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Review on regional resources and further development of Analytical Research Infrastructures

The needs and potential for macro-regional cooperation in the BSR

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Foreword

This report has been written by Sari Stenvall-Virtanen, Development and project manager at the Brahea Centre at University of Turku as part of the Baltic TRAM (Transnational Research Access in Macro-Region) project, Work Package 4.1 activities. Director Ninetta Chanioutou at Kainuun Etu Ltd has made a highly appreciated and valuable effort in collaboratively identifying the key findings and conclusions presented in this report.

Baltic TRAM project in Brief

Baltic TRAM (Transnational Research Access in Macro-Region) establishes structures to serve as interface between analytical research institutes and companies, so called Industrial Research Centres (IRECs). During the project invited companies are offered consultations and access to research facilities to test their ideas.

The Baltic TRAM project offers companies free access to state-of-the-art analytical research facilities across the Baltic Sea Region, providing technical and scientific expertise to help solve challenges associated with developing new products or services. The overall objective is to boost innovation, secure the implementation of smart specialisation strategies, and encourage entrepreneurship by supporting small and medium size enterprises – thus contributing to the regional effort of making the Baltic Sea Region innovative, sustainable and competitive.

To achieve this, Baltic TRAM also feeds into the transnational research and innovation agenda. It performs benchmarking analysis on national roadmaps for research infrastructures and smart specialisation strategies, and provides recommendations to policy makers.

Baltic TRAM builds on the findings of Science Link, an initiative which received EU project funding 2012-2014. Science Link is currently operated as a network. The purpose of Science Link network is to encourage innovation and entrepreneurship in the Baltic Sea Region, as well as to strengthen the region's competitiveness in a global context. It supports industrial research with synchrotron radiation and neutrons at research facilities in northern Europe. The aim is to create awareness of the possibilities offered at research facilities in the region and to show how research and development at these sites can contribute to innovation within European industry.

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Interreg Vb Baltic Sea Region Programme contribution: 3,207,699.40 EUR

The project runs from March 2016 until February 2019.

Baltic TRAM website: www.baltic-tram.eu

Keywords: SME development, smart specialisation, Baltic Sea Region, macro-regional cooperation, research infrastructures, innovation, regional development, science-business collaboration

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1. Introduction

As part of the on-going Baltic TRAM (Transnational Research Access in the Macro-region) project activities an extensive review on regional analytical research facilities, related intermediaries and current operational networks and resources, and their further development in the context of the transnational science-business collaboration in the Baltic Sea Region was drafted. The first part of the results of this work have been published in *Review on regional resources and further development of Analytical Research Infrastructures – Regional maps of science and business collaboration networks*[1] which brings together knowledge of the current number, status and nature of the regional analytical resources, the state of their intermediate and supporting administrative organisations and the research, development and innovation networks of the project-partner regions.

Identified actors in the Baltic TRAM project regional innovation ecosystems included the following: governmental agencies and bodies; the most important funding instruments for SMEs innovation and development; higher education institutions with research services and technology transfer offices; other research and technology organisations; commercial analytical laboratories and big companies with their own R&D infrastructures; intermediaries and regional development organisations; Incubators, science parks and chamber of commerce and other relevant trade organisations. Inevitably, this mapping exercise reflects different national and regional approaches to regional innovation systems. Thus, for example, in some cases the 'optimal region' has been defined (by the project-partner) to cover the whole country and in others the administrative regional limits shape also the regional innovation system selected for further analysis.

1.1 Objectives

The objective of the present report on *Review on regional resources and further development of Analytical Research Infrastructures* is to complement the country reports (*Regional maps of science and business collaboration networks*). To achieve this objective the report summarises the country reports, recognises the most topical development needs and challenges connected to the full utilisation of the research facilities (including the macro-regional level) in the Baltic Sea Region, and draws conclusions about the overall needs, potential and follow up actions for macro-regional research in the BSR. Furthermore this report presents some basic insights on how the collaboration between the Analytical Research Infrastructures could be optimally developed for the best performance in short and especially in long term and what focus should be taken to fill in the current gaps.

Among the most important follow up actions, planned to take place during the Baltic TRAM implementation, is the uptake of practical and operational knowledge from this report for scaling up the established Network of IReCs in respect to its structure, specialisations and overall network operation and management towards a sustainable, macro-regional research cooperation in the field of material sciences.

Wider operational and political level recommendations at regional, national and macro-regional level for optimal functionality and performance of Analytical Research Facilities in short and long term will be published separately towards the end of the Baltic TRAM project.

[1] Stenvall-Virtanen, Sari, 2018. Review on regional resources and further development of Analytical Research Infrastructures - Regional maps of science and business collaboration networks, https://www.baltic-tram.eu/sites/sites_custom/site_baltic-tram/content/e24058/e24059/e66110/e66134/ReviewonregionalresourcesandfurtherdevelopmentofAnalyticalResearchInfrastructures-Regionalmapsofscienceandbusinesscollaborationnetworks_eng.pdf, Accessed 24.4.2018

1.2 Methodology

To be able to argue on the needs and potential for macro regional cooperation on a concrete level, an integrative mechanism, rationale should be proposed as the base for the argument. One way to address this is to identify and discuss economic base proximities among the Baltic TRAM regions and, in parallel, research base gaps in the same (partner) areas. Economic base proximities relate to similar or complementary types of activities and resources that could lead, eventually, to a macro-regional area with clustering potential and economically self-sustaining research context. This approach accounts for past and present state of play of the regions. To capture the evolutionary dynamics of the regions and hence, the potential macro-regional convergences, one way would be to review the GERD & BERD[2] trends in the partner areas and match them to research services available. Yet another way would be to refer to policies and the potential proximities based on the policy provisions. One such policy is the RIS3 of the partner areas, which is acknowledged as a strong potential macro-regional integrator in the Baltic TRAM project and the respective country reports.

Thus, the present report concentrates on discussing the economic base, the research gaps and the policy orientations. However, this is only an introductory step leading to more in-depth, concrete and evidence-based analysis of the potential for macro-regional solutions.

1.3 Structure of the report

The structure of the report follows, more or less, the methodological steps presented in part 1.2. Thus, in addition to the Foreword and the Introduction sections, the remaining report comprises of the following parts:

Part 2 Regional economies and RIS3 specialisations in the Baltic TRAM regions
Part 3 First insights from the Baltic TRAM experiments
Part 4 Structures of regional research-to-business collaborations
Part 5 Regional research gaps and macro-regional opportunities
Part 6 Towards a feasible Network – based structure in science-business collaboration
Part 7 Conclusion

1.4 A word on terminology

In general, the term 'research infrastructures' refers to facilities, resources and related services used by the scientific community to conduct top-level research in their respective fields ranging from social sciences to astronomy, genomics and nanotechnologies. Examples include singular large-scale research installations, collections, special habitats, libraries, databases, biological archives, clean rooms, integrated arrays of small research installations, high-capacity/high speed communication networks, highly distributed capacity and capability computing facilities, data infrastructure, research vessels, satellite and aircraft observation facilities, coastal observatories, telescopes, synchrotrons and accelerators, networks of computing facilities, as well as infrastructural centres of competence which provide a service for the wider research community based on an assembly of techniques and know-how. RIs may be single-sited (a single resource at a single location), distributed (a network of distributed resources), or virtual (the service is provided electronically)[3]. These key infrastructures have not only been responsible for some of the greatest scientific discoveries and technological developments, but are also influential in attracting the best researchers from around the world and in building bridges between national and research communities and

[2] GERD = Gross domestic Expenditure on Research & Development; BERD= Business Expenditure on Research and Development. http://ec.europa.eu/eurostat/statistics-explained/index.php/R_&_D_expenditure .

[3] MERIL, https://portal.meril.eu/meril/

scientific disciplines[4]. In the framework of the Baltic TRAM project, the focus has been only in part of RIs, namely in *Analytical research facilities* [ARFs], i.e. material measurement infrastructures. The mapping of ARFs, their intermediaries and operational networks reflect in the Baltic TRAM framework business-university collaboration which is an important component of regional innovation ecosystems. Innovations are complex, non-linear processes, so the complexity of regional innovation ecosystems is not at all surprising either. However, the complexity of the policy support mechanisms for research and innovation poses a generally identified barrier to business engagement in collaborative activities, especially for small businesses. It also makes it difficult for governments to take a systems' view of its support mechanisms for research and innovation. The governmental actors should therefore seek to reduce complexity wherever possible and, where simplification is not possible, every effort should be made to ensure that the interface to businesses and academics seeking support for collaborative R&D is as simple as possible.[5]

[4] http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=what, Accessed 18.4. 2016.

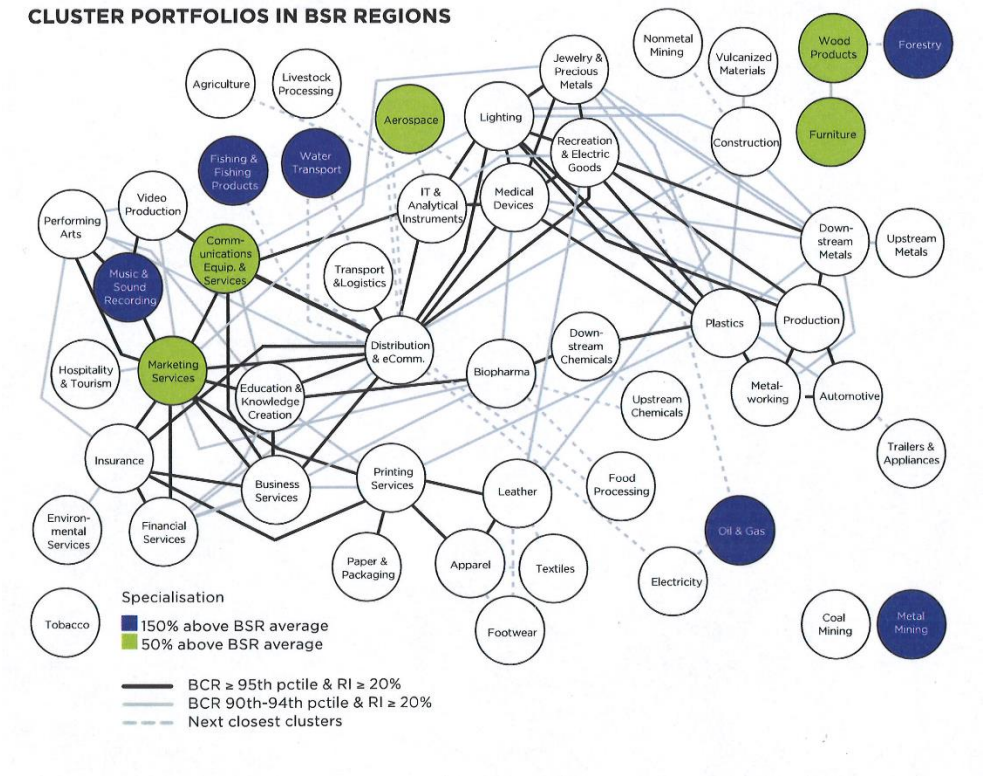
[5] The Dowling Review of Business-University Research Collaboration, 2015. http://www.raeng.org.uk/policy/dowling-review/the-dowling-review-of-business-university-research,accessed 18.2.2018

2. Regional economies and RIS3 specialisations in the Baltic TRAM regions -Towards a shared innovation base

The overall specialisation patterns across the Baltic Sea region reveal a mix of traditional and modern cluster categories emerging as areas in which the regions have a relatively high share of economic activity on European level. The Number of companies in these fields is significant. For example State of the Region report published by the Baltic Development Forum[6] identifies current cluster composition of the Baltic Sea Region (BSR) economy. Clusters are considered as important when trying to understand current specialisation patterns that may also explain the type of industries and sectors that are likely to emerge in the future.

The report uses the European Union Cluster Portal to identify strong clusters that reach particular critical mass being in the top 20% of all European regions of relative employment specialisation in this cluster category. Strong clusters have been shown to be associated with strong performance in terms of wage levels and job creation. As in the case of the RIS3 specialisations, clustering patterns deserve to be looked into further, also in terms of their macro-regional potential. Especially strong clusters are identified around Forestry and related wood products and furniture industries; Oil and Gas and related Electricity; Metal mining and Water transport.

Figure 1 Cluster portfolios in the Baltic Sea Region[7]



[6] Christian Ketels, Helge J. Pedersen (2016) State of the region report. The Top of Europe – Doing Well Today, Feeling Worried about Tomorrow. Baltic Development Forum.

[7] Christian Ketels, Helge J. Pedersen (2016) State of the region report. The Top of Europe – Doing Well Today, Feeling Worried about Tomorrow. Baltic Development Forum.

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The European Cluster Panorama[8] has in addition defined ten emerging industries in Europe that are relevant in the framework of Baltic TRAM Network of IReCs and its adopted material sciences approach. These emerging industries are in many ways connected to the strong clusters identified in the BSR. Especially interesting emerging industries in the Baltic TRAM framework are advanced packaging, biopharmaceuticals and medical services, blue growth industries, digital industries, environmental industries and mobility technologies. The need to modernise these industries requires the adoption of new technologies but also competing for new or emerging domains identifying opportunities for structural change in regions.[9]

Targeting special development activities to emerging industries would most likely require new policy instruments to support the related entrepreneurial activities and the development of new industrial segments as the foundation for the regional industrial transformation[10]. At this stage of the Baltic TRAM project it is still open if and how the open business calls in the project have managed to contribute to the development of RIS3 and of emerging industries. However, at the end of the project it will be possible to evaluate whether the Baltic TRAM project indeed has been able to showcase its support especially for RIS3 or for emerging industries. Depending on the final results of the practical experimental phase of the project the Network of IReCs can then promote itself as a network offering a novel and effective support instrument targeted to RIS3 industries or more novel emerging industries that are developing around and in the intersections of existing industries.

At the European level, tools for macro-regional and even interregional cooperation have also been introduced. Directorate-General for Regional and Urban Policy (DG REGIO) and Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), facilitated by the Joint Research Unit, have set up various thematic platforms[11]. Groups of regions (three at least) are invited to submit concrete proposals of cooperation, for example under the Agri-food or Industrial modernisation themes. The process is about identifying regional investment projects and interregional innovation partnerships. During the set up phase, there is no funding involved. The applications are required to be made by regional authorities and following that, participation of all relevant actors (business, education, research) is welcome. "These platforms are expected to act as dynamic spaces to enable experimentation, support for continued co-creation of joint roadmaps and stimulate interregional cooperation in regions with matching priorities. The identification of sustainable regional (and inter-regional) development paths, however, requires longer term strategies and investment horizons as well as broader monitoring and benchmarking settings"[12].

RIS3 is a rather recent tool of the Structural Funds (ERDF), firstly introduced in the on-going financial period 2014-2020. Therefore it is a dynamic but still very much evolving instrument, i.e. it has not yet shown its full potential. However, as an anticipatory tool for identifying emerging demand for the Network of IReC services it is a valuable reference, and it is important to take into account at least for macro-regional cooperation purposes as shared RIS3 components that the dedicated country specific reports in the Baltic TRAM have revealed[13].

[8] Ketels, C. and Protsiv, S: European Cluster Panorama (2016). Center for Strategy and competitiveness, European Cluster Observatory Report, October. pp.

[9] Foray and Goenaga 2013 in Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities, pp 7

[10] Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities, pp. 29

[11] Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities. pp. 8

[12] Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities. pp. 8-9

[13] Stenvall-Virtanen (ed.) 2018. Review on regional resources and further development of Analytical Research Infrastructures – Regional maps of science and business collaboration networks and Sime, Zane (ed.), 2017. National innovation and smart

Results from the RIS3 analysis conducted in the Baltic TRAM project show that the regional economies share at sectorial level but also sometimes at industry-level a number of RIS3 priorities. Shared components of the smart specialisation strategies for all Baltic Sea Region states include the following industrial priorities: 1) Health and Wellbeing, 2) Digital Growth and industrial modernisation (ICT applications and ICT solutions for manufacturing and production, 3) Energy and Green industries and as a shared cross-cutting priority Advanced materials[14].

The analysis also reflects the basic registered demand for the IReC services at transnational level and at the same time the biggest potential for transnational science-business cooperation in the Baltic Sea Region. Based on the RIS3 analysis made during the Baltic TRAM project[15] we argue that the following areas have the most potential smart specialisation areas at the macro-regional level and could hence form a stable industrial demand based basis for the forthcoming Network of IReCs:

- Health and wellbeing & Bio technologies (in all BSR states)[16]
- Digital Growth and industrial modernisation and ICT (in all BSR states)[17]
- Energy and Green industries & advanced materials (more common in the BSR than the EU average[18]) and
- Advanced materials

It would be important to consider, for policy makers as well as for the RDI actors, the great growth and development potential of such a shared industrial base. However, the way the shared BSR RIS3-base could be taken into account for quantifying demand for the IReC services requires and deserves still more research. While it is logical to argue that this base could be a solid foundation for the Network of IReCs and its industrial strategy it is also important to remember that policies and also activities change and adjust only with time. For example, RIS3 are under revision at the moment in many EU member states and changes in this regard can be exogenous or unpredictable. Moreover, the new period of the EU funding will again bring important changes[19] some of which are still strongly debated, for example in relation to funding arrangements, social inclusion, industrial development, linkages between the structural funds and country specific reports (CSR), etc. Nevertheless, what appears to be "permanent" is the

specialisation governance in the Baltic Sea region - Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing 4/ 2017.

[14] Sime, Zane (ed.), 2017. National innovation and smart specialisation governance in the Baltic Sea region - Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing 4/ 2017.

[15] Sime, Zane (ed.): National innovation and smart specialization governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing Series 4/2017.

