



ECONOMIC SCIENCE FOR RURAL DEVELOPMENT

Proceedings of the International
Scientific Conference

Resources and Cooperation

1. Resources and Sustainable Consumption
2. Production and Cooperation in Primary and Secondary Agriculture

“ECONOMIC SCIENCE FOR RURAL DEVELOPMENT”

Proceedings of the
International Scientific Conference

RESOURCES AND COOPERATION

- 1. Resources and Sustainable Consumption**
- 2. Production and Cooperation in Primary and Secondary Agriculture**

**Nº 29
Jelgava
2012**

TIME SCHEDULE OF THE CONFERENCE

Preparation: October 2011 – April 2012

Process: 26-27 April 2012

Agricultural University in Cracow, 2012

Alberta College, 2012

Aleksandras Stulginskis University, 2012

Corvinus University of Budapest, 2012

Council of Latvian Chamber of Commerce and Industry, 2012

Daugavpils University, 2012

Estonian University of Life Sciences, 2012

Fulda University of Applied Sciences, 2012

Institute of Economics and Social Sciences, Estonian University of Life Sciences, 2012

Institute of Economics by Latvian Academy of Sciences, 2012

Institute of Economics, Hungarian Academy of Sciences, 2012

Kaunas University of Technology, 2012

Latvia University of Agriculture, 2012

Latvian Academy of Agricultural and Forestry Sciences, 2012

Latvian Academy of Sciences, 2012

Latvian State Institute of Agrarian Economics, 2012

Lithuanian Institute of Agrarian Economics, 2012

Mendel University in Brno, 2012

Mykolas Romeris University, 2012

Poznan University of Economics, 2012

Professional Association of Project Managers, 2012

Research Institute of Agriculture Machinery, Latvia University of Agriculture, 2012

Research Institute of Biotechnology and Veterinary Medicine "Sigra", 2012

Research Institute of Economics and Business, 2012

State Revenue Service of Latvia, 2012

Rezekne Higher Education Institution, 2012

Riga International School of Economics and Business Administration, 2012

Riga Technical University, 2012

Rural Support Service, 2012

School of Business Administration Turiba, 2012

School of Business and Finance, 2012

Seinäjoki University of Applied Sciences, 2012

Tallinn University Institute of Political Science and Governance, 2012

Tartu University, 2012

University College of Economics and Culture, 2012

University of Latvia, 2012

University of Szczecin, 2012

Ural State Mining University, 2012

Valga County Government, 2012

Ventspils University College, 2012

Vidzeme University of Applied Sciences, 2012

Wageningen University, 2012

Warsaw University of Life Sciences, 2012

West Pomeranian University of Technology in Szczecin, 2012

ISSN 1691-3078

ISBN 978-9934-8304-2-6

Abstracted / Indexed: ISI Web of Knowledge, AGRIS, EBSCO

http://thomsonreuters.com/products_services/science/science_products/a-z/conf_proceedings_citation_index/

<http://www.llu.lv/ef/konferences.htm>

www.fao.org/agris/

<http://search.ebscohost.com/login.aspx?authtype=ip,uid&profile=ehost&defaultdb=lbh>

Programme Committee of International Scientific Conference

Professor Baiba Rivza	President of the Academy of Agricultural and Forestry Sciences of Latvia; academican of Latvian Academy of Sciences; foreign member of Academy of Agricultural Sciences of Russia; foreign member of Lithuanian Academy of Sciences; foreign member of the Academy Geargophily (Italy), foreign member of the Royal Swedish Academy of Agriculture and Forestry, Latvia
Professor Bartosz Mickiewicz	West Pomeranian University of Technology in Szczecin, Poland
Professor Vilija Alekneviene	Faculty of Economics and Management, Aleksandras Stulginskis University, Lithuania
Professor Irina Pilvere	Dean of the Faculty of Economics of Latvia University of Agriculture, Latvia
Professor Ingrida Jakusonoka	Head of the Department of Accounting and Finance of the Faculty of Economics of Latvia University of Agriculture, Latvia
Associate professor Gunita Mazure	Department of Accounting and Finance of the Faculty of Economics of Latvia University of Agriculture, Latvia
Professor Barbara Freytag-Leyer	Department of Home Economics, Fulda University of Applied Sciences, Germany
Professor Jacques Viaene	Faculty of Bioscience Engineering, Department of Agricultural Economics, University of Ghent, Belgium
Professor Bo Öhlmer	Department of Economics of the Swedish University of Agricultural Sciences, Uppsala, Sweden
Professor Wim J.M. Heijman	Wageningen University, the Netherlands
Professor Maria Parlinska	Warsaw University of Life Sciences, Poland
Professor Csaba Forgacs	Corvinus University of Budapest, Hungary
Professor Aina Dobele	Department of Entrepreneurship and Management of the Faculty of Economics of Latvia University of Agriculture, Latvia
Professor Liga Mihejeva	Department of Entrepreneurship and Management of the Faculty of Economics of Latvia University of Agriculture, Latvia
Associate professor Bruna Maria Zolin	Department of Economic Sciences, University of Venice, Italy
Associate professor Jonas Jasaitis	Siauliai University, Lithuania
Associate professor Andra Zvirbule-Berzina	Head of the Department of Entrepreneurship and Management of the Faculty of Economics of Latvia University of Agriculture, Latvia
Associate professor Inguna Leibus	Department of Accounting and Finance of the Faculty of Economics of Latvia University of Agriculture, Latvia
Associate professor Modrite Pelse	Head of Department of Economics of the Faculty of Economics of Latvia University of Agriculture, Latvia

The chief facilitator and project leader – associate professor **Andra Zvirbule-Berzina**

Editorial Board

The Editorial Board of the edition of the International Scientific Conference Proceedings:

Professor Baiba Rivza	Latvia
Professor Irina Pilvere	Latvia
Professor Bartosz Mickiewicz	Poland
Professor Maria Parlinska	Poland
Professor Vilija Alekneviene	Lithuania
Professor Barbara Freytag-Leyer	Germany
Professor Jacques Viaene	Belgium
Professor Bo Öhlmer	Sweden
Professor Wim J.M. Heijman	the Netherlands
Professor Csaba Forgacs	Hungary
Professor Aina Dobele	Latvia
Associate professor Bruna Maria Zolin	Italy
Associate professor Andra Zvirbule-Berzina	Latvia
Associate professor Gunita Mazure	Latvia

Editor – in-chief	Associate professor Andra Zvirbule-Berzina
Responsible compilers of the proceedings:	Associate professor Gunita Mazure Lecturer Zanete Gruzina
Assistants to the responsible compilers:	Dzesija Zeiferte Agnese Radzele-Sulce

Language editor: **Gunita Mazure**

Layout designer: **Agnese Radzele-Sulce**

Reviewers

Every article included into the Proceedings was subjected to a scientific, including international review.

All reviewers were anonymous for the authors of the articles.

The following **89** reviewers from scientific and academic institutions of **7** countries (Estonia, Finland, Hungary, Latvia, Lithuania, Poland, and the Czech Republic) have written **206** reviews.

Dzintra Atstaja	Dr.oec., assoc. prof. (School of Business and Finance, Latvia)
Anita Auzina	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Stanislaw Bagienski	Dr.hab., prof. nadz. (Warsaw University of Life Sciences, Poland)
Konstantins Benkovskis	Dr.oec., lecturer (Stockholm School of Economics in Riga, Latvia)
Dainis Berjoza	Dr.ing., assoc. prof. (Latvia University of Agriculture, Latvia)
Veronika Bikse	Dr.oec., prof. (University of Latvia, Latvia)
Ligita Bite	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Vera Boronenko	Dr.oec. (Daugavpils University, Latvia)
Ieva Brencē	Dr., assoc. prof. (Latvian Academy of Sciences, Latvia)
Inta Bruna	Dr.oec., prof. (University of Latvia, Latvia)
Veronika Bugina	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Andrzej Czyzewski	Dr.hab., prof. (Poznan University of Economics, Poland)
Alina Danilowska	Dr.hab., prof. (Warsaw University of Agriculture, Poland)
Rimantas Dapkus	Dr., assoc. prof. (Kaunas University of Technology, Lithuania)
Vija Dislere	Dr.paed., assoc. prof., (Latvia University of Agriculture, Latvia)
Aina Dobeļe	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Aija Eglīte	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Justyna Franc-Dabrowska	Dr.hab., adjunct prof. (Warsaw University of Life Sciences, Poland)
Ineta Geipele	Dr.oec., prof. (Riga Technical University, Latvia)
Barbara Golebiewska	PhD hab. (Warsaw University of Life Sciences, Poland)
Jaroslav Golebiewski	Dr.hab. (Warsaw University of Life Sciences, Poland)
Gunta Grinberga-Zalīte	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Inguna Gulbe	Dr.oec. (Latvian State Institute of Agrarian Economics, Latvia)
Māra Gulbe	Dr.math., assoc. prof. (University of Latvia, Latvia)
Uldis Ivans	Mg.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Ingrīda Jakusonoka	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Elita Jermolajeva	Dr.oec., assoc. prof. (Daugavpils University, Latvia)
Helma Jirģena	Dr.oec., assoc. prof. (Institute of Economics by Latvian Academy of Sciences, Latvia)
Inara Jurgena	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Janis Kaktins	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Leif Kalev	PhD, assoc. prof. (Tallin University, Estonia)
Laszlo Karpati	Dr., PhD (Budapest Business School, Hungary)
Bogdan Klepacki	Dr.hab., prof. (Warsaw University of Life Sciences, Poland)
Evija Kopeika	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Vulfis Kozlinskis	Dr.habil.oec., prof. (Riga International School of Economics and Business Administration, Latvia)
Zaigā Krisģane	Dr.geogr., prof. (University of Latvia, Latvia)
Gediminas Kuliesis	Dr. (Lithuanian Institute of Agrarian Economics, Lithuania)
Marika Laizane-Jurģane	Dr.sc.pol. (University of Latvia, Latvia)
Olga Lavrinenko	Dr.oec. (Daugavpils University, Latvia)
Inguna Leibus	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Sviesa Leitoniene	Dr., assoc. prof. (Aleksandras Stulginskis University, Lithuania)
Linda Leģa	M.Sc. (the Ministry of Environmental Protection and Regional Development, Latvia)

Agita Livina	Dr.oec., assoc. prof.(Vidzeme University of Applied Sciences, Latvia)
Valdemaras Makutenas	Dr., assist. prof.(Aleksandras Stulginskis University, Lithuania)
Gunita Mazure	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Bartosz Mickiewicz	PhD., prof. (West Pomeranian University of Technology in Szczecin, Poland)
Līga Mihejeva	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Tatjana Muravska	Dr.oec., prof. (University of Latvia, Latvia)
Aina Muska	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Grigorijs Olevskis	Dr.hab.oec., prof. (University of Latvia, Latvia)
Līga Paura	Dr.sc.agr., assoc. prof. (Latvia University of Agriculture, Latvia)
Modrite Pelse	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)
Irina Pilvere	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Dina Popluga	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Arturs Praulins	Dr.oec. (Latvian State Institute of Agrarian Economics, Latvia)
Agnese Radzele-Sulce	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Viktorija Rankevica	Dr.oec., assoc. prof. (School of Business and Finance, Latvia)
Priit Sander	PhD (Tartu University)
Linda Silina	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Inga Sina	Dr.oec. (University College of Economics and Culture, Latvia)
Timo Sipiläinen	PhD, assist. prof. (University of Helsinki, Finland)
Tomasz Siudek	Dr., assist. prof. (Warsaw University of Life Sciences, Poland)
Peteris Skinkis	Dr.geogr., assoc. prof. (University of Latvia, Latvia)
Teodor Skotarczak	Dr.hab., prof. (West Pomeranian University of Technology in Szczecin, Poland)
Martin Soucek	Ing. Ph.D. (Mendel University in Brno, Czech Republic)
Evelina Spakovica	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Ilze Sproge	Dr.sc.administr., assist. prof. (ISMA Graduate School, Latvia)
Neringa Stonciuviene	Dr., prof.(Aleksandras Stulginskis University, Lithuania)
Evita Straumite	Dr.sc.ing. (Latvia University of Agriculture, Latvia)
Aivars Strautnieks	Dr.oec., assoc. prof. (emeritus) (Latvia University of Agriculture, Latvia)
Voldemars Strikis	Dr.agr., prof. (Latvia University of Agriculture, Latvia)
Romena Sulca	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Tatjana Tambovceva	Dr.oec., assoc. prof. (Riga Technical University, Latvia)
Elga Tilta	Dr.oec. (Institute of Economics by Latvian Academy of Sciences, Latvia)
Ilze Upite	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Vasilijs Ustinovs	Dr.sc.ing. (Research Institute of Agriculture Machinery, Latvia University of Agriculture, Latvia)
Rando Värnik	PhD., prof. (Estonian University of Life Sciences. Estonia)
Dainis Viesturs	Dr.vc.ing. (Research Institute of Agriculture Machinery, Latvia University of Agriculture, Latvia)
Dace Viksne	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Anastasija Vilcina	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Raina Vira	Dr.paed., assoc. prof.(Riga International School of Economics and Business Administration, Latvia)
Irija Vitola	Dr.oec., prof. (Latvia University of Agriculture, Latvia)
Inesa Voroncuka	Dr.oec., prof. (University of Latvia, Latvia)
Jekaterina Voznuka	Dr.oec., assist. prof. (Baltic International Academy, Latvia)
Bogdan Wawrzyniak	Dr.hab., prof. (University of Technology and Life Sciences in Bydgoszcz, Poland)
Ludwik Wicki	Dr.hab. (Warsaw University of Agriculture, Poland)
Lajos Zoltan Bakucs	Dr. (Hungarian Academy of Sciences, Hungary)
Anda Zvaigzne	Dr.oec., assist. prof. (Latvia University of Agriculture, Latvia)
Andra Zvirbule-Berzina	Dr.oec., assoc. prof. (Latvia University of Agriculture, Latvia)

Foreword

Every year the Faculty of Economics, Latvia University of Agriculture holds the international scientific conference "Economic Science for Rural Development" and publishes internationally reviewed papers of scientific researches, which are presented at the conference. **This year the conference is organised for the 13th year running and all the papers are published in English.** Selected papers from the Proceedings are included into *ISI Web of Knowledge* database and the Faculty of Economics has applied also to Scopus database for including the Proceedings into this database.

Researchers from various European countries representing not only the science of economics in the diversity of its sub-branches have contributed to the conference this year; they have expanded their studies engaging colleagues from social and other sciences, thus confirming inter-disciplinary and multi-dimensional development of the contemporary science. The conference is dedicated to topical themes of rural development; hence, the research results are published in three successive volumes (No. 27, 28, and 29). The first volume of scientific conference proceedings was published in 2000.

Professors, doctors of science, associate professors, assistant professors, PhD students, and other researchers from the following higher education, research institutions, and professional organisations participate at the International Scientific Conference held on April 26-27, 2012 and present their results of scientific research:

Agricultural University in Cracow
Alberta College
Aleksandras Stulginskis University
Corvinus University of Budapest
Council of Latvian Chamber of Commerce and Industry
Daugavpils University
Estonian University of Life Sciences
Fulda University of Applied Sciences
Institute of Economics and Social Sciences, Estonian University of Life Sciences
Institute of Economics by Latvian Academy of Sciences
Institute of Economics, Hungarian Academy of Sciences
Kaunas University of Technology
Latvia University of Agriculture
Latvian Academy of Agricultural and Forestry Sciences
Latvian Academy of Sciences
Latvian State Institute of Agrarian Economics
Lithuanian Institute of Agrarian Economics
Mendel University in Brno
Mykolas Romeris University
Poznan University of Economics
Professional Association of Project Managers
Research Institute of Agriculture Machinery, Latvia University of Agriculture
Research Institute of Biotechnology and Veterinary Medicine "Sibra"
Research Institute of Economics and Business
State Revenue Service of Latvia
Rezekne Higher Education Institution
Riga International School of Economics and Business Administration
Riga Technical University
Rural Support Service
School of Business Administration Turība
School of Business and Finance
Seinäjoki University of Applied Sciences
Tallinn University Institute of Political Science and Governance
Tartu University
University College of Economics and Culture

University of Latvia
University of Szczecin
Ural State Mining University
Valga County Government
Ventspils University College
Vidzeme University of Applied Sciences
Wageningen University
Warsaw University of Life Sciences
West Pomeranian University of Technology in Szczecin

The following topical themes have been chosen for the conference:

- Production and co-operation in primary and secondary agriculture
- Integrated and sustainable development
- Finance and tax
- Rural business economics and administration
- Resources and sustainable consumption

The comprehensive reviewing of submitted scientific articles has been performed on international and inter-university level to ensure that only high-level scientific and methodological research results, meeting the requirements of international standards, are presented at the conference. Every submitted manuscript has been reviewed by one reviewer from the author's native country or university, while the other reviewer came from another country or university. The third reviewer was chosen in the case of conflicting reviews. All reviewers were anonymous for the authors of the articles. Every author received the reviewers' objections or recommendations. After receiving the improved (final) version of the manuscript and the author's comments, the Editorial Board of the conference evaluated each article.

All the papers of the international scientific conference "Economic Science for Rural Development" are arranged into the three following thematic volumes:

No. 27 Integrated and Sustainable Development

No. 28 Rural Business and Finance **Rural Business Economics and Administration** **Finance and Tax**

No. 29 Resources and Cooperation **Resources and Sustainable Consumption** **Production and Cooperation in Primary and Secondary Agriculture**

The publishing of the Proceedings before the conference will promote exchange of opinions, discussions, and collaboration of economic scientists on the international level. The research results included into the Proceedings are available worldwide to any stakeholder.

The abstracts of the conference proceedings provided in English are submitted to the international databases:

Web of Knowledge, which is a unified platform, that integrates all data and search terms. It provides access to the world's leading citation databases, including powerful cited reference searching, the Analyse Tool, over 100 years of comprehensive backfile and citation data. *Web of Knowledge* also delivers access to conference proceedings, patents, websites, and chemical structures, compounds and reactions. While other databases simply aggregate data, *Web of Science* information is carefully evaluated and selected. This time-tested approach helps conserve an institution's resources and researchers' time by delivering access to the most relevant resources. *Web of Science* offers a true cited reference index, which is still the best tool for discovery and the only method of retrieving accurate citation counts.

AGRIS - International Information System for the Agricultural Sciences and Technology set up by the Food and Agriculture Organisation of the United Nations (FAO UN), and especially to the databases containing full research texts set up by the academic higher education institutions.

EBSCO Academic Search Complete is the world's most valuable and comprehensive scholarly, multi-disciplinary full-text database with more than 8,500 full-text periodicals, including more than 7,300 peer-reviewed journals.

CABI PUBLISHING CAB ABSTRACTS database. *CAB Abstracts* gives researchers instant access to over 6.3 million records from 1973 onwards, with over 300,000 abstracts added each year. Its coverage of the applied life sciences includes agriculture, environment, veterinary sciences, applied economics, food science, and nutrition. **CAB Abstracts** is a comprehensive bibliographic database that covers worldwide literature from all areas of agriculture and related applied and life sciences. Published by CAB International, a division of CAB International, CABA is the world's most comprehensive database in its field containing 5 million entries of which 95% are supported by abstracts. Starting from 2009, part of entries is available as full-text periodicals.

The Conference Committee and editorial Board are open to comments and recommendations for the development of future conference proceedings and organisation of international scientific conferences.

We would like to thank all the authors, reviewers, members of the Programme Committee and the Editorial Board as well as supporting staff for their contribution organising the conference.



On behalf of the conference organisers

Andra Zvirbule-Berzina

Associate professor of Faculty of Economics
Latvia University of Agriculture

Content

1. Resources and Sustainable Consumption

Artis Bronka, Andra Zvirbule- Berzina	<i>Energy Savings and Balanced Exploitation of All Energy Resources as an Integral Part for Achieving Sustainable Development</i>	14
Skaidrite Dzene, Aija Eglite	<i>Consumption Behaviour in Europe from Sustainability Perspective</i>	19
Barbara Freytag- Leyer, Aija Eglite	<i>Life Style in Households– Similarities and Differences Between Germany and Latvia</i>	25
Ingrida Kantike, Aija Eglite	<i>Consumer Behaviour in The Market of Wholegrain Products</i>	31
Zinta Lauva, Velta Basevica	<i>Causes of Long-Term Consumption and Popularity of Offers in Fast Food Companies</i>	37
Laura Lielgaidina, Janis Justs, Ineta Geipele	<i>Sustainable Roads: Effective Use of Resources</i>	41
Anastasija Vilcina, Raivis Andersons	<i>Analysis of Latvia Households' Consumption Expenditure During the Period of Economic Recession</i>	48

2. Production and Cooperation in Primary and Secondary Agriculture

Astra Asejeva, Nikolajs Kopiks, Dainis Viesturs	<i>Age Structure of Tractor Fleet in Latvian Agriculture</i>	58
Sallija Cerina	<i>Characteristics of Poultry Meat Production in The European Union Member States</i>	62
Inese Dirina, Veronika Bugina	<i>Development Assessment of the Beekeeping Industry in Latvia</i>	69
Monika Gebaska	<i>Economic Effects of Raising Animal Welfare Standards of Broilers on Polish Farms</i>	77
Barbara Golebiewska	<i>Intensity of Production Organisation in Farms with Diversified Relations to Their Environment in Poland</i>	84
Danute Jasjko, Zane Kantane, Erika Pancenko, Tatjana Ivanova	<i>Latvian-Turkish Economic Cooperation: Future Perspectives for Business Extension</i>	89
Pawel Kobus	<i>Modelling Distribution of Winter Wheat Yield in Poland</i>	96
Janis Ozolins	<i>Dairy Processing Development Scenarios in The Baltic States</i>	103

Irina Pilvere, Inga Sikunova	<i>Organic Livestock Industry and Its Development Possibilities in Latvia</i>	109
Irina Pilvere, Dzesija Zeiferte	<i>Milk Quotas: an Instrument of the EU Common Agricultural Policy for Market Stabilisation</i>	115
Liga Proskina	<i>Assessment of Deer Breeding Industry from the Viewpoint of Producers</i>	122
Linda Silina, Dzesija Zeiferte	<i>Assessment of Fruit-Growing Industry in Latvia</i>	128
Oskars Valainis, Andra Zvirbule- Berzina	<i>Optimisation of Grain Farms in Latvia</i>	134
Aleksandra Wicka	<i>Polish Agriculture Against Selected States of the European Union</i>	140

“ECONOMIC SCIENCE FOR RURAL DEVELOPMENT”

Proceedings of the
International Scientific Conference

RESOURCES AND COOPERATION

1. Resources and Sustainable Consumption

Energy Savings and Balanced Exploitation of All Energy Resources as an Integral Part for Achieving Sustainable Development

Artis Bronka¹, Mag.oec., PhD student; Andra Zvirbule-Berzina, Dr.oec., assoc. professor
Faculty of Economics, Latvia University of Agriculture

Abstract. In the history of human evolution, the acquisition and exploitation of energy resources can be relatively divided into two periods: from the beginnings of mankind to the Industrial Revolution, when on a global scale, the extraction processes of necessary energy was dominated by renewable energy resources; and from the Industrial Revolution to nowadays, when the extraction processes of the energy required by society are dominated by fossil fuels. It has to be pointed out that the intensive use of fossil fuels over many decades has been one of the main reasons, why the carbon dioxide concentration in the atmosphere reached so high level during the 1970s that many of the local environmental issues became regional and even global issues. This created a threat on the safety of humanity's development and welfare in the future, which, in turn, was one of the main reasons behind the formation of a sustainable development concept. The idea of global sustainable development or the "essential requirement" can be interpreted as providing a mutual harmony in the relationship between the society and the environment, economy and ecology, and technology and nature. To provide the necessary environmental quality (to limit the expulsion of anthropogenic in the atmosphere), the idea of sustainable development concept is directed at the rational and balanced exploitation of all available energy resources and their preservation.

Key words: sustainable development, energy sector, energy resources.

JEL code: Q47; Q54; Q56

Introduction

In the era of information technologies, the energy security – availability and adequacy (for reasonable economic expenses) – is an issue for every country's economic growth, quality of life, and national security. This can be verified by anyone, for example, by managing a period of time without the use of any electrical device, artificial lighting, heating, or air conditioning. This would be especially impossible during a particularly cold winter, and even during a hot summer, this would cause much discomfort (Johansson, 2011).

To attain different types of energy, the primary energy resources are necessary – identified fuel supplies and energy resources, which can be used directly or for attaining energy. Issues, related to the acquisition of primary energy resources and their use for public demand, are among the central issues on a local, regional, and even global scale. Hence, given that, the International Energy Agency anticipates that, in the near future, the global demand for energy will only increase, these issues become even more apparent, and simultaneously more strained (International Energy Agency, 2011).

The research chose the primary energy resource exploitation and sustainable development concepts interaction as the **research object**. In other words, the object of research covers the assessment of the impact between how the historic growth of power generation systems (the exploitation of different primary energy resources) affected the formation of sustainable development concept and what settings this concept provides for future power generation systems development. The research is confined by the **subject of research**, which provides the assessment of mutual implications between the exploitation of primary energy

resources and sustainable development concept, viewing it mainly from a point, covering harmful substances emitted into the atmosphere (mostly in the form of carbon dioxide).

The research aim: to evaluate the mutual influence of the exploitation of primary energy resources and sustainable development concept.

The research tasks:

- 1) to summarise the historical experience of the impact on the formation of sustainable development concept from exploitation of the primary energy resources;
- 2) to describe the setting of sustainable development concept with regard to the exploitation of primary energy resources in the foreseeable future.

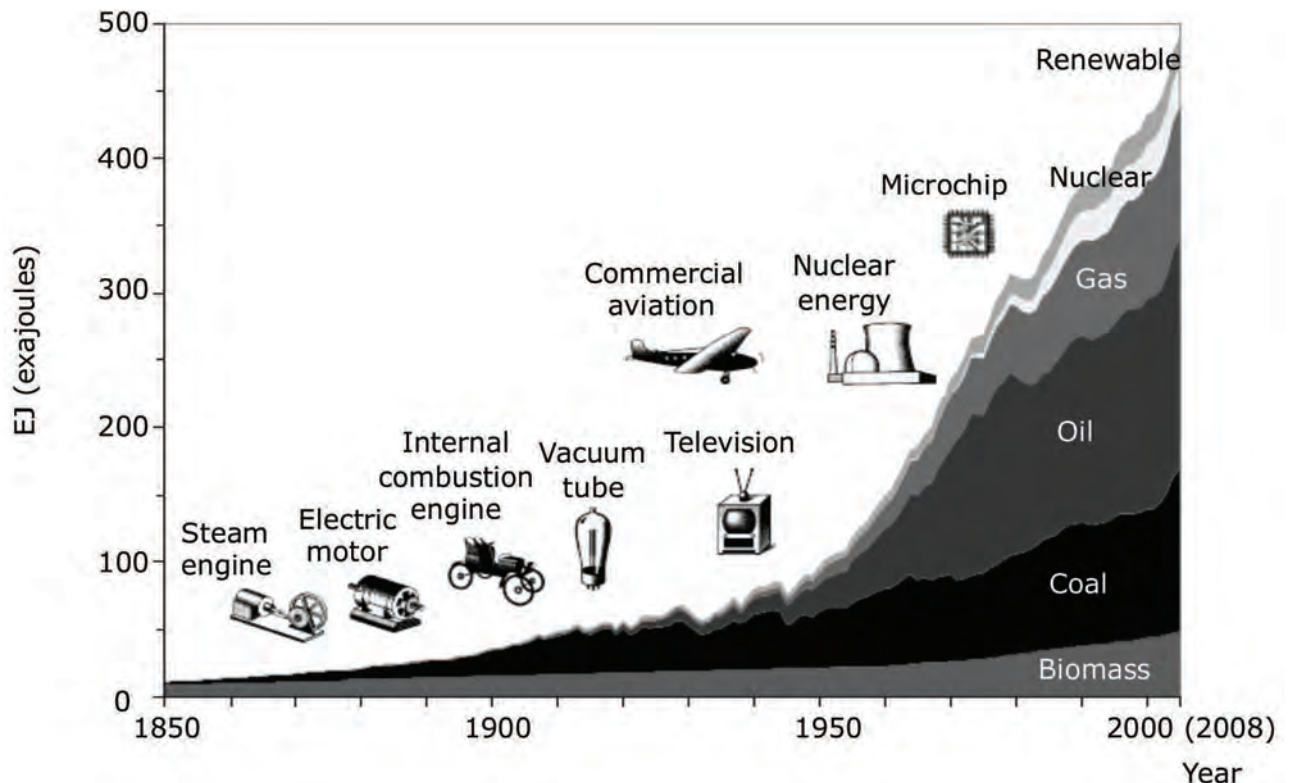
The research is theoretical, designed in 2011, and the description of the object under research, both overall and through parts of the object includes **research methods** such as analysis, synthesis, and monographic. The research was done based on research analysis carried out by academic and scientific staff (professional researchers) as well as information from some Internet sources.

