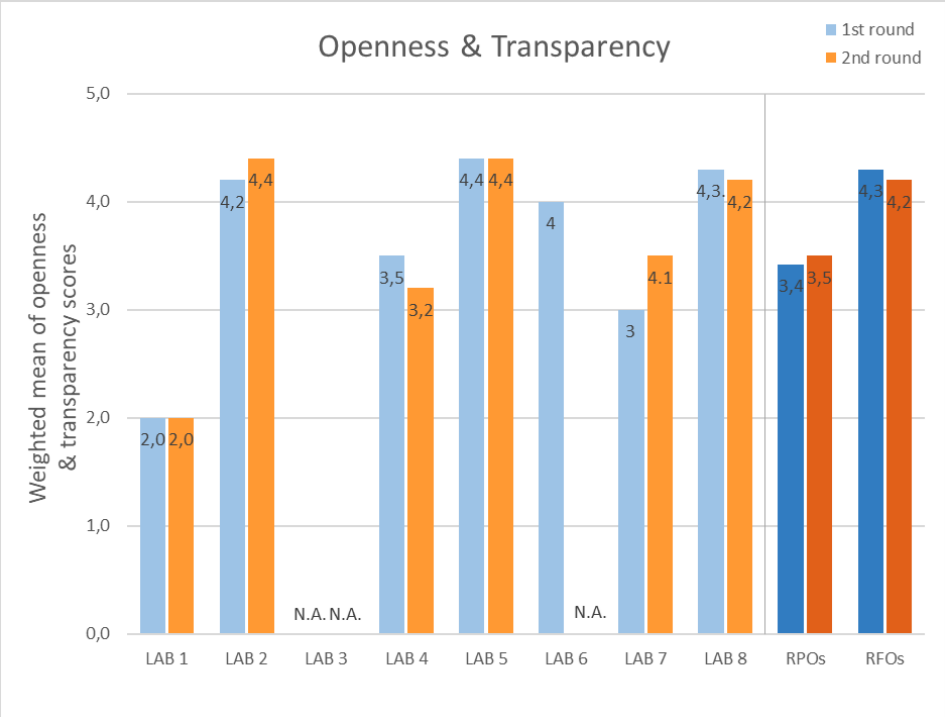

Figure 13: Weighted mean scores of self-selected KPIs per Lab in the category of Openness & Transparency

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Comparing reflection tool scores

In what follows, we compare the average scores of the three AIA dimensions – the RRI awareness, the RRI implementation, and the RRI assessment. As explained in Chapter 2, these three dimensions consist of various sub-indicators that have been scored by preferably multiple individuals (e.g., the Lab manager, external experts, etc.) of which likewise the average score has been used (Table 4). Labs have been evaluated before and at the end of the Co-Change project. By extension, this gives WP6 an estimation of how the Labs' performances have changed over time. Similar to the KPIs discussed earlier (see D6.1), this reflection tool was also a self-assessment. However, the KPIs of the reflection tool were selected by WP6 as opposed to the Labs. An in-depth reflection on both monitoring methods and results can be found in Chapter 4.

When considering the average score, it can be noticed that most Labs have experienced an increased RRI-related performance – in contrast to what the D6.1 KPI's suggest. The average *RRI awareness* has increased from 3.0 to 3.7. The average *RRI Implementation* across Labs has rose from 2,8 to 3,4, and the *RRI assessment* improved from 2,4 to 3,1 (on a 5-point Likert-scale). This suggests that Co-Change, as a project, had the greatest effect on the awareness and assessment of RRI in Labs.

When specifically scrutinising the most changing Labs, WP6 finds that NEN has increased its RRI awareness the most (by 1,4 point); RRizing Lab increased its RRI implementation the most (by 1,1 point); and VTT Lab increased its RRI assessment the most (by 2,2 points).

