

BERRY+ scoping note

Regional contribution

Individual partners' contributions are structured as follows:

- Overview
- Statistical evidence base and insights
- RIS3 concept and key priorities
- BERRY+ relevant strengths of the economic and research base in the region
- Interregional, cross border and national collaboration experiences; synergy potential



Kainuu

Overview



Kainuu is located in north-East Finland (NUTS 3 FI 1D4). It comprises 8 municipalities. It has an area of 22 687 km2 and a population of 72 306 inhabitants $31.12.2019^2$, 1,3 % of Finland. In 2016, the GDP per capita in Kainuu was \in 28,596.30, compared with a national average of \in 38,370.04 (Statistics Finland, 2019). Kainuu's unemployment rate is around 10.8% (2017). In 2017, the top 5 industries in Kainuu were: (Regional Council of Kainuu, 2018)

1. Bio-economy (renewable natural resources) (502M €); 2. Mining (300.7M €)3. Energy (226.9M €); 4. Forestry (193.6 M €)5. Metal (152.5M €). Kainuu has an important research and knowledge base relating to measurement technology, ICT, and data analytics. One of the eight European supercomputers is located in Kainuu.

BERRY+ is of strategic importance to Kainuu, as addressing the small economic critical mass of the region through research-based entrepreneurship and value chain integration are prioritised development objectives. According to the Regional Innovation Scoreboard 2019, Kainuu is a strong+ innovator region.

Kainuu BERRY+ objectives and priorities

- (i) To strengthen bio-based clusters through new products, exploring circular economy solutions; achieve market-placement for innovative products.
- (ii) To improve the effectiveness of the Kainuu RIS3 delivery.
- (iii) To support the internationalisation of Kainuu research results through value-chain collaborations.
- (iv) To benefit from interregional complementarities for developing research results to TRL 5-9.
- (v) To improve knowledge and technology transfer innovation infrastructures as cluster management units and increase their competence and effectiveness for cluster and value chain management, i.e. at regional, national and interregional levels.
- (vi) To reinforce knowledge-based entrepreneurship associated with regional clusters and related to national and interregional clusters.
- (vii) To strengthen the digital transformation of existing clusters and in that sense their attractiveness to join European value chains.
- (viii) To enhance the resonance and multiplier effect of the high-performance computing of Kainuu (LUMI supercomputer, https://www.aikaecosystem.com/) in the field of bio-based industries applications and enhance long term interregional collaboration.
- (ix) To benefit from the outward-looking potential of the smart specialisation strategy, as results from BERRY+ interregional complementarities; and to form strategic national and interregional partnerships in this domain.

¹ s3platform.jrc.ec.europa.eu

https://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin vrm vamuu/005 vamuu tau 101.px/?rxid=54be75b2-ab2c-4889-ae69-4e3fa09e6e06



Statistical evidence-base and insights

According to the Regional Innovation Scoreboard 2019³, the Regional Profile dedicated to Finland⁴ "Pohjoisja Itä-Suomi (FI1D) is a Strong + Innovator; innovation performance has increased over time (10.7%). ... The radar graph shows relative strengths compared to Finland (orange line) and the EU (blue line), showing relative strengths (e.g. Lifelong learning) and weaknesses (e.g. Employment MHT man. + KIBS services):4", Figure 1.





Figure 1 indicates that among the fields with the weakest performance are those classified under the Sales impacts category, namely: medium and high-tech products exports, sales of new-to-market or to-the-firm innovations, exports of knowledge intensive business services (KIBS); also trademark applications, and R&D expenditures of the business sector (BERD), Table 1.

			Performa to EU	nce relative 2012 in	
Fir	nland	Relative to EU 2019 in 2019	2012	2019	
SU	MMARY INNOVATION INDEX	INDEX 139.8 133.3			
1	Human resources	172.4	183.1	198.5	
1.1	New doctorate graduates Population with tertiary education Lifelong learning	143.5	167.6	158.1	

Table 1Finland innovation performance (source: European Innovation Scoreboard 2020⁶)

³ For 2020 results: <u>https://ec.europa.eu/growth/sites/growth/files/eis2020_leader_map-01.png</u>

⁴ Finland report: <u>http://ec.europa.eu/growth/industry/innovation/ facts-figures/regional_en.</u> For the comprehensive 2019 EU report: <u>https://ec.europa.eu/growth/sites/growth/files/ris2019.pdf</u>

⁵ <u>https://ec.europa.eu/docsroom/documents/36284</u>

⁶ <u>https://ec.europa.eu/docsroom/documents/41874</u>, Regional Innovation Scoreboard 2019⁶.



			Performance relative to EU 2012 in			
Fir	nland	Relative to EU 2019 in 2019	2012	2019		
SU	IMMARY INNOVATION INDEX	139.8	133.3	152.2		
1.2	New doctorate graduates Population with tertiary education Lifelong learning	114.9	136.4	146.3		
1.3	New doctorate graduates Population with tertiary education Lifelong learning	284.5	254.4	306.7		
2	Attractive research systems	151.9	126.1	173.5		
2.1	International scientific co-publications Most cited publications Foreign doctorate students	227.8	212.8	334.6		
2.2	International scientific co-publications Most cited publications Foreign doctorate students	120.5	117.8	120.6		
2.3	International scientific co-publications Most cited publications Foreign doctorate students	124.4	67.4	143.4		
3	Innovation friendly environment	184.9	159.2	321.6		
3.1	Broadband penetration Opportunity-driven entrepreneurship	169.6	210.0	390.0		
3.2	Broadband penetration Opportunity-driven entrepreneurship	202.3	125.1	275.6		
4	Finance and support	137.4	155.7	158.7		
4.1	R&D expenditure in the public sector	137.3	156.8	134.8		
4.2	Venture capital expenditures	137.6	153.8	198.9		
5	Firm investments	129.9	183.3	168.7		
5.1	R&D expenditure in the business sector	124.7	203.6	142.9		
5.2	Non-R&D innovation expenditures Enterprises providing	88.5	88.7	124.1		
5.3	Enterprises providing ICT training	177.8	253.8	246.2		
6	Innovators	171.5	111.8	153.3		
6.1	SMEs product/process innovations	177.0	126.1	176.4		
6.2	SMEs marketing/organizational innovations	141.1	95.4	115.8		
6.3	SMEs innovating in-house	195.2	114.9	170.0		
7	Linkages	163.1	169.1	167.9		
7.1	Innovative SMEs collaborating with others	247.9	187.0	246.1		
7.2	Public-private co-publications	230.4	259.4	260.4		
7.3	Private co-funding of public R&D expenditures	83.1	120.9	83.9		
8	Intellectual assets	127.1	116.5	118.7		
8.1	PCT patent applications	149.5	144.4	138.8		