[16] Statistics taken from: Christian Ketels, Helge J. Pedersen (2016) State of the region report. The Top of Europe – Doing Well Today, Feeling Worried about Tomorrow. Baltic Development Forum. http://www.bdforum.org/wp-content/uploads/2016/11/2016_RegionRep.pdf. Accessed 24.4.2018

[17] Statistics taken from: Christian Ketels, Helge J. Pedersen (2016) State of the region report. The Top of Europe – Doing Well Today, Feeling Worried about Tomorrow. Baltic Development Forum. http://www.bdforum.org/wp-content/uploads/2016/11/2016_RegionRep.pdf. Accessed 24.4.2018. Digital Growth, industrial modernisation and ICT can also be leveraged into Advanced manufacturing which refers to the use of innovative technology to improve products or processes.

[18] Statistics taken from: Christian Ketels, Helge J. Pedersen (2016) State of the region report. The Top of Europe – Doing Well Today, Feeling Worried about Tomorrow. Baltic Development Forum. http://www.bdforum.org/wp-content/uploads/2016/11/2016_RegionRep.pdf. Accessed 24.4.2018

[19] See for example 1) John Bachtler, Carlos Mendez and Fiona Wishlade, 2018.Reshaping the EU budget and Cohesion Policy: carrying on, doing less, doing more or radical redesign? European Policy Research Paper No. 104, ISBN Number: 978-1-909522-26-8, University of Strathclyde Publishing 2017 January 2018. 2) COTER-VI/040, 128th plenary session, 22 and 23 March 2018, DRAFT OPINION: The cost and risk of non-cohesion: The strategic value of cohesion policy for pursuing the Treaty objectives and facing new challenges for European regions.

thematic concentration approach[20], i.e. the RIS3-introduced approach. Thus, a possible assumption for the Network of IReC services in the future could be that the shared BSR RIS3 industrial priorities base is here to stay, and then there would be diversifications within the individual countries which need to be accounted for in the services of the IReCs. Anyway, a more extensive and in-depth analysis of the macro-regional cooperation context and tools would be required in order to form a solid policy approach. More business pilots would also be needed to support this on a practical level.

Another potentially important agent for macro-regional cooperation is the existence (or not) of regional Pockets of Excellence. The term Pockets of Excellence (PoE) are defined as "regional research and innovation ecosystems which are capable of driving regional growth and of linking up to top-European research networks" [21]. Following the definition, PoEs may exist in all types of regions but PoEs in less developed regions are likely to excel in fewer scientific fields than those in more developed regions. [22] In the context of the Network of IReCs the PoEs are more or less connected and contributing to regions' smart specialisation priorities and might also be well placed towards contributing to the creation of synergies in specific specialisation areas among the IReCs inter-regionally.

Pockets of scientific excellence do not necessarily mean direct impact on regional growth or even connectivity to the regional smart specialisation strategies but have nearly non-existent knowledge spill overs or impact on regional innovation activities or economic growth. The basis for smart specialization is a process of entrepreneurial discovery involving companies, academic and public research centres, users, public sector etc., to explore and open new domains of economic activities where competitive advantage can be built around these kinds of "micro-systems of innovation". Coalitions at regional level contribute to the creation of constructed regional advantages. It follows that patterns of coalitions (value chains, for example) and related clusters can pave the way to strategic coalitions among Pockets of Excellence regions.[23]

For the Pockets of Excellence to work well several pre-conditions need to be in place. Focus of research should be relevant for regional economy or specific technologies to drive existing or emerging industries in the region. Furthermore, the absorptive capacity of business eco-systems should be high[24]. In the context of Baltic TRAM the discussion on Pockets of Excellence might prove relevant provided the pattern, complementarity of actions or value chains of the macro-regional cooperation is well clarified and beneficial collaboration options are confirmed. In a future scenario the Network of IReCs could act as an important tool in activating and developing macro-regional pockets of excellence.

Therefore, in addition to the general RIS3 based network structure and corresponding general industrial strategy of the network, a more specific mapping of the S3 across the BSR was done based on the regional RIS3 analysis.[25] Based on the existing regional analysis and information an early map of more specialized potential "RIS3 nodes" was drawn to identify potential network structures, macro-regional pockets of excellence, and to build a basis for a more specialised collaboration and industrial activation between the regions. The term RIS3node can here be

[20] John Bachtler, Carlos Mendez and Fiona Wishlade, 2018.Reshaping the EU budget and Cohesion Policy: carrying on, doing less, doing more or radical redesign? European Policy Research Paper No. 104, ISBN Number: 978-1-909522-26-8, University of Strathclyde Publishing 2017 January 2018.

[21] Reid, A., Markianidou, P., Evrigenis, A. (2015): Pockets of excellenece with innovation potential. A study for the European Commission DG Research & Innovation, Unit A6 – RISE Team, page 4

[22] Reid, A., Markianidou, P., Evrigenis, A. (2015): Pockets of excellenece with innovation potential. A study for the European Commission DG Research & Innovation, Unit A6 – RISE Team, page 4

[23] Reid, A., Markianidou, P., Evrigenis, A. (2015): Pockets of excellenece with innovation potential. A study for the European Commission DG Research & Innovation, Unit A6 – RISE Team.

[24] Reid, A., Markianidou, P., Evrigenis, A. (2015): Pockets of excellenece with innovation potential. A study for the European Commission DG Research & Innovation, Unit A6 – RISE Team

[25] Summary table available in Annex. Inputs accessed through the JRC sites, general access at: http://s3platform.jrc.ec.europa.eu/map . Accessed 09042018.

understood as a thematic industrial field where more than one region[26] is either performing strongly at the moment or can demonstrate a clear potential in the near future. Based on the mapping five more specific macro-regional RIS3 nodes with collaborative potential among the regions were identified. In the proceeding phases of the network development the Baltic TRAM project partners will iterate this analysis further based on the quantitative analysis of the economic base and then making the final suggestion on the Network of IReCs collaboration structures. The identified RIS3 nodes are listed below.

- First identified RIS3 node is connected to Agri-Food where especially the Danish, Finnish and German regions and connected businesses are active[27].
- Second identified RIS3 node is connected to blue growth and maritime cluster binding together regions from Denmark, South-Sweden, South-West Finland and Northern Germany.
- Third identified RIS3 node is connected to metal industry more specifically connected to Finland, Sweden and Poland,
- Fourth identified RIS3 node links to mobility and aviation connected to Finland, Germany and Sweden
- Fifth identified RIS node links to wood, forestry, furniture and construction industries and is most evidently connected to Latvia, Lithuania, Germany (wooden sustainable construction) and Finland.

Eventually, the smartness of a region relates to its capacity to leverage its capacities, and its ability to integrate diverse actors in the region's innovation practice. Here leveraging regional strengths and capacities in relation to Europe's program for research and innovation strategies for smart specialisation is also essential. The role of universities is especially important. In many countries universities are taking an increasingly active role in regional development, and at the interface of universities, industry, public authorities and citizens – the so called Quadruple Helix actors in the regional innovation ecosystem - have become important enablers of innovation. The "third role" of universities can be seen as essential for maintaining smart and effective regional innovation ecosystems.[28] Competitive edge is increasingly based on a shared intent of the key regional actors to turn an area into a significant innovation hub, and for selected themes (RIS3 nodes), even an innovation frontrunner. Innovation hubs tend to have factors in common, for example they have internationally valued special expertise and business activities based on this expertise and they are able to create new knowledge that can be applied more widely. Furthermore, they very often also have new organizations, new actors representing hybrids that integrate elements and activities from.[29] In the framework of Baltic TRAM, the Network of IReCs wants to be this kind of a new emerged operator acting as a mediator between businesses and science. Therefore, the final conceptualisation of the network structures should include not only a deeper analysis of the economic base of the regions but also an additional analysis of the regional science and business collaboration structures.[30]

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[26] Regions represented by the Industrial Research Centres, See Annex 1 for more information

[27] Stenvall-Virtanen, Sari, 2018. Review on regional resources and further development of Analytical Research Infrastructures - Regional maps of science and business collaboration networks, https://www.baltic-tram.eu/sites/sites_custom/site_baltic-tram/content/e24058/e24059/e66110/e66134/ReviewonregionalresourcesandfurtherdevelopmentofAnalyticalResearchInfrastructures-Regionalmapsofscienceandbusinesscollaborationnetworks_eng.pdf, Accessed 24.4.2018

[28] Markkula, Markku; Kune, Hank 2015. Making Smart Regions Smarter: Smart Specialisation and the role of universities in Regional Innovation Ecosystems. Technology Innovation Management Review, October 2015 (Volume5, Issue 10). https://timreview.ca/article/932. Accessed 24.4.2018

[29] Launonen, M. Viitanen, J 2011. Hubconcepts: The Global Best Practice for Managing Innovation Ecosystems and Hubs. Helsinki: Hubconcepts Inc.

[30] The regional maps of science and business collaboration structures were mapped in the Baltic TRAM, see : Stenvall-Virtanen (ed.) 2018. Review on regional resources ad further development of Analytical Research Infrastructures. Regional maps of science and business collaboration networks. https://www.baltic-tram.eu/sites/sites_custom/site_baltic-tram/content/e24058/e24059/e66110/e66134/ReviewonregionalresourcesandfurtherdevelopmentofAnalyticalResearchInfrastructures-Regionalmapsofscienceandbusinesscollaborationnetworks_eng.pdf, Accessed 24.4.2018.

3. First insights from the Baltic TRAM business engagement activities

At the time of publishing this report (April 2018), the Baltic TRAM partnership is still in the process of making the final evaluation of the regions' economic activities, including raw data inputs from the demonstrated industrial demand in the form of actual business enquiries. Regarding the demonstrated industrial demand, by the end of March 2018 the IReCs had received approximately 2/3 (n=40) of the planned target number of pilot business enquiries. These enquiries have generated various types of early insights of the existing industrial demand of the regions. The most relevant insights at this stage are presented below.

Firstly, the received business enquiries have given the partnership an opportunity to pre-analyse the existing industrial demand by comparing the field of business activity with the defined smart specialisation strategies of the respective regions. What can be said from the demonstrated demand is that some 35% of the cases are aligned with RIS3 (based on NACE codes, and taking into account also related variety options up to four digit points). Hamburg is the region with the highest alignment between demand and RIS3, while the two Finnish regions and Malopolska demonstrate the least alignment.

Furthermore, the intensity of the demonstrated industrial demand was considered. By looking more deeply into the business cases at regional level one can notice that there are differences between regions on how well the cases match the additional local RIS3 that are not among the common RIS3. Differences in matching the services to defined RIS3 mostly tend to depend on the adopted local marketing strategies. Those Industrial Research Centres that have from very early on adopted a more focused marketing strategy (e.g. Finland (Kajaani), Poland, Sweden, Germany) have succeeded to attract businesses that are directly connected to the regional RIS3. On the contrary, those Industrial Research Centres that have adopted a broader marketing strategy (Finland (Turku), Estonia) by reaching out directly also to other than the identified RIS3 industries, have gained enquiries from a more broad business community hence reflecting not only the regional RIS3 but the economic structure of the respective region.

Thirdly, the location of industrial demand and the location of the analytical research facilities have also been discussed. We considered whether any patterns of demand for interregional services could be identified. Unfortunately, our sample size is currently rather small and while there already are three business cases clearly demonstrating demand for interregional analytical research facility services, they are still too few to profile any pattern. Maybe there will be more cases like this before the end of the Baltic TRAM project.

Fourth insight is connected to the quality of the demonstrated industrial demand. Current industrial demand has been distinguished into compliance services (i.e. measurements as part of regular product commercialisation functions, ensuring compliance to certain standards) and into product development – related services.

What conclusions could then be drawn based on the business engagement activities and related observations? *Regarding policy alignment as well as the quality of demand*: logically, a more thorough mapping of RIS3 structures binds nicely together the most important criteria for the sustainability of the future research-business collaboration and the existing regional industrial demand. Smart specialisation entails this same logic of prioritising some technologies and business fields[31]. According to this logic regions cannot stand out in more than a couple of domains and should therefore define priority areas where their dynamic competitive advantages can be established and strengthened. Such priority areas should be built upon a region's existing assets and resources and their development needs and potential. However, according to the first experiences one can say that this vertical and innovation-led approach is not an easy task for the regions. The inclusive consultative process and entrepreneurial discovery process raise many challenges when it comes to turning the strategies into practice. Particular attention

[31] Foray and Goenaga in Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities, pp. 5.

should be given to the potential attached to regional transformation and development of emerging industries. In a nutshell, regions should rely on their current research and innovation assets and potential, identify the technological and market based opportunities and at the same time adopt a forward-looking approach[32].

The discrepancy between RIS3 industries and demonstrated demand in the case of some regions, as well as the higher alignment in the case of other regions, indicate maybe also the importance of time, i.e. of policy and activity related maturity. Regions with historically strong economies, with historically high developed innovation spearheads, are those with the highest alignment. In such cases, it is most probably historically mature industries which, through their constant renewal processes and high R&D spending, that generate also demand for research services. In such regions, as for example in Northern Germany, analytical research facilities have been for a long time part of the regional development and success story. On the other hand, maybe the key to anticipating RIS3 generated industrial demand can be linked to KET applications (e.g. nanotechnologies, circular economy, new materials) and infer thereof the completeness (or not) of regional innovation systems and then seek complementarities at macro-regional level.

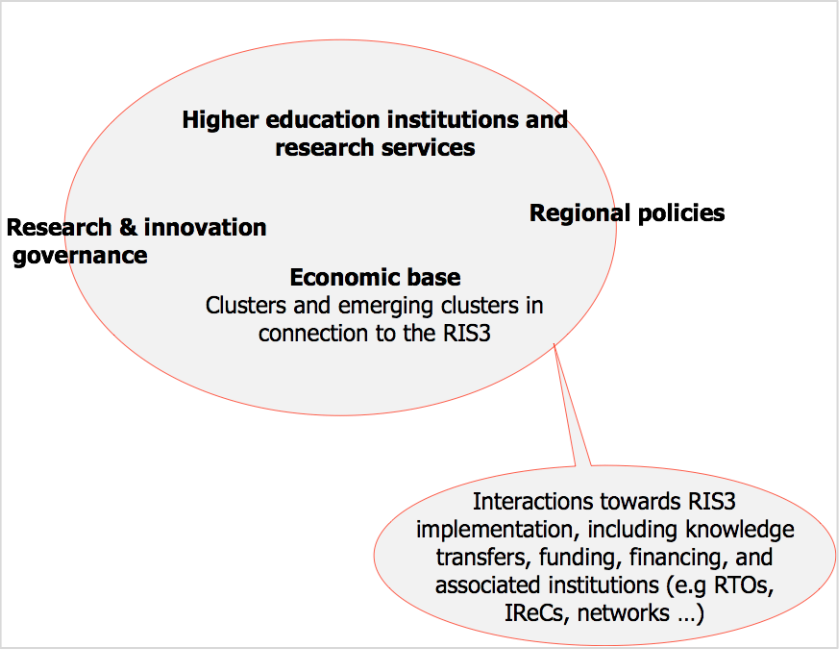
In conclusion, the Baltic TRAM business engagement activities to date (April 2018) indicate that when considering demand for research services at a strategic level, one should take into account policies (such as RIS3 for example), as well as the intensity of industrial renewal processes considered in time. As mentioned in the previous section of this report, during the remaining months in the Baltic TRAM project the partners will continue to seek in more detailed potential areas for complementarity and cooperation between regions to develop the research excellence towards industrial innovation performance and sustainable network structure.

[32] Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities, pp. 5-7

4. Structures of regional research-to-business collaboration

A regional innovation system can be understood as autonomous in the administrative sense (e.g. regarding tax collection and regional policy planning), however it is always part of a more inclusive national innovation system and examples indicate that it is the coherence between the national and regional levels that bring the best results for all parties concerned. Regional innovation systems can be seen as important enablers. This finding confirms similar results from many other research sources[33], however, they also imply (and this is what is important here) that when we discuss the needs and potential for research cooperation, this cannot be independent from the larger, national innovation context. This first important finding is summarised in Figure 1 below, in terms of five institutional and functional spaces: R&D governance, education and research knowledge base, economic base, regional policies, and the overall interactions flows that give the cohesion and allow the added value between the other four.

Figure 2 The five spaces of the regional maps and their basic interconnections



In line with the national or regional level development challenges described in the country specific reports, main current and future efforts in the BSR should be targeted to strengthen the flow from research to market and to better match the research, ARF offering and the needs of the regional industries. In this work different regions have their special needs and framework conditions to address. Accordingly as stated in the previous project publication initiatives such as for example the Baltic TRAM project should be further strengthened and intensified in order to further systematize the marketing of research services to companies in certain regional and industrial contexts. The fact that RIS3 supports KET production and applications, advanced materials and advanced manufacturing are all pointing to the relevance of macro-regional solutions.[34] Another way, besides project cooperation, to strengthen such research-to-business macro-regional initiatives would be to integrate them into regional policies, on the base

[33] See for example Markkula, Markku; Kune, Hank 2015. Making Smart Regions Smarter: Smart Specialisation and the role of universities in Regional Innovation Ecosystems. Technology Innovation Management Review, October 2015 (Volume5, Issue 10). https://timreview.ca/article/932. Accessed 24.4.2018

[34] BSR Policy Briefing Series 4/2017: National innovation and smart specialsation governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation, http://www.centrumbalticum.org/en/news_room/publications/bsr_policy_briefing.

of current and projected research needs and anticipated economic development. It follows that some targeted actions should be directed to strengthening of industry-related expertise in the regions and in the dedicated support organisations as for example the Industrial Research Centres (IReCs).