Table 4: The AIA framework scores per Lab as a result of the reflection tool

	RRI Awareness		RRI Implementation		RRI Assessment	
	Before	After	Before	After	Before	After
NEN	3,3	4,7	3,4	3,8	3,0	3,0
RAAS	3,3	4,0	3,6	3,6	2,3	4,5
SHAPELAB	2,6	3,0	2,7	3,0	2,6	3,0
AIT AI Ethics Lab	2,3	2,8	2,1	3,1	1,8	2,5
RD	2,3	N/A	1,9	N/A	1,5	N/A
RRizing Lab	2,4	3,3	2,4	3,5	2,2	1,9
CTR	4,3	4,7	3,0	3,3	1,8	3,0
WWTF	3,5	3,7	3,3	3,5	4,0	3,5
Average score	3,0	3,7	2,8	3,4	2,4	3,1

4. Reflections on monitoring Co-Change Labs

In this Chapter, we reflect on the results and use of both the self-selected KPIs (D6.1) and the reflection tool. The Chapter first reports the results from a collective reflection conducted with the Co-Change Consortium, and subsequently puts forth a brief reflection by WP6 itself.

Collective reflection

During Co-Change Forum 4, Lab representatives were invited to reflect on both the KPIs' use and outcomes. The self-selected KPIs show in some cases a constant or negative trend; the latter suggesting a decrease in the performance of Labs throughout the Co-Change project. Here, the Lab manager of Tecnalia pointed out that the performances across Labs seem relatively homogeneous with few outliers. This gives the impression that all Labs have implemented institutional changes at similar paces, and that the KPIs were understood and applied in comparable ways. Yet, the selection, creation, and scoring of KPIs tended to be done based on the Lab managers' intuition (Verlami et al., 2023).

Although there seems to be a lack of institutionalisation at first, Lab managers argued that there are various aspects that should be considered. Some Labs shared doubts regarding the monitoring timeframe of 4 months that was used for the self-selected KPIs. This was deemed too short to report insightful outcomes. VTT Lab furthermore pointed out that "it is also realistic that sometimes things objectively go in the worse direction, so we are not sugar-coating things. It is difficult to make institutional change". This points to an understanding of the institutionalisation of RRI as a dynamic process with both ups and downs.

On a different note, the scores are showing the *perceived* performances and may not align with the *de facto* performances. Both VTT Lab and RRIzing Lab suggested that the results might also reflect an increased knowledge on RRI-related institutional change, causing Labs to become more critical vis-à-vis their own performance. Because responsibility is a 'soft' concept that is perceived by Lab managers, our KPIs were found difficult to rate.

Lab managers furthermore argued that quantitative measures – such as the KPIs – give a narrow understanding of performance. They suggested that future assessments should include the use of complementary qualitative assessments – such as narratives – to better monitor the RRI performance.

WP6's reflection

WP6 has obtained a variety of insights throughout the Co-Change project regarding the monitoring of RRI. When considering the results of the self-selected KPIs, we understand that 4 months may not have been enough to perceive institutional changes. The reflection tool, however, does indicate changes which correspond with the other results of Co-Change – Labs have institutionalised a broad range of RRI-related changes (See e.g. Storymaps & Report Forum 1). It therefore seems important to take enough time for institutionalising and observing RRI-related changes. In addition, it hints at the value of capturing changes through qualitative forms of analysis.

Indeed, we may have become more critical. We do, however, realise that the reliability and validity of the KPI's deserve more attention. Both collective reflections with internal and external experts on RRI-related KPIs have pointed out several lessons.

While KPIs should not be an end but a means, we recognise the need for more reliable measurements. One way to enhance the reliability, is by using the widely adopted SMART model in formulating KPIs, i.e., Specific, Measurable, Assignable, Realistic, and Time-related. KPIs should not merely align with the strategic goals of an organisations (Stahl et al., 2017), but should also align with the broader values and worldviews of stakeholders. The latter is deemed important because organisations cannot determine what socially desirability means *a priori*, i.e., without inclusive deliberations (Bauer et al., 2021). In practice, this would mean that KPIs should be established and scored in collaboration with both internal and external stakeholders. This would preferably happen with a larger group so that average scores can account for an inter-rater variance.

