

NEW CHALLENGE FOR SOCIAL INCLUSION - MARINE PRODUCT PROCESSING DEVELOPMENT OF MUSSEL FARMING IN THE BALTIC SEA REGION

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Abstract. Product recycling opportunities that potentially increase the value of the initial product create interest in creating and developing a field. Seafood is demanded product in the world but creating a higher value of the product the value of it can be increased and in many countries it helped to solve social problems with food provision and employment. Aim of research analysis of area for mollusc farming, and mollusc-processing options to explore opportunities for development of the field. By analysing views of public administrators, entrepreneurs and researchers in selected Baltic Sea Region countries. Based on expert viewpoint (public administrators, entrepreneurs and researchers that participated in the survey), the study summarizes aspects of seafood re-processing that may affect the potential for shellfish development in the Baltic Sea region and whether educational measures can contribute to the development of processed seafood in the Baltic Sea Region.

Research methods used: Scientific publication studies on mussel farming development and marine product processing supporting and braking factors, survey of different stakeholders in mussel farming – public administrators, entrepreneurs and researchers; expert interviews. For evaluation of different aspects affecting marine product processing from mussel farming evaluation scale 1 – 10 was used, where 1 – do not affect; 10 – affect in great extent. Data obtained in the survey were analysed with indicators of descriptive statistics, cross-tabulations by gender, education level, age group and country, analysis of variance – ANOVA, correlation analysis, and factor analysis.

From the experts' point of view, the important aspects that could affect the processing of marine products in mussel farming in the Baltic Sea region were indicated as government support, education including informal education, human resources as well as marketing events. The results were statistically different by age group and by country.

Experts who evaluated aspects of education as a less important factor affecting the development of marine product processing rated the development potential of marine product processing over the next 10 years lower.

Keywords: *social inclusion, marine product processing, marketing tools, mussel farming, survey.*

JEL code: I38, L23, M11, M31

Introduction

Blue mussel farming and the results of production in those farms are discussed among the researchers, entrepreneurs and policy makers as mussel farms are producing products for human consumption and animal feed, as well as for water quality improvement and to increase its transparency. Aim of research analysis of area for mollusc farming, and mollusc-processing options to explore opportunities for development of the field. The research is conducted by analysing views of public administrators, entrepreneurs and researchers in selected Baltic Sea Region countries. Based on expert viewpoint (public administrators, entrepreneurs and researchers that participated in the survey), the study summarizes aspects of seafood re-processing that may affect the potential for shellfish development in the Baltic Sea region and whether educational measures can contribute to the development of processed seafood in the Baltic Sea Region.

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This paper analyses finding of the scientific publications on marine product manufacturing with special attention paid to blue mussel farming and processing of marine products and experience in use them for solving food problem as well as supporting social inclusion. Due to the environmental conditions of the Baltic Sea Region countries up to now there were no vivid activities done in mussel farming. Respectively, there was no action from marine product users, however, some first steps are going on to investigate the situation and develop possible solutions for the mussel farming development also in the Baltic Sea Region countries. Therefore, the viewpoint of several stakeholders is on great importance and survey of experts from the Baltic Sea Region countries was conducted. Among the important aspects analysed were opinions of experts from the Baltic Sea Region countries on how analysed factors affect development of marine product processing. Some of factors affecting marine product processing were: availability of end – use market; availability of different sources of financing (subsidies, loans); level and influence of formal and informal education of specialists involved; availability of governmental support; availability of labour force/ human resources; application of marketing events; level of taxes.

