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Regional Development with RRI Approach

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Abstract. This contribution deals with regional development. The people affected synergies their innovation ecosystem in the region. The Responsible Research and Innovation (RRI) approach from the EU is a transparent and interactive process for the development of the foreseen region. The innovation ecosystem consists of the interaction between the actors. Forward looking methodologies align with the RRI approach and engage industry & business, science & research, education, public administration, and civil society. The engaged stakeholders co-create societal accepted, sustainable, and ethically justifiable innovations. The proposed approach familiarizes the society with science and the progress in technology development. This RRI concept, developed in the DigiTeRRI project, is applied for the transition of traditional industrial regions into digitalised territories. In this paper the focus is on the region Styria in Austria. The work is performed under EU H2020 project DigiTeRRI (GA 873010).

1 Introduction

"Regional development is a broad term but can be seen as a general effort to enhance well-being and living standards in all region types, from cities to rural areas, and improve their contribution to national performance and more inclusive, resilient societies."

(OECD, regional development policy[1])

The European Project DigiTeRRI (H2020, SwafS[2]) defines the development of a region according to OECD with emphasis on the general effort to enhance well-being and living standard and for improving its contribution to national performance and a more inclusive and resilient society. This implies a well working research and innovation ecosystem in a territory as a living foundation for young and old, for highly educated and uneducated persons, for science and research, for SMEs and big companies.

DigiTeRRI project deals with Responsible Research and Innovation (RRI) for the transition of a traditional regions into digitalised innovation ecosystems. The considered regions have a long history in steel, non-ferro metallurgy, and paper production, or in the automotive and aerospace industry. Such innovation economic

[1] https://www.oecd.org/regional/regionaldevelopment.htm

[2] SwafS – science with and for society programme

Marianne HÖRLESBERGER, Brigitte KRISZT
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systems are currently undergoing major changes into a digitalised industry. This transformation holds many opportunities for the region. However, experts also raise concerns that organizations might be unable to adapt to this revolution, which is flooding our lives, our societal, cultural, economic system, and the industries.

The DigiTeRRI approach is built on the theory of innovation ecosystems. DigiTeRRI has adapted the specific Responsible Research and Innovation (RRI) approach for regional development. It integrates forward looking methodologies with co-creation workshops with stakeholders.

This paper discusses first shortly the innovation ecosystem approach. Secondly, it presents the RRI approach in general. Thirdly, based on this understanding, the specific DigiTeRRI approach is discussed. In a next step the general outcome of this approach is presented and the specific case for Styria regarding the development of a vision statement is given. Finally, the limits of this approach are discussed.

Regional development is always linked to given regional strategies and to policy agendas, to planning on the national and European level. These aspects are not considered in this contribution. Here, we only focus on the co-creation approach with stakeholders in a region.

2 The Region and Its Innovation Ecosystem

The prosperity of a region depends on the successful interaction of the industry and business with science and research, as well as with the public authorities and the civil society. It is generally accepted that the prosperity of a region depends on the success of the innovation ecosystem there. The interplay between the actors, the knowledge flow and value creation between these actors is essential for a successful innovation ecosystem. Porter has already described the interlinkage of the knowledge flow of a territory and how the industry of a region competes with industries in the same sector and other regions (Porter 1990, 1998). Porter introduced the industry cluster approach for bringing a territory to prosperity by implementing a knowledge-based economy. Today, a broader approach is proposed, where not only industry, business, research, and science are addressed, but also public authorities as well as the civil society of a region. Cortright works out that a region with a high and rising standard of living depends upon creating a high-quality business environment (Cortright 2021). An economically flourishing region depends on strong innovation capacity and rising productivity in a region. However, the quality of life will be a priority in attracting people with knowledge, on which a regional innovation ecosystem is built on and continuously evolves. Thus, this unveils that all actors in a region with their interlinkages have to be integrated into the regional development. The innovation ecosystem is an important foundation and a living basis for a region. Furthermore, the innovation ecosystem of a

Marianne HÖRLESBERGER, Brigitte KRISZT
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region builds organisational spaces for co-creation of values through collaboration (Smorodinskaya et al. 2017). Collaborative networks and their ecosystems co-create these values through their common activities.

