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Responsible Research & Innovation in three countries: Finland, Poland and Spain-Catalonia

Technical Report

RRIL - Responsible Research and Innovation Learning

Karsten Krüger (Coord.)

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Finland, Poland and Spain-Catalonia

IO-1 Summary Report

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Presentation of RRIL - Responsible Research and Innovation Learning

Responsible Research & Innovation is a genius concept developed by the European Commission for the governance of research and innovation processes with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products. It aims to shape, maintain, develop, coordinate an align existing and novel research and innovation-related processes, actors and responsibilities with a view to ensuring desirable and acceptable research outcomes.

In the Horizon 2020 programmes, there were and are some projects focusing on related training needs. But there is no substantial attempt observable to develop continuous higher education programmes supporting the implementation of this concept and the respective reorganisation processes in universities, research centres, research and innovation oriented enterprises and public authorities like cities or regional governments. This project pretends to fulfil this gap through the co-creation of higher education modules between different research and innovation actors.

RRIL will especially focus on public engagement, gender equality and ethics (in the knowledge fields Energy and Economy) testing the learning modules in innovative environments based on interactive real-problem approaches. In a later stage, the developed modules will be offered to research and innovation actors supporting the implementation of RRI principles in the organisations capacitating the learners to develop jointly innovative solution for societal problems.

RRIL is based on co-creation and open innovation processes giving a prominent role to the learners. The co-creation is conceived as multidisciplinary and transversal among different kinds of actors as HEI, research centres, NGO's and cities paving the way for knowledge exchange between them. It consists in informed learning among practitioners considering learners as a knowledgeable and critical partners in designing and implementation of the learning means. Under this perspective the potential learners – programme coordinators and tutors - are considered peers working collaboratively on the project outputs.

RRIL - consortium

Universitat Rovira i Virgili (Coordinator)

Tampereen Yliopisto (Tampere University)

Akademia Leona Koźmińskiego (Kozminski University)

NOTUS applied social research

Fundació Tarragona Smart Mediterranean City

Instytut Innowacyjna Gospodarka (Institute of Innovative Economy)

Executive Summary

The report resumed the findings of the analysis of the Research and Innovation systems, with the special focus, on the fields of energy and economics in Finland, Poland and Spain/Catalonia and the relevance of the concept 'Responsible Research and Innovation' to steer the systems. As it was expected, the three countries show different features and different innovation performance. Using the indicators of the Innovation Scoreboard of the EU, Finland is one of the frontrunners, meanwhile Spain and Poland are moderate innovators. The regional Innovation Scoreboard of the EU, classified the regions in which the cooperating universities are locate: Catalonia, Warszawski stoleczny and Länsi-Suomi as drivers of innovation in their countries, but classified only Länsi-Suomi as a leading region in Europe. two other regions are moderate innovation regions. Regard to the governance structure of the research and innovation system, the description of the three countries shows that in Finland and Poland the steering competences lies at the state level, but with the regional and local authorities as relevant actors. On the contrary, in Spain the steering competences are shared between the central state and the regional governments. The cities play a minor role related to concrete projects of urban innovation.

Our analysis on the degree of implementation of RRI as an integrated concept shows its low relevance for steering the systems, but also for the institutional governance in all three countries. At the level of the researchers, RRI is even less relevant. Naturally, there are some exceptions of this general statement. RRI has certain relevance in some universities, research and technology centres as a guiding vision, overall for those which are engaged to European projects.

But a detailed analysis of the strategic relevance of the three RRI dimension selected by the RRIL project: public engagement, gender and ethics shows a differentiated picture:

Public engagement or social compromise is of high relevance in all three countries. Finland and Catalonia have make substantial steps forward in the setting-up of triple helix configuration, meanwhile Poland seems to be a step behind. In all three countries, less efforts are observed to make substantial step forwards to the empowerment of citizens in the innovation processes, in spite of that policy documents formulate the objective to advance towards more open, transparent and democratic innovation systems.

Regard gender equality, the general interpretation pointed to assurance of the same labour rights. Finnish and Polish interviewees do not perceive gender discrimination in official staff policies, but in patterns of behaviour, which impedes women to have the same chance to access to upper hierarchical positions. On the contrary, in Catalan universities there is a relatively strong discourse observing gender discrimination in Staff Management. The interpretation of gender as a transversal topic to be inserted in innovation projects based on academic research is practically absence in practice except specific knowledge areas.

The topic of ethic seems to be even less relevant in practice and discourses of the researchers, with the exception of the areas in which the objectives of research are human beings or animals, or in which the research is treating personal data. But the reflection of the interviewees in the inquiry of the project, shows an orientation of this topic to problems emerging in the triple helix configurations.

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1. Introduction

In preparation to the development and use of learning modules in turn of three core dimensions of the concept of Responsible Research and Innovation (RRI), we have carried out an analysis of the national-regional) R&I-systems in Finland, Poland and Spain (Catalonia) und the strategies to implement RRI or strategies in the three aforementioned dimensions.

The analysis is based on desk research and series of interviews with key persons in the cities, universities and public agencies with responsibilities in responsible research, public engagement, gender and ethics. One objective was to identify strategies in these fields and to build on it the development of the learning modules. The second objective of the mapping of network structures and responsible dynamics was to identify key actors for the development and implementation of the training modules.

The outputs are three national report, on which this summary report is based on. The national reports represent a common stock of information about the structure of the R&D network in the three countries en general and the two selected knowledge fields energy and economics, but presented in different forms due to the idiosyncrasy of each R&D system.

This summary report is functionally oriented to prepare the next steps of the project – the development of learning modules in the areas of public engagement, gender equality and ethics - it focuses mainly on the relevance of the concept of RRI and the policies in turn of the three selected elements in the three countries. It starts with a description of the National Innovation systems in the following section 2 , which includes a brief presentation of the concept of National Innovation systems (section 2.1) and Responsible research and Innovation (section 3)

2. Helix innovation systems

2.1. The concept of National Innovation system

The concept of National Innovation Systems can be traced back to the 1960s, when the topic ‘innovation’ emerged as a political issue in the USA and later in Europe. In many countries reports on science and innovation policies were produced and the OECD conducted Science Policy reviews in its member states (see Freeman 1995). Following Godin (2007 and 2010), it was Freeman who first spoke about innovation systems at the end of the 1960s (see Godin 2010: 3). It becomes national innovation system linking the system approach to national policies (see Freeman 1974). It gains high relevance through the work of Nelson (1993), Lundvall (1992 and 2010) and the OECD publication. (OECD 1997). The concept itself includes the possibility to focus on other territorial units as regions or cities, but also on specific innovation or economic fields.

The concept stresses systemic, institutional, and regulatory aspects of innovation development. Its central assumption was a holistic and non-linear approach to the interactions that take place between institutions that influence innovation development. The main subject of research within

NSI is the flow of knowledge and information between individual actors active on the R&D stage. This approach is especially useful for the analysis of barriers to the emergence and diffusion of innovation. The following elements are taken into account in the system's analysis (Bukowski et al. 2012: 14):

1) flow of knowledge within the private sector,

2) the flow of knowledge between the private and public sectors,

3) diffusion of incremental innovations through the purchase of innovative goods and services,

4) diffusion of tacit knowledge diffusion due to employee mobility.

National Innovation Systems are shaped by innovation policies and implemented by the complex networks of public and non-public institutions. Indicators such as the number and effectiveness of joint research projects or clusters, the number of joint patents and publications created thanks to the cooperation of separate institutions, and the employees' competence and mobility (e.g., between the science sector and companies) are taken into account to assess NIS. Thus, the focus is less on the instruments supporting innovation development and more on the properties of the network of connections and transfers between the main entities involved in their creation.

