Responsible Innovation and Organisational Change

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Konstantina Varlami

Student number: 5163595

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Graduation committee

First Supervisor : Prof.dr.mr.ir. N. Doorn, Section Ethics and Philosophy of Technology EPT
Second Supervisor: Dr. G. van de Kaa, Section Economics of Technology and Innovation ETI
Advisor : Dr. E. Yaghmaei, Section Ethics and Philosophy of Technology EPT
Advisor : Ing. M.J. Wiarda MSc, Section Economics of Technology and Innovation ETI

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Executive summary

Nowadays, research and innovation sectors undergo continuous change through innovations. Innovations consist of numerous environmental, social and financial factors that need to be linked with social and moral values. Towards this direction, the Responsible Innovation (RI) concept has emerged. According to Stilgoe et al. (2013), RI revolves around four dimensions; anticipation, reflexivity, inclusion and responsiveness. Recently scholars have also included the Transparency & Openness dimension as a fifth core dimension of RI (Owen & Pansera, 2019; Fraaije & Flipse, 2020).

Although RI is an extensively researched topic, there is a considerable gap between scholars referring to RI and those capturing RI's institutionalisation in driving organisational change (Genus & Iskandarova, 2018; Yaghmaei, 2018). Challenges for RI's institutionalisation are the inability to involve multiple stakeholders due to financial and resource constraints, information asymmetries and intellectual property issues (Wiarda et al., 2021). Therefore, this research seeks to answer the following question:

"**How effective is the use of Key Performance Indicators for Responsible Innovation in driving organisational change?"**

A threefold analysis of eight case studies was performed via a descriptive longitudinal study to answer this question. This analysis studies eight research (performing or funding) organisations, part of the H2020 Co-Change project, which aims to boost changes in organisational behaviour. Firstly, lab representatives from the studied organisations selected, clustered and weighed the most relevant Key Performance Indicators for their innovation projects in a workshop in January 2021. Secondly, from mid-April 2021 to mid-August 2021, participants were asked to measure their selected KPIs over time to assess performance within their labs regarding RI values and evaluate to what extent KPIs were effective for them. Thirdly, between these two rounds of assessment, exploratory, semi-structured interviews were conducted with lab managers and representatives to ask for clarifications behind their choices.

Anticipation refers to activities towards taking into account any future possible positive or negative outcome of the innovation (Nordmann, 2014; Stilgoe et al., 2013; Taebi, 2017; Stirling, 2010). A common view amongst the studied labs is that anticipation is a highly relevant and desirable aspect in the innovation process that often remains at a theoretical level due to the lack of established, institutionalised activities for innovation processes.

Inclusion concerns the participation and engagement of various stakeholders in the decision-making process (Stilgoe et al., 2013; Backstrand, 2016). The *inclusion* of diverse stakeholders is essential for balancing all interests. However, it is challenging due to conflicting interests and scarcity of resources, resulting in the under-representation of several societal groups, such as end-users.

Reflexivity emphasises the need for decision-makers to be in a position to comprehend their roles and their perspectives' limitations or conflicts in comparison with those of the society (Stilgoe et al., 2013). In this study, it is conceived as the most complex dimension. Being utterly objective and putting personal assumptions, motivations or interests aside is challenging.

Responsiveness is the ability to adjust the research and technological developments to possible outcomes, technological advancements and future generations' needs. It is necessary to point out the importance of receiving feedback from society and being attentive to needs regarding innovation (Stilgoe et al., 2013; Kupper et al., 2015).

Openness refers to open access and transparency in the decision-making process (Fraaije & Flipse, 2020). More specifically, for being successful, research integrity must be present and available to everyone at all stages of innovation (Fraaije & Flipse, 2020; Kupper et al., 2015; Owen & Pansera, 2019). However, although full transparency is desirable, it cannot always be possible due to privacy limitations against competitors.

The main dimensions identified as relevant for the studied labs are diversity, transparency and inclusion of societal values in the design processes of the projects. According to the findings of this research, the labs participating in this study benefit from it in various ways; either by small, incremental changes, as a result of gaining learning experience or by no changes at all. However, even when no changes occur, the use of RI Key Performance Indicators is considered a helpful reflection tool that can eventually result in actual organisational change. There is tension between the goal of having a standardised assessment and the intention of making a change. Raising awareness and making researchers reflect on Responsible Innovation's practices and values through the use of KPIs can eventually become more effective than what can be derived by simply looking at formal assessments, leading to more positive and responsible organisational behaviour. Future research in organisations operating in other industrial sectors, for prolonged periods, with quantitative methods, could be studied and introduced to the KPIs assessment to look for actual changes in organisational performance.

1. Introduction

The fast pace of everyday life and technological development leads to constant change. According to the theory of evolution, the one who survives is neither the strongest nor the smartest, but the one who can best adapt to change. In this climate of incessant change, the research and innovation sectors undergo continuous change through innovations. Every new development, such as any innovation, consists of numerous environmental, social and financial factors that need to be aligned with social and moral values. Moreover, trying to anticipate and mitigate adverse or potentially harmful effects while being transparent and having active communication between everyone involved is required. The recently developed approach of Responsible innovation entails this concept of taking into account all these parameters.

1.1 Responsible innovation: a new epistemology in innovation management

Corporate Social Responsibility (CSR) is a domain that focuses on ensuring a neutral or positive impact on society in business practices (Porter & Kramer, 2006). Responsible Innovation (RI) is a notion that has been discussed increasingly more in the past decade (Burget et al., 2017). RI can be interpreted as the process of aligning research and innovation to society's values and expectations (European Commission, 2014). Therefore, Responsible Innovation and CSR overlap, extending the latter one's concepts to innovation processes (van de Poel et al., 2017).

Regarding Responsible Innovation (RI), there are several frameworks developed, such as the Anticipation, Inclusion, Reflexivity, Responsiveness (AIRR) framework for RI, and the 6 keys of the European Union for RRI/RI, which are Science Education, Open Access, Governance, Ethics, Gender Equality, Public engagement and Governance, developed by Stilgoe et al. and von Schomberg, respectively (Stilgoe et al., 2013; Von Schomberg, 2011). In von Schomberg's framework, these values, guiding innovation, must be known from the beginning of the innovation process and RRI must fit them in specific context regarding the aforementioned six keys. The most widely used framework developed by Stilgoe et al. (2013) focuses on the need for caring for the future through present science and innovation activities (Burget et al., 2017). Looking ahead, a sustainable future is affected by present actions and policies. Therefore, innovations in the early stages of development must consider their impact on future generations and try to deal with concerns around them (Pellizioni, 2004).

The AIRR framework focuses on the value of "caring" for future generations and stakeholders through *anticipatory*, *reflexive*, *inclusive,* and *responsive* activities. The stakeholders in the innovation process, from scientists to engineers and users, are supposed to be mobilised based on care and prevention in

their decision-making (Pellizioni, 2014). Innovators are not supposed to rely only on what they perceive as the most important values, but to take into account all perspectives and give everyone the right to be heard and taken into account. This is critical in all industries since the most affected people are the end-users and their safety. Epigrammatically, the four studied dimensions of RI are anticipation, inclusion, reflexivity and responsiveness. Anticipation concerns how much the developers think ahead and foresee potential impacts on the outcomes of the innovation process. Inclusion makes sure that all stakeholders are actively represented and involved in the process of research and innovation. Reflexivity refers to the actors' ability to comprehend how their assumptions, motivations and limited knowledge affect their decision-making through the innovation process. Finally, responsiveness is about designing innovation in such a way that can easily adapt to future changes (Stilgoe, et al., 2013).

The RI concept emphasises the importance of a philosophy that is characterised by values, knowledge transfer, and adaptive learning. This epistemology revolves around the trilateral relationship between science, innovation, society, their cooperation, responsibilities, and the required changes in them (Pfotenhauer & Juhl, 2017). Towards this direction, changes to the existing organisational norms and practices among the multiple research organisations are required. More specifically, organisations apart from ensuring high quality and technological outcomes also need to design their innovation practices in alignment with a set of requirements to face challenges. They also need to assess their end results in order to provide products or services that are not only valuable but also developed responsibly. Organisations often use Key Performance Indicators to evaluate the success of their specific activities. Thus, they become a useful tool for measuring progress towards their organisational goals (Marr, 2012).

1.2 Knowledge gap, Research question & Research sub-questions

Although there have been several studies studying practices of RI, there is a considerable gap between scholars relating to RI and those referring to the institutionalisation of organisational change (Genus & Iskandarova, 2018). Several studies have established Key Performance Indicators (KPIs) for assessing RRI/RI for organisations, but their effectiveness in driving organisational change has never been captured (Yaghmaei, 2018). This knowledge gap sets forth the following research question:

"**How effective is the use of Key Performance Indicators for Responsible Innovation in driving organisational change?"**

In order to answer this research question, it is important to investigate which product and process dimensions participants find relevant for their organisations with the following sub-question "What RI process and product dimensions are relevant for organisations?''. More specifically, product dimensions focus on the anticipation of outcomes' impact, while process dimensions focus on the whole procedure of innovation from the initial idea to the implementation of its outcomes on the society. Moreover, to assess the reasons behind their choices, the following sub-question arises "Why do organisations opt for these dimensions specifically?". Finally, in order to evaluate the usefulness of the practice, the following sub-question raises "How useful was the use of KPIs in capturing perception of institutional change in the organisations?".

1.3 Contributions of this research

From an academic point of view, answering the aforementioned question can disrupt the existing institutional logic related to responsible innovation. More specifically, changes in organisational practices get boosted by gaining new insight into how RI is perceived in a research organisations' context. Besides, it will also provide valuable and necessary insights for developing policies focusing on fostering the organisational institutionalisation of RI, by identifying which RI dimensions are often neglected or misconceived. Furthermore, it could provide a theoretical basis for developing adequate frameworks to help the involved actors/managers implement the dimensions of responsible innovation throughout innovative projects at an organisational level and in an empiric context. With this study, the literature can gain more insight into how the main current responsible innovation framework of Stilgoe et al. (2013) is perceived in a research organisations' context by people working at it.

More practically, this study is one of the very few that attempt to measure in practice the organisational change regarding responsible innovation practices, as perceived by their change labs' participants in several research organisations. Although there is extensive literature about the importance of implementing responsible innovation, this has been only at a theoretical level yet. Also, it is not well-documented to what extent it is relevant for organisations. Furthermore, the logic of assessing the activities of an organisation via using Key performance Indicators could be a valuable and useful approach for researchers. More specifically, it could provide them with easy tools, such as self-reflection or evaluation forms, to better capture at every moment their strengths and their weaknesses in terms of acting and thinking in a responsible way. Also, by gaining learning experience and getting aware of RI's values, labs can reflect on their work and promote actual changes in terms of Responsible Innovation.

2. Theory

2.1 Definitions of Responsible Research and Innovation (RRI) and Responsible Innovation (RI)

Responsible Innovation and Responsible Research and Innovation are two linked concepts that have arisen in parallel over the last decade and often get mixed up. To begin with, settling their definitions, RRI is defined as "a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on 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, 2011, p.9). Regarding RI it is defined by Stilgoe et al., (2013, p.1570) as: *"*taking care of the future through collective stewardship of science and innovation in the present."

RRI is a policy-driven discourse that has emerged from the European Commission in 2011, whereas RI has emerged mainly from academic roots. Regarding RRI, its main goal is to encourage the design of inclusive research and innovation, focusing on collaboration with society (Kwee et al., 2021). Moreover, although the concept of Responsible Innovation has emerged during the past decade its historical foundations build on discussions and concepts such as anticipatory governance, social innovation (Lubberink et al., 2017), ELSA (ethical, legal and social aspects of technologies) and constructive and real-time technology assessment that have been discussed for many years (Burget et al., 2017).

Having defined these two discourses, they are often used interchangeably, under the status of "umbrella" terms encompassing the responsibilities during the innovation process (Rip & Vos, 2013). The main distinction between the two studied discourses is that RI aims to foster a deep institutional and systemic transformation towards a more anticipatory, inclusive, reflexive, responsive, sustainable and open innovation, while the discourse of RRI seems to be less coherent, more policy-oriented, providing small chances of a systemic transformation in the innovation process (Owen & Pansera, 2019).

Both RI and RRI have been extensively discussed in the last decade, however, their widespread implementation has remained abstract and unrealised ideals. One of the main reasons is that they have predominantly been linked to emerging technologies, while the broad spectrum of other innovations in the corporate sector has been neglected. The intersection of RI with innovation systems

is still in its infancy since there has been little research on systemic responsibility in innovation. Moreover, few studies link RI with organisational studies (Owen & Pansera, 2019; Owen et al., 2021). Organisations experience both constant endogenous (changing routines and institutions) and exogenous changes (changing environment), creating challenges and pressures that need to be tackled. Towards this direction, a useful area of study is organisational institutionalism that focuses on the interrelation of individuals and organisations (Owen et al., 2021). It is crucial to shift external institutional contexts, such as norms and ideologies, especially in times of instability. RI mainly challenges existing approaches and organisational behaviours around research quality and roles of the involved stakeholders and how these are evaluated and reconfigured around innovation systems (Owen et al., 2021).

2.2 RI and Corporate Social Responsibility

The concept of Responsible Innovation takes into consideration the values of society, extending Corporate Social Responsibility's concepts to research and development within innovation processes. RI expands on concepts already used in scientific studies revolving around the responsibility of organisations by building on technology assessment, ethics and philosophy of technology, along with ethical, legal and social aspects of research (ELSA) (Burget et al., 2017). RI encourages companies to anticipate social and moral issues and integrate them into their innovation processes, while also forming their business strategy respectively for them. Simultaneously, Corporate Social Responsibility depends on moral obligation, sustainability and reputation, and requires companies to ''do the right thing'' and act in such a way that ensures society's interest apart from pure financial interests (Kwee et al., 2021).

Moreover, Responsible Innovation seeks solutions to contribute to the problems of society, by using scientific and technological knowledge. Also, it questions their ethical aspects, taking always into consideration the need to be an active part of the current market. Meanwhile, Corporate Social Responsibility's role is to provide a model to organisations in order to manage their strategies aiming to be more profitable. Furthermore, it enables them to predict whether their activities might have a negative or harmful impact on society, addressing the triple bottom line of people, profit and planet (Dreyer et al., 2017). The involved actors and stakeholders in the venture of turning the innovation process into a responsibly developed one, consist of a group of people from diverse backgrounds, ranging from researchers to policymakers and managers. Therefore, implementing RI requires

collaboration to find ethically acceptable and sustainable solutions in all stages of the innovation process (Martinuzzi et al., 2018).

The key differences between RI and social responsibility are the following: RI is multidirectional, which means that all involved stakeholders are considered to be responsible, while in current concepts of social responsibility only the corporate or the studied organisation is the responsible one. Furthermore, RI encloses responsibility at the first stages of innovation by ensuring the anticipation of the impacts of businesses within society. On the other hand, (corporate) social responsibility mostly operates in the final stages of product development aiming to increase financial performance and businesses' reputation (Dreyer et al., 2017).

In the business landscape, there are two main global challenges, which are the constantly accelerating race to innovate for maintaining competitive advantage and the need for enhancing and maintaining public trust towards the business (Herrera, 2015). Towards this direction, Responsible Innovation shifts CSR practices from being just general marginal activities to being used into core strategic decision processes. Thus, it incorporates the concept of responsibility and social values into the DNA of corporations (Martinuzzi et al., 2018). When this incorporation is successfully done businesses are able to foster public trust towards them and enhance their legitimacy, since they anticipate and reflect on potential problems before they become pressing or dangerous for society, and by leveraging the diverse multi-stakeholder network towards developing solutions to marvellous societal challenges (Martinuzzi et al., 2018).

Overall, increasingly more actors are aware of ethical, environmental, and safety risks, and demand to be considered, and be a part of, solving current or future social problems. The business industry needs to respond to this demand by having social responsibility and innovating responsibly. It has not yet been fully defined how Responsible Innovation can be implemented in industry, mainly due to the plethora of approaches in this field, such as responsible or sustainable or open innovation that can be confusing (Martinuzzi et al., 2018). Besides, the concept of RI has mainly emphasised publicly funded research and thus, its operationalisation is required to enable its implementation in the business context. Moreover, while there are several tools to evaluate CSR, there are few tools within the RI/RRI context for the industry (Yaghmaei, 2018). Also, there is confusion between RI and CSR and what should be measured for each concept (Gurzawska, 2021). For enabling the operationalisation and implementation of RI's principles in industry, it is suggested that organisations raise awareness around the RI concept (Yaghmaei, 2018). Also, persuading the industrial stakeholders to use performance

measurements to assess their alignment with RI can be useful towards the operationalisation of RI (Yaghmaei, 2018).

2.3 Dimensions of Responsible Innovation

To increase the social responsibility of the process of research and innovation Stilgoe et al. (2013) built on four dimensions, anticipation, reflexivity, inclusion and responsiveness, creating a platform for discussing the concept of Responsible Innovation. In the last decade, scholars in the field of RI have additionally focused on the dimension of openness and transparency (Owen & Pansera, 2019; Fraaije & Flipse, 2020). Fraaije and Flipse (2020), mention that all the studied dimensions (transparency, inclusion, anticipation, reflexivity and responsiveness) are each considered essential for delivering responsible outcomes. Due to the relevance of these five dimensions, the following section aims to provide a brief introduction of the knowledge accumulated on these key aspects of RI.

2.3.1 Anticipation

Anticipation is about taking into account any future possible outcome of the innovation and of how people will act towards it (Nordmann, 2014; Stilgoe et al., 2013). To be responsible is not only to fulfil current needs but also to preserve the safety of the world for future use (Taebi, 2017). Stirling (2010) emphasises that potential negative impacts and uncertainties should be acknowledged at the beginning of the innovation process. To achieve that, numerous questions can be asked at the early stages of innovation, when it is easier and less costly to make alterations, about how the future world will look like and about potential implications of the innovation, while also taking into account society's current needs and expectations (Stilgoe et al., 2013; Long et al., 2020). Moreover, it is crucial to consider every possible environmental, social, political and financial implication of the innovation. There must be a balance between being responsible for now and for the future. With this dimension, it becomes easier for the involved stakeholders to better evaluate the dynamics between the innovation and its surroundings (Burget et al., 2017). Therefore, anticipation is the first aspect of responsible innovation providing a better understanding of sociotechnical innovation pathways. Moreover, it enables forming a more solid environment for setting the basis for a robust and more effective decision-making process (Owen & Pansera, 2019).

2.3.2 Reflexivity

The second step in the responsible innovation process is reflexivity. As mentioned, this aspect stresses the importance of actors responsible for decision-making to be able to comprehend their roles and that their perspectives might not always align with those of the society (Stilgoe et al., 2013). Making compromises and discussing potential changes is part of a reflective way of thinking (Taebi, 2017). In the literature, there is a distinction between first-order and second-order reflective learning. First-order reflective learning is about taking into consideration problem definitions and evaluating solutions, measuring innovation's impact, which can become a driver for enhancing the responsible performance of the innovation (Grin & van de Graaf, 1996). For innovation to be considered reflexive, those involved in the innovation process should constantly reflect on their activities, in order to identify areas of improvement. In second-order reflective learning, there is a meta-reflection where value systems are not taken for granted but are challenged and reconfigured (Van de Poel & Zwart, 2010). Innovators need to be aware of how their values systems affect the innovation process and society.

2.3.3 Inclusion

Inclusion, the third dimension of RI, revolves around taking into account stakeholders' opinions in the decision-making process. This forms the most researched dimension in the literature (Burget et al. 2017). It aims to engage various stakeholders throughout the innovation process. Doing so, helps innovators and developers to see the bigger picture of their innovation, providing multiple different perspectives (Backstrand, 2006). Inclusion refers to taking into account the opinion of all stakeholders, not only those that participate in the innovation process. It gives the possibility to the wider public to have a say regarding the innovation and its outcomes, relying on dialogue, anticipatory governance and discussion. Its main goal is to benefit from different points of view, through open dialogues and to comprehend different opportunities and implications (Owen & Pansera, 2019). Having diverse points of view ensures that all groups affected by any development are represented in all stages of the innovation process.

2.3.4 Responsiveness

Responsiveness refers to the ability to adjust the research and technological developments in response to input from inclusive, anticipatory, and reflexive activities (Stilgoe et al., 2013). It is an adequate reaction to changing needs and circumstances of society. Moreover, it is about keeping options

available for any possible outcomes, technological advancements and future generations. As Wickson and Carew (2014) mention, responsiveness is about the willingness among all involved stakeholders to act and adapt according to the principles of co-responsibility. It connects the three previously discussed dimensions.

2.3.5 Openness & Transparency

Openness refers to transparency in the decision-making process. More specifically, all decisions, results, purposes, risks, and uncertainties must be accessible to the public for having a say in these decisions that affect not only them, but the well-being of future generations as well. All stakeholders' concerns must be taken into account no matter any conflicting interests. In this way, knowledge asymmetries get diminished and more productive debates are cultivated (Owen & Pansera, 2019). All stakeholders are supposed to be properly informed about every aspect of the studied innovation to be able to critically think about it. Transparency can be interpreted as a backwards-looking aspect of responsibility that justifies decisions already taken (Fraaije & Flipse, 2020). Full transparency about drivers might not always be possible, since innovators might face some limitations to what they can share with the public, due to intellectual property rights that prevent them from doing so. In this incident, it is suggested that innovators should also be transparent about potential limitations (Kupper et al., 2015). Finally, transparency also means that innovators need to make all the assessment criteria, used in the decision-making process, available to everyone involved (Fraaije & Flipse, 2020).

2.4 Challenges in implementing Responsible Innovation in practice

As already mentioned, the concept of Responsible Innovation has been very popular in the last decade. However, several difficulties haven't permitted its wide implementation in practice. Moreover, the actual implementation of the RI concept has been disputed by various authors. The main reason for this happening is the conflicting interests and information asymmetries within companies at society's expense (Wiarda et al., 2021). Although society requires more and more innovations for satisfying their needs, it might be negative in accepting any potential risks that these innovative technologies or products used might possess. For instance, breakthrough innovative products such as genetically modified foods or more recently the Covid-19 vaccine are needed and desirable from the society to fight the immense problems of famine, food waste and a killing pandemic, respectively. However, one significant number of people is reluctant to accept it. Also, total transparency is not always achievable due to intellectual property rights (Kupper et al., 2015). An additional reason why it seems to be

unrealistic is the limited number of involved stakeholders due to resource restrictions (Lubberink et al., 2017).

2.5 Institutional theory

2.5.1 Definition and linkage with organisations

The institutional theory revolves around the processes by which social structures are created, adopted and established as rules for social behaviour. The contemporary institutional theory aims at capturing the attention towards systems that depend on interpersonal interactions to organisational forms. It is crucial examining the processes involved when stable institutional arrangements are challenged and gradually replaced by other models. For tracking institutional change empirically, scholars focus on the types of actors, institutional logic and governance structures (Scott, 2004). In the management literature, the institutional theory revolves around the conceptualisation of national environments in respect of regulatory, cognitive, and normative standards; the conceptualisation of processes for large-scale transformation of systems; the explanation of comparative national business systems; and the explanation of common practices across organizations as a result of isomorphic pressures (Kostova et al., 2008)

Institutions are conceived as important entities that form the largest part of the political landscape because they are shaping the political behaviour and decision-making of actors. However, there is no large distinction between institutions and organisations, since the latter is considered to be influenced by wider institutional arrangements. Institutional theory has been studied by various scholars over the last thirty years to assess how these external forces affect organisational behaviours (Weerakody, et al., 2009).

Furthermore, values have a critical role in the theory of institutions. For an organisation to be institutionalised, it must take into account the relevant stakeholders. This comes in contrast with the dominant point of view that in a corporation only the involved stakeholders and their interests must be considered. As far as the institutional theory is concerned, it gives the organisation a voice resistance to short-sighted culture, guiding and enabling the adoption of a more responsible way of acting and thinking (Selznick, 1996). If institutionalisation is mature in an organisation, the organisation is more likely to have actors that are aware of their obligations, and roles regarding their involvement in common projects defined by clear sets of rules and values (Maguire et al., 2004). Thus,

the concept of institutional logic is a valuable asset for researchers, since it helps them identify and explain institutional change (Delbridge & Edwards, 2007).

Institutions do not only serve towards unfolding the pathway for change, they also change in character over time. There are three major sources exerting pressure on institutionalised norms; functional, political, and social. In order to monitor and assess the processes of institutionalisation, these pressures must be interpreted and evaluated by actors within organisations (Dacin et al., 2002). Studies have demonstrated how valuable was the use of qualitative research strategies, complementary to quantitative methods for accelerating the implementation of institutional theory (Dacin et al., 2002). Combining several methods such as interviews, records, and participant observation permitted insight into details that would have been unnoticed if the research was conducted only with quantitative studies (Dacin et al., 2002). According to Greenwood et al. (2002), changes in dominant norms undergo the processes of theorisation and legitimation by actors. More specifically, theorisation is about finding the failing parts of existing norms and practices, while also introducing new ones, taking into account potential moral considerations. With the diffusion of this process throughout organisations, new norms and practices gradually become institutionalised.

2.5.2 Key Performance Indicators (KPIs) & Institutional Theory

Innovation is a continuous process and its outcomes, according to RI's ideals, must be constantly assessed and improved based on societal, ethical and environmental needs. Key Performance Indicators (KPIs) are used for performance measurement. The role of KPIs is to provide measurable standards and goals by which organisations can monitor the implementation of changes. Business managers rely on these indicators for making objective decisions (Marr, 2012; Gurzawska, 2021).

Institutional theory is an area that discusses how organisational behaviours get established and how they change, focusing on the impact of social, political and economic systems in which organisations operate (Meyer and Rowan, 1977). KPIs allow organisations to measure how their behaviour changes over time (Marr, 2012). DiMaggio and Powell (1983) explain how these changes occur, discussing institutional isomorphism. The mechanisms of institutional isomorphic change are the following; coercive, mimetic and normative (DiMaggio & Powell, 1983). Coercive isomorphism emerges from political influence, when new rules are introduced. Thus, pressures are created that stimulate direct or indirect organisational change. Moreover, mimetic isomorphism results from copying successful forms stimulated in periods of high political or economic uncertainty. Finally, there is a normative isomorphism, which revolves around professionalisation. The existence of certain norms and

expectations make organisations work towards them and gradually accept and conform to them. While organisations might be able to learn from each other's practices (mimetic isomorphism), normative isomorphism is in particular of interest to this study. RI requires organisations to voluntarily internalise stakeholder values in a highly context-dependent environment. Overall, although several organisations are incentivised to consider values such as safety and sustainability, this barely touches upon what RI could offer to them, and KPIs can help them measure their gradual behavioural changes.

It is not easy to capture every aspect of the complexity of organisations when viewing it through a theoretical lens (Suddaby, 2010). Regarding the implementation of isomorphism, one must not forget to take into account organisational diversity and how organisations change (Kondra & Hinnings, 1998). Conforming to institutional norms increases organisations' survival chances, while governments and regulatory agencies also enforce, through coercive practices, varying degrees of isomorphism on industries (DiMaggio & Powell, 1983). Finally, institutional theory can also explain why actors may be reluctant to identify opportunities to improve the performance of their organisations. Besides, Hinings and Greenwood (1988b), claim that organisations adopt mimetic behaviour when their performance measures are not well-defined and vague. If monitoring organisational performance is not straightforward and clear, following and copying the strategies and behaviours of other similar organisations is an easy way to pursue their goals. When performance is constrained by institutional norms, if several organisations deviate from these, they might face negative outcomes (Kondra & Hinnings, 1998).

3. Methodology

3.1 Research outline

This study aims to assess RI's institutionalisation in research performing (RPO) and funding (RFO) organisations by considering RI process and product dimensions in their projects since RI's relevance for organisations is not well-documented (Stahl et al., 2017). In this chapter, the research methodology used throughout the collection and analysis of the data is discussed. The selected method uses a combination of qualitative and quantitative data for achieving triangulation. Triangulation is a technique used to ensure the validity and reliability of results by addressing research from multiple perspectives. In this study, data triangulation exists through collecting data at different periods via different methods (Sekaran & Bougie, 2016).

According to Sekeran & Bougie (2016), descriptive research can be both quantitative or qualitative, and its goal is to describe people or situations. It is a useful tool for understanding the characteristics of a group, thinking systematically about given situations and helping to make future suggestions or decisions (Sekeran & Bougie, 2016). This study aims to understand how the use of KPIs of responsible innovation can help the institutionalisation of the perception of organisational change. Thus, a qualitative study is suitable for explaining the process of organisational change in terms of RI, taking into account the perception of the participants. Moreover, a quantitative approach is required to measure any changes in KPI performance over time. It is worth mentioning that this study does not aim to develop any theory or framework but to measure in practice the perception of organisational change regarding responsible innovation practices in several research organisations, that has been only at a theoretical level yet. Therefore, given the infant state of the literature about pragmatic studies, there are no hypotheses that can be tested. Thus, there is no information about any relations of variables, an inductive, mainly qualitative (with little quantitative data) approach was chosen.

3.2 Co-Change research design

This descriptive longitudinal study aims to answer the research question by analysing eight case studies. These case studies are eight research (performing or funding) organisations part of the H2020 Co-Change project (see table 1) that aims to boost changes in organisational behaviour.

Table 1 Research organisations involved in H2020 Co-Change project

Lab no.1: RPO that focuses on Artificial Intelligence and its challenges and how they can be tackled more responsibly.	**Lab no.2:** RPO in the chemical industry, also involved in the consultancy for small and large companies in various fields of technology.
Lab no.3: RFO that intends to include RI values into funding and innovation projects.	**Lab no.4:** RPO that establishes standards and intends to implement RI principles in their standardisation process.
Lab no.5: RPO that focuses on implementing RI values and principles to their organisation.	**Lab no.6:** RPO that focuses on ethics awareness around autonomous systems based on Artificial Intelligence.
Lab no.7: RPO that focuses on high-technological solutions and wants to raise awareness and implement RI values in their functioning.	**Lab no.8:** RFO that intends to include RI values in their selection criteria for funding.

Through various activities during the project, such as training and workshops, organisations involved in the research and innovation process co-evolve. Moreover, they try to align their practices with the values, needs and expectations of innovation ecosystems. The RI KPIs are dedicated to measuring the performance of five dimensions (inclusion, anticipation, reflexivity, responsiveness, and transparency), focusing on the process and outcome (product) of research and innovation.

3.2.1 Overview of the research

This research is three-folded. Firstly, participants were asked in a workshop conducted in January 2021 to complete a self-reflection form about their activities and how important they consider the implementation of Responsible Innovation in their processes and products. Subsequently, the KPIs were presented to them using the online MIRO workshop tool, and the content of each one of them was explained to the participants. Forty-seven (47) KPIs were presented with different colours based on whether they represented process (yellow) or product (green) indicators. Process and product indicators were coupled with the studied dimensions, anticipation, reflexivity, inclusion responsiveness and openness/transparency, while also referring to the sustainability of the organisations' outcomes. Moreover, they were also able to come up and create their indicators, if they considered that an important aspect was not included.

