CHERRIES
RESPONSIBLE HEALTHCARE ECOSYSTEMS

TERRITORIAL MAPPING REPORT ÖREBRO

WP2 - Deliverable 2.2

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Constructing Healthcare Environments Through Responsible Research Innovation and Entrepreneurship Strategies, CHERRIES project will support Responsible, Research and Innovation (RRI) policy experiments in the healthcare sector in three European territories: Murcia (ES), Örebro (SE) and the Republic of Cyprus (CY).

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EXECUTIVE SUMMARY

CHERRIES engages ecosystems in South-West Europe (**Murcia ES**), Northern Europe (**Örebro SE**) and South-East Europe (**Republic of Cyprus CY**). The territorial preconditions and development paths are varying. While the size and population of the territories are similar, the administrative, economic, and innovation systems have major differences. What is the influence of these differences on the capacity of the regions to develop demand-driven health innovations; what are drivers and barriers, and what is the policy mix that supports territorial responsible research and innovation in healthcare?

Based on the mapping guidelines (D2.1), the three territorial ecosystems have been mapped. The mappings scrutinised the central **actors** in the territorial healthcare systems, their innovation behaviour and **capabilities, priorities, needs and observable trends**. Further, the policy instruments determining the innovation policy mix were analysed. The methodology builds upon a mixed-method ranging from desk research, expert interviews to bibliometrics indicators and networks. The European Commission (EC) describes its policy for **responsible research and innovation (RRI)** as diverse sets of societal actors (researchers, citizens, policymakers, business, third sector organizations, etc.) that "*work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs, and expectations of society*". The major mechanism for bringing actors together is public engagement, one of the EC's six RRI 'keys' along with ethics, gender equality, governance, open science, and science education. The capacity to support territorial health innovations in an engaging and responsible way is central to the experimentation phase in CHERRIES.

The executive summary brings together the main findings from mapping the actors and stakeholders (section 1), the policy context (section 2), and mapping of context and content in relation to smart specialisation (section 3). The extended mapping results are available in these sections; the methodology is provided in each section and referring to further documentation for details. The report comprises an understanding of the specificities of a territory, including the peculiarities of its economic structure, the idiosyncrasies of its institutions, the character of its political culture and policy-mix and its relational connections as well as the status for RRI implementation. These territorial development paths serve a baseline for further interventions (WP3 and WP4) into these systems, and subsequent monitoring (WP6).

Innovation from a responsible territorial perspective

'Smart Specialisation' is an innovation policy concept intended to promote the efficient and effective use of public investment in research. Its goal is to boost regional (territorial) science and innovation in order to achieve economic growth and prosperity, by enabling regions to focus on their strengths. This approach understands that spreading investment too thinly across several frontier fields risks limiting the impact in any one area.

The complementarities between both Responsible Research and Innovation (RRI) and Smart Specialisation (RIS3) approaches rely on some of the characteristics that differ between them. The RIS3 policy is primarily oriented towards regional competitiveness and therefore does not fully incorporate local institutions and notions of social value or choice. On the other hand, neither the theory, policy nor practice of RRI pays attention to the spatial dimension of innovation processes, which is central in RIS3 approaches. In that sense, RRI ignores the various ways in which regional context affects not only the development of innovation

but also the perception of what is responsible and socially desirable, understanding that knowledge and resources which are necessary for innovation - labor mobility, R&D collaboration- are all regional. Thus, from the innovation studies literature, we know that innovation processes are socially and spatially embedded, as the regional context creates conditions for knowledge acquisition and learning. Overall, these two approaches share their origins as a policy concept rather than a theoretically motivated framework that argues for broad stakeholder involvement in the development of research and innovation policy and the need for R&I to be oriented towards solving grand societal challenges SGC.

Actors and stakeholders supporting healthcare & innovation

In **Sweden**, responsibility for health and medical care is divided between the national government, territories, and municipalities. The foundation of Swedish health and medical care is public, but private alternatives do exist. Most private caregivers have agreements with territories. The **Örebro County** is the healthcare provider running several healthcare centres, and three hospitals with 8000 employees. Life expectancy in Sweden is among the highest in the EU. The health system performs well in providing good access to high-quality care, but at a relatively high cost. While most Swedish people enjoy good health in old age, a growing number of people over age 65 have some chronic diseases and disabilities, thus increasing demands on health and long-term care systems. The recent SOU report (2020) refers particularly to Elderly care during the pandemics and reflected on the un-preparedness of the health system. The responsibility for provision of good health care to the elderly is shared by the county's municipalities and Region Örebro County. Municipal nurses and occupational therapists, Region Örebro County doctors and physiotherapists at primary care centres are responsible for different treatment measures.The health system faces persisting challenges in providing equal access to care to the population living in remote regions, ensuring timely access to health services and achieving greater care coordination for people with chronic diseases (European Commission, 2019).

The greater Örebro (Östra Mellansverige) region is regarded as an **innovation leader** in the European landscape. A similar indication of the innovative behaviour of the region is given by the public and business R&D expenditures, which are among the highest in Europe. These indications suggest that Örebro has the experience in its close vicinity for achieving advanced innovation and therefore could try to realise pilots in ambitious fields without taking too much risk. However, while the general performance of the Swedish R&D system on the supply side is very good, there is a need to improving the links between research and innovation because of the alleged inefficiency of turning the heavy investments in R&D into innovation-based economic growth. The national science and innovation system is dominated by two major agencies in the R&I policy area, the Swedish Research Council (Vetenskapsrådet VR) and the Swedish Agency for Innovation Systems (Verket för Innovationssystem, VINNOVA), who both distribute funding for research and innovation in open calls and in specific areas and programs on instruction by the government. Especially VINNOVA puts a strong emphasis on academy-industry collaboration and Triple Helix (knowledge triangle) collaboration, with a variety of programs for academic research environments, start-ups, and innovation in established firms (Hallonsten & Slavcheva, 2018). Life sciences are a long term priority in Sweden. The publicly funded research and innovation system of the Örebro County is compact and focused on three main activities; tech-transfer, incubation, and business development.

As a result of the stakeholders'mapping exercise, the most prominent actors registered in Örebro are the Public Administration (PA, 24) and Civil Society Organizations (CSO, 19). The majority of the institutions work on a regional scale. The main Education institution in the region is the University of Örebro.

According to the 4P model, there are 6 healthcare **providers** (3 municipal and 3 regional), 3 social companies located in Karlskoga, Public health actors, churches, and CSOs. **Patients** are represented by 18 Patient-orientated stakeholders and one CSO. The **Policymakers** category is made up of 9 regional or municipal Public Administration institutions. The key stakeholders are distributed across all the organizations' typologies, albeit that private companies are underrepresented and most socially oriented.
In the Örebro region, the regional level Public Administration institutions, Healthcare providers, and one Network institution (*Partnerskapet för sociala innovationer*) are most relevant to working together in health innovation experiments. Likewise, a CSO umbrella organization (Möckelnfore ningarna) and the University of Örebro are considered part of the core group.

Policies in RRI

For many years, Sweden has invested heavily in research and development, with considerable R&D expenditure in relation to GDP. Furthermore, in international comparison, Sweden is a country with a high percentage of researchers in the population, a high percentage of scientific publications per inhabitant, and a population that has great trust in research. The Swedish Research Council (VR) has chosen three overarching themes to indicate the future choices for Swedish research strategy: *Knowledge, quality, and integrity*. Research is and shall be the starting point for the knowledge and knowledge accumulation that shall form the foundation for societal development and welfare, business competitiveness, and solutions to the societal challenges we are facing. The themes are translated into twelve items that are particularly urgent for achieving a Swedish research system of world-class. Of those items, there are a few that refer to RRI keys: 9. Promotion of Gender equality in funding; 10. Establish a national code of conduct for good research practice & scientific misconduct and awareness on research ethics; 11. Enable the transition to Open Access to scientific publications and develop a national strategy to open research data; 12. Strengthening and coordination of Science communication, and new infrastructures for knowledge dissemination. There is no specific mention of how research should engage with the public and stakeholders.

Smart specialization

The smart specialization priorities defined in 2016 within the Örebro region (Region örebro län, 2016) focus on 4 main topics that have interrelations. These topics are: Logistics, Food, Advanced manufacturing, and Health and social care. In terms of health care, Örebro set out to prioritise open social efforts, accommodative health care, and general health and healthcare. Additionally, Örebro seeks to improve its capabilities in health robotics in a collaboration between the advanced manufacturing and health care sector. In the Örebro region, private organisations are primarily specialized in metal processing and manufacturing.

In order to specify a place-based approach to smart specialisation in times of Grand societal challenges, locally and historically situated discourses and practices need to be taken into account for aligning research and society. The mapping of the regional capacity in science and technology shows that:

- Based on the publication data (2018), Örebro has shown **High Scientific diversity** and **High Scientific Complexity indicators** values. Diversity matters because regions are more likely to expand and diversify into new topics and fields that are closely related to their existing activities. The complexity of knowledge matters because it allows regions to produce idiosyncratic knowledge that few other regions can make.
- Publication data further indicate **Active Ageing**, which relates to the WHO priority connected to “Assistive health/rehabilitation” as the most occurring category in relation to knowledge production. As

an example, this includes **Nursing** and **Caring Science** as well as the carers' interactions with older patients. Also, connection with dementia care and life to death experiences. University of Örebro, Örebro Regional Development Council, and Örebro University Hospital are the dominant publishing institutions.

- The **relatedness indicator** measures the main strength and capabilities already present in the region from the scientific perspective, as shown by the **Revealed comparative advantage (RCA).** Örebro has an all-round representation of scientific subfields, however, fields in relation to *Biomedical and Health Science* are most dense, confirming the regional priority in the health sector. Fields with a high RCA compared to European partners are e.g., in **Gerontology**, which allows for a better chance to specialize in close fields such as **Rehabilitation,** that appear adjacent in the map. Interesting is also the fact that cross-disciplinary fields such as **Nursing**, Gerontology, **Psychology**, Rehabilitation that involve activities from two or more academic disciplines, overlap in two mentioned clusters (Social Science and Humanities and Biomedical and Health Science).
- Further breakdown in microfields reveals that in the top 10 the following fields stand out: “Automation & Control Systems” category, relating to **Robotics** and Artificial Intelligence, **Gastroenterology and Hepatology** (digestive diseases and inflammatory bowel diseases**) Infectious diseases** (sexually transmitted infections - STIs) and **Surgery** (surgical oncoloy, obesity and gastric bypass) as well as the **Otorhinolaryngology** field.
- **Patent analysis** registered in Örebro revealed 1.912 patents (years 1979-2019) across technological fields, where the sectors “other special machines”, “Machine tools and Civil engineering” appeared as the sectors where the majority of patents were listed. In the Health sector category (63 patents), the Medical Technology sector has 70% of the patents compared to pharmaceutical and biotechnology. The content of the patents from “medical technology” are related to implants, and patents dedicated to the construction of vehicles for the disabled, wheelchairs, chairs for conveying a person with limited ability to move, or devices for supporting and stabilizing an injured person.
- Priorities informed by the regional actors indicate another range of demand-driven priorities: **Older adults and issues related to Mental Health**. This, in connection with **Robotics**, a field that may be a potential source of solutions for the identified priorities. The goal is to tackle problems that deal with isolation and emotional well-being of the elderly group. This situation became particularly problematic during the current pandemic of Covid-19.
- A selection of **European projects** funded by Horizon 2020 (CORDIS database) and concerning priorities stressed by Örebro region show three initiatives.These projects deal with Culture aware robots for Elderly support, platforms supporting independent living of the elder at home, and a Ph.D. training to develop the field of Social Robotics with an application focus on Robotics in Eldercare. Örebro University is the regional participant organisation.

Our approach may assist policymakers in designing and implementing RIS3 strategies that not only promote smart (i.e. competitive) but also inclusive and sustainable regional economic development. By combining information on the relative strength of regional knowledge production activities (e.g. science and technology that is linked to global developments) with information about regional stakeholders, local needs, and policies, we can thus specify priorities that can help to maximise the regional development potentials.

It further shows that scientific capacities that could be useful for regional development, are not necessarily recognized by actors operating with demand driven regional needs, such as robotics. And similarly, the knowledge base that is important for the regional needs, are present but not well aligned with the actors.

Demand-driven research priority setting for funding schemes is very much in sync with RRI, but the Smart specialisation paradigm doesn't seem to include regional needs.

Reflection process on RRI implementation

Based on the initial mapping results, a discussion with territorial stakeholders about benefits, barriers and strategies for the implementation of RRI based measures started. The reflection process began during the last quarter of the year 2020 (Q4) and also in connection to CHERRIE'S WP3. Training activities were performed based on Task T3.2 "Training key stakeholder and need identification processes" in the three regions involved in CHERRIES experimentations, whose general aim was to establish the territorial experimentation process, prepare the stakeholders' system (territorial multipliers and key stakeholders) for the RRI based demand articulation, facilitating bottom-up RRI and need articulation processes, experimentation and to the co-creation process.

The training supported a learning process aimed at helping healthcare and R&I stakeholders to reflect about how to identify potential for RRI principles and approaches within the institutions that aim at increasing the service delivery quality for patients as well as to identify innovation needs and how to articulate them within and between organisations for the territorial network. This process served as an entry point for the embeddedness of RRI at the institutional level and for triggering a more open and reflexive behaviour in a broad set of relevant territorial actors. The implementation of these activities resulted in one training workshop in each of the three regions involved in the CHERRIES experimentations and through the delivering of online resources.

Besides the training workshops, the preparation stage was developed based upon bilateral meetings. The training activities were supported by K&I and conducted in coordination with the establishment of the territorial experimentation process and the finalisation of the experiment design (T3.3) and with the preparation and the publication of the Call for needs (T4.1). Task T3.2 builds on the Stakeholders Mapping exercise started in the first stage of the project (WP2) and on the development of the CHERRIES Toolbox (T3.1).