2.2. Triple and quadruple helix

As a complement to the Innovation system approach and in line with knowledge-economy approach (Foray & Lundvall 1996); Etzkowitz & Leydesdorff (1995) proposed the model of the triple helix with the university, industry and government as helix actors. It takes as grounded that innovation is a non-linear process in which intentional inputs hardly lead to the expected outputs (see *Leydesdorff 2001*). The triple helix model tried to capture innovation dynamics at different geopolitical levels - regional, national and transitional dynamics – and the multiple linkage between different innovation actors in the different stages of non-linear innovation processes. "*The institutionally defined Triple Helix is premised on separate academic, industrial, and govern-mental spheres and the 'knowledge flows' among them. Transfer is no longer considered as a linear process from an origin to an application.*" (Etzkowitz & Leydesdorff 1998: 197) The model remarks the relevance of political actors for the innovation processes, which was somehow neglected in the innovation system approach. The three helices: academia/universities, industry, and state/government including hybrid organisations are intertwined and generate innovation systems at regional, national and transnational innovation system as well as sector specific innovation systems. The model assumed also, that actors of the different institutional spheres could develop roles, which are traditional assigned to another spheres. Universities are developing entrepreneurial roles and enterprises are more engaged to academic research. Etzkowitz & Leydesdorff conceived it as a model "*for analysing innovation in a knowledge-based economy" (ibid* 198*)*. They traced it back to the second half of the 19th century but its expansion and consolidation occurred in the last part of the 20th century (see *Leydesdorff & Etzkowitz 1996*) parallel to the transition to the globalised knowledge base economy.

On the other side, the concept develops also a normative dimension steering innovation policies claiming active policy making of all actors of the triple helix system in spite of that the results of

the efforts are quite uncertain. "*The perspective of the third helix provides each of the partners with a reflexive angle that can lead to other selections than those which seem to have occurred "naturally*" (see Leydesdorff & Etzkowitz 1996: 3). In fact, it has become a guiding vision for innovation policies are European, national and regional level.

Without going in depth to the debate about triple helix approach, one main concern was that it is not sufficient as a basis for analysing and understanding the changing dynamics innovation systems. For this reason, the original concept was modified towards a quadruple helix model with the public sphere as a fourth strand, and recently to a quintuple helix model. For instance; Carayannis & Campbell (2009: 6) propose to add the '*media-based and culture-based public' or* the *'creative class'* a fourth helix. They are also talking about innovation ecosystems.

Arnkil et al (2010) used also the term quadruple helix, in the sense of open or user innovation approach: "*It is an innovation cooperation model or an innovation environment in which users, firms, universities and public authorities cooperate in order to produce innovations. These innovations can be anything considered useful for partners in innovation cooperation; they can be, for example, technological, social, product, service, commercial, and non-commercial innovations*." (*Ibid* Executive summary).

2.3. Concluding remarks

The different approaches presented here indicated the changing dynamics of the innovations processes with an apparently increasing complexity and uncertainty of the results of the setting-up and consolidation of the innovation networks. This is the context in which the promotion of the RRI-concept from part of the EU is framed in.

3. Research and Innovation Indicators for Finland, Poland and Spain

Referring to some basic indicators about Research funding und staff, we draw out some basic difference between the Research and Innovation systems of the three countries under scrutiny. First, we expose OECD figures to go then to data from the EU Innovation Scoreboard.

The last one considers Finland is an innovation leader, meanwhile both other countries Poland and Spain are considerate moderate innovators.[1] The table 1 about research funding confirms this impression. The GERD as percentage of the Gross Domestic Product (GDP) is in Finland considerably higher then in Spain and Poland. The Finnish GERD is above the average of the EU

[1] The Innovation scoreboard calculated based on a series of indicators a composite indicator of the innovation capacity classifying the countries in four categories: Innovation leader (above 120% of the EU average of normalised scores), Strong innovator (between 90 and 120%), Moderate Innovators (50% 90%), and Modest Innovators (less than 50%)

28, meanwhile Spain and Poland are below the average. During the financial crisis, Finland and Spain has reduced their GERD.[2]

Table 1
Funding of Research in Finland, Poland and Spain

	GERD as a percentage of GDP			Percentage of GERD financed by							
				Business enterprise sector		Government		other national sources		the rest of the world	
	2010	2016	2017	2010	2016	2010	2016	2010	2017	2010	2017
Finland	3,73	2,74	2,76	66,1	57,0	25,7	28,9	1,3	2,0	6,9	12,1
Poland	0,72	0,96	1,03	24,4	53,1	60,9	38,9	2,8	2,6	11,8	5,5
Spain	1,35	1,19	1,21	43,0	46,7	46,6	40,0	4,6	5,2	5,7	8,1
EU28	1,83	1,94	1,97	53,1	56,7	35,4	30,7	2,5	2,8	8,9	9,9
Source: own elaboration based on OECD data consulted 15/03/2020											

On the contrary Poland has increase it. In these both first countries, this is accompanied by a increasing transnational share of funding. The data indicate that increase of the polish GERD is due to the increase of the business part, which increased from 24,4% of the GERD in 2010 to 53,1% in 2016.

Table 2
HERD as a percentage of GDP

	2010	2016	2017
Finland	0,76	0,69	0,70
Poland	0,27	0,30	0,34
Spain	0,38	0,33	0,33
EU28	0,45	0,44	0,44
Source: own elaboration based on OECD data consulted 15/03/2020			

A similar picture offers the data about HERD. The Finnish investment in higher education is considerably higher compared to both other countries and also the EU28. The financial crisis has

[2] Besides the financial crisis, also the NOKIA crisis have had a deep impact. According to P. Soini, the Director General of Business Finland, the NOKIA crisis had a deep impact on R&I. Reports show that 10 years later following the global financial and NOKIA crisis, Finland has fallen far behind in R&I and the period has witnessed significant decrease in research investments in both the public and private sectors [Pekka Soini interview with YLE News https://yle.fi/uutiset/osasto/news/finnish_rd_on_the_ropes_private_investments_drop_by_1b-euros_over_past_decade/10221471]. According to Statistics Finland [https://www.stat.fi/til/tkker/2020/tkker_2020_2020-02-20_tie_001_en.html], "*in the 2020 budget, the R&D funding of universities totals EUR 690.4 million, which is a growth of around EUR 60 million from the previous year's budget.*" The same report indicated that the majority of government R&D funding is directed to universities.

caused a reduction of the HERD in Finland and in Spain, meanwhile Poland has increased its HERD achieving a higher HERD in terms of percentage of GDP as Spain.