During the workshop in January 2021, participants were asked to select which of those 47 KPIs they found relevant for their organisation and their innovation projects, since not all of them may be applied to each project (appendix A). In addition, RFOs and RPOs were allowed to develop any additional KPI as they seemed fit. The participants were asked to select the KPIs, which they found relevant for their organisations, cluster them in categories, and weigh them. Weighing, in this case, means that participants could indicate how important the clusters of indicators are for their organisations on a scale from 0 to 100, with the total sum of weights not exceeding 100. Participants were followed 'in action' as they discussed and selected the relevant research and innovation indicators. An overview of the 47 indicators that were set up before the participants selected any of them is presented in Appendix A.

In the second phase of this research, from mid-April 2021 to mid-August 2021, participants were asked to measure their KPIs over time to assess their institutional change, using a Likert scale from 1 to 5 with 1 being *strongly disagree* and 5 being *strongly agree* with the statements of KPIs. They were asked to fill in to what extent they agreed/disagreed with the statements of the selected KPIs regarding their organisation's performance. The measures of the selected KPIs were taken in two waves: at the beginning of the project (at the beginning of May 2021) and after three months (August 2021). Finally, interviews with representatives from these organisations were performed, between these two rounds of assessment in order to ask for clarifications regarding their choices in categorising and weighting KPIs always compared to their answers in the self-reflection forms. Before the interviews were conducted and recorded, participants' written and verbal permission and consent were asked. A sample of the consent formed is attached in Appendix D. The recordings were transcribed and analysed for finding specific themes that were used for answering the corresponding research sub-questions. Overall, taking into account their thoughts and feedback about KPIs this intervention permitted to evaluate to what extent KPIs helped them drive and measure their perception of institutional change concerning RI. Also, it was practical for seeing if they were able to exchange knowledge and gain valuable information from the other organisations that share similar values.

3.3 Establishing pre-defined responsible innovation KPIs

The Co-Change project intends to assess how organisations implement all the dimensions of responsible innovation to their research and innovation processes employing KPIs. Throughout the project, various interventions (e.g., workshops and training) were introduced to drive institutional changes and focus on how they are perceived by researchers. 47 RI process and product KPIs were pre-defined using the responsible innovation literature and taking into account the five dimensions

discussed in the theory section (Yaghmaei, 2018; Owen et al., 2021). In this case, the KPIs were predefined because stakeholders are not always aware of Responsible Innovation values and it is needed to be more suggestive to further familiarise them with the concept. Subsequently, they were formulated into statements which respondents of the research funding organisations and research performing organisations might choose when relevant for their companies. The reason why the KPIs that were established were not organisational indicators but referred to the RI framework is the aim of this research to focus on the organisations' implementation of the RI dimensions in their activities. Moreover, an extensive study was performed by the coordinator of the project in order to obtain a list of quality performance indicators of RI dimensions and these indicators were finally used (Yaghmaei, 2018; Kwee et al., 2021).

Several examples of the predefined KPIs that participants were asked to select from are presented in Table 2.

Table 2 Several examples of the predefined RI KPIs presented to the lab participants

Within the project, we value and nourish diversity (in the broadest sense) in both research, innovation, and project management
Within the project, we have equal participation of women and men in both research and project management
Within our project, we use tools and mechanisms for organizing dialogue with stakeholder on appraisal / ethical acceptability
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.)
Confidentiality of methods and results is not an issue within this research and development project
Research/innovation activities and results are actively and transparently communicated within the research network (stakeholders) during the project
This project does not influence the ecosystem or environment in a harmful way
Societal values (privacy, safety, health, security, data ownership, etc.) are actively included in the design process of this project.

3.4 Data Collection and Analysis

3.4.1 Study Participants

Qualitative sampling begins with finding the target population (Sekaran & Bougie, 2016). In this study, purposive sampling was selected, and participants were found thanks to the professional network of the advisory supervisors. The participants are all part of the studied research organisations. For privacy and GDPR protection reasons, all names and personal identifications of the respondents have been anonymised. Data collection and storage methods have been approved by the TU Delft's human resource ethics committee and are part of a data management plan.

3.4.2 Literature review: selection criteria

As already stated, this research started performing a thorough literature review that could be interesting for future research around the responsible innovation concept and its institutionalisation. The analysis started with a broad classification of the existing papers regarding responsible innovation. The criteria that were used for selecting which articles are useful for the literature review are further analysed. For this research, papers and articles were studied, excluding those that were not published in reliable, scientific journals. Furthermore, several publications were rejected from including in the study because of their age and for being non-scientific. Since the concept of responsible innovation was recently introduced in the scientific world, there are a plethora of articles analysing it. Most of them attempt to develop adequate frameworks for assessing its actual implementation in organisations. Therefore, the literature review can be benefited from recent papers of the last two decades.

3.4.3. Self – Administered Questionnaires

To evaluate the relevance of the selected KPIs to each lab, self-administered questionnaires were handed out by mail to the lab representatives. The lab representatives consisted mainly of the lab manager and several external persons in order to increase the validity of the assessment within the labs. Questionnaires were customised for each lab and were formed by presenting the selected KPIs in two rounds of assessment on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Questionnaires are a useful tool in descriptive research. The selected method for filling the questionnaires was mail questionnaires since a large geographical area had to be used (5 European countries) and due to the pandemic social distance measures. However, one limitation of mail

questionnaires is the lack of face-to-face communication which results in a lack of clarifications regarding the questions, if needed (Sekaran & Bougie, 2016). Seventeen (17) participants participated in filling these questionnaires.

3.4.4. Interviews

Throughout this research, the main data collection method used was the online interviews via Zoom, because of the Covid-19 pandemic situation and the fact that the participants are from different European countries. The aim of the eight conducted interviews (with a duration of 20 to 40 minutes) was to collect lab representatives' input on the importance of the indicators that they had selected during the monitoring workshop and to ask for clarifications regarding their selection criteria. Furthermore, the second goal was to identify better how to assess the embedding of responsible innovation to their work and activities in the context of the Co-Change project. The lab representatives consisted mainly of the lab manager and several external persons, wherever it was possible. Interviews are the most common form of data collection and belong to the qualitative research methodology (Wethington & McDarby, 2015). The semi-structured method was chosen to better understand the connection of the concept of Responsible Innovation and organisational change. Several specific questions, same for all labs, were asked to understand the reasoning behind their choices, their feedback on their experience and their meaning of the term "responsibility". However, in each lab, several customised and follow-up questions were asked according to the results from their KPIs assessments. The interviews were recorded, transcribed, and the transcripts can be found in appendix C.

3.5 Data Analysis

Coding is a method that enables researchers to reflect on qualitative data they have obtained in order to retrieve meaningful results (Blair, 2015). Coding the interviews was the selected method for analysing them, aiming at deriving results from the different participants' perspectives, experiences and thoughts. After transcribing the interviews manually and anonymising all personal data that could be used for identifying the interviewees or their labs, the transcripts were thoroughly read and codified in order to retrieve useful results. Coding is a primordial tool, in which the researcher can find what is looking for from analysing texts and eventually develop theories from the findings (Williams & Moser, 2019).

More specifically, according to Williams & Moser (2019), in **open coding,** the researcher identifies distinct themes that will be further categorised. Reading and re-reading the transcripts of the interviews systematically enables the researcher to identify general concepts. Subsequently, these themes are colour-coded, separated and further analysed. This process is called *thematic analysis* and revolves around the idea that each theme/concept must be relevant to the research questions asked. Each theme might be present multiple times in the collected data, but the number of appearances is not equal to its importance. What must be examined through thematic analysis is what the researcher looks for to retrieve from his/her data and the relevance to the study (Maguire & Delahunt, 2017). The second level of coding is **axial coding,** where the emergent concepts are further analysed and categorised. This data organisation is achieved through continuous analysis, which is done via the *constant comparison method*. In this step, the researcher constantly compares the collected data, by reading them again and again to create the refined categories. Finally, in **selective coding**, the researcher selects from the aforementioned categories and can retrieve meaningful results from the data and eventually answer his/her research questions (Williams & Moser, 2019). In this research, a thematic analysis and open and axial coding were performed to create categories and retrieve results from the interviews' inputs.

3.6 Reliability & Validity

To make a qualitative study more reliable it is important to include participants with relevant backgrounds and expertise in the research, as happened in this study. The initial goal for each lab was that the questionnaires would be filled by at least one lab manager and one or more external people to increase the validity and reliability of RI assessment within the labs. The interviews would be conducted at least with the lab manager. However, due to lack of time and due to the hectic schedules caused due to the Covid-19 pandemic situation, only a limited number of representatives from each lab were interviewed for further clarifications. Thus, the results obtained from the interviews cannot be generalised at a high level for all research organisations and their actual organisational change in terms of responsible innovation. Towards eliminating personal biases, the questions asked, emphasised the general activities of the lab, and not on specific projects. Moreover, the role of the selected interviewees as lab managers, was a determinant factor in selecting them, since they are expected to know the bigger picture, to a greater extent, of everything happening in their labs. However, the factor of personal biases regarding the interpretation of the questions or the definitions of responsible innovation and its dimensions can always be present in these types of interviews. In order to reduce these biases, the questions asked tried to evoke the general picture of what is

happening in each lab, and the answers were coded and constantly compared to find a general insight to conclude.

4. Results

4.1 Overview of the results section

The method followed in this study included semi-structured interviews with lab representatives of the studied research funding or research performing organisations. Firstly, in the results' section, the key findings of the interviews for each organisation are presented, supported with quotes. Analysing the interviews' transcripts (Appendix C) aims to explore the current state of RI dimensions' implementation in research organisations. Reading the transcripts multiple times, a colour coding was attempted with each colour corresponding to the studied RI dimensions, the organisations' goals and its feedback, as seen in Table 7 (in Appendix C). This coding aims to retrieve the most important findings for each labs' results and a universal insight for all the labs. Furthermore, it is used for interpreting these results in combination with the two rounds of evaluation. Linking the findings to the literature is used for synthesising the discussion section.

Then, in order to answer the first research sub-question, an overview of the most relevant RI dimensions (anticipation and reflexivity, openness and transparency, responsiveness and inclusion) for each lab follows according to the weights given during the first phase of the project. Then, a ranking with the less and most selected key performance indicators, product or process dimensions related, is constructed. Subsequently, in order to answer the second research sub-question, there is an overview of the reasons why organisations opted for these dimensions specifically. Moreover, an evaluation of the usefulness of the KPIs assessment in capturing organisational change, as perceived by the participants, is presented. Finally, there is a cross comparison for each dimension across labs.

4.2 A narrative for each interview's key findings

Lab no.1: Public RPO that focuses on machine learning and Artificial Intelligence.	**Lab no.2:** Both public and private RPO in the chemical industry and in consultancy.
Lab no.3: Public RFO that intends to include RI values into funding and innovation projects.	**Lab no.4:** Private RPO that establishes standards.
Lab no.5: Public RPO that focuses on implementing RI values and principles to their organisation.	**Lab no.6:** Public RPO that focuses on autonomous systems based on Artificial Intelligence.
Lab no.7: Private RPO that focuses on high-technological solutions.	**Lab no.8:** Private RFO that intends to include RI values in their selection criteria for funding.

Table 3 Table illustrating the labs' specification

4.2.1 Lab no.1

Lab no.1 is a Research Performing Organisation that focuses on artificial intelligence, its challenges and how they can be tackled more responsibly. According to its lab representative, responsibility for Lab No.1 relates to issues of privacy, trustfulness, openness, and transparency. In this lab there are developers, data scientists, and people from social sciences that cooperate and aim to have a meaningful dialogue to further understand each other's work and their perceptions regarding machine learning. For lab no.1, responsibility is crucial, in terms of research integrity and transparency, in order to stay competitive in the market. Also, responsibility in its broadest sense is quite important but still at an infant stage. This means that they desire not only to look for responsibility just a single step ahead but also to think about the effects of research.

For Lab no.1, the *inclusion* of diverse stakeholders is already highly relevant. However, in terms of research and development work, several groups, such as end-users, are not taken much into consideration compared to funders. As for *responsiveness and adaptive change*, it is quite relevant for them to evaluate how their tools might fail, or have adverse effects or outcomes that might be biased, resulting in discriminations and undesired outputs. They admit that although risk identification is part of their work, it is something that is not systematically done due to time limitations. Furthermore, regarding *anticipation* of impact assessment of their innovations, it is crucial, since for the social and ethics department's workers one of their main goals is to put themselves into the shoes of their contractors in order to understand how they perceive the reports or the tools the lab provides them. Also, on the developers' side impacts' assessments are taken into account, but at a superficial level, since their main concern is the benefit of their funders and not the impacts on the broader public and science. Moreover, regarding the *reflexivity* dimension, during the research and innovation process they reflect upon those who they are working with, their interests, their motivations and how the results will be further used if, for example, they partner with a non-democratic country. However, these issues are not yet institutionalised, and this is a point that they are working on to help the researchers to be more reflexive towards their work, without tying their hands. Finally, *transparency* and *openness* of the scientific process are traditionally integrated into this institution. However, transparency in its wider sense might be trickier, since they operate in a highly result-competitive environment. The representative mentioned, "If you are a place where you are doing a lot of research that is high-end, that is cutting-edge you are always feared that if you say everything that you have been doing in the sense of the kind of methods, the kind of data the kind of everything you are in fear that the next competitor is going to grab it from you. "

4.2.2 Lab no.2

Lab No.2 is a cutting-edge chemical laboratory that is also involved in the consultancy of small and large companies in various fields of technology. According to its lab representative, responsibility for Lab No.2 is a very important aspect that revolves around raising awareness and increasing the attention to the environment, to the workers' rights and issues around gender equality. Moreover, for Lab No.2 it is important to be the actors that promote social and ethical experts in the research as well as simultaneously observing the social situations for being able to react to improve social/ethical aspects of research projects.

Regarding the *inclusion* of diverse stakeholders in the participation of research processes, for Lab No.2 it is essential to evaluate what research project they are facing since some might need more stakeholders' aspects to be included. However, other projects that develop preliminary steps of the research might need a different approach. With respect to *responsiveness* to new technological developments, it also depends on the kind of each research project, since either the technological development/ results might be more important when the market or standards' requirements must be considered, or, in other cases, they can be neglected or considered at a later stage. Sharing motivations, interests and receiving feedback are very important for Lab No.2 since numerous projects deal with the development of new materials or new products that might have environmental impacts. In that case, these impacts must be communicated to partners and involved persons that need to be aware and sensitised about them. Also, as a chemical lab, they cannot overlook the health and safety of the workers.

4.2.3 Lab no.3

Lab No.3 is a research funding organisation that intends to include RI values in funding and innovation projects. Responsibility for Lab No.3 is ''an overall idea of sustainability in three ways; ecological, economic and social responsibility or sustainability''. Moreover, responsibility is considered as the capability to anticipate and reflect the action, the possible impacts and organisational change not only for them but also for others. Several elements of responsibility are very important since they are representing the public sector, as a municipality-based organisation. So, issues such as transparency are based on their work. However, issues regarding ethics are a key to responsible innovation about which they do not have a systematic approach in order to increase it.

Regarding the inclusion of diverse stakeholders in the participation of research processes, for Lab No.3 their closest stakeholders are the high educational institutions and public organisations. However, due to restrictions in the system of money allocation between public and private companies, they do not often come along with civil societies or NGOs since they rarely do have any connection. As for *reflexivity* and *anticipation* activities, the organisation performs well thanks to its standardised processes and the connection with its closest stakeholders within their funding ecosystem, but their impact could be still improved. For Lab No.3 *transparency* is an important issue but it contains elements that cannot be directly affected by them since as a council, they do not have the adequate mechanisms to start tackling those issues during and after the release of the projects they fund. Moreover, about *responsiveness,* environmental values are highly included and regulated already in their funding ecosystem. However, aspects such as social sustainability, safety and security are relevant for them since they often deal with projects regarding Artificial Intelligence, where these issues are crucial.

4.2.4 Lab no.4

Lab No.4 is a Research Performing Organisation that establishes standards and intends to implement RI principles in its standardisation process. For Lab No.4, responsibility revolves around the concept of involving all the parties in the innovation system concerned to develop socially desirable standards. Responsibility is quite an important issue since the developed standards are adopted by firms voluntarily, so they need to be accepted by society in order for the standardisation process to be successful and meaningful.

Regarding the *inclusion* of diverse stakeholders in the participation of research processes, for Lab No.4, it is crucial to look at all stakeholders implicated by the developed standards. Their closest stakeholders are suppliers/ manufacturers since the process is initiated by the industry and its needs and requirements. However, several societal groups are under-represented, such as end-users, since ‘’participation in standardisation still costs money’’. Nevertheless, for Lab no.4, it is important to better organise the participation in their standardisation processes, by constantly trying to look for new ways to involve more different groups of stakeholders. Furthermore, regarding *anticipation,* there are no anticipatory activities fully institutionalised for standardisation. But, since not everyone affected is always included or aware of possible impacts on them, Lab No.4 acts as a facilitator to brings people together. So, their neutral role contradicts with trying to force anticipatory activities on relevant stakeholders that come together.

As for *responsiveness,* for Lab No.4, it is a context-related term. It can be about initiating the process of standardisation. There is also responsiveness throughout the process, in which all the different inputs, from the stakeholders, need to be internalised into the standards. Moreover, there is a third type of responsiveness -quite slower- that concerns the standard after it is published, that might need to respond to environmental or technological advancements. Finally, regarding *transparency,* it is also quite important within Lab No.4. The actual process of standardisation is ''confidential to allow stakeholders to share their assumptions, opinions, motivations'', but since ''it's a very political process'' it might come at a cost for public openness' issues.

4.2.5 Lab no.5

Lab No.5 is a Research Performance Organisation that focuses on implementing RI values and principles to the faculties within their university. The lab has a supporting role for knowledge sharing to the rest of the university, and for documenting its experiences and challenges. According to lab's representatives, responsibility for Lab No.5 means doing research responsibly, and equally, while taking into account the whole ecosystem and each one involved. Moreover, at the level of the university, the academics are not fully aware of the concept of responsible innovation. Therefore, responsibility for researchers means ''to do their job in a way that is useful for the people who are enrolling in our studies and for the wider contexts in which we are''. For Lab No.5, responsibility is highly important since its primary goal is to act responsibly in each activity in which it is involved.

Regarding the *inclusion* of diverse stakeholders in the participation of research processes, for Lab No.5, at a first level, its targets are mainly the employees of the university and the students. However, on a secondary level, they also engage with the industry seeking solutions for problems. As for *reflexivity*, moral values are embedded in their fields of research, but in most cases, they are not quite used to reflect on these issues. Therefore, that is what they expect from this project, to make people ''aware about dimensions of responsibility and then get them to start thinking about it and to reflect on their experiences, and challenges and the effect that their work has on these''. Furthermore, about *anticipatory* activities, this project positively influences the lab's ecosystem in several ways making them understand that several things of their practices are in line with RI principles. On the other hand, they see what has to be improved, not only for making a better working environment but also for preparing the way for making a real institutional change that will allow participation in future project calls. Regarding *transparency,* it is also quite important for them since they need to put everything out on the table, their thoughts, their obstacles, their weaknesses, and ''are very open for all the advice from anywhere they come so we are quite transparent we say we don't know how to do this, we would like to do this''. Furthermore, there are several faculties, such as the food technology institution that

“act like third parties linked to the faculty of agriculture”. These faculties benefit from the feedback and transparent knowledge sharing among the institutions by initiating and developing discussions on ethics issues.

4.2.6 Lab no.6

Lab no.6 belongs to a Research Performing Organisation that focuses on ethics awareness around autonomous systems based on Artificial Intelligence. For its studied lab, responsibility mostly revolves around research and innovation on autonomous systems being conducted ethically right, while also taking into account society’s evaluation, acceptability and desirability. Responsibility is quite important but since the lab is technology-driven, it is not widely integrated into its actual work.

As for the *inclusion* of diverse stakeholders in the participation of research processes, for them, it is crucial that there is diversity among stakeholders since they belong in an ecosystem, which ‘’is a network of multiple and different actors”. Regarding the lab’s performance in *responsiveness* to societal demands and developments it scores quite high thanks to inherent factors**,** related to the ecosystem of the lab, and the network externalities of the involved actors. As for *reflexivity*, moral values are embedded in their fields of research regarding artificial intelligence-related technologies and the raised concerns around them, such as facial recognition or surveillance issues. Moreover, *transparency* in the research process is crucial since everything is based on openness and collaboration in an ecosystem context. Besides, for these technologies to be developed everything must be on the table.

4.2.7 Lab no.7

Lab no.7 is a Research Performing Organisation that focuses on high-technological solutions and desires to raise awareness and implement RI values in its functioning. Responsibility, for Lab no.7, is about taking care of what different people need in their context. Since they offer consultancy, they intend to create services to support internal and external organisational change and to inspire people towards acting more responsibly. Lab no.7 considers responsibility an important aspect and tries to include it in its strategic plan, but still, it is not highly institutionalised. Responsibility can be distinguished in several levels and areas; there are areas ‘’that are very well understood and very well embedded in projects, activities and strategies for example environmental responsibility’’, but also there are other topics that are still vague such as gender responsibility. Moreover, the extent to which responsibility is important in Lab no.7, depends on the different areas, teams, and cultures.

Regarding the *inclusion* of diverse stakeholders in the participation of research processes, as for Lab no.7, it is an essential dimension. They started working with internal actors and then moved on to collaboration with external actors that provide them with an extended network. So, for Lab no.7, diversifying their portfolio is crucial. They want to have stakeholders from diverse societal groups involved in their projects, but they try to reach them only when they have something concrete to offer that will bring added value to them. Therefore, the most crucial thing for Lab no.7 is the quality of connections with the stakeholders rather than the number of different groups. Furthermore, as for *responsiveness* to societal demands and developments, they are committed to the belief that society needs to change and they, as researchers and as citizens, they want to promote this change. Moreover, the dimension of *transparency* in responsible innovation's activities is quite crucial for Lab no.7, but they believe they didn't have enough opportunities to communicate their values and actions yet. "I would say that we are as transparent as possible because we want to, let's say, promote our services or sell our services in the future. The first step is being transparent, being not only transparent but also being actively transparent, like open and communicating with what we are doing". Finally, as for *reflexivity* in their innovation process, they are very attentive and very *responsive* in any needs. Besides, embedding moral and societal values in the research process is at the core of Lab no.7's activities.

4.2.8 Lab no.8

Lab no.8 is a Research Funding Organisation that intends to include RI values in their selection criteria for funding. Since it is a small organisation with very scarce resources, its main focus is on open science and gender equality. Responsibility is a very broad concept, but for Lab no.8, the main goal is to include open science and gender equality policies in their funding cycle.

Regarding *diversity* and *inclusion,* within Lab no.8, it is a dimension that was extensively studied in the past years, establishing gender-content criteria to promote equality and active representation of women in the decision-making process. Due to lack of resources and having very dedicated calls, they are not involved with citizens or non-users but only with researchers and research organisations and prefer to devote their time and money to improve openness and gender equality issues. "We have this focus on open science, and we concentrated on that as our main people that can get funded from our budget, which is restricted, are researchers''. Regarding *openness* and *transparency,* they try to constantly improve their funding guidelines, by consulting others for how to better frame an open science policy that will transform their existing one. Their main aspiration towards that direction is to ''keep it practical, not overboard many things and to stick to the own contacts and the own resources and possibilities". Moreover, as for the *responsiveness* of the lab to new societal and technological

demands and developments, they always try to take into account the mid-and long-term effects of their projects on society. However, the extent to which questions about effects and adaptive change are present depends on the project, its time frame, and its orientation. Practical calls about environmental system research or digital humanism are the ones that deal with questions regarding the *responsiveness* dimension. Regarding *anticipatory activities*, they are not the most essential aspects for them, but there is continuous communication with researchers of universities, or advisory boards before initiating any new project, or any changes to consult them.

4.3 What RI process and product dimensions are relevant for organisations?

This research aims to analyse the current state of RI dimensions in research performing and research funding organisations since it is not clear to what extent the concept of RI is considered relevant for organisations. During the semi-structured interviews, representatives from the labs were initially asked to select the relevant KPIs for their labs and to cluster and weigh them in order to explore and evaluate what is happening in each lab. The RI process and product dimensions results differ between the selection the lab managers and lab representatives made, depending on their roles and knowledge of all activities within their labs.

An overview of the most selected as more relevant dimensions, is presented below. More specifically, pie charts (Figures 1-8) with the most relevant dimensions for each lab were constructed. Towards this quantification of relevance for each dimension, the following procedure was followed for each lab. Using the forms that the lab representatives filled in at the first workshop conducted in January 2021, the frequency of relevant KPIs to each dimension e.g., inclusion, anticipation and reflexivity, responsiveness, openness and transparency selected from the labs was multiplied with the weight that they have also given to each dimension. Anticipation and reflexivity having common roots in critically thinking and reflecting on aspects are clustered together. The results were put in a pie chart that shows the relevance of each dimension per percentage for each lab according to the perception, the selection and the evaluation its representatives made in the workshop.

Lab no.1 is a Research Performing Organisation that focuses on the responsible way of solving AI's challenges. According to its lab representatives, *inclusion and diversity i*n the research process are highly relevant for the lab, as seen in Figure 1. Regarding the *inclusion* of diverse stakeholders, for lab no.1, in general, it is highly relevant in its current projects, but several groups could be better involved, such as end-users. Moreover, gender equality in the participants throughout the research process is constantly taken into consideration, in order to diminish any discrimination. The second most relevant

dimension for lab no. 1 is *openness & transparency*, which is traditionally integrated into their institution but can become a controversial issue in several aspects. Due to the highly technological competitive sector in which Lab no.1 operates, privacy issues often contradict their intention to share their activities with the public and all involved stakeholders. Subsequently, *responsiveness and adaptive change* are also quite relevant for them, in terms of risk identification and mitigation of adverse effects, especially thanks to the field of their work with artificial intelligence-related projects. Finally, the *anticipation and reflection* of the impact assessment of their innovations are relevant since they find it crucial to take care and evaluate potential implications or future problems of their projects and innovations. However, due to time limitations, it is an aspect that is not yet fully developed and institutionalised.

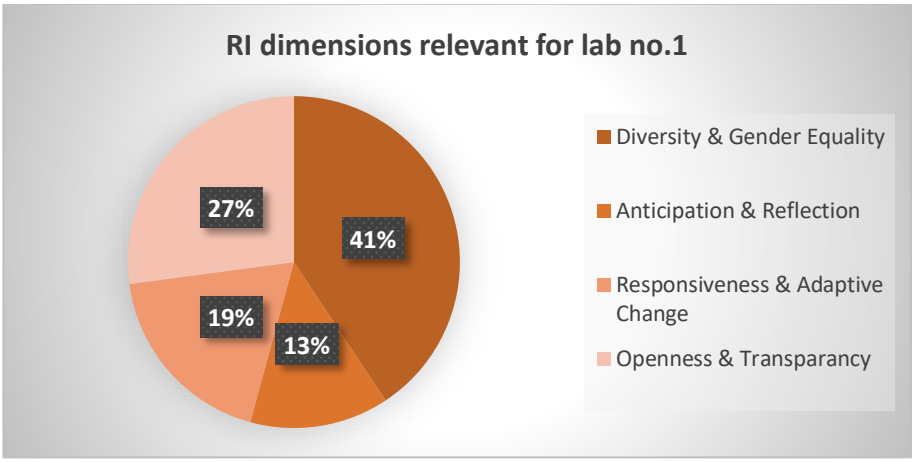

Figure 1 Relevant RI dimensions for lab no.1

Lab no.2 is a chemical cutting-edge laboratory, also involved in the consultancy of small and large companies in various fields of technology. Its representatives selected as the most relevant dimension for them, *anticipation and reflection,* as seen in Figure 2. Depending on the research project they have to handle, embedding moral and social values in their innovation processes is essential for the technology fields lab no.2 is working on. Considering the other dimensions, *diversity and inclusion* stand out as also relevant, since different approaches are required depending on each project and to what extent various stakeholders' aspects are taken into account. As it concerns *responsiveness* to new technological developments, it is related to Lab's no.2 projects. The main factors affecting this dimension are the market or standards' requirements that the projects must meet. This can differ according to the nature of the different projects. For instance, several projects need to comply with specific requirements from the beginning, while others need to be adjusted at later stages. Besides, most of the projects should be responsive to any changes even after they are published. Moreover, the *openness & transparency* dimension was also considered quite important for Lab no.2, since

sharing every aspect of the projects, motivations, interests and potential implications or challenges is crucial in the development of new materials or new products.

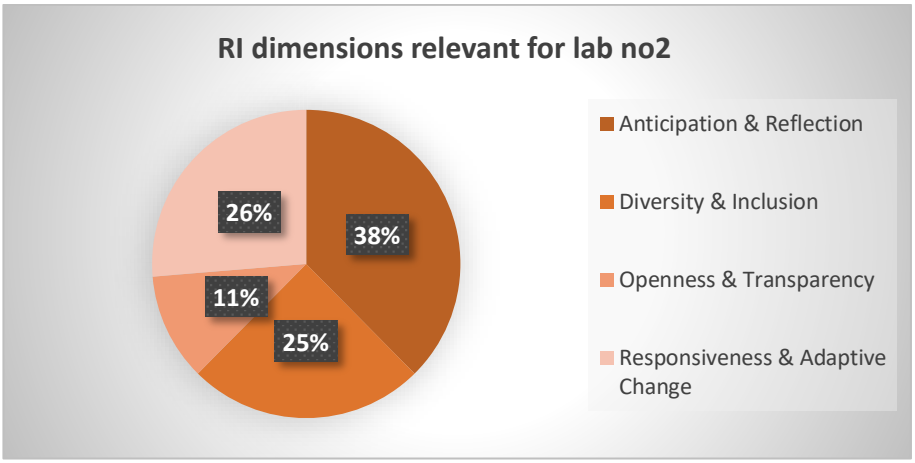

Figure 2 Relevant RI dimensions for lab no2

Lab no.3 is a research funding organisation whose aim is to include RI values in its funding and innovation projects. Their most important dimension, with a high percentage of 62%, is inclusion, mainly in terms of diversity and gender equality. However, they recognise that they lack connection with civil societies or Non-Governmental Organisations, due to specific regulations and procedures, followed in their field of work. Regarding *reflexivity* and *anticipation* activities are also considered applicable to their lab thanks to the fact that they belong in a funding ecosystem, in which these dimensions are always present thanks to inherent factors, such as sharing information and constant consultancy with their closest partners. However, the impact that these dimensions have on their actual work and their implementation on their projects can be further improved, according to the representative. Moreover, it was emphasised the importance of being able to be *responsive and adaptive to changes* regarding environmental values, social sustainability and safety along with its projects and processes.