The outcomes of these activities produced relevant up-to-date information about RRI oriented actors engaged in projects, in keys areas or initiatives identified during informal meetings and through the training workshops. The reports of these activities are at this time in local language and a further translation of the content will be integrated into the Synthesis report (task 2.2 & 2.4). However, the final round of consultation with the territorial teams to update any further information identified during the preparation and dissemination of the Call for needs and call for solution in the territory will be addressed during the reflection workshop to be conducted in March 2021, where an interregional and regional discussion will take place.

1. MAPPING STAKEHOLDERS IN THE HEALTH AND INNOVATION SECTOR – Örebro region

The European Commission (EC) conception of RRI emerged from its science with and for society (SwafS) policies and R&D work programmes. The EC describes RRI as diverse sets of societal actors (researchers, citizens, policymakers, business, third sector organizations, etc.) that "*work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs, and expectations of society*". The major mechanism for bringing actors together is public engagement, one of the EC's six RRI 'keys' along with ethics, gender equality, governance, open science, and science education. In that regard, CHERRIES project considers the bottom-up involvement of all kind of citizens, irrespective of their age, gender, ethnicity, and socio-economic background as one of its pillars (European Commission, 2018[1]).

The development of the Territorial mapping activities for CHERRIES project encompassed the mapping of relevant actors in the Health and Innovation landscape as one of the central activities during the first year of the project (2020). The engagement process has been also developed considering the adverse circumstances of the current pandemic of Covid-19. The regional partners have faced difficulties due to the physical distance restrictions that do not allow gatherings and events dedicated to the involvement process. In addition, one of the most important actors such as Hospitals and Health-related institutions (Providers), need to attend to issues of higher priority for public health during the pandemic contention. That means the engagement process has been delayed and disrupted by this unexpected scenario. However, and despite the obstacles, the regional partners have conducted a substantial effort to follow the mapping exercise.

The following results are framed in task 2.2, "*Mapping Health and Innovation sector in the pilot territories",* and were steered by the territorial actors supported by Leiden University. This Work package is conducted in collaboration with WP6 responsible for the Monitoring, evaluation, and impact assessment to secure the projects' overall impact.

1.1 Identification and assessment of territorial actors

The mapping exercise follows the methodological approach recommended in the document "GUIDELINE FOR TERRITORIAL MAPPING WP2 - Deliverable 2.1", part of WP2. The process involved the following 4 steps: 1) *Identification of stakeholders from current regional network* 2) *Addition of potential new partners from datasets* 3) *Selection criteria for stakeholders* 4) *Categorize stakeholders regarding their degree of involvement in the project.*

The results of steps 1 and 2 provide an overview of the distribution and rrepresentation of the different types of organizations identified by the region. Figure 1 displays the number of Institutions classified by each category and the geographical scope or territorial scale in which the institutions develop their activities.

[1] European Commission (2018) Science with and for Society. Work Programme 2018-2020.

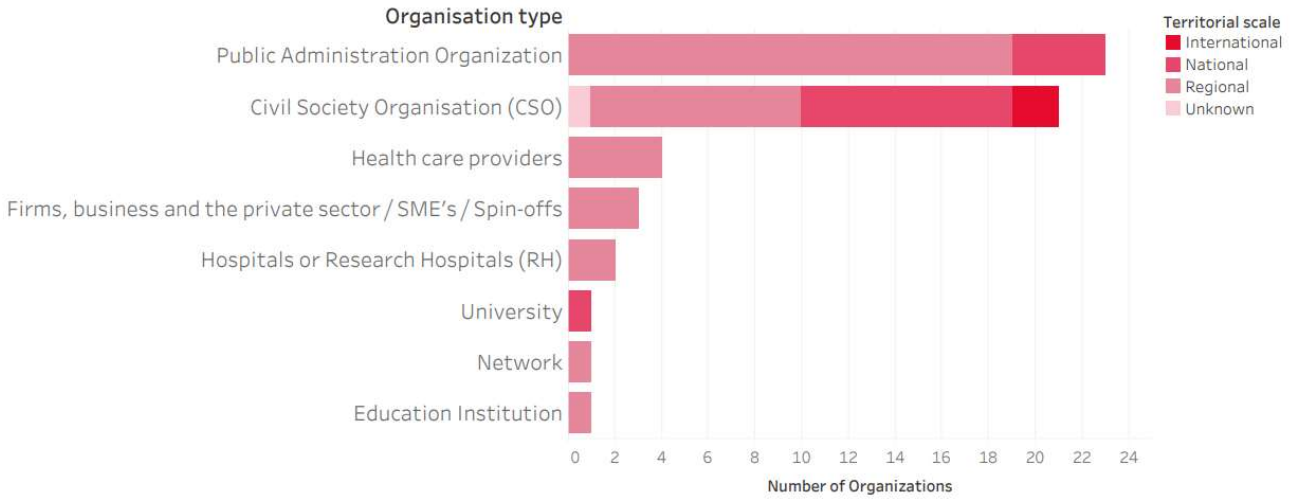


Figure 1.The number of institutions per each organization type and the territorial scale they perform.

For Örebro the most prominent actors registered are the Public Administration (PA) and Civil Society Organizations (CSO). Both categories exhibit geographical focus ranging from Regional to International scale. The region recognized 3 different types of Civil Society Organizations depending on their profile, incorporating CSO which is a parish in Östra Värmland's contract in Karlstad diocese and other Umbrella Organization. The majority of the institutions reveal the regional scale as their geographical scope. The main Education institution in the region is the University of Örebro.

The 4P model results include as **Providers**; 6 healthcare providers (3 municipal and 3 regional), 3 social companies located in Karlskoga, Public health actors, churches, and CSOs. **Patients** are formed by 18 Patient-orientated stakeholders and one CSO. **Policymakers** category is made up of 14 regional and 4 national Public Administration institutions.

The following Figure displays the results of all the regional actors recognized in the local ecosystem in Örebro by implementing the aforementioned steps 1 to 4. It covers information regarding the categorization of the groups of actors and stakeholders concerning their **level of importance.** This, is based on a set of criteria that led to values ranging from 1-3, where 1 = Less relevant; 2 = Important and 3 = Extremely important. As a result of the assessment, and applying the regional perspective each one of the actors was classified by their (potential) **degree of involvement** in the project, creating operative groups of stakeholders according to their interest and role in the project.

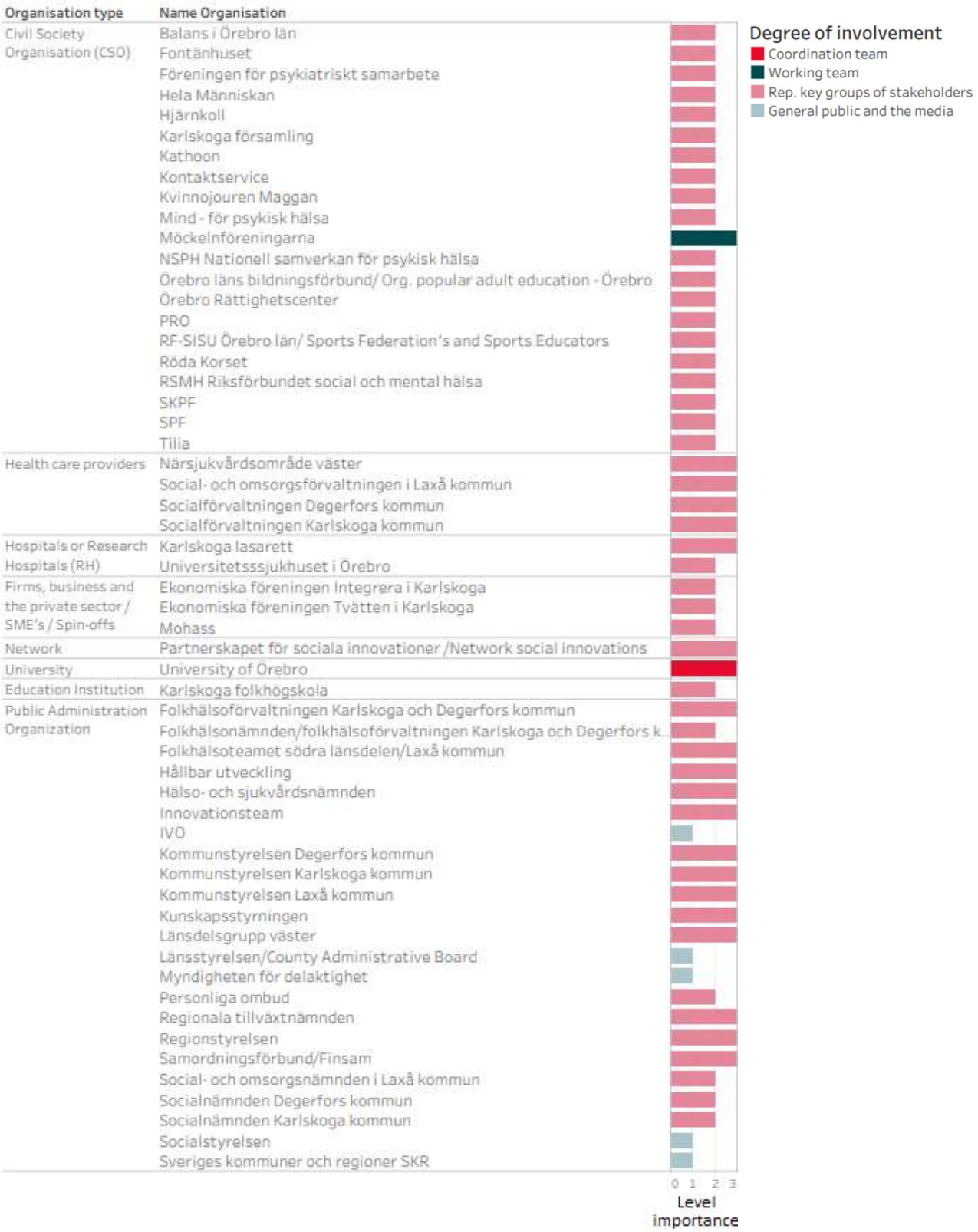


Figure 2. Identification of stakeholders in Örebro, classified by their type of organization, the Level of importance and their Degree of Involvement.

From Figure 2 we note the relevance of the actors at the regional level set Public Administration institutions, Healthcare providers, Higher Education Institution (University), and one Network institution (*Partnerskapet för sociala innovationer*) with the highest "*Level of importance"*. Likewise, a CSO umbrella organization and the University of Örebro are considered part of the core group and classified into the Coordination and working teams categories. The representatives of Key stakeholders are distributed across all the organizations' typologies, which shows a heterogeneous composition of the actors considered "important" (score=2). Regarding the General and the public media categorization, we found governmental institutions from the Public Administration sector such as IVO, County Administrative Board (*Länsstyrelsen*), and Swedish Association of Local Authorities and Regions (*Sveriges kommuner och regioner SKR*).

To visualize the composition of the Coordination and Working Team with the 4P model, Figure 3 depicts the following organizations:

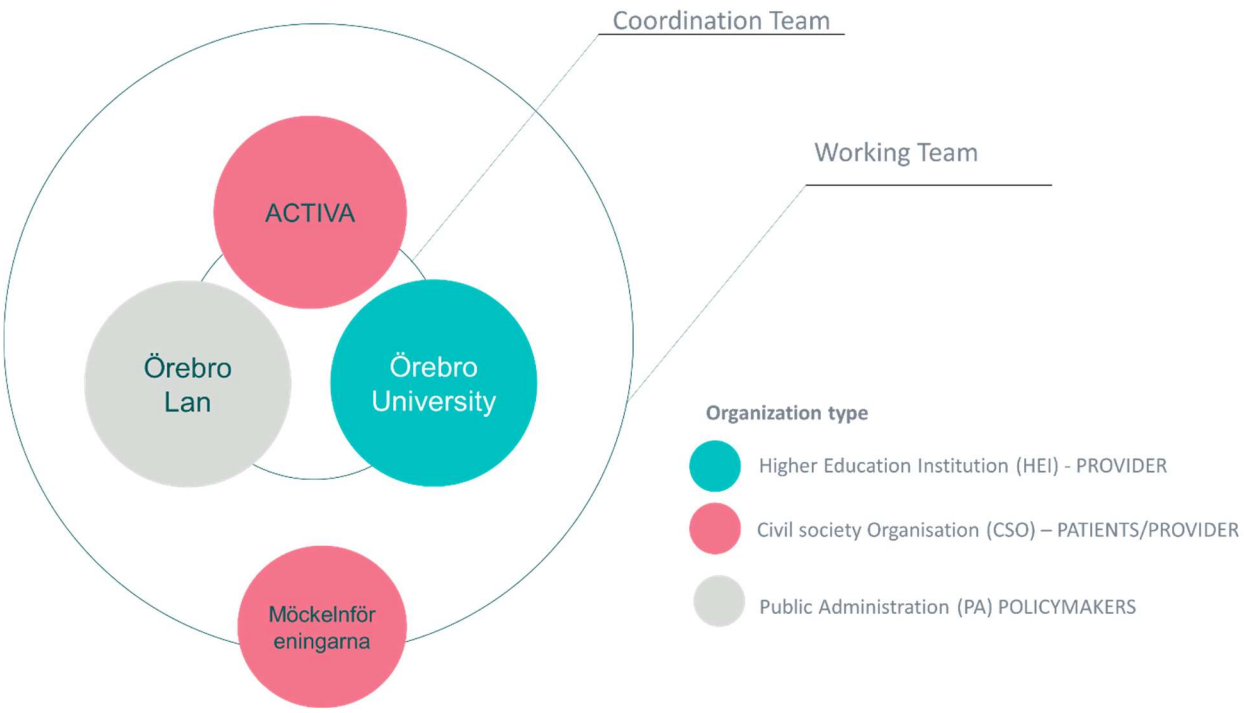


Figure 3. Diagram representing the results of the "Degree of Involvement" of the regional actors from the Health and Innovation sector in Örebro .

