Survey on Food Research and Development Institutions in the Baltic Sea Region

Report

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1. Background and aim of the survey

The food industry in the Baltic Sea region has developed into one of the strongest business sectors and it is famous throughout Europe and the world. This competitive position has to be secured in the dynamic, fast changing but relatively mature regional market. Concurrently, emerging trends require constant search for lower costs, innovations and flexible processes. This calls for both process and product innovations to be jointly nurtured and diffused by the scientific and business communities, with public institutions shaping the economic development framework.

The Baltic Sea region is the home of many cutting-edge innovations. The dense network of higher education institutions and other research institutes carries out work of the highest standards and enables innovations. Research institutions conducting food research lay ground for process and product innovations within the food industry. Although many success stories on joint efforts between science, business and public institutions exist at the regional level, it is commonly acknowledged that the potential the research institutions possess, is not fully taken advantage of especially by the SME sector. The most common obstacle in utilizing research expertise is clearly the lack of knowledge on cooperation possibilities and contact persons. New ways need to be found to match entrepreneurs and researchers, challenges and expertise. To promote the development of the dynamic and flourishing food industry in the Baltic Sea region, more effective cross-border collaboration between the actors must be established.

This survey is part of the EU-financed project **baltfood – The BSR Food Cluster: Innovation and Competitiveness in Action.** The project aims at establishing the Baltic Sea region food cluster, gathering regional food cluster organisations, food processing enterprises, and above all, food research and development institutions under the same umbrella. Strengthened collaboration and joint efforts enhance the competitiveness of the Baltic Sea region food industry. Two parallel surveys are needed to elaborate the pre-conditions for the food cluster and to identify the possible gaps: survey on existing food processing enterprises and survey on research institutions contributing to development of food industry in the region. The survey in hand concentrates on identifying expertise and facilities of the food research institutions available for the use of the food processing enterprises.

2. Realization of the survey

The online questionnaire (attached) for the survey was composed in March and April 2009 by the team of the project's work package 5. The questionnaire was modified in two online meetings and in a workshop that took place in Lund. Comments were given also via e-mail. University of Turku bore the responsibility for the survey activities.

The link to the online questionnaire was sent to potential institutions and network organisations in early May 2009. The reminder to the target group and potential organisations was sent in August-September. Project partners were asked to transmit the questionnaire to potential institutions in their countries and personal contacts of the project team were used actively. Over 250 universities were reached through the two university networks called Baltic Sea Region University Network and Baltic University Programme. In addition, the contacts of the Enterprise Europe Network were used.

By the end of October 2009 the questionnaire was opened 417 times and the programme showed 70 respondents. From those 70 respondents 66 organisations had left at least partial response (attached). Respondents came from Finland, Lithuania, Poland, Denmark, Germany and Estonia. Received information was completed with information on 26 German research institutions gathered beforehand by the Lübeck Business Development Corporation. This information did not cover all points of the questionnaire but could still be used partly.

Obviously there are more research institutions in the Baltic Sea region collaborating with the food industry than those which responded to the questionnaire. However, it is probable that the electronic questionnaire will not reach new respondents. If additional information is wanted, it has to be gathered with personal interviews.

3. Results of the survey

3.1 Concluding remarks

The results presented here give a general picture of received information. If you need organisation specific information, please contact Ari Koski (ari.koski@utu.fi). The following two chapters show figures and examples related to the collaboration between research institutions and food industry, and institutions' facilities that can be utilized by the businesses. The statements of the first chapter include German information only partially whereas the second chapter includes it fully.