Research results and discussion

1. The exploitation of primary energy resources and concept of sustainable development

During the period up to the Industrial Revolution, mankind secured the necessary energy mainly by using renewable energy resources (hereinafter – RES) such as biomass (wood, reed etc.), energy of wind, and water flow (hydro energy). The period of Industrial Revolution, when new and innovative technologies developed, pioneered the so-called fossil fuel era. Fossil fuels are such

¹ E-mail address: Artis_Bronka@inbox.lv



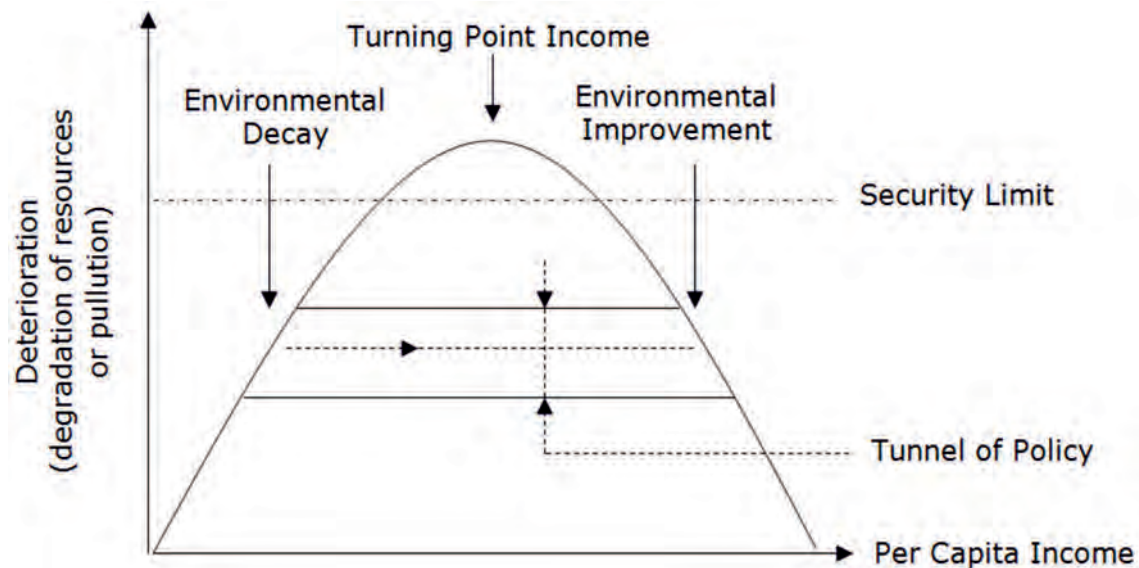
Source: Johansson, 2011

Fig. 1. World primary energy consumption (EJ (exajoules)) by fuel type from 1850 to 2008

caustobiooliths, which have formed from ancient plants and animals that lived millions of years ago (an assumption accepted by most scholars). After exploitation, these caustobiooliths can only recover over a very long period of time, this is the reason why fossil fuels are not included in the renewable energy resource group. During the early stages of the Industrial Revolution, an important part of the driving force became fossil fuels like coal, while in later years, it was replaced and supplemented by oil and natural gas. Fossil fuels (expressly oil) up to the 1970s were relatively inexpensive, readily available, and successfully integrated in industry and domestic application. Environmental and other external costs, which were associated with the acquisition and exploitation of fossil fuels of the surveyed time period, were considered as local issues. The exponential growth created by the combination of capital (the increase of material welfare) and increase in human population and scientific technical progress, came forward with the demand for both materials and energy, increasing the level of exploitation of energy resources (Figure 1). For example, around the 1970s, the Earth was already inhabited by the slightly more than 2.5 billion people who secured the necessary energy (for daily activities, industry etc.) mainly by the use of fossil fuels. Considerable acquisition of RES and the development of energy-utilising technology and, in turn, the increase in the exploitation of the very same RES for commercial purposes, since the beginning phase of Industrial Revolution had deceased in principle (Johansson, 2011 and National Energy Education..., 2011).

A presumption has even been established, dividing periods of human development by ages, to call the 20th century "the era of oil", because oil had been the most widely used energy resource (Figure 1) in the world. Only in the late 1960s and in the beginning of the 1970s, a notion of the real impact of the use of fossil fuels on the environment became clearer – the emissions of greenhouse effect creating gas (hereinafter – GHG) into atmosphere in large quantities, and the scope of this impact. At first, everyone should be aware that due to the natural greenhouse effect, the average global temperature is around 15 degrees Celsius, because these gases prevent the radiated heat from escaping into space. Accordingly, if the gas level increases, the radiation of heat into space is reduced, resulting in an increase in the average global temperature. These alterations, in turn, can result in dangerous climate changes, which are often also called anthropogenic global warming. The reason is human economic activity, resulting in increased GHG emission into the atmosphere via smoke and vapour (Klavs et al., 2010).

The largest share of total GHG emissions is constituted of carbon dioxide (hereinafter – CO₂). By burning both fossil fuels and biomass, the containing carbon increases the CO₂ emission. Biomass incineration emissions are reduced because it is perceived by the refurbished plant crops. In other words – carbon, accumulated in biomass, is already a part of the natural circulation, for example, wood expels the accumulated carbon naturally during the putrefaction process, and it is perceived by refurbished plant crops. So, if such fuel wood (and other biomass)



Source: Yandle et al., 2002

Fig. 2. Relationship between environmental quality and income per capita level – the so-called environmental Kuznets Curve

incineration processes are in balance with the refurbishing of crop, the atmospheric CO₂ concentration does not change significantly. Burning of fossil fuels on a large scale, can significantly upset the balance of atmospheric CO₂ concentration, because in the result of burning fossil fuels, the CO₂ cycle is not cyclic as it is in nature but it is linear – from the source to the waste, i.e. the CO₂, stored inside the Earth for about a million years, is returned to the nature (SIA "Vides projekti", 2005).

The situation with atmospheric CO₂ concentration changed dramatically after World War II, when technology advances, increase in human population, the creation of goods market, the development of chemical industry, and relatively low level of energy consumption efficiency markedly contributed to the conditions under which CO₂ only increased. The largest contribution to changes in atmospheric CO₂ concentration was the intensive use of fossil fuels for public purposes (the energy sector contributes about two-thirds of all GHG emissions) (Earth System Research ..., 2011).

During the 1970s, a situation had generally developed where many of the earlier environmental problems associated with local industrial pollution, were addressed by constructing higher chimneys or inserting loner wastewater discharge pipes, with a time lag had become from local problems to regional and even global problems (Earth System Research ..., 2011).

Gradually, in both the academic and political sphere, the strengthening of an understanding that the excessive use of resources (especially fossil fuels) has a negative impact on the environment and planet on a global scale. During the 1970s a comprehensive list of human development problems were identified and it was concluded that the exponential growth is starting to create a threat on the security and prosperity of all human development in the future. Already in the year 1980, the International Union for the Conversation of

Nature published the "World Conservation Strategy" (conditional primary source of sustainable development concept). This strategy was the basis for the formation of the United Nations World Commission on Environment and Development, which had to develop a global action plan, where the environmental protection objectives should be balanced (essentially isolated) with economic objectives (Mensah and Castro, 2004).

Carrying out the task, in the year 1987, the United Nations World Environment and Development Committee released a report "Our Common Future". This report has gone down in history as the first official document, which used the term "sustainable development", defining it as "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The many elements of sustainable development are usually divided into three dimensions or pillars – environmental, economic, and social. Here, the global sustainable development concept or "essential requirement" already emerges – to ensure harmony in the relationship between the society and the environment, economy and ecology, and technology and nature. Accordingly, the environment is the necessary foundation for sustainable development; economics is an instrument, while good life for all (on a social level) is the objective of sustainable development. From a historical perspective, economic development was seen as a target but the environment as an instrument – an unlimited source of resources (Mensah and Castro, 2004).

2. The concept of sustainable development and exploitation of primary energy resources

From the point of view, covering the regularities between the protection of the environment and growth of the economy, it is possible to assert that the sustainable development concept implies that environmental damage

has to be reduced by means of politics, as to comply with the theory of the country's influence on ecology or the so-called Simon Kuznets curve, it would not reach the critical point after which it should lower by itself (Figure 2) but it would be limited by the so-called "political tunnel" (Yandle et al., 2002).

Theoretically, based on the hypothesis of Simon Kuznets' inverted "U" shape curve between the capita income and environmental damage, a presumption exists that if the states reach a certain level of economic development (the primary needs are satisfied, but after comfort does not cause a rapid increase in the use of resources), they begin to acquire ecologically clean technologies, adjustments in the economy are made, and the preference for environmental quality is made, thus, reducing the negative impact on the environment and ecology made by these states (Yandle et al., 2002).

In parallel, it should be noted that the Simon Kuznets curve hypothesis is widely questioned in the academic literature. Thus, for example, in the year 2010, scientists from the University of Adelaide's Environment Institute conducted a study determining the relationship between the damage caused to the ecology by a particular state and this state's economic development. The scientists concluded: the more developed was a country, the more it destroyed natural resources. In essence, this conclusion is inconsistent with the theory of the states influence on ecology, but this fact does not change the position of sustainable development concept toward the environment – damage done to the environment has to be limited to a certain level in order to achieve a gradual reduction in later years, and in particular (essentially primarily) it relates to anthropogenic GHG emissions (Bradshaw et al., 2010).

Considering that RES are environmentally "friendly" and are CO₂ neutral, at first glance could lead to an erroneous assumption that the principle of sustainable development (Figure 2) implies only the use of RES. Such a presumption would be very wrong (at least for the current technological and economic conditions), because not without reason the use of fossil fuels has evolved so globally. In particular, an important aspect is the fuel composition and calorific value. Biomass is characterised by a low calorific value compared with fossil fuels. For example, wood chips, with 50% moisture content, have a calorific value around 2.35 MWh/t (megawatt hours per tonne), for coal it is about 7.73 MWh/t, while natural gas – around 9.35 MWh/m³ (megawatt hours per cubic meter). So, to achieve one MWh of energy, such wood chips are consumed almost 3.3 times more than coal and close to 4 times more than natural gas. An even greater difference arises when comparing calorific value per unit volume. For example, one m³ of coal produces 10 MWh to 12 MWh, while one m³ of wood chips – around 0.5 MWh to 0.7 MWh (almost 20 times less). This in turn significantly affects the fuel supply, transportation as well as technical and technological solutions in energy production, and equipment maintenance and other expenses (AS "Latvenergo", 2011).

Although, RES-using energy technologies become cheaper, the initial investment as a whole (each case will be unique) is still much higher than purchasing and installing energy technologies for fossil fuels used for commercial purposes. In this context, it should be

noted that the quality of life and welfare, and a globally competitive economic growth in any state is determined not only by secured energy but also the price of energy. At the same time, repeatedly pointing out that the global demand for energy is projected to increase in the near future. Therefore, it is important to maintain the exploitation of fossil fuels where energy is produced with highly efficient technologies, resulting in consumers being provided with relatively cheap and available energy (Klavs et al., 2010).

By acknowledging the above, it is possible to understand why the concept of sustainable development projects a prudent and rational utilisation of all energy resources, especially non-renewable and, where possible, replacing them with RES, rather than an immediate and comprehensive substitution of fossil fuels with RES. Accordingly, taking into account various considerations, the emphasis here is on the fact that the acquisition of more RES and use of energy systems over the coming decades is generally regarded as a parallel but still not a substitute for fossil fuels.

It is only logical that the matter of how the setting for reducing anthropogenic GHG emissions provided by sustainable development is taken into consideration with the continued use of fossil fuels. To justify that it is possible to comply with this setting, it is necessary to outline concisely the functions used to express the quantity of GHG emissions from energy system, the variables (Equation 1).

$$GHG = \frac{GDP}{POP} \times \frac{TPE}{GDP} \times \frac{TFOS}{TPE} \times \frac{GHG}{TFOS}, \quad (1)$$

where:

- GHG – total greenhouse gas emissions;
- POP – population;
- GDP – Gross Domestic Product;
- TPE – total primary energy supply;
- TFOS – total fossil primary energy supply.

Source: Klavs et al., 2010

Based on Equation 1, it is possible to identify the major anthropogenic GHG emissions reduction potential of energy systems on the national level. Assuming that the GHG emission reductions will not be carried out by reducing the population (variable POP) and economic activity or welfare (variable GDP/POP), there are three options remaining:

- the reduction of GDP's energy intensity (indicator TPE/GDP), or a reduction in primary energy consumption per GDP unit. Energy intensity varies by using more efficient technologies, accomplishing energy efficient measures (such as insulating of buildings) as well as with the shift in economic structure;
- the reduction of average GHG emissions on the used amount of fossil energy (indicator GHG/TFOS), by switching to fuels with lower carbon content per unit of energy (e.g. to natural gas) as well as by the use of carbon capture and storage technologies, and by the improvement of fossil fuels, by using non-fossil fuels;
- the reducing of primary amount of fossil energy in the total primary energy supply (indicator TFOS/

TPE), by greater use of non-fossil fuels (e.g. RES as well as nuclear energy) (Klavs et al., 2010).

Given that energy consumption directly affects economic development and quality of life, it is possible to assert that the primary reduction of GHG emissions should be carried out by activities that are directed at saving energy. Of course, this does not exclude the possibility of energy-saving activities integration in the field of common politics with rational use of all energy resources and the wider use of RES and/or environmentally clean fossil fuels as well as activities associated with carbon capturing and geological storing.

Conclusions, proposals, recommendations

1. In the history of human evolution, the acquisition and exploitation of energy resources can be relatively divided into two periods: from the beginnings of mankind to the Industrial Revolution, when, on a global scale, the extraction processes of necessary energy was dominated by renewable energy resources; and from the Industrial Revolution to nowadays, when, on a global scale, it is dominated by fossil fuels.
2. A reciprocal relation (or interaction) exists between the concept of sustainable development and the development of power generation systems: human evolution is impossible without securing the necessary energy, yet, at the same time, energy production and consumption creates a significant stress on the environment.
3. To provide the necessary environmental quality (to limit the expulsion of anthropogenic in the atmosphere), the idea of sustainable development concept is directed at the rational and balanced exploitation of all available energy resources and their preservation.
4. On a global scale, the existing power generation systems are not sustainable, the advancements towards sustainability, which include the use of energy in a manner, which does not jeopardise the safety of human evolution and wellbeing in the future, is one of the mankind's greatest and most pressing challenges.
5. Viewing it in point of fact, the introduction and compliance with sustainable development principles provides benefits not only for preserving the environment, but also opens up entirely new opportunities for the whole economy.

Acknowledgement

The publication has been supported by the European Social Fund (ESF) within the Project "Support for the Doctoral Studies Programme at Latvia University of Agriculture" (2009/0180/1DP/1.1.2.1.2./09/IPIA/VIAA/017) //No.04.4-08/EF2.D2.20'.

Bibliography

1. AS "Latvenergo". (2011). Energo forums (Energy Forum). Elektroniskais zurnals (Electronic Journal), Nr.3(31). Retrieved: http://www.latvenergo.lv/pls/portal/docs/PAGE/LATVIAN/EnergoForums1/EF_3_2011.pdf. Access: 3 December 2011 (in Latvian).
2. Bradshaw, C.J.A., Giam, X., Sodhi, N.S. (2010). Evaluating the Environmental Impact of Countries. Retrieved: <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0010440>. Access: 22 October 2011.
3. Earth System Research Laboratory. (2011). Trends in Atmospheric Carbon Dioxide. Retrieved: <http://www.esrl.noaa.gov/gmd/ccgg/trends/>. Access: 1 December 2011.
4. International Energy Agency. (2011). World Energy Outlook. Retrieved: http://www.iea.org/weo/docs/weo2011/executive_summary.pdf. Access: 2 December 2011.
5. Johansson, T.B. (2011). Global Energy Assessment. Retrieved: http://siteresources.worldbank.org/INTENERGY/Resources/335544-1232567547944/5755469-1239633250635/GEA_All.pdf. Access: 26 October 2011.
6. Klavs, G., Kundzina, A., Ozolins, J., Rekis, J. (2010). Atjaunojamo energoresusu izmantosana Latvijas ilgtspējīgas attīstības nodrošināšanai (Use of Renewable Energy Sources for Securing Sustainable Development of Latvia). Retrieved: http://www.sfl.lv/upload_file/2010%20gads/AER_petijums.pdf. Access: 6 December 2011 (in Latvian).
7. Mensah, A.M., Castro, L.C. (2004). Sustainable Resource Use and Sustainable Development: a Contradiction?!. Retrieved: http://www.zef.de/fileadmin/downloads/forum/docprog/Termpapers/2004_3b_Mensah_Castro.pdf. Access: 1 December 2011.
8. National Energy Education Development Project. (2011). Primary Energy Infobook. Retrieved: <http://www.need.org/needpdf/Primary%20Energy%20Infobook.pdf>. Access: 5 December 2011.
9. SIA "Vides projekti". (2005). A-Energija (A-Energy). Retrieved: http://www.videsprojekti.lv/faili/alternativa_energija.pdf. Access: 17 October 2011 (in Latvian).
10. Yandle, B., Vijayaraghavan, M., Bhattarai, M. (2002). The Environmental Kuznets Curve. Retrieved: <http://www.maclester.edu/~wests/econ231/yandleetal.pdf>. Access: 14 October 2011.

Consumption Behaviour in Europe from Sustainability Perspective

Skaidrite Dzene¹, Mg.oec.; Aija Eglite, Dr.oec.
Faculty of Economics, Latvia University of Agriculture

Abstract. Sustainable consumption nowadays is a very important scientific and political topic around the world as well as consumer behaviour, which is never losing its topicality on changing economic conditions. The aim of the paper is to analyse consumption patterns in Europe from sustainability perspective and compare them with consumer behaviour in Latvia. Consumer behaviour in 30 European countries (surveyed 5000 respondents) with particular emphasis on the questions including sustainable consumption aspects was analysed in the frame of the study of CONsumer BEhaviour ERasmus Network (COBEREN). The survey was based on Five-point Likert Scale and the results were analysed taking demographic parameters and countries as indicators of behavioural difference. The results of the survey show that positive attitude towards sustainable consumption strongly prevails over the unsustainable choices, thus, reflecting the gap between attitude and behavioural intention to purchase sustainable products.

Key words: sustainable consumption, consumer, behaviour, attitude.

JEL code: D120

Introduction

To live sustainably, the Earth's natural resources must be used at a rate at which they can be replenished. However, our consumer-driven society is putting enormous pressure on the planet. Unsustainable consumption and production patterns are increasingly affecting the natural environment, society, the economy, and business (European Commission, 2009).

Sustainable consumption concept calls for consumption patterns that conserve natural resources and ensure quality of life today without impairing the needs of future generations (Scholl G., 2011).

Promoting sustainable consumption requires improved understanding of consumer behaviour and attitudes. Consumers have different needs with respect to information, and their potential to be influenced by instruments and tools varies. Most consumers have a positive but passive view of sustainable consumption. Many variables should be taken into account, including income, age, biases, attitudes, and gender (OECD, 2008).

Sustainable consumption is based on a decision-making process that considers the consumer's social responsibility in addition to individual needs and wants (Vermeir et al., 2006).

In this study, sustainable refers both to the environmental (pollution, waste, resource use) and social (health, welfare) characteristics of products.

Thus, the **hypothesis** is that consumers in Europe have positive attitude towards sustainable consumption.

The **aim** of the paper is to analyse consumer behaviour in Europe from sustainability perspective and compare it with the situation in Latvia.

The following **tasks** are set to attain the aim:

- to describe the role of consumers in sustainable consumption issue, their behaviour and attitudes to sustainability;
- to analyse the determinants of consumer attitudes and behaviour in Europe and Latvia.

The empirical research builds on the survey of 5000 respondents in 30 European countries (Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, France, Finland, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia (180 respondents), Liechtenstein, Lithuania, Malta, the Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Sweden, Poland, Spain, Turkey, the United Kingdom), which was conducted in 2011 in the frame of the study of CONsumer BEhaviour ERasmus Network (COBEREN).

Consumer behaviour with particular emphasis on questions including sustainable consumption aspects was analysed in this study. The survey was based on Five-point Likert Scale and the results were analysed taking demographic parameters and countries as indicators of behavioural difference.

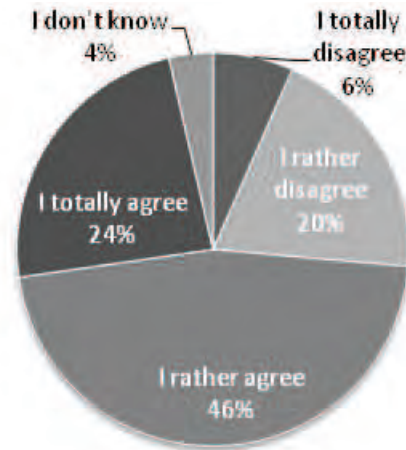
SPSS 13.0 for Windows (Chicago, IL) was used for statistical analysis. Categorical parameters were given with frequency and percent. Pearson's chi-squared (χ^2) test was used to search the differences between categorical variables. All statistical analyses with p value under 0.05 are assumed as statistically significant.

As the need for new patterns of consumption increases, so do efforts to understand consumer behaviour, with a more nuanced understanding beginning to emerge based on shared insights from a huge number of disciplines (Policy Studies Institute, 2006).

Everyday consumption practices are still heavily driven by convenience, habit, value for money, personal health concerns, hedonism, and individual responses to social and institutional norms and, most importantly, they are likely to be resistant to change (Vermeir et al., 2006).

Such habitual behaviour becomes problematic when our habits become so engrained that the effort needed to override them makes them difficult to overcome. This is particularly the case when our habits lead to personally (or environmentally) damaging behaviour, or when our habits prevent us adopting new beneficial behaviours (Jackson T., 2005).

¹ E-mail address: skaidrite.dzene@gmail.com



Source: authors' construction based on the calculations of survey results

Fig. 1. Respondents' answer to the question "I try to choose environmentally friendly products whenever I can"

However, breaking habits, or promoting the repeating of new processes and practices, is difficult but not impossible. One way of encouraging people to adopt new habits is to tap into 'moments of change', when they may be developing new patterns of behaviour anyway. These moments often coincide with key life transitions, for example, when people move house, have children or retire (Vermeir et al., 2006).

The Value-Belief-Norm theory of pro-environmental behaviour provides one of the strongest basis for analysing shifts in consumer behaviour towards sustainable consumption. This paper builds off of Schwartz's Norm Activation model (1977) and links it to the environmental value theory. The Value-Belief-Norm theory postulates that pro-environmental values, an awareness of the consequences of one's actions and an ascription of personal responsibility can lead to the acceptance of a new environmental paradigm. Through this process, an individual moves towards developing a personal norm for pro-environmental behaviour (Stern et al., 1999).

A positive attitude towards sustainable products is a good starting point to stimulate sustainable consumption. Several studies have concentrated on attitudes towards sustainability and sustainable consumption behaviour (sources are cited in details in Vermeir et al., 2006). In general, about 30% of the consumers have a positive attitude towards sustainable consumption (Vermeir et al., 2006).

However, attitudes alone are often a poor predictor of behavioural intention or marketplace behaviour (Ajzen, 2001).

How much do values and attitudes expressed in surveys tell us about sustainable behaviour? A gap between attitudes and action has been reported by numerous researchers. Vlek et al propose a model of consumption change, which suggests that action depends on a convergence of "needs", "opportunities", and "abilities" (Jackson, Michaelis, 2003).

Research findings also show that there is a widespread awareness of environmental problems and the majority of people recognise that their everyday behaviours contribute to these. Many people are willing to do a bit

more to limit their environmental impact, yet people have a much lower level of understanding about what they can do and what will make a difference (DEFRA, 2008).

According to recent studies of consumer attitudes on developed markets, the awareness of environmental and social issues is entering the mainstream: 96% of Europeans say that protecting the environment is important for them personally. Two-thirds of this group say that it is "very important" (European Commission, 2008).

As mentioned before, consumer willingness is not translating into sustainable consumer behaviour. A variety of barriers has been identified, such as availability, affordability, convenience, product performance, conflicting priorities, scepticism, and force of habit (WBCSD, 2008).

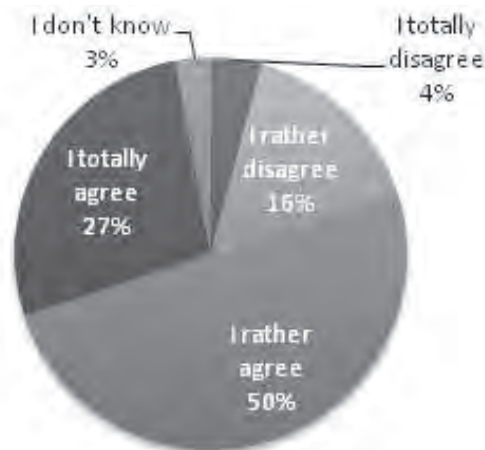
Research results and discussion

Demographic determinants are among the most essential objective determinants of consumer behaviour. They comprise age, gender, household size, stage of family life cycle, profession, education, race, and nationality among others. Despite the growing influence of social, cultural, and psychological determinants of consumer behaviour within the past decades, demographic determinants still remain essential variables characterising the consumer (Glowik, Smyczek, 2011). However, Diamantopoulos et al. (2003) concluded that demographics alone were not very significant in defining the socially responsible consumer because ethical concern and awareness have become widespread.

In this study, the survey results are mainly analysed from the perspective of demographic determinants.

Seventy per cent of 5183 respondents in 30 European countries have answered positive regarding the choice of environmentally friendly products (Figure 1), thus, showing an average result comparing with similar studies. The result in Latvia is exactly representing the result of Europe.