The engagement process is currently being developed by the Örebro region in coordination with task 2.4. This being carried as a Reflection on Territorial RRI implementation and future potentials in the Healthcare sector.

From University of Örebro the sectors involved includes the **Social Impact Lab,** an innovation environment and a programme that focuses on innovations for social sustainability, and the **Artificial Intelligence Lab**. This is aligned with the interest of the region in conducting the innovation pilot in connection to Robotics.
We acknowledge that in the successive stages of the project, the current list of stakeholders may experience changes due to the engagement process being currently developed in the reflection phase part of

CHERRIES project. These activities entail the implementation of workshops, meetings, and interviews that can show potential new partners to be involved in the project, and on the other hand, the operational group categorization will adjust under the interest and participation shown during the engagement activities.

2. POLICY MAPPING ON TERRITORIAL R&I HEALTHCARE ECOSYSTEMS

2.1 International policy instruments

The analysis of the policy instruments at international level enabled us to comprehend the connection between international-umbrella policies and guidelines, and their National or regional policies adapted to the local context. Most of the documents are elaborated by the World Health Organization and the European Commission. This task addressed 4 policy domains; Responsible Research and Innovation, Smart Specialization Strategies, Healthcare & Innovation, and its results are presented below, where main documents are highlighted.

2.1.1 Responsible Research and Innovation

For almost a decade, the RRI approach to research and innovation policy has gathered traction and it is now a cross-cutting issue in the **European Union's Framework Programme for Research and Innovation in the European Research Area** (Horizon 2020) as well as a part of **Science with and for Society Work Programme** (SWAFS). RRI and its approach seek to focus on research and the products of innovation to achieve benefits in the social and environmental realms.

The **SWAFS (Science with and for Society) Work Programme 2018-2020 (WP18-20)** from latest Horizon 2020 has been developed to reflect and support the evolution of science and society and the increased emphasis on their interplay at national and EU levels. There is recognition that co-design with citizens, stakeholders and end-users needs to be promoted in all policy instruments, including in Horizon 2020.

From this Funding programme several initiatives have been developed towards the incorporation of RRI in the European and International arena. The projects funded by Horizon 2020 have widely created tools to put the RRI concept in practice. These tools consider the development of training materials, strategies, guidelines, methodologies, and databases to enable the discussion at different territorial levels (European Commission, 2018).

2.1.2 RIS3 - Research and Innovation Strategies for Smart Specialisation

Europe 2020 is the EU's growth strategy for the coming decade. The EU aims to become a smart, sustainable and inclusive economy. These three mutually reinforcing priorities should help the EU and the Member States deliver high levels of employment, productivity and social cohesion. Concretely, the Union has set five ambitious objectives – on employment, **innovation**, education, social inclusion and climate/energy – to be reached by 2020. Each Member State has adopted its own national targets in each of these areas. Concrete actions at EU and national levels underpin the strategy. National and regional authorities across Europe shall design smart specialisation strategies in entrepreneurial discovery process, so that the European Structural Investment Funds (ESIF) can be used more efficiently and synergies between different EU, national and regional policies, as well as public and private investments can be increased.

The **Regulation (EU) 1301/2013 of the European Parliament and of the Council of 17 December 2013** is a legal base which defines 'smart specialisation strategy'. The existence of a national or regional smart specialisation strategy in line with the National Reform Program, to leverage private research and innovation expenditure, which complies with the features of well-performing national or regional R&I systems is a prerequisite for the effective and efficient achievement of a specific objective for all investment priorities under thematic objective no 1: Strengthening research, technological development and innovation. More specific guidance for regions and Member States on how to develop and implement regional innovation strategies for smart specialisation is available in the form of a methodological and practical guide. (European Commission, 2014a).

2.1.3 Healthcare policies

World Health Organisation

WHO has a long track record developing normative work and high-level international policy frameworks. The organisation identifies achieving universal coverage as a strategic priority, with the goal of 1 billion more people benefitting from universal health coverage by 2023. This work is supported by normative guidance and agreements; data, research and innovation; and leadership in the realms of diplomacy, advocacy, gender equality, health equity and human rights, multisectoral action, and finance. WHO's work is aligned with SDG target 3.8, which focuses on achieving universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all. The essence of Universal health coverage (UHC) is the access to a strong and resilient people-centred health system with primary care as its foundation. Community-based services, health promotion and disease prevention are key components as well as immunization, which constitutes a strong platform for primary care upon which UHC needs to be built. One of the core documents in this regard is the *Global strategy on human resources for health: Workforce 2030.* The main priorities established by WHO for the Universal health coverage and key policy instruments are detailed as followed

a) **Prevention:** In the European Region, preventable diseases continue to impose a high burden of premature mortality, and unfortunately, simple and cost-effective preventive and curative interventions are underused. WHO/Europe aims to strengthen public health programmes to prevent communicable and noncommunicable diseases, and address risk factors. The organisation has implemented a complete set of policy instruments in topics such as Alcohol use, Antimicrobial resistance, Food safety, Illicit drugs, Nutrition, Oral health, Physical activity, Tobacco, Vaccines and immunization, Violence and injuries. A key document at European level is the *European strategic action plan on antibiotic resistance (2011-2020)*

b) **Health promotion** is the process of empowering people to increase control over their health and its determinants through health literacy efforts and multisectoral action to increase healthy behaviours (e.g. lifestyle advise). In this context a relevant international instruments is: *Promoting health: guide to national implementation of the Shanghai Declaration (2018).* There is also a series of Resolutions that contribute to reducing health inequities.

c) **Therapeutic or palliative care** is related to the treatment of disease or disorders by remedial agents or methods for cure having a beneficial effect on the body or mind (e.g. treatments, products, technologies or

services). Palliative care is recognized in key global mandates and strategies on universal health coverage, non-communicable diseases, and people-centred and integrated health services. Some of the fundamental instruments link to this priority are: *Integrating palliative care and symptom relief into primary health care: a WHO guide for planners, implementers and managers (2018), and Strengthening of palliative care as a component of comprehensive care throughout the life course (2014).* Additionally, a set of documents on integrating palliative care and symptom relief into paediatrics and into responses to humanitarian emergencies and crises are among the Guidelines presented by WHO. At the European level, we highlight the document: *Palliative care for older people: better practices* (2011).

d) **Rehabilitation or assistive care** enables and promotes inclusion and participation, especially of persons with disability, ageing populations, and people with non-communicable diseases, e.g. through hearing aids, wheelchairs, prostheses, and devices. A key document in this topic is Rehabilitation in health systems *(2017).* Other relevant documents provide guidelines on community-based rehabilitation (CBR), the provision of manual wheelchairs in less-resourced settings, and for training personnel in developing countries for prosthetics and orthotics services

European Commission

The European Commission's Directorate for Health and Food Safety (DG SANTE) is the Commission department responsible for EU policy on food safety and health, and for monitoring the implementation of related laws. **The Strategic plan 2016-2020 – Health and Food Safety** sets out the department's vision for a five-year period, up until 2020. EU action in the public health area is mainly linked to incentives and cooperation measures and the actions focus on the following challenges:

- Achieving greater cost-effectiveness
- Competitiveness together with safety
- Tackling emerging global threats such as antimicrobial resistance
- Evidence-based policymaking
- Addressing the risk factors of non-communicable diseases
- Promoting vaccination.

The EU can adopt health legislation under the **Treaty on the Functioning of the European Union: Article 168** (protection of public health)**, Article 114** (approximation of laws), and **Article 153** (social policy). Areas where the EU has adopted legislation include Patients' rights in cross-border healthcare, Pharmaceuticals and medical devices (pharmacovigilance, falsified medicines, clinical trials), Serious cross border health threats, Tobacco, Organs, blood, tissues, and cells.
The Council of the EU can also address recommendations[2] on public health to EU countries. These recommendations address topics concerning the Prevention of drinking of alcohol and drug dependence, Cancer screening, prevention of injury, and the promotion of patient safety, including the prevention and control of healthcare-associated infections. It also covers actions in the field of rare diseases, Smoke-free environments, and Seasonal influenza vaccination.
The main funding schemes or instruments for co-financing are the **Third Health Programme (2014-2020) –** where the Regulation (EU) 282/2014 is the legal basis for the current Health Programme and provides funding to projects on health promotion, health security, and health information. Also, **The Horizon 2020**

[2] https://ec.europa.eu/health/policies/implementation/recommendations_en

research programme supports projects in areas such as biotechnology and medical technologies. EU cohesion policy supports investments in health in EU countries and regions. The European Fund for Strategic Investments.

Moreover, and specifically in relation to Healthcare systems, in 2014 appeared the *Communication from The Commission On effective, accessible, and resilient health systems.* This Communication focuses on effectiveness, or the health systems' ability to produce positive health to improve the health of the population (European Commission, 2014b).

2.1.4 Health & Innovation policies

Transformation of Health and Care in the Digital Single Market

The European Commission is working to provide its citizens access to safe and top quality digital services in health and care. In line with the Commission's Digital Single Market (DSM) strategy and after analysing the results of an Open Public Consultation, the European Commission published a Staff Working Document and a Communication on Digital Transformation of Health and Care in the Digital Single Market, empowering citizens and building a healthier society. These policy documents give direction to EU activities in this field for the coming years.

As part of its Digital Single Market strategy, the European Commission has proposed political measures for ageing well in the Communication on Health and Care. This, acknowledging that Digital technology can help older people to stay healthy, independent, and active at work or in their community for longer and it helps to improve our quality of life.

Also in line with the Ageing well with ICT framework, European policymakers, civil society, professional organisations and the industry have developed a European blueprint to address the challenges in innovating better health and care provisions for the ageing society. A key document is: Blueprint for a digital transformation of health and care in an ageing society

2.2 Research & Innovation ecosystem in Örebro

Sweden is a small, trade- and globally orientated country. In a ranking made by the World Bank, the Swedish economy was number 32 by size in the world in 2011. The total investments in research and development in Sweden – an important input for innovation – constitutes roughly one percent of the world's total R&D investments.
Sweden's R&D intensity (proportion of Sweden's GDP constituted by private and public investments in R&D) has decreased somewhat over the last decade. The statistics for international businesses reveal that large international concerns dominate the investments in R&D in the Swedish industry. They have increased their R&D investments, but primarily outside of Sweden, which represents a considerable challenge (Hallonsten & Slavcheva, 2018).

2.2.1 Main R&I actors and policies

The Swedish innovation system is characterized by a very large academic sector that is almost entirely publicly owned and that consumes more than two-thirds of the governmental appropriations on R&D, and an R&D-intensive business sector dominated by a few very big companies.

As noted, the public side of the R&I system is dominated by the universities, and there is only a marginal role for public research institutes of the type found in many other countries (Hallonsten 2017). The key governing documents for public sector research and innovation are the governmental research bill and energy research bill (both released every four years, last time in 2016), and the national innovation strategy which was issued in 2012 and provides overall guidelines for Swedish innovation policy up to 2020 (Government Offices of Sweden, 2012A). In these and other governmental research and innovation policy documents, the message is often conveyed that the research and innovation system is in a relatively healthy shape but in need of some trimming in order to secure Swedish long-term competitiveness, which is considered to depend a lot on strategic profiling and mobilisation in core areas such as materials science, life science, and climate research, and strengthening the rather weak interaction between academia and industry.

Historically, national Swedish public administration has been characterised by relatively small government ministries (in international comparison) and larger governmental agencies with responsibilities for specific policy areas. There are two major agencies in the R&I policy area, the Swedish Research Council (Vetenskapsrådet) and the Swedish Agency for Innovation Systems (Verket för Innovationssystem, VINNOVA), who both distribute funding for research and innovation in open calls and in specific areas and programs on instruction by the government. They are also important actors in providing policy advice to the government. The Swedish Higher Education Authority (UKÄ) is responsible for the statistics on the higher education sector alongside with Statistics Sweden (SCB).

The creation of the Swedish Agency for Innovation Systems (VINNOVA) in 2000 inaugurated a period of strong emphasis on academy-industry collaboration and Triple Helix (knowledge triangle) collaboration, with a variety of programs for academic research environments, start-ups, and innovation in established firms (Hallonsten & Slavcheva, 2018). Vinnova should be tasked with designing the strategic innovation areas. The projects receiving funds for strategic innovation areas should use social challenges as a starting point, maintain high scientific standards, have a level of co-financing and be able to show new or interdisciplinary collaboration.

The R&I funding landscape is complemented by several semi-public non-profit research foundations, most notably the Knowledge Foundation and the Foundation for Strategic Research, and a few private research foundations, among which the several Wallenberg foundations are especially noteworthy.

Two of the main challenges for the R&I system were identified by the Rio country report for Sweden (2018): **Improving the links between research and innovation.** While the general performance of the Swedish R&D system on the supply is very good, there is a long-lasting debate concerning the alleged inefficiency of turning the heavy investments in R&D into innovation-based economic growth. For several years the governmental research bills acknowledge the need for increasing the links between research and innovation. In practical terms, the dominant approach has been to launch a series of supply-side measures, most of all a variety of funding instruments to promote cross-sectoral collaboration.