To summarize the findings, at the general level it can be concluded that research institutions collaborate with varied branches of food industry, while the strongest relationship exists with the dairy sector. Collaboration with both the fruit and vegetables and cereal processing branches was also intensive. There exists also a large scale of technologies that research institutions have and that they offer for businesses. Majority of the research institutions operate internationally. Thus, a strong relationship between research institutions and enterprises can be seen in many operational fields of food industry both regionally and internationally. Still, active gatekeeping and marketing efforts are often needed to match researchers and entrepreneurs, and this should be one of the main tasks of the planned BSR food cluster. Furthermore, one of the next steps should be an analysis on central and continual challenges of food enterprises to which they usually cannot find solutions. After this analysis the possible gaps between challenges of enterprises and expertise of research institutions can be identified. In addition, the analysis can reveal well-known and actively utilized technologies of research institutions, as well as less familiar technologies. It can also be stated that in many cases the offered technologies overlap with each other, which provides prospects for promising collaboration between research institutions. Although, of course, many institutions probably collaborate with each other already.
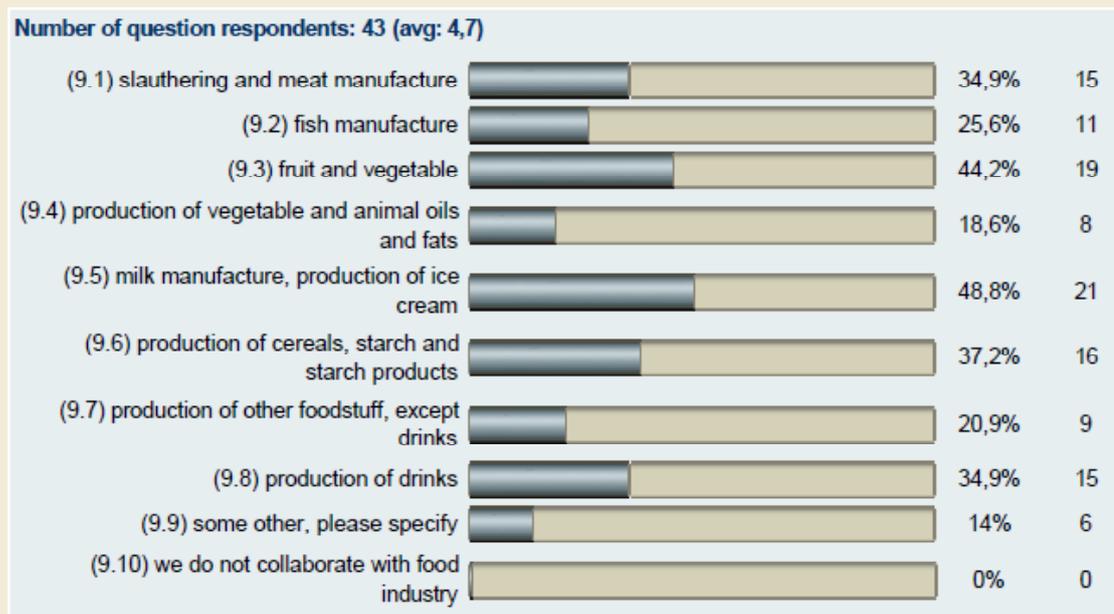
In conclusion, there is a huge pool of expertise and technologies that research institutions in the Baltic Sea region offer for food companies. However, a single point of contact, and collaboration structure between the research institutions, should exist for the companies seeking information and advise.

3.2 Branches of collaboration and collaboration in education and R&D

Research institutions were asked about their spheres of operation. According to the results, a vast majority of the institutions operate at international level. Some inform that they operate at national level and only one focuses on local level.

Figure 1 shows the branches of food industry that the research institutions collaborate with. German information is included partially. The percentage value shows how many respondents out of all respondents were collaborating with the branch in question. As shown in the figure 1., many institutions collaborate with several branches. It should be noted, when drawing conclusions on percentages, that the line between different branches is very vague in some cases.

Figure 1. *Branches of food industry the research institutions collaborate with. (Branches defined according to NACE code.)*

Number of question respondents: 43 (avg: 4,7)

Branch		%	n
(9.1) slauthering and meat manufacture		34,9%	15
(9.2) fish manufacture		25,6%	11
(9.3) fruit and vegetable		44,2%	19
(9.4) production of vegetable and animal oils and fats		18,6%	8
(9.5) milk manufacture, production of ice cream		48,8%	21
(9.6) production of cereals, starch and starch products		37,2%	16
(9.7) production of other foodstuff, except drinks		20,9%	9
(9.8) production of drinks		34,9%	15
(9.9) some other, please specify		14%	6
(9.10) we do not collaborate with food industry		0%	0

When the research institutions were asked about collaboration with food companies in regard to education, a large number of different courses was mentioned. Topics that were mentioned several times included hygiene, sensory analysis, marketing and law requirements. Two examples can be presented:

> *We have arranged several training days in marketing, hygiene, HACCP-systems and quality. One example is a bakery, which needed to update its in-house control systems. We trained all employees in hygiene and HACCP-control. After that we expanded the in-house control system to ISO 9001 based quality management including the training of management and other issues needed. The work is going on and next step will be auditing and standardization of the quality management system. (Sisä-Savon seutuyhtymä, Finland))*