Knowledge interactions and all types of knowledge flows are crucial for the performance of the innovation system. Universities, research organisations, and companies are the main actors in most innovation systems. Searching for a unique definition of an innovation ecosystem fails because there isn't such a definition. There are various approaches. Freeman, for instance, defines an innovation system as "... the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse new technologies." (Freeman 1987). Fischer et al. (2001) describe an innovation system as consisting of actors and their interaction with one another. The entirety of private and public organisations and individuals contribute to building an innovation system by their activities and interactions, including the creation and diffusion of new technologies, new products, and new knowledge.

DigiTeRRI project defines an innovation ecosystem as an open system with growing dynamics and complexity. Innovation systems are complex systems. The complexity of innovation ecosystem is given by the differentiation of actors, the specialisation of organisations, the increasing dynamics of socio-economic and socio-technological systems, the growing complexity of socio-economic and socio-technological systems and of society, and the acceleration of the interdependences with actors around the globe. An open system describes the relationships between the organisations and their environment, which is linked for resources, personnel, and legitimacy (Boyle et al. 2001).

Figure 1 presents a scheme of a network in an innovation ecosystem. Knowledge interactions between the actors play a central role in stimulating and sustaining the knowledge flows within a research and innovation ecosystem.

Marianne HÖRLESBERGER, Brigitte KRISZT
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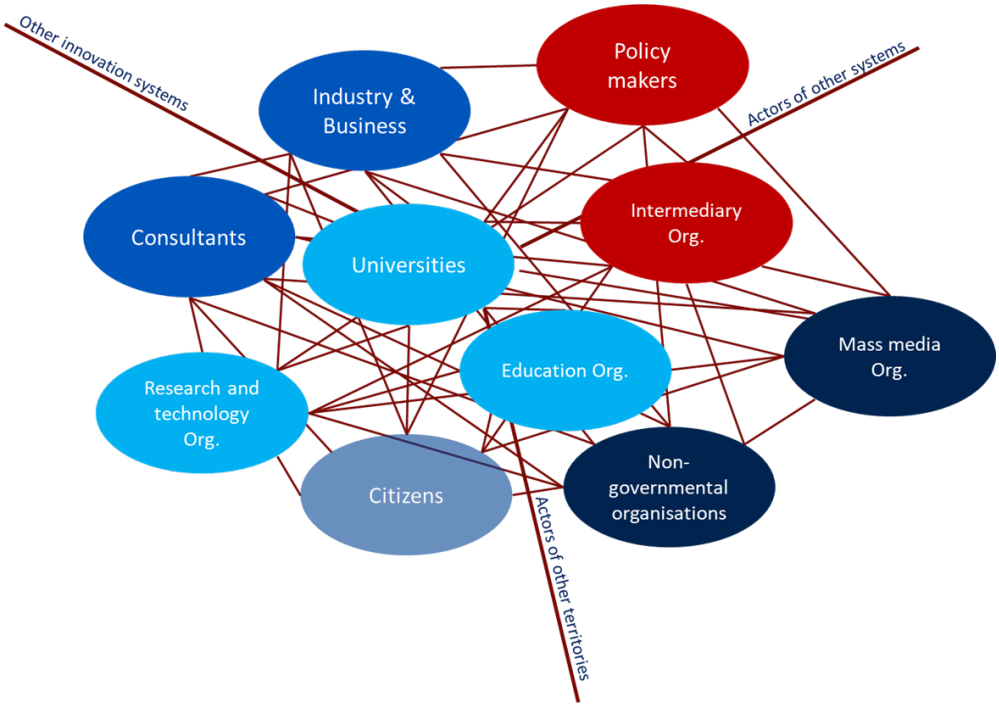

Source: Own representation (AIT, Center for Innovation Systems & Policy)

Figure 1: Network of actors in an (regional) innovation ecosystem

The further development of a region is built on these dynamics of the interactions and knowledge flow between the actors. In addition, a region depends on the commitment to the will for shifting its strategies to new forms of advantage, to render their old advantages irrelevant, before their competitors do it for them (Thurow 1999). This is a challenge. However, there is support also from the policy side.