It may also be important to better highlight the analytical level at which these KPIs relate; KPIs may, for instance, track the performance of individuals, projects, organisations, or even ecosystems. Furthermore, our KPIs have focused on the *process* and *outcomes* of research and innovation. Especially the process-oriented KPIs are deemed important to deal with the so-called Collingridge Dilemma [4](Collingridge, 1980; Genus and Stirling, 2018). This would allow actors to better govern research and innovation up and midstream (Fisher and Mahajan, 2006; Rogers-Hayden and Pidgeon, 2007) before outcomes and ramifications have materialised. However, we urge future efforts to also include the *purpose* of innovation as suggested by Stilgoe et al. (2013). Although the purpose of innovations may not change substantially over time, it is important to monitor how this purpose is established in the first place.

[4] Collingridge Dilemma: The Collingridge dilemma is a methodological quandary in which efforts to influence or control the further development of technology face a double-bind problem:

- An information problem: impacts cannot be easily predicted until the technology is extensively developed and widely used.
- A power problem: control or change is difficult when the technology has become entrenched.

5. Recommendations for practitioners

The work of WP6, as presented in D6.1 and this deliverable, has resulted in a variety of lessons learned. This Chapter puts forth recommendations that follow from these lessons and which are directed to anyone who intends to assess and monitor the RRI-performance of an organisation:

Assessing and monitoring the institutionalisation of RRI in organisations should be a collective task. We find that Labs struggled to develop and select KPIs. Therefore, it appears fruitful for organisations to acquire assistance from both KPI experts and RRI experts/ethicists. Their experience is important for guiding the process of selecting, adding, clustering, and weighting the KPIs. Organisations should also draw from a broader set of stakeholders to (1) understand what indicators are deemed important for an organisation's responsibility in their context, and to (2) score these KPIs in a more reliable and valid manner. A greater and more diverse sample size enhances quality, desirability, and accuracy of KPIs.

Driving and monitoring the institutionalisation of RRI takes time. We find that a timeframe of a few months is inadequate to drive and observe change. Institutional change took several years in the Co-Change project – both in terms of its awareness, implementation, and assessment.

Strive to make KPIs Specific, Measurable, Assignable, Realistic, and Time-related (SMART). A SMART structure helps to translate the 'soft' notion of responsibility and social desirability into more actionable KPIs. Although KPIs should not become a goal by themselves, they should be SMART to enhance the reliability of KPIs. It makes the results less prone to 'gut feelings' and changing levels of reflexivity. A SMART structure will also help judge whether strategic goals are attained or not, and thus directly contributes to the extent to which RRI can be incentivised.

Complement KPI monitoring with qualitative forms of analysis such as narratives. This will provide the story behind the numbers – the KPIs – and therefore provide a better understanding of how, and to what extent, RRI is institutionalised. It is therefore valuable to generate these narratives with multiple stakeholders during a collective reflection.

Lastly, we urge practitioners to **go beyond the assessment and monitoring of RRI**. Indeed, RRI KPIs contribute to an enhanced organisational reflexivity, but these should also align with strategic goals and capabilities of organisations so that it invites a response to insights that emerge from the observations. For instance, organisational incentive structures could guide activities towards more responsible ends – in other words, don't just talk the talk, but walk the talk.

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APPENDIX I - Overview of process and product-oriented KPIs

An overview of the process (yellow) and product (green) KPIs provided to the participants. Note: numbers of KPIs indicate ranking. #01 refers to the most selected and #45 refers to the least selected KPI (Source: Verlami et al. 2023).

Process	Product/Service
DIVERSITY & INCLUSION	
Diversity and Gender equality	
Within the project, we value and nourish diversity (in the broadest sense) in both research, innovation, and project management (KPI #05)	Diversity allows us to better innovate and thus results in better products/services (KPI #10)
Within the project we have equal participation of women and men in both research and project management (KPI #19)	The integration of gender dimensions is actively integrated in research and innovation outcomes (KPI #24)
We have organisational arrangements to progressively eliminate barriers impeding women's advancement to top positions and factors inducing women to drop out of science (KPI #37)	
Engagement	
Within our project we use tools and mechanisms for organizing dialogue with stakeholder on appraisal / ethical acceptability (KPI #18)	The outcome of this project is assessed actively using user experience tools (KPI #45)
Within this project we used a systematic approach (specified how, when and why) from the beginning to include various stakeholder viewpoints on a wide set of values (technical, social, ethical, legal, etc.) (KPI #17)	We organise science communication/education activities aimed at educating citizens and generating awareness of aspects/issues of the innovations we are working on (KPI #15)
Within this project we include input of end users/customers in the design and development process (KPI #09)	
Within this project we include input of possible non-users/indirect stakeholders in the design and development process (KPI #36)	
Within this project we include input of suppliers (materials and/or knowledge) in the design and development process (KPI #35)	
Within this project we include input of funders / investors in the design and development process (KPI #34)	