			Performa to EU	nce relative 2012 in
Fin	land	Relative to EU 2019 in 2019	2012	2019
SU	MMARY INNOVATION INDEX	139.8	133.3	152.2
8.2	Trademark applications	126.0	106.9	134.1
8.3	Design applications	93.8	85.6	78.7
9	Employment impacts	86.7	92.0	93.5
9.1	Employment in knowledge-intensive activities	133.8	132.4	144.6
9.2	Employment fast-growing enterprises	48.6	59.4	52.4
10	Sales impacts	90.6	85.3	90.1
10.1	Medium and high-tech product exports	71.9	61.6	79.7
10.2	Knowledge-intensive services exports	113.8	87.1	117.5
10.3	Sales of new-to-market/firm innovations	87.1	108.3	72.7

These weaknesses are taken into account in the RIS3 as output targets in the RIS3 monitoring system indicators, namely Indicators 3, 5 and 6.

The **export-related employment comparative advantage of Kainuu**, i.e. concentrations of exportsrelated employment compared to total regional employment is summarised in Table 2, the Balassa-Hoover index. Based on this concentration measure, the immediate diversification potential can be readily visualised, in terms of industries and types of skills available. The prioritised RIS3 industries are identified through the B-H categories.

Number of B-H 2017 **Comparative advantage of Kainuu 2017** Share jobs 2,4 % 25,55 07 Mining of metal ores 650 2,9 % 797 11,65 B Mining and quarrying 1,7 % 2,7 % 30 Manufacture of other transport equipment 468 5,72 02 Forestry and logging 730 4,11 0,5 % 08 Other mining and quarrying 4,04 137 03 Fishing and aquaculture 43 0,2 % 3,53 79 Travel agency, tour operator and other reserve-tion 154 2,92 0,6 % service and related activities 82 Office administrative, office support and other business 353 1,3 % 2,16 support activities 1609 5,9 % 2,07 A Agriculture, forestry and fishing 55 Accommodation 285 1,0 % 1,91 26 Manufacture of computer, electronic and optical 418 1,5 % 1,81 products

Table 2 The RIS3 industries, excerpt from the Balassa-Hoover analysis (source: University of Turku)



Comparative advantage of Kainuu 2017	Number of jobs	Share	B-H 2017
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	221	0,8 %	1,66
16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	339	1,2 %	1,58
O Public administration and defence; compulsory social security	2039	7,5 %	1,52
01 Crop and animal production, hunting and related service activities	836	3,1 %	1,42
23 Manufacture of other non-metallic mineral products	191	0,7 %	1,39
95 Repair of computers and personal and household goods	45	0,2 %	1,33
81 Services to buildings and landscape activities	1082	4,0 %	1,32
86 Human health activities	2740	10,1 %	1,32
42 Civil engineering	265	1,0 %	1,30
N Administrative and support service activities	2444	9,0 %	1,21
49 Land transport and transport via pipelines	972	3,6 %	1,20
Q Human health and social work activities	5519	20,3 %	1,20
63 Information service activities	99	0,4 %	1,17
69 Legal and accounting activities	318	1,2 %	1,16
93 Sports activities and amusement and recreation activities	311	1,1 %	1,16
36 Water collection, treatment and supply	34	0,1 %	1,14
88 Social work activities without accommodation	1594	5,9 %	1,10
09 Mining support service activities	10	0,0 %	1,10
87 Residential care activities	1185	4,4 %	1,10

The Herfindahl-Hirschman index measures regional resilience in the sense of the market base⁷ indicates the need that Kainuu should expand its economic base, since it is rated 14th out of the 19 Finnish regions. This applies also to the RIS3 industries.

Finally, in the context of the preparation of the BERRY+ scoping document, we have calculated also **the location quotient**⁸ and **the shift share analysis**⁹ **for Kainuu**, Tables 3 and 4¹⁰. Insights from these two Tables indicate the following:

— The location quotient (LQ) confirms the B-H index relating to the regional comparative advantage and selection of RIS3 industries. However, it also indicates that it is necessary to increase knowledge inputs to the industries such as primary production and strengthen the manufacturing industry. Location quotient identifies concentration strengths and internal discrepancies between, for example, primary production (A) or manufacturing (C) and knowledge inputs (M). The regional potential is understood as a projection of

⁷ The HHI is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. <u>https://www.justice.gov/atr/herfindahl-hirschman-index</u>.

⁸ **Location quotient** (LQ) is basically a way of quantifying how concentrated a particular industry, cluster, occupation, or demographic group is in a region as compared to the nation. It can reveal what makes a particular region "unique" in comparison to the national average. <u>https://www.economicmodeling.com/wp-content/uploads/2007/10/emsi_understandinglq.pdf</u>.

⁹ **Shift share** is an economic indicator that tells you which industries (or occupations) are competitive in your region. Shift share shows you the national growth (in terms of jobs) of a particular industry. Based on this national growth, it then calculates how much the industry is likely to grow in your region, and compares this estimation with how much the industry *actually grew*. https://www.economicmodeling.com/2020/02/27/understanding-shift-share-2/.

¹⁰ Please note that the Kainuu LQ and SSA calculations are attached in Annex to this document, in excel form.



strengths and improvement of performance weaknesses. Radical diversification is understood as part of such projections.

- The shift-share analysis (SSA) indicates that the competitive advantage of Kainuu is based on the ICT sector which has been largely enhanced by the award of the LUMI supercomputer from the EC. On the other hand, the primary production and manufacturing show positive growth projection (expected change) but negative competitive effect. This finding confirms the location quotient finding that Kainuu needs to strengthen science based inputs to its primary and manufacturing industries.
- These findings were taken into account in the revision of the Kainuu RIS3. Where relevant, associations to BERRY+ potential have been introduced (see the last column in the LQ table, and column 7 in the SSA) for further discussion at regional and partnership levels. These suggestions are discussed in the conclusions part of the Kainuu region contribution to the scoping document.