The European Commission has developed strategies for Smart Specialisation. This is a political framework for finding ways to enhance the scale and effectiveness of entrepreneurial processes. This framework for Smart Specialisation is supposed to bring forth the specific potential and the capability inside the region and brought this to shine. It is a bottom-up approach for revealing a region's best scientific and technological competences. This approach is also a foundation for the work in DigiTeRRI if the transition into a digitalised territory can be considered as Smart Specialisation.

3 Responsible Research and Innovation (RRI)

Science and innovation for what? Science and innovation are for the society finally. Responsible Research and Innovation (RRI) has started to build an impetus across the research community in the European Horizon 2020 and there, especially, in the Science with and for Society (SwafS) programme.

Marianne HÖRLESBERGER, Brigitte KRISZT
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The RRI policy assumes that society has lost control over science and innovation despite the increasing direct and indirect public funding for stimulating and facilitating research and innovation. Research policy has become increasingly oriented towards scientific excellence. Innovation policy has oriented increasingly towards competitiveness. In this process, there is a risk that the social values of research and innovation get lost, or at least is increasingly up to researchers and innovators themselves to preserve.

RRI promoters maintain that political provision creates a framework which is insufficient to control the development of research and new technologies in potentially and ethically problematic areas, such as genetics, biosciences, and information technology including digitalisation. Creating new knowledge generates opportunities to develop new technologies. However, technology should not be developed for its own sake. The consideration of the impact on the society and on the environment would be a good basis for a worth living innovation ecosystem.

RRI is promoted and implemented in many projects for bridging the gap between science and research to society. RRI is a cross-cutting approach. This approach is more inclusive, participatory, transparent, interactive, reflective, and anticipatory than conventional research and innovation processes. RRI in connection with innovation ecosystems put innovation into a broader context with particular attention to responsibility and accountability, with ethics and sustainability, embedding science and technological progress into society.

RRI seeks to raise issues in the context with research and innovation in order to anticipate the consequences for the society and involve it. The RRI approach discusses how science and technology can help creating a society we would want for future generations. It emphasises that research and innovation must align with the values and needs of the affected society. The policy agenda for RRI, therefore, focuses on both mitigating the negative effects of research and innovation in areas with potentially adverse societal effects, as well as actively supporting research in areas where the societal benefit is high, for instance in addressing the grand societal challenges. RRI envisages that responsible researchers and innovators actively construct their ‘responsibility’, reflecting the needs for researchers to communicate and to discuss their results for building social support and permitting social guidance of their research efforts (Owen et al. 2012). Organising from a rational, natural, and open systems perspective provides insight on possible uses of RRI across and between types of organisations, with respect to the individual keys and dimensions (Wittrock et al. 2021).

Marianne HÖRLESBERGER, Brigitte KRISZT
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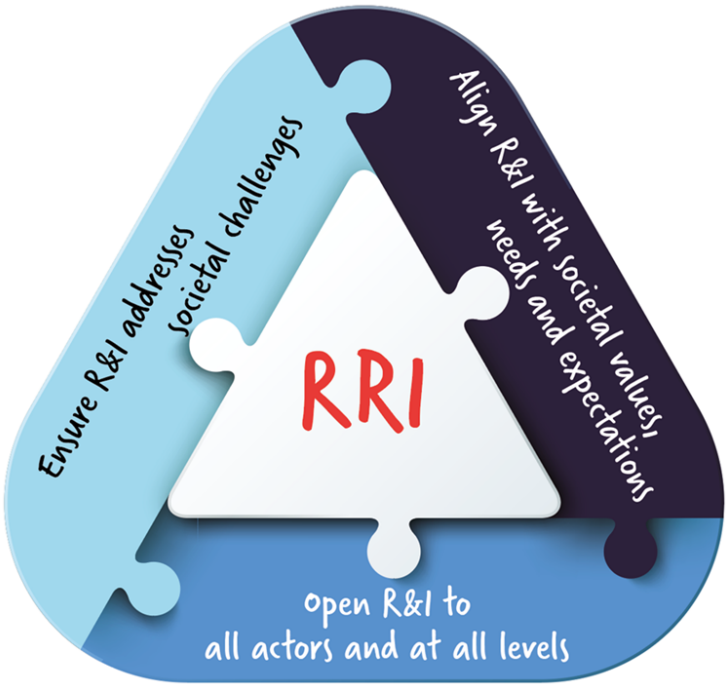

