D1.2 Institutional environment and ecosystem analysis report

Version 1.6

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EXECUTIVE SUMMARY

This report aimed at identifying the key actors and dynamics of eight Change Labs participating in the Co-Change Project. The ecosystem mapping was done in collaboration with the Change Labs and core partners to create shared understanding of the ecosystems surrounding the Change Lab, and to motivate and initiate the collaboration between associate and core partners around the Change Labs.

The ecosystem mapping exercise revealed differences but also similarities of the Change Lab ecosystems of which majority are described as innovation and knowledge ecosystems, mainly because of the dominance of research, development and education organisations in the Change Lab project. Although ecosystems have similar characteristics, RRI-driven transformations is always highly context dependent that makes “one-size fits all” policy or recommendations in practical implementation abstract. Therefore, there is an apparent need to take into account the specific goal(s) and structures of the ecosystem and tailor-make the RRI change targets accordingly in collaboration with the ecosystem actors. To embed RRI in organization and ecosystem value creation, it is important to understand varying values of ecosystem actors as well as case-specific societal drivers and pressures. The implemented responsibility dimensions need to reflect the values of all actors to be sustainable.

It is strongly believed that embedding and implementing RRI efficiently requires changes in the network of interlinked actors, i.e. in an ecosystem, instead of focusing only in the organization in the core of transformation. For this reason, it is essential to study and understand the organizational contexts where our Change Labs are embedded, and identify the key actors and interdependencies to design actions for efficient implementation of RRI. Shared understanding of common goals, visions and values in an ecosystem increases the possibility of sustainable implementation of RRI.

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1-INTRODUCTION TO ECOSYSTEMS

An ecosystem, business, innovation or knowledge ecosystem, is today's widely used concept of different kinds of cooperation networks increasingly needed in knowledge economy in which actors are interrelated to co-create value. The ecosystem is also a widely applied metaphor which has received a lot of attention in innovation and entrepreneurial policies as tool to promote not only traditional open co-operation, but also co-creation. In policy thinking, innovation ecosystems widen innovation activity from sectoral silo and promote cross-sectoral and cross-regional, and even cross-national, dialogues. Especially addressing complex societal challenges that demand multi-actor and systemic innovation solutions (Nieminen & Ikonen, 2020), the ecosystem approach is seen helpful in understanding complex multilevel relationships.

Like innovation, also change requires seamless collaboration from multiple actors who might have conflicting interests. The challenge of collaboration can be approached from a different perspectives which are closely related to the concept of ecosystem. One that emphasizes private-public collaboration is Helix-model point of view (Leydesdorff & Etzkowitz, 1996; Carayannis & Campbell, 2014) that highlight the prominent university, industry, government, and civil society relations in the innovation process. Additional concepts related to the ecosystems are clusters (e.g. Porter, 1998) and innovation networks (e.g. Powell et al., 1996) to mention few examples. In this report we have selected the concept of ecosystem instead of, for example, Helix approach because it places emphasis on interdependencies and co-creation between different actors deemed important in implementing transformative responsible innovation and ethics-driven change in organizations and surrounding ecosystems. Even single organizational change can be challenging or non-successful without compatible actions of interlinked actors. Many innovations and transformations of action models cannot be executed efficiently without actions of interlinked actors. (Adner, 2012) Thus, embedding and implementing responsible research and innovation (RRI) efficiently requires changes in that network of interlinked actors, i.e. in an ecosystem.

This is our motivation to study and understand the organizational contexts where our Change Labs are embedded. Identifying the key actors and interdependencies and planning our actions so that they take into account these interdependencies which support efficient implementation of RRI. Shared understanding of common goals and required orchestration of actions in an ecosystem increases the possibility of sustainable implementation of RRI.

The ecosystem concept

Ecosystem concept has its origin in business literature, in which an ecosystem is understood to create value through a network of different actors that are interdependent (Adner & Kapoor, 2010; Autio & Thomas, 2013; Valkokari, 2015). Following Moore, who first coined the concept in 1993, the business ecosystem can

be defined as "*an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world*" (Moore, 1996). Several authors have since then based their views on Moore's definition extending the concept outside business domain, and for example move to knowledge-based economy has changed the concept of value towards more knowledge intensive, i.e. intangible and complex.

Emphasis on knowledge has resulted that the rationale of cost efficiency is insufficient to explain value creation through knowledge sharing and social experiences (Pitelis, 2009), but multidimensional and multi-actor understanding of value creation is needed (Mele & Polese, 2011; Ben Letaifa, 2014; Vargo & Lusch, 2008). Hence, multidimensional approach is seen to distinguish ecosystem perspective from the traditional value chain analysis promoted by cluster and sectoral analyses. According to Phillips and Ritala (2019), the ecosystem concept inherently promises a broader, systems view of organizational and technological phenomena beyond traditional firm, value chain or network boundaries.

The ecosystem usually covers a wide community of organizations, institutions, and individuals, such as the focal actor and its customers, suppliers, as well as different stakeholders and governmental institutions (Peltoniemi & Vuori, 2004). The essential characteristic of an ecosystem is co-evolution (Valkokari, 2015) in which members of an ecosystem develop in interaction with each other and form symbiotic relationships. It is also good to notice that relationships are not always co-operative, but they can be characterized also, for example, as predator and prey relationships, symbiosis, parasitism, competition, and relative advantage (Thomas & Autio, 2012). Consequently, co-evolution does not mean only growth of the ecosystem, but diminishing and even vanishing of relationships are normal characteristics of ecosystem life-cycle (Moore, 1993; Valkokari, 2015).

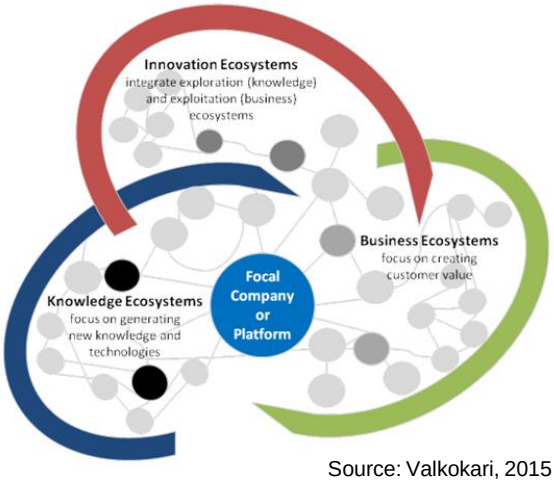
The ecosystem literature bases for instance to the innovation system and clustering literatures, from which it has evolved as one of the widely studied topics of business and management (Adner, 2017; Järvi & Kortelainen, 2017). However, conceptual ambiguity creates a challenge for ecosystems research, given its resemblance to other concepts such as inter-organizational networks, clusters, geographical regions, or platforms (e.g. Adner, 2017). Literature distinguishes several types of ecosystems:

- ***Innovation ecosystem*** - the essential idea is that innovations rarely succeed in isolation, but are dependent on complementary innovations. Thus, a firm is dependent on other firms and actors in its innovation activity. A firm is successful only if its collaborators make supportive and complementary innovations and adapt their operations so that an innovation becomes possible or successful (e.g. Adner, 2006).
- ***Business (/platform) ecosystem*** - includes customers, lead producers, competitors, and other stakeholders. The key to a business ecosystem are leadership companies who have a strong influence over the co-evolutionary processes. Each member of a business ecosystem shares the fate of the network as a whole (Iansiti & Levien, 2004).
- ***Knowledge ecosystem*** - refer to the interaction and evolutionary development of actors, which produce knowledge. Main interest of knowledge ecosystem in

creation of new knowledge through joint research work, collaboration, or the development of knowledge base (Valkokari, 2015)

- ***Entrepreneurial ecosystem*** - differ from traditional clusters by their emphasis on the exploitation of digital affordances and their organization around entrepreneurial opportunity discovery and pursuit. Additional characteristics of entrepreneurial ecosystem are emphasis on business model innovation and knowledge spillovers (Autio et al., 2018). Clusters, industrial districts, or regional and national systems of innovation are closely related concepts (Isenberg, 2010; Zahra & Nambisan, 2011).

Often the concept of ecosystem actually integrates concepts of different ecosystems (Figure 1), for example knowledge ecosystem and business ecosystem are integrated to innovation ecosystem as they help to obtain and create value of the knowledge (Valkokari, 2015). Nevertheless of the type, critical debates on the ecosystem concept also exist that argue the concept of innovation ecosystem does not bring anything new to the discussion of innovation systems, as it is factually used to refer to innovation systems (e.g. Oh et al., 2016). Likewise, it is unclear how much the concept of business ecosystem actually differs especially from the idea of extended value chain as it is, after all, very firm and value creation centered approach.



Source: Valkokari, 2015

Figure 1 Ecosystems and interlinkages

In general, ecosystems are complex to study and comprehend as they are literally and phenomenologically 'systems'. To take a holistic view of the diverse interacting elements across the ecosystem is challenging. Like many systemic approaches call for institutional conceptualization (Nelson & Nelson 2002; Ritala & Gustafsson, 2018), also ecosystem research may benefit, especially in the case of emergent ecosystem, of such conceptualization. For example, one can study the structure and dependencies between participants, socio-technological complementarities and cognitive processes (Thomas & Autio 2013; 2014).

Another valuable perspective to ecosystem analysis is a systems theory to which Phillips and Ritala (2019) offer recent methodological conceptualization. They follow

complex adaptive systems approach and suggest three essential dimensions for the ecosystem: conceptual, structural and temporal dimensions (Table 1).

Table 1 A conceptualisation of ecosystems (Source: Phillips & Ritala, 2019)

Conceptual, structural and temporal dimensions and their implications.

	Conceptual	Structural	Temporal
	How we think about the system	*What we know about the system*	*How systems change over time*
Systems-theoretic definition	Epistemology and theoretical considerations and implications for scope and design of ecosystem research	Ecosystem components and relationships between them impacting structure and processes	Temporal considerations impacting the dynamics and evolution of the ecosystem
Focus of systems-based inquiry	**Boundaries:** Determining ecosystem type and scope (e.g. business, knowledge, innovation) **Perspectives**: How to address the differing perspectives of actors, ecosystem, and environment	**Hierarchy:** Components (actors) in the ecosystem study, which may include subsystems and individuals **Relationships:** Links (and their nature) between components (actors), driven by actors' processes (schema)	**Dynamics:** Changes over time in the ecosystem, actors, relationships and boundaries **Co-evolution:** Interdependent evolution within the ecosystem *and* environment
Key research design questions	What is the focal issue? What philosophical and theoretical positioning is appropriate? What are the implications for research scope and determining the boundary?	What are the structures? What is the hierarchy (of actors and processes), How are these interrelated? How might these be mapped and studied? What is/are the appropriate level/s of analysis?	What are the underpinning dynamics of the environment, ecosystem and its components? What timeframe and approach are appropriate? How might time impact conceptual and structural considerations?

Regardless of theoretical lens, important in ecosystem analysis is to adopt a broad perspective in the (eco)system (incl. actors from financing to research) that emphasizes the systems' components and distinguishes ecosystems from mere networks. In particular, inclusion of regulatory framework is crucial for understanding different national, regional and sectoral contexts.

Identifying precise boundaries to ecosystem is somewhat impossible, key focus should hence be on systematically identifying organizations (actors) with which the future of ecosystem is most closely interwoven (Iansiti & Levien, 2004).

The ecosystem type and boundaries

Examining of the conceptual dimension brings understanding of the ecosystem type, its boundaries, focus and operation logic. Ecosystem perspectives can be narrow in focus, as for instance the system can centralise around technological platforms (e.g. Wareham et al., 2014), around a particular organization (e.g. Adner & Kapoor, 2010), or it can be wider to include an industry/sector, or geographical region. Helpful descriptions to make distinction between different ecosystem types are provided, but ecosystem types can (and most likely will) overlap; therefore ecosystem in its pure form can be difficult to observe. Table 2 gives an overview to four common types of ecosystem.

Table 2 Summary of the ecosystem types

	Business ecosystem	Innovation ecosystem	Knowledge ecosystem	Entrepreneurial ecosystem
Baseline of ecosystem	Resource exploitation for customer value	Co-creation of innovation	Knowledge exploration	Shared knowledge base
Relationships and connectivity	Global business relationships both competitive and co-operative	Geographically clustered actors, different levels of collaboration and openness	Decentralized and disturbed knowledge nodes, synergies through knowledge exchange	Clustered actors; collaboration and openness
Actors and roles	Suppliers, customers, and focal companies as a core, other actors more loosely involved	Innovation policymakers, local intermediators, innovation brokers, and funding organizations	Research institutes, innovators, and technology entrepreneurs serve as knowledge nodes	Start-ups, Financing /VC; research/education; new venture accelerators; co-working spaces
Logic of action	A main actor that operates as a platform sharing resources, assets, and benefits or aggregates other actors together in the networked business operations	Geographically proximate actors interacting around hubs facilitated by intermediating actors	A large number of actors that are grouped around knowledge exchange or a central non-proprietary resource for the benefit of all actors	The shared knowledge base relates to business model innovation and entrepreneurial opportunity pursuit and scale-up.
Source:		Valkokari, 2015		authors (based on Autio et al., 2018)

The ecosystem relationships

Analyzing the ecosystem structure reveals ecosystem hierarchy and relationships between different actors. However, a challenge in the ecosystem studies is to look beyond traditional value exchanges to more complex relationship types (Urmetzer et al., 2016). One of the key motors of the ecosystem, namely trust, pushes self-enforcing governance; whereas mutual awareness creates collective identity in the ecosystem. The multilevel approaches which include institutional environments and the interaction between these levels (Aarikka-Stenroos & Ritala, 2017) are essential and at the same time demanding to identify. In turn, to capture wide socio-technical systems, inclusion of e.g. micro and macro-levels (Meynhardt et al., 2016) is recommended. One could for instance address actors' position in value creation (Adner & Kapoor, 2010), or to recognize connectedness and address the flow of relationships.

Furthermore, since the ecosystem co-evolves, a change in one component in the system leads to changes in the other components and the ecosystem itself (e.g. Peltoniemi, 2006). Nevertheless, ecosystem dynamics change in different stages of an ecosystem lifecycle (Figure 2).

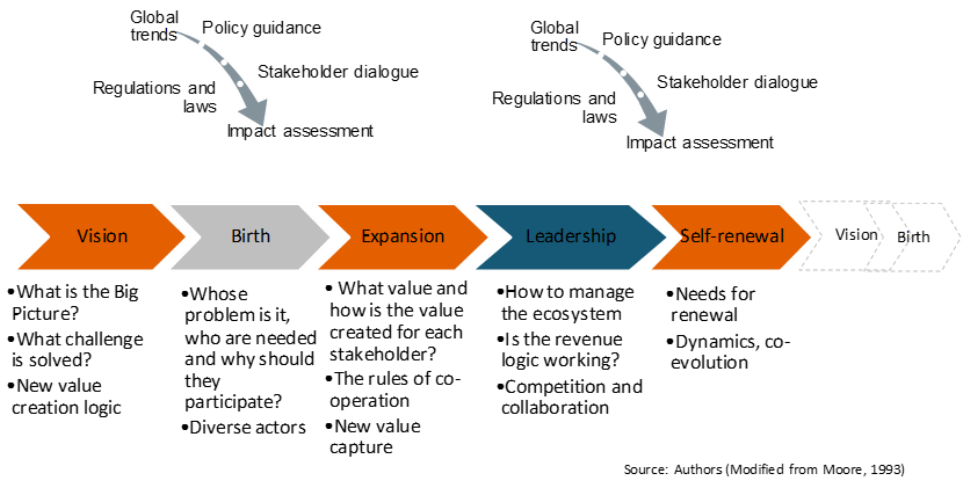


Figure 2 The ecosystem lifecycle

In fact, ecosystems co-evolve in alignment with their socio-technical environment and the success of the ecosystem is contingent on its external legitimacy (Walrave et al., 2018). It is worth noting that external processes, such as funding schemes or innovation and industrial policies, are likely to dominate in the early lifecycle of an ecosystem.

Value co-creation, responsibility and ethics

Responsibility and ethics are developed in constellations, which depend on complex interactions between various actors. A starting point for change is a systemic view of organizational change that sees organizations as open systems, which develop in constant interaction with their environment, are co-evolving and self-organizing (e.g. Nieminen & Talja, 2018).

Responsibility demands reflexivity of actors' motivation, inclusiveness of various stakeholder and citizen interests, values and perspectives, as well as anticipation of future impacts (Owen et al., 2013). Organizational strategies and capabilities are increasingly shifting from actor centric to ecosystems to capture benefits of shared value. Ecosystem's core function of interrelatedness of actors facilitates value co-creation (Clarysse et al., 2014; Ketonen-Oksi & Valkokari, 2019). In general, the ecosystem approach addresses well knowledge society and socio-technical change in which knowledge and value creation and sharing above all are important aspects.

Values, like responsibility, are construed in human systems and call for co-creative approaches to be constructed (Vargo et al., 2017). These systems can be organizational, network, societal, or national settings. Although values are also personal, values are predominantly social constructs and require inclusion and dialogue with different stakeholders. Therefore, to capture responsibility and ethics related values, we propose to expand value creation, and simultaneously the organizational change, processes outside organizational boundaries.

In the ecosystem context, value creation can be approached from the perspective of shared value which acknowledges values are created in a dialogue with different

stakeholders in cluster contexts (Porter & Kramer, 2019), or from value co-creation perspective which bases on service dominant logic (e.g. Vargo & Lusch, 2008). Value co-creation in the ecosystem centers on clear vision and shared value base, but demand also well-founded facilitation that supports interplay, also creation of new connections, between participants (Ketonen-Oksi & Valkokari, 2019). Although value co-creation is initially a business not an ethics-related concept, it is yet useful and applicable in addressing RRI themes in the system's context, like the ecosystems. Besides being significant in itself, responsibility is also an increasingly important dimension for creating business value. The production of business value requires integration of societal and environmental value creation in the products and services. One of the major advantages of the value co-creation perspective is that it takes an inter-organizational compared to intra-organizational view, and further acknowledges value as dynamic process in which value destruction is a possible outcome. Getting novel ways of action diffused in the systems require interacting with one another, so that the different actors learn about each other's expectations and needs leading to a shared internal model of action, such as RRI principles.

2- METHODS

The aim being to identify the key actors, relationships and general dynamics of each Change Lab related ecosystem, the ecosystem mapping, description and diagnosis was performed by Co-Change Change Lab representatives with the help of consortium´s core partners, which are collaborating with Change Lab partners to implement RRI. Guidelines to describe the Change Lab and its operational environment were shaped beforehand and introduced to all Change Labs and core partners in a telco in the late May 2020 (Guidelines in Appendix 1). This first telco was followed by two additional 'Ecosystem mapping clinics' in the early June 2020 to discuss and solve any challenges Labs had encountered in examining and reporting their cases.

The ecosystem mapping was done in collaboration with the Change Lab and core partners, first, to create shared understanding of ecosystems, and second to motivate and initiate the collaboration between associate and core partners around the Change Lab. The Change Labs are very different from each other (see, Table 3), and in different stages of evolvement; therefore amount of secondary material available varied between cases. The main information sources were interviews of key stakeholders (e.g. the Change Lab management and key stakeholders in the ecosystem), existing strategy documents (of host organization, related ecosystem and projects), and existing reports (e.g. annual reports, studies of host organization).

Table 3 The Change Labs

ORGANISATION	CHANGE LAB	DESCRIPTION
AIT AUSTRIAN INSTITUTE OF TECHNOLOGY	Learning about machine learning	ISP and Center for Digital Safety & Security (DSS) aim to set up a mutual learning dialogue on research (COKPIT Project).
WWTF	Digital Humanism	An upcoming WWTF call for research projects in the area of Digital Humanism. The research teams should engage in basic questions of digitalization and provide a solid basis for alternative roads in digitalization in the long term. This includes ethical questions, sustainability, inclusion / open science etc.
tecnalia Inspiring Business	RRI consultancy service	Transformation of Science, Technology and Innovation (STI) policies towards societal challenges which currently lack RRI discourse. General aim is to systematically introduce and implement RRI principles.
UNIVERZITET U NOVOM SADU UNIVERSITY OF NOVI SAD	RRIzing Lab	To introduce orientation to open innovation and create synergies for responsibility with all stakeholders.

COUNCIL OF TAMPERE REGION	Developing standardized RRI evaluation criteria	Council of Tampere Region (CTR) has developed novel RRI evaluation criteria for innovation policy in the MARIE Interreg project. Two pilot calls in 2018 and 2019 raised needs for further development and scaling of RRI.
RAAS	Research Alliance for Autonomous systems	Research Alliance for Autonomous systems (RAAS) is coordinated by VTT since 2018. It is an alliance between universities and research institutes around autonomous systems that implies several socio-ethical challenges such as: ethics, responsibility, AI, transportation, human-technology interaction, governance, regulation, employment, and training. These challenges call for better integration of RRI.
DCE TUDelft	DCE	The DCE (Delft Centre for Entrepreneurship) change lab intends to explore how RRI aspects can be included into new start-up ideas that are more likely to be successful in the market place and society. Integration of RRI and dimensions of responsible innovation within the development of new business opportunities.
NEN	NEN	NEN is the national standardization organization in The Netherlands. It brings together organizations in diverse sectors. It intends to explore whether RRI aspects should be included in the standards setting process and how this could be done in practice.

The ecosystem diagnosis concerned of the following issues: the ecosystem type, the description of main actors and operational environment, barriers and drivers related to operating, as well as history and future of the ecosystem. The Change Labs are summarized in Section 3 and full descriptions of the cases are available in the Appendix 2.