4.1 Research resources and analytical research infrastructures in the Baltic TRAM regions

Mapping of research resources and analytical research infrastructures in the Baltic TRAM project has been undertaken in the country reports and by desktop research at regional level and by utilising the Meril database[35]. In the process, it was realised that the maps in the Meril database deal more with the macro (national) and partially the meso (regional) level but do not address, at least yet, any interaction functions that are relevant in terms of the forthcoming Network of IReCs. Mapping clearly, even with some limitations in the data gathering methodology, reveals that the amount of different level analytical facilities and infrastructures is relatively high in the region in general but also relatively high in small economies like for example Estonia, Latvia and Lithuania. This implies that in terms of the IReC Network structure development, the partners need to adopt early on a clear criteria for the Network of IReCs membership and build a sustainable network structure and complementary service offering within the network. In addition, the Baltic Sea Region shows a geographical concentration of large-scale infrastructures (for example DESY Hamburg, Helmholz-Zentrum and Max IV) in the western part of the region[36] which further implies that there is a gap in this regard in the other parts of potential industrial user community and large-scale infrastructure services.

Identified actors in the Baltic TRAM project regional innovation ecosystems included the following: governmental agencies and bodies; the most important funding instruments for SMEs innovation and development; higher education institutions with research services and technology transfer [TT] offices; other research and technology organisations; commercial analytical laboratories and big companies with their own R&D infrastructures; intermediaries and regional development organisations; Incubators, science parks and chamber of commerce and other relevant trade organisations. Inevitably, this mapping exercise reflects different national and regional approaches to regional innovation systems. It is noteworthy to mention that in some cases the optimal region has been defined (by the project-partner) to cover the whole country and in others the administrative regional limits shape also the regional innovation system selected for further analysis.[37]

4.2 The IReCs network as a research-to-business enabler

The Baltic TRAM project in general serves as one of the examples of transnational science-business partnerships which is aiming to build a sustainable cooperation model for sustainable growth and competitiveness of businesses based in innovative products and services in the Baltic Sea Region. Therefore, this publication together with other publications prepared by the Baltic TRAM project will be important building blocks when the consortium will write their recommendations for further advancement of science-business cooperation in the Baltic Sea Region research,

[35] https://portal.meril.eu/meril/ ; last time accessed in December 2017.

[36] Minniberger, Christina; Ibert Oliver, 2013. Smart Specialisation in Science: A Qalititative Network Analysis of the Structures and the Effects of Research Infrastructure Cooperation in the BAltic Sea. EU flagship Project Science Link. https://www.science-link.eu/sites/sites_custom/site_science-link/content/e215/e946/e319/science_link_study_final_1404_eng.pdf. Accessed 24.4.2018

[37] Stenvall-Virtanen Sari (ed.) 2018. Review on regional resources and further development of analytical research infrastuructures – Regional maps of science and business collaboration networks. Baltic TRAM project publications. https://bit.ly/2GE1JFr. Retrieved on 4.4. 2018.

development and innovation framework and finally draft the Memorandum of Understanding for Viable Macro-Regional Cooperation of Research Infrastructures.

The objective of the IReCs is to connect local markets and companies with a transnational pool of analytical services. The demand for the IReC's services has been identified in the Baltic TRAM by combining three sources of inputs: 1) field research: the actual number of Baltic TRAM experiments (businesses receiving analytical research services)/ the total number of contacted businesses & the efforts it required[38]; 2) regional economic profiles, based on performance[39] and self-assessment[40]; 3) regional economic policies including RIS3 priorities, dedicated funds and related projects[41]. RIS3 forms, in principle, a very good base for anticipating future demand for IReC services as it combines place-based (ideally) economic specialisation priorities interpreted across shared (EU), conceptual and methodological approaches and responding also to joint performance objectives, such a development and applications of key enabling technologies (KET), industrial leadership, or societal challenges.

The network of IReCs serve these areas by identifying existing and latent demand for analytical research services in the partner regions and beyond and promote their specialisations. In the process, the IReC network is understood to also facilitate and support an evidence-based, sustainable macro-regional approach in the BSR, without excluding other EU areas. The idea is that the Network of IReCs will operate as a service and contact point network between the regional research facilities, intermediaries and businesses. The core functions of the Network of IReCs will include 1) Marketing and selling of research services to defined customer segments through awareness raising and outreach activities; 2) Knowledge transfer to SMEs to access and benefit from analytical research infrastructures and their research services; 3) Identification of latent demand especially among SMEs for research services; through close collaboration with innovation agencies and regional development companies; and 4) Promotion of a hybrid type of qualified, knowledge-based economy intermediary units (IReCs) through the Network of IReCs, project cooperation, knowledge exchange and continuous quality improvement. To achieve these objectives IReCs must, above all, be competent and up to date: competent in explaining and mediating the analytical research services to businesses including (if not especially) SMEs and business support actors and to be constantly updated by regional RIs. The IReC should have extensive knowledge about what the ARIs/ARFs offering at BSR level have to offer in terms of research opportunities and technologies.

An important challenge IReCs face, revealed through the IReC set-up discussion as well as the regional mapping conducted in the Baltic TRAM project, is that innovation intermediaries are hardly ever institutionally acknowledged in the research and innovation governance maps. It implies that the search for well-defined IReC profiles and the set-up of the network are addressing structural gaps in regional innovation systems, namely the function of research-to-business services. This function and what it requires for its qualified deployment need to be further taken into account by national innovation governance concepts. It is worth reminding that the in principle difference between Research and Technology Organisations (RTOs) and IReCs is that RTOs facilitate demand from businesses-to-research, whereas IReCs also address research-to-business activities and they provide tools for identifying latent demand for this purpose, in view of policy implementation towards improved innovation performance of regional economies. This dedicated role of the IReCs in the regional RDI ecosystem can be demonstrated as in Figure 3, below.

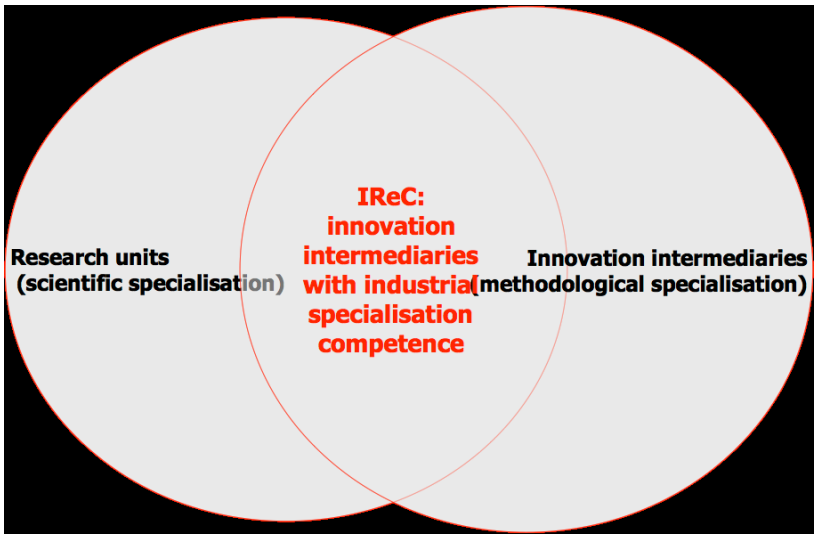
[38] Proposed indicator was: number of SMEsExperiments/(totalSMEs)*(number of contacts)

[39] Proposed indicator was: either GVA (gross added value) per industry per region or GERD + BERD per industry and region. GERD= general expenditure on research and development, BERD= business expenditure on research and development.

[40] See Annex 1 of the present report.

[41] RIS3, as a rather recent tool of the Structural Funds (ERDF), is a dynamic but still evolving agent, i.e. it ha snot shown yet its full potential.

Figure 3 The role of the IReCs in the regional RDI ecosystem



During the remaining months of the Baltic TRAM project the consortium will be developing the Terms of Reference for the Network of IReCs (ToR) which will be like a technical manual to guide the establishment of the network and management aspects of the network in the longer run. Furthermore, the ToR will state in clear terms what an individual IReC and the network jointly need to comprise. The main objective of the Terms of Reference for the Network of IReCs is to secure the long-term sustainability of the network and verify its purpose and objectives and collaboration structures and mechanisms with the relevant European research networks. The Terms of Reference for the Network of IReCs will include the core elements of the network model addressing its added value and collaboration models in the context of other existing research-business support schemes and networks.

One important aspect of the Network of IReCs, which could eventually be a reinforcement agent for the IReC network, is the open data aspect that has been piloted as both open science database and promotion of re-sue of research results, as part of the IReC service model development and business engagement activities in the Baltic TRAM project. How strongly this aspect will eventually be in the forthcoming network remains to be seen during the last months of Baltic TRAM project and drafting the guiding documents for the Network of IReCs. However, support for this has already been shown in the form of the Baltic TRAM agreement on open access enshrined in the Baltic TRAM Letter of Intent: Principles of Open Data Access, including the potential revised version of the open data regime should the Baltic TRAM partnership see fit to agree on an updated edition by the closure of the Baltic TRAM project.[42]

[42] Reference to 11.§ of the Baltic TRAM Letter of Intent: Principles of Open Data Access: https://www.baltic-tram.eu/sites/sites_custom/site_baltic-tram/content/e24058/e24059/e63869/e63871/TRAM_letter_of_intent_main_part_23.10.2017_eng.pdf

5. Regional research gaps and macro-regional opportunities

Nowadays it is common that university-business collaborations take place between universities and businesses across disciplines. However, there is still a lot more to be done to help existing efforts evolve from short-term, project-based collaborations to long term partnerships focused on industrially driven research and helping the businesses to identify industrial development challenges where applied research can provide some substantial help. Baltic TRAM project has been addressing this challenge by developing a research service model to serve the companies in the Baltic Sea Region. Results of the collaborative service development work will be scaled up in the forthcoming Network of IReCs which will officially start operating in 2019 after the experimentation and piloting phases in the Baltic TRAM project.

Providing such research based support and help to companies will not only result in increased benefits for business, as academics are able to more confidently explore areas of business interest, but also offer the chance to drive new insights in areas of fundamental research. The importance of ensuring better synergies between different European funding and support initiatives to ensure the competitiveness of European Union has been also highlighted by DG REGIO. According to Rudolf Nessler, smart specialisation can be seen as an opportunity to introduce tailored approaches to countries and regions. However, the importance of further supporting the engagement of researchers and enterprises in the international communities of innovators shaping the overall understanding of technological development is crucial. There are still gaps in funding and supporting companies until they can fully commercialise their products. Suggestions to design a tailored strand to address this matter in the next upcoming financial framework of INTERREG has also been presented for a wider consideration.[43]

Baltic TRAM project has mapped the current state of art research facilities and capacities and economic growth fields with analysis of their future needs and potential to be used to compile together a sustainable and mutually beneficial Network structure for the IReCs in the Baltic Sea Region. Gaps analysis conducted in the Baltic TRAM project has been focused specifically on companies' abilities for reaching for technological innovations bringing economic benefit through the company to the society. Currently there are gaps in the market to encourage business-university research collaborations to grow. Funding and dedicated activities are needed to enable the creation of a critical mass of use-inspired research activity and to help unlock the full strategic potential of collaborative relationships.[44]

The gaps relevant to Baltic TRAM and the forthcoming Network of IReCS can be drawn based on the regional analysis. Identified most pressing challenges and development needs concern first and foremost the following two main aspects. Firstly, there is an issue of the availability of research capabilities and competencies. Not only analytical research facilities and infrastructure resources are identified here as an issue, but also the availability of what we here call the IReC resources, organisations and their competence to guide industries in taking full advantage of the existing research facilities and companies' capacity to exploit such capacities and services. The earlier remark about the perceived lack of competent research institutes, which take on the role of IReC, shows that the Baltic TRAM work is well focused on an identified issue in the studied regions.[45]

There seems to be knowledge and communication gaps between the industry and the scientists. Different parties are not always fully aware of how to collaborate with each other in mutually beneficial ways and therefore meaningful training opportunities should be developed and promoted for both academic community and for the industrial partners on using and understanding the potential of modern analytical research for new industrial innovations. In the research side also new ways of increasing access to knowledge need to be developed. The focus

[43] Baltic Science Network transnational seminar. New tools for Spreading Excellenece and Widening Participation in Research and Innovation Programmes. Conclusions. Tallinn 16.11. 2017.

[44] Stenvall-Virtanen, Sari (ed.) 2018. Review on regional resources and further development of Analytical Infrastructures – Regional maps of science and business collaboration networks.

[45] Stenvall-Virtanen, Sari (ed.) 2018. Review on regional resources and further development of Analytical Infrastructures – Regional maps of science and business collaboration networks.

should be in speed as well as in bridging the access gap. It is widely recognised that the successful management and even operating of the research infrastructure services require a complex set of competencies and capabilities. As stated in the European Commission working document on Sustainable European Research Infrastructures – A call for action[46], there is need for strong effort to develop harmonised curricula, career paths and staff exchange programmes targeting managers and operators of research infrastructures. Furthermore the document states that the reinforcement of the ILOs seems to be essential to stimulate the RI and industry interaction. The Baltic TRAM project has found out similar results in the IReC service development processes.

The research facilities do not often have the needed knowledge and skills to address science and business cooperation properly in their service development. This topic bears also wider relevance than only Baltic. In the European Union there are at the moment on-going initiatives to address this issue[47] which will create a good basis for further development at European level. For example the Horizon 2020 project The Research Infrastructure Training Programme (RItrain) aims at improving and professionalizing the training of managerial and leadership staff in research infrastructures. Baltic TRAM aims to share its experiences and perspectives on these issues at the macro-regional level through RItrain-project's open online consultation survey on the RI Staff training needs to share dedicated training examples from the Baltic Sea Region with wider European RI audiences.

In the industrial side there are challenges which make it more difficult to reach a critical mass of interest in commercially based R&D services such as proposed by the Baltic Sea Region IReC network. These challenges concern the fact that many SMEs do not have an adequate R&D&I strategy in place to harness product or innovation development, overall R&D spending in companies is heavily dependent on economic situation and that the collaboration with external organisations on R&D projects is still not so common. Therefore the Baltic TRAM model for supporting research projects via IReCs and through the forthcoming Network of IReCs can be foreseen as a medicine that will help close this gap.

Small knowledge-intensive companies generally tend to find it easier to work with academic institutions but for the lack of resources often fail in doing so, while other companies experience a cultural gap that demands completely new ways of working in order to bridge it. According to the mapping exercise done in the Baltic TRAM project[48] the start-ups in the BSR in average have better access to the scientific knowledge and measurement services due to the fact that many of them are related or somehow connected to universities or to the larger active RDI ecosystem in the region. Even some bridge-funding exists to develop start-ups into operational companies. However, there is a gap in knowledge transfer, which is required to transfera start-up to a series-manufacturing or fully functional service company stage efficiently. Furthermore, the well-established and larger companies have enough resources to pay for the necessary research and development work, but their inertia often prevents them from changing and even identifying development needs. Of course there exist also mechanisms to increase such innovations, but a gap can be found between the amounts that the funding mechanisms are willing to support innovation in well-established companies with, and the amount of money which is needed to really get useful effects for the industry. For example a slow increase of industry 4.0 style manufacturing automation and machine vision inspection and using smart algorithms to increase manufacturing efficiency in many BSR countries is still a gap. It is also marked under RIS3 priorities as information and communication technology (ICT) horizontally through other sectors which might partially ease the situation in coming years.

Second identified challenge concerns the funding mechanisms. It is important to note that European support through structural funds is crucial for faster development of the key areas connected with RIS3 priorities in the BSR. In this picture only the clusters and businesses which are connected to the smart specialization strategies, can get

[46] European Commission 2017). Sustainable European Research Infrastructures – A call for action. Commission staff Working document – Long-term sustainability of Research Infrastructures. Printed by Publications Office in Luxembourg. Manuscript completed on 26th September in Luxembourg. pages 13,23.

[47] RAMIRI, Realizing and managing International Research Infrastructures – project (www.ramiri-blog.eu) and RItrain The Research Infrastructure Training Programme (http://ritrain.eu/) , Accessed 5.4.2018.

[48] Stenvall-Virtanen, Sari (ed.) 2018. Review on regional resources and further development of Analytical Infrastructures – Regional maps of science and business collaboration networks.

financial support from the ESIF and such programmes. Even though this is not a gap in the RIS3 sense, this means that the publicly supported RIS3-related clusters are often prioritised and strongly supported. Therefore there seems to be an existing funding gap to promote innovation in other well-established industries to harness knowledge and competence to boost innovations for societal and economic renewal. The other aspect in the financing landscape is both public and private R&I investments. Especially the share of business relevant applied research is low, which strengthens the imbalance in funding patterns under-emphasising applied research and enabling technologies as potential sources of industrial innovations.

Even though a number of valuable funding and support programmes at regional level are already in place, there are still gaps in the funding mechanisms. According to the extensive mapping done in the Baltic TRAM project, there is only one tool that addresses on-demand, interregional innovation cooperation schemes through national level bilateral collaboration agreements (ZIM, Germany), and this is about commercialisation of research and not about basic innovation services such as materials measurement services. So to be able to address macro-regional feasibility, funding and co-funding tools with interregional eligibility are needed.

Through the forthcoming Network of IReCs we should be able to bridge the gaps in science-business collaboration in a transnationally coordinated manner, where one of the core instruments is a transnational funding scheme. National concepts of innovation vouchers were indeed identified as one core instrument which could work at macro-regional level in the Baltic Sea Region. A separate Baltic TRAM Briefing note "Innovation Voucher Landscape"[49] was prepared in the Baltic TRAM project in order to study the national innovation voucher schemes in more detail and evaluate their potential development towards a transnational funding instrument in the Baltic Sea Region.