> *We have organized for example the following courses for food industry: 1. Documentation requirements for nutrition- and health claims. 2. Novel foods – How to classify a food as non-novel, and how to get an approval for marketing of a novel food. 3. Allergy and allergens. 4. Toxicological risk assessment. 5. Food contact materials – How to ensure they are suitable for food contact and in compliance with EU and US law. (DHI, Denmark)*

> *We have organized e.g. microbiology and food safety training for Estonian Food Union companies in 2008 and sensory analysis methods for SMEs in 2009-2010 (TFTAK, Estonia)*

Research institutions contribute to education also by arranging many kinds of seminars and conferences both for the national and international audiences.

Within the R&D collaboration, the food research institutions look for research partners for companies and support companies in different project application and implementation Brion procedures beside the actual research and development activities. The R&D activities usually relate to testing or developing a new production or processing method and to analyzing composition or optimizing the proportion of components of new products. For example next issues were mentioned:

- *In our testing laboratory we conducted series of tests to optimize freezing process for fruits and berries.*
- *In our testing laboratory we conducted a series of tests to optimize drying process for herbs.*
- *A company manufactures food ingredients based on fermentation with an organism, which under certain circumstances could produce a rare mycotoxin. Company wanted to get a toxicologically derived limit value for the documentation and control of mycotoxins in the final products. Based on literature research and toxicological risk assessment principles, a limit value was provided.*
- *Implementation of technology of lowered lactose milk production.*
- *Testing new type of fruit juice with probiotic bacteria.*
- *We tested suitable parameters for production of new drink for local enterprise. We made chemical (nutritional) analyses of fresh raw materials (such as berries) and processed food for product development of the companies.*
- *Company needed advice and guidance on how to implement law regulations in their daily food production. We visited their production facilities and helped them to do some improvements, including updating of company´s in-house control.*
- *Company wanted to optimize its production process to get it more efficient. We visited their production facilities and helped them by drawing new sketches on production process.*
- *Some of our projects are related with product development in certain food industries (dairy and meat industries). We have done research with production hygiene areas e.g. Listeria monocytogenes in RTE foods and Campylobacter spp. in broiler chicken meat prevalence in Estonia and problem solving possibilities etc.*

3.3 R&D expertise and facilities

The following figures and examples show expertise, facilities and technologies of the food research institutions that can be utilized by the food processing enterprises. Information includes data on German institutions.

Figure 2: *R&D expertise or facilities in **product specific technologies.***

Number of question respondents: 44 (avg: 4,2)		
(13.1) Brewing facilities	18,2%	8
(13.2) Cereals and bakery facilities	27,3%	12
(13.3) Meat processing facilities	22,7%	10
(13.4) Dairy processing facilities	36,4%	16
(13.5) Fruit, vegetables, potatoes processing facilities	29,5%	13
(13.6) Fish processing facilities	13,6%	6
(13.7) Sugar processing facilities	9,1%	4
(13.8) Something else	20,5%	9

Examples of mentioned technologies:
- *Laboratories for malt, beer and drink microbiology and small brewing installation.*
- *Technology for vine establishment (12 temperature controlled red wine mash tanks, 6 test tanks for micro oxidation, making of sparkling wine in tank or bottle fermentation procedure, use of complete state-owned vineyard of 22 ha area and 100% selling).*
- *Gluten free bakery e.g. for new type of bread: spelta, buckwheat, sensory evaluation, composition analysis, sour fermentation.*

- *Mill technology (PSF for cereal washing and milling).*
- *Hygienic testing, EHEDG certified.*
- *Fermented sausage, scales sausage, boiled sausage, technology of raw and cooked meat products.*
- *Technique and technology of boiled ham production, cuttering technique and technology, thermal treatment of meat and other products, recipe optimization for sausages, technology of meat products, ready meals and fancy food, chilling of heat treated meat products.*
- *Development of a biosensor model for assurance of product quality in dairy processing plants, identification of residues in milk.*
- *Cellar installation (up to 1.000 kg/h), processing of fruit to fruit juice and fruit wines in the plant belonging to the institute, wine and fruit juice analysis, sensory and analytical evaluation.*
- *Enzymatic induction of firmer texture in fruits and vegetables, quality improvement of fruit juices and natural cloudy fruit drinks; recovery, characterization and application of functional compounds from by-products of fruit and vegetable processing.*
- *Composition analysis, HPLC, LC-MS, GC-MS, polyphenols, antioxidative activities, sensory evaluation, masking bitternes with hydrocolloids.*
- *Half-technical facilities for sugar processing, development and modification of recipes, development of innovative products in the "sweetness" sector and functional food by biotechnical and chemical methods, process automation for securing a constant product quality, consultation on silo facilities.*
- *Microstructure analysis, Digital Image Analysis, Digital Scanning Calorymetry, biological analysis of food, experimental animals facility.*