Within this project we include input of civil society groups / NGOs in the design and development process (KPI #16)	
Within this project we include input of policy makers in the design and development process (KPI #23)	

ANTICIPATION & REFLEXIVTY

Institutional landscape

Current regulation, standards, and legislative landscape for this type of project provides no problems to our project (KPI #33)	For the outcome of this project becoming widely adopted, this project requires lobbying activities in the domain of decision making and policy development (KPI #13)
We have an official code of conduct / ethical review board that safeguards that this project can be carried out without issues (KPI #14)	

(impact) Assessment

We use on-going, continuous monitoring of ethical aspects in this project (KPI #12)	We have assessed the alignment of stakeholder values and our product/service values (KPI #11)
We use on-going, continuous monitoring of socio-economical aspects in this project (KPI #32)	We have done analysis on (or have monitored) the socio-economic impact of the products/services of this project (KPI #31)
We continuously consult other researchers and research projects to signal new and future technological trends (KPI #02)	Societal acceptance is no major risk for this project (KPI #44)
Within our project team we regularly organise group deliberation (employee engagement, coaching trainings, discussions, etc.) on societal/social/public/policy aspects (KPI #08)	The outcomes of this project can have large macro-economic effects (KPI #46)

Public and ethical issues

We document best practices about ethical acceptability for this type of project during its development (KPI #30)	There has, historically, been little public resistance against the use of the outcome of this project (KPI #47)

RESPONSIVENESS & ADAPTIVE CHANGE

Risk identification and mitigation

Within this project we apply risk identification and risk management strategies to adjust the course of our project. (KPI #22)	Initially identified risks have preventively been mitigated, leading to a better product/service (KPI #29)
Within this project we adopt a learning approach to adapt the research programme according to the viewpoints and ideas of other stakeholders. (KPI #04)	

Environmental Sustainability	
Environmental values are actively included in the innovation process (KPI #28)	This project provides substantial environmental benefits to society, compared to available alternatives (KPI #48)
	This project leads to improved resource use efficiency (water, materials, energy, pollution, waste). (KPI #43)
	This project does not influence the ecosystem or environment in a harmful way (KPI #27)
Social Sustainability	
Societal values (privacy, safety, health, security, data ownership, etc.) are actively included in the design process of this project. (KPI #01)	This project provides substantial societal benefits, compared to available alternatives (health, safety, solidarity, equity). (KPI #42)
	The implementation of the outcomes of this project in society are not hampered by issues of trust (KPI #41)
	The implementation of the outcomes of this project in society is not dependent on societal support (KPI #26)
OPENNESS & TRANSPARENCY	
Intellectual property and confidentiality	
Within this project, IP in the form of patent applications (from our side) or acquiring licenses (from others) do not play a large role (KPI #40)	Personal data and privacy issues do not play a major role in this project, once its outcomes are used (KPI 39)
Confidentiality of methods and results is not an issue within this research and development project (KPI #25)	
Open access and transparency	
Our project makes use of virtual platforms for data exchange for use inside the company (e.g., laboratory notebooks, meeting minutes, etc.) (KPI #38)	This project uses institutional mechanisms for promoting the results of our R&D activities publicly after these activities are finished (KPI #21)
Our project makes use of virtual platforms for data exchange (sharing) with clients (KPI #20)	This project uses institutional mechanisms for promoting the results of our R&D activities to involved stakeholder groups after these activities are finished (KPI #07)
Research/innovation activities and results are actively and transparently communicated within the research network (stakeholders) during the project (KPI #03)	

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