The study of the European Commission conducted in 2009 reveals that the majority of respondents in all EU



Source: authors' construction based on the calculations of survey results

Fig. 2. Respondents' answer to the question "I see myself as a health-conscious consumer"

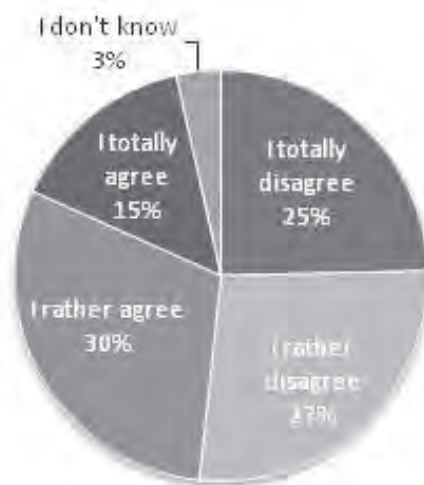
Member States and Croatia said that a product's impact on the environment was important in their purchasing decisions; only in three Member States, more than half of people had admitted this aspect as very important: Greece (58%), Cyprus (57%), and Italy (54%) (European Commission, 2009).

The authors have done χ^2 test to verify if there is a significant statistical difference between *gender*, *age*, *income*, and *occupation*. In all analysed categories $p=0.001$, thus, showing the existing difference between the factors. Women were more positive towards buying ecologically friendly products (72% - women, 66% - men); while men were more disagreeing with the statement (30% - men, 23% - women). Females and males over 38 years of age were more totally agreeing (21% - male, 30% - female) with the statement, while respondents of age 18-38 years were rather disagreeing (25%). Regarding occupation, the main difference was in the category "students" who rather disagreed to buy environmentally friendly

products (28%), i.e. more than 10% than in other categories.

Even income is found as one of the most important factors influencing sustainable consumption; yet, the share of this statement is not showing so sharp difference. The group with the lowest income (under EUR 200) displayed contradictory results – totally disagreeing (9%) and totally agreeing (26%) with the statement. One of the explanations could be related with self-production, which is mainly spread over low-income groups.

Health is one of the most important issues people are paying attention to; thus, they are ready even to change their embedded consumption patterns towards more sustainable ones. Health itself is one of the sustainable consumption indicators and motivators. European consumers are mainly seeing themselves as health conscious (Figure 2). The χ^2 test in all demographic categories has shown statistically significant difference ($p=0.001 - 0.005$). Between genders, the main difference was in totally agree unit, where women (especially over



Source: authors' construction based on the calculations of survey results

Fig. 3. Respondents' answer to the question "I go to farmers markets whenever I can"

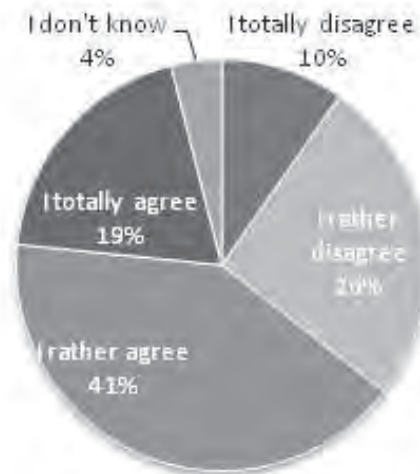
58 years of age) showed higher health consciousness (31%) as men (24%). In Latvia, the same difference between genders is noticeable. The least health conscious in the category "occupation" were the unemployed (29%) and students (25%), the employed and retired persons were below 20% in negative answers. Unexpected, yet, the respondents with the lowest income were most totally agreeing being health conscious (43%), while other groups were below 30%. However, totally positive answers in all income groups were over 75%. The results of Latvian respondents are fairly reflecting the average results of Europe.

Buying from farmers' markets is considered as sustainable behaviour, which includes two sustainability aspects – environmental (decrease of food miles) and social (support of local community). This statement is already showing the behaviour of consumers, while the previous ones are more about attitude. Therefore, the

results are not so optimistic anymore. More than half (52%) of respondents were denying to be the customers of farmers' markets (Figure 3). In Latvia, less people (16%) were totally disagreeing with this statement, while in Sweden, the Netherlands, Iceland, Austria, Germany, and Belgium, this ratio was from 40% to 50% with the total negative answer over 70%. This is closer to reality, since the majority of consumers in Europe are buying food at supermarkets. DnB Nord Latvia survey (DnB Nord Latvijas..., 2010) shows that only 7% of respondents are visiting farmers market, while 70% are purchasing goods at supermarkets.

In all demographic categories, the X² tests results showed statistically significant difference (p=0.001).

Male consumers were more disagreeing (55%) than females (49%) being the visitors of farmers' markets and the same negative answers (60-65%) were observed in the age group 18-38 years, which mainly includes



Source: authors' construction based on the calculations of survey results

Fig. 4. Respondents' answer to the question "I try to choose products that are made locally"



Source: authors' construction based on the calculations of survey results

Fig. 5. Respondents' answer to the question "Consumers should boycott products produced by irresponsible companies"

students (70%). The unemployed and retired persons were more totally agreeing with this statement (17% and 20%). In the same time, the people with high income (over EUR 3000) were among the ones who were not visiting farmers' markets (56%).

Purchasing of locally made products has the same sustainability dimension as visiting farmers markets. This supports local economics and decreases the pollution generated by transport sector. Since this statement again more shows the attitude and can be understood wider than the previous one, the results are more in favour of it; however, more than 1/3 of respondents are disagreeing with it (Figure 4) and in some countries like Denmark, the Netherlands, and Spain reaching even over 50% of disagreement. Here, the main influencing factor could be the price of the product, which has a greater importance in purchasing decision.

The χ^2 test is showing statistical significance between demographic determinants ($p=0.001 - 0.021$).

In per cents, the difference between genders is very small (3%) but greater difference is observable between the age groups - 18-38 years old persons were more than other age groups disagreeing with the statement. No significant difference between genders as well as the age groups (gender: $p=0.262$ and age: $p=0.182$) has been found for Latvia. Retired and employed persons were the ones who stated to buy local products (65%), while students (50%) disagreed. It can be explained by the price factor as well as values and beliefs of consumer groups.

Consumers should boycott products produced by irresponsible companies - is the statement reflecting the attitude and social aspect of sustainability. Although, studies are showing that ethical factors are only effectively taken into account by a minority of consumers (Vermeir et al., 2006), thus the results of survey are very optimistic, 76% of respondents agree to the statement (Figure 5).

It is reported across different research on environmental and non-environmental behaviour that responses of some people are affected by their sense of what is socially acceptable, such as what they think they should do or most people do, leading, for example, to over-claiming or agreement with a number of statements, which can be contradictory (DEFRA, 2008). This probably is the case, when people have chosen socially acceptable answer rather than their real behaviour.

The χ^2 test shows statistically significant differences for European countries in total ($p=0.001$) but no difference for Latvia ($p=0.801$).

In per cents, there is a small difference between gender, age, and income groups. Unemployed persons and students (22%) more than the employed and retired ones were disagreeing in boycotting the products of irresponsible companies.

Conclusions, proposals, recommendations

1. Seventy per cent of 5183 respondents in 30 European countries totally agree and rather agree to have positive attitude towards the choice of environmentally friendly products. This is an average result comparing with similar studies. The result in

Latvia is exactly representing the mean result of European countries.

- European consumers are mainly seeing themselves as health conscious, thus, outlining an indicator of growing awareness of sustainable consumption benefits and harm of unsustainable consumption patterns.
- More than half (52%) of respondents totally and rather disagreed to be visiting farmers' markets whenever it is possible. In economically wealthy countries (Sweden, the Netherlands, Iceland, Austria, Germany, and Belgium), about 40-50% of respondents *totally* disagreed with this statement; the joint negative answer being over 70%, i.e. closer to real consumers' behaviour, since supermarkets are still the choice of the mainstream. In Latvia, just 16% of respondents totally disagreed but in the same time, the other study shows that only 7% of respondents are visiting farmers markets, thus, indicating the existing gap between attitude and behavioural intention.
- Pearson's chi-squared (χ^2) test has shown in all questions statistically significant differences between all demographic categories, even though other sustainable consumption determinants as product price, values, and beliefs of consumer groups were showing the influence on the results.
- Seventy-six per cent of respondents agree to boycott products of irresponsible companies, thus, offering hope for the spread of more socially responsible and sustainable consumption patterns, already adopted or maintained by the minority groups.
- Although consumer attitude and information level towards sustainable consumption may be growing, sustainable product markets remain niche markets attracting consumers with a specific profile.

Bibliography

- Ajzen, I. (2001). Nature and Operation of Attitudes. *Annual Review of Psychology*, Volume 52, pp. 27-58.
- DEFRA - Department for Environment Food and Rural Affairs (2008). A Framework for Pro-Environmental Behaviours. *Report*. Retrieved: <http://www.defra.gov.uk/publications/files/pb13574-behaviours-report-080110.pdf>. Access: 28 December 2011.
- Diamantopoulos, A., Schlegelmilch, B., Sinkovics, R., Bohlen, G. M. (2003). Can Socio-Demographics Still Play a Role in Profiling Green Consumers? A Review of the Evidence and an Empirical Investigation. *Journal of Business Research*, Volume 56, Issue 4, pp. 465-480.
- DnB Nord Latvijas barometrs. (2010). Partikas produktu paterins. Retrieved: <http://www.dnb.lv/static/files/301.dnb-nord-latvijas-barometrs-24.pdf>. Access: 4 January 2012.
- European Commission. (2008). Attitudes of European Citizens towards the Environment. *Eurobarometer 295*. Retrieved: http://ec.europa.eu/public_opinion/archives/ebs/ebs_295_en.pdf. Access: 27 December 2011.
- European Commission. (2009). Smarter and Cleaner: Consuming and Producing Sustainably.

- Retrieved: http://ec.europa.eu/environment/eussd/pdf/brochure_scp.pdf. Access: 27 December 2011.
7. Glowik, M., Smyczek, S. (2011). *International Marketing Management Strategies, Concepts and Cases in Europe*. Oldenburg Wissenschaftsverlag GmbH. p. 323.
 8. Jackson, T. (2005). *Motivating Sustainable Consumption. A Review of Evidence on Consumer Behaviour and Behavioural Change. A Report to the Sustainable Development Research Network*. Retrieved: <http://www.c2p2online.com/documents/MotivatingSC.pdf>. Access: 5 December 2011.
 9. Jackson, T., Michaelis L., (2003). *Policies for Sustainable Consumption. A Report to the Sustainable Development Commission*. p. 77.
 10. OECD – Organisation for Economic Co-operation and Development (2008). *Promoting Sustainable Consumption. Good Practices in OECD Countries*. Retrieved: <http://www.oecd.org/dataoecd/1/59/40317373.pdf>. Access: 26 December 2011.
 11. Policy Studies Institute (2006). *Designing Policy to Influence Consumers: Consumer Behaviour Relating to the Purchasing of Environmentally Preferable Goods. A Project under the Framework Contract for Economic Analysis ENV.G.1/FRA/2006/0073 – 2nd*. Retrieved: <http://ec.europa.eu/environment/enveco/pdf/RealWorldConsumerBehaviour.pdf>. Access: 7 December 2011.
 12. Scholl, G. (2011). *What is Sustainable Consumption? Responder Input Paper*. Retrieved: <http://www.scp-responder.eu/pdf/knowledge/papers/RESPONDER%20input%20paper%20sustainable%20consumption.pdf>. Access: 2 January 2012.
 13. Stern, P.C., Dietz, T., Abel, T., Guagnano, G.A., Kalof, L. (1999). *A Value-Belief-Norm Theory of Support for Social Movements: The Case of Environmentalism. Human Ecology Review*, Volume 6, Issue 2, pp. 81-97.
 14. Vermeir, I., Verbeke, W. (2006). *Sustainable Food Consumption: Exploring Consumer "Attitude – Behavioural Intention" Gap. Journal of Agricultural and Environmental Ethics*, Volume 19, pp. 169–194.
 15. WBCSD - World Business Council for Sustainable Development. (2008). *Sustainable Consumption Facts and Trends: From Business Perspective*. Retrieved: <http://www.wbcsd.org/pages/edocument/edocumentdetails.aspx?id=142&nosearchcontextkey=true>. Access: 20 December 2011.

Life Style in Households– Similarities and Differences Between Germany and Latvia

Barbara Freytag-Leyer, Dr. Socio-ecology of Private Households, professor

Department Nutritional, Food and Consumer Sciences, Fulda University of Applied Sciences, Germany

Aija Eglite, Dr.oec., assoc. professor

Department of Economics, Latvia University of Agriculture, Latvia

Abstract. A starting basis using one home economic view of the lifestyle of private households is applied to make comparisons in Germany and Latvia based on statistical data. External conditions, wider living environments, and developments within the household are compared, if comparable data are available. Similarities and differences in lifestyle in Germany and Latvia can be determined on the level of private households. Regional household analyses would be required to analyse the impact on private households and the financial management more closely. Sufficiently comparable data for wider living environments shall be in existence. New regional household analyses should be developed for these purposes.

Key words: private households, regional differences, statistical data, regional household analysis.

JEL code: D12

Introduction

The article is based on the sciences of Home Economics. "Its historical origins place Home Economics in the context of the home and household, and this is extended in the 21st century to include wider living environments as we better understand that the capacities, choices and priorities of individuals and families impact on all levels, ranging from the household, to the local and also the global (local) community" (IFHE, 2011, p. 41).

The aim of the article is the comparison of the lifestyle in households in Germany and Latvia in selected aspects.

The context and some of the wider living environments are analysed from the Home Economics view. It is not possible to analyse all influencing factors.

The following questions were at the centre of focus. How have the conditions changed? Are there similar trends or differences in German and Latvian households in terms of household size and household composition, expenditure patterns, of time use, and in the detectability? What differences could be justified? Are there comparable data sources?

Materials and Methods

Statistical data from the EU as well as various German and Latvian institutions were used for the comparison. With regard to the time use, there is no newer and representative data of both countries available.

Although, the data sources are not always comparable due to different statistical databases, there are recognisable trends.

Research results and discussion

Employment/ Unemployment

Both countries have experienced the economic recessions in 2002 and 2009, albeit to varying degrees. The statistics do not show all the consequences. The employment rate of persons aged 15-64 years in both countries has increased between 1999 and 2008 (Table 1).

However, differences between the genders and age groups are determined. Thus, in Germany the employment rate among men has increased by nearly 3% and nearly 9% among women from 1999 to 2009, while in Latvia, the percentage among men has decreased by approximately 3% and increased by 7% among women. Very sharp increases are detectable in both countries among older workers between 55 and 64 years (DE 18.4%, LV 16.6%) (Table 2).

However, in Germany the percentage of part-time employees who are often women has increased tremendously by 7.1% from 1999 to 2009, while in Latvia, a contrary trend can be detected with a 3.2% decline (Table 3).

The unemployment over ten years from 1999 to 2009 shows both countries have very different developments. In Germany, the highest unemployment rate was 10.7% in 2005, which came after a relatively continuous increase. Thereafter, a continuous decline followed. Latvia has had a relatively continuous decline between 1999 (14%) and 2007 (6.0%). Then, an extreme increase followed to 17.1% in 2009 (Table 4).

While in Germany the unemployment rate among men (2.3%) and women (2.2%) declined, in Latvia men were affected by a sharp increase (9.7%), while women to a much lesser extent (3.7%). It is particularly striking in Latvia, where the percentage of unemployment among young people under 25 years is 33.6%, while in Germany it is 10.4%, yet, it is still higher than the average rate of 7.5% (Table 5).

Furthermore, it should be noted that the unemployment rate is regionally very different in the two countries. Thus, in Germany, the rate, especially in the Eastern federal states (former GDR), is much higher than in many Western states.

Demographic changes

The demographic development in Germany is running at a lower total population of barely 82 million today up to 65 to 70 million in 2060, according to

Table 1

Employment rate, age group 15-64 in 1999 and 2009 (%)

	1999	2009
Germany	65.2	70.9
Latvia	58.8	60.9

Source: *Europe in Figures...*, 2011, p. 235

Table 2

Employment rates for selected population groups in 1999 and 2009 (%)

	Males 1999	Males 2009	Females 1999	Females 2009	Older workers (55-64), 1999	Older workers (55-64), 2009
Germany	72.8	75.6	57.4	66.2	37.8	56.2
Latvia	64.1	61.0	53.9	60.9	36.6	53.2

Source: *Europe in Figures...*, 2011, p. 236

Table 3

Persons working part-time having another job as a proportion of total employment in 1999 and 2009 (% of total employment)

	Persons working part time, 1999	Persons working part time, 2009	Persons having another job, 1999	Persons having another job, 2009
Germany	19.0	26.1	2.5	3.7
Latvia	12.1	8.9	4.7	4.6

Source: *Europe in Figures...*, 2011, p. 240

Table 4

Unemployment rate, 1999-2009 (%)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Germany	8.2	7.5	7.6	8.4	9.3	9.8	10.7	9.8	8.4	7.3	7.5
Latvia	14.0	13.7	12.9	12.2	10.5	10.4	8.9	6.8	6.0	7.5	17.1

Source: *Europe in Figures...*, 2011, p. 246

Table 5

Unemployment rate by gender and age, 2004-2009 (%)

	Males 2004	Male 2009	Female 2004	Female 2009	< 25 years 2009	25-74 years 2009
Germany	10.3	8.0	9.1	6.9	10.4	7.1
Latvia	10.6	20.3	10.2	13.9	33.6	14.9

Source: *Europe in Figures...*, 2011, p. 248

the 12th coordinated population forecast. In the coming decade, the population will also age rapidly, especially the very old (Federal Statistical Office, 2009, p. 14).

In both countries, the percentage of 0 to 14 year olds has decreased in the year 2009 and is almost the same (DE 13.6%, LV 13.7%), while the percentage of 15-64 year olds in Latvia with 69% is higher than in Germany (66%). This is due to the earlier higher birth rate in Latvia. The percentage of 0 to 14 year olds in 1990 amounted to 21.4% (DE 16.0%) (Table 6).

In Germany, the population is declining, but an increase in the total number of households including smaller households can be detected in the past eight years. Meanwhile in 2010, one and two person households

had a share of 74.4% versus 70.4% in 2002 (Table 7). A continuation of the trend for decreasing total population is expected. In Latvia, a slight increase in one, two, and three-person households is detectable, while four or more person households have decreased (Table 7).

The marriage rate has declined steadily in both countries, in Germany having a very continuous decline of a somewhat lower level (EN 1960 9.5%, LV 11.0%), while in Latvia a higher level was maintained until the end of Soviet times. Married persons in the Soviet times had more social advantages due to family policy in the Soviet Union and stricter social norms in the society. In 2009, percentages are similar in both countries (Table 8).

Table 6

Population age structure by major age groups, 1990-2009 (%)

	0-14 years old 1990	0-14 years old 2009	15-64 years old 1990	15-64 years old 2009	65 years old or over 1990	65 years old or over 2009
Germany	16.0	13.6	69.2	66.0	14.9	20.4
Latvia	21.4	13.7	66.7	69.0	11.8	17.3

Source: *Europe in Figures...*, 2011, p. 118

Table 7

Households in Germany and Latvia, 2002 and 2010

	2002 Germany	2010 Germany	2002 Latvia	2010 Latvia
Total	38,720 (thousand)	40,301 (thousand)	No data	No data
1 – person Household	36.7%	40.2%	23.5%	25.2%
2 – person Household	33.7%	34.2%	30.4%	33.0%
3 – person Household	14.2%	12.6%	22.8%	22.0%
4 – person Household	11.1%	9.5%	15.1%	12.7%
5 or more persons	4.2%	3.4%	8.3%	7.1%

Source: *Data Report 2011...*, 2011, Band 1; *Statistical Yearbook 2010*, p. 46.; *Majsaimniecību budžetu apsekojuma...* 2011, p. 8.; *Zinojums par majsaimniecību...* 2003, p. 8.

Table 8

Crude marriage rate, decades from 1960 to 2000 and 2009 (per 1,000 inhabitants)

	1960	1970	1980	1990	2000	2009
Germany	9.5	7.4	6.3	6.5	5.1	4.6
Latvia	11.0	10.2	9.8	8.9	3.9	4.4

Source: *Europe in Figures...*, 2011, p. 131

Table 9

Crude divorce rate, decades from 1960 to 2000 and 2009 (per 1,000 inhabitants)

	1960	1970	1980	1990	2000	2009
Germany	1.0	1.3	1.8	1.9	2.4	2.3
Latvia	2.4	4.6	5.0	4.1	2.6	2.3

Source: *Europe in Figures...*, 2011, p. 132

With the divorce rate in 2009, there is an ascertainable percentage equal to 2.3% in both countries, while in Germany, there has been a steady increase but in Latvia, there was an increase over the decades to 5% in 1980 and then a decline (Table 9).

The birth rate in both countries has fallen below the EU average in recent years, although the rates have risen again slightly with Latvia having an even greater percentage than Germany (Table 10). In Germany, regional differences between East and West Germany are distinguished. Thus, West German women with higher education have fewer children than East German women with higher education (Federal Statistical Office, 2011, p. 43). In Latvia, this trend has come about through a new family policy and good economic situation at that time (Table 10).

However, the percentage of children who are born outside a marriage has risen in both countries

approximately continuously, albeit differently. In 2009, the share was at 32.7% in Germany and 43.5% in Latvia. Different religious ties in the countries are an important factor of influence (Table 11).

Household expenditure

Generally, there are differences between the income and the consumption expenditure of households in both countries and in regions within the countries. The economic development of regions within a country may also diverge, and thus, lead to differences even in the country (EU, 2010, p. 80).

Here, for simplicity reasons, only the expenditures of households are compared for one year. It should be noted that in Germany in 2008 the average living space was 42.2 m² per person in an apartment size of 86.4 m². In the old states, it was 42.9 and 90.2 m², and in the new states and Berlin 39.3 and 73.2 m². In 39 million

Table 10

Total fertility rate, 2003 and 2008 (live births per woman)

	2003	2008
Germany	1.34	1.38
Latvia	1.29	1.44
EU-27	1.47	1.56 (2007)

Source: *Europe in Figures...*, 2011, p. 137

Table 11

Live births outside marriage, as percentage of total live births, decades from 1960 to 2000 and 2009 (%)

	1960	1970	1980	1990	2000	2009
Germany	7.6	7.2	11.9	15.3	23.4	32.7
Latvia	11.9	11.4	12.5	16.9	40.3	43.5

Source: *Europe in Figures...*, 2011, p. 133

Table 12

Structure of consumption expenditure (%) in Germany and Latvia, 2008

	Germany	Latvia
Housing, water, electricity, gas, and other fuels	32.6	11.9
Transport	14.6	14.6
Food, alcoholic beverages, tobacco	14.3	25.6
Recreation and culture	11.4	8.3
Furnishings and household equipment	5.0	6.2
Restaurants and hotels	5.0	5.5
Clothing and footwear	4.7	7.8
Health	4.2	4.8
Communication	2.9	4.6
Education	0.9	1.4
Miscellaneous goods and services	4.4	6.1

Source: *Data Report 2011...*, 2011 p. 139; *2008.gada majsaimniecibu...*, 2009 p. 27

apartments, 43% are self-occupied, and 57% are rented apartments (Scheibelhuber, 2010, p. 182).

In Latvia, the average living area in 2008 was 27.0 m² (2009, it was 27.2 m²) per person (<http://data.csb.gov.lv/Dialog/Saveshow.asp>). Sixty-six and a half percent of the population lives in flats in Latvia. The share of persons living in flats and the overcrowding rate were the highest in Europe (EU, 2011, p. 280-281). In Germany, 24.7% of the population spent more than 40% of their disposable income on housing (EU, 2011, p. 281). In 2008, in Germany, the largest expenses (32.6%) were for housing, heating, etc., while expenses for food, beverages, and tobacco products accounted for only 14.3%, whereas in Latvia the expenditure for food had the highest share with 25.6%, while expenses for housing, heating etc. barely made up 12%. Other expenditure shares are similar or different by no more than 3%.

Time Use

The allocation of time to paid and unpaid time differs between the two countries. Men in Latvia achieve five paid hours more than in Germany. Therefore, men in

Germany work about seven more unpaid hours. In addition, the Latvian women work by 6.5 more paid hours than the German women, making for the unpaid labour of the German women about 6 hours more than the Latvian women.

With approximately 10 hours, the differences in paid work between men and women in both countries are almost identical, and the differences in unpaid work are similar. On average, the amount of hours for paid work in Latvia is higher than in Germany and the reverse applies for unpaid work (Table 13). The average working hours are longer in Latvia; thus, there is less time for household and volunteer work.

If one considers the unpaid work by field of employment, it is particularly striking that the Latvian men participate to a greater extent (LV 59%) than German men (DE 46%) in the house and yard work. However, the German men's participation in the procurement of household goods (DE 26%, LV 14%) is much higher. With care and support, the percentage share in both countries is higher for women than men, but among Latvian women it is 15% and only 10% among German women.

Table 13

Paid and unpaid work per one week 2001/2002 in Germany, Latvia 2003 (in hours)

	Paid Work		Unpaid Work	
	Latvia	Germany	Latvia	Germany
Men	27.55	22.5	12.06	19.5
Women	18.58	12	25.09	31
Total	23.04	17	19.12	25

Source: *Wo bleibt die Zeit? 2003, p. 9; authors' calculations based on Time Use of..., 2005*

Table 14

Unpaid work based on work field in % 2001/2002 in DE, 2003 in LV

	House and yard work	Craft activities	Procurement, household organisation	Care/Support	Voluntary/Informal work
Men DE	46	10	26	7	12
Women DE	63	1	20	10	6
Men LV	59	13	14	3	11
Women LV	53	8	17	15	8

Source: *Wo bleibt die Zeit? 2003, p. 10; authors' calculations based on Time Use of..., 2005*

In Germany, nursing care insurance makes it possible for a certain degree of relief in the care of nursing in private households. Latvian women have, thus, with 8% a substantially higher portion in skilled jobs (LV 8%, DE 1%).

Discussion

Private households in Germany and Latvia are substantially affected by political, economic, and demographic factors. The reunification was drastic for Germany, as was the transition from the Soviet Union to the free market with the impact on economic thinking and everyday decisions for Latvia.

Both countries felt the impacts of the economic crises and demographic changes. Germany tries to manage inflows of migrants from other countries by offering family support services, and Latvia also has family support and incentives to keep the population in the country. However, it is difficult to reduce the high percentage of unemployed youth in the current economic situation.

In Germany, the aging takes a greater extent than in Latvia. Regional differences in the infrastructure and the employment opportunities have been identified in both countries.

Private households in both countries shall be ready with these conditions and shall react accordingly in their financial management. In Germany, households will be assisted by an extensive social network but in Latvia, this is done to a much lower extent. This results in Latvia having a small increase of smaller households, despite both countries having almost the same low birth rates. In addition, bigger households in Latvia have a higher percentage than in Germany. Expenditure situations differ due to the better economic situation in Germany. The high expenditure shares for housing in Germany are due to the much larger living space/person. The living space/person in Latvia is the lowest in Europe. The high youth

unemployment does not imply that young people move to live with the parents. The share of food expenditures, in contrast to Germany, represents the largest single expense in Latvia.

Gender-specific differences are detectable in the use of time as with the working conditions. Men, in particular, have suffered in Latvia due to changes in the economic structure of unemployment.

The European Union has collected and analysed data of the households, employment and social changes generally. The data sources are partly comparable for special questions, for example, the time use in households or regional aspects.

Conclusions, proposals, recommendations

Private households in both countries are the smallest social units. Both countries have reacted to various changes with flexibility and apply continuous adjustments. Statistical data make these comparisons possible. Particularly, extensive data are available on the EU level. In addition, in regional terms, data are available but they are insufficient. However, in order to assess more accurately the impact on individual households and lead to deeper comparisons of households, regional household analysis would be required, which shall be based on comparable data for wider living environments. New regional household analysis should also be developed for these purposes.