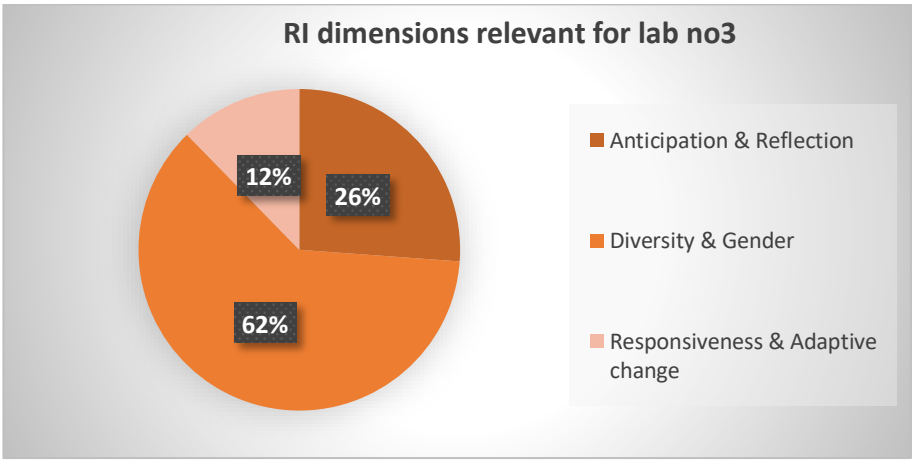

Figure 3 Relevant RI dimensions for lab no.3

Lab no.4 is a Research Performing Organisation operating in the field of standardisation that intends to implement RI principles in their processes. For Lab no.4 one of the most important dimensions is the *inclusion* that looks back on the aspects of diversity and gender equality, as seen in Figure 4. In the process of developing standards, it is considered crucial to look at everyone implicated by them, from industry to end-users. Moreover, as it concerns, *responsiveness* for lab no.4 is also highly considered since the process of developing and establishing standards must be responsive to environmental or technological advancements. Also, it must be able to transform all the knowledge and values among the different stakeholders into a standard. It is worth mentioning that *transparency & openness* is also a crucial, but controversial dimension for lab no 4. More specifically, although they intend to put every assumption, motivation and opinion on the table as standardisation is a political process, the actual process of standardisation is confidential, and non-disclosure agreements usually exist. Therefore, this may come at a cost for openness to the public in several circumstances. Finally, regarding the dimension of *anticipation*, it is also important, since the impacts the standardisation processes are provoking must always be taken into account. Although anticipatory activities are not fully institutionalised for standardisation, they are working on improving that dimension.

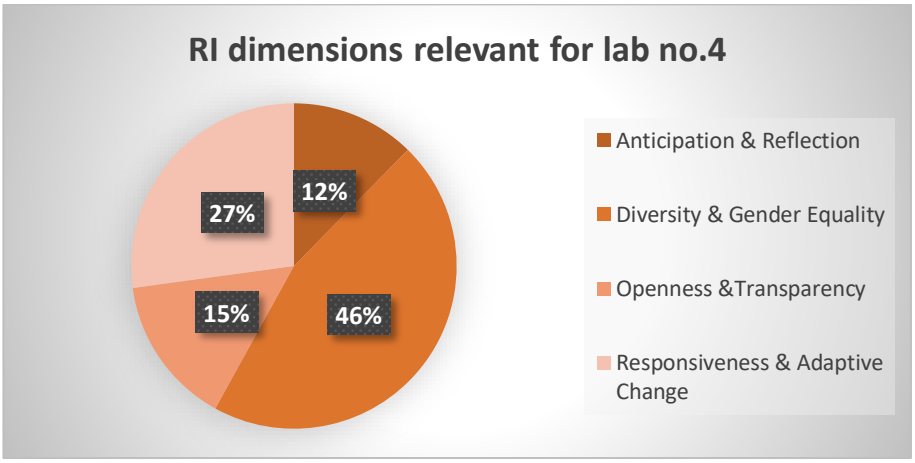

Figure 4 Relevant RI dimensions for lab no.4

Lab no.5 is a Research Performance Organisation that focuses on implementing RI values and principles among the different faculties within a university. According to the lab representatives, diversity and *inclusion* in the participation of research processes, are the most relevant ones, as seen in Figure 5. Since this lab consists of people from different backgrounds, working at various faculties, as well as cooperating with the industry, everyone must be constantly involved and taken into account. Moreover, *anticipation*, *reflexivity*, and *transparency* dimensions are also considered relevant. Although most researchers intend to embed moral and ethical values in their studies, they are not always aware of which they are in practice and mainly how they could achieve that implementation. Therefore, this lab needs to get people to start thinking towards this responsible innovation concept

in order to try to implement what they learn in their processes. In this way, their goal is not only to positively affect the lab's ecosystem, but also future generations within this field. Finally, regarding *responsiveness* to new changes and *transparency,* they are also quite essential within this lab, since they firmly encourage the sharing of thoughts, obstacles, weaknesses, through meaningful dialogues. Thus, they promote constant communication as well as giving and receiving feedback from the different faculties involved and from everyone that might be willing to listen to them and advise them.

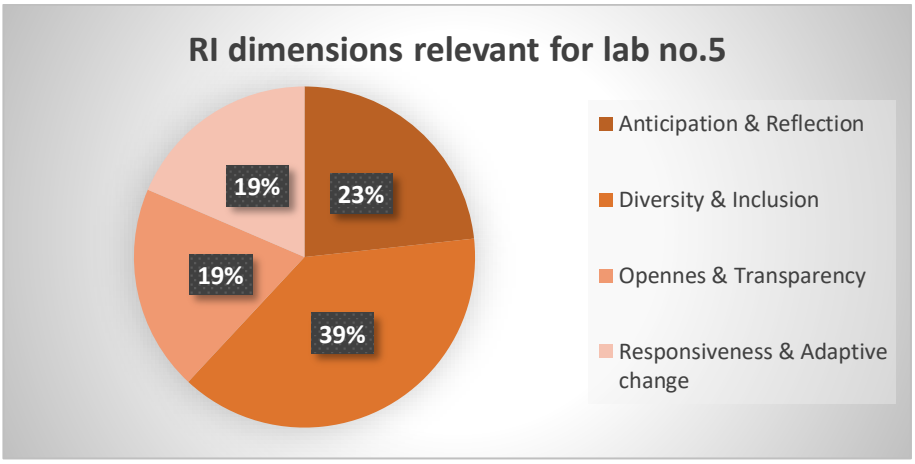

Figure 5 Relevant RI dimensions for lab no.5

Lab no.6 is a Research Performing Organisation that focuses on ethics awareness around autonomous systems based on Artificial Intelligence. According to its lab representative, *inclusion, anticipation, and reflexivity* in the research process are the most relevant dimensions for the lab, as seen in Figure 6. More specifically, all the aforementioned dimensions are crucial for the lab and ecosystem-related. Thanks to its inherent factors, this lab belongs in an ecosystem that permits and requires network externalities, as well as social and ethical awareness. Working on socially contradictory fields, such as Artificial Intelligence technologies, makes *responsiveness* to technological, environmental changes and societal demands relevant for the studied lab. Furthermore, other important dimensions are *openness and transparency* since in research and innovation ecosystems everything must be based on openness and collaboration, and everything must be straightforward and put on the table.

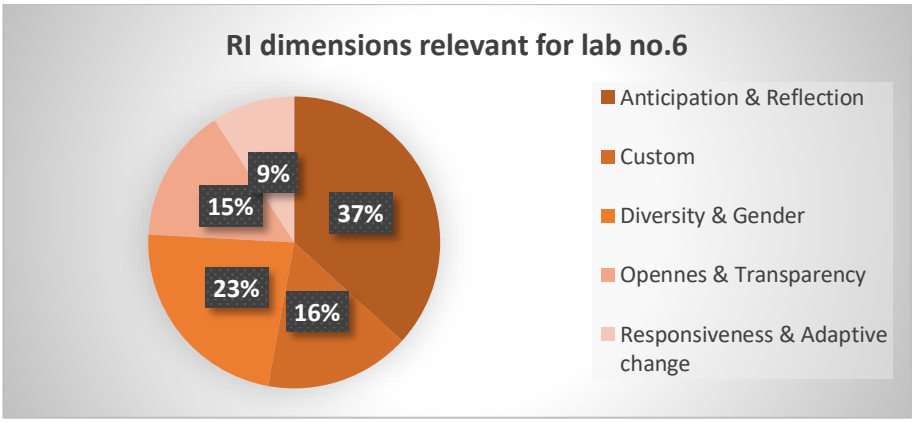

Figure 6 Relevant RI dimensions for lab no.6

Moving on, Lab no.7 is a research performing organisation that focuses on high-technological solutions and wants to raise awareness and implement RI values in its functioning. The lab representative emphasised the importance of *anticipation* and *reflexivity*. They, as a lab, firmly believe that society needs to change and they want to promote this change through their work. Towards achieving that they try to embed moral values in their research and innovation process, while also listening carefully to the needs and societal values. More specifically, regarding *inclusion* and diversity, it is crucial for the lab to have a diversified portfolio of stakeholders, but only if they have something concrete to offer to them. They emphasise more on quality than their number of connections. Moreover, the dimensions of *transparency* and *responsiveness* to changes are also relevant for lab no.7, since it is not possible to gain clients' trust and to promote their services, without being open and actively transparent regarding their activities, motivations, obstacles and thoughts.

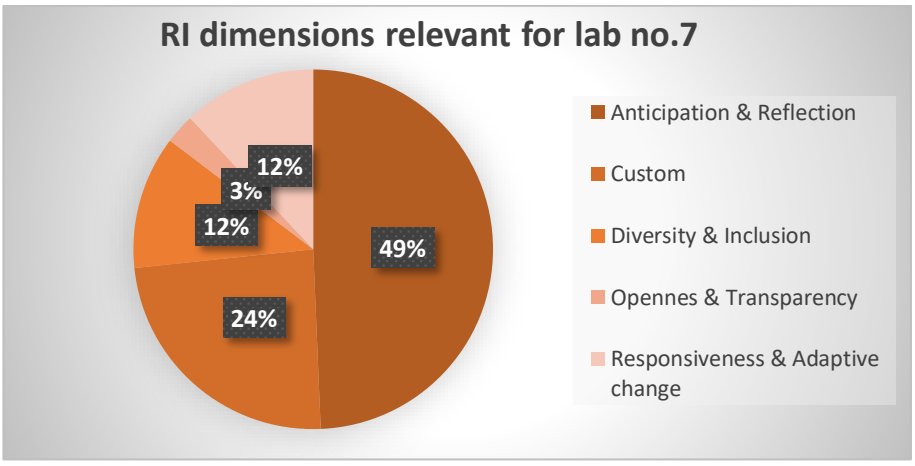

Figure 7 Relevant RI dimensions for lab no.7

Finally, lab no.8 is a research funding organisation that intends to include RI values in its selection criteria for funding projects. The lab representative emphasised the importance of *openness* and *transparency*. Due to lack of resources, they have selected to focus on the promotion of open science

policy in their funding activities, as it is an indispensable part of the funding decision cycle. Having already worked on other projects towards gender equality, diversity and *inclusion* dimension is also highly relevant for this lab. Towards achieving that, they try to change their decision-making criteria and constantly improve their guidelines in order to hamper gender-related discriminations. Although anticipation is not at the core of their activities, they always are in constant communication with other researchers to signal new and future technological trends. At this point, it is worth mentioning that representatives of lab no.8 felt the need to customise a plethora of the selected indicators, as according to them, they weren't truly reflecting the activities of a research funding organisation.

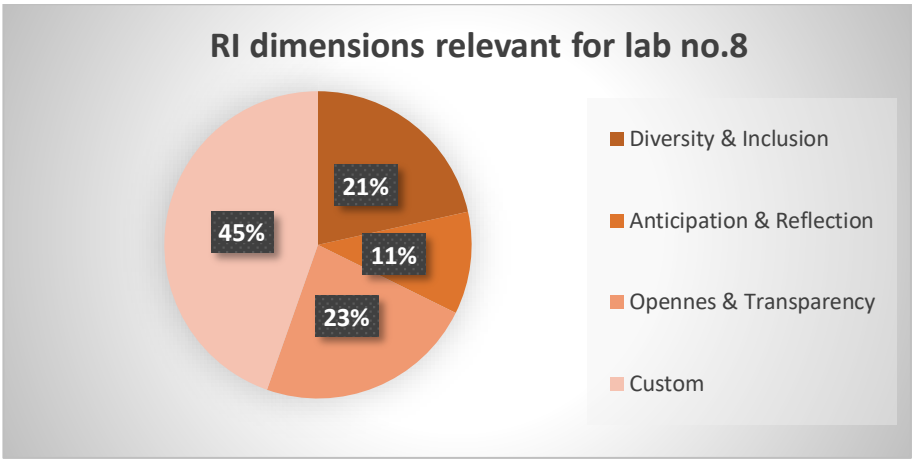

Figure 8 Relevant RI dimensions for lab no.8

Moving on to analyse more specifically the key performance indicators (product or process dimensions related), that the representatives considered more relevant to their labs the following figure 9 is presented.

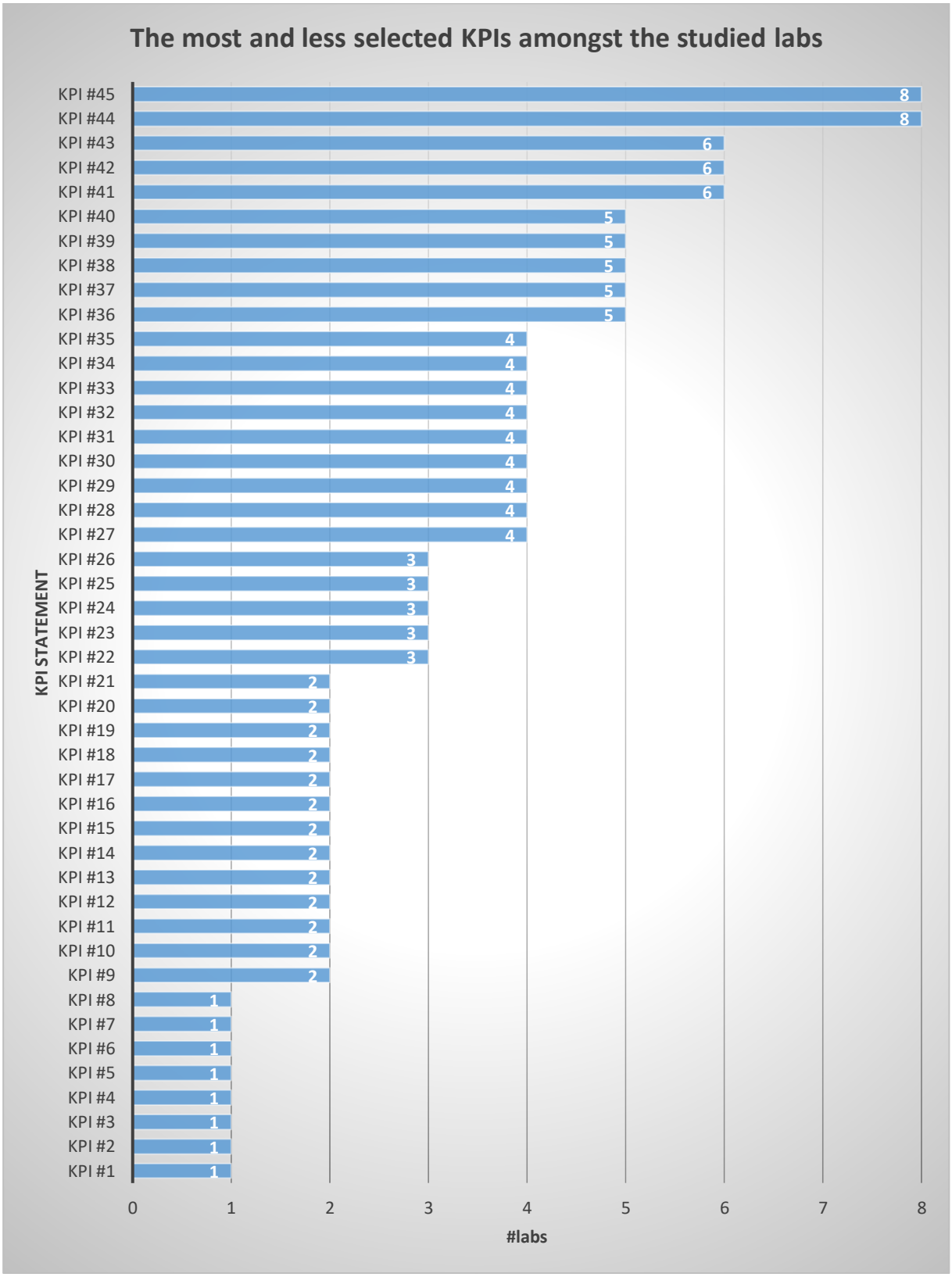

Figure 9 The most and less selected KPIs amongst the studied labs

In Table 4 the statements of each Key performance indicator are presented, with yellow indicators being process-related and green indicators being product-related.

Table 4 KPIs statements with yellow indicators being process-related and green indicators being product-related and number of times selected

#KPI	STATEMENT	Times selected
48	This project provides substantial environmental benefits to society, compared to available alternatives	0
47	There has, historically, been little public resistance against the use of the outcome of this project	0
46	The outcomes of this project can have large macro-economic effects	0
45	Societal values (privacy, safety, health, security, data ownership, etc.) are actively included in the design process of this project.	8
44	We continuously consult other researchers and research projects to signal new and future technological trends	8
43	Research/innovation activities and results are actively and transparently communicated within the research network (stakeholders) during the project	6
42	Within this project we adopt a learning approach to adapt the research programme according to the viewpoints and ideas of other stakeholders.	6
41	Within the project, we value and nourish diversity (in the broadest sense) in both research, innovation, and project management	6
40	customised indicators	5
39	This project uses institutional mechanisms for promoting the results of our R&D activities to involved stakeholder groups after these activities are finished	5
38	Within our project team we regularly organise group deliberation (employee engagement, trainings, discussions, etc.) on societal / social / public / policy aspects	5
37	Within this project we include input of end users / customers in the design and development process	5
36	Diversity allows us to better innovate and thus results in better products/services	5
35	We have assessed the alignment of stakeholder values and our product/service values	4
34	We use on-going, continuous monitoring of ethical aspects in this project	4
33	For the outcome of this project becoming widely adopted, this project requires lobbying activities in the domain of decision making and policy development	4
32	We have an official code of conduct / ethical review board that safeguards that this project can be carried out without issues	4
31	We organise science communication / education activities aimed at educating citizens and generating awareness of aspects / issues of the innovations we are working on	4
30	Within this project we include input of civil society groups / NGOs in the design and development process	4
29	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.)	4
28	Within our project we use tools and mechanisms for organizing dialogue with stakeholder on appraisal / ethical acceptability	4
27	Within the project we have equal participation of women and men in both research and project management	4
26	Our project makes use of virtual platforms for data exchange (sharing) with clients	3
25	This project uses institutional mechanisms for promoting the results of our R&D activities publicly after these activities are finished	3
24	Within this project we apply risk identification and risk management strategies to adjust the course of our project.	3
23	Within this project we include input of policy makers in the design and development process	3
22	The integration of gender dimensions is actively integrated in research and innovation outcomes	3
21	Confidentiality of methods and results is not an issue within this research and development project	2
20	The implementation of the outcomes of this project in society is not dependent on societal support	2
19	This project does not influence the ecosystem or environment in a harmful way	2
18	Environmental values are actively included in the innovation process	2
17	Initially identified risks have preventively been mitigated, leading to a better product/service	2
16	We document best practices about ethical acceptability for this type of project during its development	2
15	We have done analysis on (or have monitored) the socio-economic impact of the products/services of this project	2
14	We use on-going, continuous monitoring of socio-economical aspects in this project	2
13	Current regulation, standards, and legislative landscape for this type of project provides no problems to our project	2
12	Within this project we include input of funders / investors in the design and development process	2
11	Within this project we include input of suppliers (materials and/or knowledge) in the design and development process	2
10	Within this project we include input of possible non-users / indirect stakeholders in the design and development process	2
9	We have organisational arrangements to progressively eliminate barriers impeding women's advancement to top positions and factors inducing women to drop out of science	2
8	Our project makes use of virtual platforms for data exchange for use inside the company (e.g. laboratory notebooks, meeting minutes, etc.)	1
7	Personal data and privacy issues do not play a major role in this project, once its outcomes are used	1
6	Within this project, IP in the form of patent applications (from our side) or acquiring licenses (from others) do not play a large role	1
5	The implementation of the outcomes of this project in society are not hampered by issues of trust	1
4	This project provides substantial societal benefits, compared to available alternatives (health, safety, solidarity, equity).	1
3	This project leads to improved resource use efficiency (water, materials, energy, pollution, waste).	1
2	Societal acceptance is no major risk for this project	1
1	The outcome of this project is assessed actively using user experience tools	1

As it can be seen in figure 9 all respondents, from both research performing and research funding organisations, have indicated that the main relevant process dimensions for the research labs are the inclusion of societal values in the design processes of the projects, along with the communication with other researchers to indicate new and future technological trends. A grand majority of the studied labs (6 out of 8) also emphasises the relevance and importance of diversity in innovation, along with adopting learning approaches to adapt their research programmes taking into account other stakeholders' opinions. Additionally, transparency in research, innovation activities and their results to the research network was also considered highly relevant by the majority of both RFOs and RPOs.

Next, amongst the most selected product dimensions were those about the organisation of communication activities for educating and familiarising people with aspects of innovation and the need for lobbying activities in the decision making. On the other hand, the less selected, therefore the less considered as relevant product dimensions, were those concerning the assessment of projects' outcomes using user experience tools. Very few participants selected (25%) KPIs related to positive environmental impact, analysis of the socio-economic impact of the products/services, and mitigation of initially identified risks for their labs.

Moreover, the overall response to selecting process-related dimensions KPIs, related to intellectual property requirements, obstacles due to current regulations, or confidentiality of results was quite small (one out of eight labs for each indicator). Also, using virtual platforms for data exchange inside the company and inclusion of societal groups, such as suppliers, non-users, indirect stakeholders, funders in the research and innovation process were scarcely selected. Interestingly, indicators about gender equality and organisational arrangements towards the elimination of barriers impeding women's advancement were surprisingly scarcely selected (one-quarter of the studied labs). Furthermore, the figure also highlights that inclusion of environmental values, documentation for ethical acceptability of the projects were also hardly selected. At this point, it is worth mentioning that apart from the KPI about the inclusion of funders in the processes, none RFO addressed the aforementioned less selected KPIs.

4.4 Why do organisations opt for these dimensions specifically?

At this point it is worth recapping the studied dimensions; *Inclusion* refers to diversity and to giving the ability to every participant relevant to the projects to be represented and have their sayings heard. The T*ransparency & Openness* dimension revolves around being actively open and communicative about the activities, challenges and interests around the innovations or the projects. *Reflexivity* calls attention to a reflection on underlying assumptions, motivations and limited knowledge of participants. *Anticipation* considers taking care and thinking ahead, while also foreseeing potential impacts of the outcomes. Finally, *Responsiveness* invokes the ability to adjust to future changes and to be adaptive. All respondents have indicated that the reasoning behind choosing dimensions was not based on a systematic framework, but their primordial selection criteria were to opt for those that they found most applicable and most suitable for having more impact on their activities based on the current states of their labs and their ideas of improvement.

Several labs had already collaborated on other projects around responsible research and innovation, so the main reasoning behind their choices was to choose those that they found more important, in terms of social and ethical aspects for the H2020 co-Change project. Another approach of thinking was to opt for those that seemed more relevant to their specific activities. For example, Lab no.3, which is a research funding organisation, opted for the KPIs that were more applicable to funding activities. An additional reason behind choosing indicators, especially for the labs that value diversity and inclusion quite high, was to opt for those regarding the inclusion of diverse societal groups either in the decision-making process since all parties need to be involved in responsible innovation processes. Finally, a further reason for lab representatives' choices was their intention to give a concrete picture of their commitments to their goals and to measure their objectives as an organisation. It must be mentioned that the interviewees tried to be objective about their lab's performances but the factor of personal perception is always present in this kind of semi-structured interviews or self-administered questionnaires.

The most crucial and relevant dimensions for most of the respondents are *inclusion, anticipation* and *transparency.* Fair inclusion of representatives from diverse groups is emphasised by most of the respondents since they intend to take into account different perspectives from their network. Although *anticipation* is not always directly mentioned by respondents as a core aspect of innovation processes, it is yet considered as an important dimension towards assessing the impacts of socially acceptable projects. Regarding *reflection*, most respondents have indicated that keeping in mind all ethical considerations, moral and social values are of primordial importance towards a more

responsible innovation. Finally, it is worth mentioning that several labs added customised KPIs since they considered that there weren't enough KPIs applicable for commercial labs or research organisations that belong to larger ecosystems, or that the existing ones were not focusing on how funders operate.

In general, a summary of the key universal findings, for all labs' perception of RI dimensions and their relevance to their performance, is attempted. To begin with, the *inclusion* of diverse stakeholders and gender equality is crucial to have a balance of interests in the innovation process. However, it is not always the main goal since the quality of connections is more important than quantity. Moreover, due to lack of resources regarding funds and time, diverse inclusion of participants from all the social groups cannot always be achieved, resulting most of the time in under-representation of end-users, since it is difficult to actively include them in the innovation process.

Transparency is also considered of primordial importance since research and innovation integrity must be secured to have a strong position in the market. Sharing information, assumptions, and motivations is key for achieving common goals and shaping the expectations of all the involved stakeholders. The role of information is important to shape expectations of the process. However, although it is desired it cannot always be fully achieved in fear of competitors stealing high-end ideas related to cutting-edge technologies and projects.

According to all interviewees, in the innovation process, the environmental and social impacts must be taken into account. Thus, the dimension of *anticipation* is crucial for assessing potential risks and problems and for evaluating the desirability and the acceptance of each new project. For all the studied labs, it is a highly relevant and desirable aspect in the innovation process, that often is at a theoretical level and needs to be institutionalised.

Reflexivity is important, but to a smaller extent. For all the labs, it is essential taking into account the moral and social values and reflecting on their activities. However, it is conceived as the vaguest, ill-defined, complex, and confusing dimension for them. It is often interconnected with inclusion, anticipation, and responsiveness and even professionals are often not used to the term. It is difficult most of the time to be fully objective and put their assumptions, motivations and interests on the side. Although people are willing to incorporate the reflexivity dimension in their activities, they are still at an infant stage of actively thinking and evaluating their experiences, their interests, their challenges and how their roles affect them.

Responsiveness operates as a point of reference for the labs towards addressing technological developments and societal concerns. For all the labs, it is important to be able to respond not only throughout the process but also after each product/outcome is published. Having an active dialogue with society and possessing feedback mechanisms is important for capturing new values and needs and for promoting actual organisational, societal and behavioural change.

4.5 Evaluation of KPIs' scores over time

The research question that this study aims to answer is "**How effective is the use of Key Performance Indicators for Responsible Innovation in driving organisational change?"**. In this subchapter, the effectiveness of using the logic of KPI assessment in driving the perception of organisational change is evaluated.

To recap, this research is three-folded. Firstly, a workshop where the participants selected the KPIs that they considered relevant for them, clustered and weighed them took place in January 2021. Then the second phase of this research took place from mid-April 2021 to mid-August 2021 and included participants' evaluations of their selected KPIs. More specifically, they were asked to measure their KPIs over time to assess if any institutional change was perceived, using a Likert scale from 1 to 5, 1 being *strongly disagree* and 5 being *strongly agree with* the statements of KPIs for their organisations' performance. Two waves of measures were taken; firstly, at the beginning of May 2021 and subsequently, at mid-August 2021. The third phase of this research consisted of interviews that were conducted in the middle of the second phase as an intervention point for clarifications and feedback about their experience.

An individual assessment about the perception of institutional change according to its representatives, as well as an overall insight about the effectiveness of KPIs' assessment for capturing and boosting this organisational change within the research organisations is presented. For each lab, the bar graphs (Figures 10-18) show the selected KPIs for them and the average score the representatives gave evaluating to what extent their performance strongly disagrees (score = 1) or strongly agrees (score = 5) with the statements of the key performance indicators. The scores for the first and second round are represented with the dark blue and the light orange lines, respectively. Observing the graphs there are some small, incremental changes, which is understandable given that actual organisational change is a process that requires a lot of time and takes place gradually (Greenwood et al., 2002).

4.5.1 Comparison between 1st and 2nd round of KPI's assessment for Lab no.1

This bar graph (Figure 10) illustrates the average scores given by representatives from Lab no.1 to assess the Key Performance Indicators they had selected as more applicable to their organisation in terms of responsible innovation practices, as part of the Horizon 2020 co-Change project. For the participants from Lab no.1, the most relevant KPIs for their organisation were fourteen and two people, one lab manager and one external person filled in the questionnaire survey.

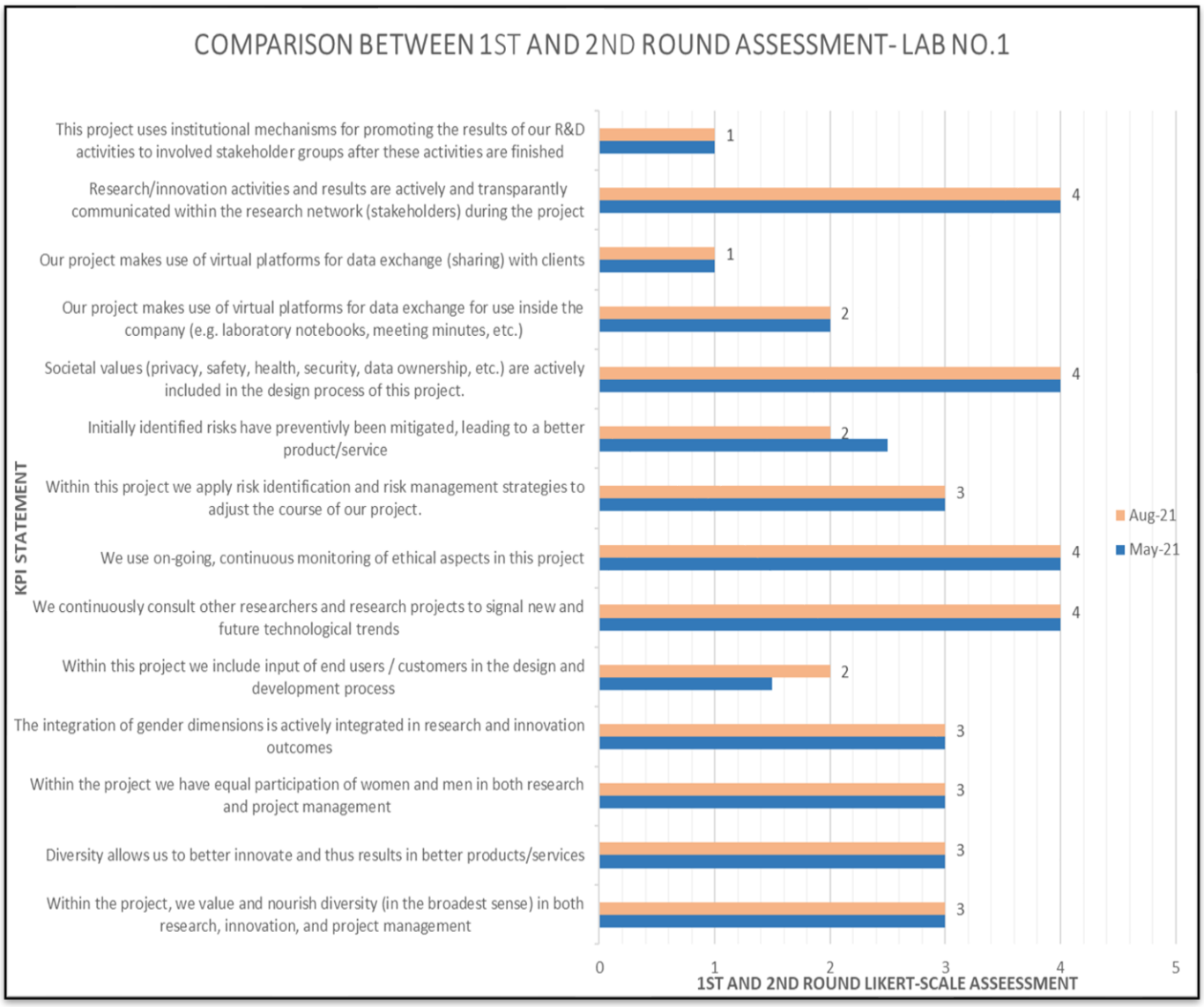

Figure 10 Comparison between 1st and 2nd round KPI's assessment Lab no.1

Overall, the scores have remained the same throughout these four months from early May until the end-August, given that actual organisational change is a time-consuming process (Greenwood et al., 2002). Moreover, one difference that can be observed is that the involvement of end-users and consumers is somewhat higher in the design and development process, as seen in Figure 10. According to the input from the lab representative, inclusion of diverse stakeholders is essential for Lab no.1. The

initial score regarding the participation of end-users was low since it is difficult for them to participate at the time being, as the lab is more focusing on research-funders. However, there is a discussion about including them in the processes, which can explain the slight increase observed in the second evaluation.