Figure 3: *R&D expertise or facilities in **preservation technologies**.*
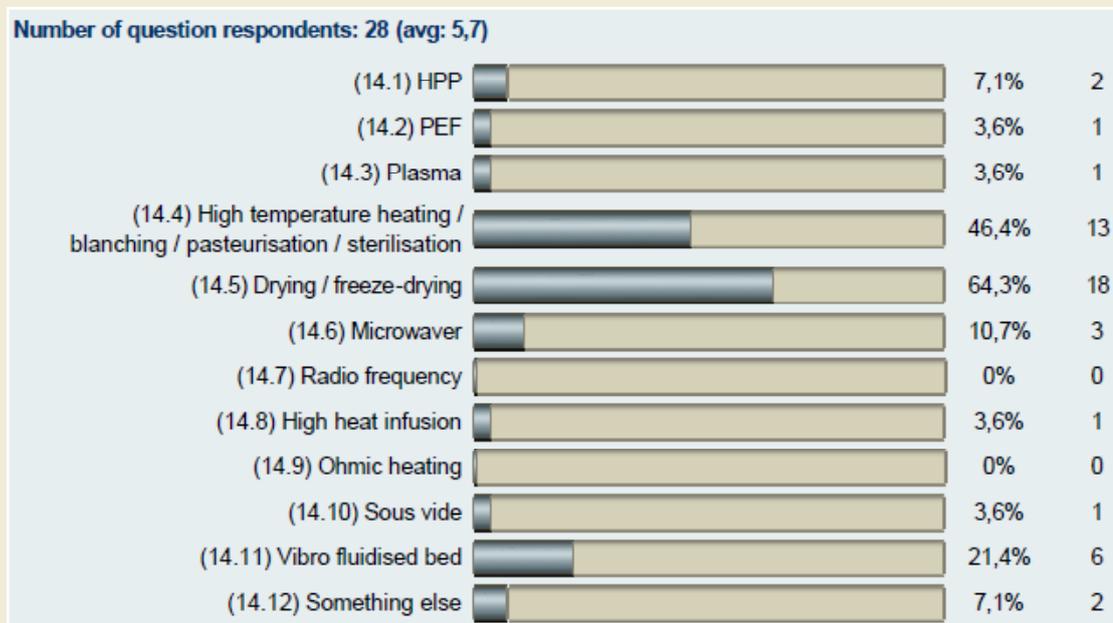
Examples of mentioned technologies:
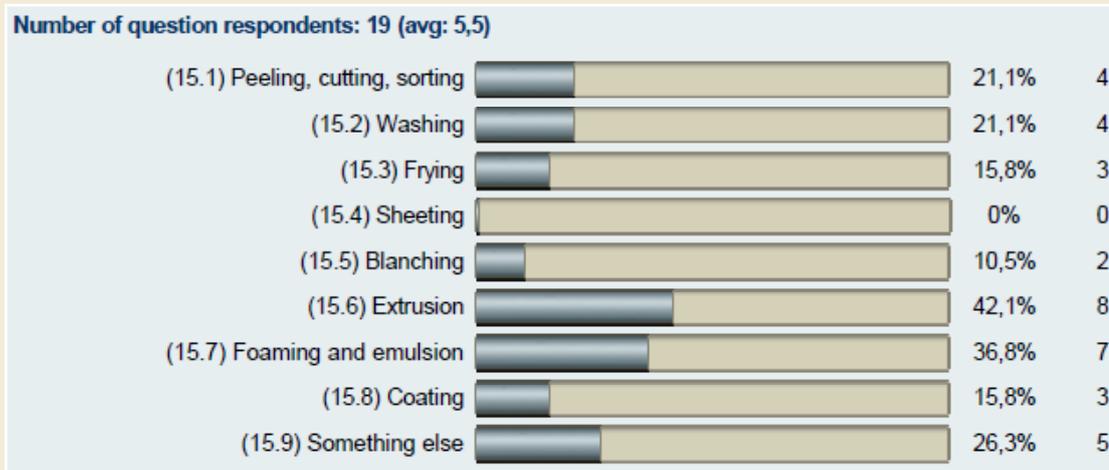- *Preservation of fermented products, improving characteristics of micro-organisms, regulating activity of enzymatic formulations.*
- *Pilot plant scale UHT- and pasteurisation equipment.*
- *High Pressure Pasteurisation Facility (10.000 bar).*
- *Pressure reactor for sterilization processes, flavour cooking in industrial scale with 500 l volume (< 1,6 bar).*
- *THA-100, KTM-Troxler GmbH.*