Bibliography

- 2008.gada majsaimniecību budzetu petijumu galvenie rezultati. (2009). Latvijas Republikas Centrālā statistikas pārvalde (CSB). Rīga., 27. lpp.
- Data Report 2011 – A Social Report for the Federal Republic of Germany (Ein Sozialbericht für die*

- Bundesrepublik Deutschland). (2011). Federal Statistical Office et al. *Bonn, Band 1 and 2*. Retrieved: <http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Querschnittsveroeffentlichungen/Datenreport/Downloads/Datenreport2011,property=file.pdf>. Access: 27 December 2011.
3. *Europe in Figures- Eurostat Yearbook 2011* (2011). European Union. Luxembourg.
4. Jaundzimušo paredzamsais muza ilgums (dzīves ilgums) *b.g.* Retrieved: <http://www.csb.gov.lv/statistikas-temas/iedzivotaji-galvenieraditaji-30260.html>. Access: 16 December 2011.
5. Latvia Population. Retrieved <http://www.tradingeconomics.com/latvia/population> Access: 16 December 2011.
6. Latvijas iedzīvotāju skaits pasvaldības (pagastu dalījuma). Retrieved <http://www.pmlp.gov.lv/lv/statistika/iedzivotaju.html>. Access: 16 December 2011.
7. Mājsaimniecību budžetu apsekojuma galvenie rezultāti 2010. gada (2011). Latvijas Republikas Centrālā Statistikas pārvalde (CSB). Rīga, 8. lpp.
8. *Migration Report 2010 – Key Findings*. (2010). Federal Office for Migration and Refugees (Bundesamt für Migration und Flüchtlinge). Retrieved: http://www.bamf.de/SharedDocs/Anlagen/DE/Downloads/Infothek/Forschung/Studien/migrationsbericht-2010-zentrale-ergebnisse.pdf?__blob=publicationFile. Access: 27. December 2011.
9. *Pocketbook: Germany*. (2009). Federal Statistical Office, Wiesbaden.
10. *Population Development in Germany until 2060. (Bevölkerungsentwicklung in Deutschland bis 2060)* Federal Statistical Office, Press Conference (9 March 2011) on 18 November 2009 in Berlin. Retrieved: http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Presse/pk/2009/Bevoelkerung/bevoelkerungsentwicklung2009__Uebersicht,templateId=renderPrint.psml. Access: 27 December 2011.
11. *Position Statements UN Millennium Development Goals 2011*. (2011). IFHE (International Federation for Home Economics), Bonn.
12. Scheibelhuber, O.(2010). *Government Housing Policy (Wohnungspolitik des Bundes)*. in: Facets of Living, publ. (Facetten des Wohnens, hrsg.) from the Household and Living Committee of the German Society of Home Economics (Fachausschuss Haushalt und Wohnen der Deutschen Gesellschaft für Hauswirtschaft). Baltmannsweiler, pp. 182-186.
13. *Time Use of the Population of Latvia* (2005). Central Statistical Bureau of Latvia (CSB). The Statistical Data Collection. Rīga.
14. Where did the Time Go? (Wo bleibt die Zeit?) (2003). Federal Ministry of Family, Senior Citizens, and Youth (BMFSFJ), Federal Statistical Office of Germany. Wiesbaden.
15. Zinājums par mājsaimniecību budžetu pētījumu rezultātiem 2002. gada. (2003) Latvijas Republikas Centrālā Statistikas pārvalde (CSB). Rīga, 8. lpp.

This research has been prepared within the framework of the ESF Project „Formation of the Research Group in Food Science”, Contract Nr. 2009/0232/1DP/1.1.1.2.0/09/APIA/ VIAA/122

Consumer Behaviour in The Market of Wholegrain Products

Ingrida Kantike¹, M.Sc. (Economics), researcher
Aija Eglite, PhD, associate professor
Faculty of Economics, Latvia University of Agriculture

Abstract. One of the basic values of healthy diet is wholegrain products, to the consumption of which large attention has been paid over the recent 10 years. The supply of wholegrain products sharply rose in the world over the recent decade. The research aim is to ascertain the behaviour of consumers on the market of wholegrain products. The method of questionnaire survey was employed in the research. Latvian consumers were surveyed and the survey result was compared with the behaviour of consumers of European countries. The highest share of permanent consumers of wholegrain products was observed in Finland and Latvia, where they accounted for 69% of the total number of individuals surveyed. The number of permanent consumers of wholegrain products reached 57% in Great Britain, 46.8% in Germany, and only 36.6% in Italy. Of the Latvian consumers, 50% believed that wholegrain products were tasty and healthy, and only 15% of the respondents believed that wholegrain products were rich in fibre, which was the basic motivation of consumers in the entire world for consuming wholegrain products. The most popular wholegrain products in Latvia were wholegrain bread and breakfast cereals.

Key words: wholegrain products, consumers, consumption.

JEL code: D03, D12

Introduction

More and more attention has been paid to healthy diets for humans over the recent decades. Consumption of wholegrain foods has been associated with a decreased risk of cardiovascular disease and certain cancers, favourable effects on blood lipids and glucose, improved insulin resistance, and higher intakes of dietary fibre and micronutrients (Franz 2006; McKeown 2002; Jacobs 1998). Finnish scientists, in cooperation with other European scientific institutions within the HEALTHGRAIN project, conducted research on whole grains and their products. One of the research directions was also consumer studies in Finland, Great Britain, Germany, and Italy. The research result showed that wholegrain products were the most popular among consumers in Finland and Great Britain, while Italian and German consumers were much more reluctant to consuming wholegrain products (Saba, 2010; Dean, 2007; Arvola, 2007). In Latvia, too, studies on consumer attitude to wholegrain products were done within an EU project* (Kantike I., Eglite A., 2011). Studies on the role of dietary fibre (wholegrain component), which is very important if following various diets, in everyday diets of humans (Slavin J., 2005) were performed in the United States of America as well. The Italian National Research Institute for Food and Nutrition, under the guidance of Marina Carcea, conducted a research on the effect of wholegrain products on the cholesterol level in patients whose cholesterol level was high. When reporting on research findings at the international congress "Flour – Bread'11" in Croatia, Marina Carcea, the president of the International Association for Cereal Science and Technology (International Association..., 2012) emphasised that positive results were already observed after a two-week period after completing a blood test on patients. The test showed that the

cholesterol level in the blood of patients decreased after they had consumed wholegrain products (Carcea, 2011). A diet that is rich in fibre plays an important role not only in reducing the cholesterol level but also in losing excessive weight. To lose weight, one of the basic diets is a low-calorie diet but one of the ways of balancing foods so that no feeling of starvation is felt, is the consumption of wholegrain products that provide the feeling of satiety after a small quantity of such products have been eaten. The feeling of satiety is caused by dietary fibre, and dietary fibre also slows down absorption of glucose by blood, which is important to diabetic patients (Whole Grain and Health..., 2006).

The research object is consumer behaviour in the market of wholegrain products.

The aim of the research paper is to assess the behaviour of consumers of wholegrain products and its effect on the consumption of wholegrain products.

The research tasks of the paper are as follows:

- 1) to develop a definition of whole grains;
- 2) to investigate trends in the consumption of wholegrain products in the world;
- 3) to ascertain consumer behaviours regarding wholegrain products in various countries.

The following research methods were employed in the present research: questionnaire survey, analysis and synthesis, the logical and constructive methods, and the monographic or descriptive method.

Within the EU project*, a survey of consumers on their motivations and attitudes to wholegrain products was conducted in 2010. A questionnaire was worked out for this survey. The questionnaire consisted of 8 basic questions and additional information on a respondent's age, gender, education, and occupation. Young individuals aged 18-20 were chosen for a target group, and they accounted for 73% of all respondents. The

¹ E-mail address: Ingrida.Kantike@llu.lv.

Table 1

Increase in kinds of new wholegrain products in the world in 2000-2011

	Number of kinds of new wholegrain products	Increase against 2000, %	Annual increase, %
2000	164	-	-
2001	264	61	61
2002	321	96	22
2003	417	154	30
2004	674	311	62
2005	855	421	27
2006	1601	876	87
2007	2262	1279	41
2008	2883	1658	27
2009	3006	1733	4
2010	3272	1995	9
2011 (August)	1538	-	-

Source: Whole grain statistics 2000-2011

number of respondents was 254. Data of questionnaires were processed and analysed by means of the SPSS software.

Research results and discussions

1. Whole grains and the consumption of wholegrain products in the world

Scientific literature contains a lot of discussions on which kinds of grain are whole grains, and, therefore, the International Association for Cereal Science and Technology has developed a definition, supplemented with all explanations, for whole grains, so that anyone – a consumer, businessman, or scientist – can have a common understanding of whole grains. Whole grains shall consist of the intact, ground, cracked or flaked kernel after the removal of inedible parts such as the hull and husk. The principal anatomical components – the starchy endosperm, germ and bran – are present in the same relative proportions as they exist in the intact kernel. Small losses of components – i.e. less than 2% of the grain/10% of the bran – that occur through processing methods consistent with safety and quality are allowed. Removal of the very outer bran layer – up to 10% of the bran or 2% of the grain – is acceptable for minimising levels of undesirable substances such as bacteria, moulds, agrochemicals, and heavy metals.

While developing the definition, the kinds of grain, which may be regarded as whole grains were identified, and they were as follows: wheat, rice, barley, maize, rye, oats, millet, sorghum, triticale, Canary seed, amaranth, buckwheat, and quinoa (Whole Grain Definition, 2010). In Latvia, in the survey conducted within the EU project, totally 91% of the respondents said that they knew what wholegrain products were; whereas later, after being familiarised with the definition of whole grains, they admitted that they were not completely aware of the definition of whole grains, while 15% admitted that they had heard of the definition of

whole grains for the first time (Kantike I., Eglite A., 2011).

According to the Whole Grains Council's information on wholegrain products in the world (in the United States of America and 22 other countries: Canada, Great Britain, Ireland, New Zealand, Australia, Mexico, China, Brazil, and other South American countries) as of August 2011, approximately 5800 kinds of wholegrain products were produced (Whole Grain Statistics, 2011). The largest consumer of whole grains is the United States of America. The information, provided by the Whole Grains Council, on wholegrain products is presented in Table 1, which indicates a sharp increase in the number of kinds of wholegrain products. The largest increase was observed in 2006, when the number of wholegrain products rose by 87% compared with 2005; while in total the number of wholegrain products increased 10-fold compared with the year 2000, which proved that consumers trusted wholegrain products. The sharp increase in the number of wholegrain products in 2006 may be explained by the intensive work of the American Dietetic Association, which explained the public the essential role of whole grains in healthy diets (Are We there..., 2009). Yet, in 2009, the Kellogg's company found out in a survey of consumers that they preferred mostly wholegrain products, as wholegrain products were healthy, rich in fibre and vitamins, and assisted consumers to lose their excessive weight. Consumers mainly choose products oriented towards tackling consumer problems instead of satisfying their taste. Therefore, the motivations of consumers change for purchasing food products. These studies prove the effects of science, public organisations, and businessmen on the consumer environment (Mancino, 2008).

Based on the experience of the authors of the present paper, one can conclude that the feeling of taste changes depending on what products are daily consumed and what taste individuals are accustomed to. A tasting of a new food product, in which consumers rate the new product according to its taste properties, has to be definitely performed.

Table 2

Distribution of wholegrain products by category, number

Category	2000	2002	2004	2006	2008	2010
Baby food	3	7	8	29	55	86
Bakery	84	158	337	639	1092	1248
Breakfast Cereals	37	74	175	414	824	971
Meals&Entrees	7	11	25	71	127	116
Side Dishes	18	47	49	127	250	277
Snacks	2	17	57	286	435	485
Other	13	7	23	35	100	89
Total	164	321	674	1601	2883	3272

Source: Whole grain statistics 2000-2010

Table 2 shows the kinds of wholegrain products produced in the world. According to it, assortments of wholegrain products increase for all kinds of wholegrain products. The most popular products are bread and related products, and breakfast cereals. The output of snacks sharply rises, which indicates that consumers prefer products that may be prepared and used fast. After analysing wholegrain products produced in Latvia, one may conclude that only wholegrain bread and, in small quantities, wholegrain flour, which is offered to be ground on request are produced in Latvia. Other wholegrain products are imported from Estonia, Poland, Germany, and Italy (Kantike I., Eglite A., 2011). Irrespective of the fact that the assortment of breakfast cereals is broad, wholegrain breakfast cereals are produced only by the Nestle Company, which supplies its products also to the Latvian market.

For instance, an average price of wholegrain pasta was USD 1.5 per kilogram in America in 2011, which was LVL 0.8 per kilogram (at an exchange rate of 0.53 LVL/USD). In 2011 in Latvia, wholegrain pasta cost LVL 1 per 0.5 kilogram on average, as it was imported and no wholegrain pasta produced domestically was available. In 2011, an average price of wholegrain bread was LVL 2 per kilogram in Latvia. It was the most expensive bread compared with any other kind of bread. No statistical data on prices of wholegrain products are available (only data on grain bread, which does not fit the definition of whole grains, are collected). According to the authors, such data might be collected after greater changes occur in consumer diets and demand for these products, as it is observed in the markets of other products.

2. Consumer rating of wholegrain products in the USA, Finland, Germany, Italy, Great Britain, and Latvia

Within the joint HEALTHGRAIN project conducted by scientists of Finland, Germany, Great Britain, and Latvia, totally 2392 consumers were surveyed in these countries; consumers aged 35 were chosen for a target group (Saba, 2010). There were questioned 679 consumers in Finland, 504 in Germany, 662 in Italy, and 547 in Great Britain. In Latvia, 254 respondents aged 25 on average were included in the survey within the EU project* in 2010.

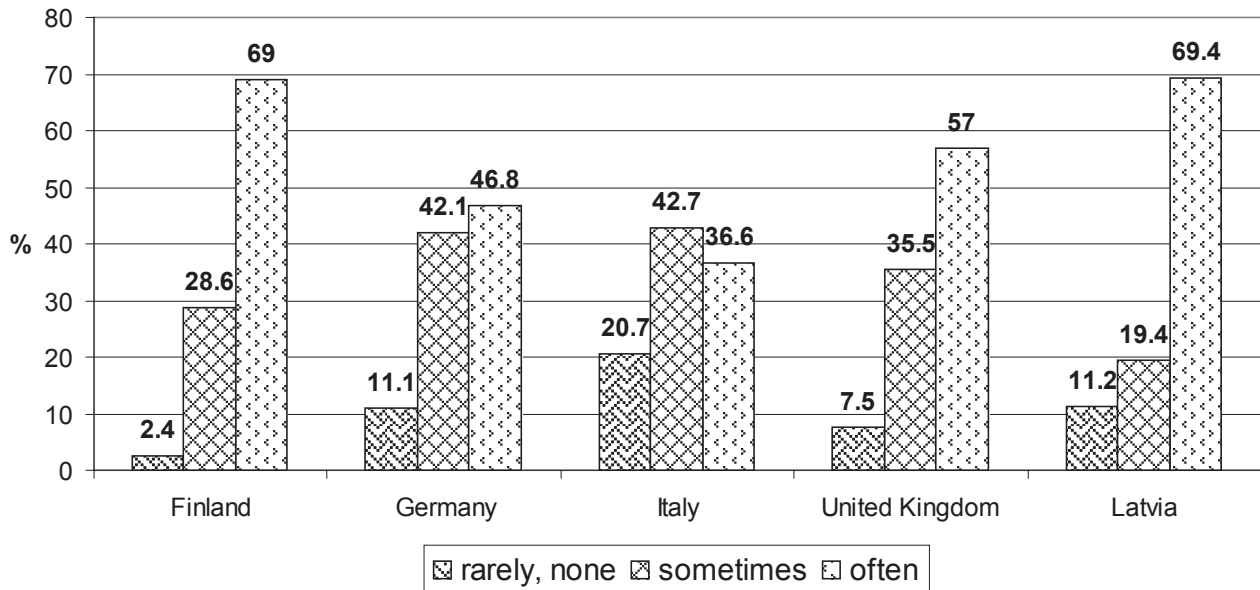
The survey results showed that the highest share of permanent consumers of wholegrain products was

observed in Finland and Latvia (Figure 1), where they accounted for 69% of the total number of individuals surveyed. The number of permanent consumers of wholegrain products reached 57% in Great Britain, 46.8% in Germany, and only 36.6% in Italy. It was found out that the highest share of consumers who sometimes purchased wholegrain products were in Germany and Italy, reaching 42% of the total number of individuals surveyed in each country. Approximately 20% of the respondents did not consume wholegrain products in Italy, which was also the highest indicator among all these countries. The results also showed that it was not very important to Italian consumers that wholegrain products were included in their daily diets. Only those consumers who realised the healthy role of wholegrain products included such products in their daily diets. Italy differed from the other countries in its traditions, as daily diets in this country included pizzas and Italian pasta that were produced from sorts of hard wheat.

In 2006, the group of scientists of the HEALTHGRAIN project conducted a survey of young individuals aged around 18 on wholegrain products (bread, pasta, biscuits). The survey results showed that the respondents questioned in Great Britain, Finland, and Italy believed that their health mostly benefited from cholesterol-lowering bread compared with German young individuals who preferred fibre-added bread.

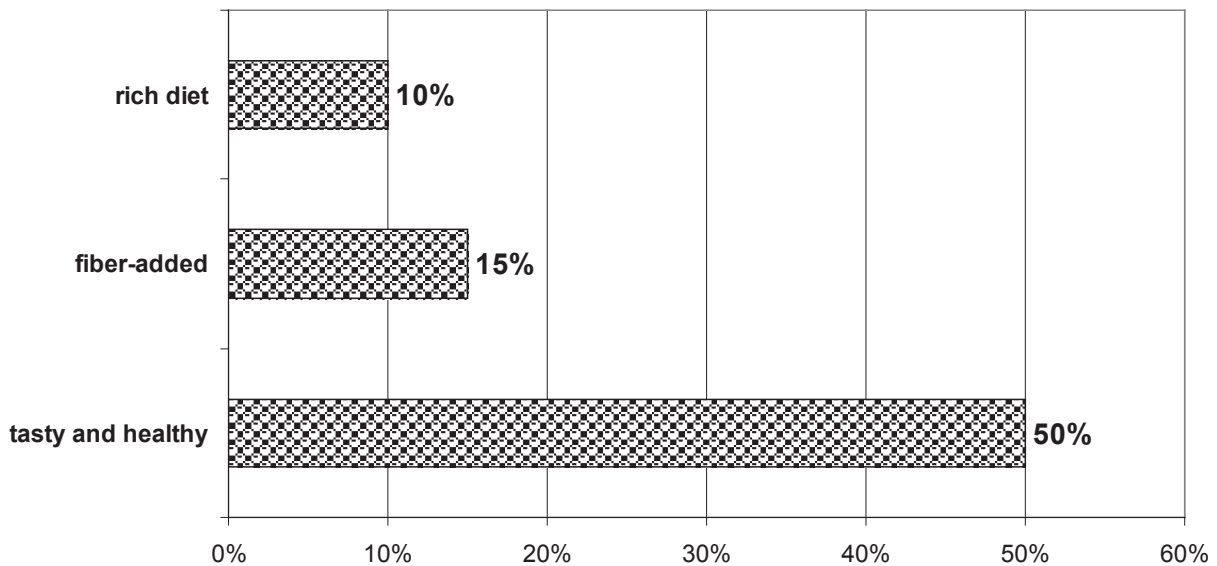
Whereas, respondents in Great Britain and Italy preferred cholesterol-lowering pasta and biscuits compared with young individuals in Italy and Germany (Dean, 2007). An analysis of consumer attitudes to wholegrain products and products made of refined flour showed that the Italian respondents consumed wheat bread daily 3 times more than the Finnish respondents who preferred wholegrain bread. Yet, the respondents of Great Britain used wheat bread in their diets only 2 times more than the Finnish respondents. The survey showed that rye bread was consumed only in Finland (Arvola, 2007).

The survey conducted within the EU project in Latvia showed that 58% of the respondents preferred wholegrain bread among wholegrain products. In general, the consumers in Latvia used also rye bread and grain bread in their daily diets just like the Finnish consumers did it. The analysis of consumer opinions on positive properties of wholegrain products showed that the Latvian consumers believed that wholegrain products were tasty



Source: authors' construction based on the EU project survey data and Finnish Health&Grain project research survey data

Fig.1. Consumption frequency of wholegrain products among consumers in Finland, Germany, Italy, Great Britain, and Latvia



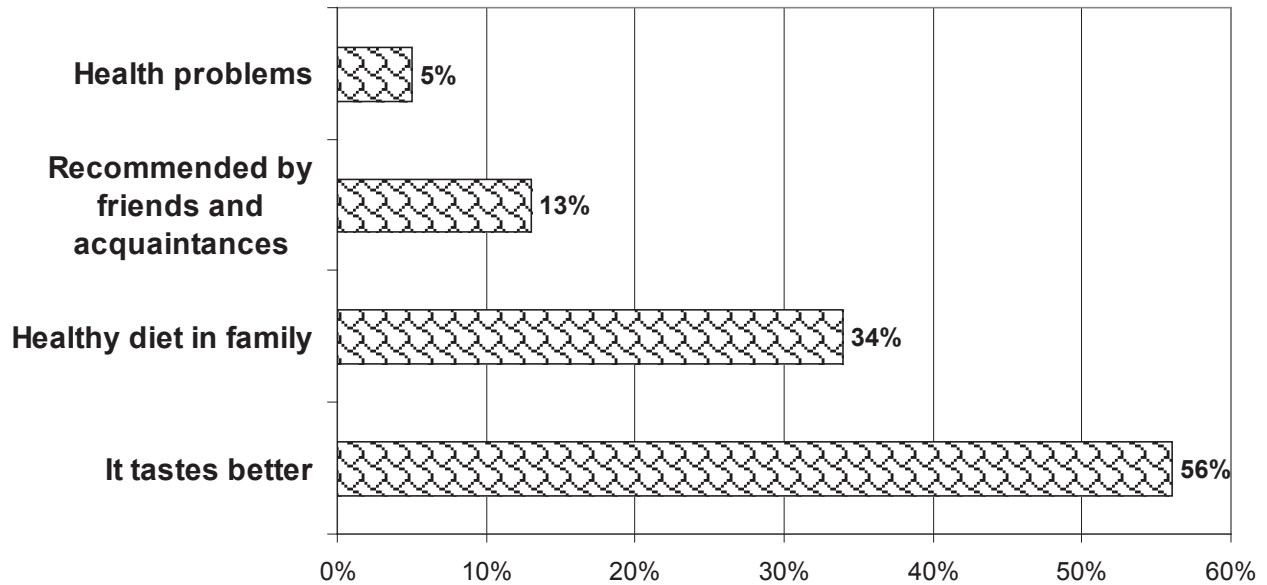
Source: authors' construction based on the EU project survey data

Fig.2. Latvian consumer rating of wholegrain products

and healthy (50%), and only 15% believed wholegrain products were rich in fibre (Figure 2), while 10% thought wholegrain products were substantial foods. The main motivation of Latvian consumers for choosing wholegrain products was their better taste (56%), and only 34% of the respondents emphasised that their family preferred a healthy diet (Figure 3). Other reasons for consuming wholegrain products were also mentioned in the survey – 5% of the respondents had health problems, 13% followed suggestions of their friends and acquaintances, and 1% was inspired to do it after

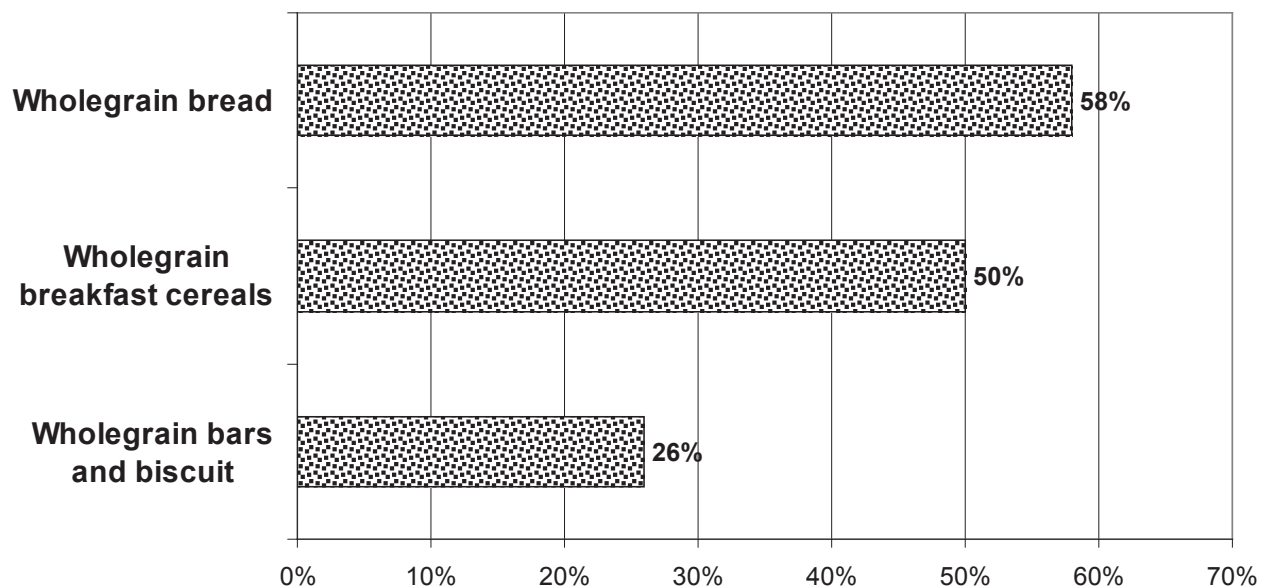
attending various seminars. Some respondents admitted that wholegrain products were easy to prepare and cheap, and that such products promoted sport achievements.

Of wholegrain products, the Latvian consumers (Figure 4) most often preferred wholegrain bread (58%) and wholegrain breakfast cereals (50%). Of the respondents, 26% used wholegrain bars and biscuits in their daily diets. Only 4% of the respondents consumed wholegrain mueslis, which are regarded as one of the dietetic foods, in their diets.



Source: authors' construction based on the EU project survey data

Fig.3. Motivations of Latvian consumers for consuming wholegrain products



Source: authors' construction based on the EU project survey data

Fig.4. The most popular kinds of wholegrain products consumed by Latvian consumers

Conclusion and recommendations

1. A wholegrain product is a product produced from whole grains. Two criteria are set for the definition of whole grains. The first criterion is that whole grains have to consist of the starchy endosperm; germ and bran (grain husk) on condition grain kernels are intact. The second criterion is that while processing, whole grains may not lose more than 2% of the grain and more than 10% of the bran.
2. Over the recent decade in the world, the number of wholegrain products has risen twenty times, which may be explained by popularising healthy lifestyles and wholegrain products in mass media.
3. According to a comparison of the survey results in various European countries, the behaviours of consumers are similar. Those consumers, who believe wholegrain products are good, consume them consistently. Latvian and Finnish consumers most often prefer wholegrain products.
4. Latvian consumers used to consume the most popular wholegrain products – wholegrain bread and wholegrain breakfast cereals.

5. While collecting data on food consumption in the future, the Latvian Central Statistical Bureau should also collect information on the consumption of wholegrain products, taking into consideration the trends in the world.