Table 3
R& D staff per 1.000 labour force

	Total researchers (FTE)		Total R&D personnel (FTE)	
	2010	**2017**	**2010**	**2017**
Finland	15,4	13,6	20,9	18,0
Poland	3,8	5,6	4,5	7,0
Spain	5,8	5,9	9,0	9,5
EU28	6,7	8,0	9,9	12,4

Source: own elaboration based on OECD data consulted 15/03/2020

Following the European Innovation Scoreboard 2019, among the three countries covered by RRIL, Finland is an innovation leader, meanwhile both other countries Poland and Spain are considerate moderate innovators.[3]

Table 4
Countries' Innovation Profile 2018
(Composite Indicators by dimension)

	ES	**PL**	**FI**
Human resources	115,9	57,6	157,0
Research systems	76,8	30,7	135,4
Innovation-friendly environment	107,1	125,2	182,3
Finance and support	75,2	35,7	113,6
Firm investments	64,0	73,2	129,8
Innovators	45,1	16,5	168,2
Linkages	58,2	31,2	152,0
Intellectual assets	71,2	69,3	151,8
Employment impacts	93,3	92,4	80,2
Sales impacts	85,0	54,5	85,4
Summary Innovation Index	77,9	56,1	134,0

Source: Innovation Scoreboard 2019 (in relation to EU28 – 2018 based on Normalised Scores) (EC 2019)

[3] The Innovation scoreboard calculated based on a series of indicators a composite indicator of the innovation capacity classifying the countries in four categories: Innovation leader (above 120% of the EU average of normalised scores), Strong innovator (between 90 and 120%), Moderate Innovators (50% 90%), and Modest Innovators (less than 50%)

Looking at the composite indicators used by the Innovation scoreboard, we observe that the three countries have quite different profiles: Finland shows in all indicators a higher score compared to the EU-28 except employment impact, which is even lower compared to Spain and Poland, and sales impact. It achieved its highest scores (> 150) in Innovation-friendly environment, Innovators, human resources, linkages and Intellectual assets (see table 1).

Spain is in the middle field of the moderate innovators, with its highest scores (> 100) in Human Resources and Innovation-friendly environment. It has its lowest scores (less then 75) in Innovators, Linkages, Firm investments and Intellectual assets.

Poland is at the cue of the countries classified as moderate innovators. It achieved its highest scores (> 75) in the dimensions of Innovation-friendly environment and employment impact. Its lowest scores (< 50) are in the dimensions of Innovators, Research Systems, Linkages; and Finance and Support.

Table 5
Countries' Innovation Profile 2018

	ES	PL	FI
Population with tertiary education	123,750	123,125	102,500
Lifelong learning	89,796	29,592	268,367
Scientific co-publications	84,401	32,327	202,808
Most-cited publications	82,461	42,069	112,756
R&D expenditure public sector	71,744	35,415	152,475
R&D expenditure business sector	47,570	48,319	132,956
Non-R&D innovation expenditures	53,976	121,529	88,869
Product or process innovators	39,049	26,312	174,891
Marketing or organisational innovators	66,326	2,497	136,577
SMEs innovating in-house	31,265	19,105	191,138
Innovative SMEs collaborating with others	49,121	30,758	189,090
Public-private co-publications	45,420	23,100	202,170
PCT patent applications	39,812	14,704	219,354
Trademark applications	110,222	70,611	137,077
Design applications	64,769	123,642	97,547
Employment MHT manufacturing & knowledge-intensive services	80,000	54,118	123,529
Sales of new-to-market and new-to-firm innovations	164,827	31,968	83,108
Composite Score 2018	77,9	56,1	134,0
Source: Innovation Scoreboard 2019 (in relation to EU28 – 2018 based on Normalised Scores) (EC 2019)			

Looking at the individual indicators used by the Innovation scoreboard, we observe that the three countries have quite different profiles: Finland shows in all indicators a higher score compared to the EU-28 except Non-R&D innovation expenditures, Design applications, and Sales of new-to-

market and new-to-firm innovations. It shows especially high scores in Lifelong learning, Scientific co-publications, Public-private co-publications and PCT patent applications (see table 1).

Spain is in the middle field of the moderate innovators, with its highest scores in Population with tertiary education, Trademark applications and especially Sales of new-to-market and new-to-firm innovations. It has its lowest scores (less then 50% of the EU average) in R&D expenditure public sector, Product or process innovators, SMEs innovating in-house, Innovative SMEs collaborating with others, Public-private co-publications and PCT patent applications

Poland is at the cue of the countries classified as moderate innovators. It achieved its highest scores in the dimensions of Population with tertiary education, Non-R&D innovation expenditures, and Design applications. Its lowest scores (less than 30% in relation to the EU28 normalised score) are in the dimensions of Lifelong Learning, Product or process innovators, SMEs innovating in-house, Public-private co-publications, PCT patent applications and especially Marketing or organisational innovators.

3.1. The National Research and Innovation Systems

The structure of the E&I systems in the three countries shows differences in the geopolitical distribution of competences to steer the systems. Meanwhile in Finland and Poland the main steering competences are located at the national system, but with a strong implication of the municipalities in Finland, in Spain the steering competences are distributed between the central state and autonomous regions.

In Poland, the governance of the R&I system lies in the competence of the central government, but are also distributed to the regions according to the administrative division of the country, to the so called 'voivodships'. Responsibilities are shared between the Ministry of Science and Higher Education, responsible for the higher education and the shaping of research policy both in the areas of basic and applied research, the Ministry of Funds and Regional Policy, responsible for innovation policy, and the Ministry of Economic Development. Regions have a considerable impact on the innovation system, but their role as well as the of the cities are strengthening through the European Funds fostering smart specialisation and regional development through innovation. They manage separate funding program for ever region called Regional Operation Program. In these program some R&D funding is offered as well. These programs are smaller than the ones offered on a central level but have similar objectives with specific Regional Intelligence Specializations for every region. They are governed by the Marshall's Office in every region. Additionally, a significant attention is brought to diminishing the differences between the Western and Eastern part of the country. The Eastern regions have access to the Operational Programme Eastern Poland which also distributes innovation funds, among the others for so called Start-up Platforms (Platformy Startowe).

Also in Finland, these competences are of the central government implying the Primer Minister, the Ministry of Education and Culture responsible for higher education and science policy targets, and the Ministry of Economic Affairs and Employment encouraging companies to embrace sustainable growth and productivity. Within the national strategies, the regions and municipalities

are encouraged to developed their own strategies responding to the challenges of the sustainable goals, e.g. regard the climate change and energy strategies.

The regional councils play significant role in the Finnish politico-administrative system and regional development. Guided by the Act on Regional Development and the Administration of Structural Funds (7/2014), the regional councils have special provisions on the structural fund programme and the European Territorial Cooperation programme, namely managing their action plans. The Regional councils in Finland are the main bodies promoting the interests of their regions and they diligently work in cooperation with central government authorities, central cities, other municipalities and universities in their regions and other parties involved in regional development. In other words, the regional council main responsibility relating development activities in regional level is the distribution of EU funds and regional planning. However, outside of administration of the funds, their role is mainly advisory and often subsidiary for municipal decision making and politics

In Spain the competences to steer the system are shared by the central state and regions. For instance, the Catalan Government has competencies in the area of Research and Innovation as it is established in the Statute of Autonomy of Catalonia of 2006. It has exclusive competences to create its own research and innovation system: its structure, its functioning and its research line. It shares competences in governing National research centres located in Catalonia. It has exclusively competences to configure the regional university system by by creating public universities and authorizing private universities, approve the internal organisation and function of the universities, regulate the access to universities etc.

In all three countries, the steering of the public funded R&I system is characterised by the existence of advisory boards in form of Research and Innovation Council (FL) Council of Innovativeness (PL) or the Council on Scientific and Technological Policy and Innovation (ES). In Catalonia, this role is fulfilled by the Inter-Ministerial Research and Innovation Commission (CIRI). These bodies are advising or the Parliament, or the governments, or both. The governmental competences are shared by a Ministry responsible for Science and (higher) education and a Ministry responsible for economic affairs. It launches and implements projects with private third and public sector aiming to increase and promote sustainable well-being and the grow business.