3-THE CHANGE LAB ECOSYSTEMS

The AIT - Learning about machine learning

An AIT ecosystem is built with a twofold role, an innovation and knowledge ecosystem. As an innovation ecosystem, it aims to forward a practical interface to law enforcement agencies, and design practicable solutions for safety and security tasks. In detail, the innovation ecosystem tackles the problems of organized crime and terrorist groups using information and communication technologies as a service. The ambition is to deliver security-related artificial intelligence (AI) technologies in the field of law enforcement, retail and trade.

Aside from delivering security-related applications, the ecosystem has an educational purpose of disseminating knowledge about machine learning. The educational target is to pool expertise in AI and integrating future-oriented technology know-how in application-oriented infrastructure issues across the ecosystem (Figure 3).

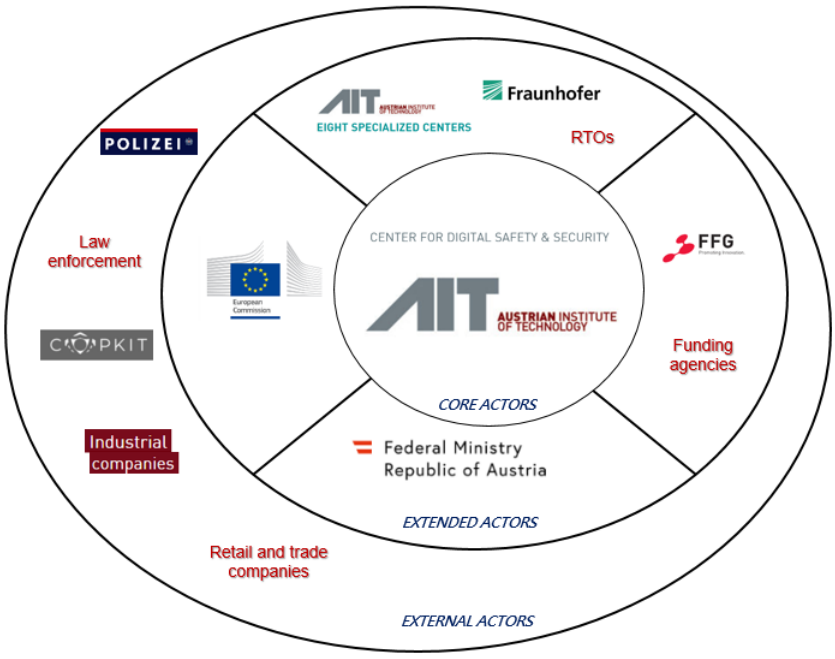


Figure 3 The AIT ecosystem

Due to an ambiguous purpose of the ecosystem, actors are diffused at multiple operational spheres (regional, national, international). Within the lab, the interrelations between the actors are often a client- and research-oriented as a form of joint research projects. The flexible collaboration between the actors is centered on core partners, law enforcement agencies, ministries, and the European Commission. Therefore, the tentacles of the ecosystem extend throughout Europe.

The WWTF - Digital humanism

A digital humanism is a knowledge ecosystem at research funding association, WWTF (Vienna Science and Technology Fund), which operates locally in Vienna. The digital humanism initiative was launched to address challenges regarding human values in the digital transition of society.

The background of the ecosystem originates from the discussion on including social sciences to technology development. The ecosystem seeks to act in this dynamic discussion and transfer knowledge of digital humanism to academic and business sectors (Figure 4). The mission is to develop a set of principles for social and human values in the digitalization, contributing positively to disadvantages and inequalities that may emerge in the digital society.

The ecosystem uses the Change Lab of WWTF as a practical venue where research can contribute to environmental change in different participatory spheres. Notably, the main focus of the Change Lab is to raise awareness of digital humanism beyond the academia and extend ideas to the business sector to tackle limitations of the technical standpoint. Moreover, it offers an opportunity to establish sustainable change within RRI aspects of the IT-start-up environment.

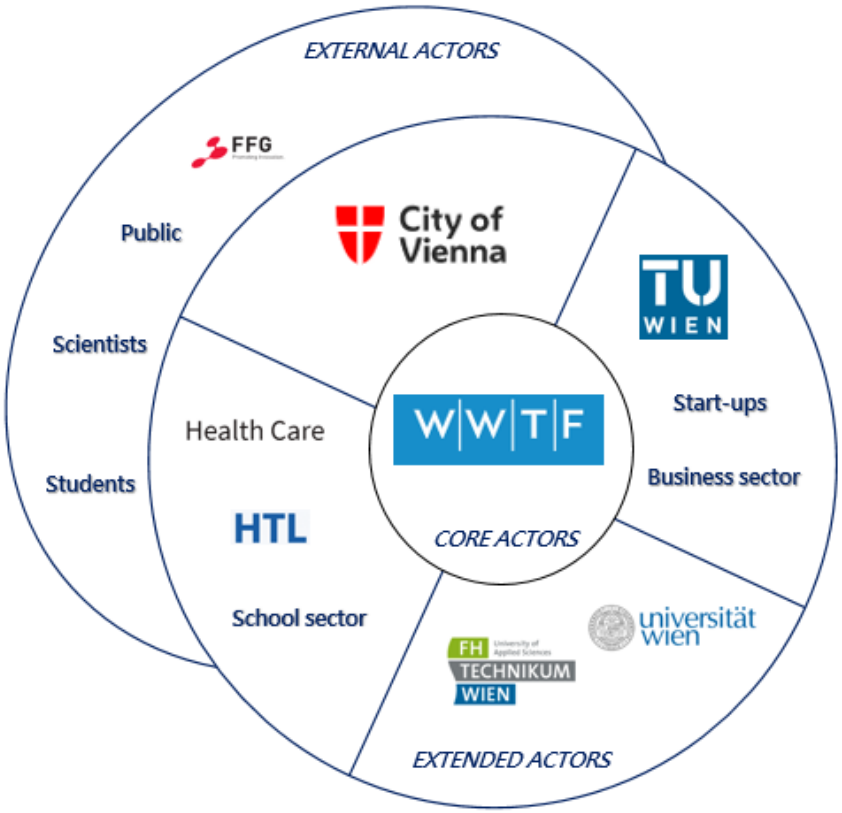


Figure 4 The Digital Humanism, WWTF ecosystem

Predominantly, the ecosystem underpins the broad dialogue on digital humanism to strengthen interdisciplinary collaboration, first and foremost among stakeholders in the city of Vienna.

The Tecnalia - RRI consultancy service

Tecnalia, as an applied research centre, is a part of a broader innovation ecosystem that is a set of actors, activities, institutions, and relations. The strategic mission of the ecosystem is tied to regional interests and it mainly focuses on evolving scientific-technological capacities and re-adaption of the technological, industrial infrastructure in the Basque Country. The vision of the ecosystem is to position the Basque Country as an innovation and research benchmark in Europe built on sustainable and economic development with the three pillars of sustainable growth, human development and smart growth.

The role of Tecnalia is to promote sociocultural change and technological solutions within the business sector and public agencies with the support of competitive public programs of research, development and innovation (R&D&I) structures. As a part of Tecnalia, the Change Lab offers practical services to improve the competitiveness of enterprises and resolve the social challenges facing the Basque Country. The Lab uses co-creative instruments and participatory methods to implement RRI principles in the daily functioning of Tecnalia. The key idea is to promote impactful and sustainable institutional change through formal RRI policies and the transformation of STI and socio-technical systems. The ecosystem is organized through R&D&I value chain and subsystems, see Figure 5.

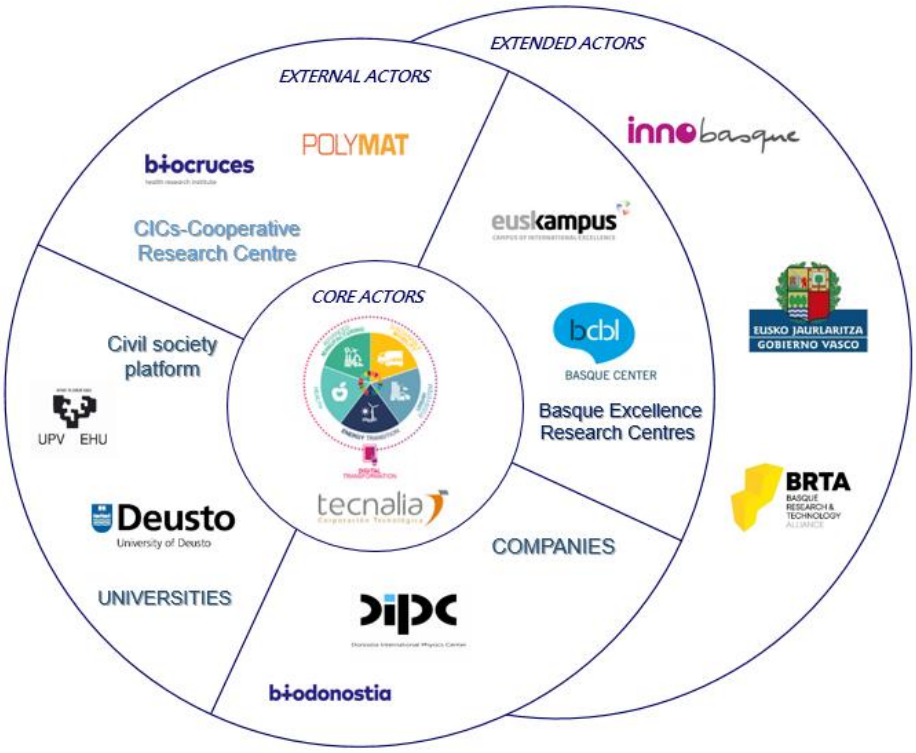


Figure 5 The Tecnalia ecosystem

The relationships of the network in the ecosystem are mainly complementary, working together throughout the entire R&D&I value chain. The future vision is to produce structural transformations in society beyond the cross-sectorial constellations of actors. The entire network comprises 120 accredited agents and Tecnalia along with other actors such as Innobasque – Basque innovation public agency, a consortium Basque Research & Technology Alliance (BRTA), Basque Excellence Research Centres, CICs-Cooperative Research Centre, Civil society platform, and private companies.

The RRIzing Lab

RRIzing Lab is a knowledge ecosystem that aims to transfer knowledge of RRI-related aspects across the University of Novi Sad (UNS). With the coalition of three actors, namely Faculty of Agriculture (PFNS), the Institute of Food Technology (FINS), and Faculty of Technical Sciences (FTN), the ecosystem directs to foster collaboration and raise awareness of RRI on the university level (Figure 6).

The main objective of the ecosystem is to disseminate the knowledge of RRI key areas, including gender equality, scientific education, and ethics, in close cooperation with the food industry and national and regional authorities. The living RRIzing lab is used as a showcase for implementing RRI-related impact. New methodologies and tools concerning RRI are applied across the ecosystem, reinforcing the old methods

and traditions. Additionally, symbiotic co-working spaces and complementary relationships between the actors will be fostered.

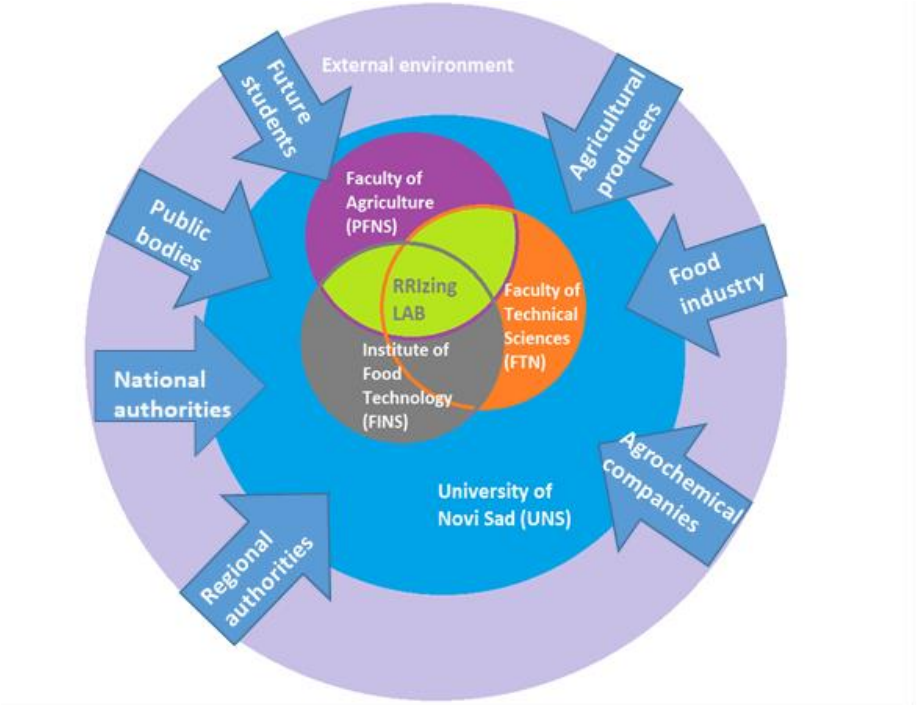


Figure 6 The RRIzing lab ecosystem

The future mission is that RRI is addressed as an emerging transformative principle of research and innovation policy at the University of Novi Sad.

The Council of Tampere region

An ecosystem surrounding the Council of Tampere Region is made up of a diverse range of partners and agents, who carry out specialized, innovation-oriented research and business development that contributes to creating growth and well-being in the city of Tampere (Figure 7). Over 60 years old, the innovation ecosystem is built on regional interest to improve local operations in terms of R&D infrastructure across academic, industrial, and technological sectors. The mission is to tackle technological and industrial challenges in the region and boost its international positioning.

On a practical level, the ecosystem consists of a dynamic, complementary network shaped with capacities and joint research activities. Tampere council holds a facilitator role for regional innovation development, bringing together the expertise of innovation funders and startups, innovation policymakers, local intermediators, higher education, innovation brokers, and other funding organizations.

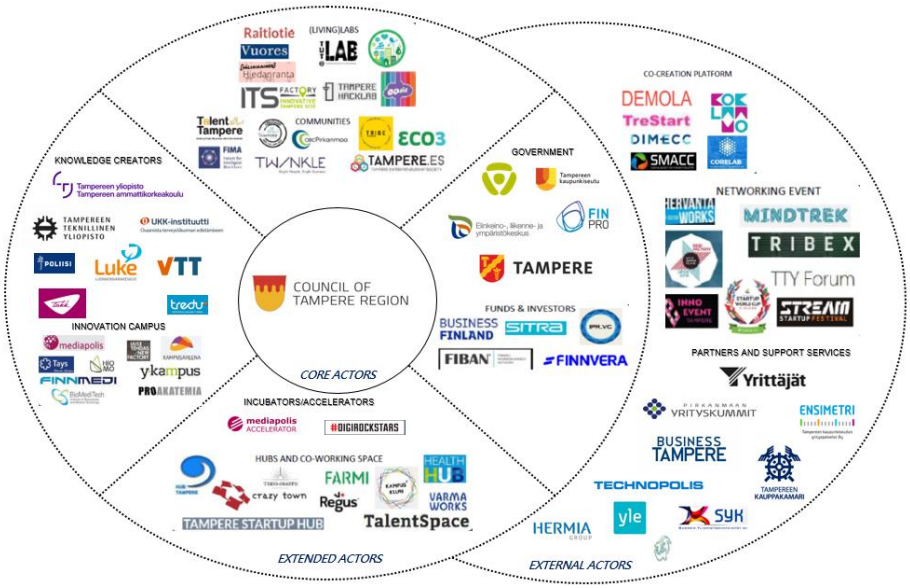


Figure 7 The Tampere council ecosystem

The ecosystem is built on a seamless bond with the public and private sectors to work together towards a sustainable and innovative Tampere region. The established Change Lab is targeted to foster RRI adoption in the European regional Development Fund (ERDF) funding and bring together research and education institutes. Thus, the lab is operating through learning-by-doing in a specific organizational context.

The Research alliance for autonomous systems (RAAS)

RAAS is a research and innovation ecosystem which is coordinated by a RTO (VTT). It integrates many research organizations and companies (SMEs and larger firms), and aims to integrate Finnish actors who work in the focus domains of autonomous systems (Figure 8). Due to the ecosystem nature of RAAS as Change Lab, its Change Lab activities tangle around different projects performed within the RAAS ecosystem.

The RAAS concentrates on interdisciplinary R&D and helps companies in their innovation activities; therefore its' main activities relate to improving industry and academia interaction and collaboration. The RAAS ecosystem offers an access point to the best talent in both national and international networks of top researchers in autonomous systems. It focuses on solving of systemic and holistic challenges and steering of long-term autonomous systems research in Finland, but offers simultaneously concrete support to autonomous systems' testbed activity and aims to develop a one-stop-shop service approach to applied research. Second, it supports to policy briefing on the national level as well as international policies, regulations, and funding regarding autonomous systems.

Figure 8 The RAAS ecosystem

The RAAS ecosystem strives to be pragmatic and efficient in the construction of the network and operates via concrete R&D projects which involve many ecosystem partners. For example, workshops, seminars, cooperation forums offer networking opportunities for the ecosystem actors.

The Delft Centre for Entrepreneurship (DCE)

DCE's Change Lab constitutes a set of interdependent actors and factors that promotes productive entrepreneurship, mainly in the Netherlands. As an entrepreneurial ecosystem, it is a complex social system with multiple dependencies in different actors (Figure 9). Through innovation, the ecosystem turns ideas into reliable tech start-ups and business ideas, as a forthcoming world-leading ecosystem for entrepreneurship.

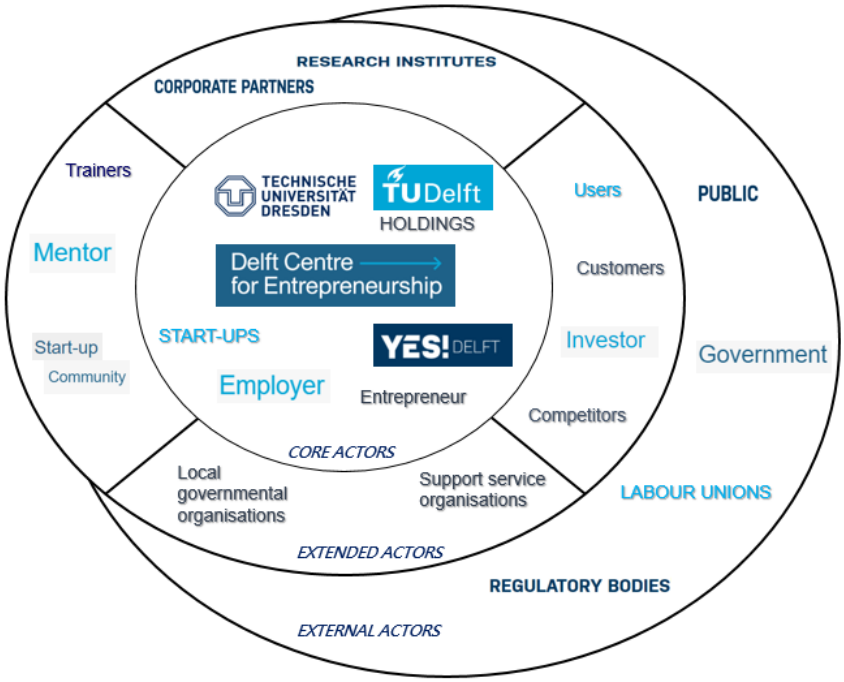


Figure 9 The DCE ecosystem

The core ideas of the ecosystem are integrating RRI principles into incubators' business developments and ventures in an in-depth and thorough manner, creating societally acceptable and desirable products/services and increasing competitiveness and legitimacy of start-ups. Secondly, the ecosystem generates recommendations for RRI in learning programs and endeavors to broaden the mindset of engineering students in RRI-related aspects.

On a practical level, the DCE Change Lab aims to support start-ups to become self-sustainable subsequently. With the acceleration of socio-economic impact, the ecosystem contributes to the moral responsibilities and values of future business models and entrepreneurial infrastructures.

Ultimately, the ecosystem is built with a focus on creating more entrepreneurial regional culture, combining a diversity of essential cultural, social, and material attributes to start-ups and creating symbiotic and heterogeneous relationships between the interconnected network actors.

The Royal Netherlands Standardization Institute (NEN)

NEN is an innovation ecosystem that concentrates on promoting a positive impact on society through meaningful committee-based standardization. The primary function of the ecosystem is to establish institutional innovations as a form of tailored, industrialized standardization across industries.

The standardization is a regulated, de jure committee-based process, including significant standardization institutes NEN and CEN (European Committee for Standardization) that facilitates communication throughout the standardization lifecycle. As an innovation ecosystem, NEN is in close cooperation between multiple partners to expand the social and economic impacts of the standardization (Figure 10).

Figure 10 The NEN ecosystem

Through close hierarchical collaboration, the ecosystem is able to mobilize the standardization into practice in a sustainable way. The future mission is to indirectly influence the competitiveness of industries, creating a broader consensus on socially acceptable standards.

4-SUMMARY OF THE ECOSYSTEM DIAGNOSIS

Ecosystems are highly context specific and diverse, therefore summarizing similarities or differences is somewhat artificial. However, some common characteristics and challenges encountered in the ecosystem mapping can be highlighted although the main reason for this exercise is make visible the actor networks and their dynamics, i.e. ecosystems, in which the Change Labs operate. To achieve sustainable transformation, it is essential to identify potential network and actors who should be integrated, or at least their existence acknowledged, in the RRI-driven transformation process.