Bibliography

1. AACC (1999). Definition of Whole Grain. Retrieved: <http://www.aaccnet.org/definitions/wholegrain.asp>. Access: 10 January 2012.
2. Are We There Yet? Measuring Progress on Making at Least Half Our Grains Whole (2009). Make Half Your Grains Whole Conference. Retrieved: <http://www.wholegrainscouncil.org/files/3.AreWeThereYet.pdf>. Access: 10 January 2012.
3. Arvola, A., Lahteenmaki, L., Dean, M., Vassallo, M., Winkelmann, M., Claupein, E., Saba, A., Shepherd, R. (2007). Consumers' Beliefs about Whole and Refined Grain Products in the UK, Italy and Finland. *Journal of Cereal Science*, Volume 46, Issue 3, pp. 197-206.
4. Cacea, M., Durazzo, A., Azzini, E., Polito, A., Sacaria, M., Maiani, G. (2011). Nutritional Value of Wholegrain Cereal Products Rich in Lignans. The 6th International Congress FLOUR-BREAD`11. Croatia, Opatija: University of Osijek. p. 19. ISSN 1848-2554.
5. Dean, M., Shepherd, R., Arvola, A., Vassallo, M., Winkelmann, M., Claupein, E., Lahteenmaki, L., Raats, M.M., Saba, A. (2007). Consumer Perceptions of Healthy Cereals Products and Production Methods. *Journal of Cereal Science*, Volume 46, Issue 3, pp. 188.-196.
6. Franz, M., Sampson, L. (2006). Challenges in Developing a Whole Grain Database: Definitions, Methods and Quantification. *Journal of Food Composition and Analysis*, Volume 19, pp. 38-44.
7. International Association for Cereal Science and Technology. Retrieved: http://www.icc.or.at/icc_officials. Access: 10 January 2012.
8. Jacobs, Jr., D.R., Meyer, K.A., Kushi, L.H., Folsom, A.R. (1998). Wholegrain Intake May Reduce the Risk of Ischemic Heart Disease Death in Postmenopausal Women: the Iowa Women's Health Study. *American Journal of Clinical Nutrition*, Volume 68, pp. 248-257.
9. Kantike, I., Eglite, A. (2011). Supply of Wholegrain Products in the Latvian Market and Appraisal from the Consumer Point of View. The 6th International Congress FLOUR-BREAD`11. Croatia, Opatija: University of Osijek. p. 125. ISSN 1848-2554.
10. Mancino, L., Kuchler, F., Leibtag, E. (2008). Getting Consumers to Eat More Whole-grains: The Role of Policy, Information, and Food Manufacturers. *Journal of Food Policy*, Volume 33, Issue 6, pp. 489-496.
11. McKeown, N.M., Meigs, J.B., Liu, S.M., Wilson, P.W.F., Jacques, P.F. (2002). Whole-grain Intake is Favourably Associated with Metabolic Risk Factors for Type 2 Diabetes and Cardiovascular Disease in the Framingham Offspring Study. *American Journal of Clinical Nutrition*, Volume 76 (2), pp. 390-398.
12. Saba, A., Vassallo, M., Shepherd, R., Lampila, P., Arvola, A., Dean, M., Winkelmann, M., Claupein, E., Lahteenmaki, L. (2010). Country-wise Differences in Perception of Health-related Messages in Cereal-based Food Products. *Journal of Food Quality and Preference*, Volume 21, Issue 4, pp. 385-393.
13. Slavin, J. (2005). Dietary Fibre and Body Weight. *Journal of Nutrition*, Volume 21, Issue 3, pp. 411-418.
14. Whole Grain and Health – an Introduction for Non-specialists (2006). HEALTHGRAIN, p. 13. Retrieved: <http://vbx.webinabox.nl/media/whole-grain-and-health-----an-introduction-for-non-specialists-background-wholegrain-information-09-05-06-352.pdf>. Access: 10 January 2012.
15. Whole Grain Definition (2010). HEALTHGRAIN Consortium, p. 4. Retrieved: http://www.icc.or.at/webfm_send/116. Access: 10 January 2012.
16. Whole Grain Statistics (2011). Retrieved: <http://www.wholegrainscouncil.org/newsroom/whole-grain-statistics>. Access: 10 January 2012.

Acknowledgements

*This research has been prepared within the framework of the ESF Project "Formation of the Research Group in Food Science", Contract No. 2009/0232/1DP/1.1.1.2.0/09/APIA/VIAA/122.

Causes of Long-Term Consumption and Popularity of Offers in Fast Food Companies

Zinta Lauva¹, Mg.paed., lecturer; Velta Basevica, Mg.soc., assoc. professor
Alberta College

Abstract. The rhythm of modern life gives a high value to every moment. Therefore, everybody seeks to get additional time for work, recreation, or family. One of the time saving methods is to use fast food services, which offer lower prices than traditional cafes and restaurants.

A survey was carried out in spring-autumn 2011 to measure the popularity of fast food enterprises and the level of customers' satisfaction with these services.

The survey involved 430 respondents, and the majority of them (86%) admitted using fast food services. The key reasons for using fast food services were as follows: 1) eating fast – 32.4%; 2) possibility of taking food away – 19.2%; 3) it is always on my way – 17.7%; and 4) low prices – 14.4%.

The survey results show that the main reasons for sustainable consumption and popularity of fast food enterprises include fast, cheap, and delicious food. It shall be also recognised that these enterprises are able to adapt to customers' demand for fresh and healthy food, since the analysis of products provided by many fast food companies shows that they increasingly offer fresh salads and food with low levels of fat.

Key words: consumer, sustainable demand, popularity.

JEL code: A23

Introduction

At the present time, people as priority choose work and career, thus, no surprise that the offer of fast food companies is playing an important role in every individual's life. The usual lunch in canteens and cafés is replaced by a hamburger, kebab, sandwich, or another snack bought on the run.

There is no doubt that the consumer's behaviour is determined by psychological, physiological, and intellectual needs of the moment. An individual's decision what to eat, where to eat and how to eat is influenced by many factors. One of the most significant ones is the lack of time, which is experienced almost by everybody. It is possibly one of the most significant factors to be taken into account by every entrepreneur thinking about the sales of his/her products, and catering companies make no exception.

Nowadays, fast food enterprises become increasingly popular. In contrast to traditional catering institutions, like restaurants, canteens and cafes, fast food enterprises in Latvia have a rather short history. LIDO may be considered as the pioneers of fast food industry in Latvia. It entered Latvian catering market in the early 1990s with innovative concept, offering customers fast cooked tasty food of good quality. It was not long before the first fast food giant came to Latvia: in 1994, McDonald opened a fast food restaurant in Riga, next to the Monument of Freedom. It triggered a chain reaction, as not only global fast food brands but also local companies started their business in Latvia, following this concept and adjusting it to the local market requirements. Why these companies and their food are so popular?

A survey was carried out to measure the popularity of fast food enterprises and the level of customers' satisfaction with their services. Its goal was to find out the key reasons for this popularity.

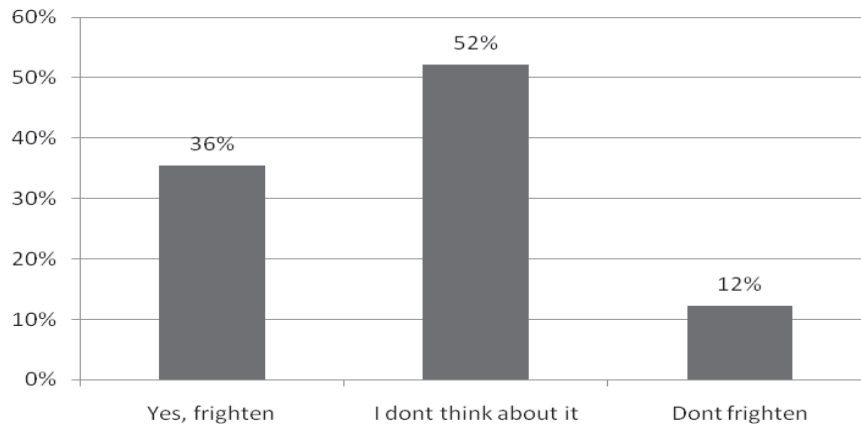
The quantitative data collection method of polling was used to obtain information for the survey. The target audience were Riga residents, as Riga offers the widest network of fast food institutions. The available (convenient) selection was used for survey sampling. This method allows obtaining data that show a certain trend, and no error can be set for such a selection. The size of the selection was based on the experience of the Gallup Institute, which uses a selection of 1500-2000 people. Consecutively, it can be said that the size of a selection for a local survey may be 400-600 people. The survey was held in spring and autumn of 2011, and the size of the selection was 430 respondents. The age of respondents varied between 19 and 45 years.

Consumer behaviour and its impact on sustainable consumption and popularity of fast food companies offer

Many Latvian marketing experts have recognised that classical principles of "fast food" do not work in Latvia. Latvian fast food industry is developing rapidly; yet, classical fast food lines like hamburgers, hotdogs, pizzas, and Chinese food are still at a very early development stage. The fact that in Latvia classical fast food lines do not develop as quickly as in other countries is related to different eating traditions and culture.

Looking at a Latvian consumer's demand for food, it is topped by various salads and pastry. There is also a strong tradition of cooking meals at home. Nevertheless, the popularity of fast food enterprises and a variety of food they offer is also growing. The growth of popularity may be explained by the fact that those fast food companies willing to stay on the market longer and to develop offer consumers mainly local products. Catering concepts are

¹ E-mail address: zinta.lauva@alberta-koledza.lv



Source: author's construction based on Lauva Z., Basevica V. survey "Popularity of fast food enterprises and the level of customers' satisfaction with their services", 2011

Fig. 1. Are you not afraid of the information that the food offered by fast food enterprises may be harmful to your health?

adjusted to Latvian consumers' taste, and an increasing number of fast food enterprises offer fresh and healthy products more and more frequently. The results of the survey show that such an approach and the services offered by fast food enterprises satisfy a majority of the respondents (62%), and only 1.9% of respondents are not satisfied.

Earlier, when the market was rather underdeveloped, the seller could forecast the buyer's behaviour based on his/her daily experience. With the number of catering enterprises growing and their offer expanding, the consumer has become more demanding. Consumers are independent market shapers who act to satisfy their needs, which, in turn, can be satisfied by offering products that meet consumers' demands. Yet, consumers, their interests and capacities are in permanent change. Nowadays, the key factors influencing consumers' choice include convenience, ethical considerations, nutritional value, ecology, use of antibiotics (hormones), level of cholesterol, and risk of food intoxication.

The survey shows that, when buying food at fast food enterprises, a half of respondents do not think about whether this food may be harmful to their health, while 36% believe that they are afraid of it.

Consumers have also become more price-sensitive. A consumer wants to buy a quality product and/or service at the maximum lowest price. Most frequently, they have no time, and thus, in addition to the main product, they want to get extra services. They are aware that other companies offer a product/service of a similar quality for a similar price. Therefore, entrepreneurs have to think how to meet the demands and wishes of their customers.

When asked about the reasons of eating in fast-food enterprises, a majority (32.4%), answered that they could get fast services, 19.2% – because food could be taken away, 17.7% – always on the way, 14.4% – cheap, 11.7% – because they had to save time, and 4.6% – because of good service.

People compensate the lack of time by spending it less on things that are insignificant at the moment or things

that, can be done faster, and eating is not an exception. The time is mainly saved by using the offer of fast food enterprises. As may be seen from the survey results, totally 86% of respondents admitted having visited fast food enterprises and 60% said that they followed the adverts of these companies.

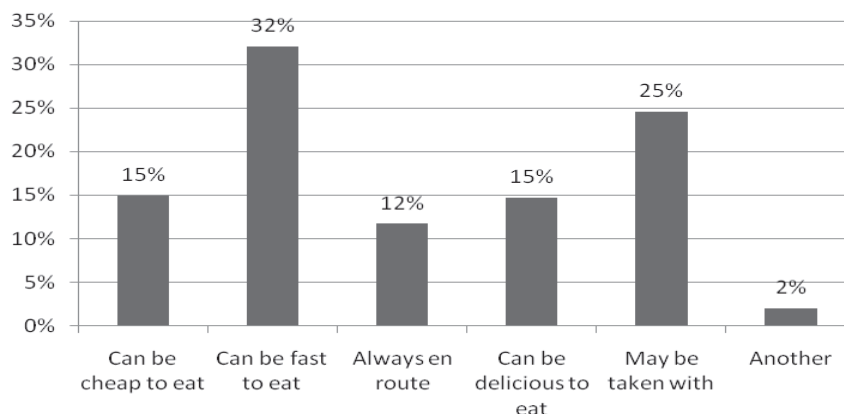
When thinking about the development of business, sustainable consumption and popularity of its offer, one must think about advertising. Advertising is considered as one of the tools enabling an entrepreneur to promote his/her goods and/or products and their popularity. Popularity, in turn, often means better sales of products/services.

Speaking about popularity factors, the respondents mentioned speed, possibility of taking food away, quality of taste, and availability (Figure 2).

When analysing the popularity of fast food enterprises offer among consumers, one should conclude that they pay much attention to product characteristics:

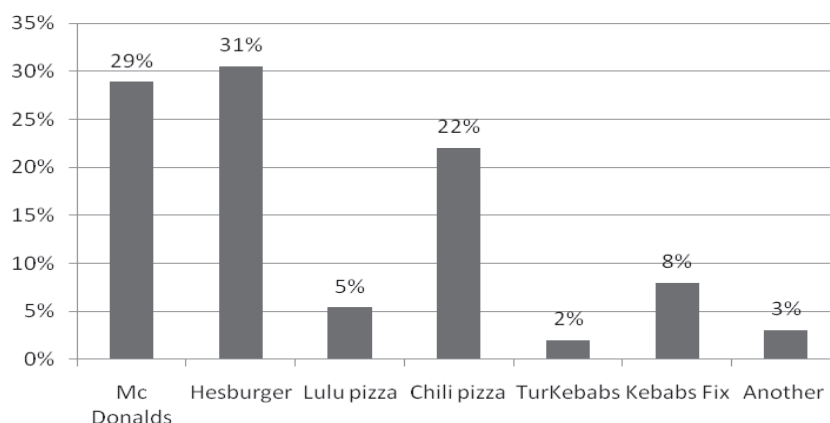
- 1) testability – to what extent the buyer can test the product, e.g. buying a small quantity of the product;
- 2) observability – to what extent the product can be checked before being bought; buyers sooner get used to the products, which are discussed more frequently;
- 3) speed of effect - the buyer is aware of the benefits of using the product; as many buyers expect an instant effect, the product is to meet these expectations as soon as possible;
- 4) simplicity – how comfortably and easily the product can be used by the consumer;
- 5) comparable advantages – what makes the product different from other similar products;
- 6) symbolism – consumers' attitude to the particular product brand.

When studying the consumer's behaviour and action in the process of buying, one shall take into consideration the consumer's psychological (motivation, perception, values, attitude), cultural (culture, subculture, social environment), individual (age, occupation, nationality,



Source: author's construction based on Lauva Z., Basevica V. survey "Popularity of fast food enterprises and the level of customers' satisfaction with their services", 2011

Fig. 2. Reasons for popularity of fast food enterprises



Source: author's construction based on Lauva Z., Basevica V. survey "Popularity of fast food enterprises and the level of customers' satisfaction with their services", 2011

Fig. 3. Most frequently visited fast food enterprises

economic situation, lifestyle, personal features), and social factors (reference groups, family, role and status).

These factors determine the purchasing behaviour model of each individual buying a specific product or service. Being aware of these factors and their role in shaping the behaviour of each individual, one can successfully plan the sales of offered products.

From the consumer's point of view, the most important sales factor is demand satisfaction. Consumers' purchase decision-making process consists of the following five key stages:

- 1) problem identification - the consumer is aware that something, e.g. food, is necessary;
- 2) information search - this stage specifies the possibilities of choice and includes internal (memories, knowledge, experience) and external (friends, family, advertising) search;
- 3) evaluation of alternatives - at this stage, the problem is specified; the consumer proposes buying criteria and finds the brand that could meet these criteria;

- 4) purchasing behaviour - the consumer is aware of his/her purchase decision and considers where to buy a product or a service. When considering it, he/she takes into account his/her experience, selling conditions, and loyalty policy. The purchase decisions may be also affected by the company's environment and the shortage of time, which is typical of consumers;

- 5) after-buying behaviour - the consumer thinks over and realises the rational value of the purchase and his/her satisfaction with the purchase.

How many times a day people make a decision that somehow affects one's life and its quality? When making many decisions, one often do not thinks about its motivation. Many decisions are being made day after day and many of them are taken without thinking but based on the previous experience and habits. For instance, when deciding what and where people would like to eat. As mentioned before, people take many decisions on lack of time conditions.

When taking such decisions, each person's own experience and that of friends plays an important role. Consumers' thinking is also often restricted by stereotypes and expectations.

Actually, the survey shows that, when choosing where and what to eat, the most important thing is whether the food is tasty (48.4%), whether its price is acceptable (36.4%), and only 7.2% of respondents think about whether the food is healthy. As the results of the survey show, from fast food companies offer consumers most frequently choose pizzas (27.2%), fried potatoes (21.4%), hamburgers (20.5%), food packages (19.6%), and 11.3% – other products, like salads, meat dumplings, kebabs etc.

Speaking about the causes of sustainable consumption and popularity of fast food enterprises offer, one shall think not only about the consumer but also about the environment where these players act. Economic, political, and social situation in the country also plays an important role in ensuring the sustainability. The consumer's awareness of the quality of offered food and its impact on the health is also significant. The authors of the survey are convinced that if fast food companies continue offer their services they will leave Latvia. If they keep on demonstrating their capability of adjusting to consumer and market interests, then their popularity is expected even to grow.

Conclusions

Sustainable consumption and popularity of fast food companies offer is affected by the consumer through his/her typical psychological, cultural, individual, and social factors, on the one hand, and demographic, social, political (legislative) aspects as well as economic development and globalisation factors, on the other hand. The globalisation has probably removed the

borders, and thus, it is difficult to determine clearly, which culture a specific food or catering method belongs to.

The growth of the fast food industry market segment is directly linked with the development of the society. The main reasons for sustainable consumption and popularity of fast food enterprises offer is that one can eat fast, tasty and at low price there.

Consumers' interests and influence change over time. Each generation usually has its typical values and behaviour.

To ensure a long-term demand for products offered by fast food companies, it would be necessary to raise the competitiveness of these companies, taking into account the evaluation of consumers, analysis of competitors, diversity of products, pricing policies, and marketing communications. The location of a company is also important.

Bibliography

1. Armstrong I.S., Overton F. (1971). Brief vs. Comprehensive Descriptions in Measuring Intentions to Purchase, pp. 114-117. Retrieved: <http://marketing.wharton.upenn.edu/ideas/pdf/armstrong2/brief.pdf>. Access: 1 February 2012.
2. Bradley, N. (2007). *Marketing Research: Tools & Techniques*. Oxford; New York: Oxford University Press. p. 531.
3. Kotler, P., Armstrong, G. (2004). *Principles of Marketing*. Pearson Education International. p. 613.
4. Labensky, S., Ingram, GG., Labensky, SR. (1997). *Webster's New World Dictionary of Culinary Arts*. New Jersey: Prentice – Hall. p. 146.
5. Vogt, W.P. (2007). *Quantitative Research Methods for Professionals*. Boston, MA: Pearson/Allyn and Bacon. p. 334.

Sustainable Roads: Effective Use of Resources

Laura Lielgaidina¹, Mg.oec, PhD student;
Janis Justs, Mg.Sc.ing., PhD student,
Ineta Geipele, Dr.oec., professor
Riga Technical University

Abstract. Good infrastructure historically proved to be an indispensable precondition for the sustainable economic development of the nations; however, governments, even in developed countries, are not able to fully finance infrastructure projects through the government budget, especially during financial crisis, and face difficulties to avoid excess consumption of non-renewable material resources. The study focuses on sustainable approach of using natural resources for road construction and maintenance in respect of the environment, economy, and society as well as shows benefits of alternative road pavement type – concrete roads.

Road construction is very specific case considering environmental issues. This industry has a huge need for raw materials and, thus, searches continuously for recycling possibilities. Many years ago, recycling did not mean much to most of the people, nowadays, when discussion about global warming and CO₂ emissions has become more topical, governments pay more attention to sustainable consumption and production issue. The use of recycled materials and products for road maintenance can deliver clear environmental advantages by saving natural resources, reducing the demand for landfill capacities, and reducing the harmful effects of transport as well.

While there are several different road pavement types, the most known and commonly used are asphalt and concrete. Historically, asphalt pavements comparing with concrete ones were applied more often due to the lower initial costs. Now, this tendency has changed. Concrete pavements are considered as more durable and sustainable in comparison with asphalt pavements. Also reduced life-cycle costs, increased safety, reduced fuel consumption of vehicles, and better light reflection has been proved. Concrete pavements are 100% recyclable.

Key words: infrastructure, sustainable development, resources, recycling.

JEL codes: L74, Q01, R42

Introduction

By applying definition of sustainability from the Report to the United Nations (1987) to the infrastructure development, it can be stated as follows: material or structure can be regarded as sustainable if it ensures "meeting the needs of the present without compromising the ability of future generations to meet their own needs". However, Van Dam and Taylor (2011) state that "sustainability is simply good engineering: optimising resources, balancing competing interests, and making incremental improvements as knowledge improves".

The concept of recycling is strongly related to the sustainable development and is getting more significant with the human population increase as it constantly demands higher amount of natural resources. Pavement construction is one of the most promising areas where incorporation of recycled materials can be performed.

Unfortunately, the overall condition of state road network in Latvia continues to deteriorate. Half of the bituminous pavements and more than one third of gravel pavements may be regarded as deteriorated. The main cause is permanent insufficient financing for the roads. According to negotiations regarding the European Union (EU) multiyear budget 2014-2020, Latvia will focus on two key priorities: sufficient financing from cohesion funds so that Latvia could faster achieve the EU average level and creation of beneficial conditions for the growth of Latvian economy and the development of infrastructure.

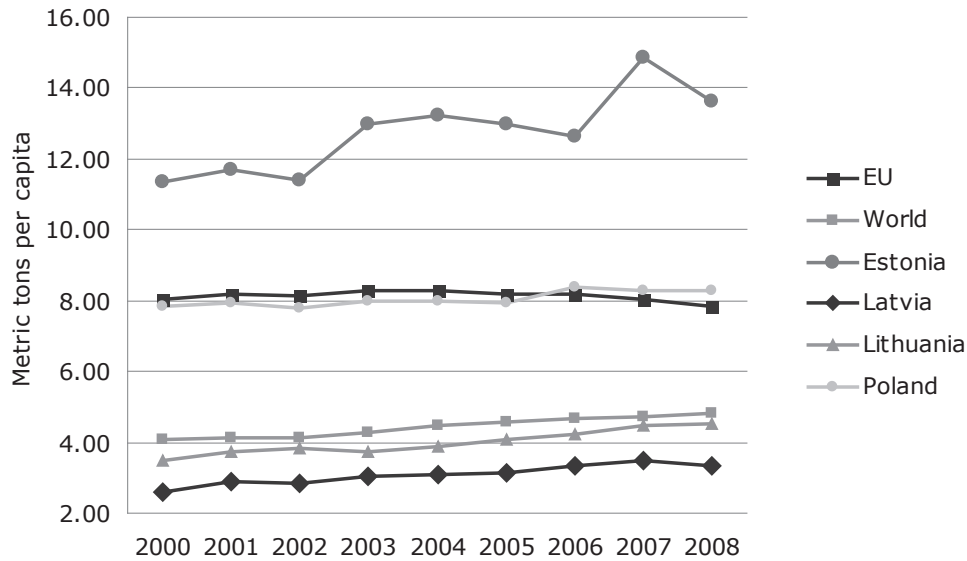
The hypothesis of the research: concrete road construction using recycled materials provides optimal solution for sustainable infrastructure development - effective use of resources and CO₂ reduction combined with prolonged service life compared with asphalt pavements.

The aim of the research is to show the necessity of building and maintaining sustainable roads considering efficient use of resources and finding optimal solutions for road pavement in respect of the environment, economy, and society.

The tasks of the research were set in order to achieve the aim: 1) to show the necessity of choosing sustainable infrastructure solutions by taking into account parameters like CO₂ emissions, increasing traffic intensity, and at the same time considering limited financial resources; 2) to describe advantages of building concrete roads and applying concept of recycling; and 3) to make initial proposals regarding concrete road implementation in Latvia.

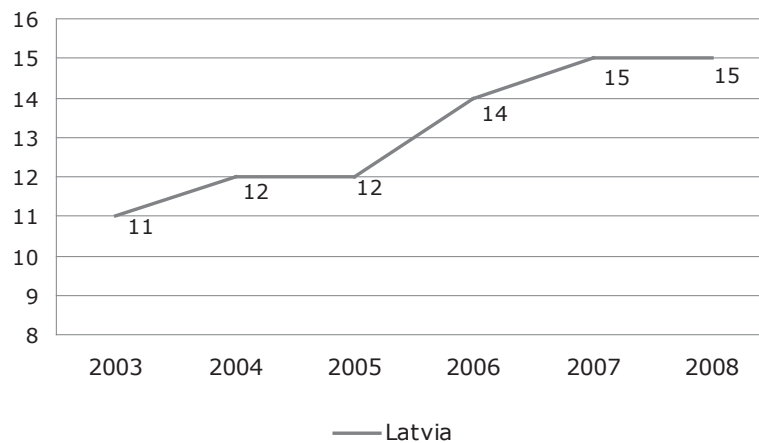
The research was performed in 2011 and the following **research methods** were used in the paper: comparative analysis and synthesis, monographic, logically constructive, and statistical. The main research sources include statistical data, publications of the infrastructure sector and aggregates production and consumption experts, unpublished documents (files) of concrete roads building companies as well as information from Internet resources.

¹ E-mail address: laura.lielgaidina@inbox.lv.



Source: authors' construction based on the Carbon Dioxide Information Analysis Centre data

Fig. 1. CO₂ (carbon dioxide) emissions



Source: authors' construction based on the International Road Federation data

Fig. 2. Vehicles per kilometre of road

Research results and discussion

1. Assessment of important descriptive statistics related to infrastructure

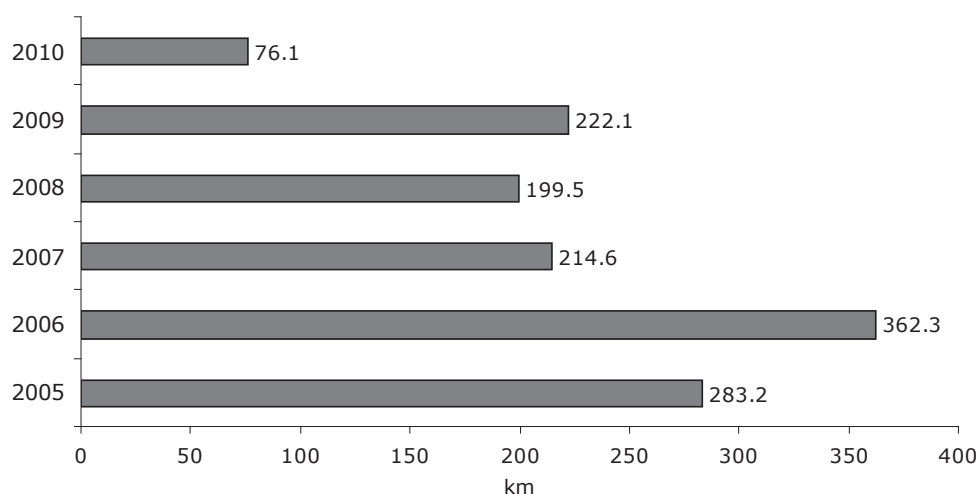
Many years ago recycling did not mean much to most of the people. Nowadays, when discussion about global warming and CO₂ emissions has become more topical, the governments pay more attention to sustainable consumption and production issue. The majority of the greenhouse gasses is formed by the carbon dioxide (CO₂). CO₂ emissions are those stemming from the burning of fossil fuels (oil products, coal, natural gas). They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. Emissions caused by the transport sector are equal to approximately one fifth of all emissions.