The third public steering level are formed by different agencies with the general aim to steer the systems by the distribution of public funding introducing a distinction between research and promotion innovation in enterprises:

In Finland, we are talking about the Academy of Finland depending on the Ministry of Education and Culture, distributing funds for research at universities, universities of applied science and public research organisations. Another funding agency is SITRA reporting directly to the Parliament. Besides there are several agencies to promote innovation in private enterprises as Business Finland, Finvera, Tesi and Finpro.

In Poland there is the National Science Centre distributing the public funds for basic research; The National Centre for Research and Development (NCRD), which is an intermediate body in operation programmes for Intelligent Development and Knowledge, Education and Development,

and Polish Agency for Enterprise Development to promote innovation and research in small and medium enterprises. These funds are distributed on a central level. Additionally, every Polish region, so called voivodship has an additional funding program called Regional Operational Program. Most of the regions established a dedicated office like Regional Development Foundation (Fundacja Rozwoju Regionalnego), however, they do not have a unified strategy.

In Spain, there is the National Research Agency responsible for the competitive allocation of public resources in the field of scientific and technical research, to control the use of the resources and their impact. A similar role plays in Catalonia the Agency for Management of University and Research Grants (AGAUR). To promote the technological development and innovation of Spanish companies, there is the Centre for Industrial Technological Development. Additionally, with a minor funding role, there is the Spanish Foundation for Science and Technology to drive forward science, technology and innovation, promote their integration and proximity to Society and respond to the needs of the Spanish Technology and Business System.

Regard to the public part of the R&D, naturally the HEIs are essential part of the R&D systems. However, the higher education systems are very different:

In Finland, there exist two types of universities: the full universities and the polytechnics. Both are public. Meanwhile the universities are state ones, the polytechnics are governed by the municipalities. Finland has 14 universities and twenty-three polytechnics.

The Spanish higher education is formed only by universities, but marked by the distinction between public and private universities, partly owned by the catholic church. In 2017, there have been a total 82 universities in Spain, 50 of them are public and 32 private universities. 7 of the public and 5 of the private universities are located in Catalonia. Mainly the public universities are carrying out research. The private universities are more focused on education except in some specific fields as economics and business science or some private universities specialised in knowledge fields as chemistry or Information and Communication Technology. But within the public universities, there is a high diversity of internal organisational arrangements with university schools, business schools, research centres, own foundations etc. with different degree of autonomy in organisational management and different degree of cooperation with other private or public entities.

The Polish higher education system is considerably more heterogeneous compared to both other countries. There are approx. 457 Higher Education Institutions (HEIs) in Poland, including 131 public institutions and 326 private ones. There are 24 cities in Poland having between one and nine HEIs while the leading cities are Warsaw, Krakow, Poznan, and Wroclaw. There are approx. 1,5 million students in total, of which around 24.4% attend private HEIs. Since the 2006/07 academic year, the number of students has been steadily decreasing, while the number of students is decreasing faster at non-public HEIs.

In Poland there are 45 HEIs considered as universities. Since 2018 the Polish word for ‘university’: *uniwersytet* has been reserved for the name of a HEI having the scientific category A +, A or B + in at least 6 scientific or artistic disciplines, covering at least 3 fields of science or art.

There are 43 public universities in Poland supervised by the relevant Ministries:

- 18 general universities
- 2 universities classified as art colleges
- 4 universities classified as economic universities
- 9 medical universities
- 3 universities classified as pedagogical universities
- 5 universities classified as agricultural universities
- 2 universities classified as technical universities.

There are also two non-public universities: John Paul II Catholic University of Lublin and SWPS University of Social Sciences and Humanities.

Regard the Autonomy of universities, Karranand & Mallinson (2017) measured it in five dimensions: (1) academic freedom in legislation; (2) institutional autonomy in legislation; (3) self-governance in legislation, (4) job security and (5) autonomy in constitution & International Agreements, For each dimension a series of questions were elaborated and used in European wide survey, to which 5,300 persons responses, 500 from the UK, Based on the answers, for each dimension a composite indicator were calculated, as well as an total composite indicators.

Table 6
Karranand & Mallinson's University Autonomy Indicators

Nation	**Total**	**Academic Freedom**	**Institutional Autonomy**	**Self-Governance**	**Job Security**	**Constitution & International Agreements**
Spain	66,5	15,0	8,5	12,0	11,0	20,0
Finland	55,0	15,0	15,0	3,0	3,0	19,0
Poland	54,5	10,0	9,5	12,5	5,0	17,5
Mean	52,8	11,9	9,3	8,6	7,3	15,6

Source: Karranand & Mallinson (2017: 28)

Following the survey, the Spanish universities are the second most autonomous EU-universities only behind Croatia. Finland and Poland are in the middle field. It is remarkable that the Spanish and Finland universities are high ranked regard to academic freedom, but the Polish universities are below the EU-28 mean. On the contrary Spanish universities are low performers regard the institutional autonomy being below the EU-28 average, meanwhile Finland is the frontrunner in this dimension achieving the highest score. Poland is in the middle field slightly above the average. Regard the Self-governance, the Polish and Spanish universities are above the EU-28 average, meanwhile the Finnish universities are clearly below. In the dimension of job security, the Spanish universities are in the group of countries offering mayor job security, meanwhile the Polish and Finnish universities are clearly below the average. At least the universities of the three countries have a high degree of autonomy in the dimension of constitution and international agreements.

The European University Association (Bennetot Pruvot. & Estermann 2017) carried out at the same time as the aforementioned study an own survey on University autonomy creating an online

to consult the results concerning the year 2016. This survey measured the university in the organisational, financial, staffing and academic autonomy. Four each dimension four clusters were established based on the following classification: High (81% to 100%), Medium high (61% - 80%); Medium low (41% to 60%) and low (0% -40%).

Table7
EUA University Autonomy indicators

Nation	Organizational	Financial	Staffing	Academic
Spain	55%	55%	48	58
Finland	93%	67%	92%	90%
Poland	67%	54%	84%	68%

Source: European University Association: The University Autonomy Too [https://www.university-autonomy.eu/]

The results are very different to the previously presented study as the first one takes a point of reference the academic freedom, meanwhile in the survey of the EUA the core question is the institutional autonomy to governance their own affair. In the EUA survey, The Finnish universities have in three of the four dimension a high autonomy and the in fourth dimension of financial autonomy they have a medium high autonomy. The Polish universities are in the field of medium high scored autonomy, except in the financial autonomy dimension, where their autonomy is medium low scored. Al least, the Spanish universities have following this survey in all dimensions a medium low autonomy.

Another essential part of the public part of the European R&D systems are the public research centres: In Finland, within the universities, several governmental research institutions promote research and innovation. The research institutions include the Technical Research Centre (VTT), which becomes the largest applied science research organisation developing new technical solutions and applied technologies to improve company's competitiveness; the Natural Resources Institute (LUKE), the National Institute for Health and Welfare (THL) and the Government Institute for Economic Research (VATT).

In Poland, currently, there exist 111 research institutes, subordinated to 16 ministries. In 2019, 38 of these institutes were integrated in the umbrella organisation Łukasiewicz Research Network to reduce the fragmentation of the public R&D system and as a reaction to the low performance of the public research centres and to increase the public private cooperation. The Polish Academy of Science is another relevant actor in the system. The PAN is a state-owned scientific institution aimed at the development, promotion, integration and dissemination of science in the society, as well as contributing to the development of education and enriching national culture. The Academy realizes its goals within the framework of scientific corporations and through a network of scientific institutes. It is formed by elected national and international members limited to a maximum of 350 persons. These members form the Generally Assembly. Another actor is the Polish Academy of Arts and Sciences, going back to the Polish Academy of Learning funded in 1872 with the aim of cultivating national science and culture. As an institution of public utility, it remains under the protectorate of the President of the Republic of Poland.