– *Freeze–drying facility, drying technique.*
– *Spray drying / crystallisation in industrial scale with vaporisation of up to 35 l / h,*
   fluidised bed facility for safe drying with high product performance in industrial scale.
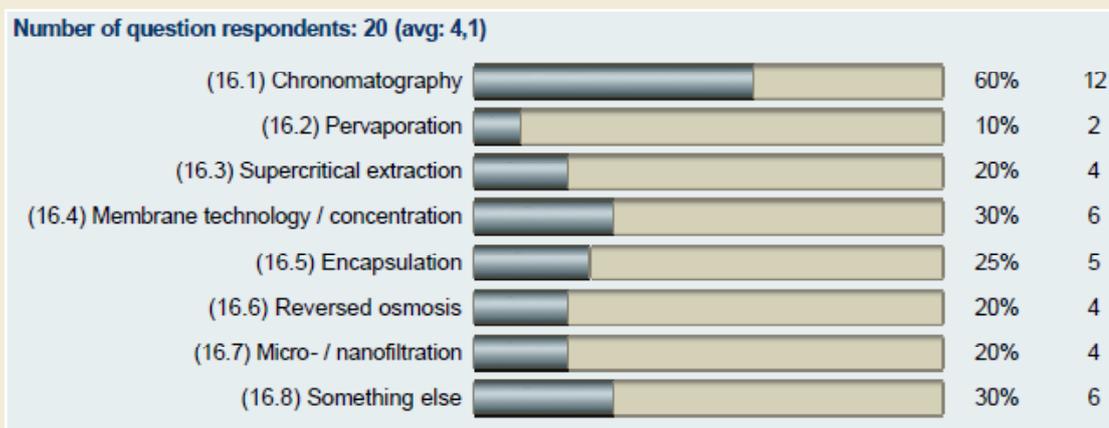– *Emission freezing, vacuum cooling, cooling and freezing technologies*

Figure 4: *R&D expertise or facilities in* **process technologies.**

Number of question respondents: 19 (avg: 5,5)

	%	n
(15.1) Peeling, cutting, sorting	21,1%	4
(15.2) Washing	21,1%	4
(15.3) Frying	15,8%	3
(15.4) Sheeting	0%	0
(15.5) Blanching	10,5%	2
(15.6) Extrusion	42,1%	8
(15.7) Foaming and emulsion	36,8%	7
(15.8) Coating	15,8%	3
(15.9) Something else	26,3%	5

Examples of mentioned technologies:
– *1. KRONEN Type GS10; 2. KRONEN Type AS4.*
– *Turbulent washing for various parts of fruits and vegetables (TURBOIDREX NILMA).*
– *Washing in CIP and COP systems.*
– *Extrusion technology.*
– *Juice production line: single belt press EBP 350, Voran; Basket press 60K, Voran.*
– *HAKE RheoStress reometer.*
– *Dairy and homogenisation technology for production of fine emulsions and supensions.*
– *Foam separation analysis, isolation and enrichment of mushroom enzymes with iso–electronic*
   focused preparative foam separation, optimization of foam fractionation for isolation of
   special plant ingredients.
– *Coating with drum coater / ploughshare mixer (industrial scale 50 l) and fluidised bed*
   facility (protective and color layers).