On the other hand, there was a slight decrease in the indicator regarding mitigation of initially identified risks. Again, according to the interviewee's input, the identification of possible adverse effects and risks is at a high level within the lab. However, it is not deeply addressed to mitigate these risks and understand them at their roots, mainly because of lack of time. This could explain the slightly decreased score in the second round of evaluation. Furthermore, there is always the factor of human subjectivity in this kind of assessment.

Overall, the feedback from lab no.1, for this project was positive, in spite of being initially approached with some scepticism about its purpose. However, in the course of it, thanks to the discussions and interaction with representatives from different fields, (e.g., developers and ethical researchers) it became a helpful exercise for the lab. As for their recommendations for improving the logic behind the KPIs assessment, they suggested better explaining and providing examples for what each value and dimension mean. It would be helpful, since dimensions' interpretation might be subjective, depending on someone's background.

4.5.2 Comparison between 1st and 2nd round of KPI's assessment for Lab no.2

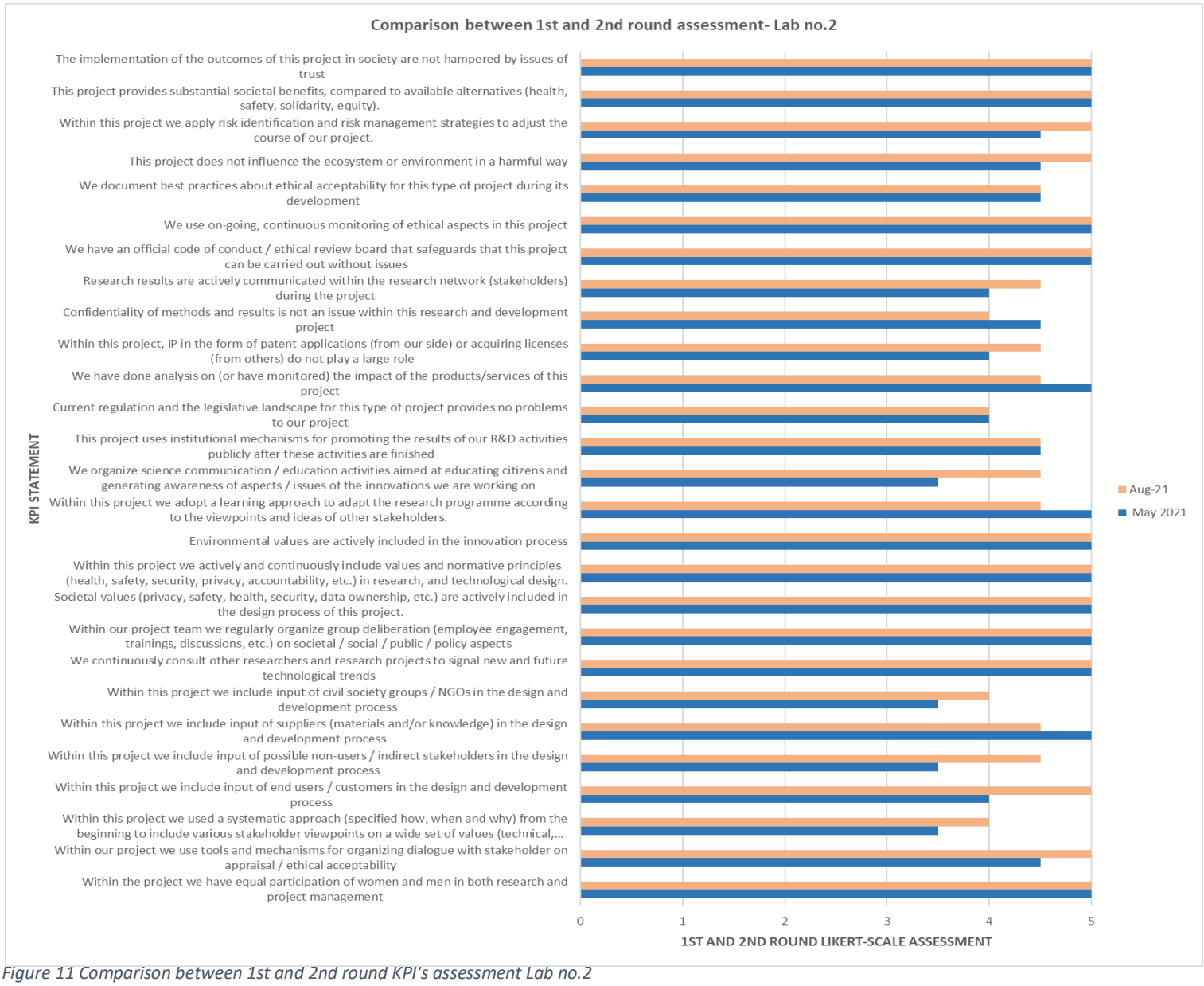

Figure 11 Comparison between 1st and 2nd round KPI's assessment Lab no.2

Figure 11 shows the average scores given by the lab manager and one external person of Lab no.2 to assess the twenty-seven most relevant KPIs for their organisation. Overall, for this lab, the scores have not significantly changed throughout this 4-month period. However, for ten indicators there was an increase of up to one unit. These indicators are about including various stakeholders systematically in the development process, organising activities for educating citizens, promoting results publicly, not having a bad environmental impact and applying risk identification and management strategies. This increase is supported by the interviewee's input about the importance of considering environmental impact, the health and safety, and sensitizing all stakeholders about these aspects since they are developing new materials or chemical products. On the other hand, there was a slight decrease for four indicators, about the confidentiality of methods, inclusion of suppliers and impacts' monitoring

which might be a result of human subjectivity, or of a better re-evaluation of their current stage about the first assessment where they had given the highest score.

Overall, the feedback from Lab no.2 was that this project was very useful for them. Thanks to it, the organisation is able to better address some general concepts and their approaches to specific research projects. However, their recommendation for improving this analysis is that it should be done in two different steps. More specifically, firstly, a broad picture of the current situation of the studied organisation should be given. Then, a second evaluation specifically addressed to each company, or each project could be done since several aspects covered by the studied indicators are context-dependent and project-related. As the representative mentioned, "if you go very deep at the beginning, it is very difficult for the companies to understand the utility, the help that also this study can give to the companies to improve their activities and to understand their approach in social and ethical aspects''.

4.5.3 Comparison between 1st and 2nd round of KPI's assessment for Lab no.3

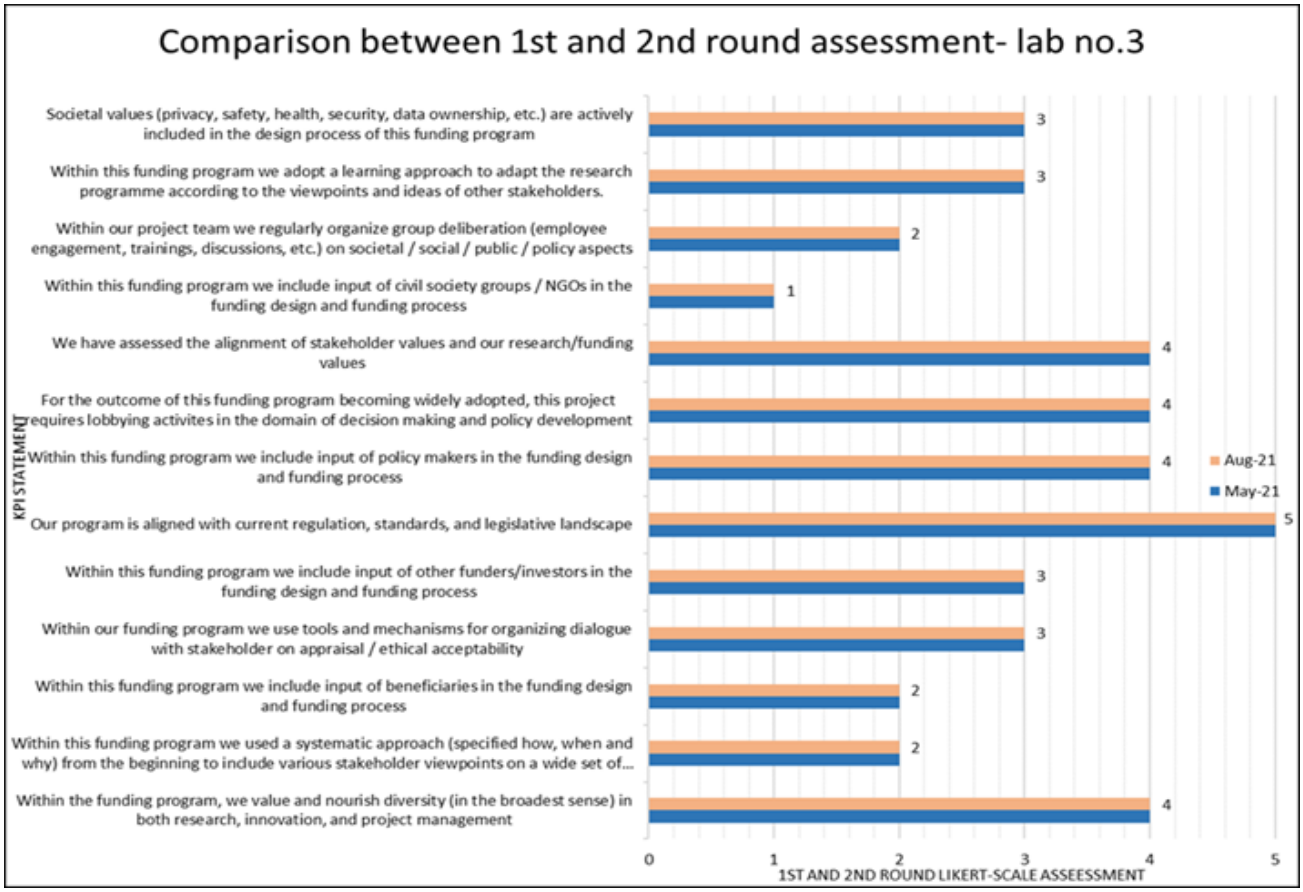

Figure 12 Comparison between 1st and 2nd round KPI's assessment Lab no.3

This bar graph demonstrates the average scores given by representatives from Lab no.3 to assess the Key Performance Indicators they had selected as more relevant for them. For the participants from Lab no.3, the most relevant KPIs for their organisation were thirteen and only the lab manager was able to fill in the sent questionnaire survey.

Overall, for this lab, the scores have remained the same throughout these 4-months, as seen in Figure 12. As the representative pointed out not many things have changed in the way this lab is thinking and acting towards its innovation projects. However, the lab representatives mentioned that they are in a transitional phase for implementing some big changes towards the direction of more responsible innovation practices. Thus, they expect to see a significant change in their scores for the plethora of their selected indicators.

Overall, the feedback from lab no.3, for this project was very positive. This project was valuable and ''a good work to do'', for them. As they stated, thinking constantly of all the relevant indicators to the work someone is doing is not an easy task. In order to select the most applicable indicators for them, they had to take a step back and reflect at a deep level about all the work that is done in their organisation. However, the little time provided to make the selection was, for Lab no.3's representative, the biggest problem that might have led to exclusion of relevant indicators, because of human subjectivity or misunderstandings. In this direction, the recommendation from Lab no.3 is to provide more time to the participants at the first stage of choosing and clustering indicators. Although these workshops are time-consuming, more time is needed, since not all people can decide at the same pace. As mentioned, ''On the one hand, you should be effective, but on the other hand, you should be able to provide enough time so it's always a complicated issue and some people can decide faster than the others.''

4.5.4 Comparison between 1st and 2nd round of KPI's assessment for Lab no.4

The following bar graph (figure 13) displays the average scores given by representatives from Lab no.4 to assess the Key Performance Indicators they had opted for as being more relevant for their organisation in terms of responsible innovation practices. The participants working on Lab no.4 decided that the most relevant KPIs for their organisation were twenty-three and three people; one lab manager and two external people filled in the questionnaire survey.

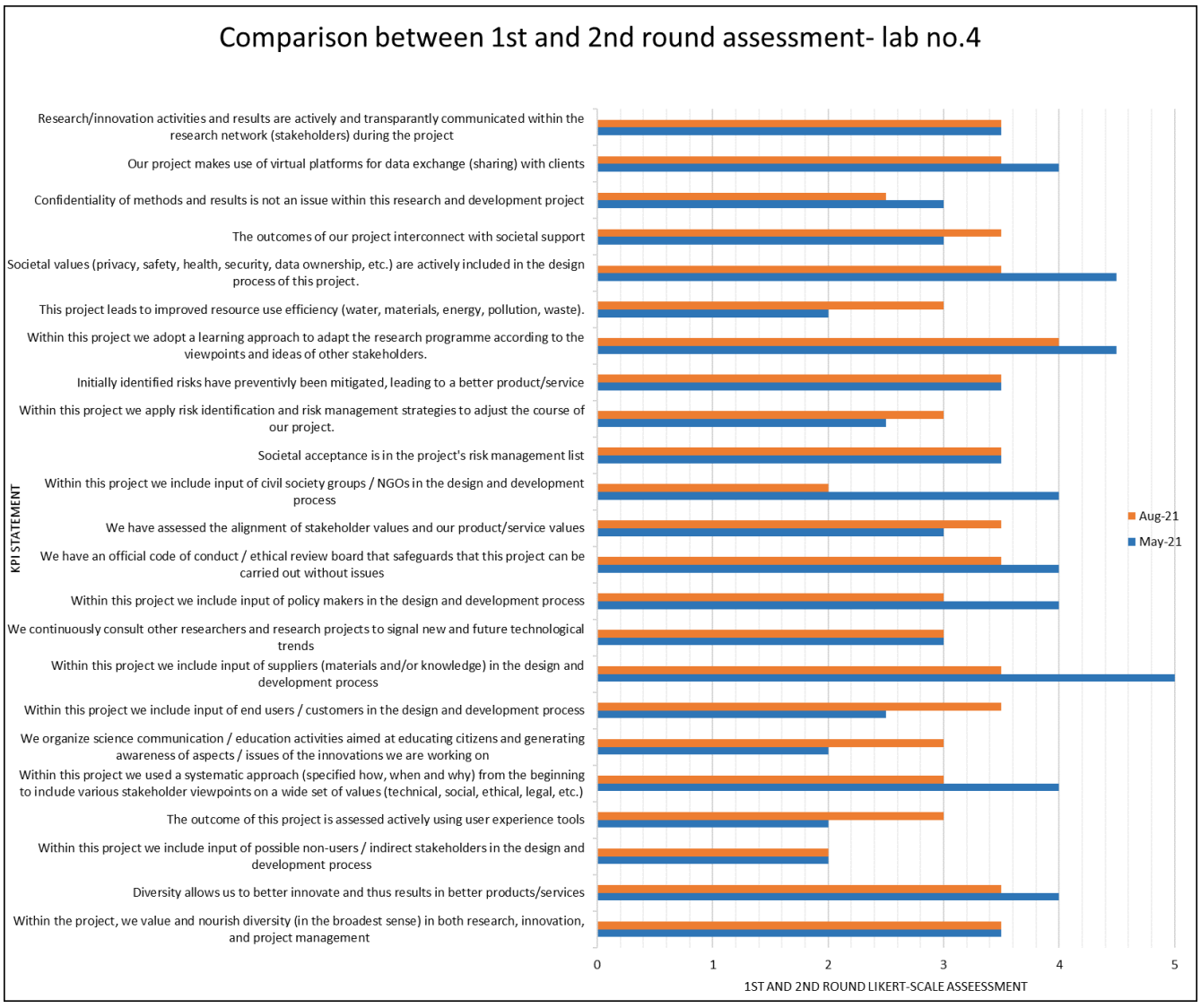

Figure 13 Comparison between 1st and 2nd round KPI's assessment Lab no.4

Overall, most of the scores have not remained the same throughout this 4-month period from early May until the end-August. More specifically, one worth-noticing finding that can be observed is the increase in seven out of the twenty-three selected indicators. These indicators are about assessing the outcomes of their projects using user experience tools, organising educational activities for familiarising the public with their projects, applying risk identification strategies and including more

end-users to their projects. This increase aligns with the interviewee's inputs about the efforts and discussions of the lab to have end-users more represented and improve their anticipatory activities. On the other hand, in ten of the indicators, there is a decrease in performance over time. The decrease relates to indicators concerning data exchange, confidentiality, and inclusion of diverse societal values, the inclusion of NGOs, policymakers and suppliers, as well as using a systematic approach for using the viewpoints of all stakeholders. At this point, it is worth mentioning the factor of human subjectivity in this kind of assessment, since the decrease in scores regarding the inclusion of diverse stakeholders contradicts the inputs from the interview and the first assessment, in which inclusion and diversity were evaluated as the most relevant for the lab. One further explanation for the results might be that the lab manager wasn't able to complete the second evaluation and one external person admitted that hadn't been in communication with the lab for a while, thus evaluating its current stage was a tricky task, implying the presence of human errors.

All in all, the feedback from Lab No.4 about this project was positive. It is considered useful and a good reflection tool. However, there were several difficulties, stemming mainly from the fact that it is a big organisation, consisting of several diverse groups, with different cultures. Therefore, it becomes difficult for the participants in the survey to generalise for everyone. To further improve this assessment, Lab No.4's representative suggested increasing the sample size, to overcome human errors that might take place due to the fact that the Likert scale used from 1-5 might be very subjective and the gap between two points e.g., from 4 to 5 might be quite marginal sometimes.

4.5.5 Comparison between 1st and 2nd round of KPI's assessment for Lab no.5

Figure 14 exhibits the average scores given by representatives from Lab no.5 to assess the Key Performance Indicators they had chosen as more applicable to their organisation. For the participants from Lab no.5, the most relevant KPIs for their organisation were fifteen and four people, one lab manager and three external people who filled in the questionnaire survey.

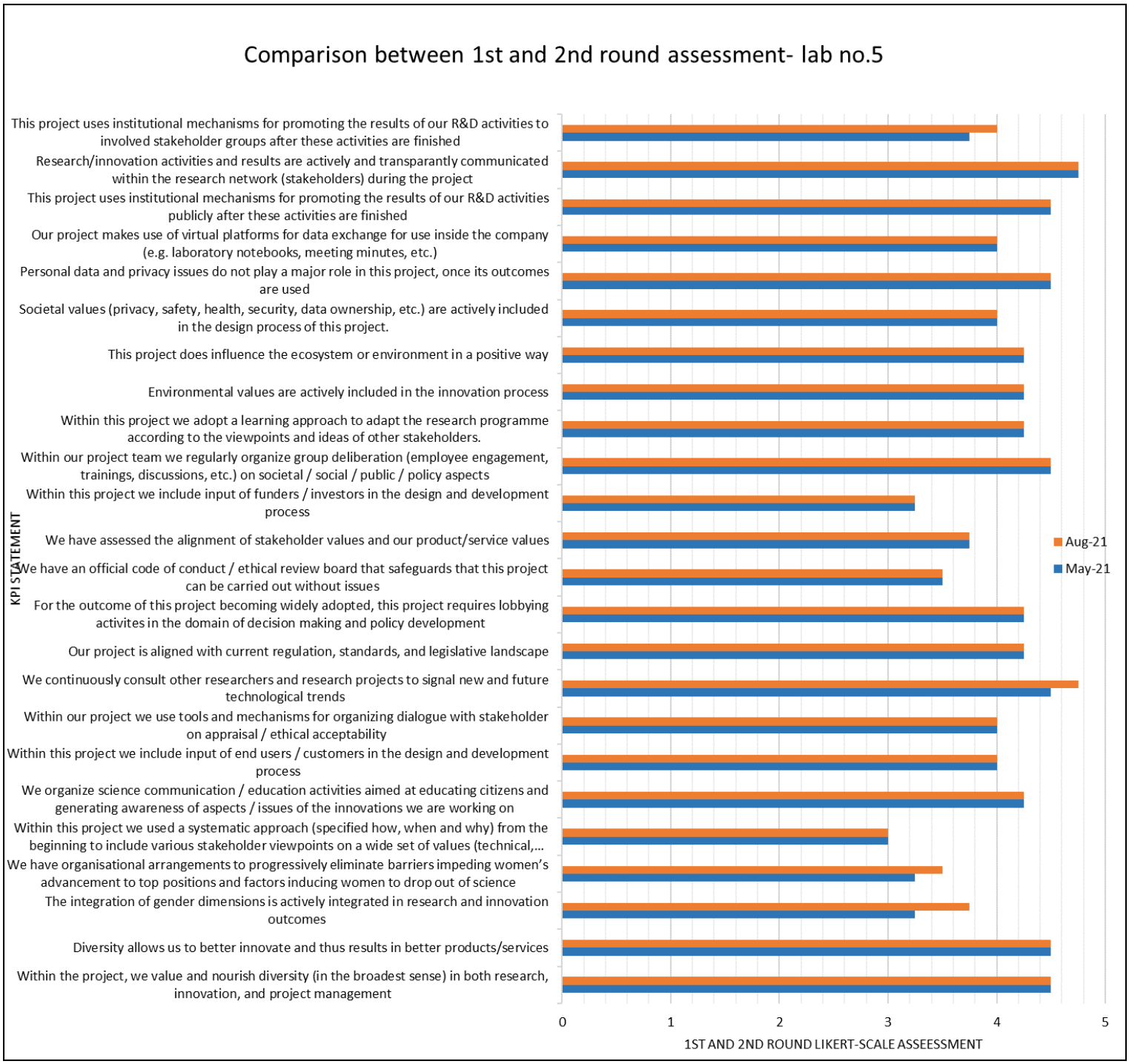

Figure 14 Comparison between 1st and 2nd round KPI's assessment Lab no.5

One difference that can be observed is the increase of four out of twenty-four indicators. The indicators with the increased scores in the comparison are about the use of institutional mechanisms for promoting results of R&D activities to involved stakeholders, the constant consultation with other researchers in order to signal new and future trends, the integration of gender dimensions and the existence of organisational arrangements for eliminating barriers that could impede women's advancement. According to the inputs from the lab representatives, the inclusion of diverse stakeholders and especially gender equality are essential for Lab no.5. However, when filling in the

first round of this survey, they were not sure about what diversity means in the context of responsible innovation. The increase could be a result of better evaluation and changes that have happened during the last months in terms of women's participation in the research process. Furthermore, transparency, as already mentioned, is a crucial dimension for them and they tend to be active in communication and consultation with everyone that is involved and willing to help. Their goal participating in this project was to make their researchers aware of responsible innovation values and to make them reflect on how to implement these aspects in their work. This is a process that takes time to show impressive results, however, the fact that this lab has the most participants that found time and were willing to fill in both the surveys as well as being interviewed increases the reliability and trustworthiness of its results. It is worth mentioning the fact that after two rounds of scores from four different people there was no decrease in any score of their indicators and a slight increase was observed in several of them.

Finally, for Lab No.5 this project was perceived as a good reflection tool. As the representatives pointed out, working with the indicators helped them become aware of how they should search for solutions to their problems, and which areas, in this case, dimensions of responsible innovation, are at a better or worse stage, thus need more improvements. There were some difficulties that they faced, due to the time pressure and the lack of having concrete answers for each of their institutions. To improve the logic behind this assessment, they suggested switching the tasks at the beginning of the workshop with the tasks of the end, giving more time available for participants to choose and evaluate how relevant the indicators are for their labs. Furthermore, they suggested having a more specific explanation of the terms used since their interpretation may differ depending on the participants' backgrounds. To quote their saying ''people from different institutions have different backgrounds and understanding of these KPIs, so if there were some kinds of additional explanation available or somebody that you can ask for clarifications that could be a really good thing''.

4.5.6 Comparison between 1st and 2nd round of KPI's assessment for Lab no.6

Figure 15 is a bar graph that illustrates the average scores given by representatives from Lab no.6 to assess the Key Performance Indicators they had found as more applicable to their organisation in terms of responsible innovation practices. As for the participants from Lab no.6, the most relevant KPIs for their organisation were twenty-one and only the lab manager was able to fill in the sent questionnaire survey. Unfortunately, for Lab no. 6, the evaluation could not be completed because of several unpredictable events. The focus of the lab that participated in the co-Change project changed ultimately, due to lack of funding and resources. Thus, a second evaluation for this lab was not valid any longer. The current activities of the lab will be re-assessed, using the same key performance indicators they had selected and the second round of evaluation will be conducted by the end of the year. However, due to time restrictions, these results will not be presented in this thesis project.

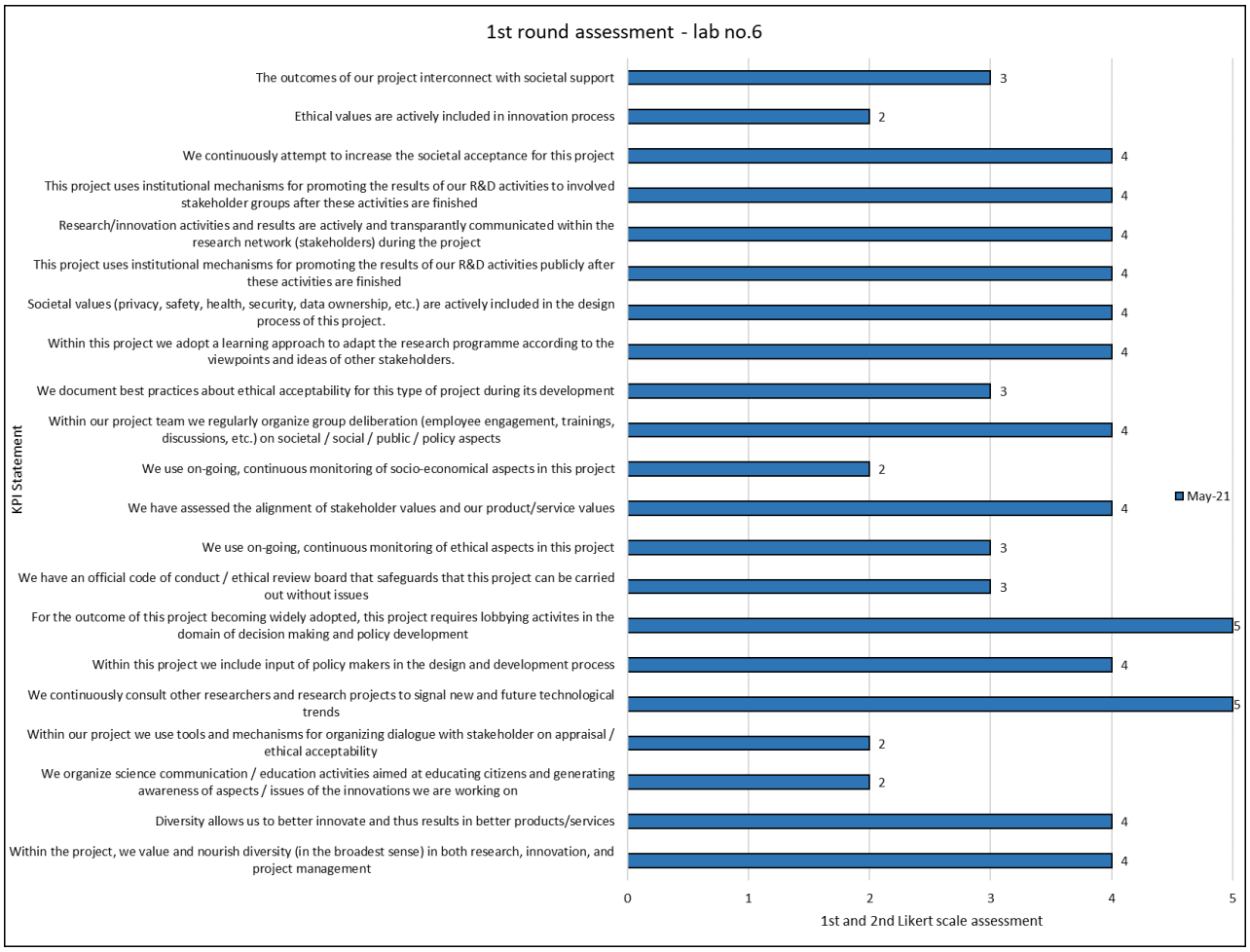

Figure 15 1st round KPI's assessment Lab no.6

On the other hand, what will be used is the feedback given from Lab No.6 about the logic of KPIs assessment for responsible innovation. For them, this project was quite helpful and was later used as a point of reference for other unrelated to co-Change project projects. The filled forms enable them to have all this reflection on the indicators together in a specific document that they can consult at any time they need it. The difficulties faced within this project was to understand the level of investigation since their lab as an ecosystem would not find all the indicators suitable for being impactful and meaningful on an ecosystem-level but more for specific project levels within an organisation. Several recommendations for future assessments would be to have more qualitative assessments since the current one with KPIs is like a hybrid of qualitative and quantitative evaluation. Also, the difference between scores and numerical evaluation in a Likert-scale ''is marginal and it's not always that straightforward'', since the difference between a 2 and 3 is not always easy to assess, but can be useful for giving a picture of the situation at the moment of investigation.