Due to the complex nature of ecosystem, challenges in ecosystem diagnosis were encountered in particular in defining the ecosystem, namely focusing and finding its boundaries. By focusing it is meant defining the central actor, namely the unit of analysis, and roles of other actors. Because ecosystems are continuously evolving and contain characteristics of different ecosystem types, boundaries are not often clear-cut. However, one of the main advantages of examining the ecosystem, its members and partners, is to identify actors who should be involved in the RRI change process. In fact, one key learning from the stocktaking workshops[1] was to recognize key internal and external actors who are needed in making the change in organization sustainable. Identifying actors is particularly challenging in starting ecosystems who should focus activities, but it is also acknowledged difficulty in mature ecosystems who have attracted diverse stabilized number of actors (e.g. CTR and Tecnalia) and should redefine itself.

According to the ecosystem descriptions (see summary in Table 4), a majority of the Change Labs operate in environments that are emphasized by a strong need for knowledge and capability development and transfer to create novel solutions, activities and services. Thus, many ecosystems combine characteristics from both innovation and knowledge ecosystems. In these kinds of environments, facilitation of knowledge transfer is vital (Ketonen-Oksi & Valkokari, 2019), but equally important is to give room for value co-creation process. In many contexts, this process is slow and open to resistance. In fact, Ketonen-Oksi & Valkokari (2019) identify four phases in value co-creation process: co-experience, co-definition, co-evolution and co-development that all have specific demands and dynamics. This multi-dimensional co-creation process with its different phases is useful perspective in planning processes how to create shared value among ecosystem actors, embedding responsibility thinking in existing practices or creating new practices and institutional structures.

[1] Virtual stocktaking workshops were organised in June 2020, and results are reported in D1.1 Stocktaking report of Co-Change project.

Table 4 The summary of Change Labs' ecosystem characteristics

	Orientation of ecosystem	Total number of ecosystem actors or actor groups (approx.)	Predominant sector(s) of ecosystem actors (Industry, Unis, research institutes, public bodies/ authorities, CSOs etc.)	Other observations
RAAS	Innovation and knowledge	3 core partners, 25 extended partners, 6 external partners	Universities, public bodies, industry	RAAS is a dynamic ecosystem in which number and role of partners varies according to on-going projects.
CENTER FOR DIGITAL SAFETY & SECURITY AIT AUSTRIAN INSTITUTE OF TECHNOLOGY	Knowledge and innovation	1 core partner, 5 extended partners, 3 external partners	Research institutes, public bodies	AIT-DSS extends to European R&D field, also to funding.
NEN	Innovation	3 core partners, 3 extended partners, 1 external partner	Industrial actors (firms and industry associations), public bodies	NEN operates in well-structured process and environment.
tecnalia Corporación Tecnológica	Innovation	1 core partner, 13 extended partners, 3 external partners	Research sector, innovation-related public bodies	Tecnalia is strong partner of regional innovation system.
COUNCIL OF TAMPERE REGION	Innovation	1 core partner, 8 extended partners, 3 external partners	Education and research sectors, business development sector	CTR operates in local city-based ecosystem that has strong innovation and entrepreneurial focus.
WWTF	Knowledge	1 core partner, 9 extended partners, 4 external partners	Education sector, public bodies, civil society	WWTF operates with local city actors.
UNIVERZITET U NOVOM SADU UNIVERSITY OF NOVI SAD	Knowledge	3 core partners, 2 extended partners, 11 external partners	Education sector, public bodies (ministries)	RRIzing lab's operational environment is highly university-based.
	Entrepreneurial	5 core actors, 10 extended actors,	Business (development) sector, finance	DCE is an entrepreneurial ecosystem in

DCE TUDelft		4 external actors	sector, university sector	which personal connections and interaction activities are important.

As stressed earlier, inclusion of key partners in RRI transformation is essential. However, these key partners are not only core partners, but key actors come from all of the layers of the ecosystem, nevertheless their roles can change in different phases of the RRI transformation process.

The multi-dimensional co-creation process emphasizes also the significance of the temporal dimension of ecosystem development. As we suggested earlier, the ecosystem development has different phases including vision building (with questions, e.g., what challenge is solved and what is the value creation logic?), birth (e.g. who are needed and why they should participate?), expansion (e.g. how new value is captured?), leadership (how to manage ecosystem?), and self-renewal (how to renew and develop practices?). Evidently, most of our Change Labs are in a situation where they need, in a way, "reinvent" (self-renewal) the already existing ecosystem by re-defining the challenges and value creation logic from the perspective of RRI. At the same time it is also important to recognize the overall development phase of the existing ecosystem and link the responsibility related questions to the questions which are typical for that development phase without disdaining other relevant questions. Some ecosystems, like WWTF's Digital Humanism and RRIzing lab's, are in turn in the emergence phase in which relevant actors are identified and common vision built.

Based on the ecosystem descriptions we have collected some tips for RRI-driven change in the ecosystem context for application and elaboration in the Co-Change project.

As argued, a common value base is essential for achieving sustainable change, to which value co-creation mechanisms offer a useful approach. For example, using different kinds of, existing and new, platforms as venues where the ecosystem actors can connect with one another, and become interested in co-creating value, is recommended (Ketonen-Oksi & Valkokari, 2019). For entrepreneurial ecosystems these can be start-up events, and co-working spaces, while innovation ecosystem actors may be more prone to connecting at seminars, events and in common research projects. Resource sharing, like common research facilities offer a platform for interaction. Furthermore, innovation ecosystem actors are accustomed to systemic approaches in developing innovations, therefore they can be easier to engage in RRI while the RRI discourse can be less familiar to start-ups and entrepreneurs taking longer for them to digest.

Given that hierarchies differ between the different types of ecosystems, engagement mechanisms are likely to differ. We can expect start-up ecosystems to be less hierarchical compared to knowledge and innovation ecosystems in which somewhat rigid academic and science hierarchies may challenge engagement, in particular engaging of right persons at the right time. Consequently, it is important to invite

ecosystem's diverse stakeholders in order to raise awareness keeping in mind that RRI value co-creation usually engages a smaller core group of people, like opinion leaders. Nevertheless, embedding RRI should be active, creative and social. Regular communication towards all ecosystem actors lowers barriers for resistance.

Like the dynamics and engagement of ecosystem actors differ, also the speed of RRI transformation is likely to differ. The more the ecosystem has industry partners, the faster it thirsts for results. Balancing with the long RRI transformation process and firm expectations for quick results is challenging, but can be overcome with open and realistic dialogue that does not over-promise RRI transformation. Overall, concrete actions with less RRI ideology may work better in the entrepreneurial ecosystem whereas innovation and knowledge ecosystems are populated with scientists who may require more substance discussions and justification.

In the next phases of the Co-change project, the Change Labs provide interesting empirical insights, how ecosystem perspective can be developed and used in practice when new ideas and value creation models like embedding responsibility thinking in existing organizational practices, is implemented. While this report offers only initial, but necessary, mapping of key actors and dynamics, together with ecosystem related theoretical thinking and results of the Co-change stocktaking (see D. 1.1.), it offers a basis for developing systemic practices, how to implement responsibility thinking in complex and dynamic actor networks.

5- CONCLUDING REMARKS

The ecosystem structure is constantly changing, it has stages and lifecycle and should be addressed these characteristics in mind. For this reason, current ecosystem descriptions can be treated as 'working documents' or 'mental maps' that co-evolve with the Change Lab transformation. New actors are likely to appear, and old ones to disappear. Also dynamics of the ecosystem will change, i.e. relationships mature and change form, and value creation processes will be more noticeable. These developments are important for embedding RRI-related transformation, but are easier to observe once groundwork for revealing the ecosystem structures is made.

The ecosystem perspective offers a lens for embedding RRI in organizational context, but what it is not able to offer is a "one size fit all" solution because embedding of RRI is highly context-sensitive activity. Institutional frames and change dynamics alter case by case. However, understanding of structures and dynamics of a system helps to navigate transformation. In the institutional change view, focus is placed on changing the practices, procedures and norms that define organizations not only from individual, but wider societal perspective. To change organizations, modifications in institutionalized practices and norms are also necessary as they provide incentives for the change.

Additional advantage of including the ecosystem lens is that the network of actors can be used for peer-learning and assessing impacts of the Change Lab by giving room for the ecosystem (actors) to evaluate the envisioned transformation. Internal assessment most likely deviates from external perspectives, i.e. from the perspective of those actors involved in the value co-creation processes.

In our opinion, embedding of RRI is not only, as it is easily suggested, dependent on combining top-down and bottom-up approaches in organization, but also inward and outward dialogue with the ecosystem actors. The ecosystem around the Change Lab should also be open to RRI having engaged stakeholders. This accounts for deep understanding of the change context, given that actors' roles in different phases of the change process are likely to differ. Some organizations may even become obsolete in the transformation. Furthermore, argumentation for the need and motivation for change should extend outside organizational boundaries to society.

Second point we like to stress is the value dependency of responsibility and ethics that demand for co-creation approaches to be embedded in a system, whether this system is a project, unit, organization, or a larger ecosystem. Ethics and values, which RRI keys largely represent, are always co-created, multidimensional and emergent. Multi-stakeholder involvement also increases the legitimization of initiatives and support besides acceptability of solutions also their desirability.

It should be also noted, that the contextuality of RRI and social values means that aspects and dimensions of responsibility vary accordingly. Certain dimensions of RRI work better in certain ecosystem contexts. For instance, in entrepreneurial context open science and research ethics may be less important issues than societal impacts

of innovation whereas open science and research ethics may be more prominent in a knowledge creation ecosystem which are education and science related. Innovation ecosystems may in turn emphasize open and social innovation aspects. The diversity of the ecosystems, their predominant goals and dynamics emphasize the importance of tailor-making the approaches and value offerings.

To conclude, we emphasize some practical key ideas for including the ecosystem perspective, which were raised during the mapping exercise.

1. There is an apparent need to take into account the specific goal(s) and structures of the ecosystem and tailor-make the RRI change targets accordingly in collaboration with the ecosystem actors;
2. There is no “one-size fits all” policy or recommendations in practical implementation due to diversity of ecosystems and actors: general guidelines may help, but remain easily too abstract;
3. It is important to understand varying values of ecosystem actors as well as case-specific societal drivers and pressures. This is a starting point to find compromises and ways to shared value thinking and new value co-creation models;
4. It is essential to include the perspective of temporal sustainability of new value creation models. The implemented responsibility dimensions need to reflect the values of actors to be sustainable; and
5. Besides shared values and a vision, a common or shared action roadmap is needed to orchestrate actors operations towards embedding RRI in value creation.

Thus, we understand the ecosystem perspective to be a relatively practical lens to guide actions and implementation in varying contexts by emphasizing interdependencies and diversity as the main questions, to which, in turn, relate number of various important other aspects from trust to value creation. In essence, this is a working hypothesis, which will be tested in the implementation of the Co-change Labs.

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Appendix 1 - Guidelines to Change Lab ecosystem mapping

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Contents

1. Motivation to study ecosystems
2. Schedule
3. Introduction to ecosystems
   - Definition
   - Ecosystem types
4. Guidelines to map Change Lab's ecosystem

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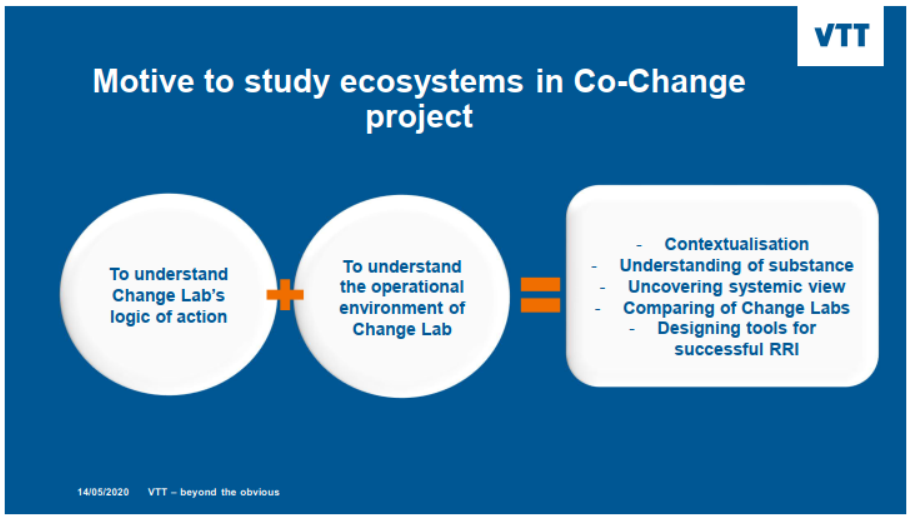

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Schedule for ecosystem mapping (WP1)

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MAY 2020

19.5 Instructions discussed in Change Lab telco

Ecosystem mapping - interviews, desk research

25.5 Ecosystem clinic, 30 min 15:00 CET *TBD*

JUNE 2020

1.6 Ecosystem clinic, 30 min 15:00 CET *TBD*

3.6 Deadline for ecosystem descriptions

Mid-June Change Lab Telco
- Summary of ecosystem analysis

WP 2: Survey with Change Lab - interviews start

JULY & AUGUST 2020

- Revised ecosystem descriptions by **30.7**
- Summer holiday period in July
- Finalising analysis and deliverable of WP1 by the end of August

WP 2: Survey with Change Lab - interviews continue

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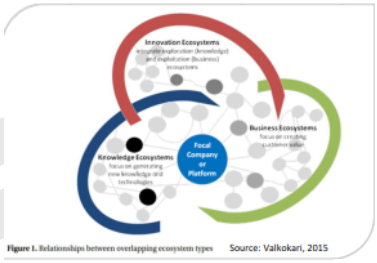

Figure 1. Relationships between overlapping ecosystem types Source: Valkokari, 2015

Ecosystem is a useful concept for understanding and making visible (complex) relationships in network of actors.

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The ecosystem

- An ecosystem creates value through a network of different actors that are interdependent (Adner & Kapoor, 2010; Autio & Thomas, 2013; Valkokari, 2015).
- Ecosystem is a wide community of organizations, institutions, and individuals, such as the focal firm and its customers, suppliers, as well as different stakeholders and governmental institutions (Peltoniemi & Vuori, 2004).
- The essential characteristic of an ecosystem is co-evolution in which members of an ecosystem develop in interaction with each other and develop symbiotic relationships (Valkokari, 2016).

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Different types of ecosystem 1(2)

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Innovation ecosystem

- innovations rarely succeed in isolation but are dependent on complementary innovations.
- a firm is dependent on other firms and actors in its innovation activity.
- A firm is successful only if its collaborators make supportive and complementary innovations and adapt their operations so that an innovation becomes possible or successful (e.g. Adner 2006; 2012).

Business (/platform) ecosystem

- *"an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world."* (Moore 1996)
- key to a business ecosystem are leadership companies who have a strong influence over the co-evolutionary processes.
- Each member of a business ecosystem shares the fate of the network as a whole. (Iansiti & Levien 2004)

Different types of ecosystem 2(2)

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Knowledge ecosystem

- Main interest of knowledge ecosystem in creation of new knowledge through joint research work, collaboration, or the development of knowledge base. (Valkokari, 2015)

Entrepreneurial ecosystem

- differ from traditional clusters by their emphasis on the organization around entrepreneurial opportunity discovery and pursuit.
- Emphasis on business model innovation and knowledge spillovers (Autio et al., 2018).

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	Business ecosystem	Innovation ecosystem	Knowledge ecosystem	Entrepreneurial ecosystem
Baseline of Ecosystem	Resource exploitation for customer value	Co-creation of innovation	Knowledge exploration	Shared knowledge base
Relationships and connectivity	Global business relationships both competitive and co-operative	Geographically clustered actors, different levels of collaboration and openness	Decentralized and disturbed knowledge nodes, synergies through knowledge exchange	Clustered actors; collaboration and openness
Actors and roles	Suppliers, customers, and focal companies as a core, other actors more loosely involved	Innovation policymakers, local intermediators, innovation brokers, and funding organizations	Research institutes, innovators, and technology entrepreneurs serve as knowledge nodes	Start-ups, Financing /VC; research/education; new venture accelerators; co-working spaces
Logic of Action	A main actor that operates as a platform sharing resources, assets, and benefits or aggregates other actors together in the networked business operations	Geographically proximate actors interacting around hubs facilitated by intermediating actors	A large number of actors that are grouped around knowledge exchange or a central non-proprietary resource for the benefit of all actors	The shared knowledge base relates to business model innovation and entrepreneurial opportunity pursuit and scale-up.
Source:		Valkokari, 2015		authors (based on Autio et al, 2018)

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Summary

- Ecosystem is a system of interdependent partners who share common value proposition.
- Ecosystem is not a value chain or network of detached partners.
- Ecosystem types vary and might blend characteristics of different ecosystems.
- Ecosystem is dynamic system, not static cluster or network of actors.
- Ecosystem resembles to concepts such as clusters, industrial districts, or regional and national systems of innovation.

Guidelines to map ecosystem

Exercise is to be performed in collaboration with core and practice partners

- The ecosystem mapping is done in collaboration to create shared understanding of ecosystems' operations and environment
- Aims to motivate and initiate the collaboration between associate and core partners around the Change Lab

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Change Labs & Core partners

Step-by-step guide

Report to word template answers to the following questions.

See the word template for detailed questions.

1) **Identify Change Lab ecosystem's key actors.** Note: key actors are those without whom ecosystem cannot work efficiently, and those who participate and contribute to the operations.
   a) Identify key actors.
   b) What are actors' motives to be part of the ecosystem?
   c) What are actors' roles and relationships in ecosystem?
2) **Describe ecosystems' operational environment**
   - What are the main targets and operations of the ecosystem? I.e. what are the main ways ecosystem actors interact? (e.g. project collaboration, R&D&I partnerships, co-working space, living labs, incubator/ start-up accelerator, funding,…)

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3) **Identify the main drivers and barriers**
   a) What are key drivers in the operation of ecosystem?
   b) What kind of (if any) conflicting motives are in the ecosystem? E.g. considering to embedding RRI.
4) **Describe ecosystem history**
   - E.g. critical events that have related to ecosystem evolution
5) **Vision future of the ecosystem**
   - E.g. in short-, medium-, long-term
6) **Illustrate the identified ecosystem based on framework**
   - i.e. the main actors (1) core actors; (2) extended actors; (3) external actors
   - List actors and their roles in the word template (see ecosystem picture for inspiration, slide 16)

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CO-CHANGE

Main sources of information:

- Interviews of key stakeholders (1-3 interviews with Change Lab management and key stakeholders in the ecosystem). See word template appendix for interview questions.
- Existing strategy documents (of host organization, related ecosystem and projects)
- Existing reports (e.g. annual reports, studies of host organization)

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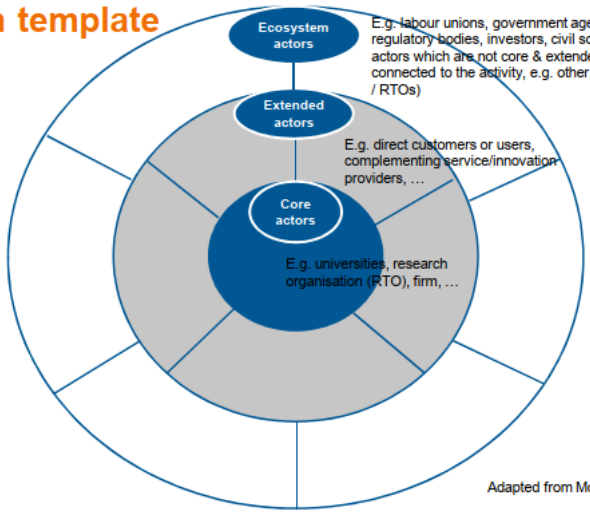
Ecosystem template

Note: Picture can be used as inspiration for identifying and categorising ecosystem actors. Describe actors & their roles in the word template.



Adapted from Moore, 1996

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Appendix 2 - The Change Lab ecosystem descriptions

Name of Change Lab:	**"Learning About Machine Learning" at the Austrian Institute of Technology (AIT), Center for Digital Safety & Security (DSS)**
Names of authors:	Peter Biegelbauer, Nikolas Reschen
Names, affiliations and dates of persons interviewed:	Sven Schlarb, AIT DSS 03.06.2020 + 04.06.2020
Name, publication year of the main documents used: (add source for online documents)	Several PowerPoint slideshows on AIT and DSS AIT STRATEGY 2018-2021 Empowering Innovation (2017) AIT STRATEGY 2018-2021 Centre for Digital Safety & Security (2017)

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem	✓	As a leading RTO in Europe, the AIT ecosystem has twofold targets regarding exchanging knowledge about machine learning and delivering innovative security-related applications to law enforcement agencies and industrial companies. The ecosystem evolves and changes project by project.
Business /platform ecosystem		
Knowledge ecosystem	✓	
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) Who are the key actors?

The key actors the AIT's DSS interacts with heavily depends on the project they are engaged in. In general, the head of the Competence Unit reports to the Head of Centre, who is reporting to the managing directors of AIT. The Head of Competence Unit Data Science & Artificial Intelligence Ross King plays a central role in the decision-making process of applying for and taking on projects, while hierarchies are rather flat. Scientists in the Competence Unit (roughly 20) usually have a thematic area they specialise in and in which they contribute to projects. This spans from (non-exhaustive list) audio-visual recognition, natural language processing, cultural heritage research as well as Block chain & Cryptocurrency expertise. Cooperation across Centres are often necessary, e.g., in case, mechanical aspects are of importance for the projects (such as audio-visual recognition).