Reducing the dependence of BERD (Business Enterprise Expenditure on R&D) **on multinational companies**. Swedish GERD (Gross domestic expenditure on R&D), while very high in international comparison, is dominated by the private sector, where, in turn, most R&D expenditure takes place in a relatively small number of very large companies. Policy efforts have aimed at increasing the level of investment in R&D among SMEs, the introduction of public venture capital, programs to increase collaboration between universities and firms and also university spin-offs, and a series of funding programs targeted at start-ups and innovation in SMEs. Sustaining the high quality of the public research base.

Concerning the R&I policies framework with a National scope, the **Strategic Innovation Programmes**, launched by the 2012 research bill and reinforced in the 2016 research bill with the launch of “strategic

cooperation programmes" in five fields (next generation travel and transport, smart cities, circular bio-based economy, life science, 11 and connected industry and new materials) can be seen as a continuation of the aforementioned supply-side measures for R&I (Swedish Government 2016d: 108-109).

The aim of the **Research and Innovation - A summary of Government Bill 2012** policy is to strengthen the international competitiveness of Swedish research, and the Government has used the following starting points for the assessments made in the bill (Government offices of Sweden, 2012B):
• freedom, long-term approach and greater opportunities for risk-taking;
• greater possibilities to achieve high quality;
• good conditions for researchers;
• initiatives for society and business; and
• increased utilisation of research-based knowledge

Last year the **Swedish National Roadmap for the European Research Area 2019–2020 (**Ministry of Education and Research, 2019) was launched. It contains measures that help to reinforce the priorities agreed at EU level. The Swedish roadmap provides an overall overview of what various stakeholders in the research and innovation system are implementing in areas such as open science, gender mainstreaming, research infrastructures and societal challenges.

Smart specialization

The practical work on the smart specialisation at the national level is delegated by the government to the Swedish Agency for Economic and Regional Growth. A detailed instruction followed this decision, where the agency was assigned by the government the role of (1) supporting regional authorities in their work with S3; (2) assisting regional authorities with knowledge and overviews of national priorities and future competitiveness; (3) supporting regional authorities in their collaboration with the EU. The agency itself emphasizes the crucial role of good communications (Tillväxtverket 2017c).
In support of pointing out the direction of high-level initiatives, in 2016 Region Örebro County developed a regional innovation strategy based on Smart Specialization. The ambition has been to create a modern innovation strategy that highlights the potential and knowledge benefits of the region in close cooperation with regional stakeholders.

2.2.2 RRI policies

For many years, Sweden has been investing heavily in research and development, with considerable R&D expenditure in relation to GDP. Furthermore, in international comparison, Sweden is a country with a high percentage of researchers in the population, a high percentage of scientific publications per inhabitant and a population that has great trust in research. Despite this, Sweden has lost ground in a relative sense when it comes to research quality, as measured by citation impact. Sweden is thereby facing several challenges. The Swedish Research Council (VR) has chosen to summarise these challenges in three overarching guidewords, to indicate the future choices for Swedish research strategy: *Knowledge, quality and integrity*. Research is and shall be the starting point for the knowledge and knowledge accumulation that shall form the foundation for societal development and welfare, business competitiveness, and solutions to the societal challenges we are facing.
The integrity and freedom of individual researchers are basic prerequisites, both for strengthening the quality of Swedish research and for new knowledge breakthroughs. Fundamental agreement on good research

practice and increased transparency are crucial for maintaining and strengthening society's high level of trust in research and researchers.
The Swedish Research Council has identified twelve items that are particularly urgent for achieving a Swedish research system of world-class. Of those items there are a few that refer to RRI keys:
9. Promotion of Gender equality in funding; 10. Establish a national code of conduct for good research practice & scientific misconduct and awareness on research ethics; 11. Enable the transition to Open Access to scientific publications and develop a national strategy to open research data; 12. Strengthening and coordination of Science communication, and new infrastructures for knowledge dissemination. There is no specific mention of how research should engage with the public and stakeholders.

2.3 Policy mapping exercise in Örebro

In the CHERRIES project and as pointed out in the Guideline for Territorial mapping report (section 3.2), this step entails the revision of sectoral policies, strategies and innovation support, based on the theoretical interface of innovation policy, RIS3, RRI, and the healthcare sector and with a focus on mission-oriented policymaking.
The exercise focuses on existing National and regional policy frameworks for territorial innovation, a selection of research and innovation strategies; and health innovation strategies, as well as other policy mixes at the national and regional scale.
The actions conducted through this policy mapping exercise consisted of the collection of policy instruments by each policy domain at the institutional level and the selection of relevant instruments for the region. The type of documents collected consist of executive or administrative policies to Technical/operational instruments, and development plans and strategies. The search effort involved the screening of documents from institutional websites and also reaching key stakeholders, requiring feedback on essential policy tools, particularly regulatory and legal as well as information and suasory instruments. Moreover, the procedure incorporated the "Snowball Research Strategies" method aiming to map networks of relations between policy actors and policy instruments. The approach begins by analyzing the documents of a single organization and follows a chain of references from this point. This is based on the assumption that a significant majority of actors in a policy network are known to each other.
As a result of the exercise the regional actors, together with Leiden University we gathered the most representative documents from each policy domain. The main results are shown below in figure 4.

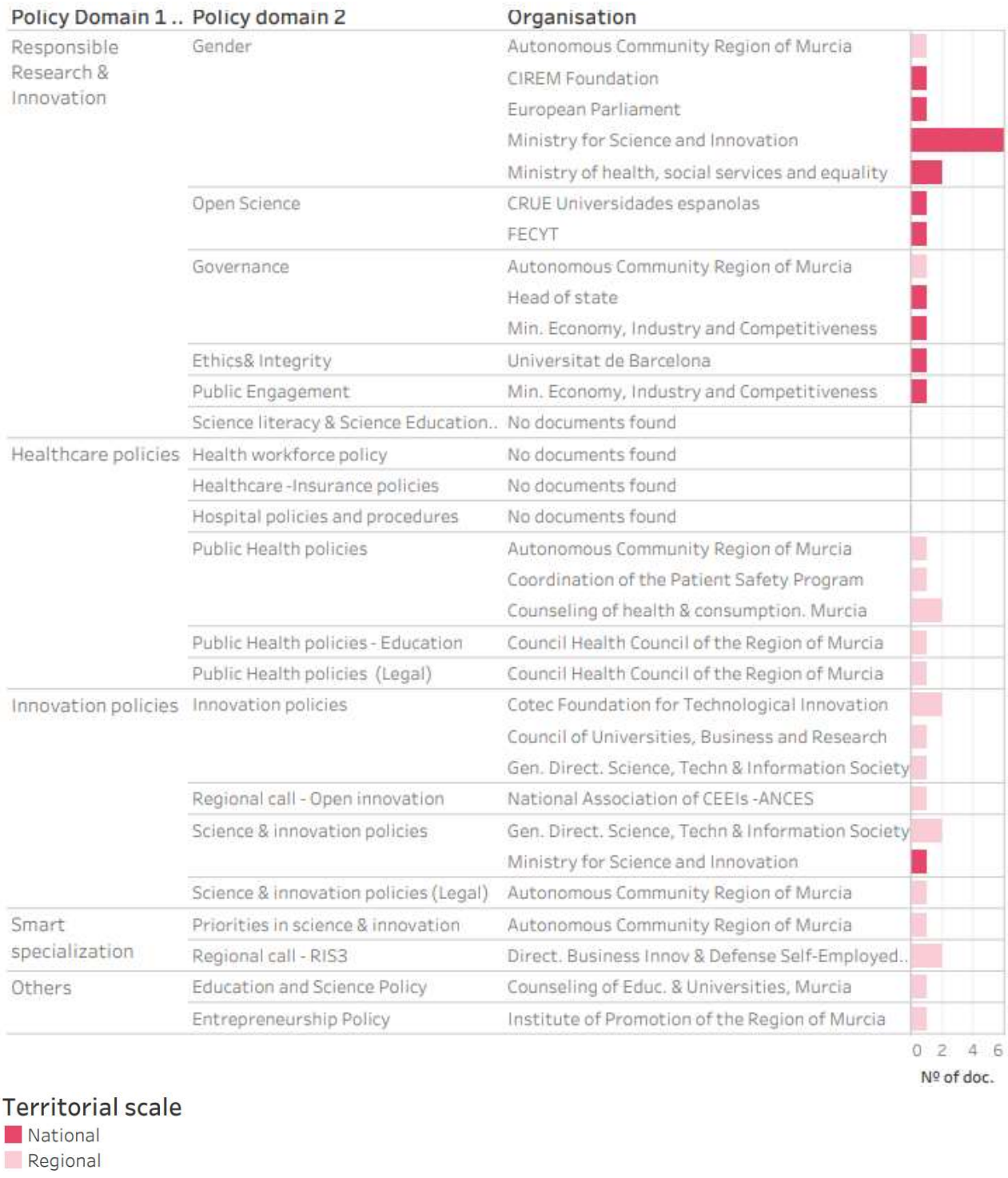


Figure 4. Results of the policy mapping activity showing the representation of the collected documents by their general policy domain (1), the specific domain (2), and the policymaker organization responsible for the elaboration of the policies. The territorial level included the differentiation between National and regional instruments.

As can be observed from Figure 4, the majority of the documents from RRI domain refer to National policies. There is also a report by Formas, the Swedish research council for sustainable development in which expectations, the general trust in science, and the increased demands for democratization of the scientific process are presented from the political level. The incipient ethical discussions about civic research are also addressed.

The health care policies at the regional level covered a wide range of social welfare aspects: Growth and sustainable development in Örebro county. (Regional development strategy 2018-2030); Policy on good and equal health; Policy on coherent care and welfare; Policy on social welfare; Operational health plan with budget 2020 and prerequisites for planning 2021-2022. The responsible institutions to elaborate these instruments is the Region Örebro County. Region Örebro County is a democratically governed authority. It is responsible for planning and providing all health care, financing privately-run health care, and levying taxes on county residents.

It should be noted that policy instruments are inherently difficult to track throughout the institutional structure of a nation or at the regional level, and therefore the fact that no documents were found for some of the policy domains or RRI keys or Healthcare policies, does not mean that they do not exist. Moreover, this task will be continued in Work Package 5 “Co-creation of a responsible innovation policy mix”. The aim is to embed learnings in the territorial policy mixes and strategies while giving the territorial stakeholder groups an active role in shaping their environment. The objectives involve to synthesize policy aspects of current WP2, the design of an RRI-compliant territorial innovation policy mix, and to validate demands and provide evidence-base for territorial RRI-compliant development strategies. For complete detail of the policy instruments and regulations compiled in this exercise see Appendix A (excel sheet).

The following table describes the status and level of development of the examined policy domains, highlighting key policy documents, and likewise the current gaps we have for the RRI keys.

Table 1. Description of national policies in Örebro by domain.

Policy Domain	Policy names
Responsible Research & Innovation	
Gender	National plan and one regional plan for Örebro
Open Science	National policy guideline document
Ethics & Integrity	No policies found
Public Engagement	National Law (Higher education - The parliament)
Governance	No policies found
Science literacy and Science Education-	One National report from ARCS (ARenas for Cooperation through citizen Science organization) although no policies found.

Citizen sciences	
Healthcare policies	5 relevant Healthcare policies address the regional context. These policies address topics concerning growth and sustainable development in Örebro county, good and equal health and social welfare
Research & Innovation policies	In 2012 two relevant documents appeared, the "National Research and Innovation strategy and the "National Innovation Strategy - A summary of Government Bill 2012". One recent document is the "Swedish National Roadmap for the European Research Area 2019–2020"
Smart Specialization policies	One Smart Specialization Strategy for the region (2017).

2.3.1 RRI keys and actors

Vinnova is Sweden's innovation agency that helps to build Sweden's innovation capacity, contributing to sustainable growth. It is a government agency under the Ministry of Enterprise and Innovation, and the national contact authority for the EU framework programme for research and innovation. It is also the Swedish Government's expert authority in innovation policy.

With regards to Open Science & Public engagement, one of the responsible organizations are **VA (Public & Science)(Vetenskap & Allmanhet),** a Swedish non-profit membership organisation that works to promote dialogue and openness between researchers and the public. It was the national coordinator of the Swedish hub for RRI tools project, and also involved in ORION project (*Open Responsible research and Innovation to further Outstanding knowledge*).

Referring more specifically to the Open access initiatives, the **National Library of Sweden** and the **Swedish Research Council** received appropriation directives from the Swedish Government. In 2017, and according to directives, the National Library shall act as a national coordinating body in the work towards a transition to open access to scholarly publications, and the Swedish Research Council shall coordinate the national work in establishing open access to research data[3].

The **ARCS, Arenas for Co-operation through citizen science**, is a collaboration project between the University of Gothenburg, the Swedish University of Agricultural Sciences, Umeå University and the non-profit organisation VA (Public & Science). It helps Swedish universities and colleges to use citizen research responsibly and sustainably to collaborate with society.

[3] https://www.openaire.eu/os-sweden

3. CONTENT AND CONTEXT SMART SPECIALIZATION STRATEGY

3.1 Introduction

The definition of 'Smart Specialisation' – as an innovation policy concept intended to promote the efficient and effective use of public investment in research. Its goal is to boost regional science and innovation in order to achieve economic growth and prosperity, by enabling regions to focus on their strengths. This approach understands that spreading investment too thinly across several frontier fields risks limiting the impact in any one area.

The complementarities between both Responsible Research and Innovation (RRI) and Smart Specialisation (RIS3) approaches rely on some of the characteristics that differ from them. The RIS3 policy is primarily oriented towards regional competitiveness and therefore does not fully incorporate local institutions and notions of social value or choice. On the other hand, neither the theory, policy nor practice of RRI pays attention to the spatial dimension of innovation processes, which is central in RIS3 approaches. In that line, RRI ignores the various ways in which regional context affects not only the development of innovation but also the perception of what is responsible and socially desirable, understanding that knowledge and resources which are necessary for innovation - labor mobility, R&D collaboration- are all regional. Thus, from the innovation studies literature, we know that innovation processes are socially and spatially embedded, as the regional context creates conditions for knowledge acquisition and learning.