Figure 5: *R&D expertise or facilities in* **separation technologies.**

Number of question respondents: 20 (avg: 4,1)

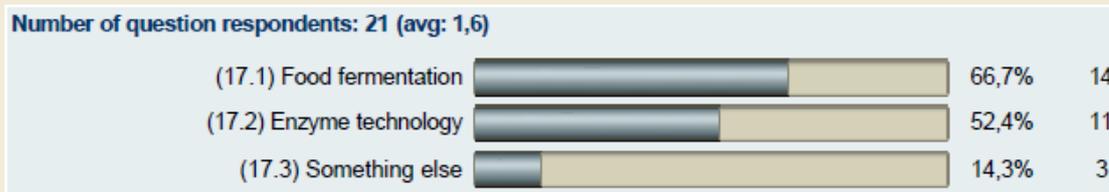|	%	n
(16.1) Chronomatography	60%	12
(16.2) Pervaporation	10%	2
(16.3) Supercritical extraction	20%	4
(16.4) Membrane technology / concentration	30%	6
(16.5) Encapsulation	25%	5
(16.6) Reversed osmosis	20%	4
(16.7) Micro- / nanofiltration	20%	4
(16.8) Something else	30%	6

Examples of mentioned technologies:
– *CG-MS, HPLC, LC-MS, column chromatography, capillary electophoresis,*
   2D-electophoresis.
– *Gas chromatography, HPLC facility, gel permeation chromatography (GPC).*

- *HPLC Shimadzu 10-Avp ; HPLC Waters ALLIANCE SP7983-2.*
- *Separation and extraction technique by screen centrifuge (output 20.000 l/h), chamber filter press in industrial scale with 6 m² filter surface, plate separator in technical scale with 12.000 l/h output and high pressure extraction facility.*
- *Continuous extraction of glykomakropeptid by membrane procedure.*
- *Mini Spray Dryer B-290 with Inert Loop B-295, Buchi.*
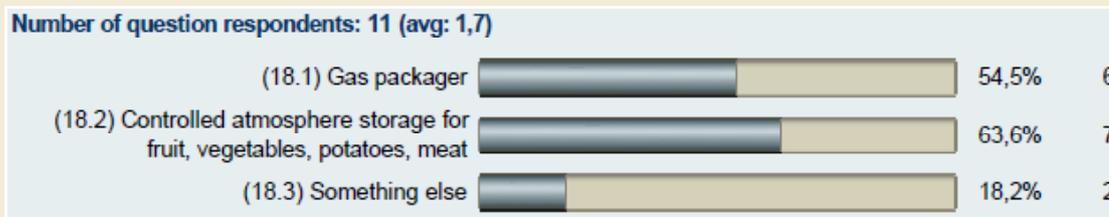- *Brine and milk purification, whey desalination.*

Figure 6: *R&D expertise or facilities in* **fermentation technologies.**

Number of question respondents: 21 (avg: 1,6)

(17.1) Food fermentation	66,7%	14
(17.2) Enzyme technology	52,4%	11
(17.3) Something else	14,3%	3

Examples of mentioned technologies:
- *Biosynthesis of vitamin B12 by lactic and propionic acid bacteria, antimicrobial and prohealthy properties of lactic acid bacteria, lactic and propionic bacteria in milk compounds bioconversion.*
- *Pectinase ferments to increase fruits and berries juice yield and to clarify juice.*
- *Fermentation facility in industrial scale with working volume of 500 l with temperature-profile-control and full-automatic process control in high pressure area.*
- *Test and Training distillery with complete installations including IT-controlled process control, fermentation-technological laboratory.*
- *Bioformulas for food technology, characteristic of bioactive compounds.*

Figure 7: *R&D expertise or facilities in* **packaging and storage technologies.**

Number of question respondents: 11 (avg: 1,7)

(18.1) Gas packager	54,5%	6
(18.2) Controlled atmosphere storage for fruit, vegetables, potatoes, meat	63,6%	7
(18.3) Something else	18,2%	2

Examples of mentioned technologies:
- *Improving packaging technology of dairy products.*
- *Vacuum Chamber Packing Machine EUROVAC, AMB, Italy for Modified atmosphere packing (MAP).*
- *Fruits and vegetables controlled atmosphere and ULO storage: Storex, NL.*
- *Incubator with controlled humidity, light and temperature.*

4. Annexes

1. Questionnaire form

Food research institutions in the Baltic Sea Region

Survey on industry related food research institutions in the Baltic Sea Region.

Survey relates to **baltfood - The BSR Food Cluster: Innovation and Competitiveness in Action.**

baltfood

More information on the Project:
baltfood c/o LÜBECK Business Development Corporation
Falkenstrasse 11, D-23564 Lübeck
Phone: +49 (0) 451 70655-0
www.baltfood.de / info@baltfood.de

More information on the survey
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(European Regional Development Fund)

Does your institution collaborate with food industry and/or are you interested to do so?