On the project level, the actor landscape looks quite different. For this analysis one project, Copkit, a *project, which focuses on the problem of analysing, investigating, mitigating and preventing the use of new information and communication technologies by organised crime and terrorist groups,* is highlighted.[2] The main partner for DSS for this project is Thalys, as the project lead, as well as ISDEFE of Spain as the communication hub between law enforcement agencies and EU institutions. The

[2] See https://copkit.eu

purpose of this is to reduce the load of direct contact with law enforcement branches, such as the Spanish Guardia Civil or French Gendarmerie Nationale, and, primarily to evaluate whether the delivered apps are functioning as they are supposed to (e.g., to fight Crime as a Service).

Key actor DSS frequently interacts with come from the industry, Research and Technology Organisations (RTO) cooperation partners, Research Funding Organisations (RFOs) and ministries.

b) What are the actors' motives to be part of the ecosystem?

Aside from the important aspect of being recognised as a leading RTO in Europe, financial considerations often play a role in applying for projects: "Research projects follow the call topics". Strategic partnerships with competitors in the field are often limited to the project level. Industry and ministries often contract the AIT for research tasks. Research Funding Organisations provide money through research and innovation calls, while RTOs often are cooperation partners in large research projects.

c) What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?

A researcher in the Competence Unit usually works on 2-3 projects, sometimes more, in case they are small projects. As already mentioned, hierarchies are described as flat, which allows also for self-initial action of Scientists, which are not on the senior level. Given the constantly changing project landscape, researchers must be rather flexible and must compensate for the loss in competence in case an employee leaves. Seniors are often more engaged in networking and project accrual. As mentioned as well, some projects require a high degree of cooperation across Competence centres and units.

The expectations of partner organisations are quite high. To provide an example, the national police departments, partners in the project Copkit, have seen many technologies over the last years and therefore have high expectations regarding new applications. Maintaining a relationship with those actors requires a lot of effort, as the project landscape is quite competitive and project tenders are not won easily. Networking can help to build trust in those processes, as partners become accustomed to one's work approaches. It is thus vital to try to accrue new projects, often based on previously successful projects with the partners.

For Copkit, the success is largely dependent on how well demo applications in machine learning are perceived by the partners. For the area of predictive maintenance, DSS has received positive feedback from industry. Due to the non-commercial nature of the AIT, the positioning in Connecting Europe, a framework for product-developing companies, is not easy.

d) Do the roles and relationships vary actor-by-actor?

The relationship to clients is often based on the level of operation (regional, national, international). Many projects come from the security and ICT-related programmes of the Austrian funding agency FFG. For those, DSS also uses „Innovation checks "for developing relationships to potential cooperation partners. In programmes such as KIRAS and FORTE, both supporting security-related projects, as well as Produktion und IKT der Zukunft ("Production and ICT of the Future"), supporting future production and communication technologies, DSS works in bigger consortia for about 2 to 3 years. In addition, DSS is in close cooperation with Austrian ministries, mainly operating in law and law enforcement, and moreover executes projects within the European Union's Horizon 2020 framework. Lastly, industrial ties play an important role for DSS, with strong ties to large ICT, but also to retail and manufacturing companies.

The work with industry often comes in the form of contract research, while research for the public sector more often results from tender opportunities. Some projects on the European level are the EU Building Blocks Initiative, Connecting Europe Facilities (CEF) which aims at building services to foster collaboration on a European level in the areas of data interoperability and archiving. An interesting relationship derives from cooperation with other large RTOs. While they are often considered competitors when applying for tender research, strategic relationships to apply for research together are very common.

3. Operational environment

a) What are the main targets and operations of the ecosystem (if there are any explicit ones)?

The targets of the AIT ecosystem include the development of technological innovations in close cooperation with law enforcement agencies and industrial companies. With security-related focus and high-quality technology development, new applications in machine learning can be delivered to partners and industry through innovative product-developing frameworks.

Simultaneously, the ecosystem aims to spread knowledge about machine learning, predictive maintenance, and automatisation, and maintain competence at a high level in these fields.

In order to be competitive, DSS must be quite flexible by adjusting their portfolio to ongoing trends, such as block chain, predictive maintenance, natural language processing or automatization in general, as the Centre is dependent financially on the accrual of contracted and tendered projects.

When it comes to the ethical conduct of DSS' operations, there are general guidelines applied in the Centre in the conduct of work with sensitive data, in order to avoid data leaks. This includes techniques to work on data without the possibility to identify individuals within the data set. For the project Copkit, encryption of data is a necessity. For EU projects, an "Ethical Review Board" goes through every deliverable and checks for violations of data protection. In order to facilitate this process, every step of the project needs to include comments on how ethical standards have been followed. For Copkit, this is crucial, as systematic bias in NLP can arise using already biased datasets (such as open-access data encyclopaedias).

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For other projects, the guidelines are less strict. However, there is also a data protection officer at AIT, who overlooks every project and must agree on the rightful conduct in planned and ongoing projects.

b) What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)

The main form of cooperation is RTD projects. RTOs have the double role of competitors and cooperation partners, depending on the consortium structure of each given call. Industry finances research provides data and sometimes as a cooperation partner in projects. Ministries tender research, RFOs feature calls for project funding. Cooperation within AIT (with other centres and groups) is increasing.

c) What is the connection between the change-lab and the ecosystem?

The lab is situated in a complicated structure of interrelations within AIT and extending the borders of AIT. The relationships between the partners are flexible. An actor who might provide funding for one, might be a partner in another project.

4. The main drivers and barriers

a) *What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment*

The driving forces to operate in the ecosystem of national and EU agencies as well as industries is to accrue projects that are financially lucrative (in order to provide funding for advanced research and innovation), relevant for the centre and executable through the available work force in the Centre.

b) *What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.*

For projects that require a high degree of ethical conduct, the administrative overhead can be quite high. This is owed to the fact that it is quite demanding to follow the State-of-the-Art approaches for these projects.

H2020 projects also require a high financial effort, as they require extensive reporting on the project execution every three months. Efforts to follow national legislation, stemming from the GDPR, also requires many time-intensive tasks within projects, as personal data needs to be anonymised, encrypted and safely stored on servers. In addition, utilised data and all functionalities of delivered software needs to be commented to ensure they are following GDPR and other requirements.

Interestingly, the EC focuses on formalised controlling functions, especially in the form of REA, and the actual project outcomes are therefore often secondary.

An alternative approach of procuring projects is presented through project tenders of the Mellon Foundation. They only require short proposals of interested parties and rely more on intensive talks as a follow-up to these proposals. The grants are then provided relatively fast and grant recipients receive a high degree of trust throughout the project. The Mellon foundation is more focused on close co-operation, while the EC is more relying on more formal support.

5. History of the ecosystem

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a) *What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment*

The Competence Unit Data Science started out as a small project team around Ross King, mainly tasked with long-term preservation and content management systems, which was added to DSS in 2008. The core team only consisted of a few people in 2008/09 and the shift to Data Science started in 2013 and was completed in 2018 with a strengthened interest in AI topics.

6. Future of the ecosystem

a) *What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?*

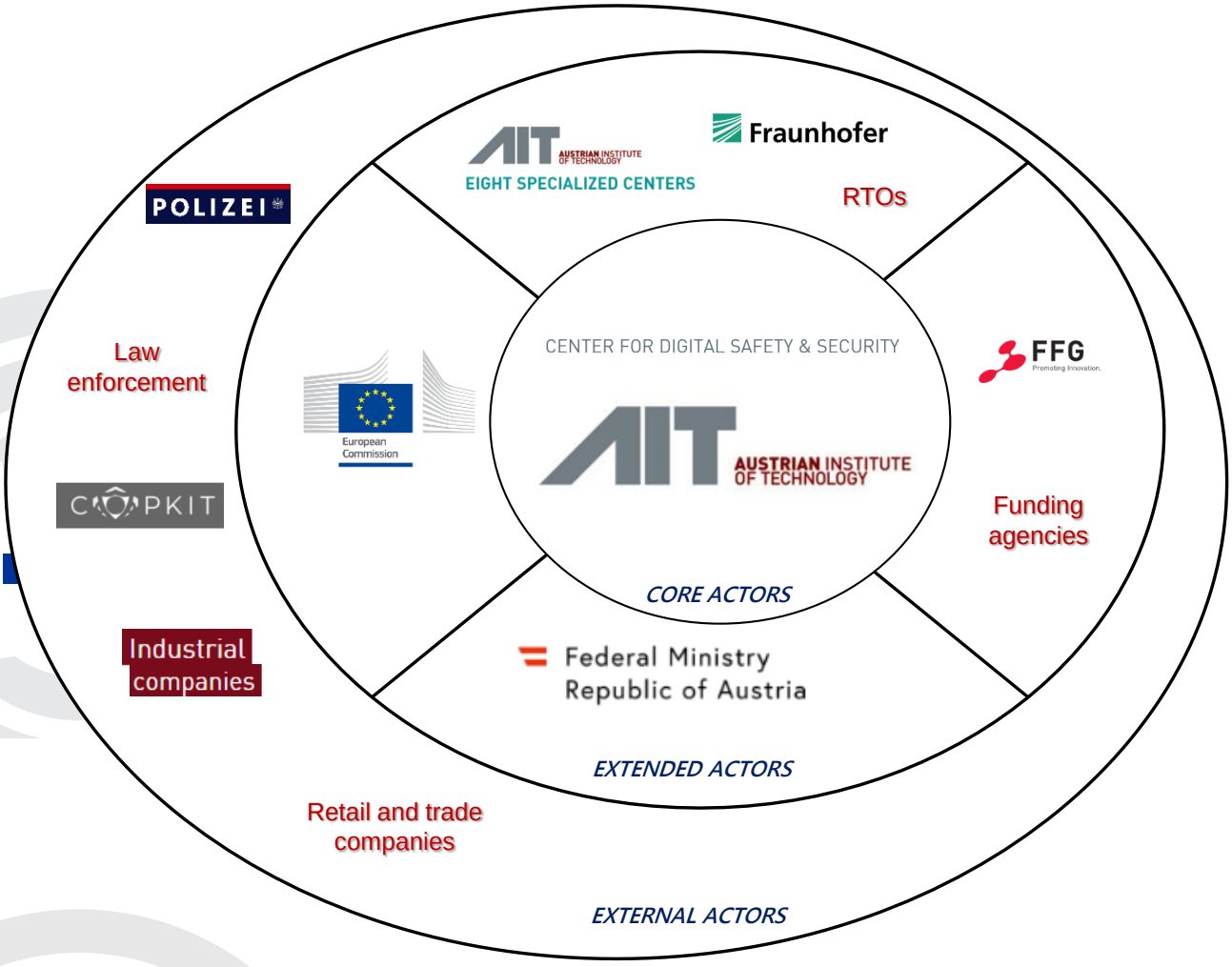
Aside from a more generalised mission statement, the AIT as well as its Centres develop three-year strategies, with the most recent one running from 2018-2021. The AIT's most recent strategy has the guiding principle "Empowering Innovation" and primarily aims at increasing business operation more generally and develop flexible exploitation paths, and thereby reaping the potential of the institute

more effectively.[3] More specifically, the AIT aims at making decarbonisation a core key area of action at AIT, pooling expertise in Artificial Intelligence and integrating future-oriented technology know-how in application-oriented infrastructure issues.

DSS' strategy defines the main areas of operation the Centre wants to focus on: Cyber Security; Border security; fight against crime and terrorism as well as Crisis & Disaster Management.[4] Arguably, all of these fields of operation require a high degree of ethical conduct and caution with sensitive data. Overall, objectives of the Centre include working in close cooperation with industry, positioning the Centre in key stakeholder communities and the development of required market drivers (e. g. standardization, regulations and legal regimes).

7. The main actors of the identified ecosystem - list using the formal framework

a) Who are the main (1) core actors; (2) extended actors; (3) external actors?



a) List of actors

[3] AIT STRATEGY 2018-2021 Empowering Innovation (2017)
[4] AIT STRATEGY 2018-2021 Centre for Digital Safety & Security (2017)

Core actors	Description of relationship
Centre for Digital Safety & Security (DSS)	The main actor within AIT
Extended actors	**Description of relationship**
Other AIT Competence Centres	Within AIT, joint projects across Centres are often built on pooled expertise for specific topics. In particular, if technical, administrative, coordinative roles need to be covered.
Ministries (Justice, Interior, Climate Action)	The Ministry of Climate Action (BMK) holds a special role as a partial owner of AIT. Projects with or for this Ministry are therefore quite common. For DSS, security-related ministries play a special role, given its research focus.
Other RTOs (e.g. Fraunhofer)	In order to apply for projects, the AIT often forms strategic partnerships with organisations operating in the same field of research. This leads to a situation in which those RTOs are considered both competitor as well as partner.
Funding Agencies (e.g. FFG in Austria)	The AIT often executes projects financed by grants of FFG and holds close ties to the funding agencies to support them in co-ordination of tasks.
European Commission	As the main client for many EU-funded projects, the AIT and here specifically DSS is in close communication with the European Commission.
External actors	**Description of relationship**
Law enforcement (e.g. National Police)	For some projects, DSS interacts directly with law enforcement bodies, such as national police entities, in others (e.g. COPKIT) actors such as ISDFE are the interface to police forces. It is vital to ensure working and practicable solutions for safety and security tasks.
Retail and trade companies	DSS develops security-related software that is used by large retail and trade companies.
Industrial companies	Similar as for trade companies, DSS develops software (e.g. predictive maintenance) that is used by large industrial companies.

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Name of Change Lab:	**WWTF, digital humanism**
Names of authors:	Edgar Subak, Nina Rilla
Names, affiliations and dates of persons interviewed:	Michael Strassnig, 23.6.2020
Name, publication year of the main documents used: (add source for online documents)	

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem		Digital humanism at WWTF is an initiative or movement that aims to develop and set principles for social and human values in the digitalisation. The ecosystem's main function is to transfer knowledge to expand the idea of digital humanism to research, society, and businesses. The ecosystem is in an emerging phase, which has not yet engaged (or identified) all the relevant stakeholders.
Business /platform ecosystem		
Knowledge ecosystem	✓	
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) What are the actors' motives to be part of the ecosystem?

b) What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?

c) Do the roles and relationships vary actor-by-actor?

WWFT is a local research funding association which operates only in the Viennese system, so it is a local operator. Another particularity is that it is private founded that collects research funding from private sources. Additional funding comes from the city of Vienna for specific programmes. WWTF is one of the many funding associations in the city, given Vienna's position as a research and academic hub. Vienna has nine public, private, and applied universities. Due to this concentration on research in Vienna, it is good to have a localised research funding association.

The surrounding ecosystem evolves while the Change Lab progresses, but resources are limited, and the ecosystem progresses gradually. Health area, especially e-health, is addressed first and second, the Change Lab addresses high-school students to observe how children perceive digitalisation processes. Thirdly, also start-ups who program the tools for society are included because it is important to see how they include RRI aspects.

Actors to integrate in the health area:

Health-related stakeholders are not yet identified; it is an exploration process who of the stakeholders are important. The idea is to address doctors, medical researchers developing new technologies, management, nursing, and representatives of patients. The different actors will be involved in different degrees, but their involvement is affected by the politicization of the health sector, meaning that lots of standards and regulations are to be considered.

Actors to integrate at school level:

To the school classes, the Change Lab intends to carry out the participatory exercise with students. Similar to the health sector, education is also affected by political issues. Lockdown due to Covid-19 has proven the failure or lack of digitalization in the education system, which shows addressing privacy and technology issues are important.

The Change Lab targets 16-17 year-olds in Technical schools ("HTL"), who have been exposed to technologies already.

Actors to integrate in the business sector:

The Change Lab will work with start-ups, but the identification process of relevant start-ups is still on-going. The start-up community is an interesting community to address questions of responsibility and innovation. Are they just about profit, or are there RRI-issues they are concerned as well? Some start-ups are concerned about the environment they operate compared to big tech giants, like Facebook. The start-ups of interest are from Vienna, which is in a tenth place in regard to ICT-start-up-cities in Europe. In general, it shards for start-ups, because the funding is stream-lined for very saturated fields, but not so in new fields. The main focus of the Change Lab is IT start-ups, not that much life science start-ups.

3. Operational environment

a) *What are the main targets and operations of the ecosystem (if there are any explicit ones)?*
b) *What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)*

WWTF concentrates on applied research and designs research programmes and calls with the lengthy process involving local university directorates, other stakeholders get involved as well, but for scientific issues the local universities have the main say. WWTF makes also own analyses with the research community for interesting research topics. Therefore, it offers dedicated research, and does not have bottom-up research calls. In case it has research calls that are designed together with international juries, local research community is not involved in the decision-making process related to funding the research. Basic funding, which makes the largest funding sources for universities, is provided by ministries based on performance. For research however, the university needs to apply external funding, e.g. from FWF concentrating on basic research or other agencies for applied research, but local research actors also participate actively in EU-funded research.

The Change Lab targets to raise awareness. One goal is to expand the idea and principle of digital humanism outside academic arenas. Lab emphasizes fields like society and businesses. The central question is what goes outwards and comes inwards, thus asking what can be learned. Therefore, including society and business in the future is central. Currently, these practitioners are not really included, although small steps, e.g. towards NGOs are made. Inclusion of enterprises is challenging as WWTF does not fund enterprises.

Moreover, the Change Lab should have broader discussions on how to adjust instruments to incorporate enterprises. Project funding should be developed so that Lab can integrate external

groups. How to be more aligned within these groups already takes place in the technology area. In addition, transforming research to address broader missions, towards solving grand challenges like digitalisation is a key development area. Overall, the research should be interdisciplinary in the Change Lab. WWTF has introduced some interdisciplinary programmes before, like in the field of mathematics, where the aim was to go beyond the limitations of the field. Environmental system research is another example of a lack of field-specificity. The Change Lab offers an opportunity in solving how to change with the environment. This is not an easy question to solve.

Currently, funding is not available for enterprises, but once WWTF has shifted addressing Grand Challenges their incorporation, also funding, is essential.

WWTF needs to change instruments, especially to include small start-ups. They need incentives, otherwise they burn time and probably will not participate. We should also think beyond top-down projects, like looking for a more extended process. It would be great to see how research can help with environmental change, for example.

WWTF has helped to contribute to workshops of the TU Vienna. WWTF organises some events itself, but the most effective way is talking to people. The community is close-knit in Vienna, but much effort is dedicated to searching for people who can join projects.

4. The main drivers and barriers

a) *What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment*

The forces or drivers are abstract. One of the main drivers is that the Change Lab wants to succeed. However, challenges are big in digitalization, so there is lots of pressure.

Digitalization is contributing to inequalities in societies, and pressure is also coming from the notion that something needs to be done. The aim is to contribute to providing alternatives and not abandon digitalization entirely. All the services that big tech companies provide are generally useful, so it is not an option to disregard big tech firms, but finding alternative ways on how digitalization is done by including more stakeholders and social scientists is a must. Digitalization is in every corner of social life, and we need alternatives to the US economy-based and Chinese surveillance-based models. It is essential to find a European model.

One clear driver is support from the city of Vienna. Vienna region has manifested the need for digital humanism. WWTF had to convince the City of Vienna, which is considered a left-wing city. Many things in digital humanism centralise inequality; thus, there are connections to left politics, which is good for cooperation. Digital humanism needed a unique selling proposition as its principles must be inscribed into their strategies.

b) *What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.*

What could go wrong? One of the main barriers is structurally conservative politics. . It is challenging, if not impossible, to change structures, and often we are confronted with interest-based politics. Programmes and mechanisms of interest are at the surface. A more general view is very hard to attain. This is independent of any political party.

Another area of concern is that there is no elaborate culture of collaboration between social sciences and technical sciences. They are not used to working together inter-disciplinarily manner. However,

some progress has been achieved in some areas, but generally, there are strong barriers between disciplinary studies on academia.

5. History of the ecosystem

a) What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment

One clear milestone was the 2019 workshop on digital humanism in TU Vienna, which resulted in the Vienna manifesto for Digital Humanism. Then, WWTF gradually involved the City of Vienna. For the call for projects, WWTF was more applied than others and attracted funding from Vienna. For the future, there are huge milestones to achieve in terms of convincing stakeholders.

6. Future of the ecosystem

a) *What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?*

Convincing the city of Vienna of the idea of Digital Humanism and continue after the project of Co-Change ends. No short-term outcomes are expected, and maybe there will be new ideas that come from collaboration between social and technical sciences in 10 years plus time. It is acknowledged that institutionalize digital humanism is a gradual change process. Weizenbaum Institute in Berlin is a prominent example of this field. So, the long-term goal is that inter-disciplinary cooperation is working successfully.

Another goal is going beyond academics as digital humanism should broaden into society and into arts, where scientists can come to artists and vice versa. An example would be “ars electronica” in Linz, which includes broader audiences, scientists, artists, etc. FFG should be considered if they include these aspects in their funding.