In Spain, the following 8 Public research entities form part of the core of the Spanish R&I system: the National Research Council (CSIC), the National Centre for Energy, Environment and Technological Research (CIEMAT), the Spanish Geological and Mining Institute (IGME), the National Institute for Aerospace Technology (INTA), the Spanish Institute of Oceanography (IEO), the National Institute of Agrarian and Agro-Food Technology (INIA), the National Health Institute Carlos III (ISCIII), and the Astrophysics Institute of Canarias (IAC). These bodies execute directly activities of scientific and technological research, of technological services and any other complementary activities. Besides there are so-called singular scientific and technical infrastructures (ICTS). These are unique large installations, resources, facilities and services, in the knowledge field of Astronomy and Astrophysics; Ocean, Life, and Earth Sciences; Health Sciences and Biotechnology; Information and Communications Technology; Energy; Engineering; Materials, and Social Sciences and Humanities. They are dedicated to cutting edge and high quality research and technological development, as well as to promote exchange, transmission and preservation of knowledge, technology transfer and innovation.

In Catalonia, the strategy of the regional government is more oriented to promote research and technology centres through organisations under private law but with a strong public funding. This is the case of Eurecat, an umbrella organisation, which was set up at the end of 2013 as a private foundation, and managed actually 11 technology centres, distributed over the whole Catalan territory. Another example is IRTA, a private foundation attached to the Department of Agriculture, Livestock, Fisheries and Food, with research centres distributed throughout Catalonia. A third example is CERCA, which is an organisation of the Catalan Government to supervise, support and facilitate the activities of the research centres[4] integrated in its network. It was set up in 2010 as a foundation and integrates 41 research centres from very different knowledge fields, following its own activity report 2018.

Besides the mentioned actors in the national R&I systems, there are a wide range of other entities acting in the systems as private enterprises, technology centres, technology parks, technology platforms, non-profit associations etc.

3.2. Energy Innovation systems

For the achievement of the sustainable goals established in the ‘European Green Deal’ the energy sector is crucial. For the transition to a decarbonised economy based on renewable energy, beneficial for the consumers and avoiding energy poverty requires efforts in social and technological innovation. In so far, research and innovation is one fundamental pillar of this transition.

This is in the line with the historical relevance of the energy sector for the national states as the energy provision is essential resources for the economic system. In spite of its focus on market

[4] These research centres are non profit organisations with own juridical personality. A condition to form part of the network is that the centres has been created the Catalan Government or that the Catalan Government is represented in the government board of the centres together with one or more Catalan universities, with other public entities or, in some cases, enterprises or foundations created by enterprises.

regulation of the energy sector, the Commission recognised that "*government intervention may sometimes be necessary to ensure that consumers in all EU countries have access to clean, sustainable and secure energy*" (see EC-DG Energy 2014).

The national energy system is an example of very relevant role of the state, as it is reflected by the National Research Centres especially in the field of nuclear energy as, for instance, in Poland the National Center for Nuclear Research in Świerk, Spain the CIEMAT (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – Centre for Energy, Environmental and Technological Research), the National Centre for Renewable Energies (CENER) and the Maritime Aggregated Research Hydraulic Infrastructures (MARHIS) and in Finland - the VTT— Technical Research Centre of Finland.

Besides there are other relevant public research centres as in Spain a series of technology centres located in the regions as for instance in Catalonia the Catalonia Institute for Energy Research (IREC), in Poland the Centre of Energetics AGH at the Technical university in Kraków and in Finland, the capability center called Smart Energy Systems Competence Center (SENECC), a joint initiative of the Tampere University and VTT, and the Vaasa Energy Institute to mention few as examples**.**

The other relevant actors are the companies acting in the national sector. In Spain, one company Red Eléctrica de España, with a 20% participation of the state; owns almost all of the Spanish high voltage electricity transmission grid. Besides, there several main electricity operators in Spain as Endesa, Iberdrola, Naturgy, EDP Spain, and Viesgo. Additionally, there are emerging some other smaller operators, some of them advocating for renewable energies, proposing now business models in the field e.g. consumer's cooperation. In Finland, there are approximately 75 energy retailers and also a number of consumers who produce electricity on a small-scale and provide it to the market. The energy supply is diversified, and it is provided by regional energy companies that both produce and distribute electricity and are mainly owned by cities and municipalities.

In Poland, the result of ongoing consolidation processes of capital groups in the energy sector is a high degree of concentration. The largest power producing companies in Poland are (as of 2018):

- 43% of electricity production: PGE Polish Energy Group, a public power company, largely controlled by the Polish State Treasury. After the acquisition of the energy companies of the EDF group, this group also became a leader on the sales market to end users.
- 17% of electricity production: Enea SA, a Polish power industry company producing electric power and heat.
- 10% of electricity production: TAURON Polish Energy, an energy holding founded by the Polish Ministry of State Treasury.

In total, these three companies own almost 2/3 of installed capacity and are responsible for about 70% of electricity production in the country. The ten largest companies are responsible for the production of 87% of electricity in the country. Poland still relies on the fossil fuels (mostly coal) for generating around 83% of its electricity. The share of energy from renewable sources was around 15% in 2019, with a limited number of prosumers.

Other actors are the association of enterprises and think tanks as in Spain FUNSEAM or in Poland, the Institute for Renewable Energy, WiseEuropa Institute and Instrat, and in Finland the Finnish Energy (ET) and the EL-TRAN Consortium to mention few as examples.

3.3. Economy Innovation systems

Economy does not appear frequently in the debate about innovation systems, but "*particularly in banking organizations are processes for innovation applied to adaptation, since the financial products and processes require the applicability as the basis for the possibility of generating economic value*" (Casparri et al. 2015: 197). Another relevant area of economic innovation is the digital economy as a current example of service innovation in general, restructuring service processes and creating new markets. These are only few examples of innovation in economic.

Sketching the research and innovation structure in the knowledge field of economy is highly complex, in spite of that its location in the world of higher education is clearly identified at the Faculties of Economic and Business or similar. The complexity is due, first, that economics as most of the social sciences is a very broad field with many subsections. Second, economics has expanded it field of analysis practically to all fields of society. Third, there are acting a series of large, medium and small consultancy or private research centres offering services to enterprises and public authorities. Fourth, economists are very active creating and dismantling research institutes, centres and consultancy in and outside the university.

In all countries, a wide range of economic research groups and centres at universities or linked to universities could be identified. Besides there must be mentioned other public research centres, for instance in Spain the centres integrated in the Spanish Council for Scientific Research CSIC or in Poland the public think-tank the Polish Economic Institute. Besides there are a wide range of private research centres or think tanks, with different degrees of independency of economic actors as enterprises or banks. Another relevant actor as the research centres of financial institutions as in Spain the BBVA, the Caixabank.

There are also a wide range and highly diverse number of private consultancy. There are the big consultancies as PwC, Deloitte, ECORYS; but also medium and small consultancy. They provide services for public and private clients in a broad field of action, as pension system, evolution of the housing market, regional and local development, labour market analysis, education and training policies etc.