○ yes

○ no, you do not need to continue with this questionnaire. Thank you!

Data on institution

Name of the institution (specify the unit)

[   ]

Address
Street address
[   ]
Postcode and town
[   ]
Country
[   ]

Website of the institution

[   ]

Number of researchers/employees implementing or available for business collaboration

[   ]

Contact person for regional and international food companies or research institutions interested in collaboration
His/her name
[   ]
His/her phone number (office)
[   ]
His/her phone number (mobile)
[   ]
His/her fax number
[   ]
His/her e-mail address
[   ]

Can the contact details be published in Internet

○ yes

○ no

Institution's sphere(s) of operations

☐ local

☐ national

☐ international

Business collaboration

Does your institution collaborate with the following branches of food industry

☐ slauthering and meat manufacture

☐ fish manufacture

☐ fruit and vegetable

☐ production of vegetable and animal oils and fats

☐ milk manufacture, production of ice cream

☐ production of cereals, starch and starch products

☐ production of other foodstuff, except drinks

☐ production of drinks

☐ some other, please specify [   ]

☐ we do not collaborate with food industry

Specify the branches of food industry with whom you have the stongest relationships

[   ]

Give a concrete example on implemented collaboration <u>in education</u> with food industry.
(e.g. In 2005 company x needed continuing education on xx. We organised...)

[text area]

Give a concrete example on implemented collaboration <u>in R&D</u> with food industry.
(e.g. Company x had a R&D problem in its new product. In our testing laboratory we...)

[text area]

Does your institution provide R&D expertise or facilities in following <u>product specific technologies</u>? Specify shortly, only with few words, what kinds of technologies, equipments, analyse methods etc. can be utilized.

☐ Brewing facilities [   ]

☐ Cereals and bakery facilities [   ]

☐ Meat processing facilities [   ]

☐ Dairy processing facilities [   ]

☐ Fruit, vegetables, potatoes processing facilities [   ]

☐ Fish processing facilities [   ]

☐ Sugar processing facilities [   ]

☐ Something else [   ]

Does your institution provide R&D expertise or facilities in following <u>preservation technologies</u>? Specify shortly what kinds of technologies, equipments, analyse methods etc. can be utilized.

☐ HPP [   ]

☐ PEF [   ]

☐ Plasma [   ]

☐ High temperature heating / blanching / pasteurisation / sterilisation
[   ]

☐ Drying / freeze-drying [   ]

☐ Microwaver [   ]

☐ Radio frequency [   ]

☐ High heat infusion [   ]

☐ Ohmic heating [   ]

☐ Sous vide [   ]

☐ Vibro fluidised bed [   ]

☐ Something else [   ]

Does your institution provide R&D expertise or facilities in following <u>process technologies</u>? Specify shortly what kinds of technologies, equipments, analyse methods etc. can be utilized.

☐ Peeling, cutting, sorting _____

☐ Washing _____

☐ Frying _____

☐ Sheeting _____

☐ Blanching _____

☐ Extrusion _____

☐ Foaming and emulsion _____

☐ Coating _____

☐ Something else _____

Does your institution provide R&D expertise or facilities in following <u>separation technologies</u>? Specify shortly what kinds of technologies, equipments, analyse methods etc. can be utilized.

☐ Chronomatography _____

☐ Pervaporation _____

☐ Supercritical extraction _____

☐ Membrane technology / concentration _____

☐ Encapsulation _____

☐ Reversed osmosis _____

☐ Micro- / nanofiltration _____

☐ Something else _____

Does your institution provide R&D expertise or facilities in following <u>fermentation technologies</u>? Specify shortly what kinds of technologies, equipments, analyse methods etc. can be utilized.

☐ Food fermentation _____

☐ Enzyme technology _____

☐ Something else _____

Does your institution provide R&D expertise or facilities in following <u>packaging and storage technologies</u>? Specify shortly what kinds of technologies, equipments, analyse methods etc. can be utilized.

☐ Gas packager _____

☐ Controlled atmosphere storage for fruit, vegetables, potatoes, meat
_____

☐ Something else _____

Additional information

Feel free to provide additional information on your institution's business collaboration

_____

Do you want more information on the results of the questionnaire?

○ yes

○ no

Do you want more information on the baltfood project?

○ yes

○ no

Do you want the baltfood newsletter?

○ yes

○ no

[Submit]