Employed labour force in area (workpla	aces) by Industry, Infor	mation, Area (workp	lace) and Year						
1	2	3	4	5	6	7	8	9	
				ABSOLUTE CONCENTRATION OF INDUSTRY IN KAINUU IN RELATION TO THE WHOLE COUNTRY	CONCENTRATION OF INDUSTRY IN KAINUU	CONCENTRATION OF INDUSTRY IN THE COUNTRY	LOCATION QUOTIENT (LQ) OF INDUSTRIES IN KAINUU IN RELATION TO THE WHOLE COUNTRY		Importance of regional LQ in respect to the national level
		WHOLE COUNTRY	MK18 Kainuu	MK18Kainuu/ WHOLE COUNTRY	MK18Kainuu industry / MK18 Kainuu	industry / whole country	concentration of industry in Kainuu/concentration of industry in country (8=6/7)	LQ index	COMMENTS IN RELATION TO REVISED KAINUU RIS3
		2018	2018						
Total	Employed labour force in area	1 494 445,00 €	15 388,00 €	1%					
A Agriculture, forestry and fishing	Employed labour force in area	48 163,00 €	1 236,00 €	3 %	8,0 %	3,2 %	2,49	2,49 >1,3	Absolute concentration; production base good for scaled up diversification> utilisation of rural funds as well; cross fertilise with research and automation.
B Mining and quarrying	Employed labour force in area	6 253,00 €	841,00€	13 %	5,5 %	0,4 %	13,06	13,06>1,3	Absolute concentration> production base good for scaled up diversification, niche that can be developed and associated products should be identified.
C Manufacturing	Employed labour force in area	296 682,00 €	2 078,00 €	1 %	13,5 %	19,9 %	0,68	0,68<1,3	Diversification and scaling up programme (productivity improvement and innovation) for the interaction between A&C, relevant to BERRY+ recommended; commercial value chains linkint to national and from national to EU global level markets.
J Information and communication	Employed labour force in area	87 420,00 €	421,00€	0 %	2,7 %	5,8 %	0,47	0,47< 1,3	There is needed radical diversification of activities for expansion of employment> PROGRAMME BASED ON LUMI NEEDED
M Professional, scientific and technical activities	Employed labour force in area	107 906,00 €	718,00€	1%	4,7 %	7,2 %	0,65	0,65<1,3	The regional innovation system needs to be strengthened and reinforces. This is taken up in BRFY+ with the cluster management unit consolitation, but interregional clustering and the national and interregional networks. There needs to be a programme, where in the beginning nearch services regionated in endbatch with research centres outside the region and they need to be made in the sense of integrated invosition systems while, in parallel, relevant coornic activities estabilished or equand to in fairnas.

Table 3 Location quotient for Kainuu

Table 4 Shift share analysis for Kainuu

			2018	2019	Growth = Difference between 2019-2018	Growth rate %	Shift share analysis https://www.aconomicmodeling.com/2020/00/27/undenstanding-shift-share-2/						
						Jobs growth rate in this case (4=3/1)	1. Industrial mix effect			2. National growth effect	3. Expected change	4. Competitive effect	
							Industry premium	Industry premium Industrial mix effect				To measure competitive effect, we subtract Expected Change from the actual regional job change in the	
							Industry growth nate- National economy growth nate	Industry growth nate- National Industry Premium x Number of Regional Industry Jobs = Industrial Mix Effect I Region here: KAINUL, employment year 2019		National Growth Rate x Number of Regional Industry Jobs= National Growth Effect	Industrial Mix Effect + National Growth Effect = Expected Change	Actual Change – Expected Change = Competitive Effect	
	Total	Establishments of enterprises (number)	394 872	400 346	5 474			Kainuu Industry employment in	Industrial mix effect per Kainuu RISJ Jadustes	Comments			
FI		Personnel in establishments of enterprises (staff-years)	1 494 445	1 524 397	29 952	2,0 %							
		Turnover of establishments of enterprises (EUR 1,000)	436 044 408,00 €	442 759 249,00 €	6 714 841,00 €								
	A Agriculture, forestry and fishing (01-03)	Establishments of enterprises (number)	75445	76998									
		Personnel in establishments of enterprises (staff-years)	48163	52943	4780	9,9 %	7,9 %	1249	98,9	Forest economy and scaled up agriculture are confirmed as RIS3 selections. There is also positive rational pull.	25	124,0	-111,0
-		Turnover of establishments of entertrines (EUR 1.000)	2 703 074.00 €	2 766 133.00 €									
	5 Mining and quarrying (05-09)	Establishments of enterorises (number)	1023	1019									
		Personnel in establishments of enterprises (staff-years)	6253	6542	289	4,6 %	2,6 %	940	24,6	A national level programme developing the extractive sector and related industries exp se, should be formulated. There is also positive national pull. BERRY+ might help in identifying partnerships.	93	117,9	-18,9
		Turnover of establishments of enterprises (EUR 1,000)	2 178 481,00 €	2 069 654,00 €									
	C Manufacturing (10-33)	Establishments of enterprises (number)	22453	22607									
		Personnel in establishments of enterprises (staff-years)	296682	299451	2769	0,9 %	-1,1 %	2110	-22,6	Here there is overall national negative trend. However there is change in EU and national policies towards re-industrialisation, therefore, the suggestion is to go by the LQ indications.	98	74,9	-42,9
		Turnover of establishments of enterprises (EUR 1,000)	137 071 157,00 €	141 248 791,00 €	4 177 634,00 €								
	3 Information and communication (58-63)	Establishments of enterprises (number)	11824	12388									
		Personnel in establishments of enterprises (staff-years)	87420	90772	3352	3,8 %	1,8 %	365	67	This brend confirms the prioritation of data analytics etc for Kainuu, but programme is needed. This is also backed by national trends.	28	30,3	17,7
		Information of establishments of entertainers (EUK 1.000)	21 377 953.00 €	22 303 901.00 €	764 006.00 C								
	technical activities (69-75)	Establishments of enterprises (number)	38512	39563									
	(11.17)	Personnel in establishments of enterprises (staff-years)	107906	111499	3593	3,3 %	1,3 %	700	9,3	The LQ behaves readenties of XBE in training, i.e., maintenaises of the regional increastion system. However, it is prostable that the thereads are aligned at national and negliceal levels, and issue would be more on (1) completing the regional innovation system and (2) strengthering the demand for its services (business-to-research). This indicates two kinded potential collaborations with other regions in a national and information thereagonal levels.	4	12,8	-15,8
		Turnover of establishments of enterprises (EUR 1,000)	16 106 405,00 €	17 038 899,00 €	932.493,00 €								
	R Arts, entertainment and recreation (90- 93)	Establishments of enterprises (number)	8191	8214									
		Personnel in establishments of enterprises (staff-years)	15620	13764	-1856	-11,9 %	-13,9 %	175	-90	This figure is very sed. With all the art and culture that Finland appreciates and can invest in, to have such a trend. It is also a hint that Kuhmo music needs to re-invent ball.	28	-6,2	-20,2
		Turnover of establishments of enterprises (EUR 1,000)	5 198 071,00 €	3 563 466,00 €	-1 634 605,00 €								