At least, the wide range of social actors in the field as entrepreneur associations, chamber of commerce, trade unions among others must be mentioned

4. What means Responsible Research and Innovation

Studies about configuration of innovation systems, coining terms as quadruple and quintuple helix systems, indicate a growing plurality of actors intervening in the different stage of the innovations processes and the diversification of the institutional contexts. This impacts the governance of the

innovation systems. This produced from hierarchical governance mechanism towards steering and regulation mechanisms. This could be observed in higher education system, where is a trend to give higher education institution more autonomy of institutional management and steer the system through financing mechanisms, e.g. increasing the share of competitive financing and the introduction of accountability mechanisms.

A similar process is observable in the innovation systems. The self-management of research funds is increased through public-private partnerships (e.g. technology platforms and joint technology initiatives), formally independent agencies are created to guide the process, e.g. through the the distribution of funds or the creation of knowledge communities with companies, research centres and public authorities.

But given the discontinuity of scientific-technological processes and their long duration, it seems more difficult to create an accountability system that goes beyond bibliometric indicators or patents. In this context the development of the concept of responsible research and innovation must placed that focuses on the quality of the processes themselves by defining six dimensions to increase the social impact:

- Public participation (Inclusiveness) not only of companies, but of society in general through civil society organizations. In other words, it is a matter of further enhancing the opening up the whole process to society at large.
- Gender equality takes up a basic principle of modern European society, namely gender equality, which has prevailed over the past 50 years. It is a question of integrating this principle not only with regard to the research team, but also in its contents.
- Scientific education, includes the principle of distributing scientific-technological knowledge as widely as possible in society by transmitting curiosity and scientific-technological knowledge to young people and other age cohorts.
- Open access to scientific and technological knowledge pursues the same objectives as the previous point and aims to contribute to greater transparency in the processes of knowledge production.
- Ethics is probably the central theme of the concept, which itself derives from changes in the system or from the basic principles of the science-technology system. It is a question of defining the cardinal points that should guide the European science and technology complex. The definition of ethical references for research is the central point for defining responsibility.
- The last point governance refers to strategies how the innovation systems should incorporate at the system level and at the level of each of the institutional actors. the parameters defined above The aim is to make these parameters the standard for research and innovation processes.

According to Owen et al. (2012) this concept has its origins in earlier work in the Netherlands, the UK and the US in the areas of technology assessment [Rip et al. 1995; Schott & Rip 1996; Guston & Sarewitz 2002], anticipatory governance [Karinen & Guston 2010], socio-technical integration, governance from within (midstream modulation) [Fisher et al. 2006; Fisher 2007; Schuurbiers & Fisher 2009; McGregor y Wetmore 2009], public participation and stakeholder participation [Stirling 2005; Wilsdon et al. 2005; Sykes & Macnaghten 2013].

The Commission expressed, in several documents, that RRI is a governance mean of research and innovation processes to respond to the major challenges facing the European Union. In this sense, the concept is born of uncertainty as to whether the efforts made in previous decades really provide solutions to these major challenges. It also responds to the Commission's wish that scientific research should lead to marketable or applicable technological products.

In this sense, the concept expresses a targeted idea of the research processes that must end in marketable innovations to solve the great challenges of modern society. The concept reinforces the idea, already presented in concepts such as the triple helix and the mode 2 of knowledge production, of overcoming the division between science, regulated through public funding, and technology, governed by the economic interests of companies to obtain marketable products and services. Emphasizing the commercialization of innovations prioritizes technological development from the beginning of knowledge production, i.e. scientific research. However, in the last years, a trend can be observed to substituted the idea of marketability for the idea that RRI is a mean to increase the capacity to achieve the sustainable development goals as they defined e.g. in the actual Green deal of the European Union.

4.1. RRI as concept and its alternatives

One common feature of the mapping of RRI in the three countries showed that it is practically unknown by the researchers in the field of economy and energy. This is consistent with findings of the Performe-project done in the nano-technology sector: "*In general, few scientists in the PERFORME interviews devoted much energy to living up to RRI. Many interviewees' stories showed that they largely dismissed RRI requirements because they had difficulty identifying any specific social concerns related to their research*." (Åm 2019:171)

Similar, at the institutional level it is also not used as guiding vision for institutional research policies, except by higher education institutes (HEIs) and research organisation which are involved in RRI projects at European or national level. However, as the example of the Tampere Region in Finland, but also in Spain (Catalonia) and Poland, that the United Nations concept of Sustainable Development Goals is actually a most prominent guiding vision. This concept as others is based in some degree on the same principles as the RRI concept.

Another concept, which is used by institution is the the 'European Charter for Researchers and The Code of Conduct for the Recruitment of Researchers'. The adequate application of the 40 principles of the Charter and Code is recognised by the European Commission through the 'HR Excellence in Research Award'. The Charter and code of conduct includes three of the core elements of RRI as public engagement including science education, gender and ethics.

In conclusion, we observe through the interviews that the concept of RRI has only a limited application in the R&I systems, in the universities and in the behaviour of the academics. An interpretation line could be that the universities are '*incomplete* organisations', in which the hierarchical decision structure is less relevant compared to enterprises or public administration. This is also the fact in higher education systems, in which the university governance is more business oriented as in the UK, the Netherlands, Austria and also Finland.

But this does not imply that the different RRI elements does not play any role in the R&I systems, institutions and in the research and innovation processes. On the contrary, the different elements are increasingly relevant but in different degrees depending on the socio-cultural and political background of the R&I systems.

From the national reports, we conclude that in all three countries the topic of public engagement is a priority. This is in the line with the strategies to implement not only a triple helix, but a quadruple helix structure. It is also in line with the European and national policies to claim for social impact of research. The gender issue seems to have a different degree of priorities, but in the line of the European strategy to conceive it as a transversal issue, it has a relative high impact on research. Ethic is a more diffuse topic, which is often perceived as a mere formal obligation to accomplish regard the treaty of human beings and animals in research and the protection of personal data. In the knowledge fields covered by this project, the topic has less relevance as the research generally does not implies experiments with human beings or animals. Only the topic of personal data has some relevance, but only regard to research in which personal data is used. But this seems to be an exception in both areas. In the next chapter, we expose more in details the findings of the national report.

4.2. RRI Dimension in practice

In this section we expose how the three selected dimension: public engagement, gender equality and ethics are handled in the national/regional R&I system at the researchers' level. As point of reference, we will take in each dimension the definition developed by an EU-expert group in their report on RRI-indicators (Strand et al. 2015). There are several definitions in discussion not only about RRI as a concept but also about the different dimension. From our perspective, it is coherent to use definitions, which has been the base for the elaboration of the degree of implementation of RRI and its elements in practice.

4.2.1 Public engagement or social responsibility of universities

Public engagement: is "*a societal commitment to provide encouragement, opportunities and competences in order to empower citizens to participate in debates around R & I, with potential feedback and feed-forward for the scientific process. Deeper forms of engagement in science and technology, where citizens are peers in the knowledge production, assessment and governance processes, also deserve attention.*" (*ibid* 21)

The national reports show different interpretations of the topic public engagement. Meanwhile, the Finnish report advocates for the interpretation of 'social compromise', the Spanish and Polish reports reflect more the interpretation of 'knowledge transfer' from research first to business and later to society. This second interpretation line is strongly linked to the obtainment of third party funding through cooperation with business and public administration by contractual research, but also to the strategy imposed by the EU to strengthening the University-Business cooperation in

public funded EU research projects e.g. Horizon 2020 but also RIS3 programmes. In this line, the Spanish interviewees tend to make a clear distinction between basic research and knowledge transfer funded outside the research programmes and/or in cooperation with non-academic entities as enterprises or public administration. This interpretation line includes also the aim to achieve a higher degree of commercialisation of the developed solutions for societal challenges. This is, for instance, the case of development of an energy-efficient and environmentally friendly economy.