Literature Review

Many countries are paying a lot of attention to scientific research in marine product processing as marine products are very popular and are getting even more popular in many countries and special scientific analysis is carried out on how marine products affect gross domestic product – analysis was carried out also in Gulf Cooperation Council GCC (ALshubiri, 2018). Researchers have analyzed aquaculture product importance in finding solution of future food needs and have concluded the growing importance of aquaculture product influence in food aspects of world agriculture resources and food security (Anderson, Asche, Garlock, Chu, 2017). Several Mussel Watch Program influence aspects in historical evaluation are on great importance (Apeti, Lauenstein, 2010) and on special attention by scientific researchers. Scientific discussions on scale of mussel production industry – either large scale or small scale as benefits and challenges are for all scales of production indicating that different countries have different approaches and different results (Gonzalez-Poblete, Hurtado, Rojo, Norambuena, 2018). Mussel farming possibilities are analyzed in many seas on the globe including the Baltic Sea (Gren, Lindahl, Lindqvist, 2009) even taking into account that the Baltic Sea is not so warm as traditional mussel farming waters in Southern part of the Earth and has not so big experience in the field. Norwegian scientists have analyzed mussel farming results and use them in food in their coastal lines (Handå, Alver, Edvardsen, Halstensen, Reinertsen, 2015) and by modelling have found the best possible solutions and have developed practical suggestions for applications in mussel farming. Several regional innovative approaches are under scientific investigations for blue mussel production for finding the best possible solution for practical use and applications in blue mussel farming (Hjalager, Johansen, Rasmussen, 2015) by different approaches presented in academic research findings (Maar, Saurel, Landes, Dolmer, Petersen, 2015). Academic research results are discussed on the use of marine products for animal feed advantages and challenges (Nørgaard, Petersen, Tørring, Jørgensen, Lærke, 2015). Blue mussel farming is considered also as water transparency and water quality improvement (Schröder, Stank, Schernewski, Krost, 2014) in different regions on the Earth (Trottet, Roy, Tamigneaux, Lovejoy, Tremblay, 2008). Business options of wind mills and mussel farming are discussion cases in scientific papers (van den Burg, Kamermans, Blanch, Pletsas, Dalton, 2017) and research findings are basis in suggesting practical applications for use of such approach in production and business development taking into account several aspects of research findings and suggestions.

Research results and discussion

Analysed aspects on factors affecting marine product processing was organized within the Baltic Sea Region countries (Denmark, Estonia, Finland, Germany, Latvia and Sweden) expert survey. Experts were selected by their experience in work with marine product processing aspects and were invited to answer questions on the main factors

affecting marine product processing. For many analysed aspects there were used evaluation scale 1 – 10, where 1 – do not agree and 10 – agree in full extent. Experts could mention if they had no opinion on respective analysed aspect – there were two to three percent of responses and they were not included in this analysis. The main statistical indicators of evaluation by experts of the Baltic Sea Region countries on factors affecting marine product processing are included in table 1.

Table 1

Main statistical indicators of evaluation by experts on factors affecting marine product processing – the Baltic Sea Region countries expert survey results in 2018

Indicators	Financing (subsidies, loans)	Education (formal, also informal)	Marketing events	Taxes	End- use market	Government support	Labor force /Human resource
Mean	7,34	6,39	7,11	6,92	8,43	7,61	6,46
Standard Error of Mean	0,301	0,321	0,269	0,321	0,206	0,270	0,329
Median	8	7	8	7	9	8	7
Mode	8	7	8	10	10	8	7
Std. Deviation	2,351	2,505	2,098	2,505	1,607	2,108	2,566
Variance	5,530	6,276	4,403	6,277	2,582	4,443	6,586
Range	9	9	8	9	8	8	9
Minimum	1	1	2	1	2	2	1
Maximum	10	10	10	10	10	10	10

Source: Zaiga Ozolina conducted survey, evaluation scale 1 – 10, where 1- do not agree; 10 – agree in full extent, n = 61

Baltic Sea region countries expert survey results indicate that the higher evaluated factor was end-use market where almost all evaluation scale was covered with arithmetic mean 8,43 and mode 10 (most often used evaluation) and median 9 (half of respondents have evaluated with 9 or less and half of respondents have evaluated with 9 or more). For those evaluations, experts had alike results as variance and other indicators of dispersion are the lowest. The next highest evaluated aspect in the survey was government support with arithmetic mean 7,61 and mode 8 and median 8; relatively lower estimate was for education (formal and informal) with arithmetic mean of evaluation 6,39 and mode 7 and median 7. For almost all of analysed aspects on factors affecting marine product processing by experts it was used all range in the evaluation scale except evaluations for availability of end-use market and government support. The highest differences of evaluations by the Baltic Sea Region experts are for analysed aspect availability of human resources/labour force in the results of expert evaluations of all analysed main factors affecting marine product processing. Therefore, the distribution of evaluations on evaluated factor – labour force / human resources by experts of the Baltic Sea Region countries is included in table 2.