In the European Union, CO₂ emissions reached the highest point in 2003, i.e. 8.27 metric tons per capita, while in Latvia and Estonia, the highest CO₂ emissions per capita were in 2007 reaching 3.48 and 14.87 metric tons

per capita respectively (Figure 1). In absolute figures, Latvia's CO₂ emissions are more than twice as low as in neighbouring countries: while Latvia had 7591 kt of CO₂ emissions in 2008, Lithuania showed 15130 kt, and Estonia even 18291 kt of CO₂ emissions. Investment in infrastructure, together with policies to structure financial and industrial markets to apply optimal solutions for road infrastructure, would improve environment by reducing carbon dioxide emissions.

Vehicles per kilometre of road (Figure 2) include cars, buses, and freight vehicles but do not include two-wheelers. Roads refer to motorways, highways, main or national roads, secondary or regional roads, and other roads. In Latvia there were 15 motor vehicles per kilometre of road in 2008, which is 36% more compared with 2003.

Unfortunately, the overall condition of state road network continues to deteriorate regardless the accomplishments in the construction of new road



Source: authors' construction based on the state joint stock company "Latvian State Roads" data

Fig. 3. Renewal of bituminous pavements in Latvia

Table 1

Construction and repair of motorways, streets, roads, airfields, runways, and railway lines in current prices, thousand LVL

New construction						
Year	Q1	Q2	Q3	Q4	Total	Annual changes
2008	10192.9	31022.3	29685.7	22740.3	93641.2	-
2009	3706.5	12636.7	25439.3	13060.4	54842.9	-41%
2010	4328.0	13251.0	23035.4	13092.6	53707.0	-2%
2011	3210.5	9807.0	17270.8	-	-	-
Repair of buildings and structures						
Year	Q1	Q2	Q3	Q4	Total	Annual changes
2008	8045.3	46830.1	71799.0	50046.5	176720.9	-
2009	5239.3	25334.2	25023.4	19032.1	74629.0	-58%
2010	4899.0	20095.0	39119.4	28951.8	93065.2	25%
2011	3786.1	29581.4	63779.4	-	-	-

Source: authors' calculations based on the Central Statistical Bureau data, 2011

sections. Half of the bituminous pavements and more than one third of gravel pavements may be regarded as deteriorated. The main cause is permanent insufficient financing of roads.

In 2010, the work on state roads was performed for LVL 41.6 million and bituminous pavements were reconstructed, renewed, or built in the length of 76.1 km (Figure 3). It is 66% less than in 2009, when 222.1 km were renewed. LVL 16.82 million were spent for pavement maintenance and it is 17% less than in 2009. In 2010, totally 205 thousand m³ of gravel or 6% more than during the previous year were utilised to renew gravel roads and eliminate depressions, holes, and sand pits (Latvian State Roads, 2011).

New construction of motorways, streets, roads, airfields, runways, and railway continued to decrease also in 2011, i.e. by 25% in the first three quarters comparing with the same period in 2010 (Table 1), meanwhile, repair works increased by 52%.

In addition, there is a positive tendency in the changes of volume of construction works done at own costs – in Q3 of 2011 compared with the corresponding period of the previous year, it has increased by 27.8% (Table 2).

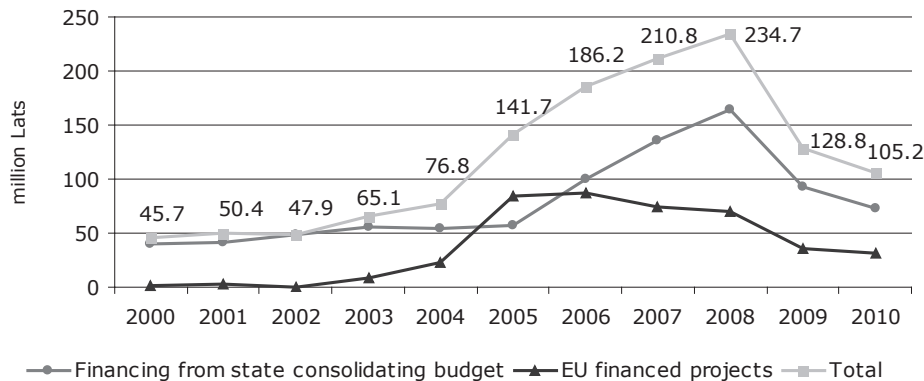
Financing of Latvian State road programme in 2010 has decreased by 18% compared with previous year and by 55% compared with 2008 (Figure 4).

National budget restrictions are leading governments to consider private financing and use Structural Funds to speed up the development of countries infrastructure. According to negotiations regarding the European Union (EU) multiyear budget 2014-2020, Latvia will focus on sufficient financing for Cohesion funds, thus, developing infrastructure faster. The Cohesion Fund is available for those EU Member States where GDP per capita is less than 90% of the EU average. Governments are not able to finance fully infrastructure projects through the government budget, especially during financial crisis, and they are not ready to supply sufficient investments for

Changes of volume of construction works at own costs

Motorways, streets, roads, airfields, runways, and railway lines, % over corresponding period of the previous year, in constant prices					
Year	Q1	Q2	Q3	Q4	Total
2009	-46.5	-44.1	-43	-48	-181.6
2010	-15.2	-24.8	6.8	10.1	-23.1
2011	-24.2	16.7	27.8	-	-

Source: authors' calculations based on the Central Statistical Bureau data, 2011



Source: authors' construction based on the joint stock company "Latvian State Roads" data, 2011

Fig. 4. Financing of Latvian State road programme

road sector. Adequate and stable financing is essential for infrastructure development, thus, supporting social and economic growth and allowing countries to participate in the global economy by increasing their competitiveness. Lack of the above mentioned leaves a negative impact on the economic well-being.

2. Regulations regarding resources and road pavement in Latvia

The Ministry of Environment has worked out Environmental Policy Strategy for 2009-2015. The objective of the policy is to ensure sustainable use and protection of land resources by encouraging implementation of the principle of sustainable consumption and production. Latvia is rich in raw construction materials – resources of sand, quartz sand, sand-gravel mix, gravel, clay, dolomite, and gypsum as well as freshwater lime and tuff. The Ministry of Economics has defined problems calling for the implementation of a specific government policy. The use of secondary raw materials creates a problem under the current economic crisis and reaching of objectives of waste recycling is difficult. Methods for extraction, recording, control, and recultivation of useful minerals have to be improved regarding the use of subterranean depths. An inventory of useful mineral mines has not been carried out. Local governments cannot appropriately monitor the small extraction sites. Recultivation of useful mineral extraction sites is insufficient. At the moment, a part of the quarries developed during the former Soviet Union is abandoned and not recultivated (Ministry of Economics, 2009). The policy anticipates increasing

public awareness of sustainable use of natural resource results and their output indicators (Table 3).

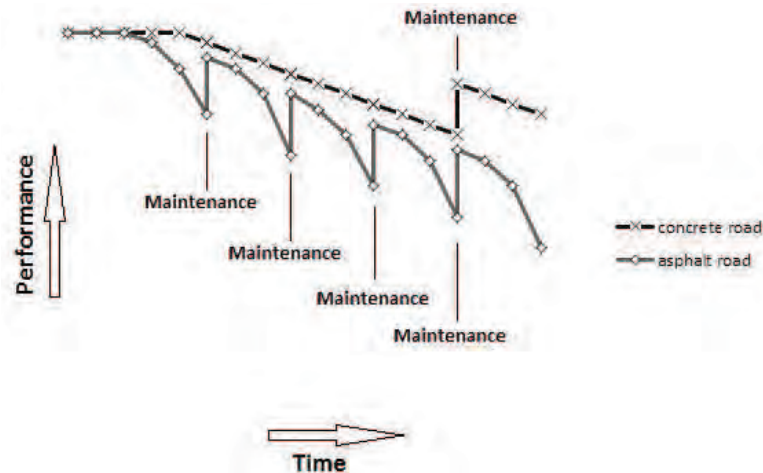
Starting from 1 October 2009, road construction standards in Latvia are regulated by the "Road Specification 2010". Only specifications on asphalt road construction are included in the document. According to the "Road Specification 2010", a contractor may choose alternative payment time for road construction but it has to prove and ensure quality and provide control. Nowadays, contractors who offer the lowest initial costs for road construction win tenders regarding infrastructure. As asphalt pavement layer is the most expensive road building material, concrete pavement inclusion in the standards would allow planning the road infrastructure repair works more efficiently.

Advantages of building concrete roads versus asphalt have been proved internationally. While in Latvia, due to the lack of interest of government institutions appropriate research has not been done to show benefits and prove cost saving considering the whole life cycle (LC) of road. Many other European countries, especially Poland, have experience in building concrete roads and assessing their efficiency regarding economy and environment. Yet, in Latvia there are no calculations done related to concrete road construction costs and impact on the environment. The Polish LC analysis proves that concrete road costs are significantly lower in long term compared with other solutions and they have a positive impact on consuming of resources and environment in general. In the authors' opinion, since Poland and Latvia have similar weather conditions and raw materials available, Latvian Life Cycle Cost Analysis could show similar results

Results of Environmental Policy Strategy for 2009-2015

Output indicator/Years	2009	2010	2011	2012	2013	2014	2015
Number of public awareness and education measures carried out by national institutions	5	5	5	5	5	5	5

Source: authors' construction based on the Environmental Policy Strategy, 2011



Source: authors' construction, 2011

Fig. 5. Concrete vs. asphalt performance (general trends)

and prove necessity of concrete road specifications in Latvia.

To implement concrete road construction in Latvia and include specifications related to this in the document 'Road specifications', it is necessary to create internal awareness of its benefits compared with asphalt pavements and its application in roads, highways, airport runways etc., to generate support from credible and independent opinion leaders as concrete road construction requires specific knowledge; to identify potential flagship project and companies with the equipment and expertise needed for pavement projects; and to rely on countries with expertise throughout the process of making Life Cycle Cost Analysis (LCA). The LCA makes it possible to assess the environmental impacts arising at all stages of product lifetime. For the life cycle of a road, the individual stages are as follows: mineral material extraction and processing; transportation; product manufacture; construction; use; demolition; and recycling (processing, re-use, waste disposal).

In Poland case, the LCA results are presented in the following categories:

- depletion of raw material resources: renewable sources – e.g. atmospheric gas (oxygen, nitrogen), carbon dioxide and non-renewable sources – e.g. rock materials (granite, basalt, dolomite etc.), iron ore, gypsum, clay, land etc.;
- depletion of energy sources: renewable sources – e.g. biomass, water energy, solar energy, wind energy, geothermal energy and non-renewable sources – e.g. crude oil, natural gas, coal and lignite, and uranium;
- depletion of water resources.

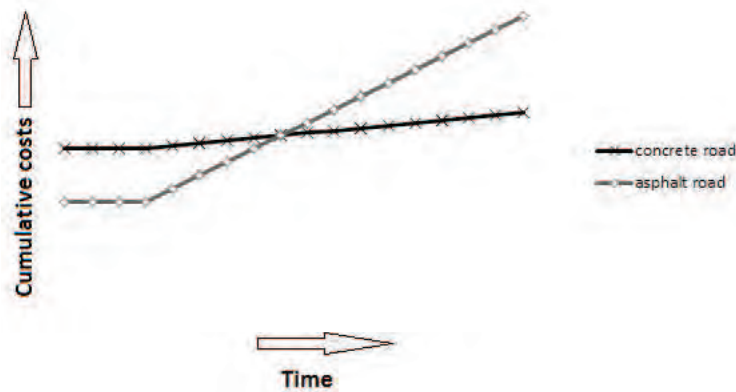
It could seem that the life cycle assessment is an issue that is very new and not yet widely used. It is not the case because the life cycle assessment has been successfully used since the 1990s (Grzesik K., 2006), as a technique that allows tracking the entire life cycle, from extraction of raw materials needed to produce a particular product until the final disposal of waste arising during its recycling at the end of its lifetime. The first standard regulations for LCA appeared in the 1990s.

3. Advantages of building concrete roads and applying concept of recycling

Concrete roads have high capacity of incorporating recycled industrial materials. Recycled industrial materials can be incorporated either in the sub base of the pavement or partially substitute aggregates in the concrete. Some types of industrial by-products such as fly ash or blast furnace slag can be used as a supplementary cementitious materials, thus, allowing to reduce cement content in concrete mix and contributing to the CO₂ footprint reduction.

In general, concrete pavements are regarded as very durable and typically have service lives of over 40 years. They also require very little maintenance in comparison with other types of pavements. General trends of the pavement performance are shown in Figure 5.

Initial costs of concrete pavements are generally higher than those of asphalt. However, according to other authors' initial construction cost amortised over a longer period combined with a lower annual maintenance requirement on a life-cycle cost basis became economically advantageous after the seventh year of a forty to fifty-year operational period, and continued to increase their



Source: authors' construction, 2011

Fig. 6. Concrete vs. asphalt cumulative costs (general trends)

commercial advantage each year thereafter (Figure 6). Concrete's long service life and low annual maintenance costs make it the most economically favoured pavement on a life-cycle basis.

The following benefits can be expected from using recycled aggregates to substitute natural aggregates:

- saving natural resources: preserve deposits for future generations;
- reducing the demand for landfill capacities: the recovery of construction and demolition waste leads to a reduction in waste disposal;
- reducing the harmful effects of transport: quarries are in theory located outside the centres of urban areas or tend to be removed further away. Therefore, the consumption of recycled aggregates leads to a significant reduction in transport and, thus, in the related harmful effects.

Conclusions, proposals, recommendations

1. Sustainable roads make efficient use of natural resources and respect the environment during their entire life cycle; they improve transport facilities for the entire community and they provide services to society in terms of mobility, safety, and comfort by means of judicious choices regarding design, construction, maintenance, and demolition.
2. Several benefits can be expected from using recycled aggregates to substitute natural aggregates: saving natural resources; reducing the demand for landfill capacities; and reducing the harmful effects of transport.
3. In Latvia, there is no research done regarding concrete road construction in Latvia. Cooperation with universities, laboratories, and professionals is required to provide reliable results related to Life Cycle Cost Analysis, increase awareness of concrete roads advantages, and initiate changes in regulations.
4. Concrete roads with incorporated recycled industrial materials contribute to the energy and natural resources saving and CO₂ footprint reduction as well as cost reduction during the whole life cycle of the pavement.

5. However, experience from the different countries, for example Poland, where weather conditions and local resource availability is similar, can be applied. Another point of choosing concrete roads is that all constituents are locally available. In the case of asphalt bituminous, it is not local product and the price of bituminous is increasing due to the constant oil price growth.
6. Summarising the results, one should ask itself whether s/he as a member of the society could afford not to build concrete roads, both in terms of costs and in terms of impact on the environment.

Bibliography

1. Aggregates Case Study (2008). Vienna: Institute for Prospective Technological Studies. p. 282.
2. Concrete Thinking in Transportation Solutions (2011). Cement Association of Canada. Retrieved: <http://www.cement.ca/en/Highways/Building-Sustainable-Highways-in-Canada.html>. Access: 16 December 2011.
3. Eiropas Savienības strukturfondu un Kohezijas fonda planosanas dokumentu 2007. – 2013. gadam sakotnejais (ex-ante) izvertējums (Ex-Ante Evaluation of NSRF and Ops). LR Finanšu ministrija (2007). Rīga: LR Finanšu ministrija. p. 37. (In Latvian)
4. European Platform for Recycled Aggregates (EPRA). *Comments on Document CA/24/2008 from the 4th Meeting of the Competent Authorities for the implementation of Regulation (EC) 1907/2006 (REACH)*. Retrieved: http://www.fir-recycling.nl/files/EPRA_Position_on_REACH_July%202008.pdf. Access: 19 November 2011.
5. Grzesik, K. (2006). Wprowadzenie do oceny cyklu życia (LCA) – nowej techniki w ochronie środowiska (Introduction to Life Cycle Assessment (LCA) – a New Technique in Environment Protection). *Krakow, Inżynieria Środowiska*, Volume 11, Issue 1, pp. 101-113.
6. IRF Bulletin Special Edition Europe. Geneva: International Road Federation Routiere Internationale, p. 24.

7. Latvian State Roads Yearbook 2010. *Latvian State Roads*. Retrieved: <http://www.lvceli.lv/en/?i=148>. Access: 15 November 2011.
8. Ministry of Environment (2009). Environmental Policy Strategy 2009-2015. *Informative section*. Retrieved: http://www.varam.gov.lv/eng/dokumenti/politikas_planosanas_dokumenti/. Access: 16 December 2011.
9. Our Common Future (1987). The Report of the World Commission on Environment and Development. United Nations World Commission on Environment and Development, Oxford University Press. p. 416.
10. Rens, L. (2009). Concrete Roads: A Smart and Sustainable Choice. Brussels: European Concrete Paving Association. p. 32.
11. Situacija uz Latvijas autoceļiem (Situation on Latvian Roads). Latvijas Valsts ceļi (2010). Rīga: Latvijas Valsts ceļi. p. 9. (In Latvian)
12. Strežs, A. (2009). Ceļu specifikācijas 2010 (Road Specifications 2010). Latvijas autoceļu avīze, December 2009, p. 3. (In Latvian)
13. Sustainable Use and Management of Natural Resources. (2005). *EEA Report*, Volume 9, Issue 2, pp. 72. ISSN 1725-9177
14. Transporta attīstības pamatnostādnes 2007.-2013. gadam (Transport Development Guidelines). LR Ministru Kabinets (2010). Rīga: LR Ministru Kabinets. p. 28. (In Latvian)
15. Van Dam T., Taylor P. (2011). Seven Principles for Sustainable Concrete Pavements. *Concrete International*, November 2011, pp. 49 – 52.

This paper has been supported by the European Social Fund within the project «Support for the implementation of doctoral studies at Riga Technical University».

Analysis of Latvia Households' Consumption Expenditure During the Period of Economic Recession

Anastasija Vilcina¹, Dr.oec.

Department of Economics, Latvia University of Agriculture

Raivis Andersons, Bc.sc.soc., Master's student

Latvia University of Agriculture

Abstract. Basing on the macroeconomic flows model in an open economy, the paper characterises the impact of economic and social factors – wages, price increase, changes in interest rates, employment, financial obligations – on households' sector within the period from 2004 to 2010, putting a special emphasis on the economic growth and recession periods. On the grounds of extensive and varied data of Household budget survey, the authors have performed the analysis of household consumption expenditure in the form of general regularities as well as by accepting the changes in short term period. The analysis was done applying changes in chain percentage points and arranging them in time series within the period from 2004 to 2010 as a result obtaining the confirmation for E. Engel's discovered regularity. The authors' performed survey of households and critical assessment of its results indicate substantial aspects of changes in inhabitants' consumption habits during the face of economic recession.

Key words: consumption expenditures, economic recession, households.

JEL code: E21, E31, H31

Introduction

One of the general indicators of inhabitants' welfare is the amount of consumption expenditures, especially – the specific weight of expenditures on food in the overall expenditure structure of households. The theoretically substantiated and detailed analysis of the abovementioned problem has been performed by Latvian scientists O. Krastins, I. Ciemina, J. Jansone (Krastins O. 2001; Jansone J., Krastins O. 2004; Ciemina I., Krastins O. 2004; Ciemina I., Krastins O. 2005; Ciemina I. 2009) and monographs and publications of other authors, which characterise the tendencies of changes in Latvia households' consumption expenditures within a several years period, investigate peculiarities of food products' consumption in households as well as reveal the characterisation of differences in consumption structure in the context of various social groups, demographic mix, and quintile and decile groups.

Nevertheless, nowadays the investigation of structure of households' consumption expenditures within various phases of economic cycle acquires special urgency and importance. It is especially seen under circumstances of economic recession observed in 2008 in the world and in Latvia when the structure of households' consumption expenditures was determined by several economic and social factors of local and global scale. The survey of the scope and significance of the mentioned factors' influence is the basis for reduction of poverty and exclusion risks also in the future; yet, these complex issues have been insufficiently analysed so far. Therefore, the aim of the paper is to assess critically the changes in the structure of households' consumption expenditure within the period of national economy recession and their effects on the welfare indicators.

Hypothesis: indicators characterising the economic recession have the most significant impact on the priority elements of consumption expenditures.

The following research tasks were subordinated in order to achieve the defined aim:

- 1) to characterise the impact of economic factors on households' sector within the phase of economic recession;
- 2) to perform a comparative analysis of the structure of households' consumption expenditures within the phases of economic growth and recession;
- 3) to survey the aspects of changes in households' consumption habits within the phase of economic recession.

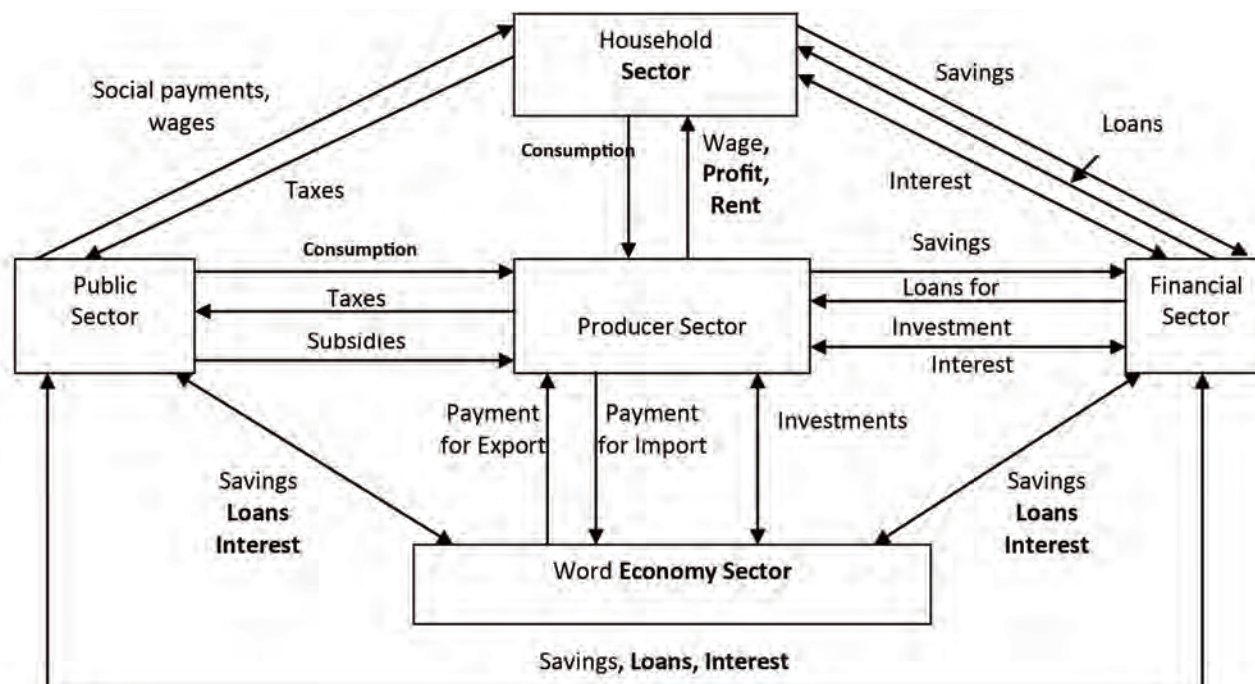
The following **methods** of economic research were used in the development of the paper:

- analysis and synthesis, induction and deduction;
- monographic;
- graphic;
- statistical;
- sociological – survey.

In the development of the paper, the authors have used theoretical findings of scientists, the main results of Latvia households' budget survey within the period of 2004-2010 and the corresponding material of the Central Statistical Bureau of the Republic of Latvia (hereafter –CSB), which characterise the most significant social and economic indicators of the economic cycle in the mentioned period as well as the results of authors' performed households survey on the changes in consumption habits.

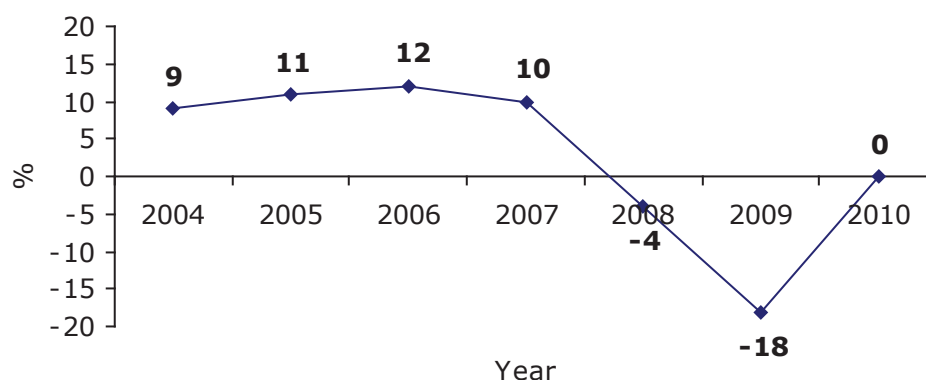
The authors have set the research limitations for analysis of the structure of households' consumption expenditures choosing the period from 2004 to 2010,

¹ E-mail address: Anastasija.Vilcina@llu.lv.



Source: Senfelde M., 2009

Fig. 1. The model of macroeconomic flows in an open economy



Source: authors' construction based on the Statistical Yearbook of Latvia, 2011

Fig. 2. GDP dynamics, changes in % against the previous year within the period of 2004-2010

when the growth and recession phases of economic cycle were observed in the national economy of Latvia. The **research object** - Latvia households and the **research subject** - expenditure of households' consumption were set to reveal the theme.

Research results and discussion

The impact of economic and social factors on the households' sector within the phase of national economy recession

National economy can be divided in several sectors each of them having different function and significance in the macroeconomic model. Such national economy division by sectors (Figure 1) facilitates economic analysis and it is possible to detect the effects of economic recession on the national economy processes.

National economy is in its nature divided in five interrelated sectors, which directly interact with each other, except micro level of households and macro level of the world economy. The households and the world economy sector interact indirectly through the other three sectors – public, producers, and financial sectors. The national economy sectors interact with each other since they depend on each other. Problems, encountered in any sector, have impact also on other sectors, which is especially felt during the face of national economy recession.

Latvia economy after the accession to the European Union on 1 May 2004 was characterised by growth, yet, it was interrupted after the USA financial sector crisis, which affected not only global but as well local economic processes like Latvia. If the GDP growth in 2007 against the previous year was 10%, then in 2008, a rapid decline

of economic activity began reaching its lowest point in 2009 – 18% (Figure 2).

Alongside with the sharp decline of GDP and changes in the national economy, the financial sector also reacted appropriately – changing its interest rates for credits and deposits in Latvian lats, thus, reaching its maximum in 2009 (Figure 3). The exception is the interest rates on long-term credits, since they were adjusted according to the inflation reduction plan introduced in Latvia.

The changes in credit interest rates affected also the interest rates on deposits. The weighted average interest rates on deposits increased exactly like the weighted average interest rates on credits. This indicates the predominant feature of crisis - increasing costs of financial resources due to risky transactions in financial markets and the realisation of investment risks. Market players wanted to restore their shrinking cash flows by credit resources, which resulted in the increase of demand and rise of interest rates on credits.