This aspect of social responsibility is taken in the Finnish report as reference point for the public engagement of universities. For instance, in the energy sector the social responsibility means the sustainable energy solutions which include the perspective from micro and macro level. The environmental responsibility in the field of energy means the willingness to reach climate goals, such as carbon neutrality, by fostering energy efficiency and new energy production, but the most disturbing fact is that very often the solutions are only 'greenwashing'. This could be also observed in the area of economy, where the social responsibility is actually also compromised with sustainability goals. Economic responsibility is very much environmental responsibility and it should be remembered that in every project that there are always unintended and unexpected consequences which must be evaluated and considered broadly also from the environmental and time dimensional perspective.

However, all three reports provide examples of institutional cooperation between universities and society, e.g. local public authorities. In Tarragona, e.g. quadruple helix cooperation was the basis of its approved Excellence initiative: Campus of International Excellence Southern Catalonia (CEICS) or the actual initiative called Extended Campus. In Warsaw's Technical Universities runs several cooperation project, one is based on cooperation with local authorities to promote energy-efficient and environmentally friendly economy. There are also other project running within the H2020 programmes based on quadruple helix cooperation.

In so far, we observe that the universities and the interviewed academics interpreted the public engagement more in the sense of working together with non-academic entities, as intermediator of the societal participation. Public engagement in the sense of empowerment of the citizens considering them as "*peers in the knowledge production, assessment and governance processes"* is less frequent. None of the examples provided by the three reports indicates substantial advances in the implication of citizens as active part of the research and innovation processes.

In a nutshell, in all three innovation systems, we observe the consolidation of triple helix configurations, which different degrees of cooperation among the three types of actors: university/ research centres; enterprises and public authorities. It seems that the Finnish system is based on a consolidated triple helix configuration, meanwhile the reports in Spain and Poland about the situation of the national innovation systems and performance put emphasis on the underperformance of the HEI-Business cooperation in the field of research.

4.2.2 Gender

Gender equality "*has two dimensions: promoting the equal participation of men and women in research activities (the human capital dimension); and the inclusion and integration of gender perspectives in R & I content.*" (*ibid* 26)

The interviews indicate that the 'gender' is conceived in the line of the first dimension mainly as

a) a matter of Staff management in the sense of equal access to work places and hierarchical position in university, research centres and groups, and of equal payment; and
b) a matter of legislation assuring equal rights and treatment.

However, as the Finnish interviewees recognised, there are highly stereotypical professions in which different gender end up in Finnish society, which is general problem in Finland. Similar argued polish interviewees pointing out that involved in there is a larger, deeply rooted social problem in Poland regarding gender inequality, which imped that women are more involved in scientific work. They mentioned also the masculine environment in academia, which allows males to progress faster in the career. Interviewees highlighted that gender equality in staff policies is only one dimension, but there are also other things that provide diversity to the research and innovation actions, such as the way of thinking and the former background for instance in professional field. This vision is shared by the Polish academics, which expressed the opinion that at universities the problem of gender discrimination does not exist and that gender does not matter when assessing competences of researchers. But they share the opinion of deeply rooted social problem in Poland regarding gender inequality.

In Catalonia, this perspective is shared by many of the interviewed academics, but there is also the strong discourse - institutionalised in gender observatories and/or vice-rectorate of gender equality and expressed in strategic plans and report - that in academia exists a gender discrimination as in the society as a whole and strategic action must be taken to achieve equality.

But this vision on gender has no reflection on research itself, in the inclusion and integration of gender perspectives in R & I contents. The interviewees in the three countries concede less relevance of the gender issue for guiding research. Only few researchers mentioned it as an issue to have in mind for research and innovation. This is the case of one economic researcher in the field of energy considering that gender is a highly relevant subject to take into account. Also for another Catalan economic research group gender is highly relevant as research perspective but now integrated in the broader perspective of social inclusion or exclusion.

In a nutshell, gender equality is perceived as a question of staff management. The problem to achieve gender equality here is considered a social problem of the masculinised environment in academia, and deeply rooted patterns of behaviour. In Finland and Poland, for different reason, the gender issue seems to be less relevant compared to Spain, where it is a main topic in the general public debate and in the debate of higher education policies. The inclusion of gender perspective in research contents is not a question of debate except the research which addressed specifically gender or in some areas of economics – as labour market research, on which the gender perspective is generalised in the analysis.

4.2.3 Ethics

Ethics refers following the *EC (2012:3*) to shared European values. "*In order to adequately respond to societal challenges, research and innovation must respect fundamental rights and the highest ethical standards. Beyond the mandatory legal aspects, this aims to ensure increased societal relevance and acceptability of research and innovation outcomes. Ethics should not be perceived as a constraint to research and innovation, but rather as a way of ensuring high quality results*."

This general orientation of ethic of the interviewees in the three countries is more centred on the research and the new configuration of the innovation systems. The Polish report stated that in scientific research, "*ethics is a set of commonly accepted norms specifying: (1) what is and is not acceptable in research; (2) sensitivity to the ethical dimension of intended research. One should know what is needed to be discussed, even when ethical aspects are difficult and ambiguous*." In this sense, it is the traditional ethic of research and its code of behaviour. But the recent years have brought new ethical challenges, which are linked on one side to the change towards a quadruple helix system and the stronger competition within the research system, and on the other side, to social and technological development of artificial intelligence and the increasing digitization, issues of ecology and genetics.

Similar, the Finnish report state that the ethical responsibility means responsible behaviour when using funds collected by taxation. This also means that there should not be any conflict in interests. An example of ethical problem is that a political interest or a lust for power may be the prime motivator to act, which harms the co-operation. Ethical responsibilities involving intellectual property rights (IPR), General Data Protection Regulations (GDPR) or Procurement have clear legislation for these areas and therefore these seldom crate problems. In social dimension the ethical questions may be vaguer and therefore interviewees commented that they use dialogue when the ethical issues occur. To promote responsibility and to solve ethical dilemmas in research and innovation there is need to focus to the ability to co-operate with different actors in multi-dimensional way and to understand the necessity of scientifically diverse perspectives in innovation process.

Responsibility in research and innovation is value-based and therefore needs broad engagement with people affected and in large in society. Also, the problems in society are so challenging that the multi-dimensional co-operation is evident. Therefore, the broad engagement to the responsible research and innovation is necessary and perspectives are widening only from technological also to the societal. Nowadays in research and innovation there is almost in every project for instance a '360 degrees' or 'systemic' impact evaluation in advance. Ethics and trustworthiness are valued in research institutions and among researchers, which promote the willingness to underline the responsibility dimension in projects. The main risk promoting responsible research and innovation is that the research funding is short-term and may be at risk for political intervention.

The Spanish report focused more on the institutional level stating that having an ethic committee is standard for universities and having established code of conduct of good research. It calls the attention, that ethics as topic is more related to science areas with clinical research, experiments

with humans or animals. But in knowledge areas as energy and economics, ethics questions are less important except in the research which is using personal data as e.g. the project carried out with the insurance sector.

Some researcher argued also about the ethics in the area of big data, but not regard to the use of big data, where ethics norms are established, but in the generation of applications which could have serious ethical implications. In this direction points also the Polish report, when it cited an interviewee regard the application of innovations: "*The responsibility at the researcher's level is not the key. Because in fact innovation becomes unethical later, at the stage of implementation (...) At the level of research and innovation, it's easier to say that I develop science."*

At least, it is also a shared impression that ethics does not play a mayor role in the university debate or for the individual researcher, but when the researchers expressed their opinion about ethic in their daily work they expressed concerns, which go beyond the general statement of the linkage to fundamental rights talking about ethics in the changing configuration of R&I systems and its implication for research.