Overall, these two approaches share their origins as a policy concept rather than a theoretically motivated framework that argues for broad stakeholder involvement in the development of research and innovation policy and the need for R&I to be oriented towards solving grand societal challenges SGC.

In that sense, we develop an approach that may assist policymakers in designing and implementing RIS3 strategies that not only promote smart (i.e. competitive) but also inclusive and sustainable regional economic development.

The Territorial mapping exercise enclosed as one of the main steps the definition of the Territorial priorities of the regions. To achieve this goal, the methodological approach follows the Research and Innovation Strategies for Smart Specialisation method (RIS3 Guide) from the European Commission (2012). The process entailed the adaptation of the steps and actions considered in the original document, to provide a more specific input required in the context of the CHERRIES project. The actions considered in this approach contemplate: *Step 1) Analysis of the regional context and potential for innovation, Step 2) Governance: Ensuring participation and ownership, Step 3) Elaboration of an overall vision for the future of the region, Step 4) Identification of priorities, Step 5) Definition of coherent policy mix, roadmaps and action plan.* This version of the strategy established a special focus on Healthcare and Innovation sector and uses more recent data and information available if compared with the previous Regional Smart Specialization Strategies.

3.2 Previous regional smart specialization strategy Örebro

The smart specialization priorities within the Örebro region are presented below, as well as value flows and potential knowledge flows between them.

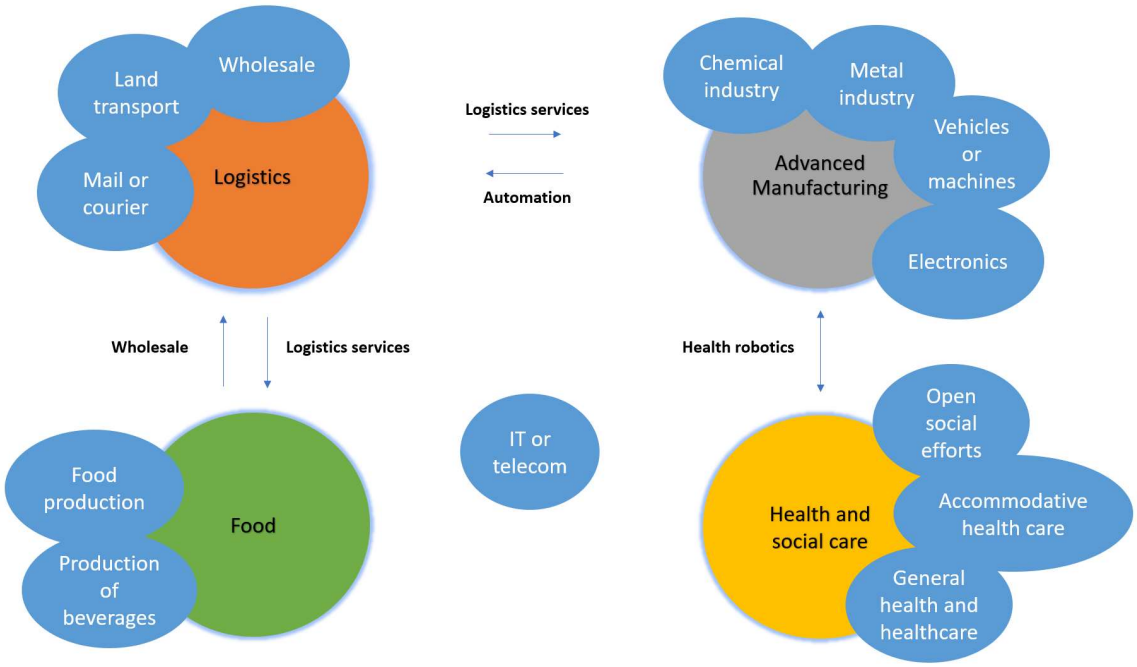


Figure 5. Diagram representing the sectors addressed in the previous Smart Specialisations Strategy.

In terms of health care, Örebro set out to prioritise open social efforts, accommodative health care and general health and healthcare. Additionally, Örebro seeks to improve its capabilities in health robotics in a collaboration between the advanced manufacturing and health care sector.

3.3 Territorial context of the region

3.3.1 Economic specialisation

We measured this variable using the cluster mapping tool, which shows the analysis of the regional ecosystem scoreboard. The regional eco-system scoreboard for clusters and industrial change illustrates conditions for successful cluster development and industrial change by region in Europe. The cluster mapping tool shows the cluster mapping analysis of the regional ecosystem scoreboard. It displays sectoral, cross-sectoral, and regional indicators of cluster specialisation and size, business performance, regional context, and other statistical information. It can be visualised the relative cluster strength and cluster development over time, cluster and regional strength across sectors and emerging industries and linkages between clusters, industrial change, innovation, entrepreneurship, and economic development.

By using this indicator, we selected two Health sectors where the organisations in Örebro (NUTS 2 - SE12) specialise. Biopharmaceuticals and Medical Devices are both part of the Life Sciences industry. Their growth has been subdued but the global market potential is perceived as high; they are also connected to large and growing employment in local health care services. The regional values are displayed in Figure 6.

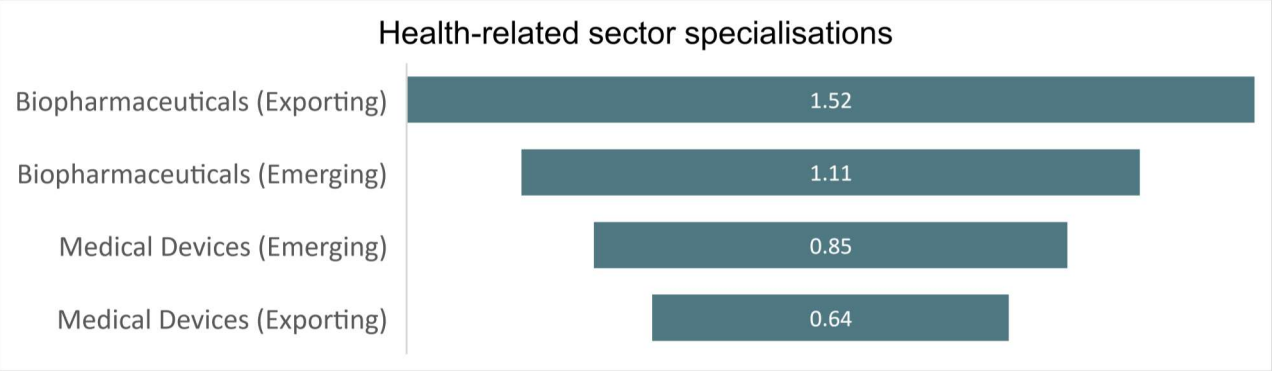


Figure 6. Greater Örebro region profile (SE12) by Sector for Specialisation, depicting four categories linked to Health (2017). Source: European Observatory for Clusters and Industrial Change mapping tool.

If we compared the values for this indicator, where Metal mining (value: 2.63), Upstream metal manufacturing (value: 2.13) and Production technology and Heavy machinery (value: 1.96) have the highest scores, the Health-related categories from Figure 6 show a moderate value for the sector specialisations.

3.3.2 Innovative behaviour

The greater Örebro (Östra Mellansverige) region is regarded as an **innovation leader** (Innovation score: 131,9) in the European landscape, although its innovation performance has decreased between 2011 and 2019 (-7.5%). The regional innovation scoreboard (RIS) is a regional extension of the European innovation scoreboard, assessing the innovation performance of European regions on a limited number of indicators.

A similar indication of the innovative behaviour of the region is given by the public and business R&D expenditures, which are among the highest in Europe. These indications suggest that Örebro has the experience in its close vicinity for achieving advanced innovation and therefore could try to realise pilots in ambitious fields without taking too much risk. However, while the general performance of the Swedish R&D system on the supply side is very good, there is a need to improving the links between research and innovation because of the alleged inefficiency of turning the heavy investments in R&D into innovation-based economic growth.

3.3.3 Health care system

The health care system in Sweden is divided between the municipalities and the region. The municipalities are responsible for the care of the elderly in daily life including medical care. The region is responsible for the medical care either in health centers or in the hospitals.

Life expectancy in Sweden is among the highest in the EU. The health system performs well in providing good access to high-quality care but at a relatively high cost. While most Swedish people enjoy good health in old age, a growing number of people over age 65 have some chronic diseases and disabilities, thus increasing demands on health and long-term care systems. The health system faces persisting challenges in providing equal access to care to the population living in remote regions, ensuring timely access to health services and achieving greater care coordination for people with chronic diseases (European Commission, 2019).

Health status Life expectancy at birth was 82.5 years in 2017 – over 1.5 years above the EU average. While stroke and other cardiovascular diseases are decreasing as causes of death, a growing number of people are dying from Alzheimer's disease, and other dementias.About half of Swedes aged over 65 report having one or more chronic diseases. Mental ill-health is a major problem among older people, reports of nervousness, anxiety and sleeping problems are frequent among the elderly population and, as in the case of younger age groups, more common among women than men. One in every three women and nearly one in every five men in the oldest age group (85 years or older) suffer from anxiousness, nervousness or anxiety. Women also consume considerably more psychopharmaceutical drugs than men, although more men than women commit suicide. A quarter of all suicides are committed by people over the age of 65 (Lennartsson & Heimerson, 2012).

Risk factors Only 10 % of adults in Sweden smoked every day in 2017, down from 19 % in 2000, and the lowest rate among all EU countries. However, the use of other tobacco products such as snuff is common, especially among men. Overall alcohol consumption per adult has decreased over the past decade, but one-fifth of adults reported heavy alcohol consumption regularly in 2014. The obesity rate among adults increased from 9 % in 2000 to 13 % in 2017 but remains below the EU average. Mental health is not only a problem among elderly but in the younger age groups, depression is a prominent problem, specially common among women than among men. This disparity evens out with age, but since women live longer than men, there are still more very old women with the diagnosis than men.

Health system Sweden has the third-highest health spending in the EU as a share of GDP (11.0 % in 2017 compared to the EU average of 9.8 %), and the third-highest per capita spending (EUR 3 872 compared to the EU average of EUR 2 884). Most health spending is publicly funded (84 %), a share also higher than the EU average (79 %). In Sweden, responsibility for health and medical care is divided between the national government, territories, and municipalities. The foundation of Swedish health and medical care is public, but private alternatives do exist.

Accessibility Access to health care is generally good, but issues concerning access in remote regions and timely access to elective surgery and other health services persist.

Resilience Health expenditure is expected to grow in the years ahead, with pressures also exerted by growing demands for long-term care. Progress has been achieved in the past decade in shifting activities from hospital to primary and community care, but challenges remain in improving access to primary care and care coordination, in particular for people with chronic conditions. The recent SOU report, Swedish Government Official Reports from the Ministry of Health and Social Affairs, refers particularly to Elderly care during the pandemic. The Commission stated that care for the elderly was unprepared and ill-equipped when the pandemic struck and that the government should have taken the necessary initiatives to ensure that elderly care is better equipped for a crisis of this kind. Staff employed in the elderly care sector were largely left by themselves to tackle the crisis.

4. DEFINITION OF TERRITORIAL PRIORITIES AT REGIONAL LEVEL

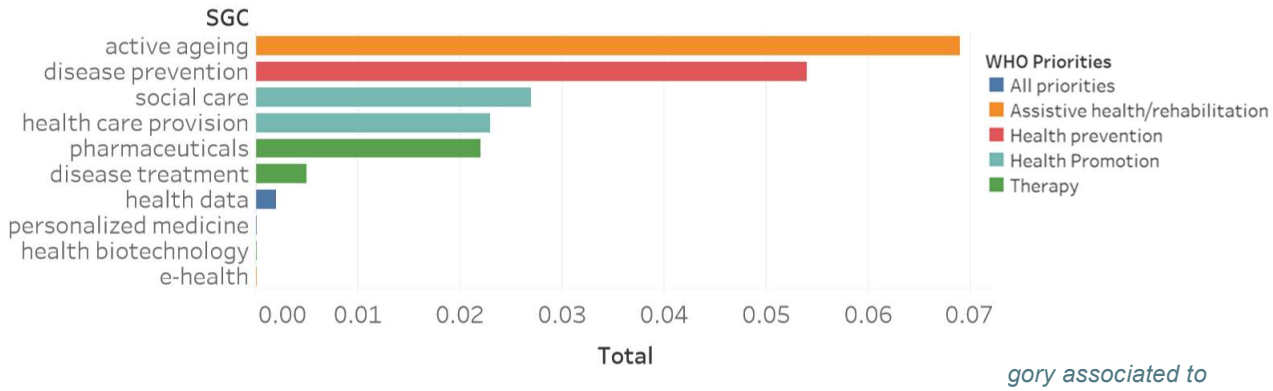
4.1 knowledge production indicators and scientific production analysis by fields of Science

As part of step 1 from the Smart Specialisation Strategy methodology (*Guideline for Territorial Mapping WP2 - Deliverable 2.1*), and regarding the analysis of the regional context and potential for innovation, this section entails the study of **Scientific and Technological specialisation** of the territory. The following analyses aim to build a profile of the current knowledge production in the regions through bibliometric analysis and using as a source of data, the scientific production in Örebro, patents' creation, and the development of European projects.