RIS3 concept and key priorities¹¹

The revised Kainuu RIS3, approved on 9.12.2020 for the period 2021-2027. Its aim is to harness innovation – based growth as a tool for competitive growth, for renewal also addressing long term challenges. It is also an enabler of national strengths and interregional complementarities.

Kainuu is at cross-roads: it is a sparsely populated NUTS3 region part of a similar (i.e sparsely populated) NUTS2 area facing critical mass challenges; it has an export-oriented specialisation base with low added value nevertheless; it faces challenges in the localised clustering structure; it is endowed with research capacities

¹¹ Kainuu RIS3 2021-2027https://kainuunliitto.fi/assets/uploads/2021/02/Kainuu-RIS3-Endorsed-in-December-2020.pdf



and innovation infrastructure resources one of which is of European importance. These findings indicate a relatively unique RIS3-context, challenging for achieving the overarching RIS3 priority which is innovation-based growth in a straightforward way.

An important part of the Theme 2 projects is based on the trainforce the existing R&D An important part of the Theme 2 projects is based on the trainforce the existing R&D Theme 1 is planned to trainforce the existing R&D DEVELOPMENT informance computing Cal JINDUSTRIES: Bioeconomy, mining, metals and ICT BETTER FUNCTIONING RESEARCH) An important part of the Theme 2 projects is based on the dialities themes 1 and 2 o priority sectors. BETTER FUNCTIONING A. Reasurement technology Caming and advarced analytics and high-promoting investment in the introduction of Industry and bioeconomy imming and bioeconomy introducts 2. Jinprove products 3. Social and health services (Innovations using digitalisation in RDI activities innovation platforms, interregional value challed to service development). 3. Emerging industries innovation platforms, interregional value challed to service development). 1. THEME 4: Digital transformation Theme 4 concerns the strengthening of digital change for the industries prioritized in Theme 2. To this end, Theme 4. 1. Deployment of Industry 4.0, including robotics and automation applications 2. Big data analytics and high-power computing (HPC) utilisation 1. Deployment of Industry 4.0, including robotics and automation applications offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1. Deployment of Industry 4.		THEME 1: Increasing research and promoting innovation	TEEMA 2: Strengt speci	TEEMA 3: Connectivity and integration, measures for interregional collaboration							
Development INNOVATION (APPLIED RESEARCH) A) INDUSTRIES: Bioeconomy, mining metals and ICT B) KNOWLEDGE-BASED SERVICE INDUSTRIES BETTER FUNCTIONING (APPLIED RESEARCH) 1. Measurement technology Services Carning and advanced simulation techniques (3D, R, AR) A. KnowLenge-BASED (Innovation susing digitalisation and bioeconomy in mining and using of products Bio Attainage interregional value and protects for all RISS priorities Cross-cutting themes and objectives for all RISS priorities THEME 4: Digital transformation Theme 4 concerns the strengthening of digital change for the industries prioritized in Theme 2. To this end, Theme 4 projects may make use of the interregional options offered in Theme 3 and / or the innovative solutions developed in Theme 5 covers both the application and development of Green Deal solutions, which will effectively lead to an environmentally friendly industrial change in Theme 2. To this end, Theme 5 projects may make use of the interregion options offered in Theme 3 and / or the innovative solutions devel	very process erve.	Theme 1 is planned to reinforce the existing R&D base	An important part of the utilization of applied rese	Theme 3 is designed as a tool to facilitate themes 1 and 2 of the priority sectors.							
Cross-cutting themes and objectives for all RIS3 priorities THEME 4: Digital transformation Theme 4 concerns the strengthening of digital change for the industries prioritized in Theme 2. To this end, Theme 4 projects may make use of the interregional options offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1 Deployment of Industry 4.0, including robotics and automation applications 2. Big data analytics and high-power computing (HPC) utilisation TEEMA 5. Green deal Theme 5 covers both the application and development of Green Deal solutions, which will effectively lead to an environmentally friendly industrial change in Theme 2. To this end, Theme 5 projects may make use of the interregion options offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1. Production and use of clean, affordable, and secure energy 2. Increasing the circular economy and environmentally sustainable production in industry 3. From field to table: a fair, healthy, and environmentally friendly food system	ent; (Instrument II) Entrepreneurial disco g; Instrument V) Technical assistance res	DEVELOPMENT OF INNOVATION (APPLIED RESEARCH) 1. Measurement technology 2. Gaming and advanced simulation techniques (3D, VR, AR) 3. Big data analytics and high- performance computing 4. Circular economy in mining and bioeconomy	2A) INDUSTRIES: Bioeconomy, mining, metals and ICT Promoting industrial modernization through investment 1. New product development 2. Improve production processes (eg introduction of Industry 4.0) 3. Improve the environmental and quality of products	 2B) KNOWLEDGE-BASED SERVICE INDUSTRIES 1. Professional (winter) sports and sports coaching and training technologies and applications 2. Activity tourism 3. Social and health services (Innovations using digitalisation will be used to increase the efficiency of service production (especially social services) and to increase the added value of services. Increase international cooperation in RDI activities related to service development). 	BETTER FUNCTIONING OF THE REGIONAL INNOVATION SYSTEM 1. Innovation infrastructures 2. Access to interregional demand-driven innovation processes 3. Emerging industries and innovation platforms, incl. interregional value chains, clusters, S3 partnerships 4. Platform economy 5. Attracting investment in RIS3 industries						
THEME 4: Digital transformation Theme 4 concerns the strengthening of digital change for the industries prioritized in Theme 2. To this end, Theme 4 projects may make use of the interregional options offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1 Deployment of Industry 4.0, including robotics and automation applications 2. Big data analytics and high-power computing (HPC) utilisation TEEMA 5. Green deal Theme 5 covers both the application and development of Green Deal solutions, which will effectively lead to an environmentally friendly industrial change in Theme 2. To this end, Theme 5 projects may make use of the interregion options offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1. Production and use of clean, affordable, and secure energy 2. Increasing the circular economy and environmentally sustainable production in industry 3. From field to table: a fair, healthy, and environmentally friendly food system	lveme ancin <u>ç</u>	Cross-ci	Cross-cutting themes and objectives for all RIS3 priorities								
TEEMA 5. Green deal Theme 5 covers both the application and development of Green Deal solutions, which will effectively lead to an environmentally friendly industrial change in Theme 2. To this end, Theme 5 projects may make use of the interregion options offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1. Production and use of clean, affordable, and secure energy 2. Increasing the circular economy and environmentally sustainable production in industry 3. From field to table: a fair, healthy, and environmentally friendly food system	rument I) Stakeholder inv strument IV) Funding & fi	THEME 4: Digital transfor Theme 4 concerns the streng projects may make use of the Theme 1. 1 Deployment of Industry 4.0 2. Big data analytics and high	THEME 4: Digital transformation Theme 4 concerns the strengthening of digital change for the industries prioritized in Theme 2. To this end, Theme 4 projects may make use of the interregional options offered in Theme 3 and / or the innovative solutions developed in Theme 1. 1 Deployment of Industry 4.0, including robotics and automation applications 2. Big data analytics and high-power computing (HPC) utilisation								
 Theme 5 covers both the application and development of Green Deal solutions, which will effectively lead to an environmentally friendly industrial change in Theme 2. To this end, Theme 5 projects may make use of the interregion options offered in Theme 3 and / or the innovative solutions developed in Theme 1. Production and use of clean, affordable, and secure energy Increasing the circular economy and environmentally sustainable production in industry From field to table: a fair, healthy, and environmentally friendly food system 	[Instr (Ins	TEEMA 5. Green deal	TEEMA 5. Green deal								
1. Production and use of clean, affordable, and secure energy 2. Increasing the circular economy and environmentally sustainable production in industry 3. From field to table: a fair, healthy, and environmentally friendly food system	iments: (onitoring;	Theme 5 covers both the app environmentally friendly indu options offered in Theme 3 a	Theme 5 covers both the application and development of Green Deal solutions, which will effectively lead to an environmentally friendly industrial change in Theme 2. To this end, Theme 5 projects may make use of the interregional options offered in Theme 3 and / or the innovative solutions developed in Theme 1.								
2. Increasing the circular economy and environmentally sustainable production in industry 3. From field to table: a fair, healthy, and environmentally friendly food system	nstru III) M	1. Production and use of clear	1. Production and use of clean, affordable, and secure energy								
3. From field to table: a fair, healthy, and environmentally friendly food system	nce i nent]	2. Increasing the circular ecor	2. Increasing the circular economy and environmentally sustainable production in industry								
	erna nstrur	3. From field to table: a fair, h	3. From field to table: a fair, healthy, and environmentally friendly food system								
4. Climate change mitigation and adaptation	З Ц Ц										
5. Preservation and restoration of ecosystems and biodiversity	22	E Duces and an attack	n of acosystams and biadi	versitv							
6. "Keep everyone involved" (just transition)	RIS	5. Preservation and restoration	IT OF ECOSYSTEMS and DIOUR								

