QUADRUPLE HELIX COLLABORATION IN PRACTICE

Insights from the EU Project RiConfigure

Fabian Schroth, Simone Kaiser, Martina Schraudner (eds.)

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ABBREVIATIONS:
CCM_ Community Creates Mobility
CSOS_ civil society organizations
ÖBB_ Austrian Railways
OI_ Open Innovation
OWL_ East-Westphalia Lippe
QH_ Quadruple Helix
QHC_ Quadruple Helix Collaboration
R&D_ research and development
SME_ small and medium-sized enterprises

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riconfigure
Reconfiguring Research and Innovation Constellations

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INTRODUCTION

Frederik Langkjær, Danish Board of Technology
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Climate change is one of the main challenges of our times. It is a wicked, complex and systemic challenge with enormous consequences requiring innovative solutions and transitions in all corners of society. For this reason, it cannot be handled by one single actor with one set of tools but rather calls for collaboration and joint problem-solving. This is notoriously demonstrated by the case of the yellow vests in France, where the government attempted to mitigate climate change via tax reforms, which instead ended up fueling riots. This case not only illustrates the importance of collaboration in general, but it also stresses the importance of collaborating with civil society in particular when seeking solutions to handle the challenges of climate change.

This importance of collaborating with civil society when addressing climate change also applies to innovation processes. When water levels rise, there is a need for adapting inhabited areas by putting into production innovative solutions such as drainage systems or dikes based on research and enabled by governance frameworks. Nonetheless, the *RiConfigure* project's investigation of innovation processes within climate change adaptation shows that entrepreneurship, know-how and regulation are not always sufficient. Sometimes, robust, innovative climate change adaptations also involve civil society, as they can provide collective intelligence that refines the adaptations, local insights that are important to context-specific adjustments, public ownership and more. This added value of civil society engagement in innovation processes not only applies to climate change adaptation but also a variety of wicked and complex challenges connected to topics such as the fourth industrial revolution, green energy, social innovation and mobility, all of which are investigated in the *RiConfigure* project.

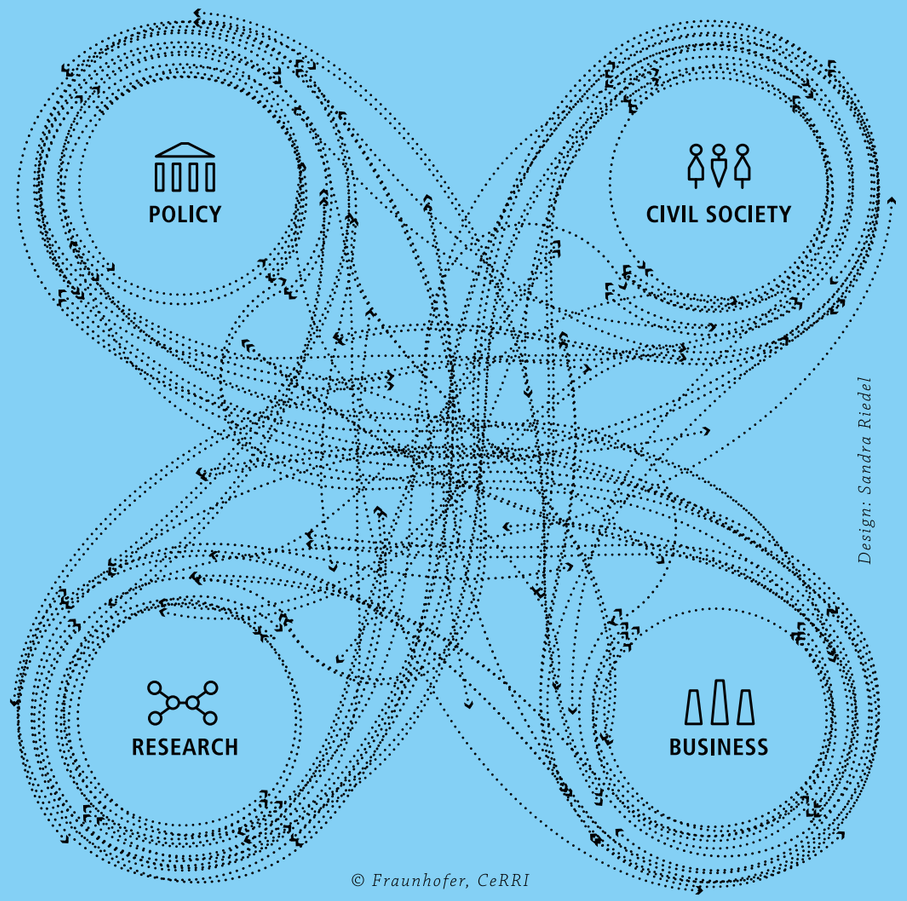

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FIGURE 1_
The Quadruple Helix Model

WHY SHOULD THE CIVIL SOCIETY BE INCLUDED IN INNOVATION?

This promise of benefits from involving civil society in innovation processes is the starting point of the *RiConfigure* project's focus on so-called Quadruple Helix Collaboration (QHC) throughout Europe, i.e. innovation constellations including actors from policy, business, research and civil society (see FIGURE 1).

According to theory, such constellations provide three benefits.

Input benefit: Civil society organizations and citizens can provide societal perspectives, insights regarding the needs of users and customers as well as lay knowledge: What are the needs of society? What problems do societal actors face? What are the experiences of civil society?

Throughput benefit: Creativity is stimulated when people from different backgrounds come together, share their knowledge and perspectives and are open to each other's inputs.

Output benefit: Innovation processes that involve civil society are more likely to address societal needs and be ethically responsible.

FROM THEORY TO PRAXIS

Despite these promised benefits and indications of the importance of collaborating with civil society, the *RiConfigure* project's investigation of existing QHCs show that reality is more complex than theory. By establishing social laboratories in Denmark, Germany, the Netherlands, Austria and Colombia, the partners of the project have gathered, observed and interacted with multiple QHCs addressing complex challenges of automatization, hydrogen technology, mobility, climate change adaptation and social innovation.

Data from these labs reveals that the integration of civil society is quite challenging, and hence reality cannot (yet) fully deliver the theoretically-described benefits. In practice, there are attempts to set up QHCs, although most of them do not involve civil society actors as theoretically imagined, i.e. as equal partners in a co-innovation process. This booklet shares stories and observations from the laboratories to provide practical insights for innovation practitioners involved in cross-sector collaborations and actors working to facilitate the multiplication of such collaboration with a particular focus on the involvement of civil society.

CHALLENGES TO ENGAGE CIVIL SOCIETY

Furthermore, the *RiConfigure* project's investigation of QHCs shows that challenges to set up these types of collaborations – and especially to include civil society – emerge at three levels.

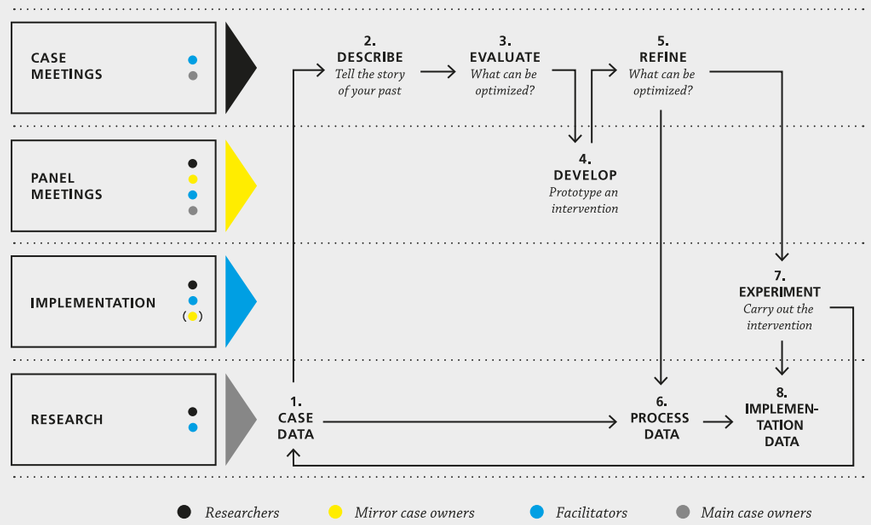

FIGURE 2_ The life cycle of the RiConfigure social labs

First, the activity level, at which actors intending to open up their processes are confronted with questions such as: Who is civil society anyway? Who should be contacted? What are the concrete benefits? This booklet provides examples of how to address these challenges in practice.

Second, the governance level, at which the background conditions for QHCs are found. Companies and research organizations are well funded and have highly trained staff, but civil society organizations often lack the necessary resources to contribute meaningfully to innovation activities. Further, while elaborated metrics exist to measure the benefit of research-industry relations, metrics to assess the social benefits of innovation are missing, which this is exactly what civil society might contribute. Consequently, it can seem risky to executives to allocate resources that support a meaningful integration of civil society actors into innovations processes. Chapter seven provides recommendations for policy-makers on how to change the background conditions to strengthen QHCs in practice.

Third, the systemic level, at which the broader conditions for both the practical activities and governance frameworks are determined. Here, the central value of innovation is economic profit, which drives the development of new products, services and technologies. Within this paradigm, it is extremely challenging to open up innovation processes to civil society actors. While this is a major barrier for QHCs, this level is not systematically addressed in the booklet.

To summarize, the *RiConfigure* project definitely demonstrates the value of cross-sector collaborations and the inclusion of civil society in innovation. However, cross-sector collaborations are rarely – and not necessarily always – proper QHCs. No systematic general description can capture the myriad of constellations of real-life collaborations. Rather, empirically-based insights acknowledging the particularity of the project, theme, legal and policy framework and partners are crucial to support the often challenging but valuable cross-sector collaborations.

RiConfigure: Re-thinking innovation from different perspectives

The EU project *RiConfigure* investigates innovation processes involving actors from research, business, policy and civil society, also known as Quadruple Helix Innovation. The project set up four social labs across Europe and Colombia, in which collaborations including the four helixes were represented. Each social lab concentrated on open innovation initiated by different helixes. In the course of the project, these social labs went through three life cycles (see figure 1) in which they explored, reflected upon and initiated novel ways of including new actors in innovation. The *RiConfigure* project gained insights into the praxis, policy and systemic level of such cross-sectoral constellations.

CHAPTER OVERVIEW

The remainder of this booklet is structured as follows:
Chapter 2 describes how QHCs work in heavy industry. In particular, it analyzes the collaboration in the community of stakeholders pertaining to the production of green hydrogen in the Netherlands. It shows that QHCs are quite frequent, but that civil society participation is primarily indirect. The problem at hand – upscaling green hydrogen – is a typical complex issue that requires the participation of all four helixes. We provide a series of lessons for strengthening QHCs and allowing the infusion of non-economic values into the design of new technologies in the industry.

Chapter 3 provides insights from a research-initiated QHC. A social lab on the future of work was established within an existing local innovation ecosystem, which provided space to reflect on the societal impacts of a new technology. The chapter shows the different resources that the four helixes may contribute to innovation processes in the field of industrial automation. Furthermore, it draws attention to the local innovation ecosystem of a QHC as well as the importance of civil society in making a technological innovation a success.

In chapter 4, the policy-initiated QHC *Community Creates Mobility (CCM)* is used to show how aspects of the Quadruple Helix (QH) Innovation model can be used at the activity level to create an innovation ecosystem for mobility of the future. By including new actors in innovation processes, CCM could take a leap towards democratization and addressing challenges of mobility, social justice and climate crisis. This chapter shows the input and throughput benefits that such a constellation can have for mobility innovation by providing insights into the praxis of setting up structures for innovation collaborations.

Chapter 5 provides insights from civil society-initiated QHCs. It discusses the case of climate change adaptation and reveals the challenges of integrating civil society actors as full-blown partners in QHC, as opposed to actors that are merely consulted. Focusing on the structure of QHC, it provides suggestions concerning how the existing will to collaborate with civil society can be fostered and supported.