Table 2

Distribution of expert evaluations on factor – labor force/ human resource affecting marine product processing – the Baltic Sea Region countries expert survey results in 2018

Evaluations	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	1,6	1,6	1,6
2	3	4,9	4,9	6,6
3	5	8,2	8,2	14,8
4	8	13,1	13,1	27,9
5	6	9,8	9,8	37,7
6	3	4,9	4,9	42,6
7	14	23,0	23,0	65,6
8	7	11,5	11,5	77,0
9	2	3,3	3,3	80,3
10	12	19,7	19,7	100,0
Total	61	100,0	100,0	

Source: Zaiga Ozolina conducted survey, evaluation scale 1 – 10, where 1- do not agree; 10 – agree in full extent, n = 61

The arithmetic mean of expert evaluations on availability of labour force / human resources is among the lower evaluated aspects by experts and the evaluations of experts for this aspect is with higher dispersion (indicators of variability characterized by standard deviations) of the Baltic Sea Region countries expert evaluations – it means that the views of experts differ in great extent. Expert evaluations have mode 7 – made by 23% of respondents, and median 7 (half of respondents have evaluated with 7 or less and half of respondents have evaluated with 7 or more).

Correlation analysis of all mentioned aspects affecting marine product processing and age group of experts and gender of experts and country of expert had not statistically significant correlation with reasonable significance level – it means that there were no differences in evaluations within experts by expert's gender, by expert's age group or by expert's country.

Average evaluations by the Baltic Sea Region countries experts of analysed aspects on factors affecting marine product processing did not show statistically significant differences in average evaluations by expert's age groups confirmed by analysis of variance (ANOVA) – the results are included in table 3. The highest significance was indicated regarding education, government support and marketing events' aspects.

Table 3

Results of analysis of variance (ANOVA) on expert evaluations on factors affecting marine product processing – the Baltic Sea Region countries expert survey results in 2018 by expert's age groups

Analyzed aspects	Sum of Squares	Sum of Squares	df	Mean Square	F	Sig.
Labor force /Human resource	Between Groups	34,603	4	8,651	1,370	0,256
	Within Groups	340,923	54	6,313		
	Total	375,525	58			
Financing (subsidies, loans)	Between Groups	24,538	4	6,135	1,090	0,371
	Within Groups	303,970	54	5,629		
	Total	328,508	58			
Education (formal, also informal)	Between Groups	7,102	4	1,775	0,266	0,898
	Within Groups	359,780	54	6,663		
	Total	366,881	58			
Marketing events	Between Groups	6,390	4	1,597	0,337	0,852
	Within Groups	255,780	54	4,737		
	Total	262,169	58			
Taxes	Between Groups	36,818	4	9,204	1,502	0,214
	Within Groups	330,810	54	6,126		
	Total	367,627	58			
End-use market	Between Groups	15,249	4	3,812	1,481	0,221
	Within Groups	138,988	54	2,574		
	Total	154,237	58			
Government support	Between Groups	6,297	4	1,574	0,330	0,857
	Within Groups	257,940	54	4,777		
	Total	264,237	58			

Source: Zaiga Ozoliņa conducted survey, evaluation scale 1 – 10, where 1- do not agree; 10 – agree in full extent, n = 58

The results of analysis of variance ANOVA (the results of table 3) indicate that the significance levels are rather high for all analysed aspects on factors affecting marine product processing in the Baltic Sea Region countries.

The Baltic Sea Region countries have very different historical experience and are on different level of marine product processing. Moreover, these countries have very different levels of economic development and have different levels of standard of living. Therefore, it is important to analyse also the experts' evaluations on factors affecting marine product processing by expert's country as the mentioned above differences could affect expert evaluations.