Table 5 Kainuu RIS3 2021-2027

The Kainuu RIS3 2021-2027 (Table 5) proposes to confront the challenges as part of a comprehensive process by building on strengths. More specifically, the revised Kainuu RIS3, is: (i) to include into the RIS3, as a separate priority (Theme 1) the reinforcement of the research & innovation infrastructure base domains linked to existing strengths; (ii) to maintain the RIS3 2014-2020 priorities (Theme 2); (iii) to strongly support interactions between the research and RIS3 industries base (Theme 2); (iv) to provide options for follow up projects foreseen to increase the TRL of research projects under Theme 1 and associated actions for research results commercialisation; (v) to include a separate cross-cutting theme on Digital Transformation (Theme 4)



addressing also interdisciplinary issues (technology capabilities x management skills) as well as data analytics issues thus linking also to the potential of the LUMI innovation infrastructure; (vi) to invest in a separate theme (Theme 3) dedicated to different forms of transregional collaboration and also include into it a sub heading dedicated to innovation infrastructures as a potential tool of supporting the realisation of the LUMI potential; (vii) through Theme 3 and S3 – based collaborations, to support European Value Chain participation (EVC) and through that, scaled-up entrepreneurship and support export of innovations to access markets.

RIS3 Themes and objectives

Theme 1 Mobilising research and fostering innovations

Objective: (1) to co-fund applied research projects based on technological strengths of Kainuu, and result in inventions that have commercialisation potential (innovations); (2) to encourage the production of technological innovations that could benefit industries scaling up and further specialisation under Theme 2; (3) to link the Kainuu research base to the interregional opportunities supported under Theme 3.

Domains: (1) Measurement technology; (2) Games & simulators; (3) Data analytics & data driven innovations; (4) Circular economy based on the potential of the Kainuu natural resources.

Theme 2 Reinforcing and diversifying the specialisation base

Theme 2 is organised into (2.A) Manufacturing and (2.B) Knowledge-based service industries.

(2.A) Manufacturing

Objectives: To support the scaling up & diversification of prioritised manufacturing industries and industrial modernisation and mobilise investments in 1) new product development; (2) improvement of production processes, improvement of productivity; (3) improvement of the environmental & quality performance of products; (4) benefit from interregional collaboration opportunities available under Theme 3.

Domains: (1) Forest bio-economy; (2) Extractive industries (implementing the Kainuu Mining Strategy and the ecoRIS3 Interreg Europe project¹² action plan; linkages to S3 platforms and the Battery Alliance); (3) Metal industries; (4) Food processing.