Source: DigiTeRRI representation (WeDo Project Intelligence Made Easy)

Figure 2: How RRI is presented in DigiTeRRI

An RRI process is anticipative and reflective, responsive and adaptive, open and transparent, diverse and inclusive. RRI engages representatives from science and research, from education, from industry and business, from policy makers, and from civil society (quadruple helix) for co-creating the future of a regions. This includes taking into account the RRI policy agendas (RRI keys) such as ethics, gender equality, science education, open access, and public engagement. Thus, it is obvious that RRI is a cross-cutting approach that aims to make research and innovation ethically responsible.

DigiTeRRI processes the transition into a digitalised region by the RRI by design, which means that RRI is implemented or realised by working with the stakeholders and anticipating the future with them. In the transition of old classical to new digitalised production, many unanswered and challenging questions will emerge. The development of a future strategy must involve both government and society, as well as science, research, and businesses. The transition into new technology opens new gates in the interaction with society and science and will offer an excellent environment for introducing and implementing RRI. Since the overall innovation system is undergoing a significant change by the transition into a digitalised system, the need for new solutions and thus the opportunity for implementing RRI actions is remarkably high. Self-organisation phenomena of complex systems reveal that constraints imposed from outside a system appear to be drivers for change.

Marianne HÖRLESBERGER, Brigitte KRISZT
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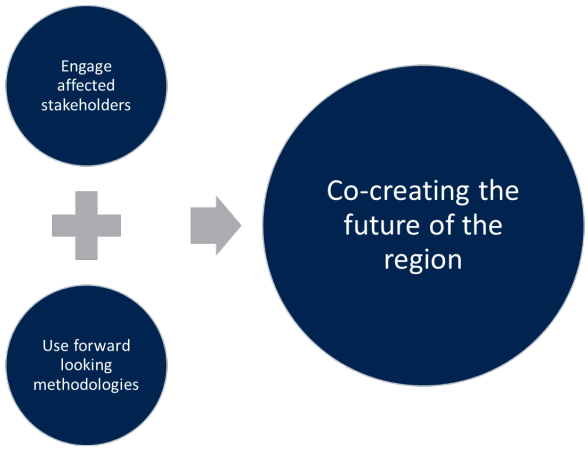
4 DigiTeRRI Project and Approach

The project DigiTeRRI elaborates a framework and develops a roadmap for a responsible transition of traditional industry regions into digitalised industrial self-sustaining R&I ecosystems by using an RRI approach. By the DigiTeRRI RRI approach the development of a region happens in a specific way. The roadmap development in DigiTeRRI is comprehensive and comprises the whole process from stocktaking and mapping to the identification of stakeholders, defining the framework, co-creating vision statements, to working out the goals, actions, milestones for a region, as well as implementing and monitoring of the actions and measures.

DigiTeRRI co-creates such a roadmap in three regions in Europe, in Värmland in Sweden, in Région Grand Est in France, and in Styria in Austria. In this paper, only the case of Styria in Austria is discussed, and first results presented. As already presented in previous chapters the project addresses the complexity of the challenges in the interplay between science, education, industry, government, and society. The interlinkages and collaborations within these actors of an innovation ecosystem generate and create innovation, products, economic success, governmental conditions for living and doing business.

DigiTeRRI combines stakeholder engagement with forward looking methodologies for co-creating the future of a region.



Source: Own representation (AIT, Center for Innovation Systems & Policy)

Figure 3: RRI approach in DigiTeRRI

4.1 Stakeholders

The stakeholders for the development of a region should come from various organisation types, from science and research, from education, from industry and business, from public administration, and from civil society organisations. Also, the RRI

Marianne HÖRLESBERGER, Brigitte KRISZT
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approach proposes these categories[3] of organisation types for the co-creation process. The representatives of these organisations, thus the engaged stakeholders, should have (1) the power to influence the organisation/territory, (2) the legitimacy for acting in the organisation/territory, (3) the urgency to claim measures (Mitchell 1997). This consideration is important when the developed strategies and actions also should be accepted and implemented. The balance in the stakeholder group is a further aspect for achieving acceptance for the developed actions. For instance, if there are 30 stakeholders engaged for this strategic process, six should come from science and research, six from education, six from industry and business, six from public administration and intermediaries, and six from civil society organisations. In addition, an equilibrium from young and old, from female and male stakeholders support the balance of diversity in the stakeholder group. Giving each stakeholder space and voice in the workshops is the challenge for the moderator. Of course, a well-designed workshop is an important basis for a successful group work, as well as properly informed stakeholders before the workshops.