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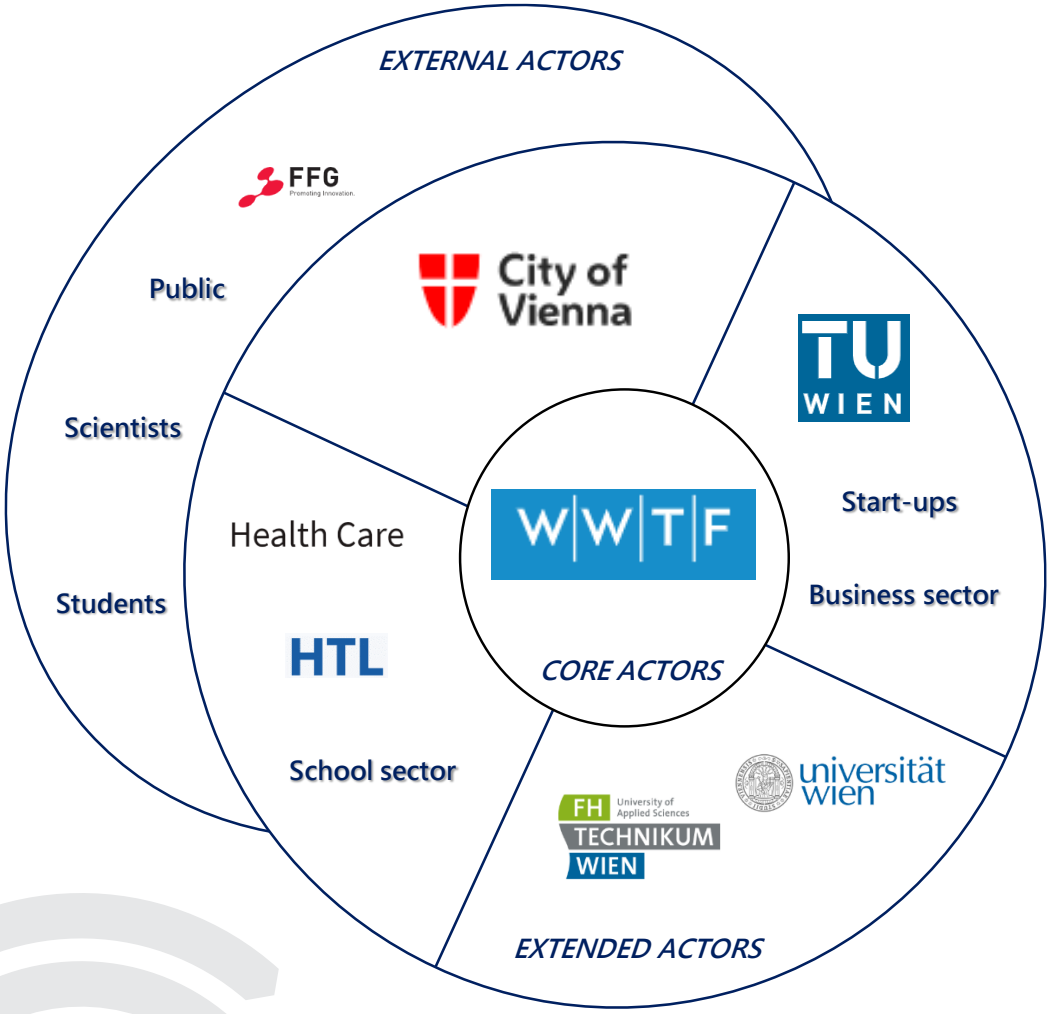
WWTF is the only funding agency in Austria dealing with Digital Humanism. In the Netherlands, there is something similar called “digital society”, which has very similar activities in integrating humanities and technical studies. Different countries have different names for similar things. However, Digital Humanism is not yet massive in Europe.

7. The main actors of the identified ecosystem - list using the formal framework

a) *Who are the main (1) core actors; (2) extended actors; (3) external actors?*
b) *List actors and their roles*



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Name of Change Lab:	**TECNALIA-RRI consultancy service**
Names of authors:	Ezekiela Arrizabalaga, Javier Mendibil, Raúl Tabarés
Names, affiliations and dates of persons interviewed:	**Eva Arrilucea**- TECNALIA Think& Do - TECNALIA Research & Innovation (26.05.2020) **Elena Arce-**Career Development - Organisational Culture at TECNALIA Research & Innovation (01.06.2020) **Rikardo Bueno (interview scheduling in process) -** Director of the BRTA-Basque Research and Technology Alliance.
Name, publication year of the main documents used: (add source for online documents)	Innobasque-Prospectiva 2019 https://www.innobasque.eus/microsite/internacionalizacion_imasde_vasca/publicaciones/publicacion-512/ Euskadi 2020 Science, Technology and Innovation Plan (PCTI Euskadi 2020) https://www.euskadi.eus/gobierno-vasco/pcti-2020/ Tecnalia.com Innobasque.eus

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem	✓	- Joint governance system with result-oriented vision - Focused towards the market - Values country capabilities - Moving towards Knowledge economy - Promotes Public-Private collaboration
Business /platform ecosystem		
Knowledge ecosystem		
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) *Who are the key actors?*
b) *What are the actors' motives to be part of the ecosystem?*
c) *What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?*
d) *Do the roles and relationships vary actor-by-actor?*

The Change Lab in Tecnalia is part of a wider innovation ecosystem that is the evolving set of actors, activities, institutions, and relations, including complementary and substitute relations that are important for the innovative performance of the institution.

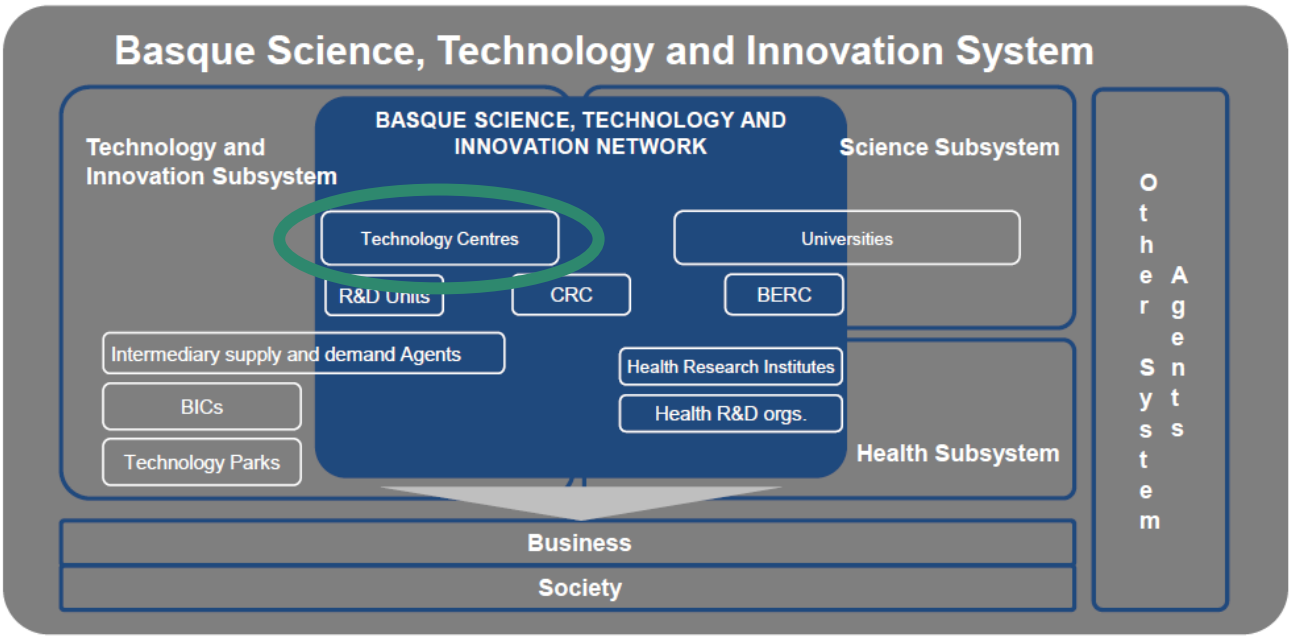
Basque regional government is the main public agency that has led the construction of the R&D&I structure in the Basque Autonomous Community. The Basque Regional Innovation System is built with a focus on the re-adaptation of its technological, industrial infrastructure and, therefore, is centred on policies to support technology centres and to encourage the clusterization of its productive fabric. The characteristics of its industrial and technological framework (networks, level of connection, etc.)

and the socio-cultural dynamics are implicit. The scientific-technological and business capacities in the region have put it at a level of countries with high innovation in Europe (Regional Innovation Scoreboard 2017), although the region has lost this condition becoming moderate + in the 2019 Scoreboard.

Science, technology, and innovation is a cross-sector process that affects multiple aspects of economic and social life, and therefore requires all the abilities and sensitivities available. **The Euskadi 2020 Science, Technology and Innovation Plan (PCTI Euskadi 2020)** seeks to position the Basque Country as an innovation and research benchmark in Europe. Its mission is to improve wellbeing, sustainable economic growth, and employment by means of an innovation and research policy based on smart specialisation and on making the Basque science, technology, and innovation system more efficient. The strategy to foster the sustainable and economic development of the Basque Country is underpinned by the three pillars of sustainable growth, human development, and smart growth.

The main actors of the system are coordinated through the Basque Science, Technology and Innovation Network (RVCTI), which is composed by the Science System, the Technology System and Innovation Support System. The network is made up of a group of Science and Technology agents who, working in a network, carry out specialised, excellent, market-oriented research that contributes to creating wealth and well-being in the Basque Country. The network is made up of 120 accredited agents and TECNALIA is part of this network. ***Innobasque***, the Basque innovation public agency, is the public entity that coordinates the whole network.

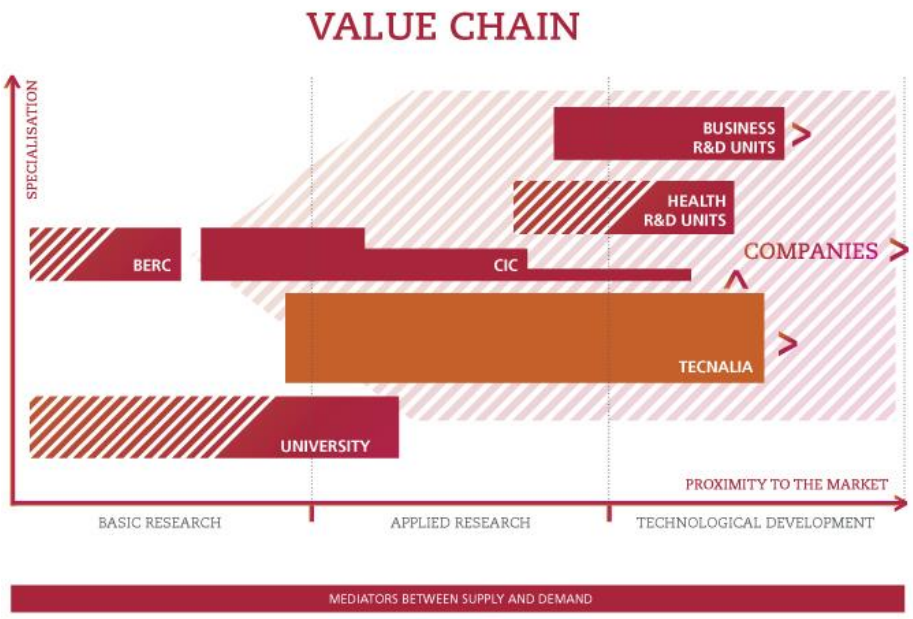
The way the RVCTI fits into the Science, Technology, and Innovation System is indicated in the figure below.



Source: PCTI (Basque Science & Technology Plan)

TECNALIA is part of the RVCTI Agents- Technology and innovation subsystem: they are the knowledge infrastructures whose main objective is to offer support services to improve the competitiveness of enterprises and resolve the social challenges facing the Basque Country. With this objective, instruments are provided which reinforce their scientific and technological capabilities.

The network is designed under an articulated structure in three subsystems based on the principal activity of each of the agents that make it up. . The basic idea is that each agent carries out activities along the R & D & I value chain to promote the integration of the whole, and promote collaboration through integrated projects to articulate connections between different subsystems. In the case of TECNALIA, the position in the value chain is showed in the figure below:



Source: TECNALIA website

TECNALIA seeks collaboration with the rest of the RVCTI agents in order to generate R&D&I value chains of greater impact and durability by aggregating complementary capacities and positions. This is explicitly reflected in its strategic lines and objectives: in essence, the aim is to highlight Tecnalia's capacity to articulate high-impact opportunities and to collaborate in structuring the Basque science, technology, and innovation system, paying special attention to the Universities, BERCs (Basque Excellence Research Centres) and CICs (Cooperative Research Centres), the aim is complementing capacities and infrastructures, gaining speed in technological development, proximity and arrival on the market.

Another key actor of the innovation ecosystem has been recently created is the ***Basque Research & Technology Alliance (BRTA).*** This is a consortium to promote the coordination of technology agents to tackle the technological and industrial challenges facing the Basque Country and improve its international positioning. The Basque Research and Technology Alliance has been created through a collaboration agreement between 16 technology centres and cooperative research centres belonging to the Basque Network of Science, Technology, and Innovation and public agents. The roles articulating the scientific-technological capacities of the agents, and the coordination of Basque science and technology in the European Research Area.

The system has a big Government implication, providing structure and finance, which enables instruments to encourage cooperation and coordination through the agents, so it is coming TOP DOWN, but the relationship in the ecosystem is COMPLEMENTARY.

TECNALIA as one of the key actors of the innovation ecosystem is a technology organisation (+ 1400 researchers). Historically, TECNALIA was established in 2010 as the result of the merging of 8 technological and applied research centres in the region, coming from different sectors, cultures and environments.

Nowadays has a new technological structure based on KETs (Key Enabling Technologies), which is structured into three technological groups: **Digital, Manufacturing, and Materials**. There are some Transversal Areas of Action (ATAs, according to its acronym in Spanish) that are coordinated transversally for the whole of Tecnalia in the following areas: **Urban Ecosystem, Advanced Manufacturing, Mobility, Health, Digital Transformation, and Energy Transition.**

3. Operational environment

a) *What are the main targets and operations of the ecosystem (if there are any explicit ones)?*
b) *What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)*
c) *What is the connection between the change-lab and the ecosystem?*

For years now, TECNALIA, as an applied research centre, has been generating advanced technological solutions in collaboration with companies and innovation ecosystem, with the support of competitive public programs to promote R&D&I. However, these technological solutions have often been oriented towards a single problem, generally business, without analysing possible applications in other social spheres.

TECNALIA and its ecosystem work together throughout the entire R&D&I process, so it is important that the process and its results are aligned with social values and needs and responsively. More and more, there is a conviction of the need for STI systems to contribute more to the transformation of socio-technical systems to respond to global challenges. The key lies in the use of participatory methods, educating in science, making the process and its results transparent and accessible, having an ethical attitude and promoting equal opportunities.

Our Change Lab aims to systematically introduce and implement RRI principles in the daily functioning of TECNALIA, which will contribute to the development of policies and the understanding of this concept. Although there are some existing organisational and individual practices related to RRI there is no institutional discourse of responsible innovation. The organisation is not committed to the development of RRI as a formal policy, underpinned by coherent conceptual development.

This situation seeks collaboration with the rest of the RVCTI agents in order to generate R&D&I value chains of greater impact and durability by aggregating complementary innovations and contextualized enabling conditions can produce systemic change and/or structural transformations in society, we need public-private alliances to support social innovations at different levels.

The innovation ecosystem interacts in different spheres and there are some mechanisms to co-create, but in general, these aimed at high-level participation and are policy-oriented. There have been numerous connections based on cross-sectorial collaborations and networking and constellations of actors that have required a shared vision to create committed partnerships. The newly created (end of 2019) Basque Research & Technology Alliance (BRTA) was born to boost the Basque technological ecosystem and aimed to give a dynamic and facilitating role to the cooperation. It further aimed to generate tools to promote these spaces, and promote the coordination of technology agents to tackle the technological challenges facing at the Basque Country. This environment is very conducive to get the objectives of our Change Lab in CO-CHANGE.

Internally in TECNALIA there have been attempts that helped the creation of social innovation spaces (networking and communities of practice) to promote collective and open innovations to solve business problems, but not in contact with the society and with limited success. Some of these experiences are the OPEN SPACE events and translucent innovation initiatives to creative solutions, collaboration proposals and verified business ideas. In general, attitudes and values are encouraged by the direction, self-organized teams are promoted through agile team structures, but in practice, there are barriers as research teams are islands of profit and loss, and there is not much freedom to propose new things. Mostly, non-radical but incremental changes.

One of the novelties of the new structure of the centre that is in force from this year is the Transversal Areas of Action, which want to promote more interactions and co-creation teams in order to solve global challenges. This new way of interaction will give more visibility to the work that is done at the research team level.

Needs:

- To boost the absorptive capacity at the organizational level to the interpretation and transformation of social problems into social innovations integrating RRI concepts.
- To act in alliance mode and establish contacts, knowledge networks, and communities at a global level, especially with all the actors in the innovation ecosystem.

4. The main drivers and barriers

c) What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment

d) What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.

DRIVING FORCES at the ecosystem level:

- The perspectives oriented towards the endogenous development of the region through its development integrated into areas and the restructuring and consolidation of a Basque Regional Innovation System have encouraged the new institutional context for the development of new public policies and programs to support regional innovation and competitiveness, with a particular focus on employment, sustainable development, social innovation, organisational change, and science and technology, among others.

- Making regional policies remain stable over time (this is the case in the Basque Country). Innovation policies do not show their results immediately.
- A transition towards a system of research and innovation with a closer relation to the societal challenges needs to be more inclusive with all the actors in society. There is a bet at Regional Level to generate impact through the achievement of the SDGs (Societal Development Goals), and the whole innovation system is seeing this as an opportunity.

DRIVING FORCES in Tecnalia:

- The new structure at the organisation, more mission-oriented: "BIG SCIENCE TO MEET BIG PROBLEMS", that carries cross-sectional analyses. TECNALIA has realized that it needs transversality. We generate very good solutions by integrating transversal knowledge.
- More and more, TECNALIA sells solutions, but also solutions focused on solving some of the global challenges, so it expected management would support the initiative.
- There are some existing organisational and individual practices related to RRI: gender equality plan, diversity charter, etc.

BARRIERS at ecosystem level:

- The term RRI (Responsible Research and Innovation) not only is unfamiliar for the general population, but also for the most part of people working on the scientific, technological, and innovation sectors.
- Limited understanding of the proposed change and its impact.
- COVID 19 and derived changes in priorities.
- Difficulty with modernising existing industries and adapting them to new scenarios in time and having an innovation-oriented mind-set.
- The necessity of making SMEs work together with other organisations in innovation projects. SMEs tend to cooperate less than socially desirable with valuable partners within and beyond the ecosystem.

BARRIERS in Tecnalia:

- Big structure (hierarchical & rigid) that might result in failure to involve employees in the change process.
- Old with low turnover, conservative institution
- Resistance to organisational culture shift, acquired inertias.
- Lack of commitment to change, based on past experience of failed change initiatives.
- The challenge today is to encourage actors in their own disciplines and fields to participate in developing Science in Society perspectives from the very beginning of the conception of their activities and there is a barrier to change the mind-set of the researchers.
- We are very dependent on funding sources
- Non-standardisation
- Lack of incentives
- Timing: change does not come in 2 years. Change is the result of persistent, systematic work related to raising awareness, effective communication, changing cultures, investing in organisational infrastructures, establishing commitment and leadership and supporting innovative experiments.
- COVID-19 Factor: The COVID-19 is affecting the working environment

5. History of the ecosystem

a) What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment

Change of consciousness. The 2008 crisis has shown that STI is very important. Many researchers left in the crisis because of the lack of resources dedicated to STI. Recovery has been more difficult because of this, and the next crisis has arrived, and we have not yet recovered from 2008. Society is aware of this. We are losing weight, in 2020, we are worse off than in 2008, so there is a need to change fast.

The current relational paradigm is structured around the Smart Specialization Strategy in which social innovation is no longer a specific axis of the innovation policies but has become a transversal working axis, consists of finding new ways to satisfy social needs that are not adequately covered by the market or the public sector, or to produce the behavioural changes necessary to solve the great challenges of society, generating new social relations and new models of collaboration.

Therefore, our change lab is presented as an opportunity to give a comprehensive and structured response to the great challenges and to do this responsively.

General Aims:

- Better and more sustainable engagement with citizens and society values
- Generate the existence of formal governance structures for RRI
- Promotion and understanding of RRI
- Impactful and sustainable institutional change

Specific Aims:

- Creation of coherent and overarching RRI approach that unifies processes, instruments and criteria for RRI at management level.
- Commission, the development of an organisational RRI Roadmap, aligned to the Strategic Plan.
- Initiate a substantial internal and external communication campaign to raise awareness of RRI and its importance, and develop an internal capacity building program for staff, which will also serve as a location for capturing learning and experiences of RRI within the organisation.
- An internal consultancy group will be established that will provide integral RRI support to researchers and their working groups within Tecnalia as well as to their external partners and affiliates. The service will cover the six keys of RRI, and the team will also explore new aspects of responsibility and ways for cooperation between science and society.

6. Future of the ecosystem

a) What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?

The policy-oriented missions are aimed at providing solutions to major global challenges (Sustainable Development Goals); they require directionality, intentionality, and strategic vision and are closely linked to the Essential Enabling Technologies (KETs) and Smart Specialisation Strategies (S3). But we still have an opportunity, including Responsible Research and Innovation (RRI), which seeks to combine innovation and society through a complete social commitment, the integration of all groups, and the promotion of an educated and committed society. An educated and informed society that is capable of sustaining and demanding long-term commitments that shape a solid, productive fabric that is resilient in the face of crises.

(Future perspectives) The new way of understanding innovation will require and will guide a new innovation system, influencing and the aspects that condition it, helping to generate a transformative change in the territory. It will seek responsible innovation that responds to the real interests and needs of society.