4.5.7 Comparison between 1st and 2nd round of KPI's assessment for Lab no.7

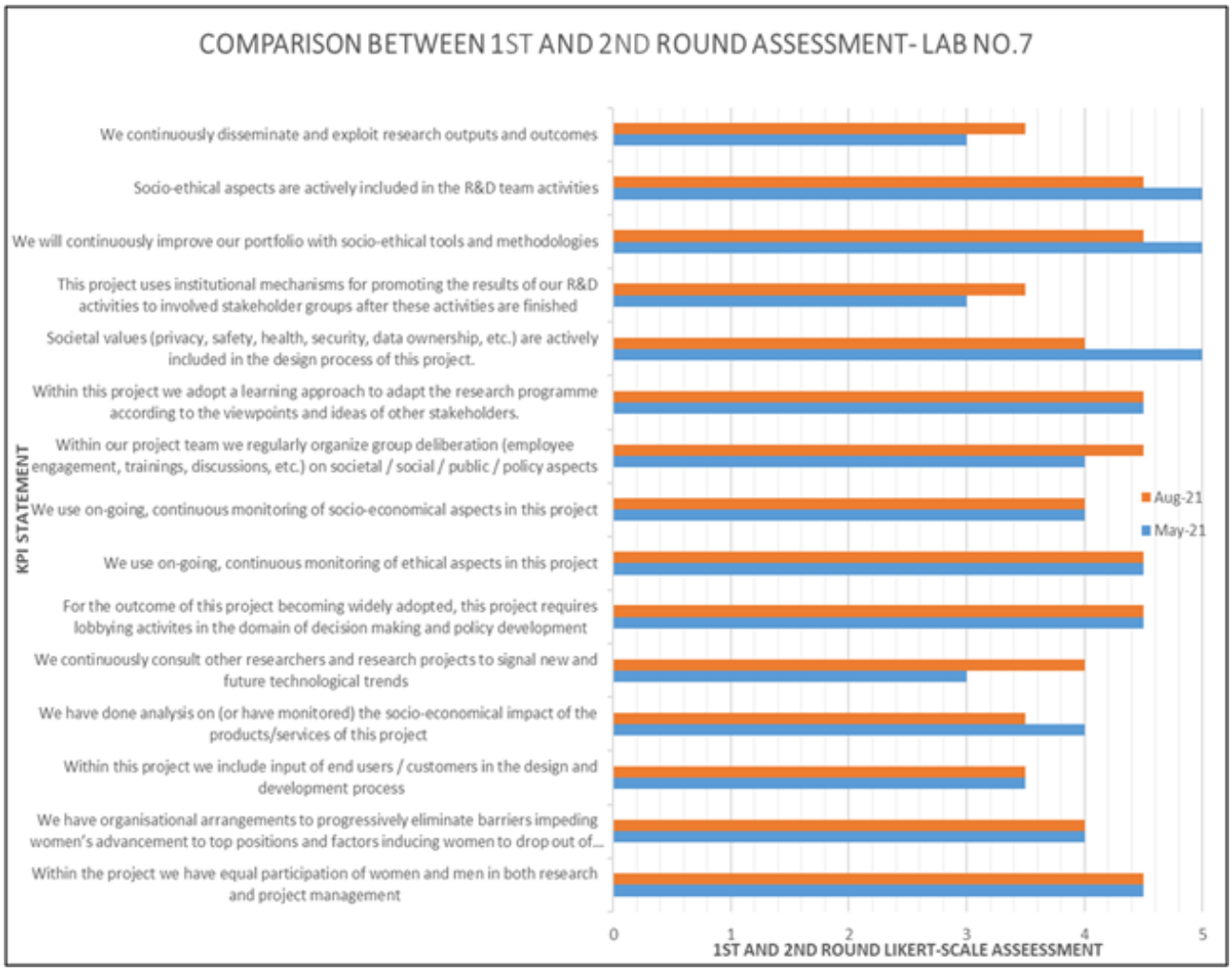

Figure 16 Comparison between 1st and 2nd round KPI's assessment Lab no.7

This bar graph (figure 16) draws a picture of the average scores given by representatives from Lab no.7 to assess their selected Key Performance Indicators as being more applicable with regards to their organisation's activities. According to the participants from Lab no.7, the most relevant KPIs for their organisation were fifteen and two people, one lab manager and one external person filled in the questionnaire survey.

Overall, there are slight differences in the scores throughout this 4-month period from early May until the end-August. Indicators focusing on learning approaches, gender equality practices and monitoring social and economic aspects of their projects have remained stable at a high level. Furthermore, the most worth-mentioning, observed differences are the increase in the continuous dissemination and exploitation of research outcomes, the use of institutional mechanisms for promoting the results of R&D activities to involved stakeholder groups, the organisation of group deliberation on social and policy aspects and the continuous consultation from other researchers to signal technological trends. According to the input from the lab representative, transparency is essential for Lab no.7. The initial score regarding the promotion of results was lower, because of misunderstanding since it is crucial for them to be transparent to all their partners in order to be successful. Also, they must be in consultation with other researchers to anticipate potential problems, to signal trends and to reflect on social issues not only as researchers but also as citizens. Moreover, they need to identify how they can adjust their needs as citizens in their research and innovation processes and outputs. Towards this direction, they are having many discussions which can explain this increase.

On the other hand, there was a slight decrease in the indicators regarding the improvement of socio-ethical aspect methodologies, the inclusion of societal values in their activities and the monitoring of socio-economic aspects. According to the interviewee's inputs, the societal values are primordial to the lab's work however the slight decrease could be a result of human subjectivity due to rush of time, or of a re-evaluation of their current stage in relation to the first round where they had given the highest score, as there is always room for improvement since more activities could be done through this direction.

All in all, for Lab no.7 this project was quite helpful since it was later used as ''a database of structured ideas'' for their project works. As it was mentioned, it helped them have a structured database of their goals and commitments for the future implementation of their ideas. Several recommendations for improving the logic of the assessment revolved around the time constraints for the different tasks that were quite challenging. Also, the fact that they had to come up with many custom-made indicators since not all of the existing ones could be applicable for them, being a more commercial organisation was a drawback for Lab no.7.

4.5.8 Comparison between 1st and 2nd round of KPI's assessment for Lab no.8

Figure 17 portrays the average scores given by representatives from Lab no.8 to assess the Key Performance Indicators they had selected as more applicable to their organisation in terms of responsible innovation practices. For the participants from Lab no.8, the most relevant KPIs for their organisation were eleven and two people, one lab manager and one external person filled in the questionnaire survey.

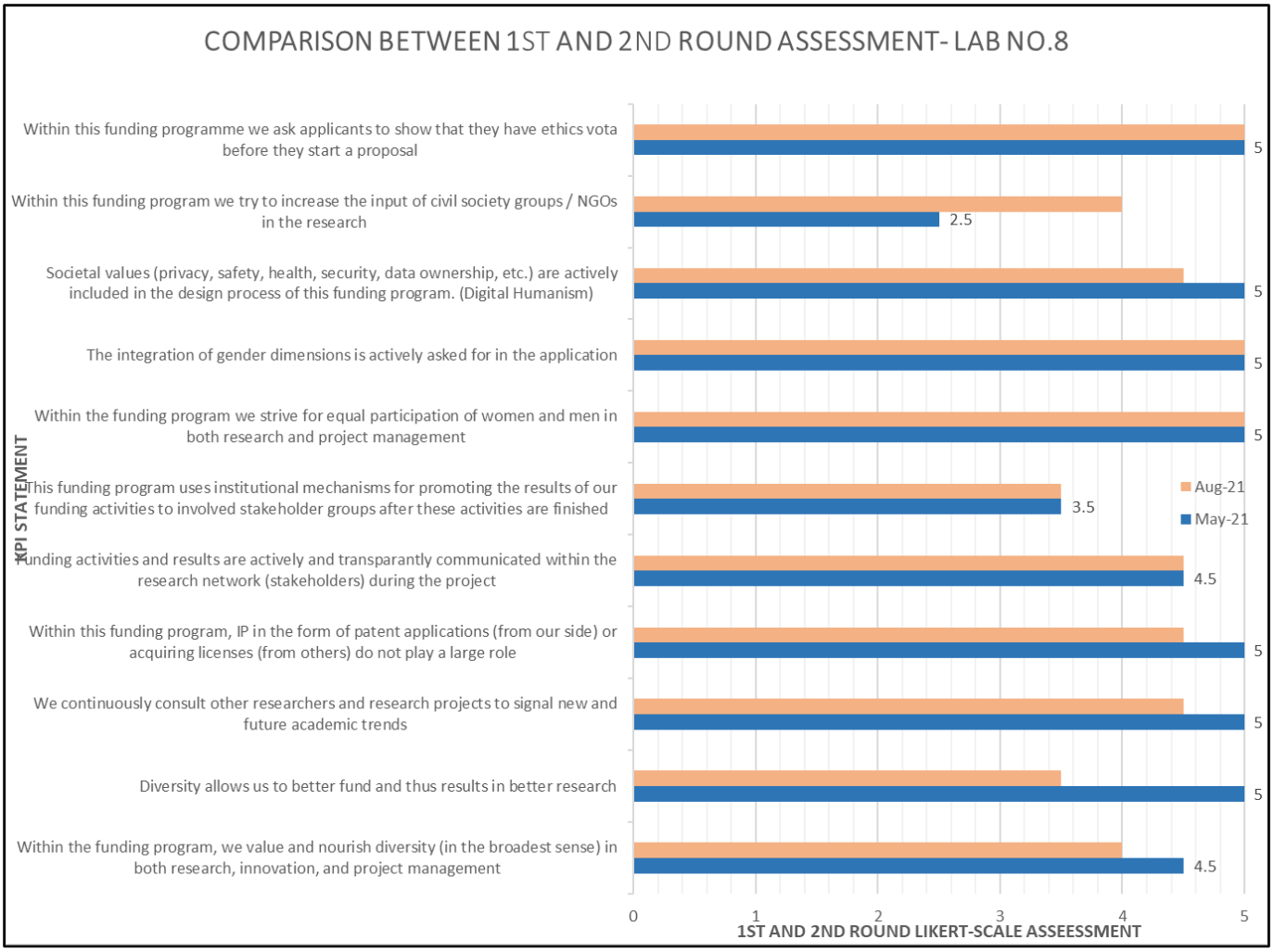

Figure 17 Comparison between 1st and 2nd round KPI's assessment Lab no.8

Overall, the scores for half of the indicators have remained the same throughout this 4-month period. Furthermore, the most significant change that can be observed in figure 18, is the increase in the score for the participation of civil society groups and non-governmental organisations in the design and development process, which was approximately doubled. According to the input from the lab representative, inclusion of diverse stakeholders is desirable for Lab no.8. However, they are a small lab with dedicated calls and scarce resources, thus the inclusion of diverse societal groups and

especially NGOs is not always at the core of their work. However, they wanted to improve that if they obtained more resources, which can explain the slight increase in the second evaluation.

On the other hand, there was a slight decrease in the indicators about the inclusion of societal values in the design process, the constant consultation with other researchers for identifying trends, and the role of intellectual properties rights for their projects. Again, according to the interviewee's input, they are in constant communication with other researchers and all their calls take into account societal values. The slight decrease could be explained by human subjectivity as the difference between 4 and 5 is marginal. Also, there was a worth-mentioning change in the importance of diversity for their performance in their funding activities. This change can be justified by having been less optimistic than the first evaluation. The representative pointed out their focus on open science and gender equality since their few resources and very specific calls don't allow them at the moment to have the most diverse stakeholders' participation. However, this dedicated approach does not influence their funding activities badly.

Overall, for Lab no.8, this project was well organised, structured, convenient and easy to follow. However, they were not sure about its usefulness for small, practically oriented labs, since the active participation in all the required tasks of the whole project required time that they could not always offer. Recommendations for improving the logic of the assessment revolved around including the workshop and KPIs evaluation from the beginning of the project, having more tailor-made solutions for each participant according to each lab's resources. Therefore, for small labs as lab no.8, it could be better to have a couple of indicators, to deal with everyone separately and to have personal discussions with the experts to better evaluate their position in terms of responsible innovation practices. Moreover, it was pointed out the representative's feeling that the role and activities of research funders were not always reflected in the existing indicators, so there was often a need to adapt most of them in order to better reflect their activities.

4.6 Cross comparison across the studied labs

Figures 18-25 show how respondents evaluated the indicators regarding each studied dimension in the two rounds of assessment on a Likert scale from 1 to 5. The scores given are on a scale from 1 to 5, with 1 being completely disagree with the indicators' statements regarding their labs' performance and 5 being completely agree. Also, a cross-comparison analysis across the labs for each dimension and how it changed over time is attempted. The aggregate measures of each dimension across the labs were calculated by summing the products of the multiplication of weights and the scores given to each indicator in the first and second rounds of assessment.

4.6.1 Anticipation & Reflexivity

Anticipation and reflexivity are two dimensions that were amongst the most relevant for the studied labs. As it can be seen in figure 18 there is a slight increase in the scores between the two rounds from May to August, with most scores being assessed at a neutral level (score=3). This aligns with the respondents' feedback about the lack of institutionalised activities regarding these dimensions within their research organisations and their complexity.

Figure 18 KPIs scores for anticipation & reflexivity across labs

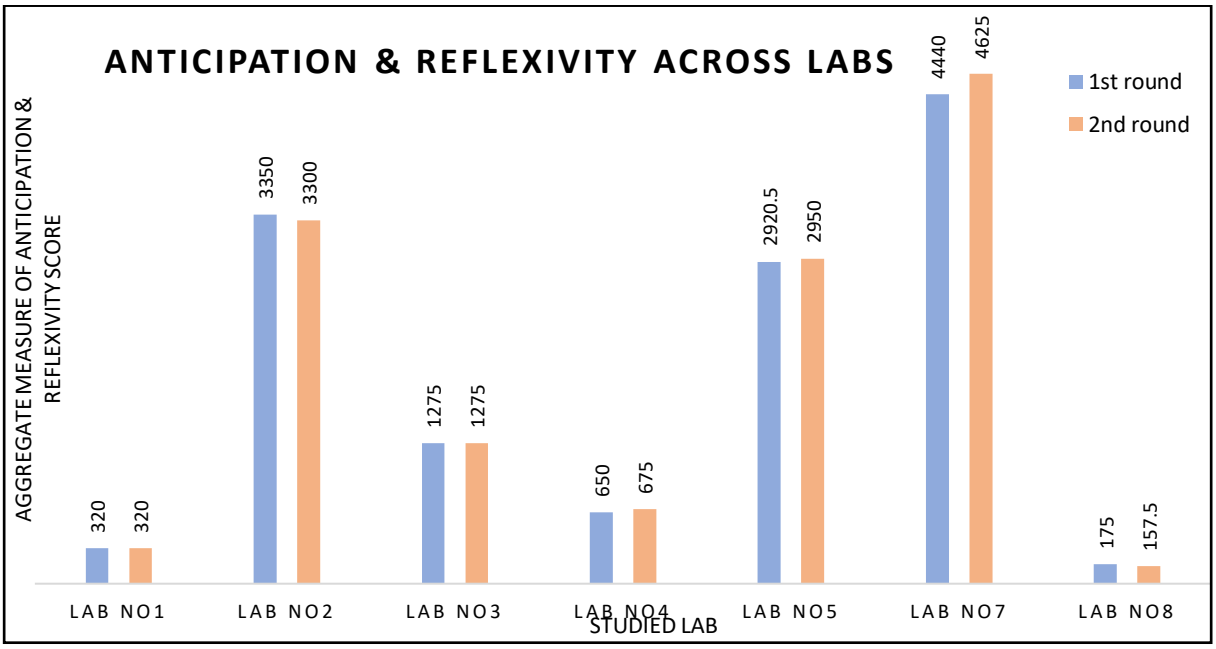

Figure 19 Aggregate measure of anticipation & reflexivity across labs for two rounds of assessment

Also, as it can be derived from figure 19 the overall scores are almost the same for both RFOs and RPOs between the studied time period, which shows the confusion of the respondents to assess the relevant indicators resulting in small changes that might not completely reflect the truth but be biased due to respondents' subjectivity.

4.6.2 Inclusion

Inclusion is one of the most relevant dimensions for the respondents, as it is crucial for them that no one's interests and points of view are neglected in the design and development of the innovation process. As it can be seen in figure 20 the scores increased between the two rounds from May to August with most indicators being assessed at a relatively high level regarding their accordance with the labs' activities. This aligns with the respondents' feedback about the primordial role of diversity and gender equality within their research organisations.

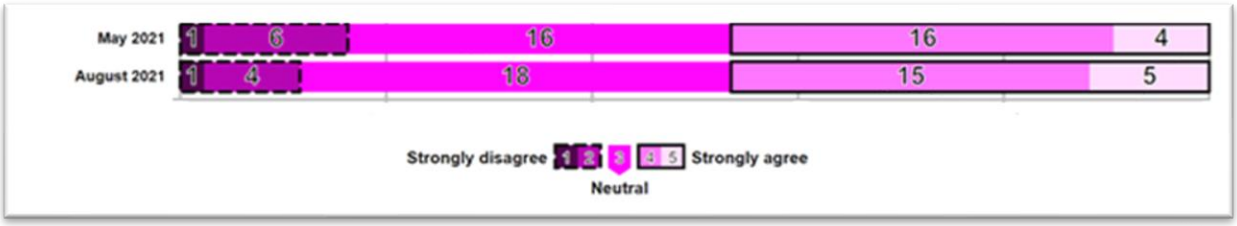

Figure 20 KPIs scores for inclusion across labs

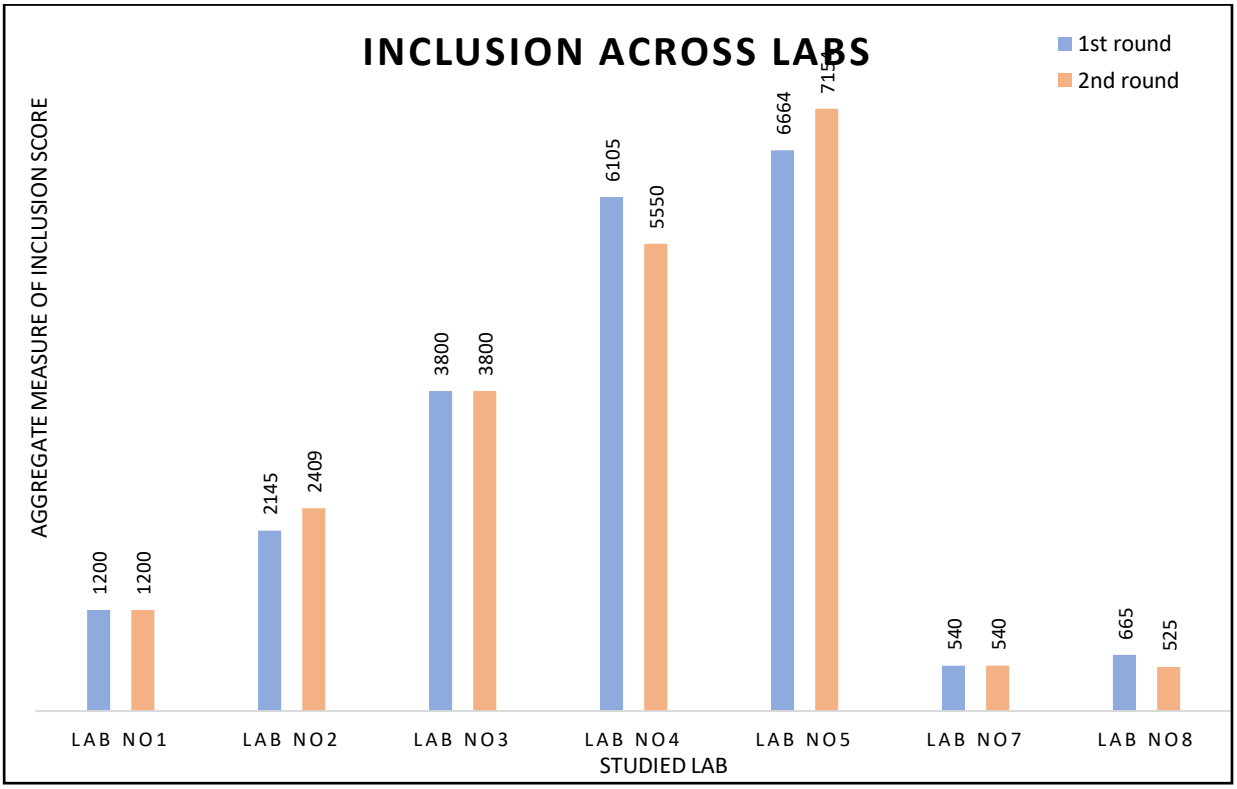

Figure 21 Aggregate measure of inclusion across labs for two rounds of assessment

Figure 21 shows that the overall scores somewhat increase for two RPOs, lab no.2 and lab no.5, in the studied time period, while in RFOs they remain the same (lab no.3 and lab no.8). Diversity was considered more or less important for every lab. However, for RFOs it is not the most essential dimension, since due to specific regulations and procedures, followed in their field of work and very specific dedicated calls they cannot always have all stakeholders represented in their decision-making processes.

4.6.3 Responsiveness

Responsiveness refers to the ability to react and to adjust to any changes. As it can be seen in figure 22 the scores increased between the two rounds of assessment with most of them being evaluated relatively high. This aligns with the respondents' feedback about the primordial role of responsiveness within their research organisations. Being responsive to societal needs and technological changes, by possessing feedback mechanisms is highly considered by the labs in order to promote actual change.

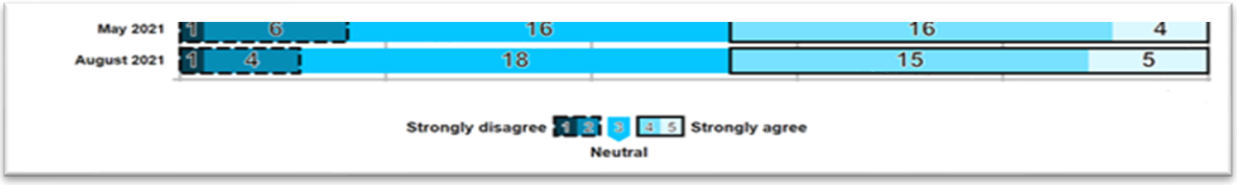

Figure 22 KPIs scores for responsiveness across labs

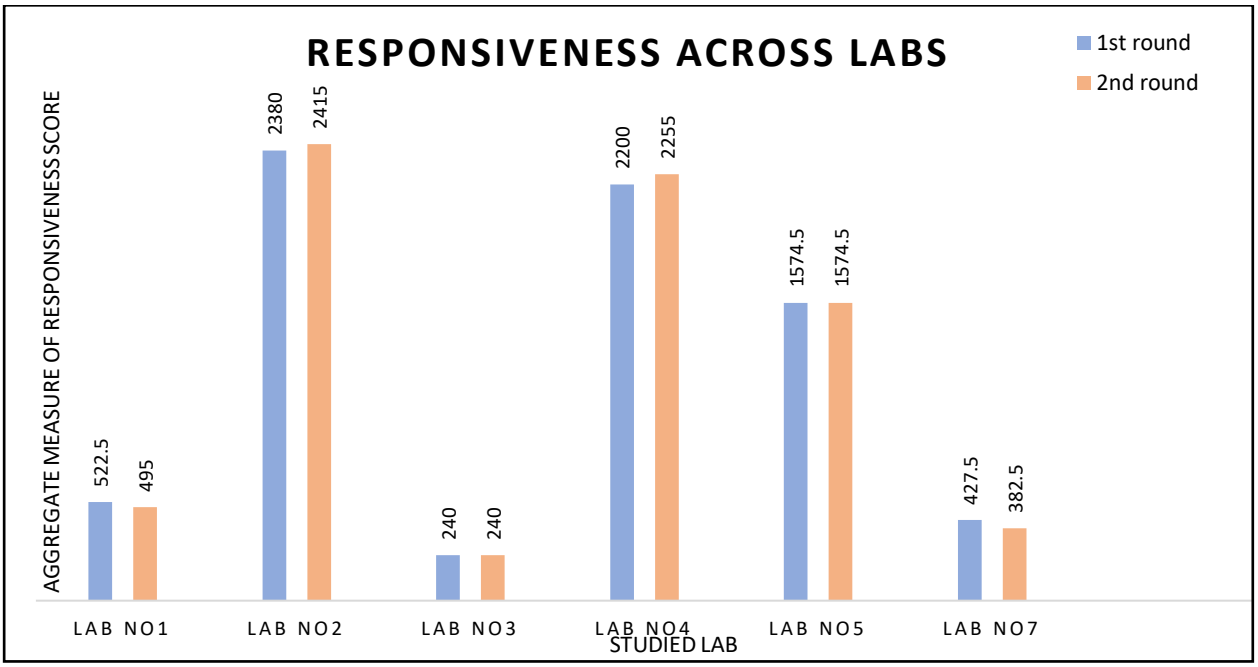

Figure 23 Aggregate measure of responsiveness across labs for two rounds of assessment

Figure 23 shows that the overall aggregate scores remained the same for both RPOs and RFOs. No matter the orientation of each studied research organisation, responsiveness is a point of reference throughout the studied period for their activities.

4.6.4 Openness & Transparency

Regarding the openness dimension, the scores did not change between the two rounds of assessment with most of them being evaluated relatively high (with a score of 4 out of 5), as can be seen in figure 24. This aligns with the respondents' feedback about the primordial role of being transparent about everything to both stakeholders and the public.

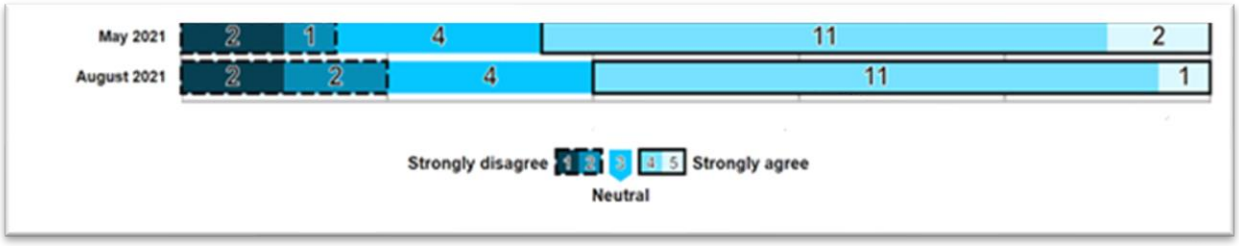

Figure 24 KPIs scores for openness & transparency across labs

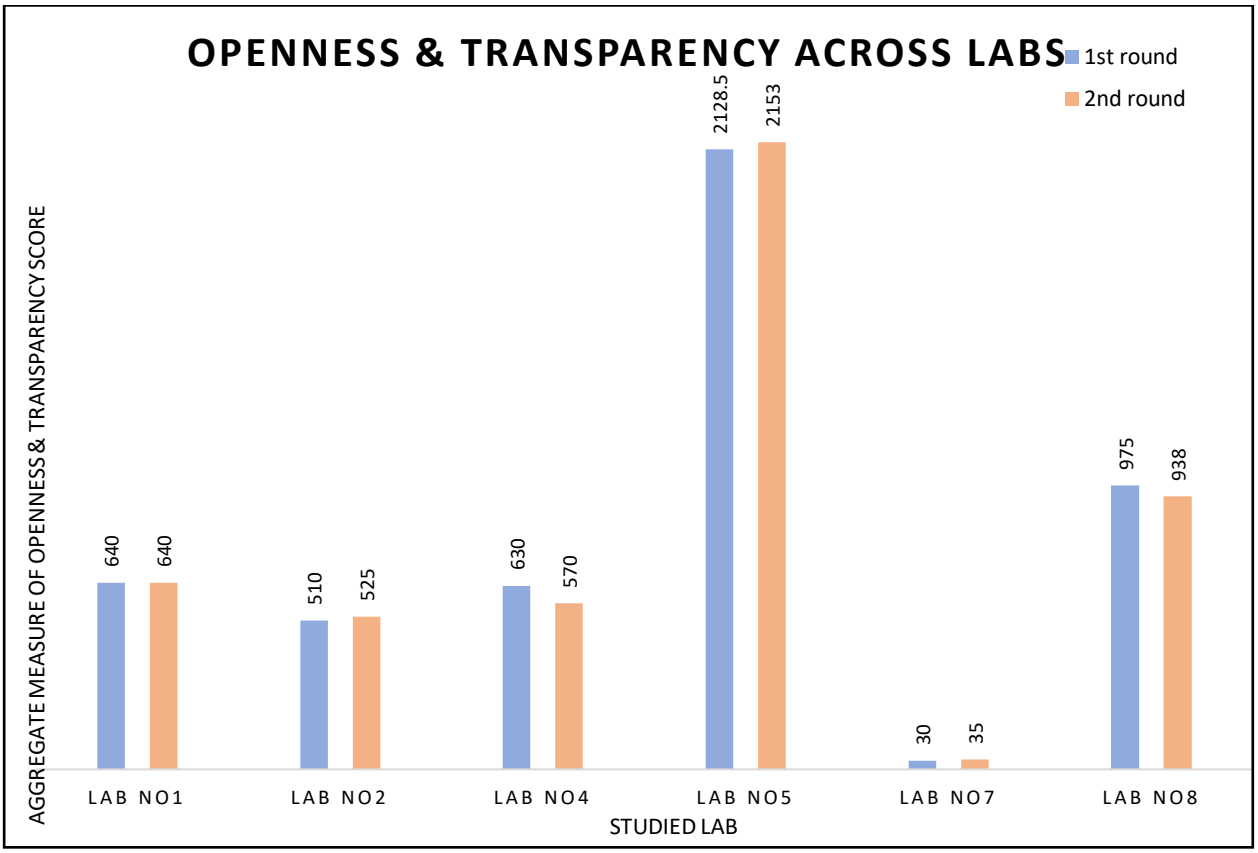

Figure 25 Aggregate measure of openness & transparency across labs for two rounds of assessment

Figure 25 shows that the overall aggregate scores remain relatively the same for both RPOs and RFOs. At this point, it is worth noticing the difficulty of being fully transparent in these highly competitive and technologically driven fields of innovation. Also, it is worth mentioning the consistency of the scores between the two rounds of assessment by different participants, with different points of view and different roles within the studied organisations.

4.7 Overall reflection on the usefulness of this KPI assessment

In conclusion, this survey aimed to assess research organisations labs' accordance with their selected KPIs in terms of responsible innovation through interviews and representatives' evaluations via self-administered questionnaires that were sent to them over time. The overall results were positive and small incremental changes seem to be perceived by the participants within their organisations' activities. Even when scores did not improve, this means that to some extent, the interview intervention and the time between the first and second assessments helped the participants to reflect on RI practices and evaluate them less optimistically. All participants found this project useful and an interesting way of reflecting on their work and their activities. There are points of improvement and recommendations for better assessment processes. Limitations of the research, and the relevance of the results with the theory of responsible innovations' concept, will be further discussed in the following section.

5. Discussion

5.1 Overview of the Discussion

This section discusses the main findings throughout this research. Analysing the interviews' transcripts, through reading them multiple times and colour coding them, the researcher's goal is to explore the current state of RI dimensions' implementation in research organisations. Furthermore, this research attempts to evaluate the usefulness of a KPI logic assessment in measuring the perception of organisational change in terms of responsible innovation. Interviews' findings along with the results of the evaluation will be discussed and interpreted according to Responsible Innovation's literature, focusing on the most widely used framework of Stilgoe et al., (2013) and relating them with the second most used framework of von Schomberg (2011). Next, a comparison with other studies' findings is presented. Finally, the limitations and contributions of this study are also discussed.

5.2 Linking the inputs from the studied labs with the theory of Responsible Innovation: Stilgoe et al. (2013) framework

5.2.1 Anticipation

Anticipation revolves around all the activities towards taking into account any future possible positive or negative outcome of the innovation and how people will act towards it (Nordmann, 2014; Stilgoe et al., 2013). For an innovation to be responsible, it needs not only to fulfil society's needs but also to preserve environmental and societal safety for present and future generations (Taebi, 2017). Innovation is a complex process and anticipation acts towards simplifying it (Lubberink et al., 2017).