In chapter 6, three cases are analyzed in the Colombian social lab to assess QHC. Governance, financing, long-term sustainability and communication must be taken into account when inviting civil society to be part of the QH Innovation process.

Instead of a concluding chapter, we end the booklet with a series of governance insights (chapter 7) specifically directed at policy-makers and legislators at various level of policy (regional, national and international). Governance actors provide the context for QHC and it is here that we see the greatest lever to realize more QHC in the future.

FURTHER READING_

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CHAPTER 2

QUADRUPLE HELIX COLLABORATION IN THE HYDROGEN ECONOMY

Eugen Popa, Wageningen University

Yes, my friends, I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable.

Jules Verne, Mysterious Island (1875)

ABSTRACT

In this chapter, we describe how Quadruple Helix Collaborations work in heavy industry. In particular, we analyze the collaboration in the community of stakeholders pertaining to the production of green hydrogen in the Netherlands, showing that Quadruple Helix Collaborations are quite frequent, but that civil society participation is primarily indirect. The problem at hand – upscaling green hydrogen – is a typical complex issue that requires the participation of all four helixes. We provide a series of lessons for strengthening Quadruple Helix Collaborations and allowing the infusion of non-economic values into the design of new technologies in the industry.

THE 'SUPER-MOLECULE'

Hydrogen is an invisible gas. It is the most abundant chemical element in the universe. It is highly reactive, which means that it bonds quickly with other elements such as oxygen in forming water, and it can be stored in liquid form. Accordingly, hydrogen is a key feedstock in a variety of industrial processes. Hydrogen holds primary interest

in refining industries and the production of fertilizers, and it can be used to create extremely high temperatures. Initially, hydrogen was produced through what is now known as 'water electrolysis', involving the separation of oxygen and hydrogen from water. However, due to increased demand for cheap hydrogen in heavy industries and a relative low price of fossil fuels, in the 1980s hydrogen producers gradually abandoned water electrolysis and turned to fossil fuels. Hydrogen is nowadays primarily produced from natural gas or other fossil fuels. It was not until the end of the 20th century that research and development turned back to water electrolysis, triggered by the increased policy push for the decarbonization of industry. An additional technology that can play a role in this process is carbon capture, the technology by which the CO_2 released from hydrogen production is not released into atmosphere but captured and stored. We thus now have a three-fold distinction between 'grey hydrogen' (produced using fossil fuels), blue hydrogen (produced using fossil fuel but with carbon capture) and 'green hydrogen' (produced using green energy and electrolysis).

So, was Jules Verne right? Perhaps hydrogen is the coal of the future? Various stakeholders are engaged in pursuing this path. Hydrogen is a very hot topic nowadays, and some refer to it as the 'super-molecule', alluding to the diversity of applications and uses for hydrogen. The term 'hydrogen economy' refers to the totality of interactions – whether communicative or financial – related to the production, transport and use of hydrogen. Since the hydrogen economy needs input from all four stakeholders mentioned in the Quadruple Helix (QH) model – policy, business, research and civil society – we could say that the hydrogen economy is something like a 'QH community'. Let's see who the members are in this community in the Netherlands.

STAKEHOLDERS IN THE HYDROGEN ECONOMY IN THE NETHERLANDS

There are many stakeholders taking part in the hydrogen economy in the Netherlands. Indeed, a great deal of our work in the social lab comprised mapping out these stakeholders and gaining a better understanding of their vision. For this purpose, we organized meetings within a hydrogen-related research project, during which we asked participants to name the most important stakeholders within the hydrogen economy and reveal their view of the hydrogen economy, including their interests, how they perceive other stakeholders' interests, their resources, concerns, etc. This was a useful occasion for us to understand the context in which we were about to work, but also for participants to express their views on the responsibilities of each stakeholder in the hydrogen economy, as well as their probable course of action in the future. In figure 1, we offer a list of the major stakeholders enumerated and their stake in the hydrogen economy.

FIGURE 3_
Stakeholders in the hydrogen economy

STAKEHOLDER	INTERESTS
INDUSTRY	
OFFSHORE WIND	*Sell green energy for the production of hydrogen*
ENERGY COMPANIES	*Transport energy from and into the energy grid*
TRANSPORT OF HYDROGEN COMPETITORS	*Move hydrogen in liquid form or as energy*
COMPETITORS	*Various production processes, find niche and sell hydrogen*
NETWORK ASSOCIATIONS	*Defend interests of businesses*
STORAGE	*Sell and maintain storage capacity*
MANUFACTURERS H PRODUCTION	*Sell and maintain hydrogen production systems*
H USERS	*Buy and use cheap, green, high purity hydrogen*
INSURANCE COMPANY	*Participate financially in the hydrogen economy*
OWNERS AND OPERATORS OF H	*Produce hydrogen safely and cheaply*
USERS OF BY-PRODUCTS	*Buy cheap by-products such as oxygen or heat*
CIVIL SOCIETY	
NEUTRAL CITIZENS	*Be informed about the hydrogen economy*
NATIONAL MEDIA	*Inform others about the hydrogen economy*
EARLY ADOPTERS	*Use hydrogen cars and hydrogen heating systems*
ENVIRONMENTAL GROUPS	*Defend environmental causes*
OPPONENTS OF HYDROGEN	*Criticize movements in the hydrogen economy*
LOCAL REPRESENTATIVES	*Defend the interests of small communities*
SCIENCE JOURNALISTS	*Inform others about research into hydrogen*
GOVERNMENT	
GAS INFRASTRUCTURE	*Transport hydrogen in gas form*
ENERGY INFRASTRUCTURE	*Transport energy from hydrogen*
LOCAL AND REGIONAL MUNICIPALITIES	*Defend regional interests*
MINISTRY OF ENVIRONMENT	*Supervise environmental aspects of hydrogen projects*
MINISTRY OF ECONOMIC AFFAIRS	*Regulate and stimulate financial side of H economy*
PORTS, INDUSTRY TERRAIN	*Develop business through hydrogen economy*
EU COMMISSION	*Supervise and regulate EU legislation surrounding hydrogen*
RESEARCH	
PRODUCTION AND DELIVERY	*Improve production and delivery*
MATERIALS	*Better materials*
ECONOMIC ASPECTS	*Predict market developments*
EDUCATION	*Teach about hydrogen*
SOCIAL ASPECTS	*Social impact of upscaling hydrogen economy*
STORAGE	*Safety in storing hydrogen*
PROFESSIONAL TRAINING	*Training for new hydrogen technologies*

DRIVERS AND CHALLENGES FOR QUADRUPLE HELIX COLLABORATIONS (QHCS)

The main lesson learned is that the main drivers arise from the political support of the technology in question. The vast majority of the stakeholders thought that if the state is sufficiently engaged in a technology push, then stakeholders will more easily collaborate and technology has a greater chance of making an impact. This means that the collaboration process is not in itself a problem or barrier, but rather the (political) conditions in which it takes place. For example, hydrogen has had its share of 'good press' lately, but there are also some critical voices and not everyone is equally enthusiastic about the technology. Some say that green hydrogen 'takes away' green energy that can be used otherwise with less loss of energy. The political context can also change quite quickly, particularly in situations of crisis.

In terms of challenges, our main observation is that civil society is not typically part of research and development (R&D) projects in this sector. Civil society representatives were sporadically present in the discussions, such as when environmental organizations were invited to take part in the discussions or when a municipality representative defends the interests of the smaller communities affected by the technology. However, generally speaking, the developments in the hydrogen economy are carried out at the intersection between the other three helixes: industry, policy and academia. An exception to this is the particular topic of the use of hydrogen in the urban environment, where the level of civil society participation is higher. Where hydrogen is used as a heat source for households, the citizen becomes a much more important stakeholder. It's not only a factory somewhere that needs change, but rather people's households. In such applications, the implication of civil society – for example, through participation in meetings or trials – is encountered much more often.

Another barrier for collaboration is that the community is somewhat divided regarding the use of two different types of hydrogen. Everyone agrees that hydrogen plays an important role in the energy transition. The reasons are straightforward: hydrogen is employed on a large scale in a variety of industries such as the steel industry. In some industrial processes, hydrogen is simply indispensable. Nonetheless, currently some 90% of this hydrogen is produced from fossil fuels (usually natural gas) with the release of greenhouse gases as a result. Hydrogen produced in this way is known as grey hydrogen. Producing hydrogen in a more sustainable way is thus a way to realize climate goals at the global level. However, it is not immediately clear how to approach the task of giving up hydrogen produced from fossil fuels with the release of CO_2. Two courses of action have spurred some discussion lately in expert and policy circles. Blue hydrogen is the hydrogen that is produced in much the same way as grey hydrogen, but the CO_2 (not all) is captured and stored or re-used so that it is not released into the atmosphere. Green hydrogen is the hydrogen produced through a process known as 'water electrolysis'. Essentially, an electric current is run through water until oxygen and hydrogen are separated. With the exception of heat and some small remnants, this process releases no CO_2 into the atmosphere. These two distinct forms of hydrogen production have led to the formation of separate sub-communities that are strongly in contact with each other but also separated by deep disagreements. Many stakeholders suggested that the collaborations in the hydrogen economy would be much better if everyone were 'on board' with one of these technologies, but that – as such – several 'camps' have been generated, whereby each defends their own technology.

A final challenge is that the hydrogen economy is still in its infancy, meaning that it is primarily open to major players that have sufficient capital to make a move. When collaboration occurs, it typically involves the top sectors of all helixes, leaving very little space for newcomers, whether it is the case of mall and medium-sized enterprises (SME) or lower-level governmental representatives. Hydrogen is thus 'big business' and until it becomes mainstream, the world of hydrogen will continue to be almost exclusively populated by major names in all helixes.

LESSONS FOR QHCS

During our collaboration with various actors in the hydrogen community, we've learned that there are many ways in which co-innovation can take place, with no standard pattern. However, we would not like to draw the conclusion that there aren't any underlying principles of a good collaboration during R&D. We have found these principles to be sufficiently general to apply in many situations, while at the same time allowing the R&D stakeholder to exercise liberty in applying specific participatory methods for the QHC.

1. Keep the agonism going!

> By 'agonism', we simply mean the state of competition between helixes and – by extension – the state of competition between alternative designs of the same technology (e.g. different ways of producing green hydrogen) and between alternative technologies (e.g. green hydrogen or blue hydrogen). At times, it is more difficult to keep this fruitful 'clash' of perspectives going, especially when the parties involved seem satisfied with a particular decision or design (of a technology or applications). However, it is important to remember that there is no co-innovation without competition over designs, as you constantly need diverse (and divergent) perspectives to ensure that the innovation process is duly accommodating alternative designs of the product

or process in question. If the set design ultimately proves to be the best one, namely the one that survives in this competition of alternative designs, all the better. Nonetheless, the design might also be improved by maintaining the agonism, so keep it going!

2. Being responsive is not the same as being uncritical

Of course, mere competition over alternative designs or alternative technologies does not mean that those alternative designs get to be expressed in the end result. However, it also does not mean that all alternative designs (or alternative 'innovation paths') are of equal value or – even less so – that every alternative design should be incorporated in the end result. The message of tolerance and plurality that is often carried out in the fields of QH Innovation and responsible research and innovation is much needed and promotes the right virtues for new inventions that are socio-ethically accountable and robust. However, tolerance should not amount to the weakening of our critical senses and the seeking of unpractical and ultimately unfeasible compromises. Try to allow various degrees of openness to alternative designs and judge these alternative designs with respect and open mindedness, but not uncritically!