(2.B) Knowledge-based service industries

Objectives: (1) To expand and diversify winter sports, activity tourism and well-being infrastructure & services, for attracting customers and investments; to contribute to the health-care social services digital transformation and scaling up. (2) To utilise research results developed under Theme 1 to reinforce to achieve objectives in 2.B. (3) To benefit from interregional collaboration opportunities available under Theme 3.

Domains: (1) Winter sports, solutions for coaching and training; includes professional winter sports; (2) Activity tourism; (3) Social and health care services (SOTE).

¹² https://www.interregeurope.eu/ecoris3/



Theme 3: Connectivity & Integration, Measures for interregional collaboration

Objectives: (1) To improve the function and completeness of the regional innovation system by benefiting from complementarities and win-win collaborations at national and European levels; (2) To explore opportunities identified through interregional collaboration schemes under Theme 3 to further reinforce the results of Themes 1 and 2; (3) To explore interregional opportunities as a tool to override critical mass challenges of the Kainuu economy; (4)To explore interregional connectivity as tool for learning, constant renewal, scaling up and completeness of the regional innovation system.

Domains: (1) Innovation infrastructures (e.g. improvements of the regional innovation system; linkages to European innovation hubs¹³); (2) Transregional access to innovation on demand (mainstreaming BRIDGES project¹⁴) and ensuring absorptiveness for the I3/Component5; (3) Emerging industries and innovation platforms, including interregional value chains & clusters; S3 partnerships (strengthening the benefits for S3 partnerships and the investment oriented approach; supporting the implementation of the BERRY+ S3); (4) The platform economy (supporting digitalised value chains and joint programming and implementation); (5) Attracting and facilitating investments in RIS3 industries.

Theme 4: Digital transformation

Objectives: (1) To effectively enable & support the digital transformation of the Kainuu economy; (2) To apply digital transformation innovations developed under Theme 1 to Theme 2 industries; (3) To support diffusing state of the art digital transformation technologies, models & value chain collaboration opportunities made accessible form the provisions of Theme 3 to benefit industries and research domains of Themes 2 and 1 respectively.

Prioritised actions: (1) Uptake of industry 4.0 including applications of robotics, automation (includes the implementation of the Interreg Europe project INNO PROVEMENT¹⁵ action plan); (2) Utilisation of data analytics.

Theme 5: Green deal and green transformation

Objectives: (1) To effectively support the implementation of the Green Deal policy; (2) to strengthen the green transformation of the Kainuu economy; (3) to promote green deal innovations as a tool for improving the competitiveness of Kainuu economy; (4) To apply green transformation innovations developed under Theme 1 to Theme 2 industries; (5) To support diffusing state of the art green transformation technologies and models made accessible form the provisions of Theme 3 to benefit industries and research domains of

¹³ This is aligned with the EC provision that digital innovation hubs will ensure ERDF funding only by being aligned with the RIS3 of the respective regions, see Gabriel Rissola (2020). Digital Innovation Hubs (DIHs): A place-based EU policy initiative to boost Digital Transformation of SMEs and public sector, 28.10.2020. <u>https://www.digitalsme.eu/digital/uploads/DIH-Presentation-by-Gabriel-Rissola.pdf</u>.

¹⁴ https://www.interregeurope.eu/bridges/

¹⁵ <u>https://www.interregeurope.eu/innoprovement/</u>



Themes 2 and 1 respectively; (4) To support the development and application of green deal innovations under Themes 1 and 5.

Prioritised actions: (1) Supplying clean, affordable and secure energy; (2) Mobilising industry for a clean and circular economy; (3) From 'farm to fork', a fair, healthy and environmentally friendly food system; (4) Mitigation of climate change & climate adaptation; (5) Preserving and restoring ecosystems and biodiversity; (6) Leave none behind (a just transition).

Governance of the Kainuu RIS3: the five Instruments

The competent regional institution for the management of the Kainuu RIS3 is the Regional Council of Kainuu (RCK). The Centre for Environment, Transport and Employment (ELY Keskus) is part of the Kainuu RIS3 management. The RIS3 management comprises planning of activities, funds management, implementation coordination, monitoring and evaluation.

To ensure better delivery of the RIS3 on-the-ground and of the management of the strategy, the Regional Council of Kainuu has included five Instruments in to the RIS3. **"Instruments"** are tools, directly managed and implemented by the Regional Council of Kainuu, planned with the purpose to facilitate and strengthen the RIS3 implementation. The five (5) Instruments planned are: (Instrument I) Stakeholder involvement; (Instrument II) Entrepreneurial discovery process; (Instrument III) Monitoring; (Instrument IV) Funding & financing facilitation; (Instrument V) Technical assistance reserve, Figure 2.



Figure 2 The Kainuu RIS3 Governance structure

Collaboration possibilities based on the Kainuu RIS3 2021-2027

Theme 3: Connectivity & Integration, Measures for interregional collaboration, is an enabler of interregional collaboration based on complementarities, with one domain explicitly dedicated to S3 partnerships.

In the next part 3.1.4 types of complementarity potential are discussed. We expect that the RIS3 enabling context will be activated through the BERRY+ exchanges and identified collaboration opportunities.

Follow up research projects reaching TRL levels 5-6-7-8-9 will be prioritised as well as projects promoting collaboration between innovative businesses co-located or not. These can be opportunities for implementing complementarities in the BERRY+.



BERRY+ relevant strengths of the economic and research base in the region

Kainuu has a significant comparative advantage in terms of its research, education and data analytics base and infrastructures.

Economic base

The economic base strengths are, at the present, mostly in the extractive industries sector. Kainuu aims at developing the forest industry side streams value chain collaborations and spinoffs, strengthen the berry, science-based economy by involving bigger businesses and developing spinoffs and their collaboration to larger companies, commercialise through internationalisation research results and solutions, especially in online censors and measurement technology, linking BERRY+ activities to data storage and data management, networking with large research infrastructures especially materials measurement units.