A common view amongst the studied labs is that anticipation is a highly relevant and desirable aspect in the innovation process, that often remains at a theoretical level. Moreover, according to all interviewees, the environmental and social impacts of every action must be taken into account in the innovation process. As Stirling (2010) emphasises, any potentially negative impacts or risks should be acknowledged, as well any possible positive outcome should be anticipated. Towards this direction, numerous questions can be asked at the early stages of innovation, when it is less costly to make changes, while also taking into account society's needs and expectations (Stilgoe et al., 2013; Long et al., 2020). In this line of thinking, most respondents pointed out that they aim to develop a channel of

continuous communication and consultancy with other researchers or innovators to signal future technological developments or trends.

Furthermore, dealing with the development of new materials, or products, makes it crucial to look for and assess environmental impacts. Additionally, any impacts on health and safety of directly and indirectly involved people, for instance, workers, consumers, and citizens need to be considered. It is also very important to take a step back and put oneself into the shoes not only of contractors but also of end-users and possible non-users in order to see what it means for them, how they perceive it and the impact it has on the broader society. Moreover, it is crucial to consider every possible environmental, social, political and financial implications of the innovation, finding a golden mean between being responsible for now and future generations. This aligns with the notion of anticipation defining the dynamics between innovation and its surroundings (Burget et al., 2017).

On the other hand, although anticipation is considered to be essential for developing socially desirable and meaningful outcomes in most organisations it remains at a superficial level. Their main challenges are not having established, institutionalised activities for all innovation processes, as well as not using anticipatory tools. Besides, often they do not have the power position to promote anticipatory activities. For instance, if their role is acting as a neutral facilitator, which is the case for funding organisations or organisations in the field of standardisation, they have to remain neutral. Thus, forcing anticipatory activities on stakeholders or committees that come together contradicts their neutral role. However, when anticipatory activities take place during the innovation process, the co-existence of various stakeholders, with conflicting interests and opinions, becomes more effective, more robust and more beneficial for everyone in the long term (Owen & Pansera, 2019).

5.2.2 Inclusion

Inclusion is the most researched dimension of RI in the literature (Burget et al. 2017). It concerns the participation and engagement of various stakeholders in the decision-making process (Stilgoe et al., 2013). By taking into account the perspectives of all stakeholders, the wider public can be heard. More specifically, the wider public consists not only of those that are directly involved in the innovation process but also of those that are indirectly affected by it.

According to the respondents, inclusion is essential to enable stakeholders to feel comprehended and have their say heard. As said, “It is crucial in research, you cannot develop anything alone, it is always inherently there”. Thus, having various perspectives, a bigger picture of the innovation can be taken,

as Backstrand (2016), supports. Their main goal, through the inclusion of various stakeholders, is to benefit from different points of view, through open dialogues (Owen & Pansera, 2019; Stilgoe et al., 2013). Moreover, it has been pointed out that this diversity of points of view supports the openness and transparency dimension, especially when indirect stakeholders are also included. It is worth mentioning that the most important thing for the respondents is to have a diversity of stakeholders only if they have something concrete to offer them, because "quality of connections matters more than quantity".

Additionally, the *inclusion* of diverse stakeholders is essential for balancing everyone's interests in the innovation process. Most respondents pointed out that in terms of the stakeholders, in general, they intend to include them more in most stages of the innovation process. However, there is often a debate about which different kinds of stakeholders are the most suitable to be included. Therefore, diversity is a subjective perception because each person might interpret it differently (Grimpe et al., 2014). For instance, establishing policies towards gender equality and promoting organisational arrangements for eliminating barriers that prevent women from advancing and participating is at the core of few respondents' work. Most of the respondents indicated that several societal groups are often under-represented, such as NGOs or end-users. The main reasons for this exclusion are the restricted resources along with the fact that participation in the innovation process is a costly procedure. Therefore, diverse inclusion of participants from all the social groups cannot always be achieved, resulting most of the time in under-representation of end-users, which is the group that decision-makers do not easily find necessary to partake in the innovation process. This contradicts the notion of Barben et al. (2008), which focuses on the importance of engaging the public from the beginning of the innovation process. On the other hand, it aligns with the belief that the continuous involvement of society in the innovation process, without time or money constraints, is challenging (Grimpe et al., 2014).

Finally, although there is the idea that if everyone is involved in the process, then all negative impacts will be mitigated, this is not always the case. As de Saille (2015) supports, receiving feedback from end-users is essential for being more successful and legitimate. However, although feedback is beneficial for understanding how the innovation will be perceived, end-users, as well as NGOs, should not have a say in anticipatory activities, such as risk identification, as they lack the expertise and knowledge needed behind these emerging technologies.

5.2.3 Reflexivity

Reflexivity emphasises the importance of actors responsible for decision-making to be able to comprehend their roles and their perspectives' limitations or conflicts in comparison with those of the society (Stilgoe et al., 2013). Innovators are required to be aware of the effects their values system has not only on the innovation process but also on society. According to the inputs from the interviews and the selection of relevant KPIs, reflexivity is important for the labs but to a smaller extent compared to other dimensions. Although, all respondents highlight the need of taking into account the moral and social values in their work, most of them admit that they conceive it as the vaguest, complex, and more confusing dimension.

Most researchers and innovators are not used to the term and more importantly in this way of thinking and reflecting on their activities and their effects. Diving to a deeper level of looking for the roots of these effects is a challenging task. The vast majority of those interviewed agreed that the main aspects in the context of Responsible Innovation are identifying the current social situation, acting towards the social good and embedding moral and social values to the research and innovation practices. They need to reflect on the effects their values and activities have on society, as well as on how their innovations will be used if collaborating with non-democratic or military countries. This aligns with first-order reflective learning which is about taking into consideration problem definitions and evaluating solutions, measuring the impacts of the innovations, while also identifying areas of improvement (Grin & van de Graaf, 1996). However, they admit that it is difficult to be fully objective and put personal assumptions, motivations or interests aside. Besides, actively evaluating their experiences, their interests, their challenges and how their roles affect these can be often neglected due to time restrictions. Thus, second-order reflexivity, in which a "meta-reflection" is taking place, questioning current value systems and reconfiguring them and the actions around them (van de Poel & Zwart, 2017) seems challenging for the studied labs at the current stage.

It has to be mentioned that for some labs, social and moral values are at the core of their job and they try to spot new values and be attentive to any social aspect. This aligns with the notion of understanding society's interests apart from organisations' interests (Fraaije & Flipse, 2020; Taebi, 2017).

5.2.4 Responsiveness

Responsiveness is the ability to adjust the research and technological developments in response to input from inclusive, anticipatory, and reflexive activities (Stilgoe et al., 2013). It is also a reaction to any possible outcomes, technological advancements and future generations' needs. Moreover, it refers to actors' willingness to take actions in order to adapt to principles of co-responsibility (Wickson & Carew, 2014).

Responsiveness operates as a point of reference for all the labs for addressing developments and societal concerns. According to respondents, there are three types of responsiveness. Firstly, there is the initiation of innovation which responds to current needs. Secondly, there is responsiveness throughout the process where the knowledge and inputs of all relevant stakeholders are taken into account in order to achieve the desired result. Thirdly, there is responsiveness to environmental, technological changes or to problems that appear regarding the innovation after its publication. Finally, it was pointed out the importance of receiving feedback from society about the innovation (Kupper et al., 2015). Moreover, respondents mentioned that innovation cannot happen without having a dialogue with the society and trying to understand its needs by its perspectives. This aligns with the theory that responsiveness is not only about reacting to changes but also combining organisations' interests with society's needs (van de Poel et al., 201). It is also worth mentioning that in their answers regarding the responsiveness dimension most of the respondents often included aspects of inclusion, anticipation and reflexivity dimensions which also aligns with the notion that this dimension is a combination of inputs collected by those three dimensions. Besides, according to their opinions, responding to any new values or needs that society has, is essential for succeeding and promoting actual change.

5.2.5 Transparency & Openness

The analysed framework by Stilgoe et al. (2013) calls for four dimensions of RI; anticipation, responsiveness, reflexivity and inclusion. However, in this study, it was decided to involve the openness and transparency dimension, as it was proved by Fraaije and Flipse (2020) that it also has a major role in RI and connects to the aforementioned dimensions. Openness refers to open access and transparency in the decision-making process (Fraaije & Flipse, 2020). More specifically, all decisions, results, purposes, risks, assessment criteria and uncertainties must be available to the public and all involved stakeholders.

The openness and transparency dimension is mentioned by all respondents as relevant for their organisations. The main arguments they had were that research integrity and communication of goals and actions are essential for succeeding and staying competitive in the market (Fraaije & Flipse, 2020). As said, "if you can't prove that your research has been performed in ways that are conforming to international standards then you are pretty quickly out of the market". Furthermore, it is essential to sensitise and make aware all involved stakeholders about every aspect of the innovation projects by putting everything on the table, cultivating meaningful dialogues and creating common goals and expectations (Fraaije & Flipse, 2020). Therefore, this aligns with the notion that through transparency knowledge asymmetries get diminished and more productive debates are cultivated (Owen & Pansera, 2019), also supporting the dimension of inclusion and diversity. Besides, apart from inclusion, the reflexivity dimension is supported by open dialogues and questioning of the researcher's limitations (Wynne, 2011). However, most of the respondents indicated that although full transparency is desirable it cannot always be possible due to limitations for protecting intellectual property rights against competitors or in political processes, such as standardisation. What was suggested is making several processes more confidential allowing the decision-makers and stakeholders to share their thoughts and personal interests. In this case, the scholars suggest that innovators should be transparent about their potential limitations (Kupper et al., 2015).

5.3 Relation of the findings with von Schomberg's (2011) framework of Responsible Innovation

Having a particular framework to analyse the findings is useful in the context of a thesis project due to time restrictions. In this study, Stilgoe's et al. framework of RI is selected since it is the most used in the literature. However, at this point, it is essential to approach the findings from a wider angle and connect them with the second most known framework of von Schomberg's (2011). In Stilgoe's et al. framework there is an emphasis on the need for caring for the future generations through present innovation, while in von Schomberg's framework (2011), the values guiding innovation must be known from the early stages of the innovation process and RI must fit them in specific contexts. Those contexts are; *ethics, science education, public engagement, gender, open access* and *governance*.

As summarised by Gianni (2020), *ethics* revolve around the need of doing the right thing, respecting and integrating moral and ethical values into all stages of the innovation process. *Science education* entails the democratisation of science making it available to the public and diminishing the knowledge asymmetries between innovators and other stakeholders. Through proper education, the objective is

to make society comprehend scientific data and be eager to accept innovations without fear and conspiracy theories. *Public engagement* revolves around the joint participation of all societal groups in the innovation process. It also acts as a way of democratising science and is the equivalent of the inclusion dimension of Stilgoe et al. (2013). *Gender* stems from the public engagement key and emphasises the need for equality and for diminishing social or gender discrimination among the participants in the innovation process. *Open access* refers to providing access to results of research and innovation to everyone and is the equivalent of the transparency dimension by Fraaije and Flipse (2020). Finally, *governance* expresses the need for the development of RI tools that integrate all the aforementioned keys by policymakers.

Moving on an attempt to relate the findings of this study with the 6 keys of the European Union framework is presented. The first keys that were extensively discussed are *public engagement* and *gender*. Fair and equal participation of diverse societal groups in the innovation process were emphasised by most of the respondents. It is crucial in their goal for having a wide stakeholders' network, without discriminations, to assess various perspectives regarding their activities. The following KPIs support this key "Within the project we have equal participation of women and men in both research and project management'', "Within the project, we value and nourish diversity (in the broadest sense) in both research, innovation, and project management"

Furthermore, as for *science education* and *open access*, they highlighted the essence of having research integrity, being transparent, and putting everything on the table. Even when due to limitations they cannot be fully transparent about their processes that might be confidential, the results must be fully accessible to everyone. As for *science education*, it was pointed out that the role of information is important to shape expectations of the innovations. Several of the most selected KPIs aligning with this key is regarding "education activities for generating awareness of aspects of the innovations" and "Research/innovation activities and results are actively and transparently communicated within the research network (stakeholders) during the project"

Regarding *ethics,* it is at the core of their work to have socially acceptable projects. Keeping in mind all ethical considerations, moral and social values are crucial according to all interviewees. Reflecting on their activities, their limitations and their impacts on society are essential, but still at an infant level. It is difficult to be fully objective and put their interests aside. Several KPIs supporting this key area: "We have an official code of conduct / ethical review board that safeguards that this project can be carried out without issues", "our project team we regularly organise group deliberation (employee engagement, training, discussions, etc.) on societal/social / public / policy aspects"

Finally, the last key of *governance* is referred to, as adequate actions of policy-makers for linking all other keys. The relevant KPIs were about "requirement of lobbying activities regarding policy development", and inclusion of policymakers was selected by a few of the respondents which means that the current policies are conceived as a barrier for most of the organisations to actively include RI practices in their work.

5.4 Comparison with previous studies

At this point, the findings of this study are compared with those of other studies developing and evaluating RI's implementation. A study focusing on 13 Scandinavian small and medium enterprises (SMEs) by Halme and Korpela's (2014), found that deliberation and inclusion of diverse stakeholders are inconsistent and vague about how and which stakeholders should be engaged in the innovation process. This aligns with the findings of this study, in which end-users and NGOs are often under-represented. Also, another study (Gurzawska, 2021) emphasises the importance of quantitative key performance indicators in measuring organisational performance and their activities' impact. These indicators are crucial for understanding the impact that businesses have. However, it is difficult to identify which KPIs should be taken into consideration, especially in the context of RI. This also aligns with the findings of this research, in which interviewees pointed out that opting for their relevant indicators was a tricky task since not all of them apply to specific contexts, e.g., commercial labs or organisations that belong to large ecosystems.

5.5 Reflection on findings and institutional theory

The institutional theory addresses how social structures are created and established as rules for social behaviour. Lately, scholars also focus on how stable organisational arrangements gradually tend to be replaced by new models (Weerakody, et al., 2009). As pointed out by the interviewees, researchers need to be aware of their obligations and roles and to think ahead, by having institutionalised activities established within their organisations. Moreover, for an organisation to be institutionalised, it is crucial to take into account its relevant stakeholders (Selznick, 1996; Maguire et al., 2004). This also aligns with the findings of this study, as they need to see their innovations from different perspectives and act more responsibly.

In this study, participants' feedback permitted insight into details that would have been unnoticed if only quantitative methods were used (Dacin et al., 2002). As mentioned by the interviewees, identifying the failing parts of existing norms and practices, while also introducing new, more

responsible ones is essential for initiating and promoting change. Thus, new norms and practices can gradually become institutionalised.

As already mentioned, the mechanisms of institutional isomorphic change are coercive, mimetic and normative (DiMaggio & Powell, 1983). Coercive isomorphism emerges from political influence. Mimetic isomorphism results from copying successful forms. Normative isomorphism revolves around achieving and gradually conforming to certain norms and expectations. This study emphasises normative isomorphism in terms of RI. Organisations need to voluntarily internalise their values in their highly technologically driven fields of innovation. As it comes out from the findings, although several organisations take into account societal values such as safety and sustainability in their decision-making, this barely touches upon what RI could offer to them. Through the KPIs assessment and the interviews intervention of this study, they admit to become more able to measure their performance and assess their behavioural changes.

It is worth noticing how organisational diversity affects organisational behaviour (Kondra & Hinnings, 1998). All respondents pointed out that conforming to institutional norms increases their organisations' survival and success chances (DiMaggio & Powell, 1983). Finally, being in communication with other researchers and RI experts, they get knowledge and increase their absorptive capacity by adopting strategies of other similar organisations to become more responsible.

5.6 Limitations of the research

Each research has its limitations. At this point, it is important to mention the limitations this study has, to evaluate the validity of its results. First of all, a limitation of this study is the sample of the research. Eight European research organisations, all having democratic regimes, participating in the EU Horizon 2020 co-Change project, were studied, resulting in comparable findings, but not highly generalisable in non-European or non-democratic countries. Furthermore, another limitation relates to the process of data collection. Due to the Covid-19 restriction and the participation of labs from five countries in this study, online interviews and surveys were conducted. This method has several drawbacks being more impersonal and not fully forming trustful relationships. Also, filling in the surveys via mail questionnaires prevents participants from asking clarifying questions if anything confuses them. To avoid this limitation clarifying questions were asked during the interviews from both sides, and guiding steps were present in the questionnaires.

Moreover, one further limitation of this research links to the abstraction of the RI concept. The limited experience of the researcher with the RI concept must be mentioned. Although an extensive literature review was performed, personal biases might have affected the interpretation of the results of the transcripts. Also, personal biases might have led to attributing the findings with wrong RI dimensions, as several of them can be overconnected, such as anticipation and reflexivity, which revolve both around critical and moral thinking. A further limitation is that the transcription was performed only by the researcher, without a second external validation.

Finally, as for participants in the study, they were all related to research organisations, having different roles in them and being more or less familiar with RI's discourse and dimensions. They had limited time to familiarise themselves with RI indicators, select, cluster them and then evaluate them at a later stage. As most respondents indicated, the lack of time was the most challenging task in the first step of selecting the most relevant indicators to them. Moreover, the RI process and product dimensions results often differ between the selection the lab managers and lab representatives made. Thus, it needs to be mentioned that not all participants were representatives of the work performed in the studied labs to the same extent. The surveys for assessing the performance of the labs concerning RI practices were filled in by lab managers and external people for increasing validity. However, not all external people are familiar with the latest current stage of the studied lab since they might not have been in communication for a while. In order to overcome this limitation, interviews were conducted with lab managers since they have an overall, more robust idea of all the practices and projects each lab works with. Clarification questions about their selection criteria were asked. However, although trying to give an objective picture of the labs' practices, the factors of personal biases are inherently there in the interviews. Finally, about the dynamic aspect of the study, identifying the relevant dimensions and indicators for the organisations does not assure that they are actively implemented in the company at the current stage, but could always be biased on the participants' point of view. However, it provides an image that cannot be generalised by could be transferable to another similar research.

5.6 Contribution of the research

5.6.1 Academic contributions

This study is one of the first attempts to explore the RI dimensions in the empiric context of research performing and research funding organisations. It aims to show to what extent process and product dimensions are practically institutionalised (Burget et al., 2017). The literature could gain more insight from this study in how the main current responsible innovation framework of Stilgoe et al. (2013), is perceived in a research organisations' context. This framework considers RI as a procedural process that complies with anticipation, reflexivity, responsiveness and inclusiveness. Moreover, this study adds to it transparency and openness as a core dimension, as proposed by Fraaije and Flipse (2020). Additionally, it provides necessary insights for the development of policies to foster the organisational institutionalisation of RI, by identifying which RI dimensions are often neglected or misconceived. More specifically, reflexivity and anticipation seem to be the most challenging for most respondents as they are not used to thinking in this way. According to the participants' inputs, in order to make anticipation and reflexivity more accessible for researchers robust and institutionalised practices need to be established and institutionalised within organisations. Thus, employing specific systematic procedures to follow and having committees that they could consult might help them think in the direction of the anticipation and reflexivity dimensions of RI.

Also, it is worth mentioning that the participants were able to customise indicators, permitting the researcher to derive new insight about how their perspectives complement the current state of the studied framework. The result of their custom-made indicators indicates that they included more KPIs regarding activities about societal acceptance, ethics and communication of outcomes. This study is further research into the lack of assessing RI's institutionalisation in organisations, as Owen et al. (2021) suggests, by studying to what extent eight European research performing and research funding organisations implement RI in their activities. This study could be a starting point for future research in boosting and evaluating RI in research organisations or companies operating in other fields.

Finally, it analyses the challenges that labs have to overcome to implement RI with lack of awareness, and time and resources' scarcity being the main difficulties. Several scholars remain relatively sceptical if companies can benefit from RI (Blok and Lemmens, 2015; Nordmann, 2014; de Hoop et al., 2016). Their main doubts concern conflicting interests and information asymmetries between innovators within businesses, at the expense of society's interests (Wiarda et al., 2021). From the participants' input, it comes out that implementation of RI in their practices is essential for educating end-users and the public about their innovations, especially in complex, contradictory fields of research such as

Artificial Intelligence. Also, total transparency is not always achievable due to intellectual property rights and trying to keep a competitive advantage (Kupper et al., 2015; Blok and Lemmens, 2015). Although respondents indicate the difficulties in being fully transparent, due to non-disclosure agreements or IP protections, they highlight that unless they put everything on the table, at least every interest, goal and limitation of research and innovation, their outputs cannot be successful.

5.6.2 Practical contributions

More practically oriented, it should be mentioned that this study is one of the few that attempts to measure the organisational change regarding responsible innovation practices, as it is perceived by the participants in European research organisations. Introducing interviews and surveys for eight research organisations' labs, the logic of assessing the activities of an organisation via using Key performance Indicators could be a valuable and useful approach for researchers. More specifically, the labs participating in this study, and the co-Change project, deploy it through gaining learning experience that can eventually result in actual organisational change. Being in communication with other companies, experts in the field of RI and through getting aware about RI's dimensions via the workshop activities, they can increase their absorptive capacity and transform the knowledge they get to actual activities inside their labs. Furthermore, through all the activities they participated in, they accumulated a systematic procedure that can be used not only for measuring their performance but also for reflecting on what can be improved. Also, discussion and dialogue within the organisations are generated, focusing not only on avoiding harm to the society but also on trying to do good to it (Doorn & Nihlén Fahlquist, 2010).

Moreover, it was also shown how organisations can deploy KPIs to implement RI. More specifically, all participants found the KPIs assessment helpful and an interesting way of reflecting on their work and their activities and as a point of reference for their commitments and goals in other projects. Therefore, this study helps the companies to reflect on their activities and have an overall picture of their current stage regarding RI implementation on their work.

6. Conclusions & Recommendations

This research aimed to seek an answer to the question: "How effective is the use of Key Performance Indicators for Responsible Innovation in driving organisational change?" Towards answering this question, a mixed method of qualitative and quantitative research was conducted based on Stilgoe's et al. (2013) framework about Responsible Innovation. This descriptive longitudinal study aims to answer the research question by analysing eight case studies, through literature review, semi-structured interviews and mail questionnaires. These cases are eight research (performing or funding) organisations that are part of the H2020 Co-Change project that aims to boost changes in organisational behaviour. For answering this main research question, three research sub-questions were examined and their key findings are presented below.

6.1 Key findings

"What RI process and product dimensions are relevant for organisations?"

Stilgoe et al. (2013) built on four dimensions, anticipation, reflexivity, inclusion and responsiveness, creating a platform for discussing the concept of Responsible Innovation. Lately, scholars in the field of RI have additionally focused on the dimension of openness and transparency (Owen & Pansera, 2019; Fraaije & Flipse, 2020). Respondents from both research performing and research funding organisations have indicated that the main process dimensions that are relevant for their labs are diversity, transparency and inclusion of societal values in the design processes of the projects. Moreover, it was highlighted how essential communication is with other researchers to indicate new and future technological trends. The most selected product dimensions were those about the organisation of communication activities for educating and familiarising people with aspects of innovation and the need for lobbying activities in the decision and policymaking for making innovation outcomes successfully adopted.

Overall, according to the labs' inputs for the five studied dimensions; the dimension of anticipation is crucial for assessing potential risks and for evaluating the desirability and the acceptance of each new project. However, it is still at a theoretical level and needs to be institutionalised. As for the inclusion of diverse stakeholders from various societal groups, everyone needs to participate in the innovation process. However, due to a lack of resources regarding funds and time, it cannot always be achieved, resulting most of the time in the under-representation of end-users or customers. Transparency is also considered essential since innovation integrity must be secured to hold a strong position in the market.

However, it cannot always be fully achieved, due to high competition in the field of cutting-edge technologies. Moreover, although reflexivity is essential for taking into account the moral and social values and reflecting on their activities, it is conceived as the most confusing dimension. Finally, responsiveness operates as a point of reference for the labs for being able to respond to needs not only throughout the process but also after each product/outcome is published. Also, it is worth mentioning that several labs added customised KPIs that they found more applicable for commercial labs or larger ecosystems or their specific activities.

"Why do organisations opt for these dimensions specifically?"

The answer to this question was based on the inputs from semi-structured interviews with lab managers and lab representatives. These interviews focused on gaining insight for having an overall picture of what is happening in each lab. According to the findings of the eight cases; all respondents have indicated that the reasoning behind choosing dimensions was not based on a systematic framework. Their primordial selection criteria were to opt for those that they found most applicable and most relevant to the current states of their labs and activities, along with their intention to give a concrete picture of their commitments to their goals and to measure their objectives. More specifically, the indicators that each lab chose were those better explaining their activities, their commitments and sometimes their goals. They opted for what they found more intrinsic and more directly implemented at their current states, according to their resources and orientation. Finally, they tried to select indicators and to add custom ones that give a concrete picture of what they find more important and easy to apply within their organisations in order to be responsible, while staying successful and competitive in the market.

"How useful was the use of KPIs in capturing perception of institutional change in the organisations?"

This question was answered based on the representatives' evaluations via self-administered questionnaires that were sent to them over time and on their feedback given in the interviews. The overall results were positive and small incremental changes were found to be perceived by the participants within their organisations' activities. Even if scores did not improve, it can be argued that to some extent, the interventions and the time between the first and second assessments helped the

participants to reflect on RI practices and re-evaluate them less optimistically. This project was characterised as a useful and interesting way of reflecting on labs' work and activities. Points of improvement and recommendations for better assessment processes, focused on the available time they had to select indicators.

"How effective is the use of Key Performance Indicators for Responsible Innovation in driving organisational change?"

To answer this main research question, the inputs from the eight case studies and the answers to the research sub-questions were analysed. The findings on how effective this logic of assessment of KPIs for Responsible Innovation was in boosting changes, as perceived by their people in the studied organisations, were compared to reach an overall conclusion. According to the findings of this research, the labs participating in this study benefited from it in various ways. First of all, incremental changes were observed for the majority of the cases, as a result of gaining learning experience through the workshops and the communication with other labs and experts in the field of RI. Moreover, they accumulated a systematic procedure that can be used not only for measuring their performance but also for reflecting on what can be improved in their labs. More specifically, according to the given feedback for the usefulness of KPIs assessment, it is emphasised that it can be used as a useful and easy way of reflecting on researchers' and innovators' activities. Moreover, it can act as a point of reference for keeping track of their commitments and goals, while also being used in other projects. Therefore, the use of RI Key Performance Indicators enables reflection on researchers' work, discussion and adoption of practices that can eventually result in actual organisational change.

On the other hand, it is worth mentioning the downsides and the challenges of KPIs assessment. The main challenges participants faced revolved around the lack of time given for selecting their relevant indicators, as well as the time that the various assessments required throughout the project. Moreover, the lack of specific context-related indicators and the vagueness of some dimensions were also drawbacks of this assessment that resulted in misinterpretations.

Overall, it can be argued that there is a tension between the goal of having a standardised assessment and the intention of making a change. Raising awareness and making researchers reflect on Responsible Innovation's practices and values through the use of KPIs can eventually become more effective than what can be derived by simply looking at formal assessments, leading to more positive and responsible organisational behaviour.

6.2 Recommendations for further research

This study is one of the first attempts to explore the RI dimensions in the empiric context of research organisations. However, some aspects could be further researched. First of all, future research in research organisations and also organisations in other industrial sectors that innovate could be studied and introduced to the KPIs assessment of measuring to what extent their activities align with the Responsible Innovation concept. More specifically, this study emphasised research organisations that mainly innovate in the standardisation, consultancy, autonomous systems and AI sectors. More study in how the work of research organisations operating in the health, medicine and food sector aligns with RI concepts is essential since breakthrough innovation, immediately affecting all people and the environment, emerges at a high rate, raising a lot of criticism and debate around it. Moreover, longer periods might be needed to show bigger changes in organisations' RI performance. Thus, studies that evaluate the organisational change in a more prolonged period (six months or a year) could provide valuable input about the time in which actual change can take place in the context of organisations. Since this study focuses on changes as perceived by participants, future research could also investigate the actual changes of organisations. This could be done with more quantitative data collection and non-parametric statistical tests for measuring any changes. Moreover, these studies could enable innovators, researchers, and decision-makers to achieve the maximum implementation of Responsible Innovation values in their activities and their way of thinking. Finally, studies in countries outside Europe could also be beneficial for assessing the current stage of Responsible Innovation in different circumstances.

6.3 Relevance to Management of Technology

Management of Technology (MOT) master focuses on educating students to identify the needs of the market in terms of technology and to better apply the abundant technologies to organisations' needs. More specifically, the Emerging Technology-Based Innovation & Entrepreneurship specialisation focuses on emerging technologies and innovations and on how these technologies affect society, the environment and the economy. Nowadays, the pace of technological advancements, the challenging competition and the hectic time pressure results in a market that aims for more and more innovations. All organisations desire to be successful in their fields. In order to achieve that, apart from investigating internal firm-related factors, constant awareness of the societal trends and open, transparent and meaningful dialogue with stakeholders is required. That is essential for anticipating the trends of the market and catching the pulse of the society's needs in order to keep a strong competitive advantage and a strong position in the market. Understanding how to responsibly take advantage of the plethora

of novel technologies, while respecting the environment, moral values and the safety of future generations provides a strong competitive advantage for managers. Bearing responsibility is an indispensable aspect for decision-makers who get involved or control innovations. Decision-making is a complex procedure that has to balance economic, social, and ethical values. In the MOT program, the course of Responsible Innovation is linked to this work. Everyone participating in innovation, no matter how crucial its role is, can influence through his or her work the outcome of the innovation (Long et al., 2020). Thus, everyone involved should be aware of one's impact on the innovation process and act and think responsibly. Identifying potential ethical, environmental or safety implications before making a decision is a prerequisite for managers and decision-makers.