3. Make a salad, not a cake!

Collaboration should not lead to the group of stakeholders melting into one, becoming a homogenous whole that thinks and acts in unison. Perhaps such a level of agreement is fruitful every now and again, at some junctures in the innovation process. However, most other times the art is to combine different perspectives without losing their identity. If we are to make a food analogy, we could say that the goal is to make a salad where every ingredient (read: value) participates in the process, not a cake where initially different ingredients end up being indistinguishable from each other. In practice, this means that identities and preferences should not always be modeled or changed during the interaction, since – as explained above – there is added value in working with a diverse team.

LESSONS ABOUT THE SL PROCESS

The social lab process did not take place as we initially planned. Our main idea in starting the social lab was that there is little or no collaboration in the hydrogen community and that we would provide our public engagement 'services' to a set of projects. In reality, we have found a tightly woven community in which most stakeholders are very active. Furthermore, we have found that the community is organized around certain centers of power that are very vocal and present in the community. This means that without their endorsement, it is very difficult to establish a presence as a project, even – or perhaps especially – as a 'side project' with a fundamentally non-technical theme. We therefore had to adapt our SL manual in a variety of ways, primarily by undertaking a more localized, small-scale version of the planned meetings. However, once the SL interventions started, we noticed that this tightly woven community is not at all closed. They are particularly interested in discussing with us and among themselves about the socio-ethical challenges of the hydrogen economy. Furthermore, they are generally very knowledgeable and opinionated on such issues, so it is not at all difficult to persuade them to speak up.

CHAPTER 3

TOWARDS COLLABORATION WITH SOCIETAL ACTORS IN THE FIELD OF INDUSTRIAL AUTOMATION

Fabian Schroth and Jakob Häußermann, Center for Responsible Research and Innovation at Fraunhofer IAO

ABSTRACT

This chapter provides insights from a research-initiated Quadruple Helix Collaboration. A social lab on the future of work was established within an existing local innovation ecosystem. The lab provided space to reflect on the societal impacts of a new technology. This chapter shows the different resources that the four helixes may contribute to innovation processes in the field of industrial automation. Furthermore, it draws attention to the local innovation ecosystem of a Quadruple Helix Collaboration, as well as the importance of civil society in making a technological innovation a success.

INTRODUCTION

How could societal aspects such as ethical, ecological and social issues be taken into account in the future of work of industrial automation? This question motivated the Future-Work Lab at SmartFactoryOWL in Lemgo, Germany.

Industrial automation refers to cyber-physical systems that connect products, machines and workers via the internet. Industrial automation will fundamentally change the interaction between humans and smart machines. Depending on the area, automation may replace or complement human labor. Overall, it is predicted that industrial automation leads to more demanding jobs in terms of complexity and with higher compensation, which means that the demand for higher educational attainment will increase.

SmartFactoryOWL is a real-life laboratory for industrial automation. It is located in Lemgo, a small town in East-Westphalia Lippe (OWL), nowadays one of the strongest economic regions in Germany. SmartFactoryOWL is initiated by Fraunhofer IOSB-INA, a research institute working in the field of industrial automation. The institute is part of Fraunhofer, Europe's largest application-oriented research organization. The main aim of SmartFactoryOWL is to enhance the transfer of technology to industry and society and strengthen the ties to local companies and industry. For this purpose, it demonstrates new technologies to interested stakeholders, communicates its benefits and prospects and connects relevant innovation stakeholders. At SmartFactoryOWL, people and organizations in the field of industrial automation come together when they meet on a demonstration shop floor. Here, researchers demonstrate new technologies on machines not only to potential customers but also to government representatives and sometimes even civil society.

The European project *RiConfigure* strived to implement a Quadruple Helix Collaboration (QHC) at the SmartFactoryOWL, a collaboration structure enabling not only business, research and policy to take part in the innovation process but also societal actors. The central motivation for the SmartFactoryOWL to start such a collaboration was to consider societal aspects when developing further solutions in the field of industrial automation. In the research-initiated social lab that SmartFactoryOWL and Fraunhofer CeRRI set up between February 2019 and July 2020, overall 21 representatives of research, civil society, business and government met four times in person as well as digitally. At the meetings, they identified and reflected upon societal perspectives to innovation in industrial automation and tested methods to integrate and use this perspective for further developments. Fraunhofer CeRRI – a research organization working in the field of society-driven and participatory innovation processes – conducted and moderated the collaboration and developed the methods that were used in the collaboration.

Five participants in the meetings represented academia, six industry, four society and one government. Societal representatives came from labor unions and vocational education and training. Five participants represented intermediary organizations, which aim at bringing together actors from science, industry, society and/or government. Participants were motivated to participate, as it was supposed to provide space to not only discuss technological aspects of industrial automation but also reflect on the social and ethical implications of industrial automation technologies both within an organization as well as on society as a whole. All participants realized the importance of broad social issues such as education and training, the new way of working together between people and machines and the importance of increased employee participation.

THE LOCAL INNOVATION ECOSYSTEM

The SmartFactoryOWL is located within an existing local innovation ecosystem, comprising the university of applied science (TH-OWL), the Fraunhofer institute IOSB-INA, various intermediary organizations, vocational schools as well as small and medium-sized companies, all of which are in close proximity. Well-established and highly professionalized connections between science and industry exist, as employees of SmartFactoryOWL advice small and medium-sized enterprises (SME) in the area, work together in joint research and develop projects together. Connections to government exist at two levels. First, government has played a role as a rule-setter and financier. Federal and state governments finance research and industry projects and set policies, programs and strategies, in which the local innovation ecosystem evolves. In particular, they co-finance the SmartFactoryOWL. Second, at the local level, there are also direct professional contacts to the various mayors and the local governments in the region of OWL. These contacts provide local political support for the innovation ecosystem. This even manifests in support for setting up physical infrastructure, including buildings, parking lots, and streets. Actors from the academic sector, business and government have established various intermediary organizations over time to intensify contacts among the actors, translate the diverse needs and languages and consolidate common interests.

Within this innovation ecosystem, no dedicated formats and processes exist to integrate societal aspects into the innovation processes. However, representatives of academia and industry have gradually become aware that media, personal interaction and the public discourse affect their work. Environmental issues such as climate change and energy consumption, ethical issues such as data protection, and societal issues such as acceptance, the need to create (new) jobs and the digital divide of society are important for the success of new technologies.

Becoming aware of the role of society for innovation, the SmartFactoryOWL has developed new formats of science communication to enter into contact with society over recent years. It has organized hackathons, an open factory day, and even provided space for voting rooms for local elections. It has also sought direct access to citizens and set up a bureau in the city center, where citizens could inform themselves about the risks and opportunities of new technologies.

THE FUTURE-WORK LAB: QHC IN INDUSTRIAL AUTOMATION

SmartFactoryOWL and Fraunhofer CeRRI invited actors from the local innovation system to discuss the future of industrial automation. At the first meeting, participants agreed that "the future of work in industrial automation" should be the central topic that they wanted to discuss in the social lab.

This topic relates to the impact of industrial automation on jobs. Media coverage and public discourse was quite critical in this regard. Studies have gone public arguing that industrial automation may cost up to 60,000 jobs in Germany alone. Moreover, it relates to ethical aspects regarding human-machine interaction. Having the space to discuss this aspect, learn about the technologies and the different perspectives in this regard motivated stakeholders from all innovation sectors to participate at the lab.

For the researchers at Fraunhofer IOSB-INA, this focus was new. Most of the time, they collaborate with engineers, technology and business experts in their research projects. In such projects, this perspective does not come to the fore, although it emerged that particularly workers' committees may be a "show-stopper" for projects and new technologies, as one of the lab members described. If they oppose such projects, companies are not allowed to invest in such new technologies. On the other hand, if their critical stake was taken into account in the further development of automation technologies, it was more likely that the research projects would come to a successful end. Moreover, in other projects, people at SmartFactoryOWL recognized that societal acceptance is relevant to successfully and efficiently implementing new technologies.

The future-work lab provided space for such discussions. The participants used specific methods to reflect on their particular role in the innovation processes and the competencies and resources that actors may provide to the future of work in industrial automation. One of these methods – a noticeboard – allowed participants of the lab to systematically display the needs and resources of different stakeholders regarding industrial automation (see FIGURE 4). Stakeholders could present and respond to ideas, solutions as well as questions regarding future of work in industrial automation and allocate them to the categories of "ethical questions", "social aspects" and "regulatory aspects".

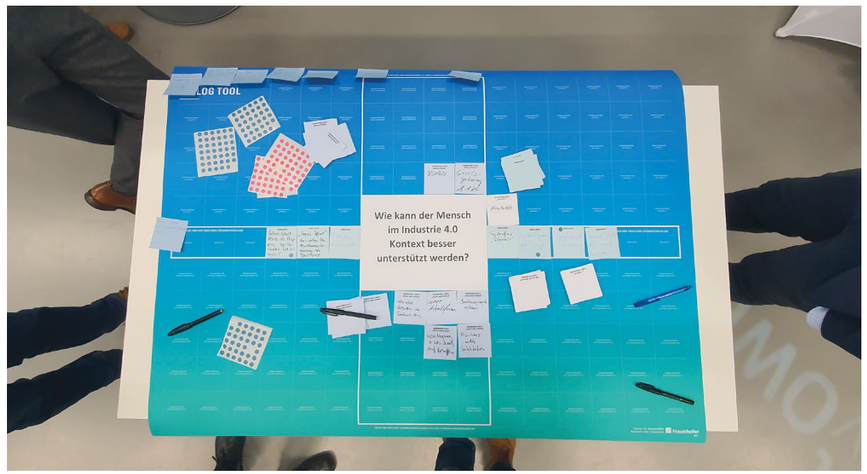

FIGURE 4_
Method used in the social lab to reflect on the different perspectives of the participants

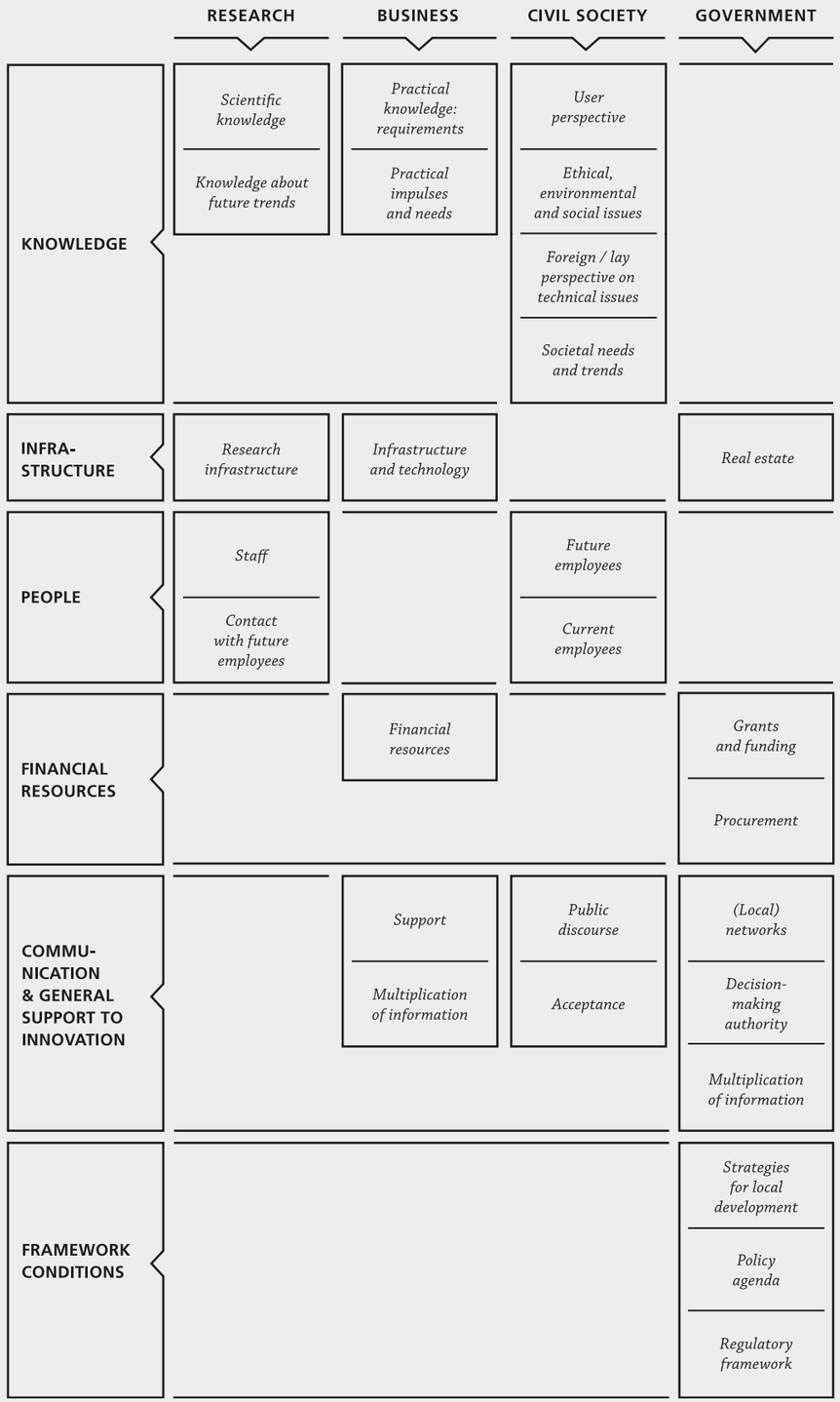

FIGURE 5_
Competencies and resources of innovation actors in the field of industrial automation

As a result of the discussions, participants identified different competencies and resources that the various actors could contribute to innovation processes in industrial automation (see FIGURE 5).