The main recommendations for further development in addition to the ones identified in the policy documents, are to focus the funding not only on R&D infrastructures but also on increasing the skills of potential users (both in public research organizations and local industry) and reduce bureaucratic procedures and top-down planning in order to motivate companies to utilise research infrastructures and to cooperate and establish collaboration platforms that focus on continuous collaboration that expands beyond the initial aim, e.g. information and knowledge exchange platforms that are engaged in traditional technology transfer activities. Here the role of the Network of IReCs is easily evident.

In addition, the shared development challenges in the RDI framework there are also special gaps and challenges connected to sparsely populated areas which is discussed in more detail in the Finnish section of the Review on Regional Resources and further development of Analytical Research Infrastructures. Summarising this thematic here briefly, one can say that in terms of linking the RIS3 together with effective regional development work in the less populated areas one of the most important objectives is to improve the effectiveness of RIS3 implementation by addressing structural challenges; in this case mismatches between the knowledge and productive base of the less innovative regions. These challenges can be remedied by strategically and operationally linking RIS3 priority industries in less advanced regions with the knowledge base available in other regions, as a way towards faster growth while, at the same time, enhancing the embeddedness of the missing knowledge through good practice transfer on at least three fronts: innovation infrastructures, methodologies for research/university to industry partnerships, and funding approaches. Linking productive and knowledge and technology bases across EU borders requires, in the first place, that advanced regions are willing to share knowledge and search for suitable transfer processes as well as less that advanced regions have the understanding, absorptiveness capacity, and willingness to invest in R&D outside their ESIF programme area. [50]

Baltic TRAM's core goal is to bridge in a transnational way the existing gaps in science-business cooperation and to develop its collaboration models. Baltic TRAM can be seen as a pioneer stepping beyond the macro-regional boundaries and reinforcing synergies between different EU policies and instruments and responding to the call for broader awareness building by reaching out beyond the so-called "usual suspects" and the existing pool of macro-

[49] Baltic TRAM Briefing Note 1/ 2018. Innovation Voucher Landscape. https://www.baltic-tram.eu/newsroom/press_releases/baltic_tram_perspective_on_innovation_vouchers/index_eng.html. Accessed 24.4.2018.
[50] Stenvall-Virtanen, Sari (ed.) 2018. Review on regional resources and further development of Analytical Infrastructures – Regional maps of science and business collaboration networks.

regional stakeholders.[51] In addition, this kind of more comprehensive approach makes sense taking into consideration that already on the European Level the understanding about applicability of smart specialisation is based on the previous findings and conclusions drawn by the OECD.[52]

Therefore also Baltic TRAM tries to ensure a transcendent institutional embedding. By exploiting how Baltic TRAM contributes to the implementation of acknowledgements and goals of other relevant innovation forums it advances the macro-regional aspirations to avoid duplication with already existing structures. However, as stated in Multi-Level Governance of Innovation and Smart Specialisation (2017) wider awareness and deeper analysis regarding potential gaps in terms of the governance level thinking about thematic priority areas and the research-intense innovation dynamics demanded by the businesses can be found for example in the publications of PA Innovation.[53]

[51] European Commission (2016). Report on the implementation of EU macro-regional strategies, p. 17 in Sime, Zane (2017): Multi-Level Governance of Innovation and Smart Specialization.

[52] Uyarra, E., Sörvik, J.; and Midtkandal, I. (2014). Inter-regional Collaboration in Research and Innovation Strategies for Smart Specialisation (RIS3). Seville: Joint Research Centre in Sime, Zane (ed.), 2017. Multi-level Governance of Innovation and Smart Specialisation. http://s3platform.jrc.ec.europa.eu/documents/20182/198909/Multi-Level+Governance_ok/cfaac19d-d8d0-4aab-9638-296053b8d4b3. Accessed 24.4.2018.

[53] Sime, Zane (2017): Multi-Level Governance of Innovation and Smart Specialisation.

6. Towards a feasible Network Structure in science-business collaboration

Based on the RIS3 analysis made during the Baltic TRAM project[54] we can say that the following areas are the most potential smart specialization areas at the macro-regional level (the Network of IReCs); health, wellbeing and bio technologies, digital growth, industrial modernisation and ICT (advanced manufacturing), energy and green industries and advanced materials. Matching these industrial areas with the mapped research competencies of the regions will naturally (industry-led) form the main thematic science-business cooperation areas for the IReC Network and lead to a transnational partnership model for sustainable growth and competitiveness of businesses based in a production of innovative products and services in the Baltic Sea Region.

In terms of building a sustainable research-business collaboration within the Network of IReCs in the long run, we need to address all the above-described conclusions and to promote industry-led excellence-based research and development focusing in research themes prioritised by respective industries. The approaches and activities of the IReCs should be planned so that the results of the collaborative research will be applicable to the prioritised industries in the regions. Interregional connectivity in this case is crucial and related to missing knowledge and research resources on regional and national levels, and availability of such resources in the innovation advanced or otherwise collaborating region within the network of IReCs. Furthermore, innovation development and management needs are research-to-business interactions that improve the quality and embeddedness of triple helix processes and ensure better access to research results. They are about complementarity of services at an interregional level when certain research capacity or knowledge source is not available locally or if research commercialisation needs can benefit from interregional solutions.

In the EU, the introduction of the RIS3 as a Structural Funds conditionality as much as an effective concept for regional economic renewal and the continuous, related and on-going strong discussion, have legitimised the notion of macro-regional innovation systems. The sustainability of the forthcoming IReC network is also part of this thematic. In this direction, the Baltic TRAM concept of the Network of IReCs and practical implementation of the network during the extended operational phase will be a combination of the current and anticipated economic bases of the regions, their current and anticipated research bases, and the policies that one way or another support specialised growth. The macro-regional network structure is eventually based on these regional mappings.

One of the key objectives of the Baltic TRAM project is to build a sustainable network of IReCs with macro-regional solutions and collaboration models where economically weaker regions are prevented from becoming more peripheral. In this work the Baltic TRAM also conducted a benchmark on other similar kinds of service networks operating in the European Union in the research fields that are thematically connected to the Baltic TRAM and the forthcoming Network of IReCs. Based on the benchmark analysis[55] the consortium started to develop the network business model and industrial and research strategies of the new network to be competitive in the research service market in the Baltic Sea Region.

In line with the national or regional level development challenges described prior in this report the main current and future efforts in the BSR are to strengthen the flow from research to market and to better match the research, the analytical research facility offering and the needs of the regional industries. In this work different regions have their special needs and framework conditions to address. Accordingly initiatives such as for example the Baltic TRAM

[54] Zane Sime (ed.): National innovation and smart specialization governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing Series 4/2017. http://www.centrumbalticum.org/en/news_room/publications/bsr_policy_briefing.

[55] Stenvall-Virtanen, Sari, 2017. Benchmarking science-business service networks. Unpublished working paper in Baltic TRAM Work Package 4.

project[56] should be further strengthened and intensified in order to further systematise the marketing of research services to companies in certain regional contexts. The fact that RIS3 supports KET production and applications, advanced materials and advanced manufacturing are all pointing to the relevance of macro-regional solutions.

One way to strengthen research-to-business macro-regional initiatives would be to integrate them into regional policies, on the base of current and projected research needs and anticipated economic development. As an example, one such strategic decision is already in the on-going BRIDGES project[57] where for example clear decisions on the implementation of a framework for research and businesses interactions have already been made, focusing on technological connectivity between advanced and less advanced regions, rationalisation and clarification of the funding of such interactions, modelling transferrable win-win types of cooperation between regions and contributions to economies of scale and commercialisation of research of the advanced innovation region. The Baltic TRAM project can learn and further develop these aspects in the framework of materials measurement services in the remaining months of the on-going regional development work.

According to the mapping conducted in the Baltic TRAM project in addition to the needs of connectivity in *research-to-business* options, also other fields of connectivity needs in lagging regions are apparent relating to *research-to-industry* and *research-to-regional innovation systems*. *Research-to-industry* connectivity is connected to the improvement of productivity and sustainability of the RIS3 (and other relevant) industries, in terms of improved or new products and processes. In research-to-industry connectivity one possible path to consider is to build on/ expand the economic base of the industries of the most performing businesses and strengthen the relevant knowledge-connectivity system. For example building consortiums around certain expertise or development question (Clusters) including partners from different regions. *Research-to-regional innovation systems* connectivity needs are more about the "dialogue" of the triple (and quadruple) helixes. There is a nominal triple helix in all the regions which, however, does not always work either because of knowledge mismatches (i.e. the knowledge and productive bases are not demonstrating effective complementarities), or because the localised triple helix is not functioning, is only partially 'meaningful, or even because the needed specialisation is also missing from the national level.

In terms of building feasible conditions for macro-regional research-business collaboration and forming a sustainable Network of IReCs in the long run, all above-described connectivity aspects also need to be addressed by promoting industry-led excellence-based connectivity focusing in issues prioritised by industries that are represented by one or several of the active centres in the Network. The approaches of the IReCs should accordingly be planned so that the results of the collaborative research will be applicable to the prioritised industries in the regions. Interregional connectivity in this case is related to missing knowledge and research resources on regional and national levels, and availability of such resources in the innovation advanced or otherwise collaborating region. Furthermore research-to-business interactions that improve the quality and embeddedness of triple helix processes and ensure access to research results should be promoted.

Connectivity needs lead inevitably to regionalised (rather than localised) innovation systems. The fundamental reason for regionalised innovation systems is that the diversification of specialisation resulting from market and research trends is so wide and fast evolving that it is very hard for regions to address comprehensively both current and anticipated research needs. It is an issue of resources[58], but also an issue of time, i.e. with the exception of leading regions, the rest of the regions need to catch up with the development while witnessing business-based income generation is slowing down[59]. Thus regionalised, i.e. network-based innovation systems, seem to be

[56] Zane Sime (ed.): National innovation and smart specialization governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing Series 4/2017. http://www.centrumbalticum.org/en/news_room/publications/bsr_policy_briefing.

[57] https://www.interregeurope.eu/bridges/, accessed 19.3.2018

[58] Overview-OECD-Finland-2016 (2016), OECD 2016, page 43. https://www.oecd.org/eco/surveys/Overview-OECD-Finland-2016.pdf .

[59] Internationalisation of research is a priority in many countries, e.g. Finland, but it is still evolving. Paavo-Petri Ahonen, Mari Hjelt, Erkki Kaukonen and Pia Vuolanto (eds.) (2009). Internationalisation of Finnish scientific research. Publication of

inevitable in the future. In the EU, the introduction of the RIS3 as a Structural Funds conditionality as much as an effective concept for regional economic renewal and the continuous, related and on-going strong discussion, have legitimised the notion of macro-regional innovation systems. The sustainability of the forthcoming IReC network is also part of this thematic. In this direction, our practical tools should be a combination of the current and anticipated economic bases of regions, their current and anticipated research bases, and the policies that one way or another support specialised growth. The macro-regional network-based development will result from facilitating macro-regional collaboration and fostering specialised growth and complementary services.

According to the mapping done in Baltic TRAM, one can say that there are certain functional gaps in the current research and innovation systems at regional level which directly refer to concrete development needs and indicate that identification of IReC network's reason or justification for existence relates to both location (what is currently missing) and methodological aspects on how to develop the collaboration between the analytical facilities and IReCs to ensure better utilisation of the facilities and fill in regional gaps in a meaningful way. The regional maps[60] indicate that at least two regions have dense, performing and comprehensive research and research service bases (Sweden and Germany), while one partner (member state level) have a very diversified and in-depth research, marketing and knowledge base (Denmark). The rest of the partners have hybrid-models that fall between these two. While both types of approaches are basically good practices, and the latter also accessible to be replicated in other regional contexts, we still need to better understand the arguments that would make the macro-regional cooperation model feasible in the Network of IReCs in the long run.

Even though the methodology in identifying the future needs in the industrial field and potential growth sectors and in the research facility side in the Baltic TRAM project was not by any means exclusive or bullet proof in terms of validity and reliability we have a full reason to believe that the analysis done by the regional experts within the project gives us a good base understanding on the matches between the regional research base and industrial needs.[61] However, In terms of forming a long-term and sustainable structure for the Network of IReCs, a methodology to conduct deeper analysis of the regional research competencies would still need to be done. The remaining months in the Baltic TRAM project will be used to study if the potential niches for beneficial macro-regional cooperation in the Baltic Sea Region really exist.[62]

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the Academy of Finland 7/09, http://www.aka.fi/globalassets/awanhat/documents/tiedostot/julkaisut/7_09-internationalisation-of-finnish-scientific.pdf.

Reformative Finland: Research and innovation policy review 2015–2020 (2014). RESEARCH AND INNOVATION POLICY COUNCIL, 2014; page 14: "Internationalisation must be integrated in all R&I development and decision-making. It is not a separate activity: global cooperation must be an elemental part of Finnish R&I. To promote internationalisation, inter-administrative cooperation will be highly needed. … Key R&I policy development areas include: … promoting the exploitation and impact of research results;… public sector reform and closer cooperation; and adequate R&D funding".

[60] Stenvall-Virtanen, Sari (2018). Review on regional Resources and further development of Analytical Research Infrastructures – Regional maps of Science and business collaboration networks. Baltic TRAM project publications. https://www.baltic-tram.eu/newsroom/press_releases/index_eng.html. Accessed on 04.04.2018.

[61] See Annex 1.

[62] The full body of information on regional research and industrial bases and anticipated research and industrial needs provided by the respective partner regions in the Baltic TRAM project is summarised in the Annex 1.

7. Conclusion

The objective of the Network of IReCs is to connect local markets and companies with a transnational pool of analytical services. The demand for the IReC's services has been identified in the Baltic TRAM by combining three sources of inputs: 1) field research on the actual number of Baltic TRAM experiments (businesses receiving analytical research services and the total number of contacted businesses and the efforts it required[63]); 2) regional economic profiles, based on performance[64] and self-assessment[65] and 3) regional economic policies including RIS3 priorities, dedicated funds and related projects[66].

This report presents some basic insights on how the collaboration between the Analytical Research Infrastructures could be optimally developed for the best performance in short and especially in long term and what focus should be taken to fill in the current gaps. In the context of Baltic TRAM the discussion on Pockets of Excellence might prove relevant provided the pattern, complementarity of actions or value chains of the macro-regional cooperation is well clarified and beneficial collaboration structures are confirmed. In such a future scenario the Network of IReCs could act as an important tool in activating and developing macro-regional pockets of excellence.

RIS3 forms, in principle, a very good base for anticipating industrial future demand for Network of IReC services as it combines place-based economic specialisation priorities defined by shared (EU) conceptual and methodological approaches and responds also to joint performance objectives, such as development and applications of key enabling technologies (KET), industrial leadership and societal challenges.

During the remaining time in the Baltic TRAM project there will still be a closer phase of evaluation in terms of finding out whether the experienced science-business cooperation processes in the Baltic TRAM really correspond to the prioritised smart specialization areas and policy-makers intended focus[67], how much the potential demand is coming from the emerging industries and where do we eventually have the strongest base for the macro-regional collaboration. As stated in the BSR Policy Briefing[68] the findings of three BSR-wide transnational priorities in smart specialisation will serve as a source for analysing whether these or other regionally outlined RIS3 priorities are of greater importance to the businesses located both within the BSR, as well as EU-wide and hence the most important for the Network of Industrial Research Centres after the experimental development phase.

[63] Proposed indicator was: number of SME Experiments/(total number of contacted SMEs)*(number of contacts)

[64] Proposed indicator was: either GVA (gross added value) per industry per region or GERD + BERD per industry and region. GERD= general expenditure on research and development, BERD= business expenditure on research and development.

[65] See Annex 1 of the present report.

[66] RIS3, as a rather recent tool of the Structural Funds (ERDF), is a dynamic but still evolving tool, i.e. it has not shown yet its full potential.

[67] Sime, Zane (ed.), 2017. Multi-level Governance of Innovation and Smart Specialisation, page 28. http://s3platform.jrc.ec.europa.eu/documents/20182/198909/Multi-Level+Governance_ok/cfaac19d-d8d0-4aab-9638-296053b8d4b3. Accessed 24.4.2018.

[68] Zane Sime (ed.), 2017. National innovation and smart specialization governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing Series 4/2017, page 30. http://www.centrumbalticum.org/en/news_room/publications/bsr_policy_briefing. Accessed 24.4.2018.

List of References

Bachtler, John, Mendez, Carlos and Wishlade, Fiona, 2018. Reshaping the EU budget and Cohesion Policy: carrying on, doing less, doing more or radical redesign? European Policy Research Paper No. 104, ISBN Number: 978-1-909522-26-8, University of Strathclyde Publishing 2017 January 2018.

Baltic Science Network transnational seminar. New tools for Spreading Excellenece and Widening Participation in Research and Innovation Programmes. Conclusions. Tallinn 16.11. 2017

Baltic TRAM Briefing Note 1/ 2018. Innovation Voucher Landscape. https://www.baltic-tram.eu/newsroom/press_releases/baltic_tram_perspective_on_innovation_vouchers/index_eng.html. Accessed 24.4.2018.

The Baltic TRAM Letter of Intent: Principles of Open Data Access: https://www.baltic-tram.eu/sites/sites_custom/site_baltic-tram/content/e24058/e24059/e63869/e63871/TRAM_letter_of_intent_main_part_23.10.2017_eng.pdf

Bridges project. https://www.interregeurope.eu/bridges/. Accessed 19.3.2018

BSR Policy Briefing Series 4/2017: National innovation and smart specialisation governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation, http://www.centrumbalticum.org/en/news_room/publications/bsr_policy_briefing.