Some of the requisites filled by the priorities defined in each territory are: 1) priority level should be smaller than whole sectors, but bigger than single activities for maximal effectiveness. 2) Priorities do not have to fit in one particular sector and can be connected to multiple sectors. This is important because often innovative concepts are formed from a diverse set of capabilities. 3) In respect to the importance of RRI and SDGs in today's society these priorities do not have to carry an economic value only 4) Stakeholders can formulate their societal visions for the future and collectively integrate these in their smart specialization priorities.

4.1.1 Scientific production in connection with Societal Grand Challenges (SGC) and World Health Organization (WHO) priorities

The chart below (Figure 7) depicts the average number of publications (normalized by population) of each SGCs category associated with "Health" for the period 2012- 2016. The colours in the chart characterise the relation between Health categories from SGC and the World Health Organization (WHO) priorities.
The data was obtained through KNOWMAK, a web-based tool, which provides interactive visualisations and indicators on knowledge co-creation in the European research area4. The analyzed period corresponds to publications from 2010 -2016.



gory associated to "Health" for the period 2012- 2016.

[4] https://www.knowmak.eu/

As we can observe in the chart above, the top category within *Health* is “Active ageing”, which relates to the WHO priority connected to “Assistive health/rehabilitation”.
By analyzing directly the publications assigned under this category, we could distinguish that publications regarding **Nursing** and **Caring Science** are the majority on this set. A relevant topic appeared in terms of the carers' interactions with older patients. Also, connection with dementia care and life to death experiences.
From this set of publications, the University of Örebro, Örebro Regional Development Council, and Örebro University Hospital are the publishing institutions.

4.1.2 Complexity and diversity indicators

Just as regions differ in size and wealth, they also vary in the diversity and complexity of their knowledge base. Especially large, metropolitan regions are capable of contributing to a wide range of fields (Nomaler et al., 2014). Every region has its own, unique knowledge base. Regions specialize because of the cumulative and path-dependent character of scientific knowledge production (Heimeriks & Boschma, 2014). The opportunities to diversify into new fields is to a large extent dependent on the existing portfolio of related knowledge (i.e. the adjacent possible). From this perspective, it is clear that the **diversity of the knowledge base** can be considered an important indicator for further knowledge developments in regions. Diversity matters because regions are more likely to expand and diversify into new topics and fields that are closely related to their existing activities. Because the diversity of topics indicates a diversity of capabilities, the results confirm the idea that more diverse capabilities are important for producing complex knowledge.

The **complexity measure** looks to explain the knowledge produced in a region combining metrics of the diversity of regions and the **ubiquity** of the fields to create measures of the relative complexity of a region's scientific portfolio. Hausmann and Hidalgo (2009) developed a complexity measure based on the diversity of outputs within territories and the ubiquity (or range) of territories across which individual outputs can be produced. For further details of the methodology applied, please refer to Heimeriks, G., *et al.,* 2019.

The complexity of knowledge matters because it allows regions to produce idiosyncratic knowledge that few other regions can make. In analogy with the production of goods (Hausmann & Hidalgo, 2009; Hidalgo *et al*., 2007), it can be expected that sophisticated regions are capable of contributing to a large variety of ‘exclusive’ fields that few other regions can develop. The complexity of a region is embodied in the wide range of knowledge or capabilities that are combined to produce outputs: less ubiquitous outputs are more likely to require a greater variety of capabilities. We thus expect that these specialized (e.g. more complex) outputs tend to be produced at relatively few locations and often provide a long-run competitive advantage.

Based on the data collected for publications (2018) and the measurement of the aforementioned indicators, Örebro exhibits values that fall into the **high category** for the **scientific diversity** and **complexity indicator**.

4.1.3 Definition of priorities using scientific relatedness analysis

In this section, we aim to communicate the main strength and capabilities already present in the region from the scientific perspective. The **relatedness indicator** measures the **Revealed comparative advantage (RCA)** by analysing the fields in which the region has an above-average concentration of publications

(Heimeriks, G., *et al.,* 2019). Likewise identify which scientific subfields are often found together in the same region, as a representation of the ability of the territory to diversify into related subfields.

This analysis allows the formation of 3 Clusters and Örebro NUTS3-region has a scientific representation on Health sciences.

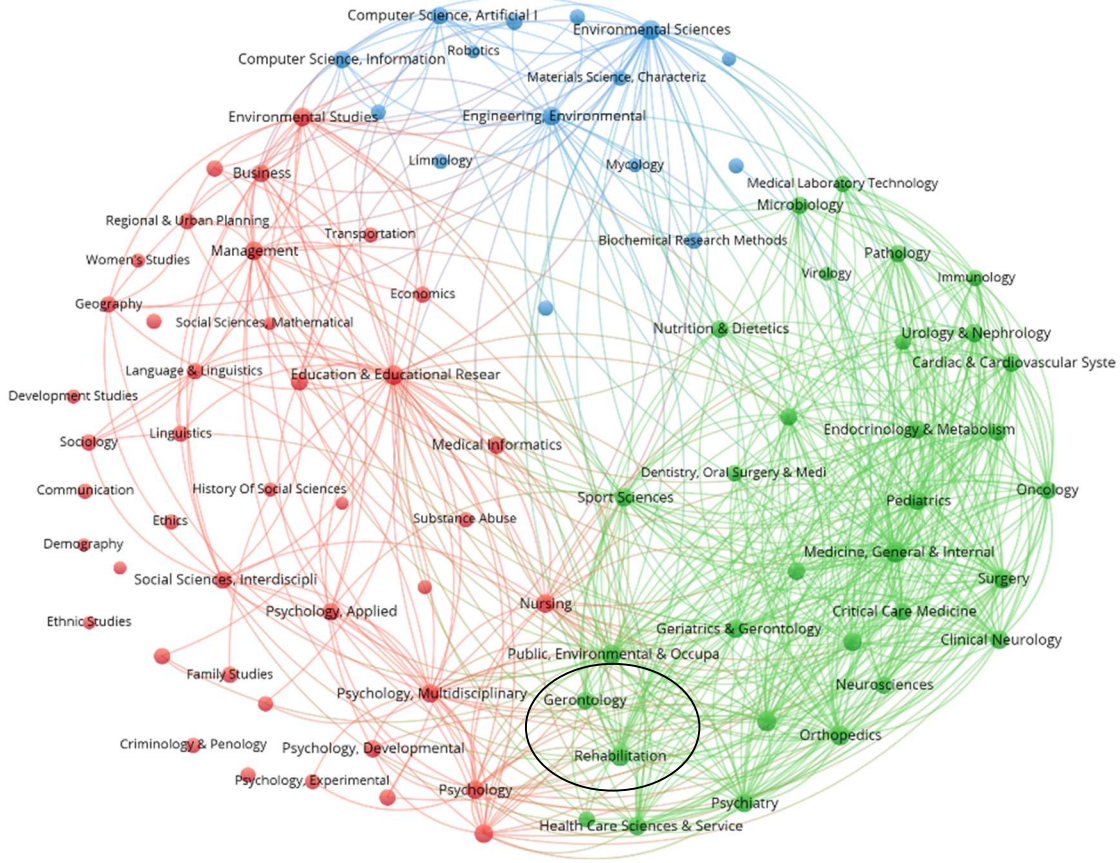


Figure 8. Results of relatedness analysis depicting fields of science with a Revealed Comparative Advantage (RCA).

As can be seen from the figure above (Figure 8), all the fields represented in the map above constitutes are where the region has a comparative advantage in relation to their European peers. The *blue cluster* shows fields belonging to Computer science and Engineering. The fields represented in red color, reflect the fields associated with Social Science and Humanities, which overlap with the Biomedical and Health Science area, characterized in green. Some of the cross-disciplinary fields between the latter two mentioned clusters are Nursing, Gerontology, Psychology, Rehabilitation that involve activities from two or more academic disciplines.

Additionally, further information that can be extracted from this map is the proximity of the fields. As an example, if a region performs well in terms of the number of publications in **Gerontology**, as it is the case for Örebro, the region would have a better chance to specialize in closer fields such as **Rehabilitation,** that appear adjacent in the map.

4.1.4 Analysis and characterization of priorities at micro-fields level

For the purpose to analyze in-depth the Fields already identified as relevant from the previous analysis, the following chart portrays a more detailed level of analysis, using the micro-level of the fields to recognize the main topics developed in those fields and possibly detect new fields where the Örebro region performs well.

From the map below (Figure 9), we can observe the results of the analysis portraying micro-level fields (Waltman & Van Eck 2012), presenting a high scientific production in the region. The different colours represent the main fields of science (Social Science, Mathematics and Computer Science, etc.), and each circle symbolize a micro-level field, where the bigger the circle (node), the highest the number of publications produced in that field. As we aim to define how specialized the region is in a specific field, we used the relative number of publications, which takes into account the total number of publications produced in the field, if compared with the rest of the world (Web of Science data). The period of the analysis considers five years, between 2014-2018.

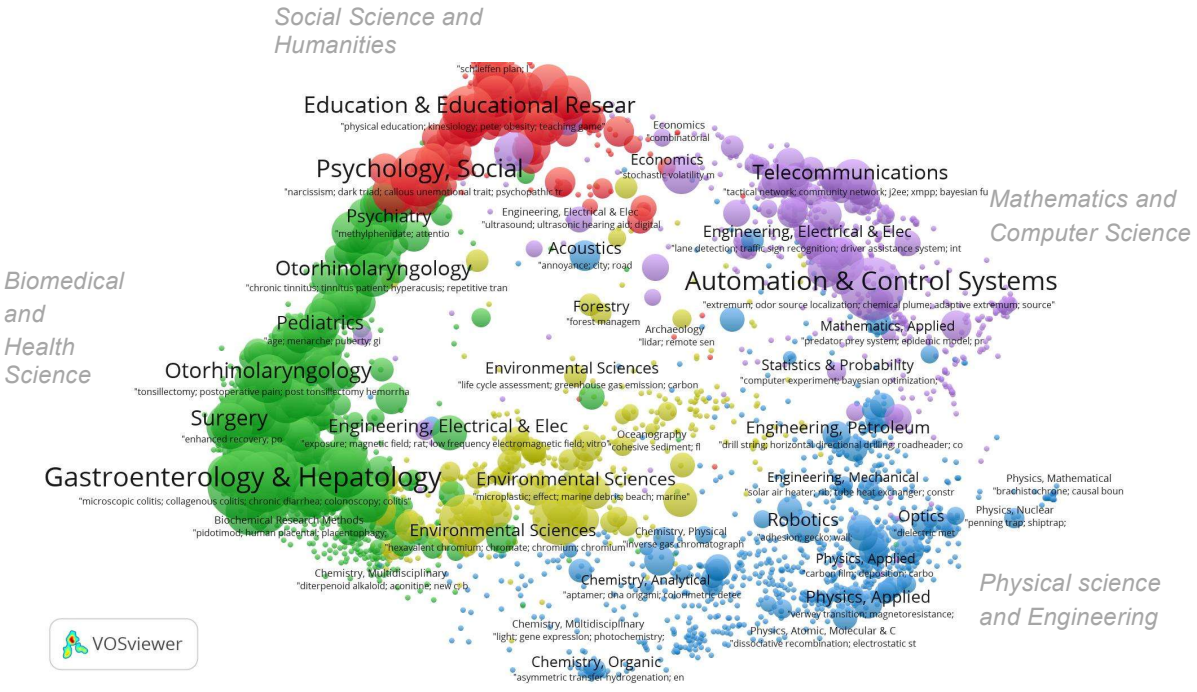


Figure 9. Results of the micro-level scientific field analysis using the relative number of publications for Örebro .

From the map above we can observe the most prominent micro-level fields emerging from the regional scientific landscape. From Mathematics and Computer Science, the one labeled as “Automation & Control Systems” refers to the expertise and use of Robotics and Artificial Intelligence for the environmental field. Likewise, it is possible to identify **Gastroenterology and Hepatology** as one of the most representative subfields from Biomedical and Health Science. **Psychology** and **Otorhinolaryngology** appeared similarly as relevant.

The next image displays a detail of the main field of Mathematics and Computer Science Physical science and Engineering. As we zoom in within the map represented in Figure 10, we see how the field of Robotic arises, involving different topics or types of specialization developed in the area.

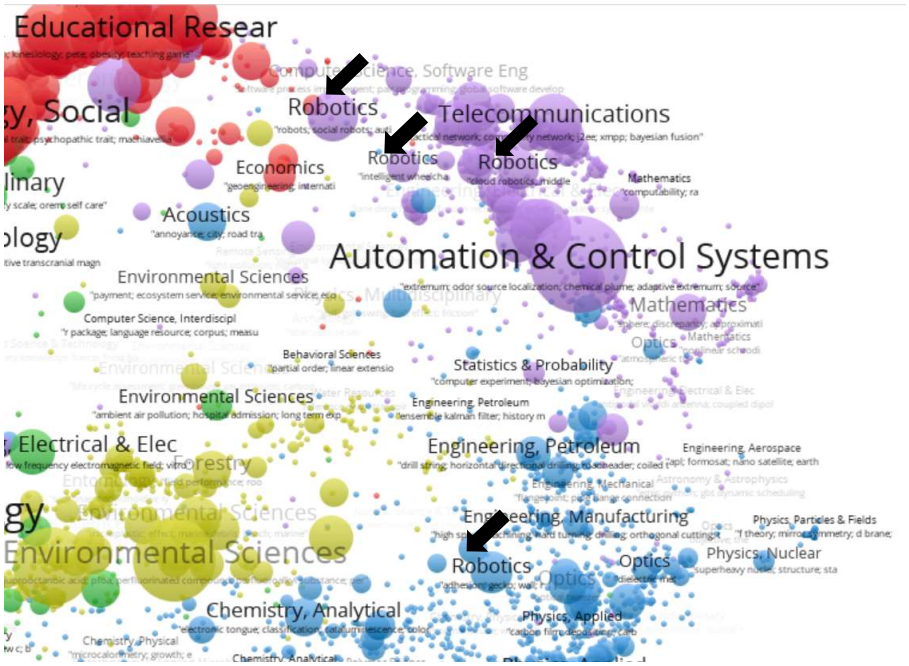


Figure 10. Detail of the micro-level fields map highlighting clusters of topics concerning Robotics.