According to the participants, the four sectors provide different resources and competencies regarding the future of work in industrial automation. "Government" shapes the framework conditions for innovation and provides financial resources. Furthermore, it offers networks to multiply information and organize support for innovation. "Civil society" mainly contributes a different sort of knowledge to innovation processes.

Societal actors have a lay perspective on technologies, allowing them to draw attention to needs, overall trends and ethical, environmental and social implications of technologies. However, society is most important for industry 4.0 as it may grant or deny the acceptance of the technology. Thus, society has a thorough impact on the success of innovation. "Business" provides practical knowledge, infrastructure and financial resources, while "research" adds primarily scientific knowledge and research infrastructure as well as personal resources and contact with future employees.

RESULTS AND LESSONS LEARNED

The future-work lab provided a format dedicated to reflecting on the societal dimension of industrial automation. As such, it revealed to the participants the complexity of industrial automation, which is not only a technological issue but one that affects human-machine interaction, the future of work, education and new business models. Industrial automation is a complex problem, particularly when it comes to implementing such automatized processes. The participants became aware of the diverse perspectives and the different resources and competencies that actors from business, civil society, research and policy may contribute to innovation in industrial automation. Furthermore, for the initiating researchers, the future-work lab explicated that an early dialog with civil society actors – with those being affected by a technology – may increase the acceptance of a new technology. With the QHC model, the project provided an analytical tool to reflect on this. As a result, SmartFactoryOWL and Fraunhofer IOSB-INA are going to open up their processes beyond direct project partners. In new projects, SmartFactoryOWL now enters into contact with these people early on to enhance the acceptance of future technologies.

What can we learn from this case for the overall question? How QHC can be set up in practice?

This chapter shows that QHC in research in industrial automation can be productive. However, some conditions must be fulfilled. We derived four such conditions from future-work lab.

1. Let a well-known and trustworthy player establish the QHC

SmartFactoryOWL and Fraunhofer are central players in the local innovation ecosystem. They have useful and resilient contacts with business, research and government in this area. They not only have a renowned name but – as a research institute – they are also recognized as a neutral and trustworthy player.

2. Establish a QHC with regional ties among the partners

In the future-work lab, all participants come from the same area, i.e. OWL. Thus, there was a common goal among the participants to support the economic, industrial and innovative basis of this area. The participants either knew each other, had the same stakeholders or some other kind of connections.

3. Let civil society be represented by professional organizations

In this case, civil society was represented by professional organizations that had already contact with the initiating stakeholder. When organizing the future-work lab, the SmartFactoryOWL invited organizations and people with whom they already had contact: labor unions, educational institutes, and intermediary organizations. It was easy to enter into contact with them, as they already had their mail address and phone numbers. As the representatives of civil society were used to meetings with industry and academia, it was not necessary to change the format or culture of the meetings. The meetings of the future-work lab took place during work time in a classical workshop format.

4. Collaborate about strategic not operational issues

The future-work lab was not about operational but strategic issues. Participants did not discuss one particular project or one particular technology. Instead, they used the time and space to reflect on the potential impact of industrial automation technologies and discuss various perspectives of it. It was mainly about learning and trust building, and less about explicit outputs.

CONCLUSION

Although setting up a functioning QHC is quite challenging, the benefits are vast. Such processes reveal new knowledge, uncover potential risks and show-stoppers, and increase acceptance for the particular innovation. Moreover, a democratic potential is revealed. In a reflection session, a participant in the lab said: "We live in a democracy. Civil society expects to participate in the creation of new technologies. We need to take this into account, otherwise new technologies may not succeed." While this is already important for high-technological fields like industrial automation, this need multiplies in what is called mission-oriented research, namely research that provides solutions to societal challenges.

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CHAPTER 4

STEPS TOWARDS QUADRUPLE HELIX INNOVATION. LESSONS FROM THE 'COMMUNITY CREATES MOBILITY' COLLABORATION

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ABSTRACT

In chapter 4, the policy-initiated Quadruple Helix Collaboration Community Creates Mobility is used to show how aspects of the Quadruple Helix Innovation model can be used at the activity level to create an innovation ecosystem for mobility of the future. By including new actors in innovation processes, Community Creates Mobility could take a leap towards democratization and addressing challenges of mobility, social justice and climate crisis. This chapter shows the input and throughput benefits that such a constellation can have for mobility innovation by providing insights into the praxis of setting up structures for innovation collaborations.

CHALLENGES OF MOBILITY ECOSYSTEMS

Innovation in the mobility sector is often equalized with the latest improvements of car engines, like e-mobility, or new business models in urban areas like e-scooter sharing models. However, innovation in this field is very broad and connects diverse industries, people and places, as well as including societal trends such as sustainability, demographic change or urbanism. Fostering change in mobility can be understood as a so-called wicked problem, characterized by social pluralism, institutional complexity and scientific uncertainty. There is a multitude of interests and diverse values in the context of mobility: for example, at the user level, daily commuters from suburban areas have different needs than urban residents. There are different kinds of organizations and institutions that have to collaborate at all levels; for instance, public administration, road construction and start-ups with specialized mobility solutions have to work together to create new modes. Mobility not only includes moving people from A to B, but it is also entangled with society and connected to issues such as climate crisis and social justice.

Community Creates Mobility (CCM) – an innovation and networking ecosystem based in Austria – addresses this wicked problem of changing mobility by creating a network of diverse actors connected to challenges of mobility innovation. In the last eighteen months, as part of the Austrian social lab of *RiConfigure*, we were able to participate and observe the way in which the Austrian Railways (ÖBB) – a publicly-owned corporation and major Austrian rail service provider with more than 40.000 employees – has set up this collaboration and tackled this challenge.

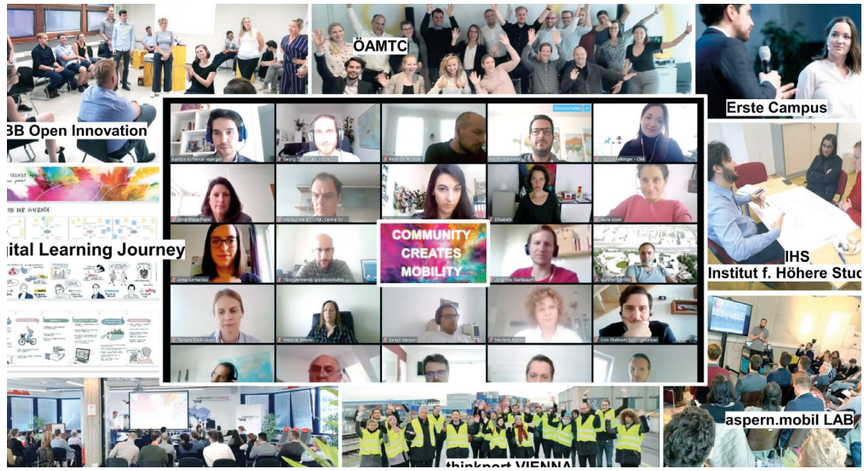

FIGURE 6_ Overview of Community creates Mobility's activities

OPEN INNOVATION IN AUSTRIA

In the social lab on policy-initiated collaborations, we first analyzed the policy and governance frameworks for innovation in Austria, where we could identify a strong policy push that helps innovators to set up new non-traditional innovation constellations. There are several policy papers and strategic documents by the Austrian Federal Government that support inclusive innovation and citizen engagement in innovation processes. The most important among these is the 2016 Open Innovation (OI) Strategy by the Austrian Federal Ministry of Science, Research and Economy and the Austrian Federal Ministry for Transport, Innovation and Technology. Austria took up a leading role in the European Union by being among the first to publish such a document. Quadruple Helix (QH) Innovation or Open Innovation 2.0 are concepts used in this context that push towards focusing on innovation in which policy, business, research and civil society participants co-create. It aims to expand innovation platforms or collaborations towards lesser in-

volved actor groups, such as artists, NGOs, or at the citizen level. Moreover, the "end-user" perspective is embraced in this strategy paper and claims that by engaging more citizens to innovation processes more complex issues can be addressed and innovation cycles can be speeded up to push Austrian innovation internationally. This perspective argues for better results for both society and the economy. However, it should be noted that while there indeed exists public funding that follows the guidance of the OI Strategy, QH Innovation is much less explicit and frequent at this level of research support.

MOBILITY INNOVATION IN AUSTRIA

In mobility innovation, the direction of the Austrian OI Strategy worked as a guide for many emerging initiatives, like urban mobility labs, makerspaces or mobility platforms. It helped these initiatives to identify partners beyond their own networks, especially using the QH model to identify actors from business, policy, research and civil society in their activities. The OI Strategy explicitly pushes for inclusive innovation to boost Austria as an attractive business location, being the "first in the EU". Besides the policy push for democratizing innovation, a strong driver for transforming innovation processes was a shared vision to strive for more sustainable mobility systems.

Austria is a small country at the heart of Europe, with one comparably large city and several smaller cities. It has a public transport system that is mostly organized around these urban areas and that is predominantly state-owned. There are some private competitors on the heavily-used connections, but – besides car industries – the major mobility players are public companies. ÖBB is one of these, as a publicly-owned major corporation with multiple responsibilities, experimenting with new forms of innovation ecosystems while maintaining and managing its very important core business providing efficient public service mobility options for Austria and beyond. In the *RiConfigure* project, we worked together with the ÖBB's OI Team and gained insights into the transition towards democratizing mobility innovation.

CREATING A COMMUNITY FOR MOBILITY

In the beginning of *RiConfigure's* engagement with the Austrian Railways' OI Team, the direction of their OI activities was linked to the OI Strategy's goal of multiplying and diversifying the actors to their innovation systems. An initial plan at this time within ÖBB was to create a larger infrastructure project where different actors would work together in a physical space to innovate together. An existing un-used industrial area close to the main station in Vienna was the imagined space to invite new players to innovate together. The inspiration for this was other larger projects like the "Tabakfabrik" in Linz (Austria), a former factory building now revived with public funding to create a hub for collaboration, innovation and arts. This space is used for working together and co-creating the future. It is a place funded by the public where arts and sciences can connect with society and business, thus in line with the idea of QH Innovation.