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APPENDIX A - Overview of the process and product KPIs

Table 5 An overview of the process (yellow) and product (green) KPIs provided to the participants

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	Diversity allows us to better innovate and thus results in better products/services
Within the project we have equal participation of women and men in both research and project management	The integration of gender dimensions is actively integrated in research and innovation outcomes
We have organisational arrangements to progressively eliminate barriers impeding women's advancement to top positions and factors inducing women to drop out of science	
Engagement	
Within our project we use tools and mechanisms for organizing dialogue with stakeholder on appraisal / ethical acceptability	The outcome of this project is assessed actively using user experience tools
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.)	We organise science communication / education activities aimed at educating citizens and generating awareness of aspects / issues of the innovations we are working on
Within this project we include input of end users / customers in the design and development process	
Within this project we include input of possible non-users / indirect stakeholders in the design and development process	
Within this project we include input of suppliers (materials and/or knowledge) in the design and development process	
Within this project we include input of funders / investors in the design and development process	
Within this project we include input of civil society groups / NGOs in the design and development process	
Within this project we include input of policy makers in the design and development process	

ANTICIPATION & REFLECTION	
Institutional landscape	
Current regulation, standards, and legislative landscape for this type of project provides no problems to our project	For the outcome of this project becoming widely adopted, this project requires lobbying activities in the domain of decision making and policy development
We have an official code of conduct / ethical review board that safeguards that this project can be carried out without issues	
(impact) Assessment	
We use on-going, continuous monitoring of ethical aspects in this project	We have assessed the alignment of stakeholder values and our product/service values
We use on-going, continuous monitoring of socio-economical aspects in this project	We have done analysis on (or have monitored) the socio-economic impact of the products/services of this project
We continuously consult other researchers and research projects to signal new and future technological trends	Societal acceptance is no major risk for this project
Within our project team we regularly organise group deliberation (employee engagement, trainings, discussions, etc.) on societal / social / public / policy aspects	The outcomes of this project can have large macro-economic effects
Public and ethical issues	
We document best practices about ethical acceptability for this type of project during its development	There has, historically, been little public resistance against the use of the outcome of this project

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.	Initially identified risks have preventively been mitigated, leading to a better product/service
Within this project we adopt a learning approach to adapt the research programme according to the viewpoints and ideas of other stakeholders.	
Environmental Sustainability	
Environmental values are actively included in the innovation process	This project provides substantial environmental benefits to society, compared to available alternatives
	This project leads to improved resource use efficiency (water, materials, energy, pollution, waste).
	This project does not influence the ecosystem or environment in a harmful way

Social Sustainability	
Societal values (privacy, safety, health, security, data ownership, etc.) are actively included in the design process of this project.	This project provides substantial societal benefits, compared to available alternatives (health, safety, solidarity, equity).
	The implementation of the outcomes of this project in society are not hampered by issues of trust
	The implementation of the outcomes of this project in society is not dependent on societal support
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	Personal data and privacy issues do not play a major role in this project, once its outcomes are used
Confidentiality of methods and results is not an issue within this research and development project	
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.)	This project uses institutional mechanisms for promoting the results of our R&D activities publicly after these activities are finished
Our project makes use of virtual platforms for data exchange (sharing) with clients	This project uses institutional mechanisms for promoting the results of our R&D activities to involved stakeholder groups after these activities are finished
Research/innovation activities and results are actively and transparently communicated within the research network (stakeholders) during the project	

APPENDIX B – KPI assessment Questionnaire

Table 6 KPI Assessment sample

	Please fill in to what extent you agree/disagree with the statements of the selected KPIs regarding your organisation	Likert-scale (1-5) with 1: Strongly disagree, 2:Partly disagree, 3: Neutral, 4: Partly agree, and 5: Strongly agree		
Nr.	**KPI**	**Cluster**	**1st assessment**	**2nd assessment**
1	Selected KPI #1	Cluster #1		
2	Selected KPI #2	Cluster #1		
3	Selected KPI #3	Cluster #1		
4	Selected KPI #4	Cluster #2		
5	Selected KPI #5	Cluster #2		
6	Selected KPI #6	Cluster #2		
7	Selected KPI #7	Cluster #2		
8	Selected KPI #8	Cluster #3		
9	Selected KPI #9	Cluster #3		
10	Selected KPI #10	Cluster #3		
11	Selected KPI #11	Cluster #3		
12	Selected KPI #12	Cluster #4		
13	Selected KPI #13	Cluster #4		

APPENDIX C – Transcripts

The analysis of the interviews' transcripts aims to explore the current state of RI dimensions' implementation in research organisations. Reading the transcripts multiple times, a colour coding is attempted with each colour corresponding to the studied RI dimensions, the organisations' goals and its feedback, as seen in Table 7. This coding is used to extract the most important findings for each labs' results and to retrieve a universal insight for all the labs. Furthermore, it is used for interpreting these results in combination with the two rounds of evaluation and linking them to the literature for synthesising the discussion section.

Table 7 Colour-coding for analysing the interviews

GOALS	**ANTICIPATION**
INCLUSION	**REFLEXIVITY**
RESPONSIVENESS	**TRANSPARENCY&OPENNESS**
EXPERIENCE&FEEDBACK	

Interview -Lab no.1 (28:36)

1. What does responsibility mean to your lab?

Well, the lab is on machine learning and artificial intelligence so, when we are talking about responsibility, we are talking about issues of privacy, and we are talking about issues of trustfulness, openness, transparency. So, in this lab are people that are developers and data scientists and there are people from social sciences and we are trying to cooperate in there and the more important step to begin with for the social scientists and for myself was to better understand what developers are doing when they are doing machine learning when they are engaging to machine learning technologies. And we are still learning, there is a lot to be learnt but we have gained enough understanding so we can have a meaningful dialogue, I think by now for some of the issues in other issues we still have to learn. But, on the other side, the developers have learnt a little bit about what we are interested in and I think a few of the things they have found interesting until now, let's see if we can get them interested in more.

2. **How important is responsibility for Lab no.1?**

I mean in a general way research integrity is important, because if you can't prove that your research has been performed in ways that are conforming to international standards then you are pretty quickly out of the market. As you may know, we are an exchange and research institution and most of our projects, about a third of the projects, are European projects and another third of the projects are also projects which funded by ministries, the ECT, the European commission and places like that and all of them are very internationalised so they are always looking at each other, and at the different competitors that are researching and research integrity is very important. Responsibility in the wider sense has some importance but, I think there we can go quite some way, still. So, my feeling is that many colleagues are looking for responsibility just a single step ahead, everything that is very new to them they are covering it and it's important but to go two steps, for example, to think about the effects research has also signed in. That is two steps. And I think there is not much thinking along these lines at the moment and there should be.

3. **Moving on to some more specific questions. If you remember the workshop that you participated in where you had to select from a MIRO table, several key performance indicators that were presented to you, as the most relevant for your lab. You selected fourteen (14). What was the reasoning behind choosing these specific indicators?**

Well, I was there together with one of the developers from the data science site and we simply discussed which of the indicators we thought they would be valuable based on the discussion we already had and so we chose them.

4. **Before this step you had to complete some self-reflection forms, which was also asking generally to give a score for your lab regarding different RI dimensions. According to the results of these self-reflection forms and the KPIs assessment it comes out for your that although inclusion of diverse stakeholders is crucial, score in the participation of several groups (e.g., end-users) was quite low while other groups such as funders or suppliers or non-users were not selected at all. So, how important is diversity in the participation of research processes for your lab?**

To begin with, it was very interesting I was the first one who was going through this self-assessment tool and I filled in after my understanding of the different scores. But then I was told ''what would be really interesting is to have someone else from your lab doing that'' and I again called the developer and said ''would you like to go through that with me and we discuss what you think and I 'll tell you what I have been doing and then discuss about the reasons that we have'' In a number of indicators we had pretty similar ideas we thought some could be quite important but what they would be doing in terms of machine learning probably some of the indicators would be

ignorative but in a few areas we took clearly different measurements and he had different values in some of the questions. And so, we began to talk about it and then learnt more again about how they see the things and from the developer's side so that was a very interesting exercise and we changed some values as an effect of what we were doing and sent back to you the new scores. Now in terms of the stakeholders in general I think we thought that would make sense to include them more as is being done at the very moment and we have been debating about the different kinds of stakeholders. I think from the kind of research and development work that they are doing, end-users, is a difficult term for them it is easier to think in terms of who is giving me the money to develop a certain algorithm and a certain tool and those guys, who are giving me the money, are my clients or whatever. I think that they would think about them as clients or as research-funder as they are providing them with funding for the research. I don't think they think in terms of end-users.

5. **Regarding responsiveness and adaptive change dimension in the initial self-reflection forms the scores were quite low, while the scores on relevant KPIs regarding risk identification and risk mitigation are quite high. What is the story behind it?**

I think the idea was that they are thinking quite a bit about how their tools might fail, and how they might have adverse effects in terms of being biased, having outcomes/output that might is heavily biased that means somebody might be discriminated against and that means that the output of the tool simply is wrong and it is not helpful for those providing the money for this tool. I think the identification part is well-covered because it's part of the daily work they have to do otherwise, they fail. There is to think again one step further and to say ''well. it's not only about risk identification but it's also why are there effects, why the groups etc it would be preferable it would make a lot of sense and I think the developer would think that and would argue for that but we had been talking about that and he said in most work they are doing they don't take money for it so they would have to do it on Sunday afternoon instead of playing with their children. They could sit down and write a report or do some additional development in work and nobody is doing that.

6. **According to the high scores given to the relevant KPIs, your lab's performance in anticipation of the impact assessment of the innovations is very high. What do you think makes you so good at this dimension?**

In my line of work at the social sciences we always have to think about the impact of the work we do that constantly. It is very important to put yourself into the shoes of your contractor and to see when they are having now this report or this tool or whatever what does it mean for them, how somebody perceived this and what kind would it have and on the developers' side I think, from what I understand, they are thinking along similar lines but again it's this first step it's for the person that is giving them

money it's not about thinking about the broad public not thinking about what kind of impact it has on general relations what is the impact on broader science.

7. **To what extent are your lab's activities linked with the Reflexivity dimension which is about embedding moral values in the decision-making and design process of the lab's innovations?**

I think reflexivity has a role in there. From talking to several people on the developers' side I know that they also think on a personal level and on an institutional level, I don't know, if there is somebody from the military from a non-democratic country is involved. Would they really want to work with them, what are they going to do with the results after research to their people? So, they are thinking about this. It's present. However, it is not inscribed into institutional rules so there is not a board where you can turn to and ask ''you know in this project there are some partners I don't know where they are coming from, they come from this and that country. I am not sure if I can trust them, if this is a defence project, is it in democratic hands, is it controlled by a parliament or is it in the hands of some autocrat. We are missing that, so people are aware of this, but they are missing the institutional dimension of this.

a. So do you think you are working on this? Do you try to have any processes to improve that?

Yes, we already had several discussions on this problem and we have been talking about what could be/ we might do about this. Is it possible to have institutional solutions that will be helpful to researchers because the goal cannot be to tie the researchers' hands and they cannot move anymore but the goal should be if the researchers themselves are already reflexive to help them in a reflexive work and make easier for them to do research? Then, yes, we have been talking about it.

8. **How important is the sharing of motivations, interests and receiving feedback in the research process (transparency) not only among the stakeholders' network but also within the public?**

Transparency in the sense of laying open in the scientific process of what you have been doing like open method and things like that it is very important it is traditionally integrated into our institution I think that part is ticking off the box on a wider sense, transparency that's a little bit more difficult as in a result-competitive environment in science you have the problem with open access and open science. If you are a place where you are doing a lot of research that is high-end, that is cutting-edge you are always feared that if you say everything that you have been doing in the sense of the kind of methods, the kind of data the kind of everything you are in fear that the next competitor is going to grab it from you. There is a tension one there is the angel at the side of the researcher that is saying ''make it very open, everybody should know about it you are good researcher, you have nothing to hide'' and there is the devil and the devil in the management says ''don't make it open because they

are grabbing away our cutting-edge'' so there is always a lot of a tension and I think it's normal for all institutions and we have that too.

9. **How did you experience this practice? / Did you find it useful for your organisation?**

To be honest, at the beginning I was a little bit sceptical. When I saw this long list of different indicators and the long list of models that were given to us and I confess I think I knew only 2 out of 20 or something so I was oh my god what is he doing and I was really sceptical and I began to fill it myself and then I began to talk with the developer and then I saw that the things were not as clear cut as I thought they are because of this interaction and the differences we what made it for me was the workshop when we had two hours' time to think about these different indicators and there we had really a lot of discussions. That was really helpful. So, all in all, I think it is a very helpful exercise. I think this is really something.

10. **Do you have any recommendations for changing the logic behind the assessment of KPIs? Did you find any difficulties? As you already said you had some difficulties at the beginning.**

I had some difficulties at the beginning to understand these different models and these long lists. Now I know a few of them, I heard about them or I have seen something about them since then and I had difficulties especially with the very first list I had thought it was not clear cut to me what all these dimensions or values sometimes mean. It depends a little bit on the institution and on the department, you are working it can mean different things. And when I had these discussions with the developers at the beginning it turned out we were understanding different things so it's a little bit subjective, it's a little bit fuzzy but then again, I think the only way to fight that could be to write a paragraph and say this is this and that or provide an example that one could do but, in the end, I think that we have made sense from these dimensions and KPIs for ourselves also so I think we are not far away from the truth. Plus, we had this discussion if it would have been only one of us it wouldn't be so good, I think this discussion really helped us.

a. So, you think it's better to have multiple people from different backgrounds, not only developers or not only ethical researchers, to complete these forms.

Yes, I think it was very good to have that.

Interview Lab no.2 (21:21)

1. **What does responsibility mean to you?**

Responsibility is very important for my company since Lab no.2 started as a chemical/biological laboratory, but we are also involved in the consultancy for small and large companies so that we can also increase the attention to the environment, to the workers' rights, for gender equality and so on. So, we give consultancy also for the other companies to reach the certification. And so, firstly, Lab no.2 is certified according to social accountability of the company, according to s8000 and we also promote social and ethical experts in our research, since Lab no.2 is also a research company both for the public administration for example together with the university, the research center also for public aspects and also for the small/medium enterprises, private enterprises so that we can provide also social and ethical analysis of any research results and so we can go in parallel for the social aspects together with our partners in the research projects. So, I can say that it is very important.

2. **How important is responsibility for Lab no.2?**

It is very important. We can be, just to add some more information, like the actors in the social analysis together with our partners or our customers and also, we can be like some observers just to see how is the situation. For example, for a research project that can go towards a result/ target, we can just check how is the social situation, then we can act to improve some aspects.

3. **What is the reasoning behind choosing these specific indicators?**

Well, starting from the previous experience, we collaborated as a pilot project in the Prisma project, so we identified some more important, in terms of social and ethical aspects for that project instead of others. But I think more or less comprehensive of lots of aspects that can deal with the indicators for research and social aspects for the research itself.

4. **According to the results of self-reflection forms and the KPIs assessment it comes out that although the inclusion of diverse stakeholders was firstly evaluated not so crucial (It had a score of 2) for you, the score in the KPIs regarding the participation of diverse groups is high (4). What is the story behind it? How important is diversity in the participation of research processes?**

Well, it also depends on several research projects that we can have or face off, so that you have to understand for each research from another one you can consider some specific indicators for example for the stakeholders' aspects they have to be more included, more advised of for example for the results or for some specific steps instead of for example for other projects that are developing some previous steps of the research they are not addressed to end-users, population, and so on, but they

are preliminary, so it is different the approach in my opinion instead of other projects that are more addressed to the final consumers, so stakeholders can be more involved.

5. **Why haven't you chosen any KPIs regarding the dimension of responsiveness to new technological developments and adjusting the research, while it was evaluated relatively high in the self-reflection forms?**

In this case, it also depends on the specific research project that you are considering, in some cases, the technological development/ results and address it's more important since you can consider for example the market or some regulation requirements some new let's say standards that you have to take in mind. In other cases, it is different. You have not to consider them or you can just say let them on one side and consider them later.

6. **What makes you so good at reflexivity of embedding moral values in your innovations (according to the high scores given)?**

This is difficult. I think it also depends on what you are searching, what you are looking for, what is your problem in the specific research project so it is difficult to generalise for all.

7. **How important is the sharing of motivations, interests and receiving feedback in your research process?**

It is important surely. For lots of projects, you have to communicate the importance, for example, of environmental impact. This is for lots of projects very important since we deal with the development of new materials, new products, but you have to look at the environmental impact at the end. So, the partners, the stakeholders and the involved persons have to be aware of these aspects, you have to inform them, you have to sensitise them to these aspects. But in other cases, it's normal that you have to think about these aspects. For example, for the health and safety of the workers, you are for example developing a new process you have to consider the impact for the workers in terms of health and safety. From our side, it is obvious that the project has some impact in these terms so you have not to underline some issues, some problems and so on. I don't know if I can explain better in some way but there are lots of different situations where you can put the attention on several aspects, it is not a rule.

8. **How did you experience this practice? / Did you find it useful for Lab no.2?**

Yes, sure, very useful. They are very useful for a lot of applications, a lot of different research projects, they are more or less innovation, research, so you can identify the indicators, you can apply them to a lot of fields, lots of different kinds of research. In some cases, you have to better address some general concepts/approaches to the specific research project so that you have to personalise the study and the approach dependent on the specificity of the aims of the projects.

9. Do you have any recommendations for changing the logic behind the assessment of KPIs?

Well, I think that it is very good to cluster them in general aspects/approaches and this is, I think, the 1st step to consider. So, you have to provide an overview without any detail then when you go deep into the social and ethical aspects of research and of the organisation you could provide more detailed information/ more detailed analysis of the specific situation. From my point of view, it is very good to have a first picture of the situation, very general, not so detailed and a second picture specifically addressed to the company, the situation, the project. This could be my consideration and suggestion for this study. Since if you go very in depth at the beginning it is very difficult for the companies to understand the utility, the help that also this study can give to the companies to improve their activities and to understand their approach in social and ethical aspects, and so this could be done in two different steps.

Interview-Lab No.3 (30:49)

1. What does responsibility mean to your lab?

I think we handle the concept of responsibility in the same way as we handled it in the RRI evaluation criteria that was actually executed in another project. How it is related in co-change it's because the work that was done with the evaluation criteria was planned to continue and develop further in co-Change and that's why we chose the criteria to the change lab. So, the idea of the Change lab is to evaluate impacts of the used evaluation criteria and develop the idea of how this kind of criteria can be used in future funding courses and funding programs. So that was the target and I think that the responsibility means the same as with what we have been dealing with in the past few years, meaning on the other hand it's an overall idea of the sustainability in three ways; ecological, economic and social responsibility or sustainability whichever term you want to use. So, we have this kind of general idea that whatever is relevant in that context of this ecological, economic or social responsibility you should take into account, meaning that it's always very context-related, what kind of issues you have to consider in your case but overall, it's a very broad definition of responsibility and definitely not directly with the definition RRI which is a commission-based term. On the other hand, we also define responsibility as the capability to anticipate and reflex the doing, kind of like yourself and the possible impacts and kind of in that way it is also kind of like organisational change for ourselves, meaning that we have to encourage the others to be more anticipative and being more able to reflex their doings but also that's for us we have to be able to do those also.

2. How important is responsibility for Lab no.3?

Some elements or keys, if you want to name them, are of course very important because we are representing the public sector, we are funded by the municipality, so we are a municipality-based

organisation. So, you can imagine that issues such as transparency, openness issues they are on the basis of our work everything has to be justified you cannot do the things secretly on public sector, but thing like ethics is a bit of example of key/element of R(R)I/responsibility is not something we systematically try to increase or take into account, of course, it doesn't mean that Lab no.3 has been doing its work unethically it means we have not considered that systematically, we do not have systematic approach how to take care of ethical issues when we do for example funding.

3. **What is the reasoning behind choosing these 13 specific indicators?**

I remember the workshop where we chose the indicators that were the more suitable for us. The change lab and co-change are very different from each other I was choosing the most relevant because our change lab is so related to the funding. So, I had to choose the indicators that were relevant to funding activities, more particular I do not have any other reason.

4. **According to the results of self-reflection forms and the KPIs assessment it comes out that although diversity in the participation of research processes is crucial for your lab, several groups {eg. NGOs, beneficiaries) score low. What is the story behind it? How important is diversity in participation?}**

There is a clear reason why for example our activities and our closest stakeholders are the high educational institutions and public organisations because in the country the money is allocated to two organisations partly it is the councils, like us, who deliver some of the funding and then there is another organisation who is delivering particularly the money that goes directly to the companies, so private sector organisations and also, they deliver in the European social funds. European social development funds they are particularly targeting non-governmental organisations like some kind of voluntary societies can apply funding from social development funds, whereas the councils in the country that only get to deliver the money that goes for universities, public organisations or research organisations. So, that's why our activities have unfortunately very less stakeholders or any activities related to civil societies or NGOs because they cannot apply funding from us, we cannot fund them, the only connection we have is in some of our funding projects might have stakeholders in those groups or they can some civil society into their projects as end-user perspective, but they cannot be part of the project and we cannot give funding for them. That's why they are rather far away from us.

5. **According to the high scores given, it comes out you are doing very well in reflexivity and anticipatory activities. What makes you so good at these dimensions?**

First of all, I do not think we are that good, I think we could be much better. I had to score that well is that still have these kinds of standardised processes here dealing with the close stakeholders that we have in this innovation funding ecosystem regionally. We already have a lot of different kinds of

processes that we involved and share information with the closest partners here, but I do think that these are still things that could be developed and we could do much better. Even though we have processes, this doesn't mean the impact is as good as it could be.

6. **Most of the KPIs that were chosen were about inclusion, ethical diversity, engagement and legitimacy. What is the story behind not choosing any KPIs relevant to responsiveness to new societal demands or to transparency in activities?**

I would need to see these indicators to see why I didn't choose them. Now I can't remember why I thought these were not relevant enough. Let me read them first.

About transparency…

I was most likely thinking that to me these felt like very important issues, first of all, I could have chosen them but I was thinking, on the other hand, they are elements that we have rather less to affect we have rather less capabilities to affect to them, meaning that IP issues, patent applications are not relevant to the projects we are funding, we are not dealing with those kind of issues at all and then privacy issues, data exchange are rather well already kind of regulated in the sense they are definitely important issues, but maybe as a council, we do not have mechanisms to kind of start tackling those issues during the project and especially after the project that we fund. I think those are well regulated in Finland and we don't have mechanisms to do anything different based on those regulations that exist and particularly after the projects are finished then we do not have any mechanisms to follow how these things are handled. Most likely because of these reasons I decided that it's better to choose indicators that we have some kind of control with.

About responsiveness…

Environmental values are highly included already in the ERDF funding so that's why I didn't choose that because they are strongly there already. It was not in our change lab in the RRI evaluation criteria we did not include any environmental elements because they are already very much regulated in the ERDF funding, and then social sustainability safety and security were elements that we included in the evaluation criteria because we targeted at some point some money to AI where safety and security issues were important.

6.1 This one for example as I see you have chosen it but you have clustered it as ethical diversity. It doesn't mean that all have to come under the same dimension, since you were also able to customise and cluster them.

7. Did you find it helpful and useful for your organisation, this assessment, the whole workshop, the evaluation process?

I could have answered better after the workshop. Now I am struggling to remember what was going on. I remember the workshop; it means that it was valuable because I have many workshops that I cannot remember at all which means they were not relevant enough to my work. I remember that it was good and actually very difficult to start thinking of which indicators are relevant to the work that we are doing. Because you have to know very well the work when you are choosing the indicators and in this kind of projects, EU-related projects the plans of the change can be changing a little bit all the time to kind of like get yourself together to think like what is the change what we are doing to measure it and it is not always easy and it was a good work to do and it kind of put my thinking together I remember I was in the meeting I did it with a representative from lab no.6 she is at least a little bit familiar with the work that we are doing and it was good to have a partner to discuss. I remember that we had little time, we had too less time so most likely some indicators were excluded just because of time but it was good to have a partner because otherwise, it would have been very difficult to do it by myself.

8. Do you have any recommendations for changing the logic behind the assessment of KPIs?

No. No development ideas.

8.1 So, you found difficult the part of the time given, but how was overall your experience?

I think this kind of work is always very time-taking. On the one hand, you should be effective, but on the other hand, you should be able to provide enough time so it's always complicated issue and some people can make decisions faster than the others. If I remember correctly, the time was the biggest problem.

Interview Lab no.4 (17:20)

1. **What does responsibility mean to you?**

This is a very good question. Let me see, actually, Konstantina, I did a study on this and maybe it's just good to pick the definition. I think of something like all parties concerned process that aims to develop socially desirable standards so in Lab No.4 the developing standards is done together with all the parties in the innovation system, essentially all the parties are included then and they all work towards a common goal of making a socially desirable standard and that is considered responsibility or responsible innovation in the context of standardisation.

2. **How important is responsibility for Lab no.4?**

I would say pretty important because the standards that are being developed by firms or companies they adopt or use those standards in a voluntary manner. So, they need to be socially desirable, they need to be accepted by society in order for them to be successful and in order for the process of standardisation to make sense. So, if responsibility leads to social desirability of the standards that is incredibly important for the business model for the organisation both and the process of standardisation.

3. **What is the reasoning behind choosing these specific indicators?**

I think we chose quite some, 23. But, as you might have noticed a lot of them are in the cluster of inclusion, that looks back into the definition we have of responsibility or responsible standardisation, because all parties, all relevant stakeholders need to be involved in the process, so inclusion is more central or most important dimension for standardisation and of course reflexivity or responsiveness are also important. I think within Lab no.4 they find anticipation also important because they would like to develop socially desirable standards and therefore you need to anticipate about the impacts you are making and anticipation is the last institutionalised concept or dimension of RI/RRI within the standardisation. Generally, I would say inclusion is the most important.

4. **According to the results of self-reflection forms and the KPIs assessment it comes out that although the inclusion of diverse stakeholders is crucial for you, you score very low and very high in the participation of several groups {e.g. end-users and suppliers, respectively. What is the story behind it? How important is diversity in the participation of research processes?}**

That's a good question. So, the process of standardisation is initiated by the industry and I think predominantly suppliers/ manufacturers they are the ones that initiate the process generally and are most involved. Of course, it's incredibly important to also look at other stakeholders that are implicated by the standard because that directly relates to the social desirability of the standard. But,

participation in standardisation still costs money, so if there is no direct incentive for those end-users, for those other stakeholders to be involved, so it is quite hard to actually convince them that they should partake. So, generally see that those standardisation processes are under-represented for some specific societal groups. That of course contradicts with RRI, contradicts with what Lab no.4 would like to achieve or organise between their standardisation processes and therefore this is also a terrain we are currently working on. We are looking at new financial models or new ways of involving them but that has been a challenge, I think already for decades. We are looking at new ways for involving those other stakeholders. Therefore, it's quite low but very important.

5. **What is the story behind the slightly poor performance of your lab in anticipatory activities (according to the scores of KPI assessment (2 in anticipation cluster))?**

So, on one hand, anticipation is important, because you want to develop socially desirable and meaningful standards, but on the other hand, there are no anticipatory activities fully institutionalised for standardisation. Until now, the thought was that if everyone is involved and if everyone is partaking in the process, and everyone defends/ looks out for his/her own interests, then all negative impacts will be mitigated because everyone knows ok this will affect me partly, therefore, we should do something about it however not everyone is always included, not anticipatory activities/tools are used and not always is everyone aware that it might impact them badly, nor do they have the power position to think ways stand up for themselves and Lab no.4 as a facilitator intends to be a neutral facilitator. So, they acknowledge you that their uses or the metaphor they use is that they are essentially around a table that just brings people together but they do not have a say/voice within those discussions. If you want to force anticipatory activities on those committees/groups/stakeholders that come together, then you are per definition no longer neutral. So, this is also a tension that they are currently struggling with and I think they are a bit divided, there are a lot of people within Lab no.4 that say we need to move away from the neutral position, whereas others who say no, this is something we are good at. These are core identity, core business, so we need to stay neutral, so this is why they score quite low in anticipation and also, they do not have the know-how, so even if they want to anticipate they would be able to.

6. **What makes you so good at responsiveness to societal demands and developments, according to the high scores given?**

So, responsiveness can mean different things at thinking about their context. On the one hand, responsiveness can mean initiating the process of standardisation so respond to some needs therefore we standardise. I think Lab no.4 is the central standardisation organisation in the Netherlands, so it is quite well-known, therefore it is quite approachable and everyone could essentially initiate this process although it does require some fees. On the other hand, which I think is more important is

responsiveness throughout the process. If you have all these stakeholders on board, and they provide these inputs, and they have these values/needs know-how they need to respond to that, they need to internalise that into the standard. They need to adjust the standard as being developed based on the input which I think also means responsiveness because you do that before the negative impacts manifest themselves and standardisation specifically is consensus-based, so the standard can only be established and published if all parties agree so you have to respond on each other if you don't then there is no going to be consensus so I think that business model or that process on itself lands itself really well to be responsive. That being said there is a 3rd type of responsiveness you could argue, that is once the standard is already published then the environment might change so the technology might advance or problems within the standard might be found. Then that standard must be adjusted/improved which you can also argue it is responsiveness because even though these negative impacts might have already manifested themselves, you try to respond then to avoid more of these negative externalities in the future. So, but that process happens once every three or five years that they come together and evaluate standards, that's very little. Although they can initiate earlier, I think there has to be a direct reason to do so if there is no one then they will likely not improve it. On the other hand, standards provide stability, so they are rules those technological developments adhere to, and stakeholders should take those standards for granted and therefore invest in their technologies to adhere to those standards and if you change the standard then it won't provide stability anymore, because it will change the technological landscape. So, there is also attention in there. Overall, I think standardisation is quite responsive but also after its publication it's quite slow at responding.

7. **How important is the sharing of motivations, interests and receiving feedback in the research process?**

I think that's really important within Lab no.4, because you need to have a common goal and expectations, or sharing expectations so you need essentially to put everything out on the table and be transparent about it. Lab no.4 makes that process of standardisation confidential to allow stakeholders to share their assumptions, opinions, motivations because if you haven't heard about agenda generally being bad for achieving consensus, in the end, I would say they do quite well but it comes at a cost of transparency for the public and of course it's a very political process you can never be 100% sure that they have shared everything.

8. **How did you experience this practice? / Did you find it useful for Lab no.4?**

It's actually I filled in it with the contact person at Lab no.4 and he had a lot of difficulties because Lab no.4 is a really big organisation and they work of course on these groups that they are quite separated from each other, these committees and those cultures and the way they work in those committees is quite different. So, it is definitely hard for example to say end-users are involved in the process because

that differs per committee, so he had quite some difficulties doing that. Nevertheless, I think he finds it also a good reflection tool so it allows you to take a moment and think about these points and also wonder why are we scoring bad or why are we scoring good and it has its upsides and its downsides.

9. Do you have any recommendations for changing the logic behind the assessment of KPIs?

I am not sure I do not have improvement points per se, but I do think it's good to mention that a Likert scale from 1 to 5 (strongly disagree to strongly agree) is of course very subjective and step between 4 and 5 might be quite big because it's difficult to fill in. One of the things you could do, maybe, is increase your sample size by allowing more respondents to partake and fill it in so you can take an average or look at the different cultures or groups within an organisation somehow it needs to be easier to fill in. Those are currently the things that I am thinking of.

Interview-Lab No.5 (36:57)

1. What does responsibility mean to you?

Interviewee #1: Responsibility for our lab means that of course everything we do, we do it in a responsible manner, so we try to make good research with good results which are applicable in practice but also, we take into account the whole ecosystem and each person involved in the whole process so we try to equally distribute the amount of work that has to be done if there are some funds we try to distribute it equally as much as possible so we try to take into account the gender issues, we tend a lot to give some tasks to the people that they do not feel good enough in doing so we try to be responsible on each level not only to gain good results but also on a personal level regarding each person in the whole process more or less in general.

Interviewee #2: This is a specific situation since the boundaries of our lab are a bit porous because I do not know if you are aware of our specific lab. The lab itself is located in the faculty of agriculture where interviewee #1 is from and myself and interviewee #3 are at other institutions in the same university. So, we have some kind of supporting role and team role, especially in my case, it is to share the experiences of the lab to the rest of the university, to the other 13 institutions of the university, and to try to document the experiences and challenges also being experienced in the faculty of agriculture and make some sort of a narrative for them to distribute it further so the other institutions could learn. If you ask me about responsibility at the level of university mostly the academics are not aware of thinking in that way and it is always an eye-opener for them to talk about being responsible towards the society so I think, what does it mean to be responsible in my perspective as someone who is researcher and professor at the university is to do my job in a way that is useful for the people who are enrolling our studies and for the wider contexts in which we are.