The average assessment by the Baltic Sea Region countries experts of analysed aspects on factors affecting marine product processing were compared by the use of analysis of variance. The obtained results did not show statistically significant differences in average expert evaluations by expert's country (Denmark, Estonia, Finland, Germany, Latvia and Sweden) – confirmed by analysis of variance (ANOVA); the main results are included in table 4. The highest significance was indicated for financing and end-use market aspects on factors affecting marine product processing by expert's country.

Table 4

Results of analysis of variance (ANOVA) on expert evaluations on factors affecting marine product processing – the Baltic Sea Region countries expert survey results in 2018 by expert's country

Analyzed aspects	Sum of Squares	Sum of Squares	df	Mean Square	F	Sig.
Labor force /Human resource	Between Groups	29,459	5	5,892	0,902	0,487
	Within Groups	346,067	53	6,530		
	Total	375,525	58			
Financing (subsidies, loans)	Between Groups	20,467	5	4,093	0,704	0,623
	Within Groups	308,042	53	5,812		
	Total	328,508	58			
Education (formal, also informal)	Between Groups	27,773	5	5,555	0,868	0,509
	Within Groups	339,108	53	6,398		
	Total	366,881	58			
Marketing events	Between Groups	29,353	5	5,871	1,336	0,263
	Within Groups	232,817	53	4,393		
	Total	262,169	58			
Taxes	Between Groups	33,727	5	6,745	1,071	0,387
	Within Groups	333,900	53	6,300		
	Total	367,627	58			
End-use market	Between Groups	9,629	5	1,926	0,706	0,622
	Within Groups	144,608	53	2,728		
	Total	154,237	58			
Government support	Between Groups	24,837	5	4,967	1,100	0,372
	Within Groups	239,400	53	4,517		
	Total	264,237	58			

Source: Zaiga Ozolina conducted survey, evaluation scale 1 – 10, where 1- do not agree; 10 – agree in full extent, n = 58

Experts who graded the development potential of marine products processing over the next 10 years with 6 and 7 indicated financing aspect lower than other experts.

Experts who evaluated aspects of education as a less important factor affecting the development of marine product processing rated the development potential of marine product processing over the next 10 years lower.

Table 5

Results of analysis of variance (ANOVA) on expert evaluations on factors affecting marine product processing and chance of marine product processing development in the next 10 years – the Baltic Sea Region countries expert survey results in 2018

Analyzed aspects	Sum of Squares	Sum of Squares	df	Mean Square	F	Sig.
Labour force /Human resource / chance of marine product processing development in the next 10 years	Between Groups	29,459	8	8,425	1,354	0,237
	Within Groups	346,067	56	6,221		
	Total	375,525	64			
Financing (subsidies, loans)/ chance of marine product processing development in the next 10 years	Between Groups	20,467	8	4,339	0,686	0,702
	Within Groups	308,042	56	6,327		
	Total	328,508	64			
Education (formal, also informal) /chance of marine product processing	Between Groups	27,773	8	6,746	1,160	0,339
	Within Groups	339,108	56	5,815		
	Total	366,881	64			

development in the next 10 years						
Marketing events /chance of marine product processing development in the next 10 years	Between Groups	29,353	8	6,407	1,341	0,243
	Within Groups	232,817	56	4,779		
	Total	262,169	64			
Taxes /chance of marine product processing development in the next 10 years	Between Groups	33,727	8	8,726	1,322	0,252
	Within Groups	333,9	56	6,601		
	Total	367,627	64			
End-use market / chance of marine product processing development in the next 10 years	Between Groups	9,629	8	4,225	1,196	0,318
	Within Groups	144,608	55	3,533		
	Total	154,237	63			
Government support/ chance of marine product processing development in the next 10 years	Between Groups	24,837	8	4,922	0,942	0,490
	Within Groups	239,4	56	5,226		
	Total	264,237	64			

Source: Zaiga Ozolina conducted survey, evaluation scale 1 – 10, where 1- do not agree; 10 – agree in full extent, n = 64

Scientific research in many fields investigate differences in evaluations by expert's gender even taking into account that expert is expert and gender characteristic attitudes have not influenced the evaluation results. To check experts' viewpoint on factors affecting marine product processing in the Baltic Sea Region countries t – test was carried out by expert gender statistical hypothesis testing on average evaluations of analysed aspects. H0 was stated: average evaluations of experts by expert gender do not differ statistically significant and respectively alternative hypothesis: average evaluations of experts by expert gender differ statistically significant.