However, the infrastructure plans by the ÖBB were transformed: changes in government and resulting barriers beyond the collaboration and financial uncertainties of how such a large infrastructure project can be justified towards taxpayers made ÖBB's OI Team reshape the process towards creating an innovation ecosystem for mobility. There was a shift in understanding concerning what was needed before being able to create a physical space for collaboration. One of the innovation managers later reflected: "We then understood that we need a community before we can think of developing a physical space". This re-thinking of the process helped to navigate through the barriers both by the institutional setting of a public company and the challenges of finding collaboration partners. There was still a drive towards opening up and creating a community that could work together to face the challenges of the mobility of the future.

Out of this new perspective, CCM was born. Initiated and managed by the ÖBB OI Team, the loosely-organized initiative aimed to challenge the status quo of mobility innovation by sharing their learnings through a series of meetings open to people interested in mobility (futures). A shared vision was created with a number of respondents and later described in the co-created document, the Mobility Manifesto. By the end of 2020, CCM and its events had attracted more than 300 people and established a management board. This is how they described themselves at the International Mobility Days 2020:

> **"Community creates Mobility is an open knowledge and network ecosystem around the topic of mobility, which connects people with an affinity for mobility, shares information, and encourages open discussion. The community is a turn-to platform that follows a participatory and inclusive way of debating and shaping future solutions. It already cooperates with over 200 corporates, start-ups, public institutions, civil society, and science to create a basis for expertise and initiatives"**
>
> *International Mobility Days, 2020*

With the theoretical background of the *RiConfigure* project, we interpret this shift as a way of using the QH model as a tool to navigate through the barriers given by the environment and the collaboration itself. The transformation that we observe is not a linear process but a vision that many of the strategic decisions have headed towards. The QH Innovation model was thus used to identify gaps and challenges of the anticipated change, adopted to be useful for their praxis. In the following, we will describe the key transformations connected to "QH thinking" and derive recommendation from our learnings.

ORCHESTRATORS FOR BUILDING UP THE STRUCTURES

How did CCM become an innovation community? In the first phase, ÖBB's OI team's goal was to reach different actors in mobility to broaden the discussion on mobility of the future and share learning from innovative ventures to create a community. The social lab of *RiConfigure* accompanied these steps from the beginning by participating, providing reflections and input from *RiConfigure's* research on non-linear innovation and the inclusion of civil society. Within the project, the IHS (Institute for Advanced Studies, Vienna) – as part of *RiConfigure* – therefore represents the research helix of the QH model.

The OI team of the ÖBB provided a structure in the initial phase of CCM. This included a space for meetings, providing an online workspace, communication strategy, facilitators, etc. and was the main driver of CCM. The activities were organized as meetings for exchange and mutual learning, as regular workshops called learning journeys. During each time, initiatives or projects engaged in mobility innovation would present their learnings and challenges. The idea was to create a community that would work together by sharing and informing each other and providing opportunities for working together. Another praxis example of this early phase was a blackboard with collaboration ideas, open spots or spaces for workshops that was put up at each event, which conveyed a sense of responsibility and opportunity to work together.

Across the process, CCM actively tried to better involve actors from civil society, including NGOs, NPOs and citizens. Similar to the experience in all of *RiConfigure's* social labs, this type of actor was most challenging to identify and engage in such a collaboration. The other three groups of actors had a strong (business) interest in joining, as well as the resources to do so. One way in which CCM addressed the underrepresentation of civil society actors was to specifically ask actors outside the traditional settings to speak at learning journey events, and they used the QH model as a tool to shed light on the consumer or citizen perspective, which is often not visible in innovation settings or business networks.

After the first phase of building up a community of like-minded people and institutions, the ÖBB's OI team approached members of the CCM ecosystem to be part of the management board and become so-called orchestrators. These can be seen as representatives of the community who manage the community. This role was shared among different types of actors. In this case, the four sectors of the QH model were explicitly used to uncover the power structures and explicitly engage people from civil society. This goal was discussed and agreed on during the *RiConfigure* social lab meetings. From them onwards, the orchestrators were in charge of several management tasks, including strategic decisions and supporting the administrative team. Nonetheless, this voluntary role was designed quite openly and allowed other members to join in if they wished to do so. This was written down in a ten-point checklist to specify the tasks that would be taken on. Members of the CCM – who had resources given by their organizations – were more likely to join than actors who had no organization backing them. For this reason, it was difficult to find civil society actors to contribute, including because the goals and benefit of joining CCM in this phase were most likely too vague for these actors.

MOBILITY MANIFESTO: SETTING GOALS AND ALIGNING INTERESTS

Parallel to building formal structures for future collaboration, CCM designed an open and participatory goal-setting process. The idea was to co-create a document with guiding ideas and values for mobility. This document was created in two workshops that invited all members of CCM. There, participants collected main topics that the community should address and specified the direction in which the community should proceed. Participants from different fields within the mobility sector (e.g. development of AI, public transport companies or researchers in the field of logistics) contributed and broaden the spectrum of challenges and defined the direction that the community could take. Between the workshops, a shared online document was used to gather and revise input. CCM members who could not participate in the workshops also had a chance to contribute to this goal-setting process. It was a smaller core group that mainly shaped the content of this document.

The outcome of this process was the Mobility Manifesto, which included a new perspective on mobility. "Mobility as a Commons" was introduced in one social lab meeting as a new way to tackle mobility challenges besides competition-thinking and the scarcity of space and resources. This includes some degree of self-governing mobility with the aim to be socially and environmentally sustainable. CCM translated this to their language as "an orientation of new innovation on the needs of citizens" and "orientation on the values of fairness and inclusiveness". The first version of the Mobility Manifesto was presented at the one-year celebration of the CCM in July 2020.

FIGURE 7_
Cover of the Mobility Manifesto

COMMUNITY IN ACTION: MUTUAL LEARNING AND QUICK ADOPTION TO NEW SITUATIONS

The core activity of CCM is mutual learning and participatory events on mobility innovation, which are organized as regular events called "learning journeys". CCM used the QH model as a tool to identify speakers and give people from civil society a voice in these events. They also gave CCM members a chance to present their work and their organizations, e.g. urban mobility hubs or public mobility organizations like the Austrian Touring Automobile and Motorcycle Club (ÖAMTC).

When the first lockdown in March 2020 started, due to rising numbers of COVID-19 cases across Austria, the orchestrators team decided to start an online event series on "Mobility and Corona" to gather the knowledge and experience from CCM members and co-create possible and wishful future scenarios. Three workshops were set up to canalize the energy and new challenges stemming from COVID-19 for mobility. The workshop included a pre-assessment of challenges, participatory sessions, work on a collaboration whiteboard and resulted in establishing working groups to tackle the challenges. Approximately 100 people from Austria, Germany and Switzerland joined in this process and developed a resource of challenges and new thinking that can help mobility and society to overcome these new challenges. CCM managed to initiate these online reflection workshops without much delay, while others still struggled to set up their working environment.

CONCLUSION: WHAT CAN WE LEARN FROM THIS PROCESS?

The QH Innovation model is a normative framework that is based on democratic values. However, it has shown to be quite challenging to be implemented and transferred to real-life settings. The future of mobility is a wicked problem and the approach to tackle it was by joining forces with diverse organizations and people interested in mobility. For the praxis of CCM, some aspects of the QH model proved to be helpful to achieve a higher degree of democratization and social value inclusion.

The QH model helped to show power inequalities, the dominance of selective (business) interests and the lack of representation of civil society actors:

> In one of *RiConfigure's* workshops, we used the four helixes to divide the participants and make the representation of sectors at the workshop visible: this simple step was used in following activities of CCM. A live voting tool was used to show what helix the participants identified with.

> This was used in all subsequent events to also show that there is space for non-traditional actors. This repeatedly showed the strong presence of business and policy, the low participation of research and almost entirely absent participation of civil society in most places. However, it was also highlighted in the external communication and at each event that there is space for non-traditional actors in this ecosystem. One way to overcome the low participation of civil society was to actively include all helixes as speakers and invite NGOs to show benefits of joining, as well as enabling future collaborations.

With the help of the QH model, a new collaboration structure was set up in a transparent and inclusive way:

> The QH concept helped in the process of setting up a structure for future innovation activities. Due to the engagement in the social lab process, there was space to reflect on inclusiveness and transparency. The strong knowledge, workforce and network backbone of a major public company helped to focus on non-economic goals as described in the Mobility Manifesto. It shed light on the pressure to only include same-sector actors, who have a similar culture, speed, resources and goals. In cases of *RiConfigure's* empirical research, it was shown that a strong structure is needed to enable all actors (especially civil society actors) to join such a collaboration. The administrative structure and the outcome of the activities needs to be clear and easy, as resources of actors from civil society are most often limited.

A shared goal can help to overcome individual or institutional thinking:

> The step of co-creating the Mobility Manifesto with common goals and a normative direction for the collaboration supported the new management board to formulate their goals that might be in conflict with the public-sector initiator and empower others to join in based on the goals. Alignment of interest was one of the core activities of the CCM, yet in a new phase this will be re-evaluated and it will be decided what role this should have in the CCM's activities. Moreover, in *RiConfigure's* findings, we saw in other cases that "envisioning even idealist perspectives may help to motivate partners to overcome barriers by aligning goals and potential values". Although the Mobility Manifesto is not core to all activities of the collaboration, it shows that the general direction of the CCM is based on inclusiveness and holistic solutions to the wicked problem of mobility futures.

A national funding strategy that supports QH Innovation and pushes for more non-linear innovation systems made it possible to think beyond institutional borders:

A strong policy push in Austria towards Open Innovation 2.0 supported new actors to collaborate and experiment with inclusive innovation processes. New collaborations could be established on different topics. In mobility innovation, new urban mobility hubs, publicly-funded initiatives and the CCM emerged from this. These are currently collaborating and facilitating new connections of policy, business, research and civil society or citizens.

Change is to come: mobility innovation faces different challenges that are complex and connected to different values in our society. Through the social lab of *RiConfigure*, we identified and jointly shaped an ecosystem for innovation inspired by ideas of democratization as suggested by the QH model to co-create the mobility of the future.

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CHAPTER 5

CHALLENGES OF ENGAGING CIVIL SOCIETY IN INNOVATION PROCESSES ON CLIMATE CHANGE ADAPTATION

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ABSTRACT

This chapter provides insights from civil society society-initiated Quadruple Helix Collaborations. It discusses the case of climate change adaptation and reveals the challenges of integrating civil society actors as full-blown partners in innovation collaboration across sectors, as opposed to actors that are merely consulted. Focusing on the structure of Quadruple Helix Collaboration, it provides suggestions concerning how the existing will to collaborate with civil society can be fostered and supported.

INTRODUCTION

Climate change is one of the main challenges of our times. As it does not respect established structures and remits of society, tackling the challenge requires a high level of cross-sector collaboration and alternative organizational setups. When the sea level rises and rainfall increases, it affects us individually as well as collectively and raises questions like "how should we adapt?" and "who should pay for it?". In order to avoid the problem being pushed around between different societal actors resulting in expensive, unequally distributed and suboptimal symptomatic treatment as opposed to robust solutions, the questions require a collective answer and democratic approach to innovation. For this reason, Social Lab IV located in Denmark focuses on climate change adaptation, which includes both wastewater management and coastal protection. The experiences from the lab are based on five cases.

SUSTAINABLE RECREATIONAL AREAS

A democratically-governed housing association wants to adapt its residential areas to climate changes. Consequently, the association has established a collaboration with the local utility company, the municipality, its neighbors, and a facilitating partner that – among other things – draws in academic expertise. The idea is that the adaptation should both protect the residents from floods, recycle water sustainably, and make the areas more attractive to its residents.