DigiTeRRI tries to link the stakeholder identification as just described with the RRI keys, also known as RRI policy agendas. The following table gives an overview, how each RRI key can be linked with specific stakeholder features.

Table 1. Stakeholder linkage to RRI keys.

RRI Key	Comment	Stakeholder groups
Gender equality	Gender equality is seen primarily in the way in gaining the same conditions for males and females with respect to career position and salaries.	Any organisation dealing with gender equality or with the situation of females in society to get the same "professional" conditions for women as men.
Science education	Encouraging young people to take up a science education. With respect to a socio-economic system any kind of higher education in digitalisation.	Taking also into account organisation offering life-long learning programs or any organisation promoting higher education.
Ethics	Digitalisation asks for new considerations with respect to "digital ethics".	Any organisation or panel dealing with ethical issues, especially focusing on digital ethics.
Open access	Open Access is seen as low barrier access to science	That can be organisations offering public repositories and access to

[3] https://rri-tools.eu/about-rri.

Marianne HÖRLESBERGER, Brigitte KRISZT
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RRI Key	Comment	Stakeholder groups
	publications for spreading knowledge. This also generated new groups of organisations offering repositories or access to literature, or editors for open access journals (media).	knowledge in kind of written or digital media. Often, libraries offer such services, but organisations offering share points or hubs can be relevant stakeholders too.
Public engagement	In most of the RRI literature NGO´s are mentioned as representatives for public engagement.	Within the DigiTeRRI project stakeholder representing the public will be rather local initiatives.

This approach for stakeholder identification and engagement, namely (1) representatives of the five actor types in a territory (science, education, industry, public authority, civil society), (2) stakeholders having the power, legitimacy, and the urgency, and (3) with the background of RRI keys, is a promising foundation for the success of regional co-creation of the future.

4.2 Roadmapping as One of the Forward-Looking Methodologies

The roadmap approach is applied because of the possible shorter timeframe. A roadmap considers the future of the next approximately five years. In case an implementation of actions, or a realisation of measures should happen in the near future, roadmapping is a proper instrument. In this way, first implementation actions can already be monitored during a project duration.

When considering a roadmap from a general point of view, we can say that a roadmap is an itinerary of paths that leads to some geographical space. A roadmap serves as a tool for travellers, which provides essential understanding, proximity, direction, and some degree of certainty in travel planning. A roadmap guides the driver of the vehicle to the destination.

In management literature, a roadmap is a metaphor for strategic planning. Roadmapping bridges the strategic planning with operational innovation management. Roadmapping describes the process of roadmap development. The earliest approaches to roadmapping date to the 1980s. Since then, roadmapping has become a standard methodology of future-oriented research.

The creation of roadmaps has its roots in technology-intensive companies. Due to the increasing complexity of products and processes, these companies faced the problem of how to keep track of important technologies. There was a shortage of explicit, framework-structured representations of future developments in products and