Complementarity potential

Statistical analysis by business and NACE codes, revealed that the wood processing cluster in Kainuu is a strong player in the regional economy, with internationalisation potential and, as well, structural challenges. The wood processing cluster core activity is represented by a group of interconnected business leading to the construction of wooden homes. The turnover of the whole cluster, generated in Kainuu is about 253 000 000€ annually, while the core group has an approximate turnover of about 122 000 000€ annually. The cluster, besides the production line of wooden homes and their components, includes logistics (transport companies), metal companies providing necessary products for the wooden construction, architectural offices, logging (with a turnover of about 61 000 000€ annually), clean energy producers (1 large national business with branch also in Kainuu, interested in side stream valorisation, with an annual turnover of about 1,5 billion € and value chain growth driver), retail activities, and electricity co-generation based on the waste. The cluster is flexible and open to collaborations with architecture and design schools, as well as forest industry ingredients and side streams applications to wood processing and especially components of wooden homes and wooden homes per se. In conclusion, one of the important interregional complementarity potentials of Kainuu is the wood processing cluster.

Moreover, in Kainuu, there is an important ICT and Electronics agglomeration, with an approximate turnover of 50 000 000€. The businesses active in this agglomeration provide, inter alia, automation products and services, digital architecture design, data management. It implies that it is possible to plan for interregional value chains based on automation and in collaboration with the BERRY+ regions that might be interested.

In relation to other renewable natural resources, such as berries etc., the clustering is rather weak with two medium sized businesses organised in vertical mode of production and oriented to exports already. They buy raw materials from abroad and locally. Nevertheless, renewal of the natural resource industry is a priority in Kainuu. For this reason, in 2018, Kainuu implemented a technology-based value chain analysis of the sector¹⁶. This value chain analysis was used, in preliminary testing, to identify Kainuu strengths and interests. Strengths were identified in automation (cleaning, separation and drying of berries), in online censors, and in processing and measuring various types of foods and concentrates, and in related research results. Kainuu is interested to cooperate in these domains, transfer technology and research results, and jointly develop or localise

¹⁶ The value chain analysis was made during the BRIDGES project, and it is part of one feasibility study. It was realised by the Natural Resource Centre (LUKE) of Finland.



products. Moreover, Kainuu is interested in promoting science-based entrepreneurship models and programmes and interested and interested to explore such approaches with partners that have similar interests and a compatible or complementary base.

Finally, small businesses in traditional industries, face problems of innovation and technology absorption and in collaboration between and among them. Related good practices and joint development solutions and models are needed.

Knowledge and research base

CSC

In Finland, high performance computing services are produced by CSC, a Finnish center of expertise in ICT. CSC provides ICT expert services for research, education, culture, public administration and enterprises. CSC is a non-profit organization with a special mission, owned by the state of Finland (70%) and the Finnish higher education institutes (30%). CSC offices are located in Espoo Keilaniemi and Kajaani Renforsin Ranta business park, which also has the universities' centralized data center environment. CSC is part of the Center for Measurement and Information Systems (CEMIS), a contract-based research and education center specializing in measurement and information systems.

Using CSC's high performance computing capacity requires strong competence in the use of the environments, mainly by researchers and research institutes. Therefore, not all potential user groups are able to actively utilize CSC's computing services due to the lack of technical knowledge and required skills. They may also experience a high threshold for learning the services, especially in the case of incidental computing experiments. Due to these factors, there is a need for complementary solutions for CSC's operations that provide high performance computing services to a larger user group. This group includes e.g. students, scholars interested in this field, and other groups that aim at practicing with high performance computing or conducting small-scale experiments and tests – getting a quick and easy start. As their expertise and skills develop, transferring to CSC's services is easier.

One of the most powerful supercomputers in the world, LUMI, will start its operations in CSC's data center in Kajaani, Finland, in 2021. The peak performance of LUMI is an astonishing 552 petaflop/s. To date, the world's fastest computer, Fugaku in Japan, reaches peak performance of 513 petaflop/s. (https://www.lumi-supercomputer.eu/lumi-one-of-the-worlds-mightiest-supercomputers/). LUMI is a European endeavor, with ten European countries and the EuroHPC Joint Undertaking (EuroHPC JU) investing in one joint system. It is set to boost research, employment, and competitiveness throughout Europe. In addition to the remarkable computing power, LUMI is also one of the world's most advanced platforms for artificial intelligence and it will be one of the world's best known scientific instruments throughout its lifetime. LUMI contributes to the realisation of the European High-Performance Computing strategy. The pre-exascale supercomputer hosted by the LUMI consortium will be among the top 5 in the world. Together with the other Euro HPC pre-exascale and petascale supercomputers that will be deployed in 2021, the LUMI supercomputer will help Europe's public and private users address many daunting research and innovation problems across different areas from weather and climate change through cybersecurity to drug discovery and personalised medicine. LUMI supercomputer aligns the Digital and Green Deal policies of the European Commission, using 100% renewable carbon neutral energy. The heat generated will provide 20% of the district heat of the area, being one of the most efficient



supercomputers in the world. LUMI is an investment of over 200 million euros, covering the whole lifecycle of the system.

Exploiting the potential of the data economy is crucial for Europe's competitiveness. The uptake of HPC will remarkably increase the competitiveness of small and medium-sized enterprises (SMEs) in Europe remarkably. Up to one-fifth (20%) of LUMI's resources will be available for industry and SMEs. LUMI supercomputer will further strengthen Kajaani's and Kainuu's position as a leading data center location in Finland and the EU.

The operators of the region, including Kainuu Regional Council, City of Kajaani, Kajaani University of Applied Science (KAMK), other RDI organizations under CEMIS research and education centre.

Kajaani University of Applied Sciences (KAMK)

KAMK has incorporated smart solutions into its strategic profiling, extending through all the operations and competence areas at KAMK: Business (sport, tourism and business), Technology, Nursing and Health Care. The strategy has been put into practice by reinforcing data-based competence and environments in education, allocating resources for RDI projects and strengthening networks. KAMK's four RDI themes are: 1) Serious gaming, Virtual reality (VR)/Augmented reality (AR) and exergaming, 2) Artificial intelligence and Software tools for robotics, 3) Circular economy and measurement technology, and 4) Digitalization in health care and palliative care. The goal is that these themes will bring international contacts and projects, stimulate new innovations and create new businesses.