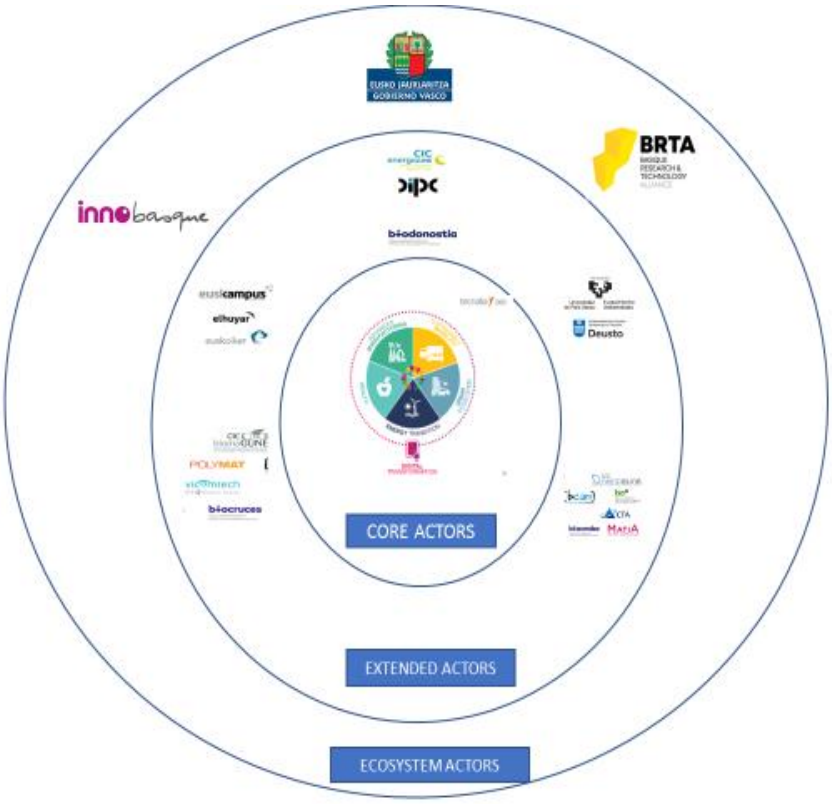
Thus, when facing challenges, more than isolated developments, patterns gain the importance of innovation that promotes the system's transitions towards sustainability. This will require to contemplate social and sustainability criteria throughout the innovation process. The values and culture will be as important as technical knowledge to obtain a successful transition of the system. This implies the need to integrate perspectives, on the one hand, of science and engineering and, on the other, of the humanities and social sciences.

To build our own future opportunity, we will need to set goals for the challenges we want to tackle and act together to achieve them. Our innovative future will require a shared vision. If we want to be innovative as a territory, a common vision is essential, only if society, as citizens and the base of organizations, has reasons to believe that it is actively involved in innovation and in defining its policies, and assumes that its risks, benefits and costs are shared, will support it and make it possible efficient cooperation to innovate. We need society to feel part of the importance of innovation in all its facets and that it can benefit from its results.

To solve the complex challenges, we face with innovative solutions, we require looking at innovation from different points of view, and throughout its entire value chain. We are faced with technology-based innovation in relevance with innovation concepts that go beyond the standard definition: open innovation, user innovation, social innovation, frugal innovation, innovation in business models, etc. This collaboration will also generate a new way in which innovation is organized, which passes of research centres and companies to be conceived as something that happens in any part and at any time, constituting an open, distributed and networked phenomenon. All this implies that innovation becomes complex and occurs in complex ecosystems. At the time of complex systems, the competitive advantage will lie with communities that are able to adapt to unpredictable developments.

RESPONSIBLE KEY PERFORMING INDICATOR, RESPONIBLE PARTNERS, RESPONSIBLE INVESTOR, RESPONSIBLE EMPLOYER, RESPONSIBLE EMPLOYEE, RESPONSIBLE CITIZEN.

7. The main actors of the identified ecosystem - list using the formal framework
    a) *Who are the main (1) core actors; (2) extended actors; (3) external actors?*
    b) *List actors and their roles*



Source: Own made

CORE ACTORS:

Staff from Tecnalia (In process, we are developing a RRI champions list, more reflection is needed). Will participate in the project

Responsibilities of Transversal Areas of Action & Research teams

- Business strategic support and intelligence
- Urban Ecosystem: Eneritz Barreiro
- Advanced Manufacturing: Mikel Niño
- Mobility: Javier Coleto
- Health: Aymar Casas
- Digital Transformation: Joseba Laka
- Energy Transition: Fernando Espiga

Alfa Team: identification of new business opportunities

- Mikel Barrado
- José Calleja
- Javier Coleto
- Yolanda De Miguel
- Javier García-Tejedor
- Edorta Larrauri
- José Luis Malo
- Jesús Marcos
- Hugo Martínez de la Hidalga

(.....)

EXTENDED ACTORS: Agents from the Basque Science & Technology network that TECNALIA most cooperates & companies, society. They will be invited to participate in events.

- Universities & Euskampus
- BERCs- Basque Excellence Research Centres
- CICs-Cooperative Research Centre
- Civil society platform
- Companies

ECOSYSTEM ACTORS: Basque Science & Technology network coordinators, give a strategic and long-term view.

Basque Research & Technology Alliance (BRTA), this is a consortium to promote the coordination of technology agents, between 16 technology centres & public administration.

Innobasque – Basque innovation agency.

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Name of Change Lab:	**RRIzing lab: from PFNS to UNS**
Names of authors:	**Branislava Lalić, Mila Grahovac, Petar Vrgović, Milica Pojić, Aleksandra Mišan**
Names, affiliations and dates of persons interviewed:	
Name, publication year of the main documents used: (add source for online documents)	**http://serbiaforexcell.com/wp-content/uploads/2018/07/Faculty-of-Agriculture-Novi-Sad-1.pdf**

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem		Education of students at the bachelor, master and doctoral level. Knowledge transfer to agricultural producers, agrochemical companies, food production sector. Scientific research and development of innovative solutions for agricultural production and the food industry through various national and international projects. Production of different agricultural commodities (fruits, vine, cheese, etc.), quarantine services (plant diseases and pests), services of evaluation of agrochemical products, food safety, etc.
Business /platform ecosystem		
Knowledge ecosystem	✓	
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) *Who are the key actors?*

The main actors are enthusiastic individuals (academic staff) with available resources of belonging institutions (PFNS, FINS, FTN).

b) What are the actors' motives to be part of the ecosystem?

Gaining knowledge, possibility to actively co-create change and improve science education, gender equality, and ethics at the institution in accordance with personal beliefs and the beliefs of their colleagues, under the guidance of experienced project partners. Motives to be part of the wider ecosystem are innovative and creative involvement in scientific activities (agricultural and food production) and service providing, gaining and sharing knowledge, regular incomes.

c) What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?
Most of the relationships are symbiotic and complementary, as well as network-like. In the wider ecosystem, hierarchical and top-bottom relationships are also represented.

d) Do the roles and relationships vary actor-by-actor?

Yes, to some extent. The differences refer to the RRI key that the actor is covering, as well as to relate to the project i.e., project partner (PFNS) or third parties (FINS, FTN). In wider ecosystem, actors' roles differ depending on the area of their scientific expertise.

3. Operational environment

a) *What are the main targets and operations of the ecosystem (if there are any explicit ones)?*

Gender equality, science education and ethics promotion at PFNS, FINS and FTN – serving as a showcase to the wider ecosystem (UNS).

b) *What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)*

Ecosystem actors interact by co-working space, living labs (offices and laboratories are in the same building of PFNS and FTN, and in the same university campus - PFNS, FINS and FTN), actors share possibilities for funding sources.

c) *What is the connection between the change-lab and the ecosystem?*

The connection between the RRIzing lab and wider ecosystem (PFNS, FINS, FTN and UNS) is the fact that the lab consists of a group of people employed at subunits of UNS (University of Novi Sad) – PFNS (Faculty of Agriculture), as well as people employed at FINS and FTN (also two subunits of UNS) gathered with an aim to introduce RRI principles at PFNS and to use it as a showcase for UNS.

4. The main drivers and barriers

a) What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment

The main driving force is an enthusiasm of lab participants, supported by PFNS management, to be active agents of change, to improve certain RRI keys (science education, gender equality, ethics) at PFNS level as well as to trigger the process beyond PFNS, at the university level.

b) What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.
The main barriers are scepticism and resistance, lack of art of dialogue, lack of expertise, COVID 19 implications**.**

5. History of the ecosystem

a) What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment

Up to 1990ies PFNS was Faculty in "soft" socialist country. From a scientific point of view, it means strong top to bottom management but with broad communication with the international scientific

community. Gender rights, close relations between science and education and public engagement of scientists (communication with specialised and general public) was the norm.

From 1990 till 2000 the country was hermetically isolated, and it made a major impact on scientific community. International communication, approach to journals and conferences was practically cut off, producing a huge gap between PFNS scientist and colleagues abroad. RRI was not a topic.

Twenty years later, we are trying to catch up with the scientific community to reinforce old methods and traditions with new methodologies and tools in all areas, including RRI.

All above mentioned can also apply to FINS and FTN.

6. Future of the ecosystem

a) *What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?*

The best description of the future of the PFNS as the ecosystem can be found in the Strategy of scientific development of PFNS drafted by prof. Branko Ćupina, vice dean for science and international education (http://serbiaforexcell.com/wp-content/uploads/2018/07/Faculty-of-Agriculture-Novi-Sad-1.pdf). In the strategy internationalisation and RRI are addressed as emerging transformative principles of our research and innovation policy.

7. The main actors of the identified ecosystem - list using the formal framework

a) *Who are the main (1) core actors , (2) extended actors (3) external actors*

In the text below, can be found the description of the ecosystem of the RRIzing lab, which is taking place at PFNS (project partner), greatly supported by FINS and FTN (third parties) and partially realized in these institutions. The term “wider ecosystem” used at some points refers to the three involved institutions (PFNS, FINS, and FTN), which are all part of one system – UNS:

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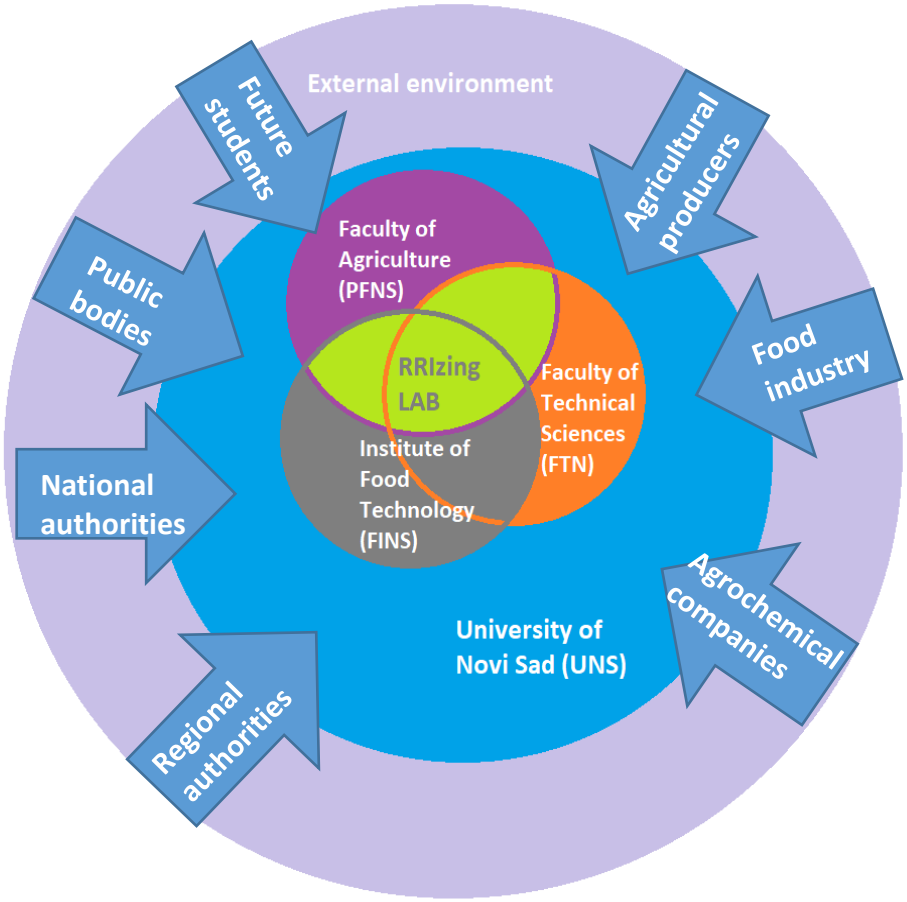
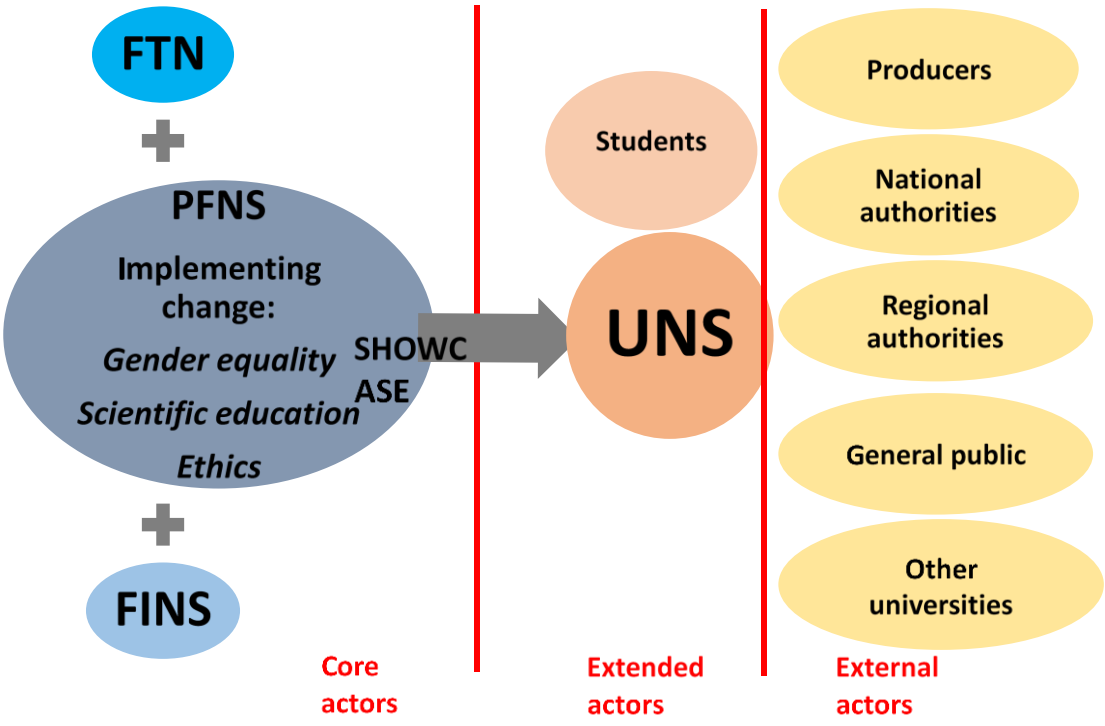


b) List actors and their roles

Core partners	• **PFNS** • **FTN** • **FINS**
Extended partners	• UNS • students
External actors	• other universities • National authorities (Ministry of Education, Science and Technological Development; Ministry of Agriculture, Forestry and Water Economy; Science Fund of the Republic of Serbia; Innovation Fund of the Republic of Serbia) • Regional authorities (Provincial Secretariat for Higher Education and Scientific Research; Provincial Secretariat for Agriculture, Water Management and Forestry), • Agricultural and food producers • General public.



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Name of Change Lab:	**CTR - Developing standardized RRI evaluation criteria for funding**
Names of authors:	Tiina Ramstedt-Sen
Names, affiliations and dates of persons interviewed:	-
Name, publication year of the main documents used: (add source for online documents)	-

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem	x	The key idea of a regional-based ecosystem is to support the foundation of various local organizations and help them to innovate and globalise in changing environment. The ecosystem consist of innovation policymakers, local intermediators, HEIs, innovation brokers, and other funding organizations. The ecosystem is regional based on Tampere.
Business /platform ecosystem		
Knowledge ecosystem		
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) Who are the key actors?

Key actors are those organisations that operate jointly in the local innovation environment. It means organisations that fund innovation projects (Council, Business Finland, TEM, ELY, and City of Tampere) and the organisations that implement innovation projects: HEIs, business development agencies, research organisations and municipalities, SMEs and big companies.

b) *What are the actors' motives to be part of the ecosystem*?

To remain competitive in research and innovation, enabling different members to achieve a shared vision and find jointly supportive roles. To boost the competitiveness of the regional companies and to create well-being from it.

c) What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?

Network-like, complementary relationships.

d) Do the roles and relationships vary actor-by-actor?

Yes they vary, but of course HEIs have certain role, as also the research organisations = research and applied research. Municipalities often have a role of providing the problem or the platform for the development (e.g. infrastructure of a municipality). Business development agencies have a focus on creation of new companies and business opportunities. Companies have a role to create new business.

3. Operational environment

a) What are the main targets and operations of the ecosystem (if there are any explicit ones)?

No explicit one, but the all in all target is to boost the competitiveness of the companies located to Tampere Region.

b) What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)

Many ways, as the ecosystem is not limited to a subject. Main function of Council of Tampere Region is to provide funding. Overall, different ways of operation can be found. There for example, services to start-ups, event and seminars.

c) What is the connection between the change-lab and the ecosystem?

This change-lab is targeted to the ecosystem actors, especially to those that can apply ERDF funding. In particular, research and education institutes, like University of Tampere.

4. The main drivers and barriers

a) What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment

Close connections and network of actors in the region. People know each other and there is a common trust in between the different actors.

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b) What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.

Innovation projects are highly focused on technological issues, and sometimes the social impacts are seen less relevant.

5. History of the ecosystem

a) What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment

The ecosystem has been growing and evolving since the university came to Tampere in 1960's. The latest big event was when the three universities in Tampere merged and composed a single big university in 2019.

6. Future of the ecosystem

a) What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?

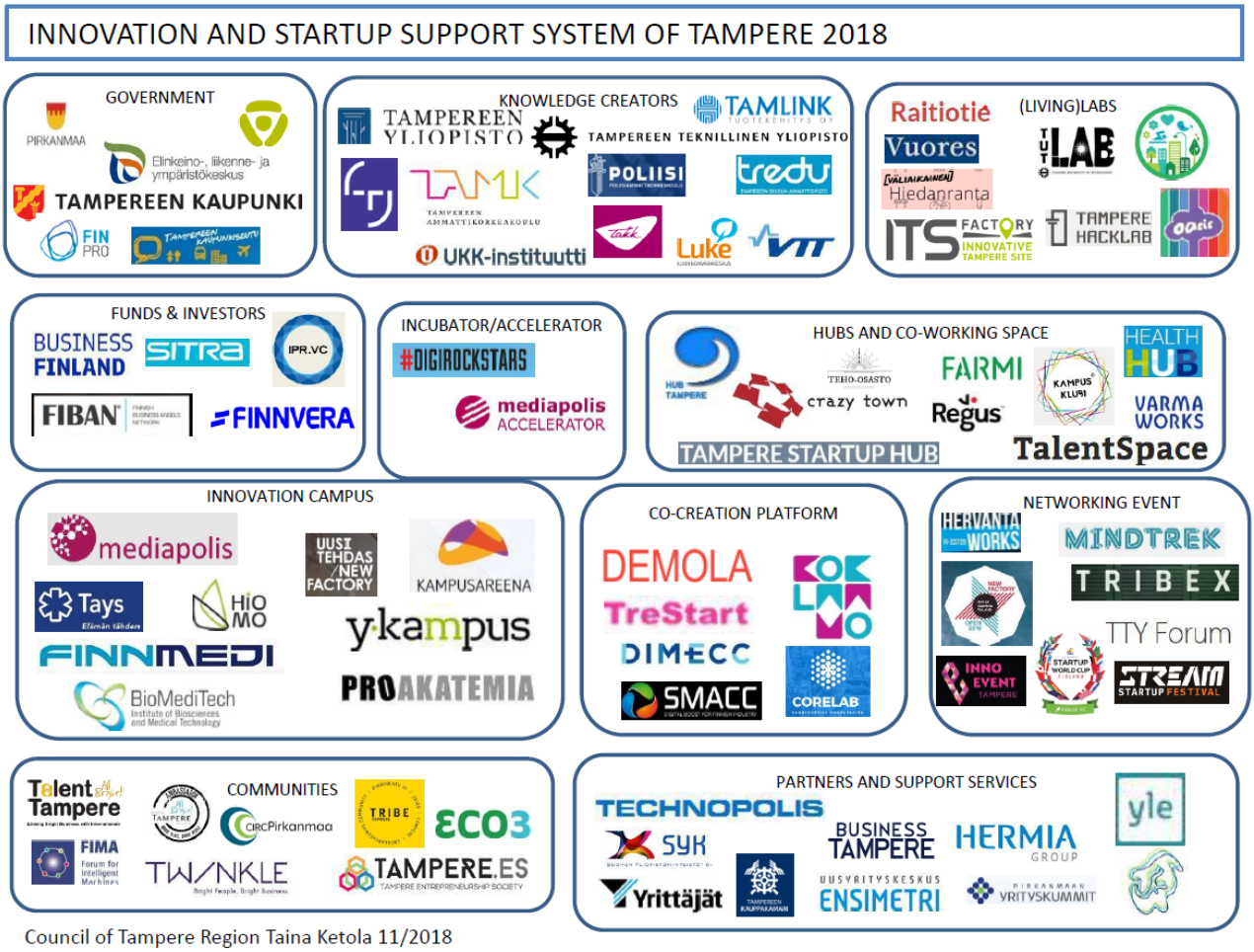
Many interests and visions exist. Creation of a European Digital Innovation Hub is one vision that is highly supported at the moment related to the manufacturing industry.