The average evaluations of experts by gender do not differ statistically significant with reasonable significance level but for all analysed aspects affecting marine product processing evaluations averages by female experts were higher – see table 6.

Table 6

Main statistical indicators of evaluations on factors affecting marine product processing – the Baltic Sea Region countries expert survey results in 2018 by gender

Analyzed aspects	Gender	N	Mean	Standard Deviation	Standard Error of Mean
Labor force /Human resource	F	39	6,51	2,635	0,422
	M	20	6,05	2,395	0,535
Financing (subsidies, loans)	F	39	7,51	2,372	0,380
	M	20	6,90	2,404	0,538
Education (formal, also informal)	F	39	6,33	2,619	0,419
	M	20	6,30	2,364	0,529
Marketing events	F	39	7,51	1,972	0,316
	M	20	6,35	2,254	0,504
Taxes	F	39	7,15	2,368	0,379
	M	20	6,25	2,751	0,615
End-use market	F	39	8,69	1,454	0,233
	M	20	7,85	1,843	0,412
Government support	F	39	7,62	2,172	0,348
	M	20	7,55	2,114	0,473

Source: Zaiga Ozolina conducted survey, evaluation scale 1 – 10, where 1- do not agree; 10 – agree in full extent, n = 58

The analysis of obtained results did not show statistically significant differences in expert evaluations testing with t – test. One of the most often applied multivariate analysis method – factor analysis was applied to reduce factors and finding common factors influencing marine product processing. Factor analysis results on factors affecting marine product processing are included in table 7.

Table 7

Factor analysis results on evaluations on factors affecting marine product processing – the Baltic Sea Region countries expert survey results in 2018

Rotated Component Matrix ^a		
Analyzed factors affecting marine product processing	Component	
	1	2
Labor force /Human resource	0,179	0,834
Financing (subsidies, loans)	0,785	0,402
Education (formal, also informal)	0,709	0,311
Marketing events	0,748	0,030
Taxes	0,160	0,858
End-use market	0,383	0,633
Government support	0,783	0,265

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 3 iterations.

Source: Author's construction based on Zaiga Ozolina conducted expert survey

As the result of factor analysis by applying extraction method – Principal Component Analysis in three iterations by varimax rotation with Kaiser Normalisation there were extracted two complex factors or components: first complex factor consisting of initial factors - financing, education, marketing events and government support, but second complex factor consisting of initial factors - human resources, taxes and end-use market – it was indicated by correlation coefficients bigger than 0,5 of the complex factor and initial factors.

Conclusions, proposals, recommendations

1. Marine product development has been an efficient tool for reduction of social exclusion and finding inhabitant involvement in development of new innovative products which could be introduced in the countries of the Baltic Sea Region including Latvia.

2. Among the marine product processing influencing factors in the Baltic Sea region countries the most important are availability of end-use market, then followed by government support, by financing availability including loans, by marketing events, by taxes, by availability of labor force and by education (formal and informal).
3. The evaluation results of experts from different countries on analyzed aspects for marine product development in the countries of the Baltic Sea Region did not differ statistically significant by expert's age group, by expert's gender and by expert's country.
4. Experts were invited to evaluate the prospect of marine product processing development in the next 10 years. Experts who graded the development potential of marine products processing over the next 10 years with 6 and 7 indicated financing aspect lower than other experts.
5. Experts who evaluated education aspects as a less important factor affecting the development of marine product processing rated the development potential of marine product processing over the next 10 years lower.
6. Research results could be used in development of marketing strategies for consumption improvement of the production and development more effective information on new product.

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The research was supported by the NATIONAL RESEARCH PROGRAMME “LATVIAN HERITAGE AND FUTURE CHALLENGES FOR THE SUSTAINABILITY OF THE STATE” project “CHALLENGES FOR THE LATVIAN STATE AND SOCIETY AND THE SOLUTIONS IN INTERNATIONAL CONTEXT (INTERFRAME-LV)”