Business Expenditure on Research and Development (BERD). http://ec.europa.eu/eurostat/statistics-explained/index.php/R_&_D_expenditure .

COTER-VI/040, 128th plenary session, 22 and 23 March 2018, DRAFT OPINION: The cost and risk of non-cohesion: The strategic value of cohesion policy for pursuing the Treaty objectives and facing new challenges for European regions.

The Dowling Review of Business-University Research Collaboration, 2015. http://www.raeng.org.uk/policy/dowling-review/the-dowling-review-of-business-university-research. Accessed 18.2.2018

European Commission (2016). Report on the implementation of EU macro-regional strategies, p. 17 in Sime, Zane (2017): Multi-Level Governance of Innovation and Smart Specialization.

European Commission (2017). Sustainable European Research Infrastructures – A call for action. Commission staff Working document – Long-term sustainability of Research Infrastructures. Printed by Publications Office in Luxembourg. Manuscript completed on 26th September in Luxembourg.

European Commision (2018). Smart Specialisation Platform. Registered countries and regions in the S3 Platform. http://s3platform.jrc.ec.europa.eu/regions, last accessed on 9.4.2018.

Foray and Goenaga 2013 in Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities, pp 7

Gross domestic Expenditure on Research and Development (GERD), http://ec.europa.eu/eurostat/statistics-explained/index.php/R_&_D_expenditure .

Internationalisation of research is a priority in many countries, e.g. Finland, but it is still evolving. Paavo-Petri Ahonen, Mari Hjelt, Erkki Kaukonen and Pia Vuolanto (eds.) (2009). Internationalisation of Finnish scientific research. Publication of the Academy of Finland 7/09, http://www.aka.fi/globalassets/awanhat/documents/tiedostot/julkaisut/7_09-internationalisation-of-finnish-scientific.pdf.

Ketels Christian, Pedersen, Helge J. (2016) State of the region report. The Top of Europe – Doing Well Today, Feeling Worried about Tomorrow. Baltic Development Forum.

Ketels, C. and Protsiv, S: European Cluster Panorama (2016). Center for Strategy and competitiveness, European Cluster Observatory Report, October. pp.

Launonen, M. Viitanen, J 2011. Hubconcepts: The Global Best Practice for Managing Innovation Ecosystems and Hubs. Helsinki: Hubconcepts Inc.

Markkula, Markku; Kune, Hank 2015. Making Smart Regions Smarter: Smart Specialisation and the role of universities in Regional Innovation Ecosystems. Technology Innovation Management Review, October 2015 (Volume5, Issue 10). https://timreview.ca/article/932. Accessed 24.4.2018

Meril database. https://portal.meril.eu/meril/. Last time accessed in December 2017.

Overview-OECD-Finland-2016 (2016), OECD 2016, page 43. https://www.oecd.org/eco/surveys/Overview-OECD-Finland-2016.pdf .

RAMIRI, Realizing and managing International Research Infrastructures – project (www.ramiri-blog.eu) and RItrain The Research Infrastructure Training Programme (http://ritrain.eu/) , Accessed 5.4.2018.

Reformative Finland: Research and innovation policy review 2015–2020 (2014). RESEARCH AND INNOVATION POLICY COUNCIL

Reid, A., Markianidou, P., Evrigenis, A. (2015): Pockets of excellenece with innovation potential. A study for the European Commission DG Research & Innovation, Unit A6 – RISE Team.

Research Infrastructures – defininition. http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=what, Accessed 18.4. 2016.

S3 Platform. JRC sites, http://s3platform.jrc.ec.europa.eu/map . Data accessed 9.4. 2018

Sime, Zane (2017): Multi-Level Governance of Innovation and Smart Specialisation. October 2017. Council of the Baltic Sea States Secreatariat.

Sime, Zane (ed.), 2017. National innovation and smart specialization governance in the Baltic Sea region. Laying grounds for an enhanced macro-regional science-business cooperation. BSR Policy Briefing Series 4/2017. http://www.centrumbalticum.org/en/news_room/publications/bsr_policy_briefing.

Stenvall-Virtanen, Sari, 2017. Benchmarking science-business service networks. Unpublished working paper in Baltic TRAM Work Package 4.

Stenvall-Virtanen Sari (ed.) 2018. Review on regional resources and further development of analytical research infrastuructures – Regional maps of science and business collaboration networks. Baltic TRAM project publications. https://bit.ly/2GE1JFr. Retrieved on 4.4. 2018.

Uyarra, E., Sörvik, J.; and Midtkandal, I. (2014). Inter-regional Collaboration in Research and Innovation Strategies for Smart Specialisation (RIS3). Seville: Joint Research Centre.

Vezzani, A.; Baccan, M. Candu, A.; Castelli, A.; Dosso, M. and Gkotsis, P. (2017) Smart Specialisation, seizing new industrial opportunities.

ANNEX 1: Identified research cooperation needs and potential

Table 1: Identifying research cooperation needs and potential in Southern Denmark

Economic base

What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance?

Strong Clusters in Region Southern Denmark (alphabetically)

- Danish Food Cluster
- The design cluster - Design2Innovate
- The energy efficiency cluster - Lean Energy Cluster
- Offshore Centre Denmark and LORC
- RoboCluster
- The welfare technology cluster – Welfare Tech Region

Defined RIS3

Denmark does not have one single national innovation strategy for smart specialisation (RIS3). In addition, on the regional level there is not a single comprehensive RIS3 framework put in place. In brief, each of the five regions in Denmark prepares its own regional growth and development strategy. Anyhow, the RIS3 framework of Denmark has a strong focus on the development of viable clusters and innovation networks.

Networks of ARFs

What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base?

The full table on the regional ARFs by research competence areas can be found in the Annex 1 and in online ARF catalogue

1. HEIs

2. RTOs and commercial laboratories

3. Multipliers/ Intermediaries

4. Regional policy makers and Structural Funds MA/IBs

In the Region of Southern Denmark the biggest higher education institution is the University of Southern Denmark. Aalborg University is also present in the region with its campus in Esbjerg.

The Danish GTS institutes (RTOs) sell their services on commercial terms in Denmark and abroad with an international competitive strengths adopting quickly to the innovation needs of the industry.

The clusters and innovation networks in Denmark play an important role in facilitating the cooperation between research institutions and companies. The intermediate between academic and industrial research within their business area. These are complemented by the business development institutions at regional and municipality level.

Anticipated industrial trends

What kind of specialisation or even diversification current strengths will require to keep up regional performance?

The overall strategic document *Research 2025* identifies various new technological opportunities within digitalisation, bio- and life sciences, production and materials.

The document divides these areas in further subthemes e,g. digitalisation into Internet of things, Big data and artificial intelligence, Quantum computer, IT-security, Blockchain, Digital infrastructure, Interaction design and usability.

Anticipated research base needs

What kind of investments and time resources are required for diversifying the current research base?
The investments in the research base are reflected by the funding schemes and topics focusing on innovation and knowledge transfer as well as on topics such as: Sustainable energy and environment, Health, food and welfare, Strategic growth technologies, Individuals, disease and society, Peace and conflict, Transport and infrastructure.
The Second roadmap for research infrastructures published in 2015 defines the framework for investments in the Research infrastructure, which is partly associated with associated with ESFRI.
Special emphasis is given to the European Spallation Source (ESS), seeing as Denmark is one of the host countries, and seeing as ESS is one of the largest European research infrastructure projects and central to Danish as well as European research in a number of areas.

Policy

Are current economic development policies supporting competitiveness and specialisation?

The overall strategic document *Research 2025* guiding research and innovation in Denmark was published in June 2015 by the Ministry of Higher Education and Science. The strategy focuses on following topics: Better health, Green growth, People and society, New technological opportunities (digitalization, bio- and life sciences, production, materials).

In addition the Danish Ministry for Higher Education and Science published in 2015 a strategic plan for how Denmark can make the most of the ESS. The strategy encourages and involves also all research organizations in Denmark to make the best use of the ESS facilities for research and innovation.

Table 2: Identified research cooperation needs and potential in Estonia

Economic base What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance? Best performing industries with percentage of gross value added (2016): Manufacturing (15.7%), wholesale (12.2%), real estate activities (10.3%), transportation and storage (7.7%), construction (6%), information and communication (5.8%), health-related activities (4.2%), mining and quarrying (1.2%). Innovation performance (R&D total expenditure in total, RD024 table 2016): ICT (total 72.M€), manufacturing (total 34M€, out of which manufacture of computer/electronic/optical products is 9M€, manufacture of electrical equipment is 5.5M€, manufacture of food products is also 5.5M€, manufacture of vehicles is 4.5M€, manufacture of chemicals is 2.3M€, manufacture of machinery is 1.6M€), mining and quarrying (3.1M€). **Strong Clusters (based by ESCA assessment)** Connected Health Cluster, Defence and Security Cluster, Development Cluster of the Woodworking Industry, Digital Construction Cluster, Estonian Smart City Cluster, Estonian Wind Technology Cluster, ESTRONICS, ICT Cluster, Medicine Estonia, Real estate and Energy Cluster KEN, SportEST– health for active life innovation cluster, Wooden Houses Cluster **Defined RIS3** ICT, Health Technology and more efficient use of resources.	**Networks of ARFs** What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base? Modern equipment SEM/TEM, x-ray tomography, 3d metal printing. Modern research facilities. Several world class research groups. **1.HEIs** TÜ, TTÜ, TLÜ, TKTK, University of Life Sciences, Art Academy, Music and Theatre Academy. **2. RTOs and commercial laboratories** STACC, KBFI, TFTAK, Metrosert, Inspecta, NPM Silmet's Lab, etc. **3. Multipliers/ Intermediaries** ADAPTER, Estonian Enterprise, Estonian Research Council, Archimedes, TAK-s (Competence Centres), Unions, Clusters, Estonian Chamber for commerce and industry, county development centres, etc. **4. Regional policy makers and Structural Funds MA/IBs** EAS, ETAG, Archimedes, Ministries of Estonian Republic
Anticipated industrial trends What kind of specialisation or even diversification current strengths will require to keep up regional performance? Automation of production and investment in the adoption of artificial intelligence is needed to keep up the performance. Relevant education programs are also needed. In a small country diverse technology development is a value as it prohibits failures in country level if there is a particularly strong but narrow specialisation branch.	**Anticipated research base needs** What kind of investments and time resources are required for diversifying the current research base? The country should increase investments in R&D – this by itself should increase competitiveness of research infrastructures. The major challenge is to provide of sustainable development of research infrastructures created and upgrade during last 5-6 years. Joining the activities of large scale research facilities would provide an access to world class research infrastructure, which are by far too large and expensive for Estonia
Policy Are current economic development policies supporting competitiveness and specialisation? On the policy level the goals are addressed, but the main amount of investments comes from European Structural funding, which has to be replaced by support from the Estonian State Budget to ensure a long term sustainability.	

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Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

Table 3: Identified research cooperation needs and potential in Kainuu, Finland

Economic base What are the most performing industries (RIS3) and what is their competitiveness (e.g GVA) and innovation performance? **Strong Clusters** ICT, games & data centre business Mechanical and chemical wood processing Metal industry Mining Tourism **Defined RIS3** **1. INDUSTRIES** TECHNOLOGY INDUSTRY INNOVATIONS: Measurement technology & its further internationalisation; Games and simulators; Metal industry. BIO ECONOMY & MINING INNOVATIONS: Industry processes & environment monitoring; Forest bio economy, food & blue bio economy. HEALTH and WELL BEING INNOVATIONS: Activity tourism; Health, physical training and sports. **2. CROSS CUTTING THEMES** Applying Key Enabling Technologies (KETs) systematically (e.g. Industry 4.0, applications of advanced manufacturing and advanced materials) to the prioritised industries Utilisation of robotics, automation, data centres and data analysis New solutions and applications of circular economy, innovations in resource efficiency, decarbonisation and climate change mitigation Increase the cohesion (through interactions) of the localised innovation system; seek sustainable partnerships beyond the region towards a regionalised innovation system.	**Networks of ARFs** What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base? **The full table on the regional research infrastructures by RI category can be found in Annex 1 and in the online ARF catalogue** **1. HEIs** Kajaani University of Applied Sciences (https://www.kamk.fi/en) **2. RTOs and commercial laboratories** University of Oulu, MITY (http://www.oulu.fi/kajaaniuniversityconsortium/node/13348) University of Jyväskylä, Sports technology Centre (http://www.cemis.fi/in-english/expertise/university-of-jyvaeskylae and http://www.sportperformancecentres.org/centres/vuokatti-sports-institute) CSC, University of Oulu, University of Jyväskylä, VTT: water research measurement technology (CEMIS centre of measurement technology, localised measurement technology projects) (http://www.cemis.fi) Kajaani University of Applied Sciences (KAMK): applied research in mining. (https://www.kamk.fi/en) **3. Multipliers/ Intermediaries (alphabetically)** Arktiset Aromit (http://www.arktisetaromit.fi) Kainuun Etu (KE) (www.kainuunetu.fi) KAMK MITY Sports technology Centre Woodpolis (http://www.woodpolis.fi/index.php) **4. Regional policy makers and Structural Funds MA/IBs** Regional Council of Kainuu (https://www.kainuunliitto.fi) Kainuu ELY Centre (https://www.ely-keskus.fi/en/web/ely/ely-kainuu) *relevant in the field of materials sciences

Anticipated industrial trends	**Anticipated research base needs**
What kind of specialisation or even diversification current strengths will require to keep up regional performance? The revised RIS3 aims at addressing industrial trends such as automation, circular economy, and eventually industrial leadership. There is very strong effort to valorise traditional industries in new ways, taking into account research findings and international market trends. Internationalisation of the economic base is becoming an acknowledged priority. Internationalisation actions include exports as well as knowledge exchange, participation in value chains, linkages to research results in view of applying them locally, participation in pilot actions, joint development and policy analysis, and, finally adopting a system-based approach supporting a coherent distributive base across the region.	What kind of investments and time resources are required for diversifying the current research base? There will be needed inputs in terms of clustering methodologies and best practices regarding various types of internationalisation; There will be needed research inputs for the development of new industries and applications. There will be needed efforts to consolidate and internationalise applied research solutions produced locally.

Policy

Are current economic development policies supporting competitiveness and specialisation?

Yes, they are. Policies support competitiveness and specialisation by co funding RIS3 industries-related development projects and taking into account state of the art knowledge. The most successful clusters are cooperating regularly with specialised knowledge actors from outside the region to define concrete development actions for example. These co-operations happen as a result of multi actor projects, co funded by regional and structural funds.

Kainuu has two possible growth paths (without one excluding the other): the starting point is that it has to deal with its small productivity base,.To deal with it, either the GVA increases so much that the restricted economic base is counter balanced or that it attracts / generates additional economic actors (businesses). In both cases, it will require programme-approaches, evidence-based (feasibility studies) knowledge-intensive types of solutions and stressing the importance of non-price factors for competitiveness.

Table 4: Identified research cooperation needs and potential in Southwest Finland

Economic base What are the most performing industries (RIS3) and what is their competitiveness (e.g GVA) and innovation performance? **Strong Clusters** Health & Wellbeing Drug discovery, development & diagnostics and biomaterials) Finnish Pharma Cluster and Biomaterial Cluster Food Production Manufacturing Industry and especially shipbuilding ICT Automotive industry **Defined RIS3 (2018-2021)** Blue Growth and industrial modernisation Innovative value chains in Food Sector Life Science and Health Technologies	**Networks of ARFs** What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base? **The full table on the regional research infrastructures by RI category can be found in Annex 1 and in the online ARF catalogue.** **1. HEIs** **University of Turku (Finnish speaking) and Åbo Akademi (Swedish Speaking)** Turku Materials Research Instrument Center (TuMRIC) Turku Bioimaging Instrument Centre Turku Centre for Biotechnology Turku Clinical Biomaterials Centre TCBC Functional Foods Forum Center for Functional Materials (FUNMAT) Process Chemistry Centre (PCC) **Turku University of Applied Sciences** Biomaterials, food and diagnostics laboratory Energy and environment, especially solar energy systems laboratory Protein Production Laboratory **2. RTOs and commercial laboratories** Lounas-Suomen vesi- ja ympäristötutkimus Oy Solar Simulator Top Analytica Auria Biobank LUKE, Natural Resources Institute, Finland (Turku): Green Bioeconomy, Blue Bioeconomy, Innovative Food System Machine Technology Center: Calibration laboratory; Production Automation Laboratory **3. Multipliers/ Intermediaries** Turku Science Park Ltd Smart Chemistry Park Werstas Labs (Life Science Accelerator) Yrityssalo Ltd Ukipolis Ltd **4. Regional policy makers and Structural Funds MA/IBs** Regional Council of Southwest Finland

	Centre for Economic Development, Transport and Environment (ELY Centre) in Southwest Finland.
Anticipated industrial trends What kind of specialisation or even diversification current strengths will require to keep up regional performance? Regional strengths are the diversity of the economic structure, number of RDI competent business is high; many strong industries as for example Sea and maritime; Life-Science and Agri-Food; Good geographical location and infrastructures; strong educational offering at all levels. The national and regional innovation policies should aim at diversifying the structure of the industries, improving the level of research activity and reforming public sector research structures to support sustainable growth and employment in RIS3 areas in the regions. The second challenge is connected to declining public and private R&I investments. Especially the share of business relevant applied and academic research is low. Automotive trends: The business logic in car industry is changing. Industrial manufacturing trends: To take advantage of digitization and robotization, industrial manufacturers need new operating models, aggressive hiring, smart partnerships, and targeted investments Pharmaceuticals and Life Sciences Trends: The New Health Economy is inspiring fresh ways to manage data, place a value on medical treatments, and deal with empowered patients. Southwest Finland is at the moment the fastest growing region (Positiivisen rakennemuutoksen alue) but the growth will need to be supported by appropriate activities.	**Anticipated research base needs** What kind of investments and time resources are required for diversifying the current research base? • Advanced but small peripheral market, companies need to export early to secure growth which demands continuous process development and advanced product development. • Industries need to collaborate together to build stronger cluster collaboration and cross-disciplinary innovations. • The universities are profiling their strategies and research based on specialisation which means that some domains are excelling in research funding and further development. • Lack of vision, ambition and holistic approach to develop new forms of public-private partnerships and innovation programmes to tackle industrial renewal can hinder industrial innovations and this needs to be addressed. There is needs for research inputs for the development of new industries and applications in those domains where the region do not have enough strong research and/ or research infrastructures.
Policy Are current economic development policies supporting competitiveness and specialisation? The Growth Agreement (AIKO funding) of Turku for the 2016 – 2018 time frame include strategic investments in blue and green economy (including maritime cluster), bio-economy, clean technologies, digital economy and health sector which is fully aligned with the RIS3 policies. In addition the ongoing preparations to conclude a joint Bridge Agreement between the State of Finland and regions of Southwest Finland and Satakunta will potentially increase input also to some of the RIS3 sectors. The RIS3 strategic thinking has been included in the regional programme development and drafting and the coordination of the ESF/ ERDF has also been aligned accordingly. Different activities to support the maritime, car industry and construction industry in the region have been introduced as part of the PORE (positiivisen rakennemuutoksen edistäminen) regional development work Research in Biosciences and medicine is at the international top of the field which creates a strong competence base for the academic and applied research. In other listed disciplines the research at University of Turku can considered significant and high quality at national level. The UTU furthermore has a leading role in sea and maritime research which strengthens the regional expertise cluster in the Southwest cost of Finland.	