7. The main actors of the identified ecosystem - list using the formal framework

a) Who are the main (1) core actors; (2) extended actors; (3) external actors?

The key actors are the HEIs, research organisations (like VTT) and Business Tampere (regional business development agency).

The picture below presents actors, communities, platforms and activities of the innovation and start-up ecosystem of Tampere Region.



a) List actors and their roles

Core partners	• **Council of Tampere region**
Extended partners	• Knowledge creators • Innovation campus • Living labs • Communities • Government actors • Funds and investors • Incubators/accelerators • Hubs and co-working spaces
External actors	• Co-creation platform • Networking event • Partners and support services

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Name of Change Lab:	**RAAS -Research Alliance for Autonomous Systems**
Names of authors:	Nina Rilla
Names, affiliations and dates of persons interviewed:	Hannu Karvonen, Coordinator of RAAS, 8.6.2020
Name, publication year of the main documents used: (add source for online documents)	– RAAS action plan (in Finnish), for 2018-2020 (internal document) – Annual reports from 2018-2019; 2019; 2019-2020 (in Finnish)

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem	✓	RAAS is a research and innovation ecosystem which is coordinated by a RTO (VTT). It integrates many research organisations and companies (SMEs and larger firms), and aims to integrate Finnish actors who work in the focus domains of autonomous systems. RAAS concentrates on interdisciplinary R&D and helps companies in their innovation activities. Current focus domains are 1) Land transport, 2) Maritime 3) Drone systems, and 4) Mobile work machines. RAAS has also educational targets, e.g. provides university training, to secure availability of skilled professionals.
Business /platform ecosystem		
Knowledge ecosystem	✓	
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) Who are the key actors?

RAAS is coordinated by VTT, a large Finnish Technical Research Centre. RAAS consists of more than 200 Researchers from 18 Finnish research organisations and universities, and more than 50 industrial partners. In addition, the ecosystem has 40 representatives from other stakeholders, e.g. authorities. Although RAAS operates mostly domestically, it has also 10 international research partners.

Research partners /organizations[5]:

- Universities (9): **Aalto University[6]**, **LUT University**, **University of Helsinki**, Uni of Jyväskylä, **Uni of Oulu**, **Uni of Tampere, Uni of Turku**, and **Uni of Vaasa**, **Åbo Akademi University**
- Universities of Applied Sciences (9): Centria, **Novia**, **Oulu**, **Satakunta**, Tampere, **Turku,** XAMK- South-Eastern Finland, Metropolia, Seinäjoki
- RTOs (1): **VTT Technical Research Centre of Finland Ltd** (coordinator)

Companies:

- Land transport: Third Space Auto, GIM/Sensible 4, Roboride, Rightware, VTT Senseway
- Maritime: ABB Marine, Aker Arctic, DIMECC, Finnpilot, Kalmar, Kongsberg, Meyer Turku, Wärtsilä, Tallink, BMT Group (UK), Atlas Elektronik (DE)

[5] https://autonomous.fi/members/

[6] Central partners, i.e. those who have received funding to RAAS operations, are highlighted in bold.

- Drone systems: Securitas, Fleetonomy, Insta, Nokia-drones, Skydata, Elisa, Port of Oulu, Wing, Avartek, DAGroup, Solita, ANS Finland
- Mobile work machines: Sandvik, Normet
- General autonomous systems: Hermia Group, Tieto, Ericsson, Deal Comp, Furuno (JP), AILiveSim
- Associations: ITS Finland (intelligent transportation)

Other stakeholders:

- Funding organisations: Business Finland
- Regional authorities/cities (3): Cities of HKI, Salo and Turku
- National authorities (3): Finnish Defence Forces, Finnish Transport Agency, Finnish Transport Safety Agency
- Ministries: Ministry of Economic Affairs and Employment of Finland (a funder until autumn 2020), Ministry of Transport and Communications of Finland

International collaboration

- Nordic: Chalmers University of Technology, SE; Gateway Norway, NO; Mobility Services, SE; Mistra SAMS Sustainable Accessibility (SE); Norwegian University of Science and Technology, NO
- European: De Vlaamse Waterweg, BE; Delft University of Technology, NL; EurA (SCAS - Systems and components for autonomous ships), DE; École Polytechnique Fédérale de Lausanne (EPFL), CH; Estonian Maritime Academy, EE; University of Technology, EE; Fujitsu Laboratories Europe, UK; Gdynia Maritime University, PL; -ITI, University of Madeira, PT; University of Glasgow, UK; University of Porto, PT; University of Strathclyde, UK; ICS-IRIT, University Toulouse 3, FR
- Asia: Industrial Technology Research Institute (ITRI), TW; Korea Maritime and Ocean University (KMOU), KR; Ship and Ocean Industries R&D Center (SOIC), TW; Wuhan University of Technology, CN

Internationalisation strategy of RAAS is based on three models which all emphasise developing globally attractive hubs, test areas and testbeds: (1) Multinational Hub strategy (building interconnected network); (2) Invest-In strategy; (3) International Hub strategy (networking with other hubs).

b) What are the actors' motives to be part of the ecosystem?

The main motivation for companies to be part of the RAAS ecosystem is access to world-class knowledge of autonomous systems and access to test facilities (test beds); whereas for research partners RAAS ecosystem helps to get access to interesting use cases and application areas as well as offers cross-disciplinary cooperation opportunities with various research partners. Also, RAAS ecosystem offers fast dissemination channel for the latest research results. For education partners, motivation to participate centralises on shared training and education offering on autonomous systems. RAAS ecosystem aims to develop long standing intangible capital (know-how) that is independent of participating organisations.

The RAAS is also an international ecosystem which offers connections to international research and markets for Finnish and foreign companies and research partners. As common characteristic to innovation and knowledge ecosystems, RAAS addresses phenomena and solving of systemic multidisciplinary challenges rather than single technological or business challenge. RAAS aims to be

an easily approachable and collaborative partner, through which ideas, observations and inventions can be effectively transformed into innovations of high impact.

c) *What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?*

RAAS can be seen as enabler for its partners to find the best possible know-how without restricting its members' activities in their own domains. Therefore, RAAS is an open network which accepts new national and international full and associate members whose relationships are however bound by consortium contract. To become a member of RAAS and receive funding from Ministry of Economic Affairs and Employment of Finland, organisation is required to invest 50% of own funding. Funding is available for domestic partners only.

d) *Do the roles and relationships vary actor-by-actor?*

The roles and relationships vary according to whether organisation is a full member or not. However, the role of RAAS is to combine and transfer knowledge that requires open and equal relationships among partners. R&D consortiums vary in projects which means that some of the partners may have tighter relationships compared to others.

3. Operational environment

a) *What are the main targets and operations of the ecosystem (if there are any explicit ones)?*

RAAS is well established ecosystem which has gained its position in the field of autonomous systems. It has well recognised 'brand' and its activities are well received by its audience.

RAAS operations are divided into 10 tasks, called Research Task Forces (RTF) which have their own strategic plans and thematic roadmaps that are a key tool and the centerpiece for the building of R&D. Each of the RTF involves some 10-20 persons, mainly researchers, from member organisations. Also international partners can be called to be a part of RTF group activities.

1) Legal
2) **Ethical, Acceptability, Desirability and Impact Assessment**
3) Artificial Intelligence & Data-Intensive Analytics
4) Operational Design & Development Processes
5) Business
6) Situational Awareness & Intelligent Control
7) Connectivity
8) Cyber security
9) Remote Monitoring and Operation &
10) Reliability and Maintenance

RAAS's activities in ***the R&D sphere*** relate to improving industry and academia interaction and collaboration. RAAS offers an access point to the best talent in both national and international networks of top researchers in autonomous systems. It focuses on solving of systemic and holistic challenges and steering of long-term autonomous systems research in Finland. RAAS also provides support for autonomous systems testbed activity and aims to develop a One-Stop-Shop service approach to applied research.

In ***the decision-making sphere***, RAAS supports to policy briefing on the national level by acting as intermediator between quadruple helix pillars. It aims to affect international policies, regulations, and funding regarding autonomous systems. RAAS acts as a mediator in international co-operation with

authorities to help integrate national interests in autonomous systems into common-sense practices and rules that emphasize the safety and human factors orientation of solutions.

b) What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)

RAAS strives to be pragmatic and efficient in the construction of the network and operates via concrete R&D projects which involve many ecosystem partners. Workshops, seminars, cooperation forums offer networking opportunities for the ecosystem actors.

Given that RAAS combines world leading autonomous systems' research from different application domains and maximizes cross-domain benchmarking and learning, it uses different types of mechanisms to improve co-creation, knowledge sharing, learning and information flow in general. Examples of ***research-related interaction tools*** include:

- Building strong links to business-relevant testbeds, e.g. company, ecosystem, city and research testbeds. Testbeds form one of the central interaction tools in RAAS and these are designed for all domains. Testbeds offer good opportunity to engage different user groups and channel for start-ups and smaller companies to pilot their solutions.
- Project accelerator service to build research consortia. Here project ideas are taken to idea conceptualisation phase but actual projects are performed outside RAAS resources. In addition to research partners, consortia can include different types of actors, e.g. city, authority, company, etc.
- High-profile seminars and workshops, e.g. International Autonomous Systems Event.
- Keeping people up-to-date, via e.g., newsletters and introducing possibilities for cross-domain benchmarking.
- Forming of strategic partnerships with related business ecosystems.

Given that knowledgeable person form backbone for new autonomous solution, educating new professional is crucial. For this reason, RAAS supports national education needs with several activities.

Education-related mechanisms:

- Doctoral school of Industrial Innovations for autonomous systems which is organized on national level contain special role for each university. Doctoral school integrates academia and industry. Current 5 actors are Aalto-University, Tampere University, Turku University, Vaasa University and Åbo Akademi University.
- Re-education/training courses for adults by offering life-long learning possibilities.
- Recruitment, course work and education/training possibilities from the involved universities.

RAAS serves industry with specific services that aim to lift companies' innovation readiness by linking different ecosystem (and actors outside ecosystem) together. These ***business-related mechanisms*** include:

- Round table sessions which are, e.g. 1-day, "think tank" especially for SMEs on development challenges, finding partners, etc.
- Project accelerator service, a short-term effort to define basic concept and consortium for multilateral R&D project entity.
- Innovation challenges, e.g. "Hackathon" competition leading to piloting of winner solution is aimed to startup/SME teams + researcher teams.

c) *What is the connection between the Change-lab and the ecosystem?*

The Change-Lab, i.e. RAAS, is the ecosystem. Although VTT is the coordinator of RAAS, Change-lab related activities concern the ecosystem not VTT. In practice, Co-Change Lab is different concrete projects (e.g. autonomous tram) and various activities (e.g. awareness raising, stakeholder engagement, citizen involvement) in Ethics RTF.

Key questions for Co-Change project: How to engage civil society better to ecosystem activities? For example, awareness raising on responsible and ethical innovation and RRI are important aspects to develop in the activities of RAAS.

4. The main drivers and barriers

a) *What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment*

RAAS is a good example of innovation ecosystem which has created a common pool of research knowledge that companies can utilise to co-creating sector specific systemic innovation. Systemic innovations require multidisciplinary approach which is one of the key focus areas of RAAS.

b) *What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.*

Hindrances can in turn be created by unequal funding and resources by partners. For example, some of the partners have advanced technical resources compared to others that might result in conflicting interests in cooperation. Different financial interests may also create conflicts, for example regarding autonomous system's solutions.

In addition, designing of internationally renowned testbeds has turned to be more demanding, as invest-in mode, than expected in the beginning. Common areas of interest between application domains have bene challenging to identify, which has hindered cross-domain collaboration and identification of common roadmaps. Overall, RAAS's internal cooperation in innovation ecosystem preparation has not functioned as intended given that it has been extremely difficult to find responsible resources for project/ecosystem entity preparation.

5. History of the ecosystem

a) *What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment*

2017: RAAS is established with the support the Ministry of Economic Affairs and Employment of Finland (TEM). TEM provides part of the funding to set- and scale-up the ecosystem.

The initial idea for RAAS ecosystem came from maritime industry which was in need of network that integrates research partners together, integrates and diffuses fast knowledge and expertise. This task was taken by Aalto University, VTT and Technological University of Tampere (nowadays merged with University of Tampere) who are leading research organisations in the areas of autonomous systems, especially in maritime field.

Other key research partners when RAAS was launched were University of Helsinki, Uni of Oulu, Uni of Turku, Åbo Akademi University, University of Applied Sciences Novia, University of Applied Sciences Oulu, and University of Applied Sciences Turku.

2018: Positive funding decision from TEM.

2019: Series of round table -workshops with companies to inquire development needs and raise awareness of RAAS.

Development of six business-driven ecosystem projects for the research funding round.

Co-organising a seminar on Safety and Security of Autonomous vessels (ISSAV 2019)

2020: Refocusing on safety of autonomous systems and launch of new name "Rethinking Autonomy and Safety".

RAAS webinar was introduced and a virtual side event in TRA2020 conference was organised in spring.

Improvements in RAAS's social media, e.g. establishment of YouTube-channel, Twitter-account and LinkedIn-group.

Setting up the Doctoral school (*international student call for applications is pending and launch is envisaged 2021).*

Restructuring of funding base is needed for the continuation of the ecosystem given that funding from TEM is ending in October 2020.

6. Future of the ecosystem

a) *What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?*

SHORT-TERM:

In the future operations, RAAS wants to continue to act as a catalyst for companies' ecosystem-type innovation activities and accelerate new solutions to the area of autonomous mobility and transport. It will be a central actor in autonomous systems-related business by accelerating economic and societal competitive advantage. Future focus of RAAS operations is on "***Building trust in autonomous mobility AI – Systematic way to build evidence-based trust".*** This process integrates multiple layers, e.g. citizens, authorities, education and industry.

Future activities include (1) coordination of ***the education and training*** of autonomy professionals, and (2) offering ***expertise and services*** to help companies certify and demonstrate the safety of autonomous AI solutions to authorities. Here special focus area are simulation-based verification, validation, and qualification. However, RAAS should concentrate on selected concrete mission and related enabling services to bring added value and activities for companies and research community.

MID- AND LONG-TERM:

RAAS ecosystem is attained to be viable in ten years, and it has been able to grow and re-new itself and gain expertise in novel areas of autonomous systems. Sustainability of 9 RTF is to be seen and their continuation to be evaluated from co-operation perspective after TEM funding ends in 2020. Doctoral school is established and recognised provider of training for various domains of autonomous systems, and world-class industrial e-education packages are running.

Key questions for Co-Change project: How RRI and responsibility issues could be integrated in the curricula? How RRI and responsibility issues can be included in expert services to companies?

7. The main actors of the identified ecosystem - list using the formal framework

   a) *Who are the main (1) core actors; (2) extended actors; (3) external actors?*

   b) *List actors and their roles*

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Name of Change Lab:	**DCE**
Names of authors:	Martijn Wiarda, Geerten van de Kaa, Emad Yaghmaei
Names, affiliations and dates of persons interviewed:	Victor Scholten (Delft Centre for Entrepreneurship), TBA
Name, publication year of the main documents used: (add source for online documents)	**Websites** www.YES!Delft.com www.Tudeflt.nl **Academic references** Blok, V., & Lemmens, P. (2015). The emerging concept of responsible innovation. Three reasons why it is questionable and calls for a radical transformation of the concept of innovation. In *Responsible innovation 2: Concepts, approaches, and applications* (pp. 19–35). https://doi.org/10.1007/978-3-319-17308-5 Fraaije, A., & Flipse, S. M. (2020). Synthesizing an implementation framework for responsible research and innovation. *Journal of Responsible Innovation*, *7*(1). https://doi.org/10.1080/23299460.2019.1676685 Porter, M. E., & Kramer, M. R. (2011). The Big Idea: Creating Shared Value. *Harvard Business Review*, *89*, 62–77. Scholten, V., & van der Duin, P. (2015). Responsible innovation among academic spin-offs : how responsible practices help developing absorptive capacity. *Journal on Chain and Network Science*, *15*(2), 165–179. https://doi.org/10.3920/JCNS2015.x005 Stam, E., & Spigel, B. (2016). *Entrepreneurial Ecosystems* (No. 16–13). Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy*, *42*(9), 1568–1580. https://doi.org/10.1016/j.respol.2013.05.008 Tassey, G. (2000). Standardization in Technology-Based Markets. *Research Policy*, *29*, 587–602.

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem		"*a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory*"(Stam & Spigel, 2016, p. 1)
Business /platform ecosystem		
Knowledge ecosystem		
Entrepreneurial ecosystem	x	

2. The main actors in the ecosystem

a) Who are the key actors?

Technology-based start-ups as participants of the YES!Delft incubator programs (validation lab and accelerator program) form the central actor. The start-ups are generally micro organisations (<10 employees) with the main goal of (1) creating market value. The short term goal is (2) validating the market need of their products and (3) accelerating their business by gaining customers. They are challenged to continuously engage with customers (and the broader public) according to the lean start-up methodology to validate their and further develop their technology and business models. Delft Centre for Entrepreneurship (DCE) is tasked with research and education on entrepreneurship & innovation. They strongly promote entrepreneurial endeavours both in education as well as on campus.

Many of these start-ups are academic spin-offs of the Delft University of Technology (TUD). TUD frequently holds a portion of their shares through her TU Delft Holdings sub-organisation in return for (non-)financial support. This support can include know-how, intellectual property, facilities, and financial/human capital. TU Delft Holdings embodies both the Delft Enterprises B.V. and TDH Services B.V. as university knowledge Valorisation organisations.

On the other hand, spin-off frequently relies on support from a diverse range of actors. YES!Delft plays an important broker in this regard. They facilitate access to corporate partners (e.g., DSM, 3M, ENGIE), research organisations (TNO, Robovalley, TUD), governmental organisations (Delft municipality, EIT, TechLeap), other support service organisations (EY, Hike One, Bird&Bird), investors (Royalis, Ugoo, Fundsup) and the broader startup community (150+ startups). Furthermore, YES!Delft links (external) mentors and trainers to the start-ups.

Ultimately, the start-ups operate in a larger ecosystem where labour unions, governmental organisations, standardisation organisations, competitors, regulatory bodies and the wider public (as mentioned before) also influence their dynamics.

b) What are the actors' motives to be part of the ecosystem?

It is believed that the technology-based start-ups have the potential of creating (societal) value through their businesses. Actors in the ecosystem predominantly aim to aid in this process of value creation. This can be either for economic or societal reasons. On the other hand, many corporate partners, investors and support service organisations can directly benefit from the start-up's success. This can be done through the acquisition of start-up's shares, knowledge spill overs, products/services or by treating them as (future) clients. Of course, social and economic value likely go hand in hand, which is often referred to as 'shared value' (Porter & Kramer, 2011). The ultimate goal is to stimulate entrepreneurship that can do both.

c) What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?

The various actor roles can differ per relationship and maturity period. Generally, actors invest recourses in start-ups to ultimately gain future (economic or societal) benefits. It is hence a 'give-and-take' relationship. Subsequently, most actors would benefit from start-up success. Therefore, the ecosystem could be perceived as a symbiotic one.

d) Do the roles and relationships vary actor-by-actor?

The roles and relationships vary actor-by-actor, which makes up for a complex social system. This is the result of different resources (e.g. information, capital, etc.) flows between them. Relationships are hence heterogeneous. Capabilities of start-ups and their dependencies on other organisations change over time. This makes their heterogeneous relationships additionally dynamical.

3. Operational environment

a) What are the main targets and operations of the ecosystem (if there are any explicit ones)?

The main target is to (1) validate the start-up's business model and technology-market fit, and (2) accelerate the start-ups to the scale-up phase. Here they would have to acquire clients and grow towards a self-sustaining business. In other words, the target is to support the start-up in becoming self-sustainable and allowing it to grow to make a socio-economic subsequently.

b) What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)

Interactions are predominantly characterised by their flow of resources. Interactions offer investments, knowledge, facilities or formal support to start-ups. Start-ups offer shares, knowledge spill overs, products/services, or they can become (future) consumers of paid services.

c) What is the connection between the change-lab and the ecosystem?

It seems important for start-ups to create societally acceptable and desirable products/services to increase their competitiveness and legitimacy. Hence, this could lead to scaling up their business and make an economic and societal impact on a larger scale. This requires the alignment of their business models with their moral responsibilities. Subsequently, this can be done by obtaining information on the underlying values in the system.

Valorisation is officially the third mission of TUD. Support organisations like the TUD and YES!Delft receive financial support from the government in return for their socio-economic impact. Along this line, changing the system structures to allow for more responsible practices would benefit this mission.