KAMK invested in following the smart environments in the recent years: 1) versatile game development laboratory equipped with the latest VR and AR devices, 3D modelling tools and supercomputing capacity, 2) esports classroom equipped with the latest technology, 3) high performance computing (HPC) environment and robotic laboratory, and 4) smart home care environment. The activities around these environments have strengthened by KAMK's RDI profiling and its effectiveness both locally and internationally.

University of Oulu

The University of Oulu produces new knowledge for building a more sustainable, healthier, and more intelligent world. They participate in solving global challenges by combining multidisciplinary approaches, high-quality research, and fruitful collaboration. Their research is top-level in the world on their selected focus areas: sustainable materials and system, lifelong health, digitalization and smart society, changing climate and northern environment, and understanding humans in change. Their compact combination of a science and technology university provides an excellent basis for influential research. The eight faculties and the research units in the University of Oulu form a strong science community, which makes it possible to do ground-breaking, multidisciplinary research. They increase the effectiveness their research by systematically developing international and national networks with our selected partner universities and research institutes.

VTT

VTT's strategy is to help businesses and society to find solutions to global challenges using science and technology. Their help their customers to build new sustainable business that leads to a brighter future. The



use of experimental research and technological infrastructure, demonstrations and piloting are central elements of research and innovation activities. VTT's unique research infrastructure and development environments are an important part of the Finnish national innovation infrastructure. VTT's research environments enable product development from basic research to piloting and even small-scale production. The majority of their research environments – including Bioruukki, industrial biotechnology, the development environment for fibre-based products, the 5G test network, Micronova, Mikes, PrintoCent, Smart manufacturing and robotics (SMACC), materials technology, transport and energy systems, and the Centre for Nuclear Safety – are also engaged in networking at the EU level.

In the bio-based economy domain, the knowledge base includes, in addition to the above, also¹⁷

- The Natural resource Centre of Finland (LUKE) focusing in Kainuu on aquaculture and
- ProAgria Kainuu ry (https://www.proagria.fi), Kainuu branch. ProAgria is a Finnish national agricultural advisory and development organisation. It offers services to agricultural and rural entrepreneurs all over Finland and works closely with various actors in the entire food chain¹⁸.

Complementarity potential

- Commercialisation of research results
- Uitlisation and further development of measurement technology and online censors
- VTT fibre-based research including forest industry
- Joint data management projects

The cluster management unit

In Kainuu, the rôle of the cluster management unit will be assumed by MITY research centre, part of the University of Oulu. MITY is a research and technology transfer centre, sopecialising in online censors, measurement technology and collaborations building on natural resources innovations. To implement this rôle, MITY will use national funding to plan and implement the new function. The new unit will enhance the regional innovation system and strengthen it, by adding one qualified innovation intermediary.

Complementarity and collaboration potential

- Enhancing functionalities of the cluster management unit to include interregional collaboration with the other cluster management units towards identification and exploration of complementarities and joint development actions
- Joint development of value chain analysis tools for easier identification of complementarities
- Participate in the definition and operation of a thematic, interregional innovation hub.

Interregional, cross border and national collaboration experiences; synergy potential

The Regional Council of Kainuu and all of the research base of Kainuu have strong experience in interregional and transnational collaboration. The issue of complementarities is addressed also through

¹⁷ Kainuun liitto - Ilmasto- ja ympäristövastuullinen Kainuu 2040-hanke (A757776); Ramboll Oy, Heikki Savikko, Essi Kortelainen, Venla Viskari, ja Jounas Hokkanen (2021). Kainuun biologiset kierrot.

¹⁸ https://fi.wikipedia.org/wiki/ProAgria .



- cross-border investment projects (CBC Programme).
- the industrial transition project ELMO dealing with the definition of a cross border RIS3, by bringing together all East and North Finland regions. ELMO project could be a synergy option for BERRY+ complementarities with the identification of potential partners in the North & East Finland.
- the participation of the Regional Council of Kainuu in several S3 partnerships:
 - ClusSport on sports and well-being: ClusSport can be a synergy partner to BERRY+, in relation to functional foods value chains suitable for sports and well-being activities.
 - Water on the blue economy: the Water S3 partnership can be a synergy partner to BERRY+, in terms
 of water cleaning and measurement technologies related to industrial production processes.
 - Mining
 - Batteries
- Create synergies between funding and financing instruments: There are various different funding mechanisms in Finland for excellence, innovation and business competitiveness and internationalisation. National-level funding is mostly dedicated to research, innovation, and business development¹⁹. There are also funding options for sustainability, innovation and business internationalisation allocated by various ministries such as the Ministry of Education (research), the Ministry of Environment, and the Ministry of Employment and the Economy. Such funding usually does not address interregional options. Intra-regional (i.e. between Finnish regions) options have been addressed, during the preceding period 2014-2020, by the INKA programme, linking the most important urban centres. Synergies, or continuities between various funding and financing instruments are not yet explored, either. We hope to be able to look into these issues during the next period.
- Collaboration between the regional and national level: Kainuu considers benefitting from the national innovation system an important potential. This kind of collaboration has not been a priority for a number of years. However, the new regional development law (Valiokunnan mietintö HaVM 9/2021 vp, HE 47/2021 vp), recently approved, dealing with the Structural Funds implementations and the Fair Transition Fund (JTF), brings together "national legislation on regional and structural policy to be brought together as proposed, including specific national provisions for the new Fair Transition Fund (JTF) and the Interreg and Interreg external border programs. This will clarify the whole of regional development and enhance the coordination of national and EU regional and structural policies" (page 1). Nevertheless, Kainuu, during the recent period, puts emphasis on collaborations, and is strategically and operationally collaborating with other Finnish regions in North & East Finland, as well as in south and western Finland, and is also stressing interregional solutions. The plan is, through the activation of Component 3 in BERRY+, to activate further collaboration with other Finnish partners.

¹⁹ Important national level funding organisations include Business Finland (<u>https://www.businessfinland.fi/en/for-finnish-customers/home</u>) providing co-funding for provides funding for research, innovation and business internationalisation and also loans to businesses to help them overcome the covid19 crisis; the Academy of Finland (<u>https://www.aka.fi/en/</u>) which funds excellence projects, and SITRA (the Finnish Innovation Fund <u>https://www.sitra.fi/en/</u>) seeking "human-oriented operating models and promote sustainable business" (https://www.sitra.fi/en/topics/project-funding/).