Table 5: Identified research cooperation needs and potential in Hamburg

Economic base What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance? **Strong Clusters (alphabetically)** **Aviation** Hamburg Aviation **Creative society, ICT and media** nextMedia.Hamburg **Health industry** Gesundheitswirtschaft Hamburg **Life sciences** Life Science Nord **Logistics** Logistik-Initiative Hamburg **Maritime economy** Maritimes Cluster Norddeutschland **Renewable energies** Renewable Energy Hamburg Cluster (EEHH) **Defined RIS3 of Hamburg**[69] • Logistics • Renewable energy • Media • Health industry • Creativive society • Aviation • Life sciences	**Networks of ARFs** What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base? The full table on the regional research infrastructures by RI category missing from the Annex 1 but to be found in the online ARF catalogue. **1.HEIs of Hamburg** **Universität Hamburg** Medicine, Mathematics, Informatics and Natural Sciences Center for Earth Systems Research and Sustainability (CEN) Center for Free-Electron Laser Science (CFEL) Center for Structural Systems Biology (CSSB) German Center for Infection Research (DZIF) Center for Hybrid Nanostructures (CHYN) Center for Mathematical Physics (CMP) Center for Optical Quantum Technologies (ZOQ) The Hamburg Centre for Ultrafast Imaging (CUI) Lothar Collatz Center for Computing in Science **Hamburg University of Technology** Integrated Biotechnology and Process Engineering, Climate Protecting Energy- and Environmental Engineering, Regeneration, Implants, Medical Technology, Product-Oriented Materials Development, Aeronautics, Digital Production, Logistics, Maintenance, Repair and Overhaul (MRO), Maritime Systems, Logistics and Mobility for Sustainable Value Creation **Helmut-Schmidt-Universität** Electrical & mechanical engineering **Hamburg University of Applied Sciences (HAW)** Engineering & Computer Science, Life Sciences **2. RTOs and commercial laboratories** **Deutsches Elektronen-Synchrotron (DESY)** Synchrotron PETRA III Free electron laser FLASH NanoLab **DESY Research Campus** European XFEL Helmholtz Zentrum Geesthacht (HZG) European Molecular Biology Laboratory (EMBL) Max Planck Institute for the Structure and Dynamics of Matter Universität Hamburg Center for Free-Electron Laser Science (CFEL) Center for Hybrid Nanostructures (CHYN)

[69] European Commission, Eye@RIS3: Innovation Priorities in Europe, http://s3platform.jrc.ec.europa.eu/map, retrieved February 14th 2018

	Center for Structural Systems Biology (CSSB) Center for Optical Quantum Technologies (ZOQ) **Fraunhofer CAN** (Center for Applied Nanotechnology; part of the Fraunhofer IAP, Institute for Applied Polymer Research) **Fraunhofer CML** (Center for Maritime Logistics and Services; part of the Fraunhofer IML, Institute for Material Flow and Logistics) **Fraunhofer IAPT** (Institute for additive manufacturing technologies) **Fraunhofer IME** (Department ScreeningPort, Institute for Molecular Biology and Applied Ecology IME) **Fraunhofer ISIT** (Anwendungszentrum Leistungselektronik für regenerative Energiesysteme; application centre for power electronics; part of the Fraunhofer ISIT) **Max Planck Institute for the Structure and Dynamics of Matter** **Max Planck Institute for Meteorology** **3. Multipliers/ Intermediaries** **Innovation Centers Hamburg** Innovation Centre Hamburg Bahrenfeld Hamburg's Center of Applied Aeronautical Research (ZAL) hit-Technopark Hamburg Innovation (HI) **4. Regional policy makers and Structural Funds MA/IBs** **Investment Banks** Hamburgischen Investitions- und Förderbank **Chambers of Commerce and Industry** Handelskammer Hamburg **Regional Development Organisations** Hamburg Business Development Corporation (HWF)
Anticipated industrial trends What kind of specialisation or even diversification current strengths is required to keep up regional performance? Hamburg identified a lack of innovation parks, which is why Hamburg decided to plan four new innovation parks linked to existing incubators for innovation.	**Anticipated research base needs** What kind of investments and time resources are required for diversifying the current research base? Hamburg identified a lack of innovation parks, which is why Hamburg decided to plan four new innovation parks linked to existing incubators for innovation.
Policy Are current economic development policies supporting competitiveness and specialisation? **InnovationsAllianz Hamburg** Together with 160 partners from science, economy, politics, institutions and organizations, the *Behörde für Wirtschaft, Verkehr und Innovation (BWVI)* developed strategic guidelines for Hamburg in 2010. During periodic events (e.g. workshops), partners from economy, science, politics and administration meet to further develop the existing strategy. **Two new Fraunhofer institutes** By 1 January 2018, two research institutes were transferred into Fraunhofer institutes: • **Fraunhofer IAPT** (Institute for additive manufacturing technologies, former Laser Zentrum Nord GmbH) • **Fraunhofer CAN** (Center for Applied Nanotechnology; part of the Fraunhofer IAP, Institute for Applied Polymer Research; former Nanopartikel der CAN GmbH) Hamburg is planning to invest more than 30 million Euros during the next five years to strengthen the Fraunhofer Institutes for 3D printing and nanotechnology.	

Table 6: Identified research cooperation needs and potential in Schleswig-Holstein

Economic base What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance? **Strong Clusters (alphabetically)** **ICT and media** DiWiSH – Digitale Wirtschaft Schleswig-Holstein **Life sciences** Life Science Nord **Logistics** Logistik-Initiative Schleswig-Holstein **Maritime economy** Maritimes Cluster Norddeutschland **Nutrition industry** foodRegio **Renewable energies** Schleswig-Holstein Renewable Energy Network Agency (EE.SH) windcomm Schleswig-Holstein **Tourism** Tourismus-Cluster Schleswig-Holstein + two emerging clusters/networks: **Nanotechnologies** Norddeutsche Initiative Nanomaterialien (NINa) **Power electronics** Netzwerk Leistungselektronik Schleswig-Holstein **Defined RIS3 of Schleswig Holstein**[70] • Nutrition industry • ICT and media • Renewable energies • Life sciences • Maritime economy	**Networks of ARFs** What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base? The full table on the regional research infrastructures by RI category missing from the Annex 1 but to be found in the online ARF catalogue. **1.HEIs of Schleswig-Holstein** **Christian-Albrechts-Universität zu Kiel** Mathematics and Natural Sciences, Agricultural and Nutritional Sciences, Medicine Kiel Life Science (KLS) Kiel Marine Science (KMS) Kiel Nano, Surface, and Interface Science (KiNSIS) **Kiel University of Applied Sciences** Agriculture, Computer Science and Electrical Engineering, Mechanical Engineering **Universität zu Lübeck** Medicine, Computer Science, Life Sciences, Biomedical Engineering **Flensburg University of Applied Sciences** Institut für Nautik und maritime Technologien Wind Energy Technology Institute Zentrum für nachhaltige Energiesysteme **2. RTOs and commercial laboratories** **Helmholtz Zentrum Geesthacht (HZG)** (Centre for Materials and Coastal Research) **European XFEL** Free electron laser XFEL **Fraunhofer ISIT** (Research Institution for Silicon-based Technology) **Fraunhofer EMB** (Research Institution for Marine Biotechnology and Cell Technology) **Max Planck Institute for Evolutionary Biology** **Heinrich Pette Institute** (Leibniz Institute for Experimental Virology) **Research Center Borstel** (Leibniz Lungenzentrum) **3. Multipliers/ Intermediaries** **Innovation Centers Schleswig-Holstein** Wirtschaftsentwicklungsgesellschaft des Kreises

[70] European Commission, Hamburg, According to http://s3platform.jrc.ec.europa.eu/regions/de6/tags/de6, February 14th 2018

	Segeberg mbH mariCUBE Technik- und Ökologiezentrum Eckernförde Gewerbezentrum Eutin Technologiezentrum Flensburg Geesthachter Innovations- und Technologiezentrum Gründerzentrum Hohenwestedt Innovationszentrum Itzehoe Kieler Innovations- und Technologiezentrum Wissenschaftszentrum Kiel GmbH Wissenschaftspark Kiel Technikzentrum Lübeck Centrum für Angewandte Technologien Logistik- und Innovationszentrum Neumünster Nordfriesisches Innovations-Center GmbH Gewerbezentrum Oldenburg Gewerbe- und Technikzentrum Raisdorf **4. Regional policy makers and Structural Funds MA/IBs** **Investment Banks** IB.SH: Investitionsbank Schleswig-Holstein **Chambers of Commerce and Industry** Industrie- und Handelskammer zu Flensburg Industrie- und Handelskammer zu Kiel Industrie- und Handelskammer zu Lübeck **Regional Development Organisations** Witschaftsförderung und Technoglogietransfer Schleswig-Holstein GmbH (WTSH)
Anticipated industrial trends What kind of specialisation or even diversification current strengths is required to keep up regional performance? According to the new strategic guidelines of 2016, Schleswig-Holstein lacks a concept for an enhanced cooperation of science and industry to enable innovation. The "Bündnis für Industrie.SH" recommends further specializing on technologies for the energy transition, for maritime industry and for digitalization/industry 4.0.	**Anticipated research base needs** What kind of investments and time resources are required for diversifying the current research base? As some starting points for a better innovation infrastructure, Schleswig-Holstein plans • to strengthen the existing Fraunhofer institutes and improve the network of non-university research institutes, • to foster the knowledge and technology transfer in maritime industry, renewable energies and medicine, • to modernise existing innovation parks and innovation centres and incorporate new ones. The *Bündnis für Industrie.SH* recommends: • Financial support for the development and installation of innovative storage systems • Increase of the financial support for higher education institutes by the federal state of Schleswig-Holstein and increase the number of research projects, being co-financed by partners from industry

	• Enhance the network of higher education institutes • Formation of an innovation centre for ocean engineering

Policy

Are current economic development policies supporting competitiveness and specialisation?

Bündnis Industrie Schleswig-Holstein
The *Bündnis Industrie S.H.* (Alliance of the Ministry of Economic Affairs, Transport and Employment, Technology and Tourism and partners from industry) summarized recommendations for action for the energy transformation, maritime industry, education, digitalization and marketing.

Table 7: Identified research cooperation needs and potential in Latvia

<table>
<tr>
<td>Economic base

What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance?

Strong Clusters (alphabetically)

• Latvian High Added Value and Healthy Food Cluster
• Latvian IT Cluster

Defined RIS3

• knowledge-based bio-economy;
• biomedicine, medical appliances, bio-pharmacy and bio-technology;
• advanced materials technologies and engineering systems;
• smart energy;
• Information and communication technologies.</td>
<td>Networks of ARFs

What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base?

The full table on the regional research infrastructures by RI category can be found in the Annex 1 and in the online ARF catalogue.

1. HEIs

• University of Latvia
• Riga Technical University
• Latvia University of Agriculture
• Rīga Stradiņš University
• Daugavpils University
• Vidzeme University of Applied Sciences
• Ventspils University College
• Rezekne Academy of Technologies

2. RTOs and commercial laboratories

• The Institute of Solid State Physics
• Latvian State Institute of Wood Chemistry
• Latvian Institute of Organic Synthesis
• Institute of Food Safety, Animal Health and Environment "BIOR"
• Latvian State Forest Research Institute "Silava".

3. Multipliers/ Intermediaries

• Latvian Technological Centre, http://innovation.lv/en/ltc/
• Investment and Development Agency of Latvia, www.liaa.gov.lv

4. Regional policy makers and Structural Funds MA/IBs

Ministry of Education and Science, www.izm.goc.lv

Ministry of Economics, www.em.gov.lv

Investment and Development Agency of Latvia, www.liaa.gov.lv</td>
</tr>
<tr>
<td>Anticipated industrial trends</td>
<td>Anticipated research base needs</td>
</tr>
</table>

BALTIC TRAM
Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

What kind of specialisation or even diversification current strengths will require to keep up regional performance? The main industrial areas where strong activities are taking place are electronics, wood industry and food industry. Clusters in ICT and Food industry are being strengthened and expanded so further regional development is needed not only to ensure successful implementation of these activities, but also increase the impact of them. Besides clustering, a move towards implementation of tech-intensive activities and development of products with a higher added value are important as well, especially in industries like food and wood. Thus, further work on raising awareness of necessity to innovate and possibility of cooperation among research organizations is needed to ensure growth in this area.	What kind of investments and time resources are required for diversifying the current research base? Investments that build the technology transfer capacity at research institutions as well as companies both in human resources and infrastructure as an insufficiently appropriate environment is one of the bottlenecks in university-industry cooperation. Besides the skills necessary to ensure technology transfer processes, equipment and its accessibility for the use of companies is extremely important.
Policy Are current economic development policies supporting competitiveness and specialisation? Innovation development particularly by encouraging university-industry cooperation including technology transfer is of high priority in Latvia therefore multiple funding mechanisms are dedicated to this area. The most relevant programmes are the Practical research grants (MoES) and Commercialisation and Patenting Fund (LIAA) with both providing funding for applied research and experimental development while the latter also funds commercialisation activities and is implemented within the much broader programme – "Support for Technology Transfer System", developed and implemented by LIAA. The programme also includes Innovation Vouchers and various "soft" activities, such as workshops and networking events for researchers and entrepreneurs. The programme also provides support for start-ups developing new tech-intensive products. All the funding incentives are developed in accordance with national specialisation areas.	

Table 8: Identified research cooperation needs and potential in Lithuania

Economic base

What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance?

Strong Clusters (alphabetically)

Baltic Furniture Cluster;

Laser & Engineering Technologies Cluster(LITEK);

Lithuanian Medical Tourism Cluster LitCare;

Lithuanian Photovoltaic Technology Cluster;

Lithuanian Plastics Cluster;

Lithuanian Prefabricated Wooden Houses Cluster PrefabLT;

Užupis Creative Cluster;

Wellness Cluster iVita.

Defined RIS3

Furniture, New or improved service processes;

Advanced manufacturing systems, Photonics;

Human health activities (medical services);

Power generation / renewable sources;

Chemicals & chemical products, Rubber & plastic products;

Construction;

Creative, arts & entertainment activities;

E-Health (e.g. healthy ageing).

Networks of ARFs

What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base?

1. HEIs and Open Access Centres (OAC)
Vilnius University (VU):

VU OAC: Joint Life Sciences Centre;

VU OAC: Joint Centre of Innovative Medicine;

VU OAC: Laser Research Centre Facility "NAGLIS";

VU OAC: Physical Sciences and Technologies Research Centre;

VU OAC of Nature Research;

VU OAC: Information Technology Research Centre.

- **Center for Physical Sciences and Technology** (CPST):

OAC of Processing Technologies – BALTFAB ;

Structural Analysis OAC;

Prototype formation and integration OAC;

Coating Formation OAC.

Vilnius Gediminas Technical University (VGTU):

VGTU OAC: Civil Engineering Research Centre.

- Kaunas University of Technology (KUT):

National Open Access R&D Centre within KUT;

KUT OAC: Competence Centre for Food Research and Technology.

Lithuanian University of Health Sciences (LUHS):

LUHS Medicine Academy OAC for the Advanced Pharmaceutical and Health Technologies;

LUHS Veterinary Academy OAC: Research Centre for Animal Nutrition, Health, Biotechnologies and Food.

Lithuanian Energy Institute (LEI):

LEI National Open Access Scientific Centre for Future Energy Technologies.

- Aleksandras Stulginskis University (ASU):

ASU Open Access Joint Research Centre of Agriculture and Forestry.