2. How important is responsibility for LAB NO.5?

Interviewee #1: To our institution, in the faculty of agriculture Lab no.5 I think is also a general question it should be important, highly important to any institution but I think that most of the people did their best to be responsible during their professional careers they were just not like conscious that they are doing so, that is part of some process possible they just thought, of course, I will responsible researcher in the future, that is some that goes along with you, that is the way you act. That is how I see it. I think that each institution has that primary goal to act responsibly in each activity it is involved in. It is of high importance also for our institution.

3. What was the reasoning behind choosing these 24 specific key performance indicators?

Interviewee #1: They seemed the most suitable for our current state of mind and the whole environment we work In and also with the ideas we had about how to improve something that we thought to be problematic in our institution. That was our standpoint.

Interviewee #2: If I remember correctly most of the other indicators were not applicable for this institution. So, we first eliminated the ones who were completely not relevant and then chose from the others the ones we believed made more sense and which were most applicable in this situation.

4. **According to the results of your initial self-reflection forms and the KPIs assessment it comes out that although the inclusion of diverse stakeholders was firstly evaluated not so high for your lab, the score in the participation of diverse groups is very high (e.g., funders/investors), but gender equality scores relatively low. How important is diversity in the participation of research processes for your organisation?**

Interviewee #1: I had the same problem when I was filling it: which diversity do you think of these different stakeholders, or which kind of?

a. Diversity can be about many things; it can be about the quality of the connection you have with your different stakeholders; it can also be about the number of different stakeholders, but we mainly mean including the different groups of people. E.g., NGOs, investors, end-users, consumers to take into account the points of view of people that belong to different groups that might be affected by your projects/activities.

Interviewee #1: Particularly with the co-Change project I am not sure that such diversity is present in our activities I think who are targeted mostly with our activities are actually the employees of our faculty and the broader university as well as students but of course if it influences our work to make it more responsible than it actually influences everything we come to when we work, it also influences the industry if they are seeking some solutions for their problems or obstacles in their production from us that influences our agriculture producers we can solve some problems also for them there is like a primary diversity which is not as diverse as may be acceptable but on a secondary level yes it may be quite diverse in fact, if I am on the right track with this sense

5. **In the question about the dimension of reflexivity; if the lab embeds moral values in its innovations. Also, in this dimension, the scores given were relatively low, while the scores of the relevant key performance indicators regarding it are high?**

Interviewee #1: I would go with the higher grade if I can say that I am not quite sure it must have been a mistake or some misunderstanding giving the grade 1, so we do our best actually for ethical values to stand for them, and I think we are on a good way that we are doing a pretty good job on our lab, so I would go actually for grade 4.

Interviewee #2: So, this is about reflexivity, right? It is quite an important term but I don't think that in most cases we are used to reflecting on these issues and therefore I believe for this co-change lab to actually establish a practice of reflection on these topics because one thing is to get people aware about dimensions of responsibility. But it is another thing to get them to start thinking about it and to reflect on their experiences, and challenges and the effect that their work has on these. So, I also believe it is very important but I also believe it is a very complex issue to tackle.

6. **According also to the results it comes out that you take into account very much the anticipatory activities about the impacts that your projects might have for the ecosystem and generally for the future generations. Could you elaborate more on which is the story behind it?**

Interviewee #1: Well, I think this is the first project of this kind may be at university-level, I am not sure, but for the faculty agriculture definitely, the first project of this kind, so it positively influences our ecosystem in several ways, so we feel good about things we see we actually did right and we were not aware that these were actually RRI so we have many examples where we were actively practising some RRI principles but we were just not aware of that. So, it gives us a good feeling about our work and our organisation. On the other hand, we also see some things that have to be improved, not only be improved to make a better working environment, of course, this is the first reason to doing do to make our ecosystem more suitable for each one of but it will also give us a ticket, if I can say that, to participate in some upcoming projects, so if we don't deal with some issues at our faculty and if we don't make some real institutional change we may lose possibility to participate in many project calls so in that way it is also very important and it influences not only us but also the future generations.

7. **What makes you so good at transparency and accountability? What is the story behind this dimension also for your lab?**

Interviewee #1: We are very transparent, at least I think so, we really talk openly about all issues and we openly say that we do not have enough knowledge/ experience to deal with all the issues we encounter in this process and we are very open for all the advice from anywhere they come so we are quite transparent we say we don't know how to do this, we would like to do this, the reason we are doing this is not only to make the environment better but everything I said to the previous answer so I think we are very open to all the people that find the time to deal with these issues because I think the lack of time is the biggest problem among others but the lack of time think is a major difficulty in this process so we are very transparent and open to all the people that show the interest to this.

Interviewee #3: If I may add, I am from the institute of Food technology we are like third party linked to the faculty of agriculture who brings this project and as far as transparency is concerned their activities are very communicated with others so some of the changes that are positive in the faculty of agriculture and experiences are shared with us so thanks to them we started some discussions basically on ethics issues in food science, this is where we are related so we are kind of copycats we follow their example because they already have started that so If I can contribute to that.

8. **How did you experience this practice? / Did you find this workshop useful for your organisation? Were there any difficulties?**

Interviewee #1: Talking, in general, each workshop we really had to stop and think and see what is the conclusion we can extract from that, that can be valuable for us. It needed some time to be analyzed and then to say "aha this is why we did this or that" and of course we wished for faster solutions, we wished for something: "okay let's go through this exercise, that's the way I should go, that's the path I should do, follow but along the way we realised that there is nobody that can tell us in concrete examples what we should do''. So, they were useful in that global level of making us aware of where should we search for our solutions or for our problems, where should we look to see if something is good or bad and should be improved. So I must confess that I was a bit disappointed sometimes because I was always asked waiting for the answer how will we do something for concrete answers because I am from natural sciences and there is always one or two answers to each question, but in this case, it is not possible to do in that way so there is no one answer and there are no universal concrete questions and problems and each story is the story for itself and actually there are differences among the institutions of the university that are involved on this project. In some cases, maybe some things that seem to be good at the faculty of agriculture may not work in other institutions. That is something we learnt along the way that we have to look for specific solutions for ourselves. But we had something offered, we knew where to seek after each workshop.

Interviewee #2: Can I add something about this specific workshop? If I remember correctly, we were both a little bit frustrated because the task was quite late in the workshop and therefore, we were already a bit stressed out and tired and then we had to think and evaluate if I remember correctly, we had to do this in the MIRO table or whatever. As far as I remember I felt a bit frustrated with the amount of work at the end of the workshop. My idea would be to switch with the tasks we did at the start of the workshop if I remember correctly.

Interviewee #1: Yes, if I can add I can remember we were working together and we made a deal okay I will do this part you will do that part we were really frustrated to make everything done in the time that was given to us.

9. Do you have any recommendations for changing the logic behind the assessment of KPIs?

Interviewee #1: Yes, maybe more time and when we come to specific terms maybe they should be explained what do you really mean by them because sometimes we were like okay, they probably think this or that, so sometimes we were not sure about what are we actually questioned about.

Interviewee #2: We think the same, I wanted to say the same thing because people from different institutions have different backgrounds and understanding of these KPIs, so if there were some kind of additional explanation available or somebody that you can ask for clarifications that could be a really good thing.

Interview Lab no.6 (26:44)

1. **What does responsibility mean to your lab?**

In the Lab no.6 it is mostly about responsible research and innovation so in the meaning of RRI in general terms so that the research on autonomous systems is made ethically right and also conducted so that it follows research ethics of course that's one of the aspects, but also these autonomous systems are also evaluated from the society's perspective, so that these are acceptable and desirable what they are producing when we are talking for example drones, self-driving cars, there are many ethical issues

2. **How important is responsibility for?**

It is important but the lab is very technology-driven like it often is, it was led/coordinated by our organisation and we are a technology organisation and responsibility are acknowledged but it is not integrated that much in the actual work. It is always on the side when we are raising our hand that ''hey, don't forget ethics, don't forget responsibilities'', but it's not in the core of activities.

3. **What is the reasoning behind choosing these specific indicators?**

Really hard to say. There were many indicators to select from and that was mostly based on my personal feeling which would be suitable for the lab because the lab is not an organisation, is not a project. It is an ecosystem. That was a bit difficult for me to actually select these indicators because most of the indicators, like they usually are, when we are evaluating something, they are very specific on project or organisation and in our case, we have a wider network that is our actor in the lab. I can't say that I had any systematic framework I was following.

4. **According to the results of self-reflection forms and the KPIs assessment it comes out you score very high in the participation of several groups. How important is diversity in the participation of research processes?**

It is crucial in research and especially in the autonomous systems you cannot develop anything alone, it is always inherently there, and therefore especially because it is an ecosystem and there are already different kinds of actors so I find those KPIs not even that suitable to evaluate the ecosystem because inherently an ecosystem is a network of multiple and different actors. So, it was evident that those indicators were selected for our lab.

5. **What is the story behind the very good performance of your lab in responsiveness to (new) societal demands and developments?**

You can't develop this kind of technologies without having some sort of dialogue with the society, even though I don't see that it was that strong but considering that it is an ecosystem, so there are many actors and each one of these actors have their own networks, their own stakeholders; there are students, there are researchers and there are different kinds of groups involved I think it is somehow again inherently there that it scores in a way high.

6. **Although in self-reflection forms reflexivity scores are not so high, the relative KPIs' scores are very high. How would you explain that?**

Maybe I made a mistake there because I was hesitant to make this evaluation because it doesn't make sense to make it anymore since we are not working with it. But it might be because of the wording of KPIs is not always that clear what is meant in the context of the ecosystem. So, it might be that I did not understand that this word is the meaning of the indicator for example, correctly. So, this kind of human errors can be involved.

6.1 To what extent is reflexivity important for your lab?

Of course, they do embed you can't do research without moral values, there is no doubt. Well, it is important definitively, there is certain ethics/ certain morals that are included in the research and especially in this kind of field when we are talking about artificial intelligence related technologies. I think, it's really important that there is so much discussion about what AI can do, and what It can do wrong for the humans and for the users. For example, surveillance issues, facial recognition, this kind of things, so more questions are definitely included.

7. **How important is for your lab the sharing of motivations, interests and receiving feedback in the research process? (transparency)**

Very important. It's all based on this openness and collaboration and especially in this ecosystem context that these partners are forming together research consortium so they need to be sharing information otherwise, these technologies will not be developed.

8. **How did you experience this practice? / Did you find it useful for your lab?**

Yes, actually the first assessment we made, I don't know if I am mixing a little bit the different excel doc that we were sent but based on the excels and one of the evaluations, I was actually using for the final reporting of this Lab no.6 lab that the coordinator had assigned me for the financier, which is a ministry of employment and economy in the country, and for that, I was basing the ethics and responsibility assessment on those indicators and I think for that it was really useful because otherwise, I would not have had any data, any information as good information as I had, so it was

really useful but of course now the situation is quite unfortunate that this lab kind of ended and it wasn't as sustainable as we thought it would have been. It would be nice now to also continue this evaluation and see how it will progress since there is no really any formal coordination any longer so it is a bit difficult to continue it. But I find it anyway good that we have these indicators. What is always a little bit difficult with indicators what is that the level of investigation, what is your case, what you are evaluating and our case is a bit different than the others since it is an ecosystem so it is wider than an organisation so not all these measures and indicators, they are not suitable for assessing an ecosystem. Assessing and evaluating an ecosystem is really difficult anyway but in general, at least for me, they are happy and useful.

9. Do you have any recommendations for changing the logic behind the assessment of KPIs?

I also acknowledge that it's not very easy to include all of the perspectives when you are creating a list of indicators and these indicators should be general enough to fit to all of the labs and anyway, I think also that responsibility and ethics area are really context-dependent and they vary in different countries, different organisations, different contexts. So, it is not very straightforward either to introduce a set of KPIs indicators that suit everyone and I do not know if that is even meaningful. Because this kind of evaluation needs also to take the context specificity into account and but what would be the standard solution? Maybe also to have a bit more qualitative assessment/ evaluation but I think this type of evaluation that we are running here is somewhere therebetween. It's not purely quantitative, but it's somewhere in between. I was actually thinking when you were saying that I gave a 2 to something and 3 to something else. You know the difference between 2 and 3 is marginal and it's not always that straightforward either. If you are assessing something, is it 2, is it 3, is it 4? So, this kind of numerical evaluation it gives us a kind of a picture of the situation and it gives the picture of that moment. Maybe things change the next day, I would have scored things differently. But these are general issues that are related to assessing impacts and evaluations.

Interview-Lab no.7 (34:13)

1. What does responsibility mean to your lab?

Responsibility for our lab means spreading the seeds that different people need in their context and taking care of these seeds. However, it is not that structured as other labs and we offer the proposal a kind of consultancy that we are going to work with other experts, we are not to create something on our own, we are going to create services to support our organisational change and also to support external organisational change, other organisations. This is much more different than what other labs are struggling with. Then, in the negotiations with the management level, they said that we cannot use the word consultancy because we already are a research organisation and you cannot have consultancy within a research organisation. But still, we are operating as a consultancy, what we do is spreading the idea of responsibility, and taking care of it in a way that people need it. So, this is our responsibility, inspiring people and then helping them do the change that provokes innovation in their areas.

2. How important is responsibility for Lab no.7?

As you can imagine it is very difficult to speak on behalf of an organisation that has more than 1500 employees but in general Lab no.7 is striving to include the topic of responsibility in the strategy plan and our lab is part of this change and in general, there is commitment, there is understanding but still, it is not so institutionalised, the term of responsibility. When you speak about responsibility of course you have so many levels and areas of responsibility that you have to distinguish that some are very well understood and very well embedded in projects, activities and strategies for example environmental responsibility well we have a whole division working on this and doing a great job, but then you have topics that are advancing like gender responsibility or things like this, we have approved a gender plan but it took us years to get to this gender plan, and then we are implementing it and there are very soft topics where we have to just start almost from the beginning so it is very difficult to say. In general, it is important but all these different areas are growing at different speeds and it depends on the area you are working on and the team that you are going to deal with but there is interest and there is commitment if you want to generalise, we are moving towards the direction of social responsibility and ethical responsibility and that's why we have a lab because if anything was straight, we wouldn't need the lab.

3. What is the reasoning behind choosing these (15) specific indicators for your lab?

Well, let's say that the project contains this measuring part. And I think that measuring objectives is extremely important, because teams and organisations get often lost and if you do not have these indicators and these objectives' outcomes, then many times you can go in different directions, which

does not mean bad directions, but you still want to stick to the objectives of the project and to the objectives that we created in a joint way. It was not easy but we got very good support from Martijn and Emad because we didn't very well indicators or the measures because sometimes the measures overlap with the outcomes, but what we created, as a result, is our commitment to what we want to achieve, in Lab no.7, and we are working on it, we use the KPIs often in internal meetings and also when we talk to the management level, we say '' remember that in the co-Change project we have this as a KPI, so this helps a lot also to keep visibility to the lab, we call it shape-lab, and the reasoning, yes, we didn't pick these indicators because of the indicators. We picked these indicators because they reflected what we want to do.

4. **According to the results of self-reflection forms and the KPIs assessment it comes out that although you haven't given high scores in the self-reflection forms for stakeholder engagement, your scores regarding the relevant KPIs are high in the participation of diverse groups. How important is diversity in the participation of research processes?**

Diversity is very important, of course. The question is how you define diversity, how many stakeholders are enough to say that we have diversity, and it's a very subjective perception because when you speak about diversity there is a big risk someone says ''oh we have diversity, I am speaking with 2 universities and that's enough. Or someone could say to have diversity you need a big scope of different from a geographical perspective and from industry's point of view. What I want to say it's very risky to talk about generic terms like how important it is, of course, everybody would say diversity is important, but it deviates digging into questions how much diversity, how much do you need not to do more than they need, because then you get into troubles that are complicating your work more than facilitating it and then the question is how do you combine diversity with what you are doing, not just do diversity and forget your work. So, diversity should facilitate your work and these are questions that we are taking in mind: how much diversity, what means diversity, to what extent, what stage and what's the right measure.

a. **In this case, we mean if you take into consideration also other researchers, end-users, public actors, diverse groups of interest.**

We have this for example we started our lab working with internal actors but then we had a very good candidate which is external and our bosses had the preference that we do the change within Lab no.7 because our organisation also needs to be changed more towards responsibility, but then we had a very good candidate which was external, and then we saw it a very good candidate, because it is a small company that has high objectives and works with a lot of different actors that we don't actually have in our close network, they work with small & medium industry and companies, so we immediately spotted this as a very good candidate and we started intensively working with them. So, we achieve

this big scope of actors and end-users through them, because we are creating, we are coaching them and finally, we are creating something in common a portfolio that affects, we hope, a big number of companies. Apart from this we started also working with research groups within Lab no.7 and each research group is involved in research projects and these research projects they have their own words so I really believe that we have a big scope of stakeholders currently involved and as I said in the previous answer, we try not to bother people without offering them something concrete. Each time we try to contact a new stakeholder, we create an offer for them, an offer that brings value, because if you involve stakeholders just because you need a number of stakeholders you are going to lose them because you don't bring this value. If you contact them with an idea, look I reviewed what you are doing and I thought about what I am doing and I think we have a very interesting overlap and then you prepare the meeting and you take notes and draw an analysis you see that the connection with the stakeholders is more important than the numbers. I don't remember exactly the questions in the questionnaire but if we have evaluated well, it was because of the quality of the connections not of the number because now in the co-Change lab we started really establishing long term connections and that's why we are very happy about it because these connections return into collaborations that bring more stakeholders, so it's more the quality and the depth of the work that we are doing now than the greatest number.

5. **According to the high scores given, what makes you so good at responsiveness to societal demands and developments and at anticipatory activities of your lab?**

I think we are really committed and we really believe that society needs to change and that we have the responsibility not because of the co-Change but as citizens as researchers, as part of the world to promote this change and we see the co-Change project as a way to do this. Before starting co-Change, we were searching for ways to do this, and we did it also before, but co-Change provided us with the right framework. We have the background of doing this and the background, the expertise and also, let's say, the need to do it and I think that we are very dynamic and we really think about society and how to also democratise science so that it is not only part of research organisations but that citizens can also be part of this process. Very often I think on challenges rather as a citizen than a researcher, I am changing roles, and I think okay as a citizen I would like to do this and then I re-come to my role as a researcher okay I have to do this so that other people feel included and have their say so changing roles and changing perspectives, trying out new things and the most important thing is the belief, the commitment, the true commitment to change of this world because it's the only way to the things.

6. **What is the story behind the relatively low performance of your lab in transparency and accountability about RI activities?**

We have responded two different people and I don't remember the scores we have given. I have to think about it because we are actually very transparent but maybe we did not have enough opportunities to communicate our values and actions. We are trying to be transparent and I don't see any obstacle not to be any transparent, just the opposite. So, it is good that you raise this question in the next evaluation, we are going to take it more seriously because sometimes it's a lack of understanding, you say how transparent you are and we are interpreting it in a different way. I would say that we are as transparent as possible because we want to let's say promote our services or sell our services in the future, the first step is being transparent, being not only transparent but also being actively transparent, like open and communicating with what we are doing, so yeah, we have to revise it we have to see why this came out. You could also interview another representative because in the whole co-Change process everyone has a different personal view or things and for sure you will obtain completely different feedback from her than from me although we are working together than from me so it could be useful for you to talk to her.

7. **It also comes out that societal values (privacy, safety, health, security, data ownership, etc.) are actively included in the design process of your projects. To what extent do you take into consideration embedding moral values in your research and innovation process?**

Of course, to a very big extent. I mean everything that we do, we do it because of social values, following the societal values and now so we are constantly aware of new values, we are not so fixed on what the commission says and what values are listed on the white papers, we are very attentive and very responsive in the way if we spot a new need or value, we are going to capture it and see what we can do with it. So yes, without any doubt the societal values are at the core of our job.

8. **How did you experience this practice? / Did you find it useful and helpful for your organisation?**

Absolutely, because as I said it brings structure and it keeps you focused on the long term and it also gives a kind of official commitment, because we know what we want to do we are not going to forget it, but sometimes when we have conversations with external parties or managers and they say no this isn't what we wanted in co-Change, you just take this picture and say no we did it and it is in the work-package sheets, so you use it as kind of official statement, and normally internally you are not going to do it because you say "I know what I am doing" but what we discovered later is that we go back to the document when need to communicate with others and also when we need to brainstorm for new services, for new products we always come back to the documents and "let's see what we did in the workshops' exercise" and it helps us because it's a kind of database of structured ideas like ''oh look

we forgot about research outreach or scientific issues, we talked about it and it's a kind of picture of what you wanted at a certain moment, it's not forever, because I am sure we are going to add new things, but I would rate it as very useful.

9. **Do you have any recommendations for changing the logic behind the assessment of KPIs? Did you find anything difficult/ would you prefer something else?**

It is very difficult to say I remember we were in a time rush and we were pushed to do this in 10-15 minutes when normally to manage to do this, it takes 3 months because you think I have to give more importance to this or that and then we were said we have 10 minutes to give scores to these. It was a tough challenge! But sometimes with a bit more time maybe it works better, but maybe not, because when you are in a hurry you are more productive and you gesture that in normal time that you are not going to achieve. I have to think of recommendations for sure things can be improved. I remember that in the case of Lab no.7, which is a bit more commercial, or commercial in the future, we had to add more, new KPIs and then I had to transform the real KPIs because we were said that these were not KPIs but like ambitions and we had to put them more as indicators. But this is just a comment, we learnt more about KPIs and they learnt more about what we want to do and how we want to do it. So, the whole procedure was useful for both teams and I wouldn't rate it as negative the opposite, we learnt more about each other's tasks. In general, I have to add my comments, and recommendations when I see what they have done at the end because very often things look strange because you don't understand the whole process, but then they come with analysis, prefix, and things that you say ok it perfectly makes sense so to be honest now it's early to make recommendations because I want to see the end result that of course will be at the end of the project and then I can say if it was useful or it was not useful for our project because it is still in a relation process.

Interview Lab no.8 (22:36)

1. **What does responsibility mean to your lab?**

So, we took one of the areas of RRI. There were 5 of them. We discussed all of them and we mainly concentrated on open science. It doesn't mean that this is responsibility for us but we it's just because we are a small organisation and gender was part of another EU project where we had 4 for years to just concentrate on gender and this is why we took the open science aspect.

2. **How important is responsibility for Lab no.8?**

Are we talking now about open science?

Yes, responsibility as you defined it for your lab.

I define it as open science because talking about responsibility would take like a few hours what responsibility means. So, taking this one approach is one and several. As I just mentioned with gender our main focus is research so, at the moment, we are trying to figure out what kind of definition or what that means to us.

3. **What was the reasoning behind choosing these (11) specific indicators but as far as I understand they were those concerning diversity and transparency?**

You mean the indicators in one of the workshops where we had evaluation? I actually took the ones that were there, I sorted out what was most relevant and transformed a little bit to our needs because they were not quite shaped to our needs. As they were more focusing on companies or research organisations but not funders as we operate differently.

4. **From the assessment it comes out that the scores for gender diversity and especially representation of women are very high. Could you elaborate on the actions that are taken towards eliminating barriers to discrimination?**

Isn't it the focus of co-Change? As I said before, we had a 4-year EU project, EU funded project, really concentrated on the gender dimension and there we made a change and looked at the whole funding cycle. So, we made quite a few changes about our decision-process about our decision criteria. We installed gender-content criteria which were new this is actually not the focus of the co-change project. If you are interested, there is an interview, a blog entry that I have written in a blog, where actually everything was written down what we did in the course of this to reach more gender equality. This could be a nice source for answering this question.

Yes, if you could share it with me, I would be happy.

5. **According to the results of self-reflection forms and the KPIs assessment it comes that you score relatively low in the participation of several societal groups {e.g., NGOs or indirect stakeholders e.g., possible non-users or end users}. What is the story behind it? Is there a reason for that?**

As just mentioned before, we are a very small partner in the project so we don't have a lot of resources dedicated to the whole of the project. We are a very small organisation. So, to understand we are basic science funder with very dedicated calls, very specific calls, not a big organisation so this is why as mentioned before we kind of selected only a few topics that we would concentrate on as we cannot transform ourselves and we are not in this fear of science communication or citizen engagement, there are other organisations that do that. It's not our purpose and not our strategy to do that and this is not the focus and I also understood that not every organisation has to have every RRI aspect, and this is why as mentioned before we have this focus on open science and we concentrated on that as our main people that can get funded from our budget which is restricted are researchers and research organisations and this is and we won't change it as we don't have more money if we would get more money out of the project we would change it maybe but this is not what we are doing.

6. **As you said, the most selected KPIs were about openness and active and transparent communication, which is your main focus as you mentioned. Could you elaborate on what makes you so good at this RI dimension? Or how important is the active sharing of motivations, interests and receiving feedback from others?**

At the moment we changed or we rewrote our funding guidelines, as you may know, as posted on the website this is what we are doing now in the change lab, we included parts that there will be a gender policy and an open science policy in place which is also important and at the moment we are just doing that. So, at the moment we are looking at what others are doing in open science field and then we will frame an open science policy we have an open access policy in place, but this is maybe outdated we will check that, we will check how up to date that is and then we'll maybe transform it to make it a little bit more open and until then I don't know what exactly we are doing. We just have feedback from our decisions board to keep it practical, to keep it to our structures, not to overboard many things because a lot and a lot of organisations are doing a lot at the moment also very big funding organisations and it's really important to stick to the own contacts and to the own resources and possibilities that you have and this is actually what we are doing the next half of the year to elaborate more on that.

7. **Also, there were a couple of indicators that were selected that were regarding other dimensions of RI, such as the responsiveness of the lab to new societal and technological**

demands and developments. To what extent is responsiveness taken into account in your lab's activities?

We always have like a question that regards to mid- and long-term effects and also effects to the society, every proposal has to answer that. In our calls we always have, but for several topics, it might be more important than for others. Even the time frame may be different for some of them it might be earlier than for others, some are more oriented or easier oriented towards these goals, others may be more long-term and we have for example calls in environmental system research where there is maybe more practicability, more for example city people involved, so more really, more urgent questions towards citizens the same is true with the digital humanism call we have where it might also be more prominent this question and I will put in the links to these two calls that I just mentioned so you could have a quick check of them as well, as they are the programs that mainly motivated as well to look at this question of open science. So, I will put in this environmental system research and the other one about the digital humanism initiative where we already have outcomes.

8. **Also, anticipatory activities were mainly chosen about the constant consultancy with other researchers about taking care of the future generations or about signalling new and future technological/academic trends? How helpful/useful is the communication with other researchers for you?**

I am not quite sure if I understood the question correctly but if you are asking if we have contacts to researchers and applicants there is continuous communication with the representatives of the universities, of the main biggest universities in Vienna or also like applicants or advisory board for example and we always have contact with researchers or university stuff when we think about a new program, a new call or talk about changes, for example, the ones in our guidelines.

9. **How did you experience this practice (the whole practice from the workshop with choosing the KPIs then evaluating them? Did you find it useful for your organisation? Did you face any difficulties?**

I was actually a little bit surprised by it. I wasn't aware that this wart part of the game also because our input as I mentioned before is very limited so we only have 3 person max available for the whole 3 years and it's actually nothing and we actually try to bring our lab forward but I really find it very well organised and very well structured so it was easy to follow with this dashboard, this whiteboard or what it is called, it was technically very well done. I am not sure if all the indicators if they are really the right one, some of them I took because they made sense but as already discussed the gender part was actually part of another project so as it's not the core of my/our part of the project, it was also quite hard to use a lot of resources for that just to be honest. So, it's not in the main focus of my work and what we are doing, I am not quite sure how helpful this actually is to be honest, as we are so small,

we are very practically oriented, we have other things to do first, to reach our goals and then maybe we could put more focus on that one.

9.1 The focus of this research was to make you aware and to make you reflect on these dimensions and by presenting all these dimensions and making you try to select which are relevant or not maybe gave a bigger picture of your current state in terms of RI. Maybe it was helpful in this way?

We will see, we will see at the end of the work.

10. Do you have any recommendations for changing the logic behind the assessment of KPIs?

I was wondering maybe to include it a little bit more prominently from the beginning, it was more like a side-effect, for me it was not very logical what is coming now, why, what we have to do, how it is used, maybe I missed a part but for me, it was like an add-on, a very well structured and very well-prepared add-on and the workshop was one of the nicest and most convenient that I had and the consortium it was very well structured and prepared. But for me, it was more what am I doing now with them and it should be tailored to the resources of everyone. People who are involved in the project and I don't know with 15 or more persons could dedicate more time than we, with the very small/ slight budget we cannot even do the things we want to do but we have to do the evaluation. It's not the best balance I would say so maybe for us it would be most important to take 2-3 indicators and to make it more clear to deal with everyone separately and to make the differences more clear as well to have discussions with the organiser to understand what we are actually doing, as the consortium was so diverse there were so many organisations, so many different goals and sometimes I really had the impression that there is no understanding of what a research funder is and what we are doing but yes this is why I took the indicators and then adapted them a little bit to our needs. This was quite a process but again it depends what is in for us and what is in for research someone else is doing because it's interesting for them and to evaluate it but until now I don't see the usefulness, you have to dine in deeper, I mean we are doing evaluations on our own, each of that is really deep-dived, a lot of work is put on, so for me is really quick and dirty is it really the best way to go? This is not that clear to me!

APPENDIX D – Consent form

Informed consent form template for research with human participants

Consent Form for [*Responsible Innovation and Organisational change*]

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated [29/06/2021], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves [an audio recording and transcripts of these recordings]	○	○
I understand that information I provide will be used for [the H2020 co-Change project and my thesis]	○	○
I understand that personal information collected about me that can identify me, such as [my name, my email-address], will not be shared beyond the study team.	○	○
Future use and reuse of the information by others		
I give permission for the [*audio recordings and transcripts*] that I provide to be archived in [*SURFdrive*] so it can be used for future research and learning.	○	○

INFORMATION SHEET

This study aims to assess Responsible Innovation's institutionalisation in research performing, and research funding organisations by considering Responsible Innovations process and product dimensions in their projects. This descriptive longitudinal study aims to answer the following research question: "How effective is the use of Key Performance Inidicators for Responsible Innovation in driving organisational change?" by analysing eight case studies, conducting interviews. These cases are eight research (performing or funding) organisations that are part of the Horizon 2020 Co-Change project that aims to boost changes in organisations' behaviour. I will be working with audio recordings that will be transcribed in order to ask for clarifications regarding the choices in categorising and weighting Key Performance Indicators. All data will be stored in a SURF-Drive into which me, Dr. Emad Yaghmaei and Ing. Martijn Wiarda will have access. Personal research data will be destroyed after the end of the research project Anonymised or aggregated data will be shared with others for 10 years or more, in accordance with the TU Delft Research Data Framework Policy for research purposes, which are in-line with the original research purpose for which data have been collected. The audio recordings will be anonymised once they are transcribed by removing personal identifiers, that could lead to the professionals being identified.

Figure 26 Consent form sent to interviewees