It is worth noting that, despite **Robotics** is a strong field in the region, in terms of the level of specialization, the scientific production and the Research groups developing new knowledge, the most relevant application is related to the environmental risk field. This, mostly related to the automation of processes, mobile robots, and detection of leakages in gas operations. The connection of Robotics and its application to Biomedicine and Health Science will be further analysed in this report (section 5.2).

Characterization of the most relevant fields from Biomedical and Health Science

The following image (Figure 11) will characterize the key subjects developed in the fields previously identified from the micro-clusters analysis (Figure 9). This, in order to obtain an enhanced level of detail of each one of the fields and understand the core topics published by the region. We selected the top 10 fields as the most representative at regional level. This threshold can be extended if the interest of the region is to explore a larger set of scientific areas or fields.

From the chart below, the columns indicating the number of publications show two sets of data. In one side the *Relative number of publications*, to specify the level of specialization in each field and also the absolute number of publications in the field, to depict a full counting of the publications, disregarding the measurement of specialization. It should be noted that a higher degree of specialization should be accompanied by a minimum amount of scientific production. For this reason, we set a minimum threshold of 5 publications per field during the analyzed period (2014-2018). Fields with less than that were not considered in the analysis.

A total of 3.957 publications were considered in the analysis including articles, reviews, and conference proceedings.

In methodological terms, the description of the fields represented below in Figure 11, considers the name of the most representative Journals where the region publishes, and the content of the publications by using the titles of articles contained in each micro-level field. For the ones having a larger set of publications, we used text mining techniques or term maps (Vosviewer software) to detect the core topics in the abstracts of the publications.

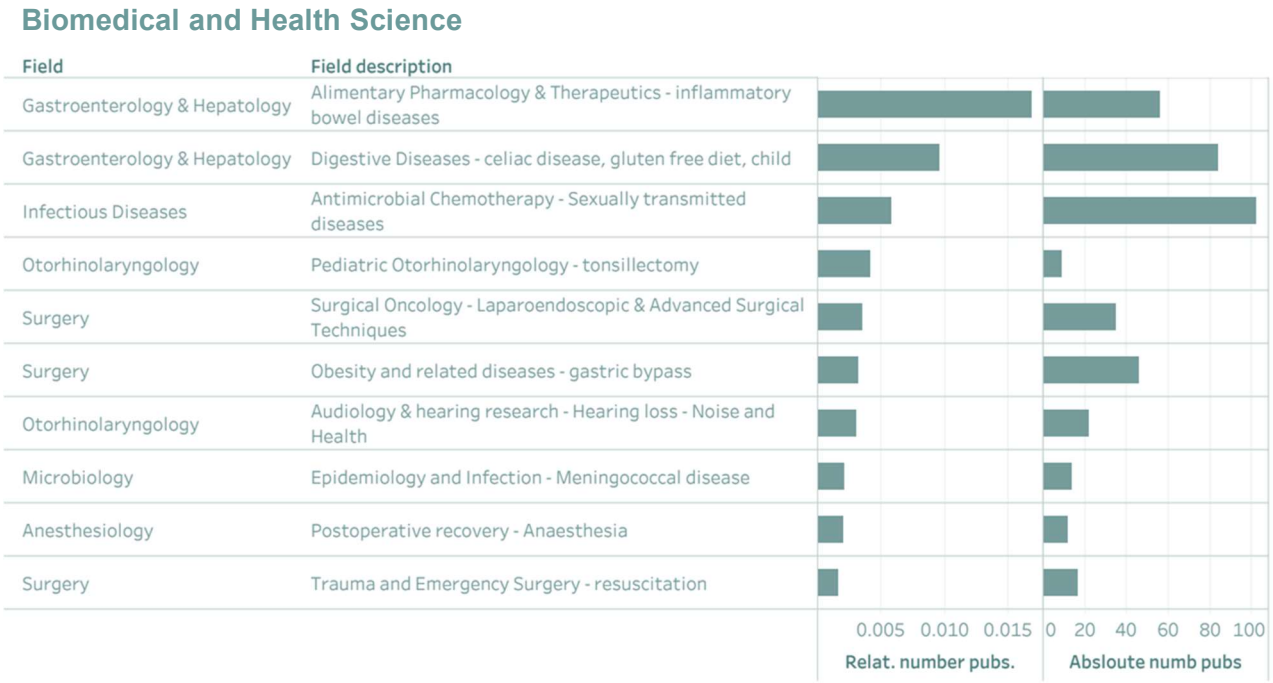


Figure 11. Top 10 micro-level fields within Biomedical and Health Science. Values refer to the relative and the absolute number of publications for Örebro.

From the chart above (Figure 11), we observe that the 3 first microfields belong to **Gastroenteropatology & Hepatology** and **Infectious diseases**, where the scores are high for the level of specialization and likewise the total value of scientific production (absolute number of publications). Similarly, the **surgery field,** related to different areas of expertise shows high scores.

4.2 Addressing territorial priorities raised by the regions

4.2.1 Robotics in connection to Health science

During communication with regional partners in Örebro, the areas of interest were specifically the work with Older adults and mainly addressing some issues related to Mental Health. This, in order to tackle problems that deal with isolation and the emotional well-being of the elderly group. This situation became particularly problematic during the current pandemic of Covid-19. Additionally, and taking into consideration the existing

technical capacities reflected on the scientific knowledge production the region has in Artificial Intelligence and Robotics, the field may be a potential source of solutions for the identified problems.

To understand how the subfield of Robotics develops in the regional context and allowing an interdisciplinary approach, it was performed a publication level analysis, based on a text-search of keywords related to the **Robotics** field. In this way, we used the micro-level field analysis to identify the areas of expertise within this field. In the next figure, we observe the topic is addressed mainly in Mathematics and Computer Science & Physical science and Engineering.

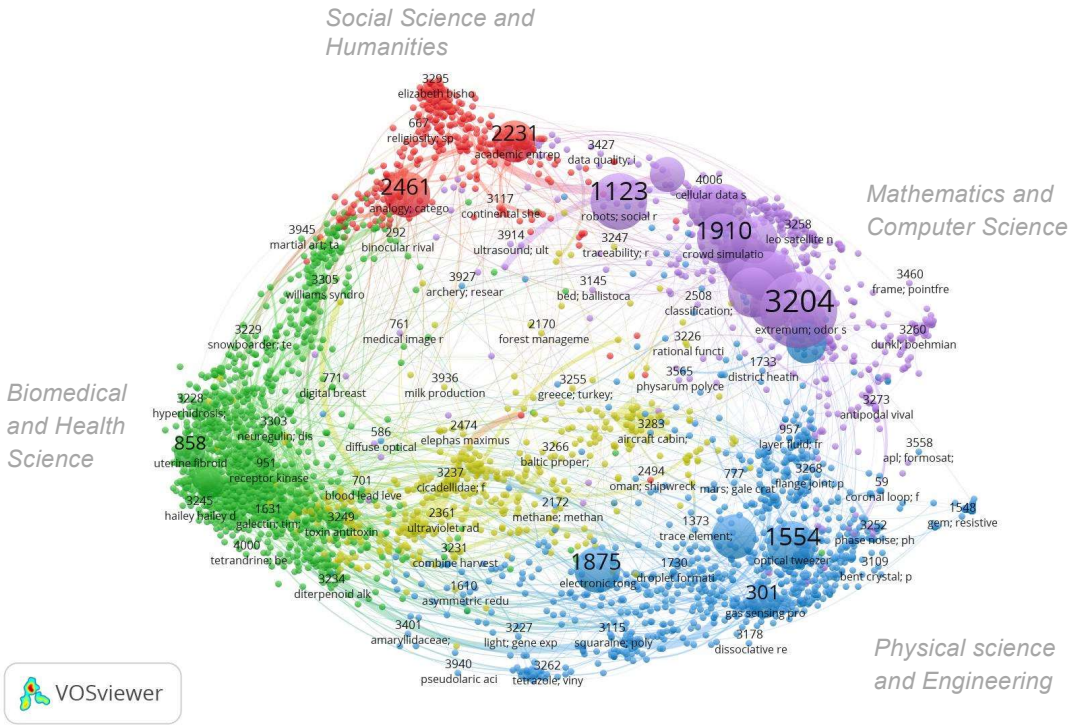


Figure 12. Results of micro-level fields analysis showing the Robotics field predominance among the main fields of science.

The results of the analysis show that *Mathematics and Computer science* display the major development of the discipline. Cluster color purple where the nodes appear more prominent, reflecting the scientific output. The connection between Robotics and the Biomedical and Health science characterized by the research output is related to **human-robot interaction** and the treatment of **autism with social robots** (node 1123 figure 12). There is also present a topic linked to assistive rehabilitation, intelligent wheelchairs, and disabilities, although with low number of publications. If looking at Biomedical and Health Science, the Application of Robotics in surgery for the fields of **Urology & Nephrology** (laparoscopic), oncology (transoral robotic surgery) appeared as well in the regional research.

By analyzing a set of publications selected by text-search of keywords related to elderly people (“older adult”, “ageing”, “elder”) we could identify a large sub-set of articles whose content is directly connected to the regional priorities. Specially referring to the well-being and care of elderly people using **Social Assistive Robots** or **ICT platforms** to monitor and assist them in their daily life. Also addressing **socio-technical**

challenges in the implementation of monitoring technologies in Elderly Care. A selection of these publications is shown below in table 2.

Table 2. Description of selected scientific publications associated with regional priorities.

Publications addressing the regional priorities		
Publication details	***Content description***	***Link***
Effects of Tracking Technology on Daily Life of Persons with Dementia: Three Experimental Single-Case Studies	It investigates the effects of using tracking technology on independent outdoor activities and psychological well-being in 3 persons with dementia (PwDs) and their spouses.	Link
Cloud Robotics Solution to Improve Social Assistive Robots for Active and Healthy	Potentialities of a cloud robotic system for the provisioning of assistive services for the promotion of active and healthy ageing	Link
Assessment of interaction quality in mobile robotic telepresence: An elderly perspective	Importance of evaluation MRP (mobile robotic telepresence) system from two perspectives, the pilot user's and the local user's.	Link
Development of a Socially Believable Multi-Robot Solution from Town to Home	The analysis adopts an end-user-oriented perspective, considering some of the main attributes of acceptability: usability, attitude, anxiety, trust and quality of life.	Link
Socio-Technical Challenges in Implementation of Monitoring Technologies in Elderly Care	Investigate the socio-technical challenges that arise during implementation of monitoring technologies in elderly care	Link
To Meet the Needs of Aging Users and the Prerequisites of Innovators in the Design Process	It analyzes cases where participatory design with different stakeholder groups was a beacon in the development of innovations. An important aspect was a strong foundation both in the needs of the elderly and in the feasibility from the market side.	Link

4.2.3 Relevant actors involved

Considering Örebro University and Örebro University Hospital as the main regional actors in knowledge production, there were identified two Research groups that could be interesting to engage in the project.

The first group is from Nursing science field and is called "**Older people's health and living conditions - from cell to society" (**website). They collaborate with the Centre for Nursing Science Örebro University Hospital, and seem to connect many topics around elderly people, including mental health. Two of their projects appear to be relevant for the innovation pilot: Rate yourself healthy (link): Reliability and utility of the Abbey Pain Scale-SWE for pain assessment among people with dementia ***(***link)

The second group, is the **Centre for Applied Autonomous Sensor Systems (AASS)** link. They appear as an active group publishing in the field of Robotics (table 2). The research group performs multidisciplinary research in autonomous systems with a focus on their perceptual and cognitive capabilities and their

integration as solutions for elderly care in domestic environments. An example in Ängen senior residence facility in Örebro run by Örebro municipality.

Likewise, the **School of Business** and the **School of Health and Medical Sciences** from **Örebro University**, authored one of the selected publications.

Outside the regional limits, it should be noted the work done by Karolinska institute and at Gothenburg University. They have done extensive work in the field of social sience and elderly. In Stockholm there is the Äldrecentrum (Stockholm Gerontology Research Center foundation[5]), a research and development fundation that specialises in matters regarding elderly. The mission is to increase information about older adults' living conditions, health, ill health, and medical and social care needs.

4.3 Patents analysis by technological field and in the Health sector

It was analyzed the number of patents registered in Örebro region according to the classification of technological fields. The source of information is PATSAT - Worldwide Patent Statistical Database - EPO database 2020 Autumn edition. Patent statistics and bibliometric analysis are used as indicators of the inventive activity of the regions. This analysis considers only companies registering patents and not individuals, between the years 1979 and 2019 (1.912 patents).

In the figure below we observe the categories: other special machines, Machine tools and Civil engineering appearing as the sectors whit the majority of patents. This classification encompasses three groups related to the Health sector: Medical Technology (44 patents), Pharmaceuticals (13 patents) and Biothecnology (6 patents).