Climate center

A collaboration between a utility company, a municipality, private actors, and academics aims to establish an innovation center explicitly based on the model of Quadruple Helix Collaboration (QHC). It is the vision of the center to facilitate the establishment of QHCs to solve challenges within the areas of climate change adaptation, green transition, circular economy, and the environment.

Citizen-driven climate adaptation

The municipality is required by law to make a plan for adapting certain areas to climate changes. In order to provide the necessary adaptations, the municipality has decided to involve the citizens and/or landowners as primary decision-makers. The municipality believes that this involvement will create ownership among the citizens and make the financial contributions that the landowners have to pay for the adaptations more acceptable.

Engaging climate adaptation

The municipality is required by law to make a plan for adapting certain areas in the city to climate changes. The municipality has decided to address this challenge by developing a holistic model that breaks down the demarcations between legislation, the municipality, the utility company, and the landowners and establish a close collaboration in the best interests of the city.

Collaborative climate adaptation

A housing association received funding for adapting their residents to climate changes. At the same time, the municipality was outlining a new climate change adaptation plan. This prompted the housing association, the municipality, and the utility company to join forces and initiate a larger climate change adaptation project in the city.

THE CONTEXT OF THE QHC: GOVERNANCE FRAMEWORKS

Experiences from the Danish social lab show that QHCs are problem-driven. They emerge out of a context in which partners recognize the importance of collaboration because the problem cannot be solved by one single actor or because there is no immediate answer to the problem. In our social lab, the collaboration-prompting context is closely related to the framework that governs climate change adaptation and involves both wastewater management and coastal protection.

WASTEWATER MANAGEMENT

As a minimum, wastewater management in Denmark involves the municipalities (public sector) and the utility companies (private sector). However, it also often involves citizens (civil society) to develop sustainable and robust solutions.

The municipalities are responsible for planning and focus primarily on protecting the environment and determining the service level provided to the citizens. The service level defines the extent to which the citizens experience wastewater at street level due to system overload. The utility companies handle wastewater and deliver clean water to households and industry. They are also responsible for complying with the environmental and service goals determined by the municipality but at the same time responsible for finding cost-efficient solutions that reduce the citizens' service costs.

This allocation of responsibility causes a number of potential tensions. On the one hand, both the municipality and utility company's interest in technical solutions is focused on meeting the service level requirements. In addition to this, they can have interests in potential added value connected to alternative ways of managing water such as recreative spaces, cloudburst mitigation, and savings on technical systems.

On the other hand, the citizens are primarily interested in low water taxes and technical solutions that protect them against floods. They are only secondarily interested in innovative planning solutions.

Moreover, the utility company is restricted economically by requirements of cost-efficient investments in a way that the municipality is not. This also means that the utility company can only support municipal or private investments in climate change adaptation related to management of wastewater from roofs and surfaces.

These differences in responsibility and interests constantly raise the questions of what the different actors are required and allowed to do. For example, it is difficult to determine when climate change adaptation is related to the surface of a certain area, which makes it

difficult to assess whether the utility service is allowed or required to support municipal or private investments. A common interest in wanting to overcome these tensions and uncertainties to effectively tackle the climate change challenge creates an incentive for cross-sector collaboration.

COASTAL PROTECTION

Coastal protection in Denmark is regulated by the coastal protection law, which obliges the municipality to protect the coast but leaves it with the competence to decide where and how. This also means that the municipality can ask landowners that benefit from the decided protection to contribute financially to its realization. However, the law does not describe in detail when a coast should be protected and when a landowner benefits from the protection and hence should contribute financially. Consequently, this raises an obvious risk of conflict that the actors want to avoid, which gives them an incentive for cross-sector collaboration.

THE DANISH SOCIAL LAB: ENGAGING CIVIL SOCIETY IN INNOVATION ON CLIMATE CHANGE ADAPTATION

The aim of our social lab is to explore how civil society organizations initiate new constellations based on the assumption that the initiator of the QHC is important to the nature of the results of the collaboration. However, experiences from the lab show that civil society organizations hardly ever initiate cross-sector collaborations dealing with climate adaptation. In the cases where they have a somewhat initiating role, the organizations are more reactive than proactive, being incentivized to act under pre-defined circumstances, e.g. replying to other actors' encouragements or accepting funding that is reserved for narrowly-defined purposes. Nonetheless, the cases still suggest ways to support the role of civil society in innovation processes.

Relating to the activity level, practitioners should pay attention to the fuzziness of the concept of civil society, which covers everything from unorganized – sometimes marginalized – groups to strong civil society organizations, making it challenging to determine both what civil society is and how to involve it in innovation. This has been a recurrent theme in the lab, where the non-civil society participants have been asking questions such as: How do we get in contact with civil society actors? How and to what extent should civil society be involved? How do we delimit civil society? While there is no definite answer to these questions, they are constructive to consider early in the innovation process, ensuring that the role of civil society is concretized and defined from the beginning.

Relating to the governance level, practitioners should be aware that civil society organizations rarely possess the time and money required to initiate an innovation process, explore possibilities for collaboration, build professional networks, etc. The civil society organizations of the lab are non-profit and membership-based, which means that their budgets are small and reserved for very specific purposes, narrowing the space for maneuver. Furthermore, their decision-making processes are democratic and non-hierarchical, which makes it difficult to keep up with the pace and ambitions of the other helixes. In one case, a partner expressed that he thought the civil society organization often felt below par. In another case, a housing association occasionally blocked decisions that a steering group for the project thought they could make. Consequently, collaborations should align their expectations with the reality of civil society organizations and seek out external funding and/or specific activists that can support the civil society organizations in transcending business as usual.

FOUR ELEMENTS OF A STRUCTURE FOR A SUCCESSFUL QHC

The cases in our social lab demonstrate that building a clearly-defined and transparent structure is crucial to the success of a QHC. Building such a structure is an ongoing and complex process and not a one-time exercise. From our cases, we can derive four elements of a structure that may help a QHC to prove successful.

FINANCIAL FRAMEWORK

The financial framework is obviously important to the success of a QHC. Most cases in the Danish social lab are externally funded by the EU, the government or special allocations, which is why the partners work within a given and well-defined financial framework. As long as the external funding suffices, money does not seem to be an issue in the collaborations. However, in cases where the external funding does not suffice due to unforeseen expenditures or where the partners fund the project themselves, the partners constantly need to negotiate who should pay for what. In many cases, this causes delays and postponements and sometimes complete stagnation within the collaborations.

AUTHORITY AND ROLE DISTRIBUTION

When involving different partners with different organizational setups, cultures, languages, interests, and financial resources, it is important to agree and make it clear who decides what, when, and how. Experience from the lab shows that this is most effectively achieved by formalizing the agreements. In one case, the partners established an overall steering group with representatives from all partners, taking executive decisions,

complemented by a coordination group and several working groups. In a similar case, the partners never formalized their agreements, which caused a constant confusion concerning who was responsible for what. They lacked a common forum for discussions, decision-making and coordination. On the other hand, there is also a possibility that one individual is part of more helixes. In one case, one of the individuals involved in the collaboration held prominent positions in two different organizations, enabling him to make shortcuts concerning decisions, agreements, and role distribution.

Relatedly, partners need to clarify their license to operate within their respective organizations. They need to ensure that the executive levels of their organizations know what is going on and that the collaboration fits with their interests. In one case, the municipality had not involved the political level from the start, causing constant adjustments of the project plan and difficulties with implementing new climate change adaptation solutions. However, in another case the partners sometimes had an excessive focus on the interests of their organizations, occasionally derailing partners from focusing on the goal of the collaboration, thus causing delays and postponements. Thus, it is a difficult and delicate task for the partners to strike a balance between ensuring organizational buy-in and keeping an eye of the collective goal.

FIGURE 8_
Stakeholder analysis used by one of the cases

Finally, some of the QHC in the lab not only counted partners from each of the helixes but also a partner acting as a facilitator or dedicated third-party project manager within the collaboration. Experience shows that this role sometimes acts as a catalyst for initiation and pushing collaboration forward and helping to keep eye on formal frameworks, role distribution, and collective goals.

COMMON VISIONS AND GOALS

As alluded above, establishing and sharing common visions and goals is key to successful collaboration. In one case, the partners shared the goal that they wanted to adapt the residential areas of a housing association to flooding and at the same time add value via the chosen solutions. However, the partners had a difficult time agreeing which solutions would add value and to whom they should add value. Should the solutions solely add value to the tenants by building recreational spaces restricted to their use or should they also add value for a larger population inviting the neighboring parts of the city to enjoy the recreational spaces? For the same reason, the partners in the project decided to reboot the project after a panel meeting in the lab to approach the issue from a different angle. In another case, they devoted strong effort to making an overall vision, mission, and strategy easing the collaborative work. In general, the cases show that keeping a constant focus on the common goal is important. It is easier to agree on goals when they are articulated, but more difficult when the work is in progress and decisions are to be made.

COMMUNICATION

Like with governance frameworks, the involvement of different partners with different organizational setups, cultures, languages, interests, and financial resources requires clear and elaborated communication channels. In many cases, both internal and external communication has been a challenge. Essentially, it requires a major communication effort every time that a decision is made, a deadline is approaching, the project plan is changed, the budget is negotiated, or an external actor is involved. This work should not be underestimated and considered from the very design of the project. In one case, partners did not count on how much time and money they were to spend on communication. In another case, the lack of clear communication caused a lot of confusion and frustration.

CONCLUSION

The context of climate change adaptation calls for new ways of collaborating across sectors including civil society. However, experiences from our social lab show that it is challenging to establish new collaboration constellations in innovation that engages civil society. The different innovation actors are willing to collaborate with civil society and frequently recognize the potential of doing it. However, on the one hand, innovation actors such as private companies, universities and public authority do not always have the capabilities or knowledge of how to engage civil society. On the other hand, civil society often lacks the financial and organizational resources needed to engage in innovation constellations and keep up with the other partners. Furthermore, the high requirements for organizational buy-in, coordination, and communication in a cross-

sector collaboration do not make it easier for civil society actors to take part. Consequently, the integration of civil society in innovation processes needs consideration in the project design and a larger allocation of financial resource to truly succeed, which is crucial to finding robust solutions to important societal challenges.

LESSONS LEARNED

Based on the experience in the Danish social lab, we derived the following lessons to be learned:

- It is important to consider how to delimit civil society, to what extent civil society should be involved and how to enter into contact with civil society actors early in the innovation process to ensure that the role of civil society is concretized and defined from the beginning.
- All partners of a QHC should align their expectations with the reality of civil society organizations and seek out external funding and/or specific activists that can support the civil society organizations in transcending business as usual.
- Collaborations benefit from formalizing agreements on who decides what, when, and how.
- Partners need to clarify their license to operate within their respective organizations.
- Partners with a facilitating role sometimes act as a catalyst for initiation and pushing collaboration forward and helping to keep eye on formal frameworks, role distribution, and collective goals.
- Establishing, sharing and keeping a constant eye on common visions and goals is key to successful collaboration.
- Internal and external communication should not be underestimated, and it should be considered in the design of the collaboration.

CHAPTER 6

ADDRESSING SOCIETAL AND ENVIRONMENTAL CHALLENGES USING QUADRUPLE HELIX COLLABORATION IN COLOMBIA

Francisco González, Asociación Colombiana para el Avance de la CIencia - Avanciencia

ABSTRACT

Three Colombian cases were analyzed in the Colombian social lab to assess Quadruple Helix Collaboration at the activity level. Governance, financing, long-term sustainability and communication must be taken into account when inviting civil society to be part of the Quadruple Helix Innovation process.

INTRODUCTION

The RiConfigure project was designed to include a contrast social lab outside of Europe. ACAC (now AvanCiencia) was in charge of managing this social lab and bringing its outcomes to the RiConfigure project's analysis of Quadruple Helix Collaboration (QHC) cases.