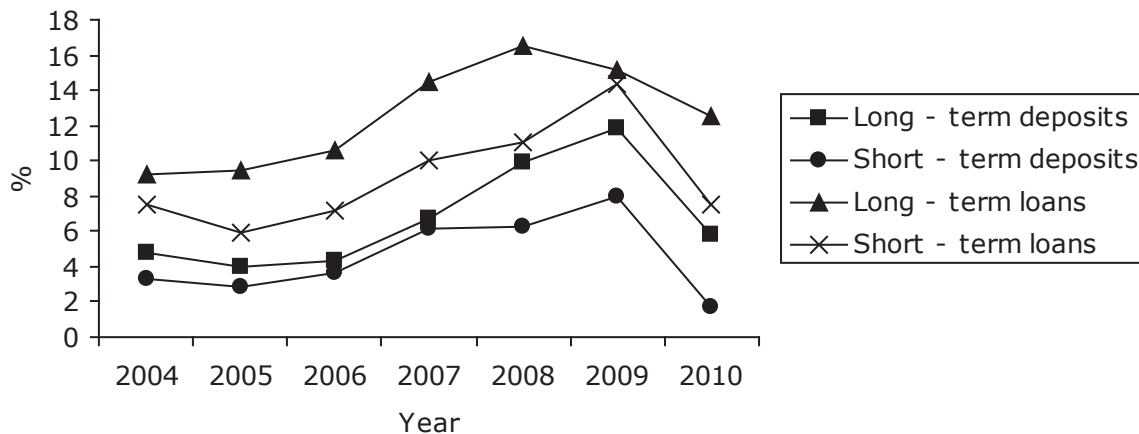
Moreover, additional factor was banks' losses due to bad credits. It was necessary to have additional amount of money, which could have been attracted from the households sector in the form of deposits. Short-term and

long-term deposit interest rates were raised in order to motivate households to deposit.

The changes in weighted average interest rates on both credits and deposits, and the fall in GDP gave evidence that the state suffers economic recession phase. In 2009 and 2010, the necessity to reduce national budget expenditures occurred as well as the state orders for private sector were limited. Alongside with the financial sector problems, real economy faced difficulties resulting in sharp decline of the economic activity, which led to a real confirmation of increase in the number of job seekers (Figure 4).

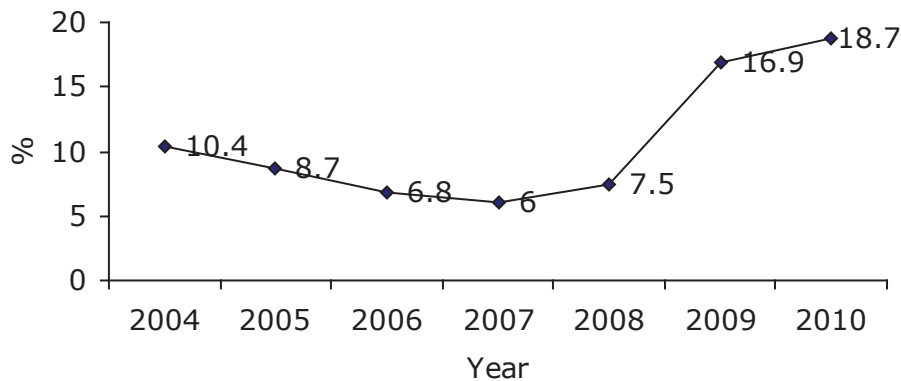
Alongside with the employment decline, the households faced problems to fulfil their obligations. Those households, in which their main breadwinner had lost job, had to move from the income derived from employment, self-employment, or entrepreneurship to the income made of state or local municipality social transfers.

In the period of 2004-2010, the average net wages had annually increased by LVL 34.42 (Figure 5). The changes from maximally reached average net wage LVL 350 in 2008 lowered to LVL 316 in 2010, thus, forming the difference of approximately LVL 34.



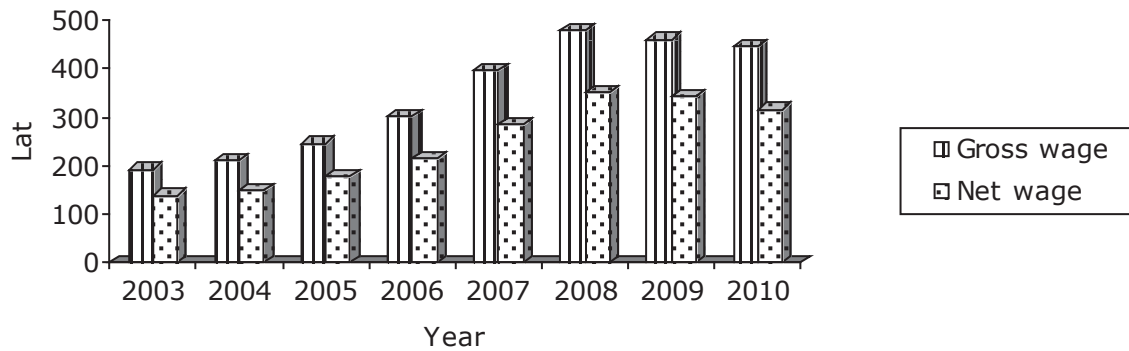
Source: authors' construction based on the CSB data

Fig. 3. Weighted average interest rates on deposits in LVL and credits issued at credit institutions in Latvia in the period of 2004-2010



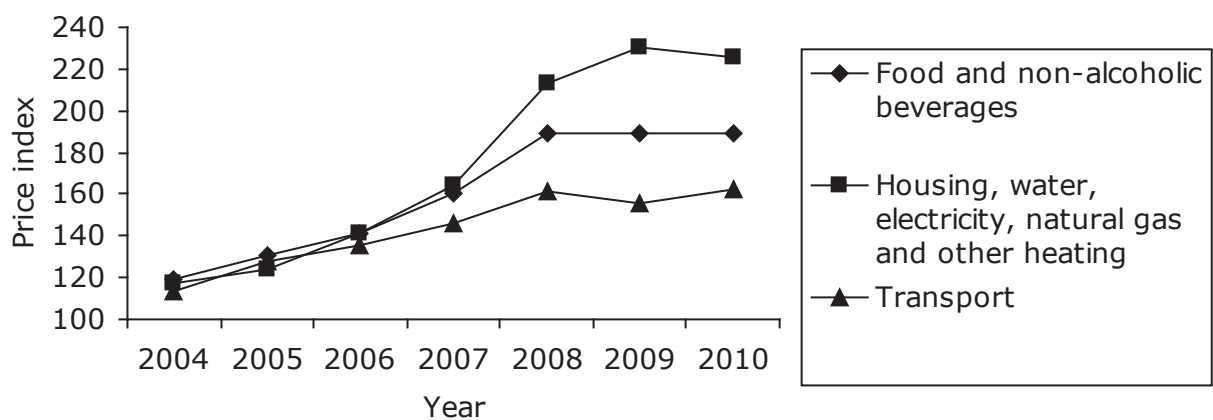
Source: authors' construction based on the Statistical Yearbook of Latvia, 2011

Fig. 4. Dynamics of the proportion of job seekers within economically active inhabitants in the period of 2004-2010, %



Source: authors' construction based on the Statistical Yearbook of Latvia 2011

Fig. 5. Monthly gross and net wages of Latvia working population in the period of 2004-2010



Source: authors' construction based on the CSB data from PCG02. Consumer price indexes and changes in groups and subgroups

Fig. 6. Consumption price indexes and changes in groups and subgroups, index (base 2000=100) from 2004 to 2010 in Latvia

The changes, which reflect that the average wage has annually increased by LVL 34 since 2004 and then followed a period of comparatively small decrease from 2008 to 2010, could be explained by the increase of efficiency on the background of redundant employees. During the economic downturn, when the average rate of job seekers made up 17–19% of Latvian labour force, those employees who remained at their workplaces were possibly more motivated to work in order to retain their jobs.

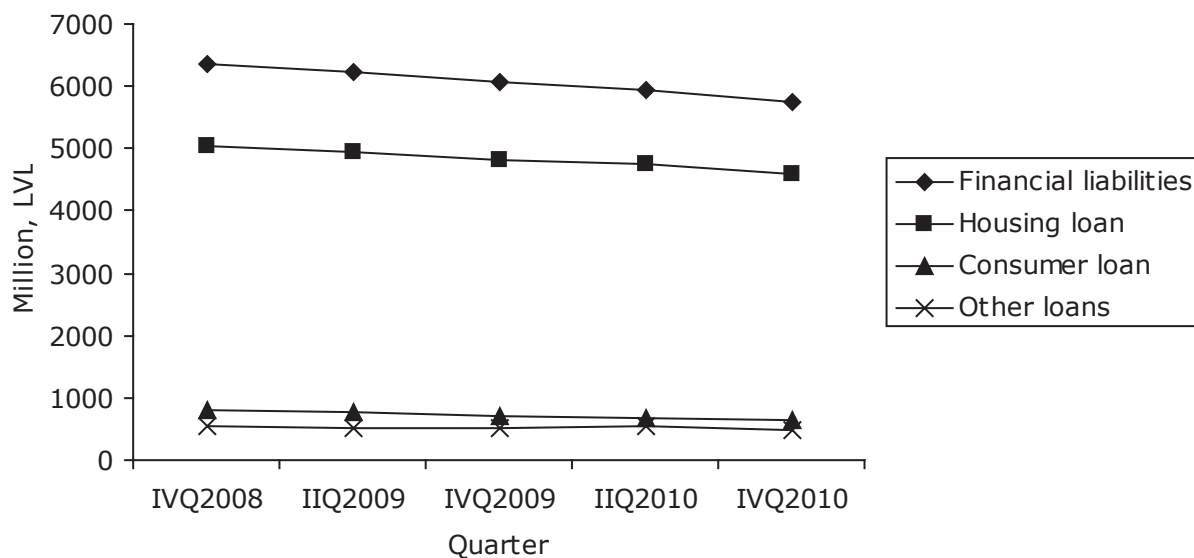
Significant changes took place also in the tax system – the VAT standard rate and reduced rates as well as the excise tax on fuel etc. were raised, which resulted in growth of inflation.

The information aggregated in Figure 6 reveals that during this period the most significant increase in prices was characteristic in 2009 for services related to housing maintenance. During the past three years, the price level of food and non-alcoholic beverages has constantly remained high.

The households sector during the recession is significantly affected by the amount of accumulated wealth and debts. Those households, which according to their accepted life standards have higher standard of

living, will be less tended to save. Whereas, households having lower standard of living will be more tended to save, especially during the recession phase, when the source and level of income is unpredictable and savings are insufficient to ensure the households' existence for at least one month ahead. Moreover, the debts accumulated during the economic growth phase have to be paid despite problems of income generation during the recession phase. In this aspect, the so-called appetite for risks plays an important role – how good are household's possibilities to manage risks connected with its income, ability to consume, and skills to invest in long-term assets. Households with low risk appetite have significantly weaker consumption possibilities, which are determined by unpredictable future of households' financial condition (DeLong B. J., 2002; Senfelde M., 2009).

The information aggregated in Figure 7 reveals considerable amount of households' liabilities of which the largest proportion consists of housing loans that in the beginning and end of the period constituted approximately 80% of the total amount of financial liabilities. It means that the households' financial liabilities will reflect on reduction of households' consumption expenditure in the long-term.



Source: authors' construction based on SEB Households' financial review, April 2011

Fig. 7. Financial obligations of households (million. LVL) in Latvia within the period of 2008-2010

Table 1

Chain structure changes of consumption expenditure by Latvia households against the previous year in percentage points during the period of 2004-2010

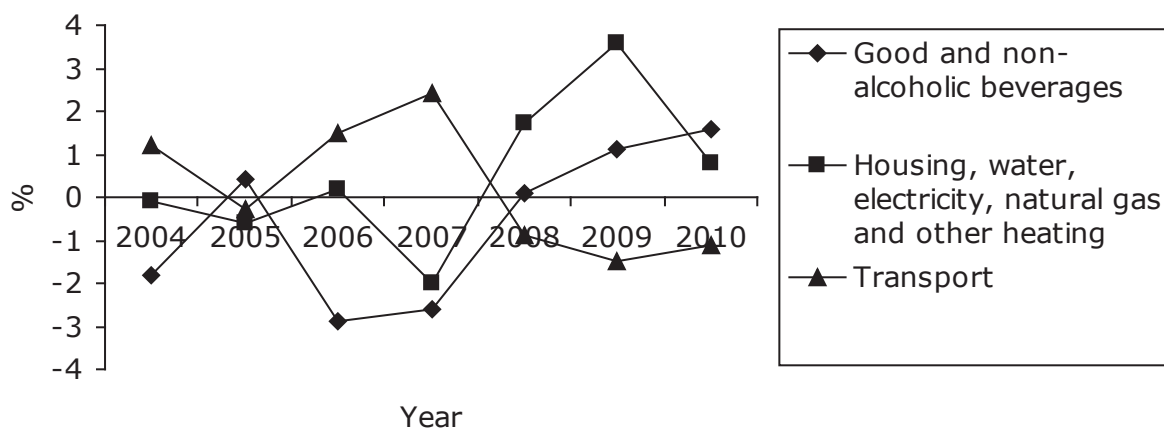
Consumption expenditure	2004	2005	2006	2007	2008	2009	2010
Food and non-alcoholic beverages	-1.8	0.4	-2.9	-2.6	0.1	1.1	1.6
Alcoholic beverages, tobacco	-0.1	-0.2	0	-0.3	0.2	0.4	-0.1
Clothing and footwear	-0.3	0.6	-0.1	0.9	-0.8	-2.5	0.6
Housing, water, electricity, gas and other fuels	-0.1	-0.6	0.2	-2	1.7	3.6	0.8
Furnishings, household equipment and routine household maintenance	-0.3	0.4	0.3	0.4	0	-1	-0.9
Health	0.3	0	-0.2	1.2	-0.1	0.5	0.5
Transport	1.2	-0.3	1.5	2.4	-0.9	-1.5	-1.1
Communication	0.6	-0.5	0	-0.9	-0.6	0.5	-0.1
Recreation and culture	-0.4	0.5	0.8	0.7	0.1	-0.3	-1
Education	0.2	-0.3	-0.1	-0.2	0.2	0.4	0.1
Hotels, cafes and restaurants	0.4	0.3	0.3	-0.1	-0.3	-1.2	-0.4
Miscellaneous goods and services	0.2	-0.2	0.2	0.4	0.5	0	-0.1

Source: authors' calculations based on the Statistical Yearbook of Latvia: 2005, 2008, 2010, 2011

Analysis of households' consumption expenditure within various phases of economic cycle

During the period of 2004-2010, the amount of households' consumption expenditure per household member has increased until 2008 reaching LVL 232.05 at the end of the year, which is LVL 118 more than in 2004, whereas in 2010, it was 76.7% of the 2008 year's level (Statistical Yearbook of Latvia: 2010; 2011).

The analysis of the structure of inhabitants' consumption expenditure during the period of 2004-2010 gives evidence that the first positions are occupied by expenses related to food and non-alcoholic beverage purchase, dwelling and its maintenance expenses, and transport expenses (Majsaimniecibas budzeta apsekojuma... 2010, 2011). The increase of consumption expenditure on food, which was 28.3% of the total amount of consumption expenditure in 2010,



Source: authors' construction based on the Statistical Yearbook of Latvia: 2005, 2008, 2010, 2011

Fig. 8. Dynamics of the structure of Latvia households' consumption expenditure during the period of 2004-2010

points to the reduction of inhabitants' living standards since in highly developed countries the proportion of food expenditure is within the range of 10–20% of total consumption expenditure (Krastins O., 2001). In order to emphasise the changes in a short-time period according to the phases of economic cycle, it is meaningful to use percentage changes in the chain arranging them in time series (Ciemina I., 2009).

The calculations aggregated in Table 1 give evidence that during the economic growth phase the proportion of priority goods and services decreases in the total structure of households' consumption expenditure. Whereas, during the economic recession phase, the proportion of priority consumption expenditure increases (except transport costs) in the total structure of households' consumption expenditure due to the decreased proportion of expenditure on secondary goods and services.

After the analysis of change dynamics (changes against the previous year) within the three largest households' consumption expenditure groups, significant changes were detected in the period of 2004-2010 (Figure 8). This confirms the regularity discovered by a German statistician Ernst Engel that according to modern requirements is formulated as follows: alongside with the growth of households' prosperity, their expenditure on food and non-alcoholic beverages increase in absolute numbers with the decrease of their proportion against the disposable income amount envisaged for consumption (Ciemina I., 2009).

The dynamics of consumption expenditure changes from 2005 to 2007 indicates that within this period, the proportion of households' expenditure on food has annually decreased for approximately 2%, which complies with the regularity formulated by E. Engel. The year 2008 indicates the deterioration of welfare indicators – expenditure on food and non-alcoholic beverages increased by 0.1%; whereas, the year 2009 already indicates the increase of expenditure on food – 1.1%. That points to the deterioration of households' financial situation caused by the economic recession phase, which began in 2008.

Similar dynamics of changes was observed in housing expenditure. The increase of this expenditure proportion was significantly affected by the government's activities introducing a tax on buildings, increasing land tax, and abolishing the reduced VAT rate on natural gas and electricity. Moreover, increasing prices of energy resources in the world markets had additional effect. In general, the average increase of the housing expenditure proportion was 3.6% from 2008 to 2009.

In contrast to expenditure on food and housing, the transport costs have been reducing since 2007. This phenomenon could be explained by the fact that the economic recession resulted in unemployment, and the programme providing a school bus for pupils was implemented on the national level, which contributed to the transport costs' proportion decline in the households' consumption expenditure.

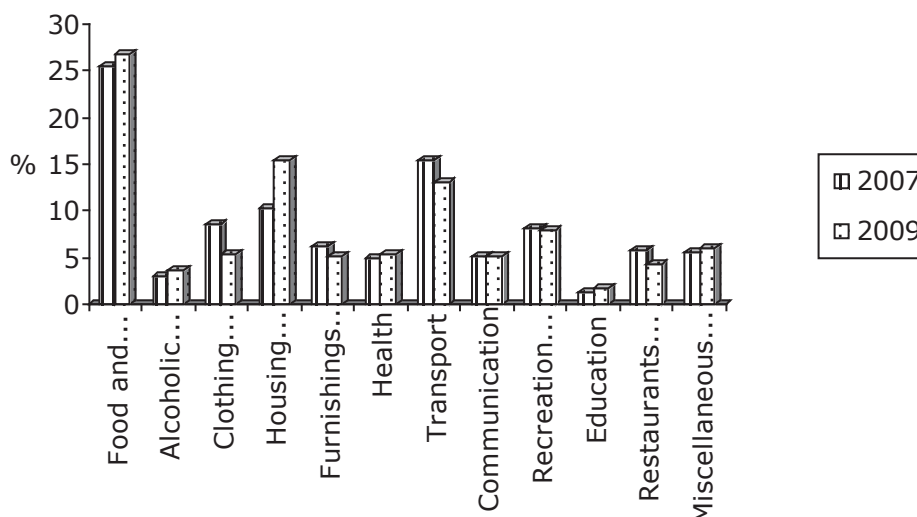
The analysis of the last year of the state's economic growth – the year 2007 and its comparison with the hardest economic recession year 2009 reveals obvious changes that have taken place within the phase of economic recession (Figure 9). One of the most significant changes is the increase of housing costs. In absolute figures, the difference is approximately LVL 10 – increase of costs from LVL 20 to LVL 30.

The changes of consumption expenditure from 2007 to 2009 reveal that inhabitants have tried to reduce their costs in those goods and services' groups, which are not necessities or are durable goods. The households tend to refuse from goods and services providing physical or mental pleasure – recreation and culture, restaurants, cafes, and hotels.

The alcohol and tobacco expenditure proportion has increased, which could be explained by rising of the excise tax on alcohol and tobacco as well as tendency to consume more alcohol caused by the economic recession phase.

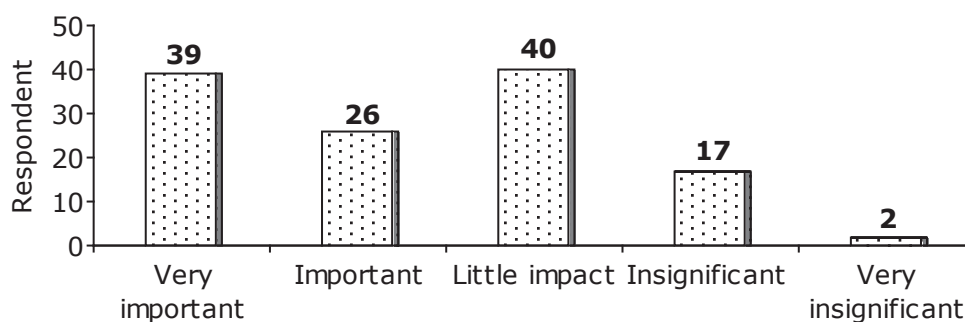
Changes in households' consumption habits during the phase of economic recession

In scope of the performed research, critical evaluation of 124 households' survey results obtained



Source: authors' construction based on the Statistical Yearbook of Latvia: 2005, 2008, 2010, 2011

Fig. 9. Structure of Latvia households' consumption expenditure from 2007 to 2009 (% of total consumption expenditure)



Source : authors' construction based on the survey data aggregates

Fig. 10. Changes in respondents' consumption habits during the economic downturn period in comparison with economic growth period, n=124

in March 2011 is important alongside with statistical data analysis. The available research sample consisting of 18-74 years old respondents was surveyed using an electronic questionnaire. The most important consumption expenditure positions highlighted by respondents completely comply with the overall situation of expenditure hierarchy, however, totally 61% of respondents have claimed reduction of costs amount on clothing and footwear as the most essential changes in expenditure structure, 59% - on recreation and culture, and 57% - on restaurant, cafe, hotel visits.

In aspect of spending, generally 66% of respondents claimed reduction of spending amount in conditions of the economic recession phase, more than 1/5 of respondents declared that their spending had not changed, whereas every tenth respondent stated that they had begun to spend more. The analysis of the overall changes in consumption habits leads to the conclusion that more than half of respondents recognise facing significant changes in consumption habits (Figure 10).

The survey results also indicate relationships between spending and consumption habits – the less is the

spending, the more consumption habits are changed. Whereas 76% of respondents stated that the need to purchase a commodity was being carefully considered, while almost one third of respondents claimed that advertisements had a little impact on the likelihood of purchases. Moreover, a comparatively small number of respondents who purchase goods spontaneously or purchase discount products give evidence of household consumers' particular level of resistance against marketing activities. Possibly, advertisement for Latvia households is only a source of information about advantageous price or unique properties etc. of a commodity or a service. The particular situation suggests that households have their own consumption model, in which external irritators and needs enabling factors play only a secondary role against primary consumption role – to satisfy the basic needs of households' functioning.

It means that people fearing for their future income more carefully begin to plan their purchases and no longer allow purchasing any goods at any price. Besides, the reduction of investment amount in economy, which could promote the consumption, urges people to be

more careful with expenditure. Thus, the households' consumption is being maximally reduced to optimal level ensuring households' existence (Mankiw N.G., Taylor M.P. 2008). Such tactics cannot be used for a long term, since each household has needs and wants, which will have to be met in the future in order to maximise the overall validity at the particular income and goods and services' price-level.

Conclusions, proposals, recommendations

1. The main factors of economic recession phase affecting households' sector are related to the changes in wages, taxes, employment, interest rates, and prices.
2. The indirect influence of the world economy on households' sector was implemented by energy price increase, instability, and decline in demand tendencies.
3. The analysis of changes taken place in consumption expenditure in dynamics within the economic growth period of 2005-2007 approves E. Engel's regularity, since the proportion of expenditure on food has annually decreased by approximately 2%.
4. In economic recession, the tendency of reduction in the amount of households' disposable income per one member was not the only one observed. In 2010, it accounted for 77% of the year 2008 level. The decline in households' expenditure to meet secondary needs was another tendency.
5. The year 2008 characteristic tendency of increase in the expenditure share on food, which in 2010 accounted for more than 28% of the total consumption expenditure, gives evidence of deterioration of inhabitants' welfare level.
6. The increase of prices on goods and services during the economic recession phase causes more significant changes in those groups of households' consumption expenditure, which account for the largest proportion in the structure of total consumption expenditure such as expenditure on food and housing.
7. Considerable amounts of financial liabilities, inflation increase forecasts, and households' failure to make savings will also have negative impacts on the structure and amount of households' consumption expenditure in the economic growth phase.
8. The analysis of survey results points to particular regularities in the context of available money amount and consumption habits – the less money one starts to spend, the more one's consumption habits are changed, putting emphasis mainly on economic factors.

Bibliography

1. Ciemina, I. (2009). Latvijas iedzīvotāju paterina izdevumi un to izmaiņu tendences pēdējā desmitgadē (Consumption Expenses of Latvian Residents and their Change Trends in the Recent Decade). Latvijas Universitātes raksti. Ekonomika. Vadības zinātne. 743.sejums. Latvijas Universitāte, 34. – 42. lpp.
2. Ciemina, I., Krastins, O. (2004). Dati par iedzīvotāju labklājību: salīdzināšanas iespējas, novērtējums (Data on the Welfare of Residents: Comparison Possibilities, Assessment). Statistikas un pārvaldes problēmas 2004. Rīga: Latvijas Statistikas institūts, 70. – 81. lpp.
3. Ciemina, I., Krastins, O. (2005). Ja sodien nevienam nav viegli, tad kam ir visgrūtāk (If Nobody is Doing Well Today, Who has the Biggest Problems) . Latvijas Vestnesis, 25.02.2005.
4. DeLong, B. J. (2002). *Macroeconomics*. Boston: McGraw-Hill Higher Irwin, p. 523.
5. Jansone, J., Krastins, O. (2004). Par mājāsaimniecību paterina prioritātiem. Vertējumi un padomas (On Household Consumption Priorities. Assessments and Thoughts.). Rīga: Latvijas Statistikas institūts, 86. – 89. lpp.
6. Krastins, O. (2001). Statistika par mums pašiem (Statistics on Ourselves). Rīga: Latvijas Statistikas institūts, 96 lpp.
7. *Latvijas statistikas gadagramata 2005 (Statistical Yearbook of Latvia 2005)*. Rīga: Latvijas Republikas Centrālā statistikas pārvalde, 2005, 302 lpp.
8. *Latvijas statistikas gadagramata 2008 (Statistical Yearbook of Latvia 2008)*. Rīga: Latvijas Republikas Centrālā statistikas pārvalde, 2008, 568 lpp.
9. *Latvijas statistikas gadagramata 2010 (Statistical Yearbook of Latvia 2010)*. Rīga: Latvijas Republikas Centrālā statistikas pārvalde, 2010, 600 lpp.
10. *Latvijas statistikas gadagramata 2011 (Statistical Yearbook of Latvia 2011)*. Rīga: Latvijas Republikas Centrālā statistikas pārvalde, 2011, 496 lpp.
11. *Mājāsaimniecības budžeta apsekojuma galvenie rezultāti 2009. gada (Main Results of Household Budget Survey in 2009)*. Rīga: Latvijas Republikas Centrālā statistikas pārvalde, 2010, 41 lpp.
12. *Mājāsaimniecības budžeta apsekojuma galvenie rezultāti 2010. gada (Main Results of Household Budget Survey in 2010)*. Rīga: Latvijas Republikas Centrālā statistikas pārvalde, 2011, 39 lpp.
13. Mankiw, N.G., Taylor, M.P. (2008). *Economics*. London: Cengage Learning, p. 830.
14. Praude, V. (2009). Pateretāja vertīguma un pateretāja kapitāla veidošana (Formation of the Worthiness and Capital of Consumers) Latvijas Universitātes raksti. Ekonomika. Vadības zinātne. 743. sejums. Latvijas universitāte, 34. – 42. lpp.
15. Sassatelli, R. (2007). *Consumer Culture. History, Theory and Politics*. London: SAGE Publications, p. 237.
16. *SEB Mājāsaimniecību finanšu apskats, Aprilis 2011* Retrieved: http://www.seb.lv/data/Analitiska-Info/Makroekonomika/Baltic-Household-Outlook_04-2011-LV.pdf. Access: 03 January 2012.
17. Senfelde, M. (2009). *Makroekonomika (Macroeconomics)*. 3. izdevums. Rīga: RTU izdevniecība. 241 lpp.