[5] https://www.aldrecentrum.se

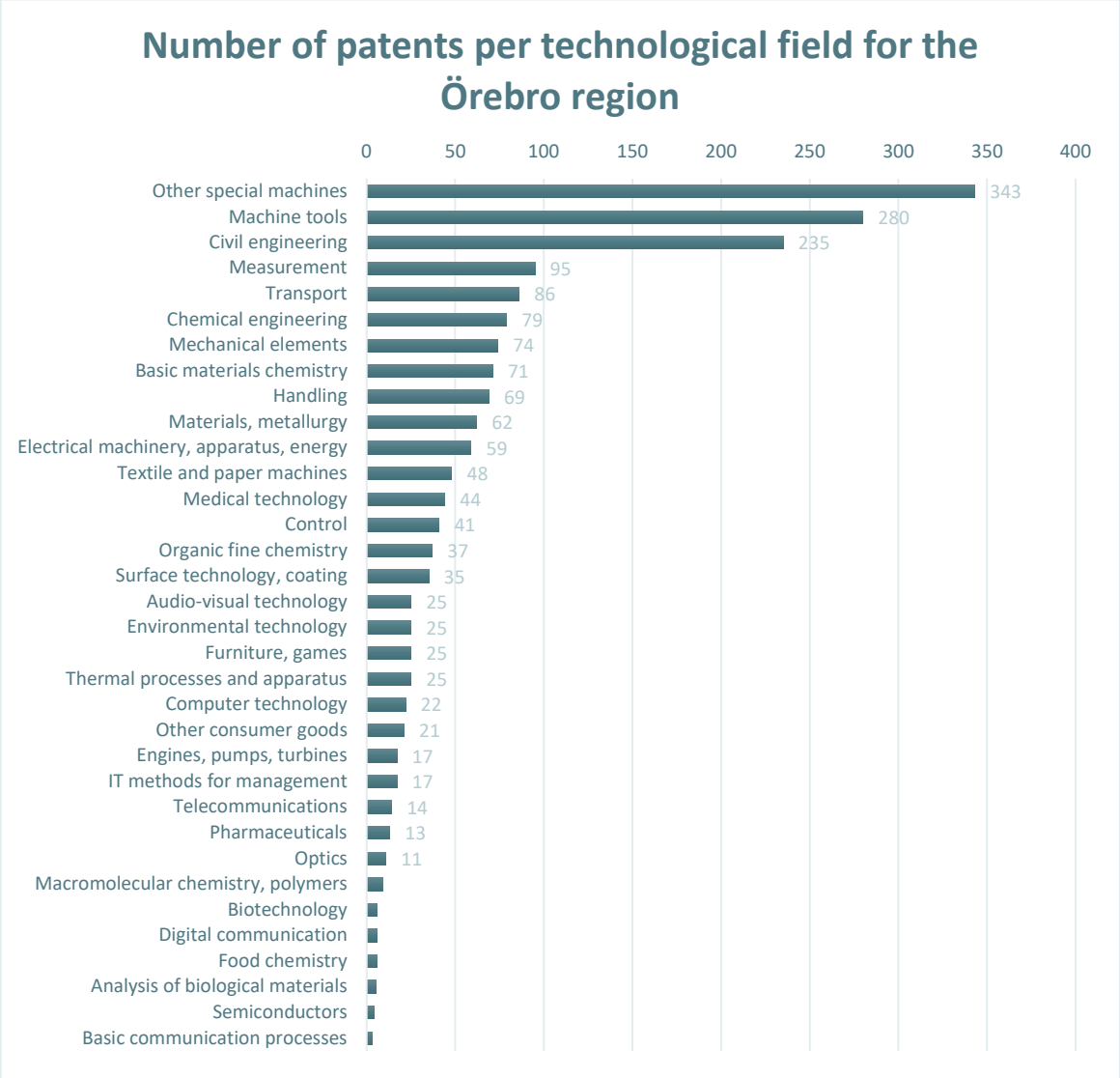


Figure 13. Number of patents per technological field in Örebro between 1979 and 2019.

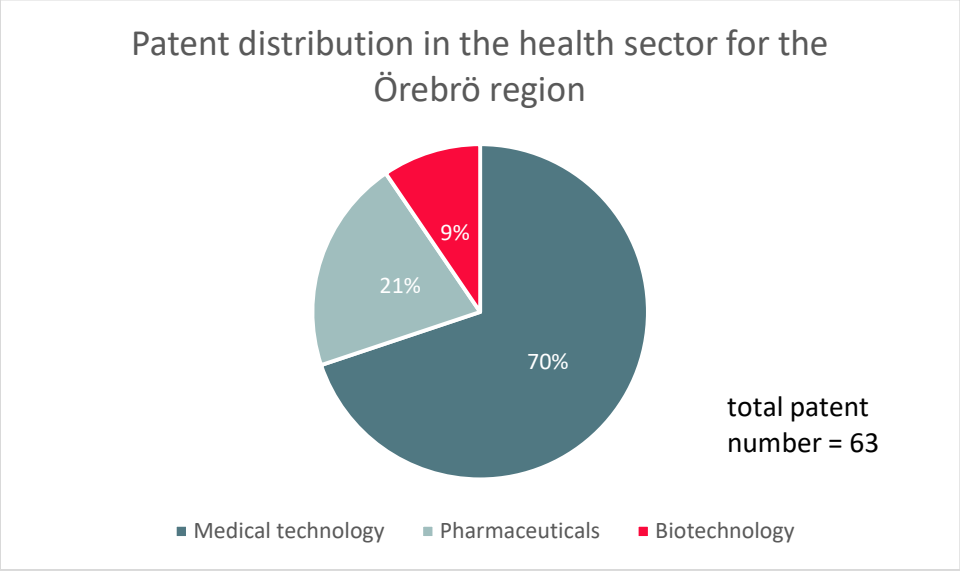


Figure 14. Percentage of patents belonging to the three major groups linked to the Health sector.

When analyzed the content of the patents by their titles, the topics emerging from the "medical technological" classification are implants for ostomy methods, tools for angiographic procedures, and processing systems and methods for blood components. Likewise relevant are patents dedicated to the construction of vehicles for the disabled, wheelchairs, chairs for conveying a person with limited ability to move, or devices for supporting and stabilizing an injured person.

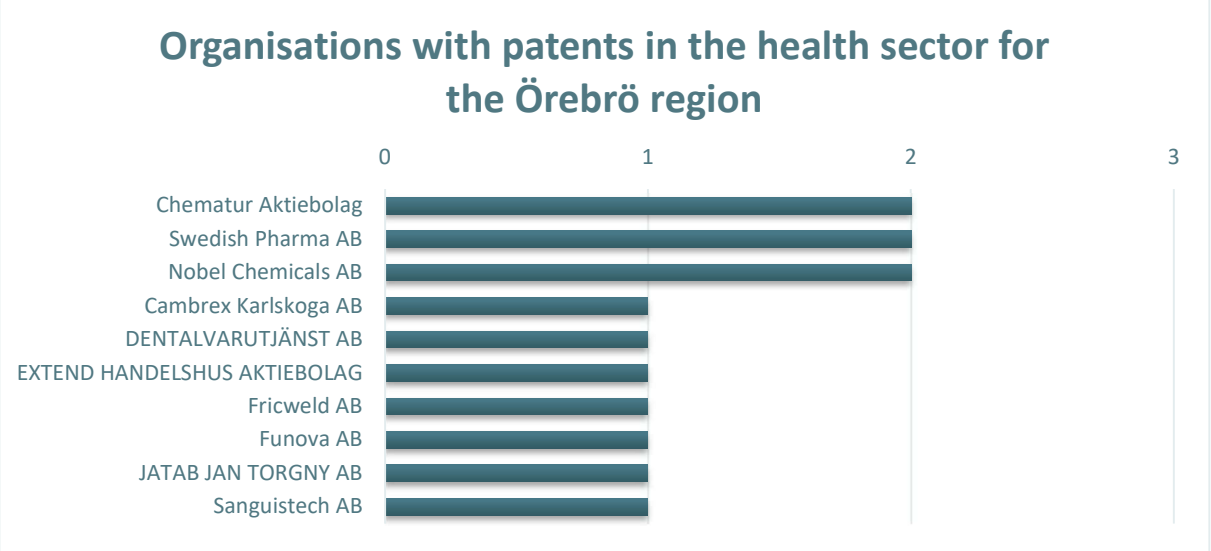


Figure 15. List of companies with inventions registered in the Medical Technology, Pharmaceutical, and Biotechnology sectors.

4.4 European projects and territorial priorities

The goal of selecting the following projects is twofold; to identify projects and initiatives developed in Örebro which relate to the main priorities stressed by the region as a result of the stakeholder engagement process and, secondly to build a potential assortment of initiatives that could serve as an innovation story for task 2.3 (Study of innovation biographies of health pilots). The project relates therefore to assistive health-rehabilitation and the use of artificial intelligence to address active and healthy ageing. The source of information correspond to the EU Cordis database from the Horizon 2020 funding programme. The following table characterizes the initiatives:

Project acronym	Name	Description	Period	Regional Organisation
CARESSES	Culture Aware Robots and Environmental Sensor Systems for Elderly Support	The objective of the project is to build culturally competent care robots, able to autonomously re-configure their way of acting and speaking, when offering a service, to match the culture, customs and etiquette of the person they are assisting. CARESSES' innovative solution will offer elderly people a safe, reliable and intuitive system to foster their independence and autonomy	2017 -2020	Örebro University
MoveCare	Multiple-actOrs Virtual Empathic CARgiver for the Elder	It develops and field tests an innovative multi-actor platform that supports the independent living of the elder at home by monitoring, assist and promoting activities to counteract decline and social exclusion.	2017 – 2020	Örebro University
SOCRATES	SOcial Cognitive Robotics in The European Society	SOCRATES is a PhD training program for 15 young researchers, created to develop the field of Social Robotics with an application focus on Robotics in Eldercare. The robot's functionality and design, and will be addressed from a range of perspectives in five research workpackages: Emotion, Intention, Adaptivity, Design and Acceptance.	2016 -2020	Örebro University

5. IDENTIFICATION OF FINAL PRIORITIES IN THE REGION

Shaping the territorial dimension of future policies for sustainable growth requires understanding the territorial diversity – key challenges and development perspectives – of different places as well as formulating policy approaches and implementation tools that can help to maximise their development potentials. Each region has a unique perspective on global developments. To specify a place-based approach to smart specialisation in times of Grand societal challenges, locally and historically situated discourses and practices need to be taken into account for aligning research and society.

Our approach may assist policymakers in designing and implementing RIS3 strategies that not only promote smart (i.e. competitive) but also inclusive and sustainable regional economic development. By combining information on the relative strength of regional knowledge production activities (e.g. science and technology that is linked to global developments) with information about regional stakeholders, local needs and policies, we can thus specify priorities that can help to maximise the regional development potentials. As a result of the analyses conducted, the territorial priorities identified for the region are summarized below.

Outcomes from the relatedness indicators show all the fields several fields from Biomedicine and Health Science exhibiting prioritized fields, based on RCA values. Some of this fields area: **Surgery, oncology, Endocrinology & metabolism, Urology & Nephrology, Sport science**. A complete list can be found in Figure 7. Some of the cross-disciplinary fields between Social Science and Humanities, which overlap with the Biomedical and Health Science clusters are Nursing, Gerontology, Psychology, Rehabilitation that involve activities from two or more academic disciplines. As indicated by the regions these fields are considered a focus of analysis.

Also, from figure 7 (relatedness analysis) judging by the proximity of the fields, as the region performs well in terms of number of publications in **Gerontology**, as it's the case for Örebro, the region would have a better chance to specialize in closer fields such as **Rehabilitation,** that appear adjacent in the map.

The analysis in greater detail using the Micro-level field analysis signaled one of the most prominent micro-level fields emerging from the regional scientific landscape in Mathematics and Computer Science, labeled as "**Automation & Control Systems**" it refers to the expertise and use of **Robotics and Autonomous Systems**. In the same way, the analysis of the Biomedicine and Health Science field at the micro-level, denotes the appearance of new fields connected to **Gastroenterology and Hepatology.** This, concerning inflammatory bowel diseases and digestive diseases. Likewise, it is possible to identify the **surgery field,** related to different areas of expertise (oncology, obesity, trauma) as showing high scores.

It is worth noting that, despite **Robotics** is a strong field in the region in terms of the level of specialization, of the scientific production and the Research groups developing new knowledge, the most relevant application is related to the environmental risk field and the use of mobile robots for industrial operations. The connection between Robotics and Biomedical and Health science characterized by the research output appears related to **human-robot interaction** and the treatment of **autism with social robots**.
However, we found at the publication level, the use of Mobile Robotic Telepresence for elderly people.

By analyzing the regional research output at the publication level, we found an extensive set of publications whose content is directly connected to the regional priorities. Specially referring to the **well-being and care**

and monitor of the elderly people using **Social Assistive Robots** or **ICT platforms**. Some of the articles also address **socio-technical challenges** in the implementation of monitoring technologies in Elderly Care.

Concerning the relevant actors in the field of Robotics, the **Centre for Applied Autonomous Sensor Systems (AASS)** is a strong research environment that performs research on autonomous systems, with a focus on their perceptual and cognitive capabilities. They develop a range of autonomous-systems solutions for elderly care in domestic environments as in *Ängen senior residence facility* in Örebro run by Örebro municipality.

When analized the content of the **patents** for the region, the most relevant topics emerging from the "medical technological" classification are implants for ostomy methods, tools for angiographic procedures and processing systems and methods for blood components. Likewise relevant are patents dedicated to the construction of **vehicles for the disabled**, wheelchairs, chairs for conveying a person with limited ability to move, or devices for supporting and stabilizing an injured person.

The selection of **European projects** funded by Horizon 2020 (CORDIS database) and concerning priorities stressed by Örebro region on assistive health-rehabilitation and the use of artificial intelligence for active and healthy ageing concern three initiatives (CARESSES, MOveCAre & SOCRATES). These projects deal with Culture aware robots for Elderly support, platforms supporting independent living of the elder at home and a Ph.D. training to develop the field of Social Robotics with an application focus on Robotics in Eldercare. Örebro University is the regional participant organisation.

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