AvanCiencia is a grassroot civil society organization that has been promoting the advance of science, technology and innovation in Colombia since 1970. The Colombian social lab was established to observe whether there are common patterns of QHC in the selected cases, as well as acknowledging the particularities that the regional and national context might evidence.

According to USAID, Colombia has the second highest number of civil society and philanthropic organizations per capita in the Western hemisphere. This fact show how active civil society is in the country, and the importance of inviting these organization to participate in collaborative innovation projects.

In the first panel meeting of the lab, nine cases were invited, where civil society had a role in these collaboration initiatives. Although not all of these cases could be cataloged as QHC instances, they brought valuable insights into how civil society organizations participate in co-creation processes.

CASE	CIVIL SOCIETY ORGANIZATION
CASE 1	*Indigenous community*
CASE 2	*Farmers community*
CASE 3	*Local community*
CASE 4	*Local community*
CASE 5	*Associates to a green commerce chamber*
CASE 6	*Science appropriation foundation members*
CASE 7	*Environment protection foundation*
CASE 8	*Civil society involvement in policy-making activist movement*
CASE 9	*Community libraries foundation*

FIGURE 9_
Civil society organization in each of the nine invited cases to the first panel meeting

Of all of the above initiatives, three main cases (projects) were invited to be part of the social lab. Although each of these cases had different goals, they shared two key aspects. On the one hand, all of them were addressing some societal challenge, and on the other hand, their project outcome involved some kind of environmentally sustainable solution. Moreover, each project can be considered as a QHC case.

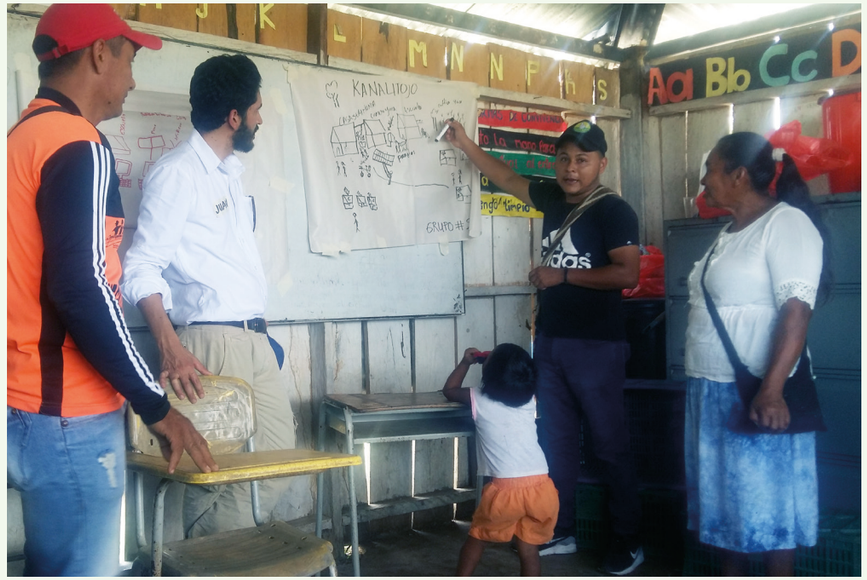


FIGURE 10_
Project members at a meeting

CASE 1

IDEAS FOR CHANGE: CHALLENGE COMMUNITY AND ENERGY IN MOTION ENERGY THAT IGNITES PROGRESS!

Ideas for Change is a MinCiencias (Ministry of Science) initiative that fosters science, technology and innovation appropriation among communities, with a social inclusion perspective and environmental sustainability. Under this program, the "Challenge Community and Energy in Motion. Energy that ignites progress!" project goal was to implement a science-based technological solution to provide energy to a cassava processing plant and increase the Kanalitojo indigenous community (organized civil society) wellness.

Researchers from a private non-profit organization brought the conceptual and technical analysis for the project. A solar energy company provided the hardware and implementation process, and the public sector was represented by MinCiencias, which was also the funding partner.

ADDRESSING SOCIETAL AND ENVIRONMENTAL CHALLENGES USING QUADRUPLE HELIX COLLABORATION IN COLOMBIA

FIGURE 11_
Bamboo (guadua) crops

CASE 2

BAMBOO FOR PEACE

Some zones of Colombia were – and in some cases still are – affected by the armed conflict. This situation has provoked massive migrations towards large cities, including from the Rionegro region in Cundinamarca.

In this project, local bamboo farmers union, a civil society organization, alongside the mayor's office explored ways to make environmentally responsible use of their crops while making this economic activity viable in the Rionegro region, thus avoiding migration from the countryside to the cities. University researchers' involvement in this project was to bring capacity building for local farmers in subjects like the responsible use of soil, financing, marketing and distribution of their crops. Private sector was represented by a foundation that provided technical and legal assistance to the bamboo farmers, who wanted to enrich their ancestral wisdom with this new knowledge.

FIGURE 12_
La Mojana region

CASE 3

REHABILITATION OF THE AMPHIBIAN SOCIO ECOSYSTEM OF THE LA MOJANA REGION

La Mojana region – located in the northern part of Colombia – is one of the most bio-diverse places in the country, but at the same time it is strongly challenged by the armed conflict, pollution, and poverty.

The "Rehabilitation of the amphibian socio-ecosystem of the La Mojana region" project's aim was to restore the wetlands ecosystems to protect its bio-diversity and sustainability. By achieving this goal, local communities are benefiting from the restored landscape by increasing their quality of life and adopting global climate change awareness.

Aside from the local community, the Ministry of Environment, an international cooperation agency and a private corporation were involved in this project.

SOCIAL PANEL ACTIONS

The three cases were already ongoing projects when invited to the social lab activities, and they have had face-to-face meetings among team members at this point. Their collaboration dynamics had been partially set by contractual agreements and thus these were rather inflexible.

The expected goals of the social lab were to energize, facilitate and empower civil society participation at the action level of collaboration through intervention actions such as dedicated training sessions on collaboration facilitation, stakeholder identification, role playing in panel sessions and mentoring activities. Most of these actions and meetings were held in Colombia's capital of Bogotá. As previously mentioned, the three main projects were located in rural areas of the country, so this brought participants to a "neutral" territory where civil society member could feel more at ease and less constrained by the formal contractual boundaries.

INTERSECTIONALITY

Throughout the execution of the social lab, there were noticeable manifestations of stakeholders who do not identify themself as the formal "blade" of the Quadruple Helix (QH) that they are supposed to represent. For instance, some civil society representatives often spoke about their concepts of business models that could be applied to the other projects in the lab. In other cases, academia members felt more at ease when discussing civil society topics. This evidence showed that there might be a hybrid and dynamic QHC structure, and that people who represent one helix often modulate their actions in the collaboration process depending on their affinity to one or more of the other helixes besides the one that they are contractually bound to act for.

TRUST AND COMMUNICATION

One of the most common issues that arose on each of the cases was the perception that each helix had their own goal and that there was not a common objective to be achieved. While partly true, this problem does not conflict with the setting of a common goal but affected trust among case members. This complication is strongly rooted in the lack of communication – in a clear and transparent fashion – of the common goal to all members of the QHC project.

There was evidence that when case partners were asked to assume someone else's position on a particular subject, they tended to be more receptive of each other's ideas and more understanding of the "helix goal" in the context of the particular project. For example, during a panel meeting, after a cross-role exercise, a civil society representative said "now I have recovered my trust in government".

From the above, it follows that there must be a set of communication rules and mechanisms available – even from the design phase of a project – to ensure fluid exchange of ideas between partners and external parties. This requires a minimum set of shared concepts to be established to create a common language.

FINANCING AND GOVERNANCE

Most of the cases are funded by public resources and limited to a specific time frame. This situation hinders the continuity of the QHC process in the long term. Civil society partners were deeply concerned about the financial sustainability after the project's legal deadline is reached.

As financial resources are usually provided by public institution or even international cooperation agencies, public sector members (institutions) set the rules on how and when to allocate the money during a project execution. Moreover, civil society actors tend to have a less influential role in the decision-making process, whereby they end being marginalized to less participatory aspects of the project and relegate their status to mere beneficiaries.

In two of the three main cases of the Colombian social lab, civil society was represented by underprivileged communities lacking sufficient financial resources to travel or even electricity and internet access to participate online in project meetings. This implies that often their opinions on collaboration dynamics and project outcome decisions are "interpreted" by the other members of the QH or even ignored entirely.

QHC UNDERSTANDING

Each of the main cases represent some kind of QHC, although members of the projects didn't necessarily identify themselves as part of a QHC structure. In some cases, participation during the social lab introduced them to the concept of QHC and its characteristics. As the social lab was carried out, most of the project members started to acknowledge the QHC concepts.

QHC theory is fairly new, and members of the helixes are starting to learn how to interact with each other, use its tools and strengthen their collaboration process. Budget and time restrictions of the ongoing projects limit the full application of the QHC tools learned by the case members to their current cases, although the second phase of the La Mojana used most of this new knowledge to design a more QHC-inspired project.

COVID-19 AND CONNECTIVITY

After March 2020, Colombia entered in a lockdown stage that prevented social lab participants from attending to the physical panel meetings. To overcome this limitation, an online social panel was held in May 2020, although unfortunately civil society members didn't attend to share their thoughts and learning experiences. As mentioned above, these participants find it very difficult to gain dedicated internet access or even electricity to power up a computer to use it. This prompted AvanCiencia to change its strategy to reach to the lab participants and it decided to create a didactic instrument that should be used as a poster to remind about best practices of the QHC. This recycled paper printed document explains in a very attractive and graphical – step by step – way the policy brief stemming from the RiConfigure's second dialogue event held in June 2020.

FIGURE 13_
Dialogando poster

CONCLUSIONS

Societal and environmental challenge should be tackled with a multi-stakeholder approach and civil society must act as a relevant actor to address these problems. In Colombia, there are several ways in which civil society manifest itself, either as neighbors of a community aligned with a common goal or as large NGOs with philanthropic purposes. This diversity can become an issue when trying to standardize ways to engage civil society in the collaborative innovation process. Nevertheless, there are major benefits when involving civil society in innovative collaboration processes. As previously mentioned, civil society actors can bring a closer look to societal needs to the table, add new perspectives that can foster new creative and innovative approaches when addressing an issue on a project, and finally wrap the collaboration dynamics inside a social awareness cocoon. To ensure fair and active participation of civil society, and thus boost the trust level among members of a collaboration project, there must be a clear governance framework that guarantees civil society participation, not only as a beneficiary of the outcomes of a particular initiative but also as active partners taking part in the decision-making process. This participation must be also supported by a mid- to long-term financial funding strategy to maintain civil society actors interested in all aspects of the collaboration cycle. A clear common goal must be established and communicated across all the members of a project to foster multi-stakeholder collaboration and co-creation. This requires the use of a common language that ensures knowledge transfer between all actors. Finally, it is recommended that in the design phase of a project networking goals must be set to create long-term relationships with relevant stakeholder that could bring life to an initiative beyond its limited time frame.

CHAPTER 7

GOVERNING THE QUADRUPLE HELIX. INSIGHTS FOR POLICY-MAKERS

Eugen Popa, Wageningen University

INTRODUCTION

In this chapter, we want to provide a series of governance insights specifically directed at policy-makers and legislators at various level of policy (regional policy, national policy and international). These governance insights have been gathered during our interactions with the innovation cases selected for our five social labs and through desk research of similar cases.

We have observed that civil society organizations (CSOs) are primarily involved 'downstream', i.e. at the end of a development process where a product or service needs to be brought to the market (although noteworthy exceptions have been found). Civil society – also known as the fourth helix – is then not part of the innovation process but something like its receiver, the endpoint and supposed beneficiary. The dominating perspective in the innovation systems is that the civil society is disfavoured since they do not understand or cannot speak the technical language of research and development (R&D), whereby the other helixes end up deciding for them on matters of various degree of importance. Although the switch away from this 'deficit model' is partly a matter of a larger cultural transition, the switch can be fostered and accelerated by creating the background conditions for CSOs to flourish and other helixes to benefit from this flourishing. Although the competition between helixes needs to be maintained, the helixes can be brought closer to one another through very specific policy interventions and frameworks. Below, a series of policy recommendations that can trigger this transition are outlined.