Marianne HÖRLESBERGER, Brigitte KRISZT
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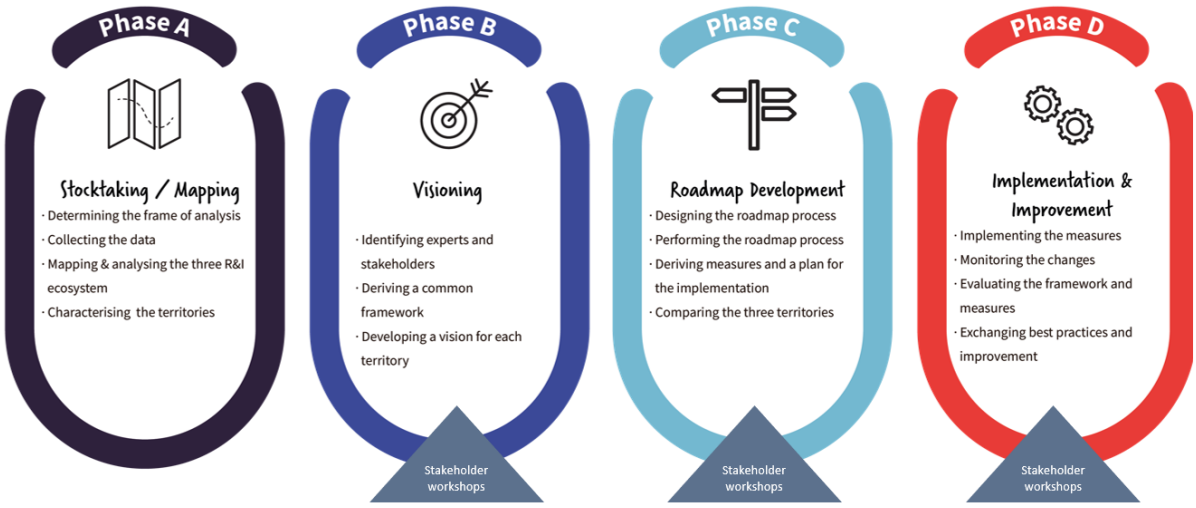
production processes for many organisations. Roadmapping offers an approach to address this challenge.



Source: Own representation (AIT, Center for Innovation Systems & Policy, adapted from International Energy Agency (2014).)

Figure 4: Roadmapping process in DigiTeRRI

The roadmapping process starts with the stocktaking and mapping, with collecting data for the mapping of the characteristics of the region. The next step is the visioning. The co-creation of a vision statement is crucial since it guides where to go. This step comprises the identification of experts and stakeholders, the deriving of a common framework, and the active co-creation of the vision statements in co-creation workshops. The next step deals with working out the roadmap itself. It co-creates the goals, tasks, milestones, action, and prioritises them. The last step implements the developed measures and actions. It also covers the monitoring of the changes, detecting best practices and improvement.

The co-creation is the foundation of the regional development. The group work with the stakeholders generates creative ideas. Furthermore, the group work creates an understanding of the colleague on the table, when done with stakeholders from different organisation types, and brings off awareness for the mindset of the colleagues. The different stakeholders (of one group) agree on common goals and work out actions, measures, milestones, and priorities. Finally, the actions and measures are implemented into the regional agendas.

On the one hand there are limits in implementation given by the power and legitimacy of the stakeholders committed to the co-creation actions. However, in case the stakeholders do have the power, legitimacy, and urgency, this approach is successful also in terms of the commitment of all participants of this co-creation work. The decisions are supported by a broader community.

Marianne HÖRLESBERGER, Brigitte KRISZT
DOI: 10.3217/978-3-85125-855-4-09

5 Outcome

Generally, the DigiTeRRI approach energizes the actors on an innovation ecosystem in a region[4]. Science & research organisations, industry & business, public authorities, and representatives from civil society have started to work together in each of the three regions of DigiTeRRI (Styria, Grand Est, and Värmland). This approach has started to develop a way for a worth living world in the region. It strengthens the relationships between stakeholders of the Quadruple Helix[5] thanks to the visioning and the road mapping processes. This includes well-functioning research, successful industry and economy, well-functioning public administration and a liveable living space for young and old, for highly educated and less educated people, for a diverse society. DigiTeRRI strengths relationships between academia, enterprises, and local authorities, and it implements methodologies for identifying and analysing RRI practices.

The DigiTeRRI approach enables robust exchanges between various stakeholders with more than 100 participants. It uncovers also the current fractured nature of how the actors work on the same or similar issues. The outputs of the co-creation workshops are being directly utilised within the regional work in relation to e.g. Smart Specialisation and the wider development of the regional work. It works on the operational and on political level within the regional authority. The DigiTeRRI stakeholder workshops are an excellent platform for discussing and learning about RRI and about various approaches how to implement RRI.

Each of the three DigiTeRRI regions has developed a vision statement. Due to the frame of this contribution the case Styria is presented. Before the vision statement is described, the region Styria is shortly drafted.