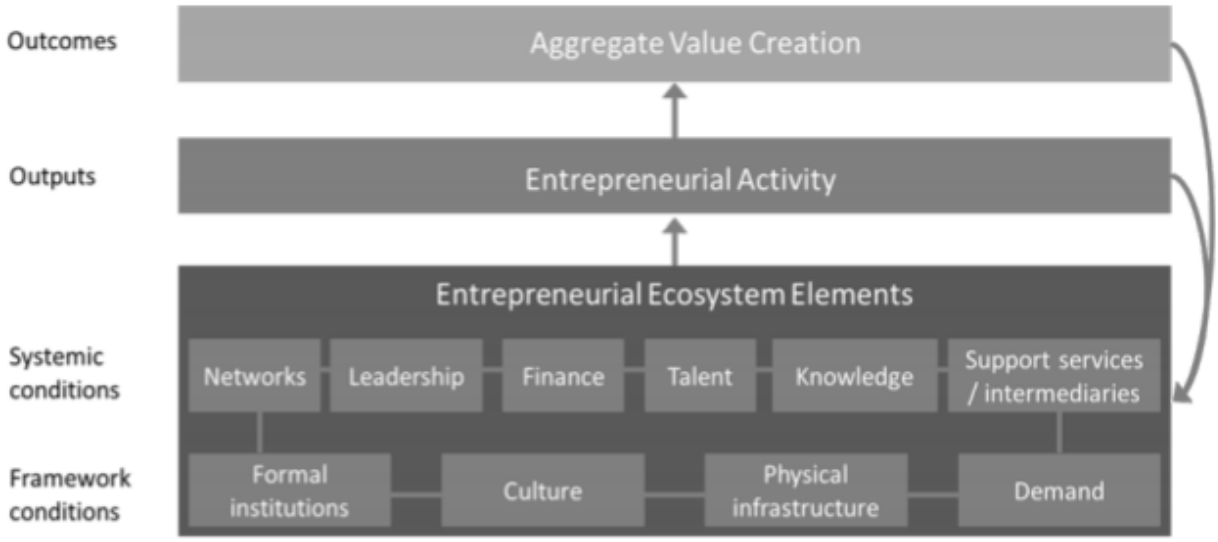
The DCE change-lab plans to integrate RRI into incubators' new business developments via YES!Delft incubator, pilot students' venture ideas to embed RRI principles into their ideas within Delft Center for Entrepreneurship (DCE), develop recommendations for embedding RRI in the DCE learning program, and broaden the mindset of engineering students on social and RRI aspects.

4. The main drivers and barriers

a) What are the driving forces /success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment

According to the entrepreneurial ecosystem theory, the value created by entrepreneurial activity is dependent on a variety of conditions. Start-ups need interconnected cultural, social and material attributes to thrive. They need strong networks of actors that help them to acquire knowledge and learn about the social institutions in place. They need an ecosystem culture that encourages risk-taking, change, and innovation. This culture is complemented by formal institutions that support and protect entrepreneurship. Of course, an exogenous demand for their products and services is essential for their survival and physical infrastructure that enables actor interaction. Entrepreneurship requires a strong, visible, accessible and committed group of entrepreneurial role models that provide leadership in the ecosystem. Both finance, talent and knowledge form valuable resources needed for the birth and growth of start-ups. Lastly, support services/intermediaries (e.g., incubators, investors,

mentors, etc.) are vital for increasing the chances on success of start-ups (Stam & Spigel, 2016). From the perspective of DCE, the key drivers are encouraging physical and social infrastructure with years of profound experience and knowledge of entrepreneurship.



Source: Stam & Spiegel (2016)

b) What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g. considering to embedding RRI.

RRI requires elements that allow for inclusive (preferably transparent), anticipatory, reflexive and responsive activities (Fraaije & Flipse, 2020; Stilgoe et al., 2013). These can likely be hindered by a lack of the above-mentioned driving force since the ecosystem factors greatly determine the entrepreneurial capabilities and activities. In more practical terms, it is expected that start-ups might not possess the resources (particularly finances) that allow for these (information acquiring) activities to happen in an in-depth and thorough manner. As a result, this can affect their absorptive capacity (Scholten & van der Duin, 2015) and result in more bounded rationality.

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Lastly, RRI in industry preferably requires transparency of innovation activities (Blok & Lemmens, 2015). However, transparency is suggested to be difficult since many firms depend on information asymmetries or future patent protection. At least, from the perspective of DCE due to increasing the market-based competition of technology start-ups. It is expected that some start-ups might be hesitant in being completely transparent.

5. History of the ecosystem

a) What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment

Fifteen years ago, the Delft University of Technology cooperated with governmental organisations and set up the YES!Delft business incubator. The incubator has gained great support from a variety of organisations. Currently, it is perceived as one of the world's best university linked business incubators[7]. Consequently, it has gained more legitimacy. Generally, the grand challenges of our

[7] https://www.yesdelft.com/news/yesdelft-among-the-top-5-business-incubators-in-the-world/

society, combined with the valorisation mission of the university, and previous success, push actors to create an even better entrepreneurial ecosystem. Recently, YES!Delft has opened her doors for digital technology-based start-ups as opposed to merely hardware-based start-ups. This opening will greatly increase the diversity of the ecosystem.

6. Future of the ecosystem

a) What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?

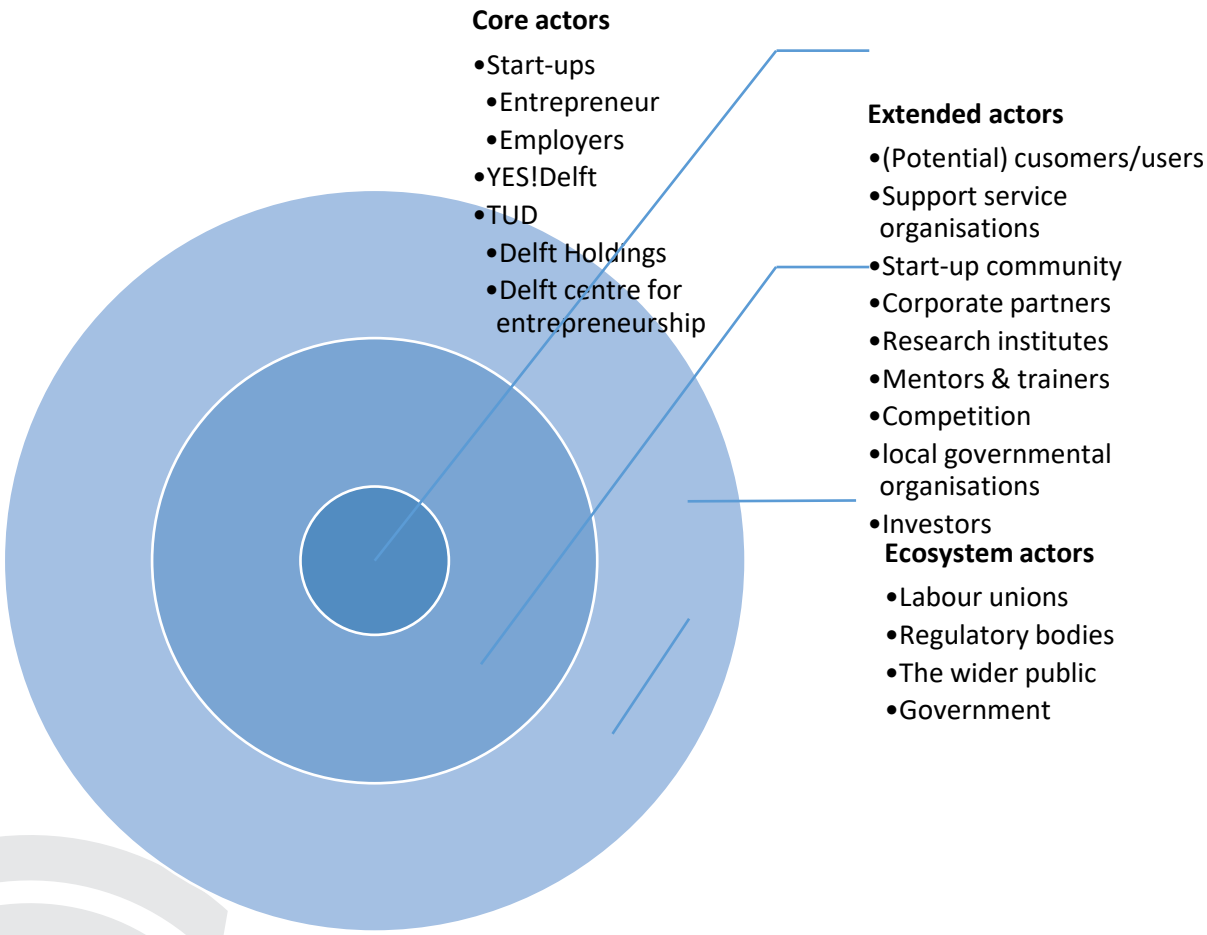
The ecosystem's short-term goal (1 - 3 years) is (1) to support start-ups in validating the business models and thus the product-market fit, and (2) to support the acceleration of the start-up's growth.

The mid-term goal (+/- 5 years) is to collectively strengthen the ecosystem by creating a more entrepreneurial regional culture.

The long-term goal (5+ years) is to become the world-leading ecosystem for entrepreneurship. YES!Delft is already a leader in hardware technology-based start-ups. However, recently the incubator opened her doors for digital technology-based start-ups as well. Strengthen the ecosystem around this teams seems an important goal.

7. The main actors of the identified ecosystem - list using the formal framework

a) Who are the main (1) core actors; (2) extended actors; (3) external actors?



b) List actors and their roles

ACTOR	ROLE	INTERACTION WITH START-UP
CORE ACTORS		
Start-up	Create value	-
YES!Delft	Incubate start-ups	Creates the environment in which start-ups can thrive. The support start-ups to more quickly validate their business models, pivot if needed, and accelerate their growth.
TUD	Produce, exchange and valorise knowledge	They can provide knowledge, know-how, facilities, and financial & human capital often in return for shares in start-ups (held by Delft Holdings). TUD is both shareholder of Delft Holdings and YES!Delft.
DCE	Research & education	They organise research and education on entrepreneurship. It provides valuable knowledge that could spur the ecosystem and aids in creating an entrepreneurial culture and human capital base.
Delft Holdings (support service organisation)	Supports university valorisation	Delft Holdings is responsible for realising the valorisation goals of TUD. They coordinate, for example, the knowledge licencing and patent filing of research and innovation originating from TUD.
EXTENDED ACTORS		

Consumers and users	Consume	They can choose to use or not use products and services of the start-up. They carry valuable tacit information both on their needs and values.
Support service organisation	Create value	They can help start-ups with a variety of tasks. Often this is done on a pro bono basis or as a means of acquiring the start-up as a future client.
Corporate partners	Support start-up	Corporate partners tend to invest in, collaborate with, and/or acquire start-ups to internalize value in their businesses.
Start-up community	Exchange knowledge	They form role models and/or exchange information, such as best practices with each other.
Research institute	Produce and exchange knowledge	They can collaborate with start-ups for their own research or valorise their own work.
Mentors	Provide market-specific coaching	A mentor is provided by YES!Delft and has industry-specific (entrepreneurial) know-how and experience. They exchange this knowledge with the start-up.
Trainers	Train entrepreneurs	Trainers aim to develop entrepreneurs into lean start -up practitioners. This helps entrepreneurs to quickly validate their business models. Additional training is given on, for example, acquiring funding, talent, etc.
Competitors	Create value	They compete with start-ups for market shares.
Local governmental organisations	Governing or support	They can play a facilitating role in strategic niche management so that start-ups can experiment with their technology and acquire valuable information.
Investors	Invest	They invest in start-ups to gain a financial return on their investments and/or to create a positive societal impact.
EXTERNAL ACTORS		
Labour unions	Represent segments	Unions can represent and protect segments of society.
Regulatory bodies	Facilitate standardisation	Facilitate standardisation processes with the outcome of "a set of specifications to which all elements, products, processes, formats, or procedures under its jurisdiction must conform. The process of standardisation is the pursuit of this conformity, intending to increase the efficiency of the economic activity" (Tassey, 2000, p. 55). It benefits systems in which actors favour a universal outcome to problems that are susceptible to multiple ones
The wider public	-	It can give resistance or legitimacy to start-ups.
Governmental organisation	Governing or support	It can establish and enforce institutions that can drive or obstruct the success of start-ups. They can additionally support start-ups by providing resources.

Name of Change Lab:	**NEN**
Names of authors:	Martijn Wiarda, Geerten van de Kaa, Emad Yaghmaei
Names, affiliations and dates of persons interviewed:	Arnoud Muizer (NEN), TBD
Name, publication year of the main documents used: (add source for online documents)	**Websites** NEN.nl **Academic references** Blind, K & Mangelsdorf, M (2016) Motives to standardize: Empirical evidence from Germany. Technovation 48, pp.13-24 Wiegmann, P, Vries, H, & Blind, K (2017) Multi-mode standardisation: a critical review and a research agenda

1. The ecosystem type

Type	✓	Description of the main characteristics
Innovation ecosystem	x	Industrial actors interact to establish standards. These can be considered institutional innovations. For a successful establishment, information must flow freely between actors. NEN is the core actor for facilitating this committee-based standardisation process.
Business /platform ecosystem		
Knowledge ecosystem		
Entrepreneurial ecosystem		

2. The main actors in the ecosystem

a) Who are the key actors?

The Nederlandse Normalisatie-Instituut (NEN) is a Dutch standard developing organisation (SDO). Although it interacts with the European Committee of standardisation (CEN), their tasks are predominantly linked to the Netherlands. They facilitate committee-based standardisation processes (de jure standardisation). Any party is able to initiate a committee. These often embody a plurality of industrial actors, although governmental organisations and other non-profit organisations are also able to join. Thus, SDO's take an alternative route to standards as opposed to the market-based route (de facto standardisation). Therefore, NEN can be seen as a facilitator in the innovation system that enables actors to negotiate. Although de jure standardisation is open to anyone, it is assumed that predominantly incumbents are involved since they possess the resources to do so. The SME's can hence be marginalized in some cases. From a broader perspective, standards influence not just technicalities, but the larger socio-economic system. It implies that the wider public is implicated. These broader stakeholders, however, are often neglected since these can make negotiations harder and longer.

b) What are the actors' motives to be part of the ecosystem?

Standards benefit systems in which actors favour a universal outcome to problems that are susceptible to multiple ones. Standards can highly influence the R&D processes, and thus, the market competitiveness of the industry. Thus, industrial actors prefer an outcome that is not just a universal

one, but also one that favours their position. Of course, consensus needs to be achieved in order for a standard to be widely adopted.

c) *What are the various actors' roles and relationships in ecosystem with each other (symbiotic, complementary, predator-prey, hierarchical, network-like, equal, bottom-up, top-down…)?*

Although de jure standardisation is often referred to as networked-based. It is important to note that not all parties have the same power positions. Some actors have more resources than others to engage in negotiation. Besides the potential gains/losses from standardisation are also heterogeneous across the network. Therefore, it is likely characterised by an implicit hierarchical network.

d) *Do the roles and relationships vary actor-by-actor?*

There seem to be two distinct roles in the system for the main actors. That is (1) the broker and (2) the negotiator. NEN forms a central brokering actor while the remaining actors negotiate. The heterogeneous motives and power positions might differ and result in different 'sides'. However, the overall interactions appear rather similar.

3. Operational environment

a) *What are the main targets and operations of the ecosystem (if there are any explicit ones)?*

The main target is creating a meaningful standard that is not only agreed upon by consensus but one that also positively impact society.

b) *What are the main ways ecosystem actors interact? How close they are to each other? (E.g. co-working space, living labs, R&D&I partnerships, incubator/ start-up accelerator, funding)*

Negotiations can take on formal and informal forms. Formal forms are collective meeting in which the terms of the standard are negotiated and determined. Informal forms can be the interaction between specific actors outside meetings. These forms result in dynamics 'on and off' display for anyone.

c) *What is the connection between the change-lab and the ecosystem?*

NEN is one of the few SDO's that does not merely desire well-adopted standards. In addition, they would like to see 'good' standards. In other words, standards that have a positive impact on society. They currently lack the knowledge on how to incorporate practices that make standardisation and their outcome responsible.

The NEN change-lab plans to apply the Co-Change project method within one of the NEN committee, implement, and validate it, if possible. The main aim is to understand how NEN committees and their ecosystem work, how the NEN committees can change its work based on the proposed indicators by the Co-Change project, and how this can improve NEN committees and their role towards RRI principles.

4. The main drivers and barriers

a) *What are the driving forces/success factors in the operation of the ecosystem? E.g. regional coherence, favourable regulative environment*

Drivers are actor's motives to standardise (to open up markets, spur innovation, increase product competitiveness, or the gain market share).

NEN is probably also interested in using labels/stamps of approval to encourage its innovation ecosystem to adopt NEN guidelines.

b) *What kind of (if any) barriers/ conflicting motives are in the ecosystem? E.g., considering to embedding RRI.*

Barriers include heterogeneous motives, visions, potential gains, and goals. Furthermore, the lack of resources can obstruct the ability to engage in negotiations.

Actors tend to be opportunistic. They aim for standards that are favourable for their technologies. This aim does not per definition align with their moral responsibilities. Often market competitiveness, market shares, and hence an increased profit of their innovations have priority. Therefore, standards that can support this cause are preferred. These preferred standards can cause a misalignment between the actors' moral obligation and their economic role. Also, various motives and power positions can lead to conflicts during negations between actors.

5. History of the ecosystem

a) *What are the critical events that have related to Change Lab ecosystem evolution? E.g. launch, change of focus/strategy, new funding, shock in external environment*

Over 100 years of standardization, NEN, as the 'Main Commission for the Standardization of the Netherlands', has grown into an organization nationally and internationally active in all fields with over 1400 standards committees and more than 5,000 active committee members.

During the history of standardization, NEN is convinced that its standardization provides the necessary coordination to achieve business and societal objectives and make a positive contribution to digitized society. The aim is to promote morally right standards for external demand, which may generate the need to change organizational policies and practices internally.

6. Future of the ecosystem

a) *What are short-term (2-5 years); mid-term (6-10 years), and long-term (beyond 10 years) visions of the ecosystem?*

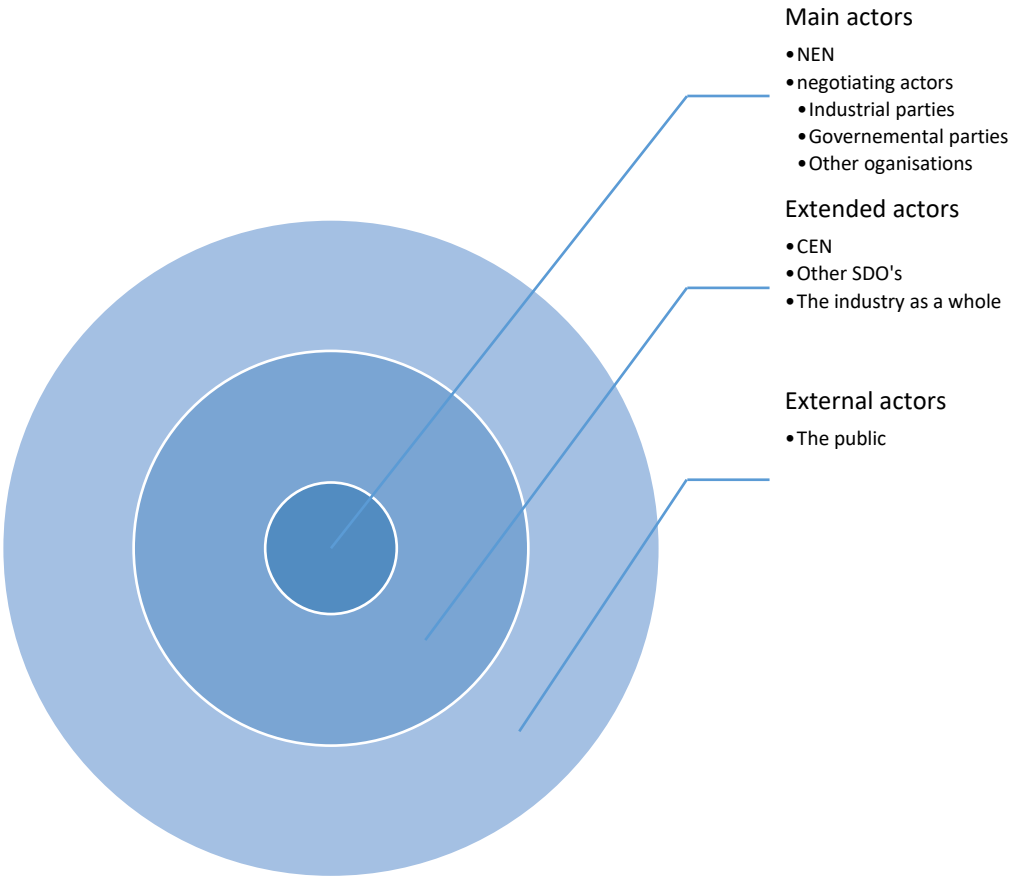
The short-term goal of the ecosystem is to bring actors together and establish economically and socially acceptable and desirable standards.

The medium-term goal is to help actors deal with uncertainty, by providing a standard on which they can fall back. Helping actors can avoid market-based standard battles. Ultimately, the medium goal is thus to spur innovation.

The long-term goal is to increase the economic and social impact of innovations that rely on standards.

7. The main actors of the identified ecosystem - list using the formal framework

a) *Who are the main (1) core actors; (2) extended actors; (3) external actors?*



b) List actors and their roles

ACTOR	ROLE	INTERACTION WITH NEN
NEN	Facilitating of de jure standardisation in the Netherlands	-
Negotiating actors: industrial, governmental, and other organisations	To negotiate standards	They make use of NEN's services
CEN	Facilitator of de jure standardisation on European level	Facilitate the standardization process with NEN
Other SDO's	Facilitator of de jure standardisation in other domains or countries.	Can establish/facilitate standards that support or conflict with standards of NEN.
The industry as a whole	Creating value	Their practices and (future) innovations are influenced by the standards
The wider public	Citizens	Can provide resistance or legitimacy

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