STRENGTHEN FUNDING MECHANISMS FOR CSOS

Often lacking the funding to enter into Quadruple Helix Collaborations (QHCs), CSOs start with a handicap. Through social innovation funds and other funding mechanisms, CSOs can be encouraged to participate 'upstream' in the innovation process and thus have the opportunity to influence the R&D decision-making process. Of all the helixes studied in RiConfigure, the fourth helix comprising CSOs and citizens was the most underrepresented (compared with the participation of the other three helixes). Their impact during R&D process can be gradually accelerated by ensuring access to resources without which a minimal intervention in – or critical observation of – innovation processes is practically impossible. In many cases, CSOs that focus on science and technology are coerced by their lack of resources into taking an auxiliary, almost decorative role in the decision-making process. With additional resources stemming from funding mechanism, CSOs can build capacity, attract talents on the job market and increase their autonomy as stakeholders in the R&D process. Additionally, policy-makers can create novel modes of resource allocation such as lump sums and flexible frameworks that allow adaptation, failure and experimentation within funded projects. In this process, the financial support of learning communities and infrastructure for collaboration should not be forgotten.

METRICS FOR THE SOCIAL IMPACT OF QHCS

The lack of certified metrics for measuring the societal impact of QHCs has a negative impact on both sides of the measuring process, as policy-makers cannot measure the effect of CSO-encouraging policies, while CSOs cannot demonstrate their impact for policy-makers. Past RRI projects such as MoRRI (http://morri-project.eu/) and current societal investment metrics provide a starting point for policy-makers to incentivize QHCs and measure their integration of value from all four helixes. Our analysis of governance structures revealed that most R&D policies are still market-oriented in the case that they evaluate the success of R&D by investigating usable artifacts and patents produced and in some cases research-oriented by investigating academic publications. The output of such projects for supporting democratic institutions (policy values) and promoting and fulfilling societal and environmental values (civil society helix) is virtually absent from the policy-makers' evaluative toolkits.

COMPENDIA OF BEST PRACTICES OF QHCS

QHCs are nowadays largely based on an implementation of the certified knowledge from earlier paradigms of stakeholder management such as that of the 'public understanding of science'. Although industries have gradually moved towards a co-creation paradigm where the customer is involved in the product development process, this typically only creates dual collaborations between businesses and customers. We can conclude that there is an urgent need of 'exemplars', those paradigmatic examples of QHCs that can inspire and engender new QHCs. Such exemplars can foster QHCs by providing methodological insights regarding the setup of efficient QHCs, empowering of stakeholders, integration of different values into the design process, promoting a nuanced, multidimensional view of innovation, addressing conflict, etc. Several starting points for creating such compendia of best practices have been provided by past Horizon 2020 projects such as RRI-Tools.

TRAIN PRACTITIONERS

The relationship between the policy helix and all other helixes is most fundamentally influenced by the governance frameworks set in place for innovation (see point 1). However, ultimately the policy helix needs to absorb knowledge of QHCs and principles of RRI for these novel governance frameworks to be effectively implemented. Nowadays, practitioners who can have a major impact on the success of QHCs are recruited from either the political/administrative sciences or the specific technical sciences in which the collaboration takes place (e.g. engineering, medicine, etc.). Since traditionally these fields do not offer additional training in fields such as responsible research and innovation, Quadruple Helix (QH) Innovation, value-sensitive design, etc., it is unsurprising that the impact of the delegated practitioner in concrete innovation processes is limited. In some cases, the policy helix is seen as a proxy for the societal helix such that the support from the former should secure the support from the latter (if 'the politics' is in order, 'the society' will accept the innovation). A more consistent training of practitioners into the advantages and the methodology of QHCs could empower policy actors to achieve their goal as representatives of the policy helix, i.e. ensuring the fair and democratic participation of stakeholders in socio-technical transition and specifically concrete R&D processes.

FROM STAKEHOLDER TO (INTEGRATED) PROCESSES

Naturally, it is important to identify stakeholders and understand the institution (and more generally the field) from which they seek to make a contribution to a socio-technical transition. The QH model takes a first step in this direction since it identifies four types of stakeholders and thus 'forces' acting with their specific interests on the R&D process: industry, policy, research and civil society. Of course, this is an expedient analytical and prescriptive tool for policy-making, but ultimately each stakeholder participating in a QHC is nothing but a representative of a higher-order institution and field governed by specific values. If the end goal of a democratized R&D process is to incorporate the values into the design of new products and services – i.e. to eliminate

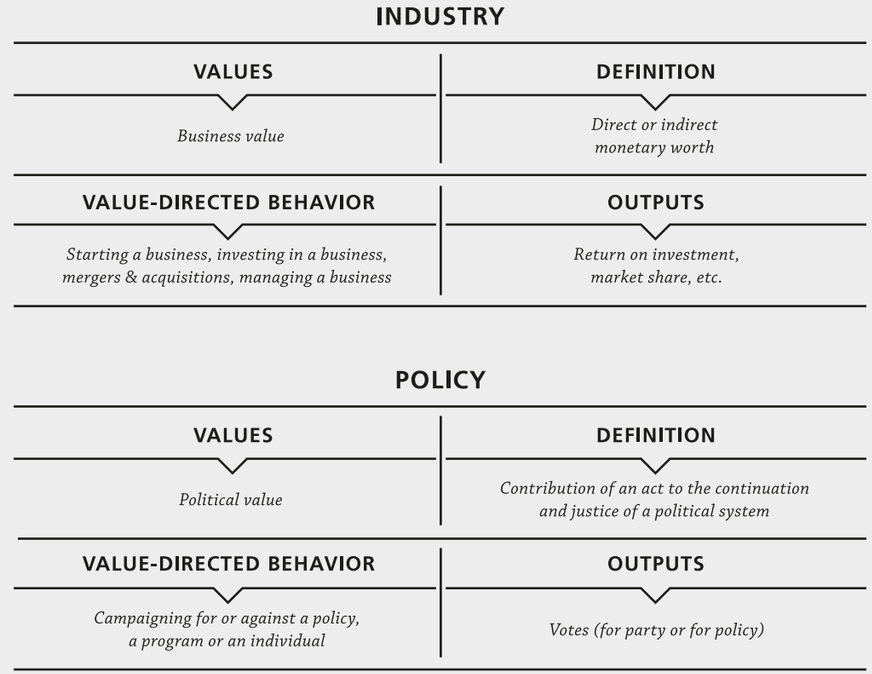
specific types of risks (societal risks, market risks etc.) – then the process should in time become more important than the stakeholders. In principle, you don't have to be a CSO representative to defend CSO values at the proverbial round table, nor do policy goals need to be defended by policy-makers exclusively. In time, a gradual shift from stakeholders to processes can accelerate the co-innovation process since it establishes goals at the level of product/service design through the incorporation of value. An overview of the 'building blocks' of such an integrated R&D process – i.e. the helix-specific processes and values – is provided in the FIGURE 14.

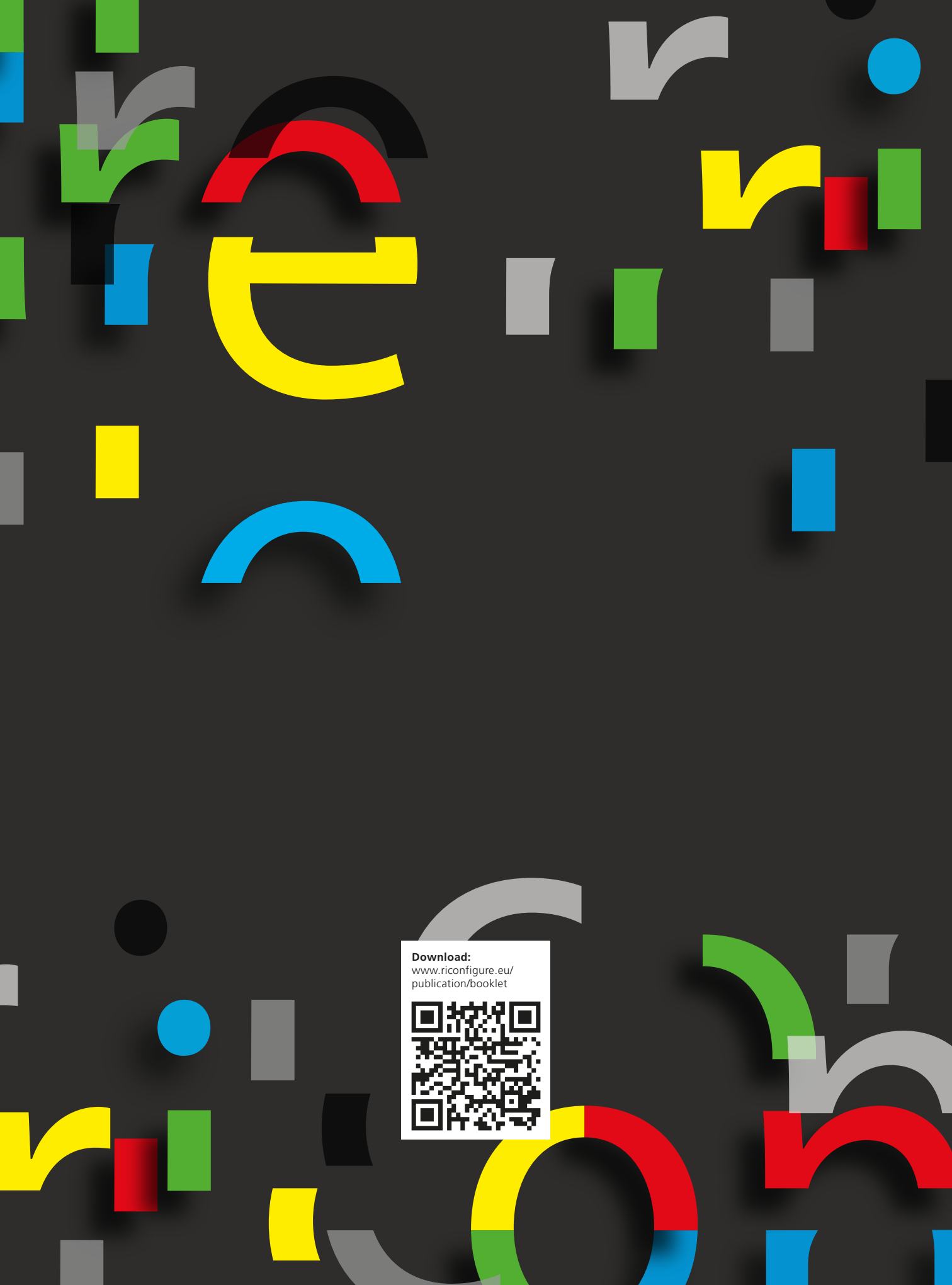
A large body literature on participation, inclusion and collaboration as well as many (indeed most) examples of co-innovation stemming from management literature espouse a 'round-table' approach to co-innovation where the process is achieved by actually bringing stakeholders together and encouraging them to enter various forms of dialogues and interactions. This remains a very natural and useful approach. However, an integration of the values specific to each helix might be enhanced by alternating between the focus on stakeholders and a focus on co-innovation process defined as a process where the parties – regardless of their stakeholder group and titles – integrate the four types of value into the design of the novel product or service.

FURTHER READING_

POPA E. O., BLOK V., WESSELINK R. (2020). A processual approach to friction in quadruple helix collaborations. In: Science and Public Policy. Vol. 47 (6), 876–889, https://doi.org/10.1093/scipol/scaa054

FIGURE 14_
Building blocks of an integrated R&D process





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