Styria is a federal province located in the south of Austria with a population of approximately 1.2 million inhabitants. Styria is traditionally both a resource-based and industry-oriented territory. It hosts automotive industry and electronics industry such as semiconductors or electronic components around the city of Graz with 284,000 inhabitants. In the northern part of Styria iron ore mining and metallurgy of iron and steel traditionally dominate the industry of this mountainous region, especially in the Mur-Mürz valley. Today, many suppliers or customers around the steel industry are settled in this area. The emphasis is on material production and other material producing segments such as polymer engineering, industrial logistics, or

[4] The mapping investigates the output of the innovation system in the regions. It unveils the current visible science activities, the collaboration networks of national and international projects, and the patent activities. The results are an important starting point. Presenting these results would, however, go far beyond the scope of this contribution.

[5] Quadruple Helix describes the organisation types „science & research", "industry & business", "public administration", and "civil society".

Marianne HÖRLESBERGER, Brigitte KRISZT
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environmental engineering. Regions with a tradition in metallurgy and steel industry have been facing crises repeatedly, so also in 2008. This crisis initiated a heavy loss of jobs in the region. This loss of jobs was correlated with a decrease in population especially with young people moving to urban centres. In 2017, the general employment rate of females was about 40%. When considering especially the industrial segments, the rate of female employees is lower than 35%. However, Styria has many universities. These universities collaborate closely with the industry. The innovation ecosystem in Styria is highly recognised as innovative region in Europe. This short draft about Styria should give the reader the possibility to get the starting point for the development of a vision statement for Styria.

The vision development in a stakeholder co-creation workshop resulted in the following vision statement:

> *"Upper Styria is an attractive and open living space for all generations. Digitalisation accelerates learning in the region and opens new perspectives in traditional and new fields. It is knowledge and business oriented. The pillars for international competitiveness and high quality of life are excellent research and innovation implemented with modern infrastructure and cooperation."*

The vision statement was developed in German, translated into English, and further translated into the following image. This process itself is an excellent exercise for sharpening the vision statement.

Marianne HÖRLESBERGER, Brigitte KRISZT
DOI: 10.3217/978-3-85125-855-4-09

Source: The graphical translation into this picture is the work of Mario Magaña from WeDo in close cooperation with Julia Schmidbauer (MUL), Brigitte Kriszt (MUL), and Teresa Riedenbauer (ZAT).

Figure 5: The visualisation of the vision statement for Styria.

The vision statement development contributes to emphasis the commitment for the development of a common future inside the stakeholders in the region. A vision statement is needed for roadmapping because it guides the goals, tasks, action to be developed in the roadmap. This is the logical next step in DigiTeRRI. Describing the compendium of the whole roadmap would go beyond this paper. The concrete goals and measures are described in a next paper.

Marianne HÖRLESBERGER, Brigitte KRISZT
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6 Discussion

This DigiTeRRI approach is developed for a specific direction, namely for the digital transformation of a region. This approach works for specific topics, where many and various stakeholders are affected. Being affected make stakeholders engaged. This is a crucial aspect, getting the relevant stakeholders engaged. Besides the theoretical considerations in 4.1 also an excellent networker is needed for attracting the relevant stakeholders. However, the stakeholders are most relevant in this DigiTeRRI approach. The work for bringing the idea to many relevant stakeholders and to inspire them is hard work. This DigiTeRRI approach builds a bridge between the different stakeholders and creates awareness in the society.

The stakeholder discussion will uncover the different interests of stakeholders and their different and often very diverse expectations. Moderators and designers of such workshops should be prepared for dialogues with diverging contents. Emphasising the well-being of a broader society could support finding a solution. However, RRI in the context of industry and business which have to compete on the globe need smart ways for implementing RRI.

Building a core team with representatives of Triple Helix (science & research, industry & business, and public authorities) is an important success factor for working out the design, the process steps, the preparation of the workshops because understanding the different backgrounds and point of views are already depict inside the core group. Therefore, different opinions and ways are already known inside the core group as to be prepared for the stakeholder workshops.

A project such as DigiTeRRI initiates regional development. It opens the mind of decision makers and creates awareness. But for all that changing of culture and mind-sets need request time. Thus, DigiTeRRI and similar projects have the limits due to limited time and resources.

Acknowledgement

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Marianne HÖRLESBERGER, Brigitte KRISZT
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