4.3. Concluding remarks on the implementation of RRI

The analysis of the relevance of three core RRI-dimension in R&I systems showed that regard public engagement and gender, the praxis falls behind the definition proposed by the EU-expert group (Strand 2015). Public engagement is mainly linked to the triple helix configuration of R&I systems and the need of the university to obtain third party funds. Less relevant is the empowerment of the citizens considering them as peers in the innovation processes. Steps towards a quadruple helix innovation system in the sense of more open, transparent and democratic R&I systems are still pending.

Similar can be said for gender, which is of high priority in the European agenda. It is transversally included in all political area. In the three R&I systems, gender is mainly conceived as an HH.RR. topic aimed to achieve equal access to positions in the system. The interviewees in all three systems admit that this objective is still not fully achieved due more to the masculinised patterns of behaviour and attitudes in society and R&I system, which are difficult to change. The objective of the inclusion and integration of gender perspectives in R & I content is practically absent in the narratives in the R&I systems.[5]

On the other side, ethics seems to play a minor role in the academic discourse, assuming that the 'natural' behaviour of researchers are guided by the ethic research standards. Its relevance seems to be restricted to some concrete areas e.g. health research. But the reflections of interviewees go beyond the common definition of ethics in the frame of the RRI concept, which put in the foreground fundamental rights. Besides the traditional ethic standards of good scientific behaviour, the reflections address the implication of the changes in the mode of knowledge generation towards a mayor cooperation with non-academic actors in the processes and the need to make transparent the non-academic interests, which are co-driving great part of the research.

[5] We do here refer to staff in the R&I systems, which are not gender expert.

5. Conclusion

The three countries covered by the RRIL project shows different features. Following the Innovation Scoreboard of the EU, Finland is an Innovation leader, meanwhile Poland and Spain are moderate innovators. Looking at the regional level, the regions are more similar compared to the states. Länsi-Suomi (FI19) considered as an Innovation Leader and behind region of Helsinki-Uusimaa (FI1B) the driver of innovation in Finland. In Spain, Catalonia is together with Madrid and the Basque Country the innovation driver and considered by the Regional Innovation Scoreboard as a Moderate + Innovator. The same consideration received the Polish region Warszawski stoleczny, which is the innovation driver in Poland. It can be assumed that a look on the metropolitan areas of Tampere, Warsaw and Barcelona would probably show that they are all innovation leaders not only in their country but also in Europa. Another consideration would receive the region of Camp-Tarragona, which is would not be fall in this category except in the field of chemistry and chemical engineering.

Regard to the governance structure of the research and innovation system, the description of the three countries shows that in Finland and Poland the steering competences lies at the state level, but with the regional and local authorities as relevant actors. On the contrary, in Spain the steering competences are shared between the central state and the regional governments. The cities play a minor role related to concrete projects of urban innovation.

The analysis of the relevance of RRI-principles in R&I systems is difficult due to fact that universities, who has been the main objective of our analysis, are considered incomplete organisation compared to the hierarchical structured enterprise. In incomplete organisation, the workers – in our case the academics – maintain a considerable autonomy in front of the higher management (presidency or rectorate). The application of RRI principles as social compromise, gender and ethics depends highly on the policies of the faculties, departments, research centres and groups, and at least on the individual researcher.

In spite of the difference in the R&I systems, our analysis showed that RRI as an integrated concept has a low relevance for the system steering, but also for the institutional governance. At the level of the researchers, RRI is even less relevant. Naturally, there are some exceptions of this general statement. RRI has certain relevance in some universities, research and technology centres as a guiding vision, overall these organisations which are engaged to European projects on this issue as the example of the Catalan region indicates. But our analysis shows also, that the different RRI principle are relevant for guiding research & innovation strategies.

A detailed analysis of the strategic relevance of the three dimension selected by the RRIL project: public engagement, gender and ethics shows a differentiated picture. First at all, the narrative on these topics are different to the definition promotes by the EU-documents. This is evident of the topic of public engagement, which in the narratives of the interviewees is linked to the triple helix configuration, but not to the empowerment of the citizens to become peers in the knowledge creation process in the sense of building up quadruple helix configuration in the sense of more open, transparent and democratic innovation systems. One interpretation is that it is an intentioned effect of the promotion of triple helix configuration in the whole EU innovation systems and the

increase of the dependence on third party funding. In so far, the topic of public engagement and social compromise is highly relevant for all three R&I countries, but with a different degree of implementation. Finland and Catalonia have make substantial steps forward in the setting-up of triple helix configuration, meanwhile Poland seems to be a step behind. In all three countries, we observe less efforts to make step forwards to the empowerment of citizens in the innovation processes.

Also regard gender equality there are difference between the perception of the interviewees and the definitions of the RRI. Both coincide in the interpretation of the the equal participation of men and women in research activities, which is overall a question of Staff Management. But meanwhile the Finnish and the Polish report stated that the interviewees do not perceive gender discrimination in academia, but patterns of behaviour, which impedes women to have the same chance to access to upper hierarchical positions, in Catalan universities there is a relatively strong discourse observing gender discrimination in staff management and the need to develop institutional strategies to achieve gender balances. On the other side, the second dimension of the inclusion of gender perspective in R&I contents is not present in practice in none of the national R&I systems except some specific knowledge areas e.g. labour market research or specific gender research areas. In a nutshell, the topic gender has no high relevance in Finland or Poland, but in Catalonia, where it is discursively of high priority at university and in society as general.

The topic of ethic seems to be even less relevant in practice and discourses of the researchers, with the exception of the areas in which the objectives of research are human beings or animals, or in which the research is treating personal data. But the reflection of the interviewees in the inquiry of the project, shows an orientation of this topic to problems emerging in the triple helix configurations, the stronger cooperation with enterprises and public authorities and its inappropriate use outside research. The use of big data for the development of application to steer social behaviour is one example for the new ethical question emerging in research systems strongly oriented to applicable innovation. Economy is another good example for the interwovenness of academic research and political strategies questioning the independency of academic research from political interest.

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To consult the references used to elaborate the national reports, please consult the reports available at dia-e-logos.eu and also at RRIL Project space at research gate:

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Responsible Research & Innovation (RRI) is a genius concept developed by the European Commission for the governance of research and innovation processes with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products. It aims to shape, maintain, develop, coordinate an align existing and novel research and innovation-related processes, actors and responsibilities with a view to ensuring desirable and acceptable research outcomes.

RRIL – Responsible Research and Innovation Learning will develop and test learning modules focusing on three core dimension of RRI: public engagement, gender equality and ethics based on interactive real-problem approaches. Previously, the implementation of RRI and its principles in the R&I systems of Finland, Poland and Spain (Catalonia) has been analysed based on desk research and series of interviews. The results are presented now in a series of 4 discussion papers (DP) by dia-e-logos:

DP 1: Responsible Research & Innovation in Catalonia
DP 2: Responsible Research & Innovation in Finland
DP 3: Responsible Research & Innovation in Poland
DP 4: Responsible Research & Innovation in three EU-countries

The reports are the inputs for co-creation and open innovation processes giving a prominent role to the learners. The co-creation is conceived as informed learning among practitioners as knowledgeable and critical partners in designing and implementation of the learning means.