	• Vytautas Magnus University (VMU): Instrumental Analysis OAC. • Klaipėda University (KU): KU OAC for Marine Research. **2. RTOs and commercial laboratories** The list of accredited testing laboratories (ISO/IEC 17025) can be found online[71]. **3. Multipliers/ Intermediaries** Kaunas Science and Technology Park; Klaipėda Science and Technology Park; Northtown Technology Park; Visoriai Information Technology Park; Sunrise Valley Science and Technology Park; Science and Technology Park of Institute of Pfysics; Lithuania Innovation Centre. **4. Regional policy makers and Structural Funds MA/IBs** Research Council of Lithuania; Ministry of Education and Science (MES); Ministry of Economy (ME); RCL Science Found; Lithuanian Business Support Agency; **Agency for Science, Innovation and Technology** (MITA); Research and Higher Education Monitoring and Analysis Centre (MOSTA); State Studies Foundation; Centre for Quality Assessment in Higher Education (SKVC).
Anticipated industrial trends What kind of specialisation or even diversification current strengths will require to keep up regional performance?	**Anticipated research base needs** What kind of investments and time resources are required for diversifying the current research base? During the 2007–2013 EU investment programming period the main focus has been put on the development

[71] Lithuanian National Accreditation Bureau (LA), 2018, The list of accredited testing laboratories (ISO/IEC 17025), http://www.nab.lt/The_list_of_accredited_testing_laboratories, retrieved March 19th 2018.

According to a *Smart Specialization Strategy Progress, First Report (Vilnius, 2017)*[72] survey of business structure made by MOSTA, the changes in produced added value and the FTE (full-time equivalent) employees in 2010–2014 – economic sub-sectors related to the priorities of the Smart Specialization Strategy – may be classified as follows:

- Sub-sectors where added value and the number of employees increased at a lower pace than the country's economy: agro-innovation and food technologies, educational technologies and smart energy systems.
- Sub-sectors where added value grew faster, but the number of employees increased more slowly than the country's economy: solar energy.
- Sub-sectors where both added value and the number of employees grew faster than the country's economy: photonic and laser technologies, structural and composite materials, flexible production systems, generation of energy from biomass, transport, molecular technologies, digital construction, and the implementation of breakthrough innovations.
- Sub-sectors where the number of employees increased faster, but the added value grew more slowly than the country's economy: functional materials and coatings, advanced technologies for health, and ICT.

Methodological problems in allocating economic sub-sectors to Smart Specialization priorities and the limitations of statistical indicators have so far prevented performing a more thorough in-depth analysis and making quantitative, unambiguous conclusions[73].

of R&D system in Lithuania. Over 378 million euro was invested into the R&D&I of Integrated Science & Studies & Business centers (Valleys) in order to implement a smart specialization strategy. It was the largest investments into R&D&I during the whole independence period of Lithuania Republic since 1991. Five Valleys were built, more than twenty Open Access Centres / Labs were opened and advanced infrastructure for R&D was developed. Despite huge investment in this field more significant breakthrough for improving the performance of the R&D and innovation system and their impact on the country's competitiveness has not been achieved (3-4 years period is too short to achieve significant goals). The main reasons caused the discrepancy between the anticipated expectations are the following:

- Insufficient attention to the development of human resources in general (social guarantees of scientists, brain drain and etc.);
- Insufficient investments of private sectors in R&D. According to business sector expenditure, Lithuania's indicator (0.28 % of GDP, 2015) is more than 4.6 times worse than the EU average (1.30 % of GDP, 2015, source: R&D expenditure, Eurostat 2017);
- Public R&D expenditure in 2015 amounted to 0.76 % of GDP. This indicator corresponds to the EU average. It is important to emphasize that the majority of R&D expenditure in Lithuania is funded by the EU Structural Funds.

Policy

Are current economic development policies supporting competitiveness and specialisation?

Taking into account global and national trends and challenges more than 100 experts from Lithuanian academia, science, business, and decision making institutions have been engaged in the design and development of National Research and Innovation Smart Specialization Strategy (RIS3). The strategic goal of the RIS3 is to increase the impact of high value added, knowledge-intensive and highly-qualified-labour-intensive economic activities on the GDP and structural changes of the economy by means of the R&D and innovation decisions. The strategic goal includes the following objectives:

- create innovative technologies, products, processes and/or methods and, using the outputs of these activities, respond to global trends and long-term national challenges;

[72] Dunauskas, Jaujininkas, Lapienis, Reimeris & Valatka, 2017, Smart Specialization Strategy Progress, First Report (Vilnius, 2017).

[73] Dunauskas, Jaujininkas, Lapienis, Reimeris & Valatka, 2017, Smart Specialization Strategy Progress, First Report (Vilnius, 2017).

- increase competitiveness of Lithuanian legal entities and their opportunities for establishing in global markets – commercialization of knowledge created in the implementation of the R&D and innovation priorities as well as knowledge created in developing the R&D and innovation priority areas otherwise and using the unique synergy arising from the collaboration of science and businesses, economic entities and other public and private sector entities.

It has been selected six RDI Priority Areas and their priorities (twenty) by mapping national scientific potential and excellence:

- Energy and a sustainable environment;
- Inclusive and creative society;
- Agro-innovation and food technologies;
- New production processes, materials and technologies;
- Health technologies and biotechnologies;
- Transport, logistic and information and communication technologies.

RIS3 was approved on the 30th of April 2014 by the Resolution of the Government of the Republic of Lithuania No 411.c.

Table 9: Identified research cooperation needs and potential in Poland (Malopolska region)

Economic base

Of the 7 RIS3 industries identified, the life sciences industry, the metal and mineral processing industry, the chemical industry and the energy industry are developing innovative products and services at the highest rate: 94% of chemical industry enterprises reported they had implemented innovations in the 2012-2014 timeframe; this applied to 69% of manufacturers of non-metallic mineral-based products; 54% of manufacturers of synthetic and rubber products.

Strong Clusters (alphabetically)

The clusters which appear to be the most engaged for the benefit of their members and display a level of activity which portends well for the future are the two Małopolska clusters which have the status of Key Clusters, namely:

Life Science Cluster

Sustainable Infrastructure Cluster

Of the 23 clusters operating out of the Małopolska region, 18 match at least one smart specialisation.

Defined RIS3

Of the 7 specialisations defined by regional authorities, 5 merit attention as they represent the most potential in the context of Baltic TRAM initiative:

Life sciences;

Sustainable energy;

Chemical industry;

Manufacturing of metals and metal products as well as products made of mineral non-metallic materials;

Electrical engineering and machine-building industry;

Networks of ARFs

What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base?

The full table on the regional research infrastructures by RI category can be found in the Annex 1 and in the online ARF catalogue.

There are no region-specific platforms of cooperation which involve only or primarily ARFs. A nationwide ARF network – IATI - which was co-founded by Małopolska's AGH University of Science & Technology brings together research-performing universities with the express purpose of creating opportunities for closer ties and mutually beneficial cooperation between research teams and businesses. There is no single-entry mechanism offered by IATI which provides access to the cumulated expertise and technology offered by member universities. The commercial offer of the participating universities is promoted instead by way of regular business lunches where individual ARFs have the chance to present their services to invited representatives of industry.

1. HEIs

• Jagiellonian University in Kraków

-Narodowe Centrum Promieniowania Synchrotronowego "Solaris"

- Jagiellońskie Centrum Rozwoju Leków

- Małopolskie Centrum Biotechnologii

• AGH University of Science and Technology

-Centrum Inteligentnych Systemów Informatycznych

-Centrum Zrównoważonego Rozwoju i Poszanowania Energii

-Międzynarodowe Centrum Mikroskopii Elektronowej dla Inżynierii Materiałowej

- Energy Centre (including the Rooftop Wind Turbines Lab)

• Krakow University of Technology

-Małopolskie Centrum Budownictwa Energooszczędnego

-Centrum Badań i Rozwoju Urządzeń Przemysłowych „CEBEA"

- INTECH PK

• Międzyuczelniane Centrum Nowych Technik i Technologii Medycznych (PK, AGH, UJ, AWF)

	2. RTOs and commercial laboratories We consider the market for services offered by RTOs and commercial laboratories in the Małopolska region to be a niche market with few players but –we assume - with significant growth potential. Examples of private sector RTOs which offer R&D services to private as well as public entities (enterprises, institutions) in the Małopolska region are: • Createc (website link here; services centred on material analysis); • EC Engineering (website link here; services focused on product design for the automotive, railroad, aeronautic sectors). • Selvita (website link here; company offers drug discovery support at every stage of the early discovery phase up to the preclinical research phase for pharmaceutical and biotechnology companies) **3. Multipliers/ Intermediaries** Each university in the region has its own technology transfer centre, which functions as an intermediary between departments/laboratories and business clients. Technology Transfer Centre @ Cracow University of Technology (no specialization as such; TTC has online updated database listing the R&D services of 23 university laboratories & research units, 123 solutions/methodologies developed in-house and offering commercialization potential) Technology Transfer Centre @ AGH University of Science & Technology (no specialization as such; TTC currently seems to be focused on helping commercialise R&D generated by university researchers and students, including spin-off companies Centre for Technology Transfer CITTRU @ the Jagiellonian University [offers two entry-points: innovation (28 innovations displayed) and contract research (88 profiled departments/laboratories/ research groups detailing expertise and possible range of research services)] PSTRYK – government-run single-entry commissioned research website (akin to ADAPTER website) which via one embedded form + attachments allows companies to submit their R&D challenges to over 50 technology transfer centres (including those named above) with a target 48-hour initial response period. Website link here. There are also several key multipliers, specifically, trade associations which can reach and cater to specific audiences. In the opinion of the authors, however, these are less effective vehicles than cluster-type organisations to create opportunities for R&D excellence for their member companies. A prominent trade association in the region is the Cracow Chamber of Commerce (192 member companies; multiple sectors represented, no clear policy or visible action where innovation is promoted, supported etc.).

	4. Regional policy makers and Structural Funds MA/IBs -
Anticipated industrial trends In the Małopolska region, as throughout Poland, there is a clear need to support growth of sectors of the economy which are best placed to expand on foreign markets. While the electrical engineering and machining sector in Małopolska are very export-oriented, other sectors of the economy are less so. Internationalisation support for businesses from national funding programmes will most likely overlap with parallel Małopolska-level funding for smart specialisations such as machines and equipment; IT/ICT; biotechnology and pharmaceutics; furniture This effort goes hand in hand with the desire to support the development of products with take-up potential on the global market. Even though there are national-level plans to create funding instruments based on venture capital seed funds, there has to date been no trickle-down of this concept to regional strategies, which still primarily rely on traditional funding instruments (e.g. co-financed grants). Another policy likely to impact developments in certain industries is a serious effort at the reindustrialisation of the country. On the national level a focus has been put on several areas which are not of immediate interest or relevance to the Małopolska region (e.g. shipping, recreational boating industry); however, some flagship projects such as the "Biotechnology Development Centre" and "Polish Medicinal Products" are likely to advance policymaking in Małopolska in these areas.	**Anticipated research base needs** A substantial research base already exists because of the high concentration of research-performing institutions in the main metropolitan area of the Małopolska region and conscious efforts by regional authorities to foster interaction between the research community and businesses representing particular smart specialisations. In terms of exposure of research communities to collaboration with industry, the life science & ICT–linked research communities are perhaps the most industry-oriented, because of ongoing clustering efforts (Life Science Cluster, Kraków Technology Park) which are actually making a difference as well as key homegrown and foreign industry players present in the region which contribute to positively branding of the region as attractive to these particular sectors (e.g. Comarch, Capgemini, IBM for ICT). It should be noted in this context that regional funding focused on targeted growth of industry-research collaboration has led to the development of SPIN centres for knowledge transfer which currently cater to the life science, sustainable development, ICT. Meanwhile, there is still a need for a stable SPIN centre for chemical research for industry, electrical engineering/machining for industry and metalworking for industry. This is all the more important, if one considers that e.g. there is a considerable concentration of companies in the Małopolska region serving the automotive sector (Delphi Poland, S.A., Valeo Autosystemy Sp. z o.o., Mabuchi, MAN &c) which would no doubt take advantage of an improved research base and more cooperation-savvy counterparts in the regional community than is currently the case.
Policy Current economic development policies are supporting competitiveness and specialisation, but especially in the case of specialisation, do not follow a strategy as such, because a strategy explaining directions that public policy toward the marketplace should take are not described or elaborated in any regional strategic documents. Specialisation is thereby a byword for target support that regional authorities are fully aware of, but there is currently no targeted specialisation agenda to advance this targeted support, other than via formal criteria in funding schemes organised by regional development authorities.	

Table 10: Identified research cooperation needs and potential in Blekinge and Skåne, Sweden

Economic base

What are the most performing industries (RIS3) and what is their competitiveness (e.g. GVA) and innovation performance?

Strong Clusters

Skåne Clusters

- Media evolution
- Mobile Heights
- Packbridge
- Livsmedelsakademin
- Sustainable Business Hub
- Resilient Regions Association
- IUC Syd (Industriella Utvecklings Centra)
- Medicon Valley Alliance
- SMTF (Svenskt Marin Tekniskt Forum)

Blekinge Clusters

- Blue Science Park (marintechnology, e-Heath and telecommunications/ ICT).
- Netport
- TechTank
- Telecom city
- Tech Network
- Swedish Waterjet Lab
- Energiklustret

Defined RIS3

Blekinge

- Internet of Things
- Metal working
- Marine Energy
- Marine Technology
- Mobile Health
- Water Jet cutting

Networks of ARFs

What are the strengths of the regional research base? What is the actual and anticipated coherence between the current and anticipated economic and research bases? What is the actual competitiveness at national and macro-regional levels of the current research base?

The full table on the regional research infrastructures by RI category can be found in the Annex 1 and in the online ARF catalogue.

1.HEIs

- Lund University
- MAX IV
- ESS – European Spallation Source
- NRC – Neuronano Research Center
- LBIC – Lund University Bioimaging Center
- nCHREM - The National Center for High Resolution Electron Microscopy
- SCIBLU
- Lund Nano Lab
- Lund Nano Characterization Labs
- The Lund Laser Center (LLC)
- Malmö University + OpenLab which is a part of the Malmö University, offering lab space, instrumentation and expertise for outside users, within the fields of life science, chemistry and materials science.

Biofilms Research Center for BioInterfaces

- Blekinge Institute of Technology
- Blekinge Institute of Technology,
- SLU Alnarp is a part of the Swedish University of Agricultural Science

2. RTOs and commercial laboratories

- Colloidal Resources Competence, CR
- SARomics Biostructures
- Androit Science
- Swerea IVF / RISE

3. Multipliers/ Intermediaries

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• Energy Optimisation • Intelligent transport systems • Digital Media Skåne • Personal Health – products, services, business models and systems for preventive healthcare • Smart Sustainable Cities • Smart Materials	• Business Region Skåne (Marketing group of Skåne) • Innovation Skåne • LU Innovation • IDEON Science Park **Medicon Village** **Smile Incubator** • Medeon – Science park and Incubator • Partners for Development Investments in Life Sciences, P.U.L.S. AB • Blue Science Park **4. Regional policy makers and Structural Funds MA/IBs** • Regional Council Region Skåne • FIRS
Anticipated industrial trends What kind of specialisation or even diversification current strengths will require to keep up regional performance? • Strengthened Innovation Culture • Systemic Innovativeness • Cooperation • Entrepreneurship • Research • Skills and Training • Finance	**Anticipated research base needs** What kind of investments and time resources are required for diversifying the current research base? • Establish or attract IReCs to the region • Increase efficiency in cooperation between Industry and Academia.
Policy Are current economic development policies supporting competitiveness and specialisation? Yes, the policies are guided by the RIS3 objectives and goals. The identified regional weakness in IReC availability is being addressed through e.g. participation in Baltic TRAM.	

ANNEX 2: Summary Table of reported RIS3

http://s3platform.jrc.ec.europa.eu/regions, Accessed on 9.4.2018

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
Hamburg [DE6]	**Aviation**	C - Manufacturing	06 - Industrial production and technology	A - Aeronautics & space
	Aircraft and aircraft systems, cabins and ...	C.30 - Other transport equipment	06.61 - Manufacture of other transport equipment	A.01 - Aeronautics
			12 - General advancement of knowledge	A.07 - Transport & logistics
			...	
Hamburg [DE6]	**Creativive society**	F - Construction	10 - Culture, recreation, religion and mass media	C - Cultural & creative industries
	Architecture, visual arts, performing arts...	F.41 - Construction of buildings	10.84 - Broadcasting and publishing services	C.16 - Development of regional cultural & creative industries
		F.42 - Civil engineering	10.85 - Cultural services	C.17 - Support to link cultural & creative industries with traditional industries
		...	...	...
Hamburg [DE6]	**Life sciences**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	Bio-technology, pharmaceuticals and medica...	C.21 - Basic pharmaceutical products and pharmaceutical preparations	06.52 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	E.39 - Industrial biotechnology
		M - Professional, scientific and technical activities	07 - Health	G - Public health & security
		...	...	...
Hamburg [DE6]	**Health industry**	Q - Human health and social work activities	07 - Health	G - Public health & security
	Health industry	Q.86 - Human health activities	07.65 - Health promotion	G.46 - Ageing societies
			07.68 - Personal health care for vulnerable and high risk population	G.49 - Public health & well-being
			...	
Hamburg [DE6]	**Logistics**	H - Transportation and storage	04 - Transport, telecommunication and other infrastructures	J - Sustainable innovation
	Logistics	H.49 - Land transport and transport via pipelines	04.28 - Transport systems	J.66 - Smart green & integrated transport systems
		H.50 - Water transport		
		H.52 - Warehousing and support activities for transportation		

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
Hamburg [DE6]	**Media**	J - Information and communication technologies	10 - Culture, recreation, religion and mass media	C - Cultural & creative industries
	New storytelling and data journalism	J.58 - Publishing activities	10.84 - Broadcasting and publishing services	C.16 - Development of regional cultural & creative industries
		J.59 - Motion picture, video and television programme production, sound recording and music publishing activities	12 - General advancement of knowledge	H - Service innovation
		...	...	...
Hamburg [DE6]	**Renewable energy**	D - Electricity, gas, steam and air conditioning supply	05 - Energy	B - Blue growth
	Renewable energy	D.35 - Electricity, gas, steam and air conditioning supply	05.33 - Energy production and distribution efficiency	B.09 - Blue renewable energy
			05.36 - Other power and storage technologies	J - Sustainable innovation
				J.68 - Sustainable energy & renewables
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Southwest Finland [FI1C1]	**Smart bioenergy**	D - Electricity, gas, steam and air conditioning supply	05 - Energy	J - Sustainable innovation
	Smart bioenergy	D.35 - Electricity, gas, steam and air conditioning supply	05.37 - Renewable energy sources	J.68 - Sustainable energy & renewables
		INFORMATION NOT UPDATED FOR 2018-2021		
Southwest Finland [FI1C1]	**Smart learning with special focus on innovation pedagogics**	P - Education	09 - Education	I - Social innovation
	Smart learning with special focus on innov...	P.85 - Education	09.81 - Special education	I.57 - Social innovation with regard to education, skills & training
				K - Other
		INFORMATION NOT UPDATED FOR 2018-2021		K.72 - Other
Southwest Finland [FI1C1]	**Tailored health and wellbeing**	Q - Human health and social work activities	07 - Health	G - Public health & security
	Tailored health and wellbeing	Q.86 - Human health activities	07.65 - Health promotion	G.49 - Public health & well-being
			07.71 - Public health services	
		INFORMATION NOT UPDATED FOR 2018-2021	...	

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Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
Southwest Finland [FI1C1]	**Blue-green industry**	M - Professional, scientific and technical activities	12 - General advancement of knowledge	B - Blue growth
	Utilisation of KETs, innovation platforms ...	M.74 - Other professional, scientific and technical activities	12.107 - Physical sciences	B.09 - Blue renewable energy
			12.108 - Social sciences (psychology, economics, business, sociology, law, political science and geography)	B.12 - Marine biotechnology
		INFORMATION NOT UPDATED FOR 2018-2021		B.14 - Shipbuilding & ship repair
Southwest Finland [FI1C1]	**Smart, sustainable living environment, cities and countryside**	E - Water supply; sewerage; waste managment and remediation activities	04 - Transport, telecommunication and other infrastructures	E - KETs
	Utilisation of KETs, innovation platforms ...	E.36 - Water collection, treatment and supply	04.23 - Civil engineering	E.38 - Advanced materials
		E.38 - Waste collection, treatment and disposal activities; materials recovery	04.24 - Construction and planning of building	E.39 - Industrial biotechnology
	INFORMATION NOT UPDATED FOR 2018-2021	...	...	...
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Kainuu [FI1D4]	**Health and Well-being**	I - Accommodation and food service activities	10 - Culture, recreation, religion and mass media	G - Public health & security
	Activity tourism, innovations of nutrition...	I.55 - Accommodation	10.85 - Cultural services	G.49 - Public health & well-being
		Q - Human health and social work activities	10.87 - Recreational and sporting services	H - Service innovation
		...		...
Kainuu [FI1D4]	Forestry biomass and bioenergy.	A - Agriculture, forestry and fishing	05 - Energy	E - KETs
	Forestry biomass and bioenergy.	A.02 - Forestry and logging	05.31 - Energy conservation	E.39 - Industrial biotechnology
		D - Electricity, gas, steam and air conditioning supply	05.37 - Renewable energy sources	J - Sustainable innovation

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
		D.35 - Electricity, gas, steam and air conditioning supply	...	...
Kainuu [FI1D4]	ICT and information systems	J - Information and communication technologies	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
	Measurement technology, data-centres, game...	J.61 - Telecommunications	04.27 - Telecommunication systems	D.18 - Advanced or High performance computing
		J.62 - Computer programming, consultancy and related activities	10 - Culture, recreation, religion and mass media	D.19 - Artificial intelligence, cognitive systems, augmented and virtual reality, visualisation, simulation, gamification & interaction technologies
		J.63 - Information service activities	...	...
Kainuu [FI1D4]	Natural resources	A - Agriculture, forestry and fishing	01 - Exploration and exploitation of the earth	J - Sustainable innovation
	Mining (Green mining, process and environm...	A.02 - Forestry and logging	01.03 - Earth's crust and mantle excluding seabed	J.61 - Bioeconomy
		B - Mining and quarrying	01.06 - Mineral, oil and natural gas prospecting	J.63 - Eco-innovations
		...	...	...
Kainuu [FI1D4]	Wood industry	A - Agriculture, forestry and fishing	04 - Transport, telecommunication and other infrastructures	E - KETs
	Woodworking industry, wood construction an...	A.02 - Forestry and logging	04.23 - Civil engineering	E.37 - Advanced manufacturing systems
		C - Manufacturing	04.24 - Construction and planning of building	
		...	...	
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Latvia [LV]	**Biomedicine, medical technologies and biotechnology**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	Chemical and biotechnological methods and ...	C.10 - Food products	06.51 - Manufacture of chemicals and chemical products	E.39 - Industrial biotechnology
		C.20 - Chemicals and chemical products	06.52 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	G - Public health & security

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Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
		...	06.57 - Manufacture of computer, electronic and optical products	G.49 - Public health & well-being
Latvia [LV]	**Smart Energy**	C - Manufacturing	04 - Transport, telecommunication and other infrastructures	J - Sustainable innovation
	Development of smart grids - development o...	C.27 - Electrical equipment	04.24 - Construction and planning of building	J.66 - Smart green & integrated transport systems
		C.28 - Machinery and equipment n.e.c.	05 - Energy	J.68 - Sustainable energy & renewables
		...	...	
Latvia [LV]	**Smart materials, technology and engineering**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	Implant materials, composite materials, th...	C.20 - Chemicals and chemical products	06.51 - Manufacture of chemicals and chemical products	E.37 - Advanced manufacturing systems
		C.23 - Other non-metallic mineral products	06.54 - Manufacture of other non-metallic mineral products	E.38 - Advanced materials
		...	...	E.41 - Nanotechnology
Latvia [LV]	**Advanced ICT**	J - Information and communication technologies	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
	Innovative knowledge management, system mo...	J.61 - Telecommunications	04.27 - Telecommunication systems	D.20 - Big data, data mining, database management
		J.62 - Computer programming, consultancy and related activities	12 - General advancement of knowledge	D.23 - Cloud computing and software as a service and service architectures
		J.63 - Information service activities	...	...
Latvia [LV]	**Knowledge intensive bio-economy**	A - Agriculture, forestry and fishing	02 - Environment	E - KETs
	Sustainable and productive forest growing ...	A.01 - Crop and animal production, hunting and related service activities	02.17 - Solid waste	E.39 - Industrial biotechnology
		A.02 - Forestry and logging	05 - Energy	G - Public health & security
		...	...	...
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Lithuania [LT]	**Inclusive and creative society:**	J - Information and communication technologies	09 - Education	D - Digital transformation

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
	modern self-development and education tech...	J.62 - Computer programming, consultancy and related activities	09.78 - Post secondary non tertiary education	D.28 - e-Inclusion (e.g. e-Skills, e-Learning)
		P - Education	09.79 - Pre- and primary school	H - Service innovation
		...	...	...
Lithuania [LT]	**Health technologies and biotechnologies:**	M - Professional, scientific and technical activities	06 - Industrial production and technology	D - Digital transformation
	molecular technologies for medicine and bi...	M.74 - Other professional, scientific and technical activities	06.52 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	D.27 - e-Health (e.g. healthy ageing)
		Q - Human health and social work activities	07 - Health	E - KETs
		Q.86 - Human health activities	07.66 - Monitoring the health situation	...
Lithuania [LT]	**New production processes, materials and technologies:**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	photonic and laser technologies; functiona...	C.13 - Textiles	06.39 - Improving industrial production and technology	E.37 - Advanced manufacturing systems
		C.20 - Chemicals and chemical products	06.44 - Manufacture of textiles	E.38 - Advanced materials
		...	...	...
Lithuania [LT]	**Energy and sustainable environment:**	C - Manufacturing	02 - Environment	D - Digital transformation
	smart systems for energy efficiency, diagn...	C.26 - Computer, electronic and optical products	02.08 - Monitoring facilities for measurement of pollution	D.22 - Cleaner environment & efficient energy networks and low energy computing
		C.27 - Electrical equipment	02.18 - The elimination and prevention of pollution	D.23 - Cloud computing and software as a service and service architectures
		...	...	...
Lithuania [LT]	**Transport, logistics and ICT:**	H - Transportation and storage	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
	smart transport systems and information an...	H.52 - Warehousing and support activities for transportation	04.23 - Civil engineering	D.19 - Artificial intelligence, cognitive systems, augmented and virtual reality, visualisation, simulation, gamification & interaction technologies

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
		J - Information and communication technologies	04.27 - Telecommunication systems	D.20 - Big data, data mining, database management
		...	04.28 - Transport systems	...
Lithuania [LT]	**Agricultural innovations and food technologies**	A - Agriculture, forestry and fishing	06 - Industrial production and technology	G - Public health & security
	sustainable agri-biological resources and ...	A.01 - Crop and animal production, hunting and related service activities	06.41 - Manufacture of food products	G.48 - Food security & safety
		C - Manufacturing	06.42 - Manufacture of beverages	
		...	...	
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Malopolskie [PL21]	**Life sciences**	A - Agriculture, forestry and fishing	02 - Environment	E - KETs
	Active and healthy life; medicinal product...	A.01 - Crop and animal production, hunting and related service activities	02.08 - Monitoring facilities for measurement of pollution	E.39 - Industrial biotechnology
		C - Manufacturing	02.09 - Noise and vibration	F - Nature & biodiversity
		...	...	...
Malopolskie [PL21]	**Chemical industry**	A - Agriculture, forestry and fishing	06 - Industrial production and technology	E - KETs
	Chemistry in health care, agriculture and ...	A.01 - Crop and animal production, hunting and related service activities	06.40 - Recycling waste	E.37 - Advanced manufacturing systems
		A.02 - Forestry and logging	06.51 - Manufacture of chemicals and chemical products	E.38 - Advanced materials
		...	...	...
Malopolskie [PL21]	**Creative and leisure industries**	I - Accommodation and food service activities	10 - Culture, recreation, religion and mass media	C - Cultural & creative industries
	Creative industries; graphic design and in...	I.55 - Accommodation	10.85 - Cultural services	C.16 - Development of regional cultural & creative industries
		I.56 - Food and beverage service activities	10.86 - Racial, cultural and social integration, sociology of science, religion, art, sport and leisure; media, language, libraries, archives and cultural policy	C.17 - Support to link cultural & creative industries with traditional industries
		...	10.87 - Recreational and sporting services	

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Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
Malopolskie [PL21]	**Production of metals, metal products and non-metallic mineral products**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	Innovative pro-ecological construction sol...	C.24 - Basic metals	06.55 - Manufacture of basic metals	E.38 - Advanced materials
		C.25 - Fabricated metal products, except machinery and equipment	06.56 - Manufacture of fabricated metal products, except machinery and equipment	
Malopolskie [PL21]	**Sustainable energy**	D - Electricity, gas, steam and air conditioning supply	05 - Energy	J - Sustainable innovation
	Smart grids and energy storage; clean foss...	D.35 - Electricity, gas, steam and air conditioning supply	05.30 - CO_2 capture and storage	J.68 - Sustainable energy & renewables
			05.31 - Energy conservation	
			...	
Malopolskie [PL21]	**ICT**	J - Information and communication technologies	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
	Technologies of medical engineering, inclu...	J.58 - Publishing activities	04.27 - Telecommunication systems	D.18 - Advanced or High performance computing
		J.59 - Motion picture, video and television programme production, sound recording and music publishing activities	12 - General advancement of knowledge	D.19 - Artificial intelligence, cognitive systems, augmented and virtual reality, visualisation, simulation, gamification & interaction technologies
		...	12.104 - Mathematics, computer and information sciences	...
Malopolskie [PL21]	**Electro technical and mechanical industries**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	Technologies of medical engineering; innov...	C.10 - Food products	06.57 - Manufacture of computer, electronic and optical products	E.37 - Advanced manufacturing systems
		C.11 - Beverages	06.58 - Manufacture of electrical equipment	E.38 - Advanced materials
		...	06.59 - Manufacture of machinery and equipment n.e.c.	...

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Skåne County [SE224]	**Smart Sustainable Cities**	H - Transportation and storage	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
	Knowledge, products, processes, services a...	H.49 - Land transport and transport via pipelines	04.23 - Civil engineering	D.30 - Intelligent inter-modal & sustainable urban areas (e.g. smart cities)
		J - Information and communication technologies	04.25 - General planning of land-use	
		...	...	
Skåne County [SE224]	**Smart Materials**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	Material science and its innovation	C.32 - Other manufacturing	06.39 - Improving industrial production and technology	E.38 - Advanced materials
			12 - General advancement of knowledge	
			...	
Skåne County [SE224]	**Personal health**	J - Information and communication technologies	07 - Health	D - Digital transformation
	The development of new products, services,...	J.60 - Programming and broadcasting activities	07.65 - Health promotion	D.27 - e-Health (e.g. healthy ageing)
		J.62 - Computer programming, consultancy and related activities	07.66 - Monitoring the health situation	G - Public health & security
		...	...	G.49 - Public health & well-being
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
South Denmark [DK03]	**Experience based industries**	R - Arts, entertainment and recreation	10 - Culture, recreation, religion and mass media	C - Cultural & creative industries
	Experience based industries	R.90 - Creative, arts and entertainment activities	10.85 - Cultural services	C.16 - Development of regional cultural & creative industries
		R.91 - Libraries, archives, museums and other cultural activities	10.86 - Racial, cultural and social integration, sociology of science, religion, art, sport and leisure; media, language, libraries, archives and cultural policy	C.17 - Support to link cultural & creative industries with traditional industries
		R.93 - Sports activities and amusement and recreation activities	10.87 - Recreational and sporting services	

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
South Denmark [DK03]	**Health and welfare innovation**	Q - Human health and social work activities	07 - Health	G - Public health & security
	Health and welfare innovation	Q.86 - Human health activities	07.65 - Health promotion	G.46 - Ageing societies
		Q.87 - Residential care activities	07.68 - Personal health care for vulnerable and high risk population	G.49 - Public health & well-being
		Q.88 - Social work activities without accommodation	...	G.50 - Public safety & pandemics
South Denmark [DK03]	**Sustainable energy**	D - Electricity, gas, steam and air conditioning supply	05 - Energy	J - Sustainable innovation
	Sustainable energy	D.35 - Electricity, gas, steam and air conditioning supply	05.32 - Energy efficiency - consumption	J.68 - Sustainable energy & renewables
			05.33 - Energy production and distribution efficiency	
			...	
Name [NUTS ID]	**Description**	**Economic Domains**	**Scientific Domains**	**Policy Objectives**
Estonia [EE]	**Enhancement of Resources**	C - Manufacturing	04 - Transport, telecommunication and other infrastructures	J - Sustainable innovation
	biomass (primarily timber and food) and oi...	C.10 - Food products	04.23 - Civil engineering	J.61 - Bioeconomy
		C.11 - Beverages	04.24 - Construction and planning of building	J.65 - Resource efficiency
		...	...	J.68 - Sustainable energy & renewables
Estonia [EE]	**ICT: e-Government and Data Science**	J - Information and communication technologies	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
	incl. big data and data mining	J.62 - Computer programming, consultancy and related activities	04.27 - Telecommunication systems	D.20 - Big data, data mining, database management
		M - Professional, scientific and technical activities	06 - Industrial production and technology	D.26 - e-Government (e.g. e-Procurement, open data & sharing of public sector information)
		...	...	
Estonia [EE]	**Biotechnology**	M - Professional, scientific and technical activities	06 - Industrial production and technology	E - KETs
	incl. food that supports health; medicine:...	M.72 - Scientific research and development	06.41 - Manufacture of food products	E.39 - Industrial biotechnology

Name [NUTS ID]	Description	Economic Domains	Scientific Domains	Policy Objectives
			06.42 - Manufacture of beverages	G - Public health & security
			...	G.49 - Public health & well-being
Estonia [EE]	**Materials Technologies**	C - Manufacturing	06 - Industrial production and technology	E - KETs
	incl. nano-technologies in new materials, ...	C.13 - Textiles	06.38 - Increasing economic efficiency and competitiveness	E.38 - Advanced materials
		C.20 - Chemicals and chemical products	06.39 - Improving industrial production and technology	
		...	...	
Estonia [EE]	**e-Health**	J - Information and communication technologies	07 - Health	D - Digital transformation
		J.62 - Computer programming, consultancy and related activities	07.66 - Monitoring the health situation	D.27 - e-Health (e.g. healthy ageing)
		J.63 - Information service activities	07.69 - Public health legislation and regulations	
		...	...	
Estonia [EE]	**ICT: Industry 4.0, Robotics and Embedded Systems**	C - Manufacturing	05 - Energy	D - Digital transformation
		C.10 - Food products	05.33 - Energy production and distribution efficiency	D.24 - Digitising Industry (Industry 4.0, smart and additive manufacturing)
		C.11 - Beverages	06 - Industrial production and technology	D.35 - Robotics, autonomous and cyber physical systems (e.g. vehicles, embedded systems)
		...	...	...
Estonia [EE]	**ICT: Cyber Security**	J - Information and communication technologies	04 - Transport, telecommunication and other infrastructures	D - Digital transformation
		J.62 - Computer programming, consultancy and related activities	04.27 - Telecommunication systems	D.29 - ICT trust, cyber security & network security
			13 - Defence	
			13.109 - Defence	

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