“ECONOMIC SCIENCE FOR RURAL DEVELOPMENT”

Proceedings of the
International Scientific Conference

RESOURCES AND COOPERATION

2. Production and Cooperation in Primary and Secondary Agriculture

Age Structure of Tractor Fleet in Latvian Agriculture

Astra Asejeva, Mg.oec

Department of Business and Management, Latvia University of Agriculture

Nikolajs Kopiks, Dr.sc.ing.; Dainis Viesturs, Dr.sc.ing.

Research Institute of Agricultural Machinery, Latvia University of Agriculture

Abstract. This paper deals with trends in the evolution of the tractor fleet in Latvia's agriculture characterised by statistical indicators: average age, renewal rate, and priority tractors. The average age of the tractor fleet is 22.4 years but the renewal rate of tractors has decreased by 25% over the period of 2005-2010. The paper presents the factors having an impact on the abovementioned indicators. The forecasts regarding the quantitative contents of the perspective tractor fleet are also included in the paper.

Key words: tractors, structure, age period, renewal trend.

JEL code: Q19

Introduction

In agricultural production, particularly in crop cultivation, tractors play the main role in technological processes and constitute the basic energy component on the farm. Therefore, the number of tractors, their structure and length of service need systematic economic analysis and argumentation, which is particularly important today due to the considerable increase in the prices of tractors in recent years, as well as the increase in their efficiency due to higher capacity and speed. The costs of the product may increase disregarding these facts.

The paper aims to provide the analysis of age structure of the tractor fleet characterised by the share of tractors having different lengths of service. The analysis considers the renewal trends of the tractor fleet on farms with various areas under crop cultivation as well as the number of tractors undergoing technical inspection. Based on the abovementioned data and other indicators, it is suggested that a perspective structure of the tractor fleet should be determined. The methods of statistical analysis and the data obtained from the Central Statistical Bureau of the Republic of Latvia and the State Agency of Technical Supervision are used in the present paper.

Results and discussion

The age structure and power intensity of the tractor fleet are very important factors for its renewal, since the overextended service life of tractors increases the prime cost of operations due to the loss of time while the machines are idle, increased costs of repairs, and no possibility to use the machines intensively at a high level of physical wear-and-tear. In many ways, the age structure determines the execution of the operations in fixed agrotechnical terms. The average age T_{avr} of a tractor fleet can be determined by the ratios of tractors having different age periods of use.

$$T_{avr} = \sum_{i=1}^n T_i \alpha_i,$$

where:

T_i – age period of the use of tractors;

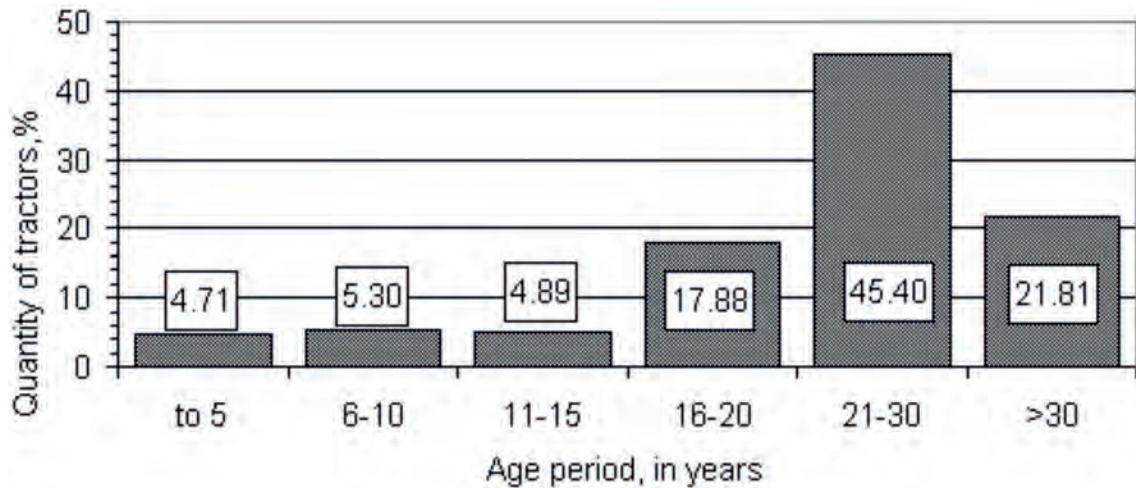
α_i – ratio of the tractors within the i -th age period of their use;

n – quantity of the age periods.

The data analysis showed that, in the following age periods: T_1 = up to 5 years; T_2 = 6-10 years; T_3 = 11-15 years; T_4 = 16-20 years; T_5 = 21-30 years; T_6 > 30 years, the average age of the agricultural tractors constituted 22.4 years. The graph in Figure 1 shows the share of tractors in their total quantity by age periods.

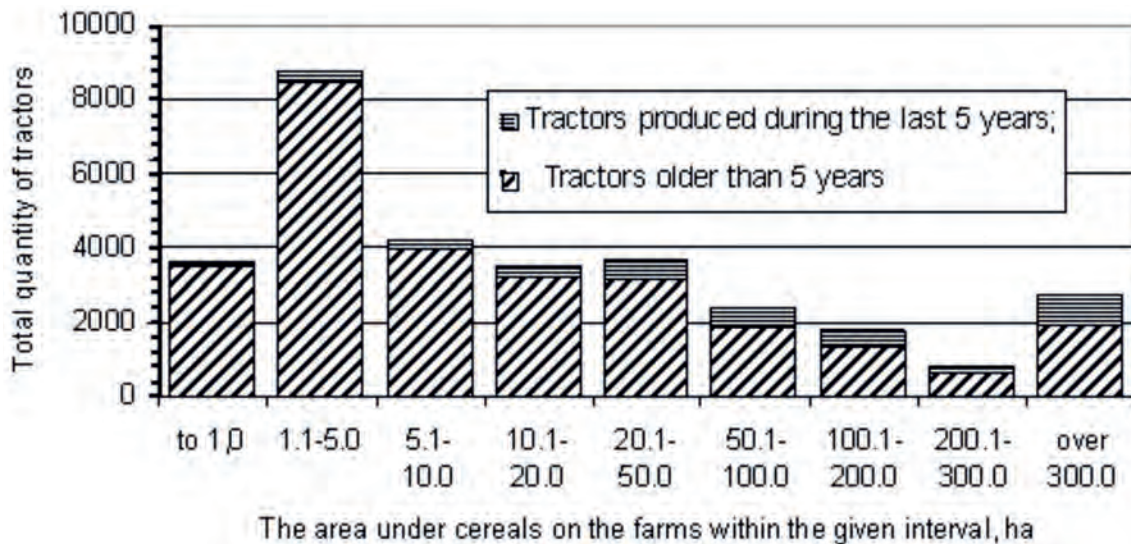
It is evident from Figure 1 that the share of tractors grows in relation with the increase in the age period, indicating that a significant part of tractors in their total quantity is outmoded because their average age is high. Figure 1 also shows that the share of tractors in the age period of 21-30 years reaches 45.4%, which is almost half of the tractor fleet, but for the age periods of up to 5 years and from 6-10 years it is 10.1%. Consequently, the level of technical provision mainly includes obsolete and non-serviceable tractors. In this case, the efficiency decreases, the costs for maintaining the machinery in operable condition increase, and this does not promote a reduction in the deficit of manpower (machine operators).

In many respects, the changes in the age structure of the tractor fleet depend on its renewal rates and the retirement of obsolete machinery. According to the data from the State Agency of Technical Supervision, only 36% of tractors undergo technical inspection, and this constitutes only 27805 tractors out of the 77236 tractors used today in agriculture. Thus, it is confirmed that a considerable number of tractors in the tractor fleet are in a non-serviceable state. The average age of tractors, which have passed technical inspection is 14.8 years. Besides, totally 27.8% of the tractors refer to the age period up to 5 years and from 6-10 years. The renewal of such number of tractors at the existing rate may take



Source: authors' calculations based on the data from the State Agency of Technical Supervision of Latvia

Fig.1. The share of tractors in their total quantity by age periods



Source: authors' calculations based on the data from the Central Statistical Bureau of Latvia

Fig.2. Breakdown of tractors depending on the areas under cereals on the farms

place every 15 years. This is the average number of tractors undertechnical inspection.

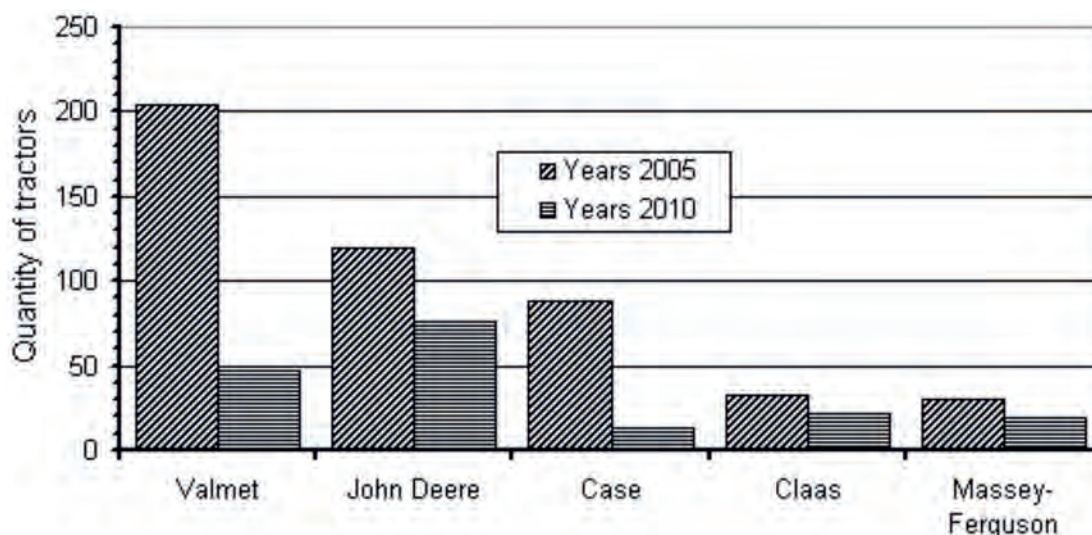
The trend in the growth of contemporary machinery on the farms and enlargement of farms make it possible to predict the number of tractors, which may reach 26 – 30 thousand in the future (Asejeva A., Kopiks N., Viesturs D., 2006; Kopiks N., Viesturs D., 2006).

The renewal rate of the tractor fleet has been considerably reduced in recent years. A great part of the tractors exceed the depreciation period by the time of service, and the reduction process of obsolete and physically worn-out tractors is slow. In many ways, this situation can be explained by an insufficient economic potential of the farms, insufficient subsidies from the state as well as the current situation with the prices in the market of agricultural products.

Breakdown of tractors under 5 years of age and the total number of tractors depending on the areas under cereals is presented in Figure 2.

Figure 2 shows that the number of tractors up to 5 years of age on the farms having crop cultivation areas less than 20 ha constitutes 5.11% of the total number of their tractors (20105), while on farms with large sown areas they amount to 23.32% of the total number of their tractors (11430). For small and big farms, the quantity of tractors under 5 years of age constitutes 11.7%. This number does not include farms without crop cultivation areas.

Such a quantitative difference of tractors can be explained, in many ways, by a different economic potential of this group of farms. For instance, the average productivity on the farms with areas under crop cultivation of up to 20 ha is 1.95 t/ha, while the average



Source: authors' calculations based on the data from the State Agency of Technical Supervision of Latvia

Fig.3. The dynamics of acquisition of new priority tractors on the farms

productivity on the farms having large sown areas is 2.59 t/ha (data from the Central Statistical Bureau, 2010). Higher productivity is observed on the farms, which have cultivated areas exceeding 20 ha, since it is mostly connected with one of many factors affecting its value. It is the process of renewal and application of modern, highly-efficient machines, which ensure the execution of operations in high quality and in due time.

A considerable resource for efficient use of the tractor fleet is the improvement of its age structure. The tractors with a small age period (up to 5 years) have less losses of time, particularly in the intensive periods of their use. This is especially important for the agricultural operations the intensity of which is of cyclic character and which shall be executed in fixed agrotechnical terms. However, it is also necessary to remember that the renewal of the tractor fleet should take into account the correlation between its structure and the production technology of agricultural crops. Scientists in Estonia studying their tractor fleet have come to the same conclusion (Traat U., 2007; Olt J., Traat U., Kuut A., 2010).

In many respects, the slow renewal of the tractor fleet can be explained by the fact that the replacement of obsolete machines should be of a complex character considering the correlation between its structure and the production technology. The new modern tractor units cannot be introduced without considering the entire technological process, which includes also other units characterised by their efficiency and the required quality of the performance.

Lack of conformity between the already existing machines and the newly acquired ones has an impact on the efficiency of the executed production processes as well as on the insufficient application of new organisational forms of the use of machines (Pawlak J., Pelizzi G., Fiala M., 2002).

The structure of the tractor fleet is renewed every year at the expense of improved tractors. The dynamics of their acquisition is shown in Figure 3.

Figure 3 shows that the quantity of the acquired priority tractors has not increased. Comparing the years 2005 and 2010, it can be stated that the acquisition of tractors of the Valmet brand has decreased 4.3 times, John Deere – 1.6 times, Case – 6.8 times, Claas – 1.5 times, and Massey-Ferguson – 1.6 times. It should be noted that the tractors of the Valmet and Case brands have the lowest percentage of increase. The average increase rate of the new tractors acquired in the period of 2005-2010 has diminished by 25%. The main reason for the decrease is the reduction of state subsidies to agriculture, and an overall decrease in the economic activity in this period. The subsidies in the period from 2006 to 2010 have decreased four times (Ministry of Agriculture, 2011).

The bulk of the annually acquired tractors are those of the brand MTZ. Yet, the number of purchased MTZ tractors is decreasing from year to year in contrast to all the other brands of tractors acquired in the respective years. For instance, in the year 2010, their acquisition diminished 6 times. Data indicate that ever-increasing preference among the acquired tractors is given to the following brands: John Deere, Claas, and Massey-Ferguson, which are recognised as priority brands. This indicates that the determining factors in the renewal process of tractors today are not only their reliability, economy, power-intensity, efficient applicability, comfort, and other indicators but also their price. One of the reasons for the low renewal rate of the tractor fleet is insufficient financial support to the farms and the current difficult economic conditions.

Conclusions

The average age of agricultural tractors is 22.4 years, only 36% of them being in good working order. The bulk of the new and non-defective tractors are on the farms having crop producing areas of more than 20 ha and high productivity.

The average increase rate of the new tractors acquired in the period of 2005-2010 has decreased by 25%, which can be explained by lower economic potential and financial support to the farms in the second half of the period.

A trend towards the enlargement of the farms and renewal of machines makes it possible to predict the quantity of tractors, which may constitute 26–30 thousand tractors in the future. The renewal of such a number of tractors at the present rate may take place in every 15 years.

Bibliography

1. Asejeva, A., Kopiks, N., Viesturs, D. (2006). The Choice of an Optimum Ploughing and Sowing Aggregate for Different Amounts of Work. *Proceedings of the International Scientific Conference Economic Science for Rural Development*. No. 10. Jelgava, pp. 139-144.
2. Kopiks, N., Viesturs, D. (2006). Power Supply of Tractors on Agricultural Farms: *Proceedings of the 5th International Scientific Conference Engineering for Rural Development*, Jelgava, pp. 53-57.
3. Latvijas Lauksaimniecība (2011). Statistisko datu krājums. Riga: LR CSP, 62 lpp. (Agriculture of Latvia, Collection of Statistical Data) (In Latvian).
4. LR Centralas statistikas parvaldes materiāli. 2005-2010 (2010). Riga: LR CSP. (Latvian Agriculture 2005 ...2010. Central Statistical Bureau of the Republic of Latvia).
5. Valsts tehniskās uzraudzības aģentūra pārskati 2000.-2011. Riga: LR Zemkopības ministrija (Reviews of the State Technical Supervision Agency 2000...2011), Riga, Zemkopības ministrija (In Latvian).
6. LR Zemkopības ministrija. Gada ziņojums, 2011. 60 lpp. (LR Ministry of Agriculture. Annual Report 2011). Riga, Zemkopības ministrija (In Latvian).
7. Olt, J., Traat, U., Kuut, A. (2010). Maintenance Costs of Intensively Used Self-propelled Machines in Agricultural Companies: Proceedings of the 9th International Scientific Conference "Engineering for Rural Development", Volume 9. Jelgava, pp. 42-48.
8. Pawlak, J., Pelizzi, G., Fiala, M. (2002). On the Development of Agricultural Mechanisation to Ensure a Long-Term World Food Supply. *Agricultural Engineering International: the CIGR Journal of Scientific Research and Development*. Invited Overview Paper. Vol. IV. June, p. 22.
9. Traat, U. (2007). Review of the Maintenance of Tractors in Estonian Agricultural Companies in 2007. Proceedings of the International Conference "Technical and Technological Progress in Agriculture", No. 12. Raudondvaris, pp. 110-116.

Characteristics of Poultry Meat Production in The European Union Member States

Sallija Cerina¹, Mg.oec., PhD student
Faculty of Economics, Latvia University of Agriculture

Abstract. Topicality of the research is growing consumer demand for quality, health-beneficial poultry meat in the European Union Member States (EU). The aim of the paper is to characterise the production of poultry meat in the EU and development in Latvia. Research results show that the production and consumption is almost in balance in the EU. The total poultry meat production in the EU has steadily increased from 11.0 million tonnes in 2004 to 11.8 million tonnes in 2009, and consumption has increased from 10.3 million tonnes in 2004 to 11.6 million tonnes in 2009. Total poultry meat produced in Lithuania were 71437 tonnes (65.2% of the total poultry meat in the Baltic States), followed by Latvia - 23168 tonnes (21.2%) and Estonia 14882 tonnes (13.6%) in 2009. Consumers demand poultry meat with increased omega group fatty acids, antioxidants, and low level of cholesterol. In this aspect, feeding trial was conducted with cross Ross 308 broiler chickens by applying composition of the spruce needles neutral extractives substances in their diet. It is possible to improve broiler chicken meat quality significantly by increasing the level of antioxidants carotenoids and decreasing cholesterol level. It was concluded that profit from sales of innovative composition meat was 11.34% in comparison with commercial production. In the perspective, the quality of poultry meat should be increased by production of poultry meat that is innovative. Thus, the production costs will increase together with the productivity of the poultry.

Key words: poultry meat, produce, consumption.

JEL code: O13

Introduction

The production of poultry meat continues to expand in Latvia as in most other countries due to increasing consumer demand for poultry meat. Poultry meat is produced more rapidly and uses less space and natural resources compared with other livestock. From the early 1990s, the market share of poultry meat has benefited from the growing popularity of the opinion that the white meat is healthier than red meat as well as the increased use of poultry in frozen processed products and ready-meals. The following five factors are believed to have contributed to the increasing popularity of chicken meat: value/price compared with other foods; good nutritional profile/low in fat; convenience/ease of preparation; versatility; and well suited for quick-service and casual dining menus.

Of all poultry meat produced in the European Union Member States (EU), around 81.6% is chicken meat due to the advantages of broiler chicken over other animals that are the following: broilers have a growth cycle of six to seven weeks, which allows for repeated production throughout the year; more broilers than layers can be placed in a shed; broilers have high feed conversion efficiency (FCE); and return from the investment in broilers is fast (Poultry Meat &..., 2010). Production of enriched composition meat requires additional expenses, possibly significantly increasing the sales price. The price difference is primarily due to the costs of additional feeding stuffs included in the avian feed (Michella S.M., Slaugh B.T., 2000).

Consumers' demand for quality, healthy poultry meat products is increasing. Good quality and healthy poultry meat (innovative composition) is characterised

by a high content of polyunsaturated fatty acids, vitamins, anti-oxidants and mineral substances, and low level of saturated fatty acids and cholesterol (Holub B.J., 2002, Population Nutrient Intake..., 2003). In a recently conducted research study, poultry daily ration was enriched with forestry by product spruce needles green biomass containing feeding stuffs - spruce needles neutral extractives substances to obtain broiler chicken meat of an innovative composition.

Therefore, the following research hypothesis was stated: dynamic development of poultry meat sector in the European Union Member States (EU) and Latvia mainly depends on consumers' demand.

The aim of the research is to characterise the production of poultry meat in the EU Member States. The following tasks are defined to achieve the set aim:

- 1) to analyse the current situation of the EU Member States poultry meat sectors including the Baltic States;
- 2) to assess production costs and possible revenues from the broiler chicken meat of innovative composition produced as a result of practical trials in Latvia.

- 3) The studies were carried out at the Research Institute of Biotechnology and Veterinary Medicine "Sigra", Latvia University of Agriculture. The annual statistical data from the database of Food and Agriculture Organisation of the United Nations and the Central Statistical Bureau of Latvia, the European Commission (Agriculture and Rural Development DG) were used in the research. Generally accepted economic research methods were used for the purposes of the study like a monographic method and a method of comparative analysis and synthesis.

¹ E-mail address: sallija_cerina@inbox.lv.

Table 1

The EU Member States poultry meat supply (thou. t), 2004-2009

Indicators	2004	2005	2006	2007	2008	2009	2009/2008, %
Gross production	10985	11076	10744	11452	11645	11803	1.4
Total exports	1300	1240	1.24	811	905	928	2.5
Total imports	500	640	650	829	864	848	-1.9
Consumption	10350	10550	10250	11469	11604	11630	0.2
Consumption per capita, kg	22.5	22.9	22.1	23.2	23.4	23.3	-0.4
Rate of self-sufficiency %	106.0	105.0	105.0	99.9	100.4	100.8	0.4

Notes: partial provisional or estimated

Source: author's calculations based on the AVEC Annual report, 2010

Table 2

Poultry meat production and self-sufficiency rate in the selected EU Member States, 2009

Member State	Poultry meat production total (tonnes)	Share of the total poultry meat production in the EU (in %)	Self-Sufficiency rate, %	Chicken meat production (tonnes) of total poultry meat production	Chicken meat (% of total poultry meat)
Belgium-Luxembourg	460339	3.9	165	n.a.	n.a.
Estonia	14882	0.1	n.a.	n.a.	n.a.
France	1672493	14.2	120	1039000	62.1
Germany	1288743	10.9	87	785868	61.0
Hungary	386949	3.3	124	n.a.	n.a.
Italy	1144405	9.7	106	822300	71.9
Latvia	23168	0.2	49	n.a.	n.a.
Lithuania	71437	0.6	80	66638	93.3
Netherlands	842313	7.1	188	763709	90.7
Poland	1144940	9.7	118	1059780	92.6
Portugal	283140	2.4	93	247347	87.4
Romania	371383	3.1	n.a.	n.a.	n.a.
Spain	1205470	10.2	96	1179470	97.8
UK	1652129	14.0	98	1463140	88.6
Others	1241467	10.5	n.a.	n.a.	n.a.
EU	11803258	100.0	100,8	9631397	81.6

n.a. - not available

Source: author's calculations based on the data from FAOSTAT, AVEC Annual report, 2010

Research results and discussion

1. The current situation in the EU Member States poultry meat sector

Poultry meat is the second most important among meat species in the EU today. The European annual gross production is 11.8 million tonnes and the consumption equals about 23.3 kilograms per capita per year 2009 (Table 1). The European poultry industry employs 673,000 staff across Europe, it has an annual turnover of EUR 107 billion and consumes about 20% of the total EU cereal production for poultry feed and is, thus, of a significant economic importance (AVEC Annual Report, 2011).

While the total meat consumption in the EU has been negatively affected by the economic recession, poultry

meat, which is the cheapest source of animal protein, was less affected. The total poultry meat consumption has increased from 10.3 million tonnes in 2004 to 11.6 million tonnes in 2009 (Table 2). The consumption growth was slower than the population increase, showing that consumption is slightly decreasing per capita (Magdelaine P. et al., 2008). In per capita terms, the demand for poultry meat in 2004 was 22.5 kg/head and in 2009, it increased by 3.6%, thus, equalling to 23.3 kg/head (Table 1). The consumption per head was high in Spain, the United Kingdom (UK), Denmark, and relatively low in Germany and Italy.

For the EU, the production and consumption is almost in balance. In 2009, the EU gross production was 11803 million tonnes and the consumption was 11630 million tonnes (self-sufficiency rate of 100.8%).

Table 3

Indicators of chicken meat production in the selected EU Member States, 2004-2009

Member State	Unit of measurement	2004	2005	2006	2007	2008	2009
France	tonnes	1106000	920503	819383	920500	931800	1039000
Chain increase rate	%	×	-16.8	-11.0	12.3	1.2	11.5
Base increase rate	%	×	-16.8	-25.9	-16.8	-15.8	-6.1
Germany	tonnes	609400	605117	608418	687696	764000	785868
Chain increase rate	%	×	-0.7	0.5	13.0	11.1	2.9
Base increase rate	%	×	-0.7	-0.2	12.8	25.4	29.0
Italy	tonnes	703549	694997	628474	733005	790319	822300
Chain increase rate	%	×	-1.2	-9.6	16.6	7.8	4.0
Base increase rate	%	×	-1.2	-10.7	4.2	12.3	16.9
Poland	tonnes	704418	795824	824379	896474	729842	1059780
Chain increase rate	%	×	13.0	3.6	8.7	-18.6	45.2
Base increase rate	%	×	13.0	17.0	27.3	3.6	50.4
Spain	tonnes	1083000	1083970	1064940	1131030	1081740	1179470
Chain increase rate	%	×	0.1	-1.8	6.2	-4.4	9.0
Base increase rate	%	×	0.1	-1.7	4.4	-0.1	8.9
UK	tonnes	1294570	1333790	1288830	1270170	1259060	1463140
Chain increase rate	%	×	3.0	-3.4	-1.4	-0.9	16.2
Base increase rate	%	×	3.0	-0.4	-1.9	-2.7	13.0
EU	tonnes	8544866	8522250	8209198	8723699	8704506	9631397
Chain increase rate	%	×	-0.3	-3.7	6.3	-0.2	10.6
Base increase rate	%	×	-0.3	-3.9	2.1	1.9	12.7

Source: author's calculations according to the data from FAOSTAT

The EU poultry meat exports increase gradually over the medium term by 2.5% in 2009 compared with 2008 (Table 1).

In 2009, the EU poultry meat import has decreased by 1.9% compared with 2008. Some countries, like the Netherlands, France, Belgium-Luxembourg, Poland, and Hungary, are at the same time importing and exporting poultry meat. France is the only country exporting large amounts of poultry meat to the third countries. The Netherlands were mainly exporting fresh poultry meat to Germany and the UK. The EU poultry meat self-sufficiency level has increased by 0.4% in 2009, but decreased by 4.9% compared with 2004 (Table 1).

Poultry meat production takes place throughout the EU territory but it is found in particularly large concentrations in France and the UK, parts of Germany, Spain, Italy and Poland (Table 2). Production is usually situated in or near cereal production areas or in coastal areas in close proximity to ports, which receive imports of feed ingredients (at least two thirds of the cost of a live bird is in the cost of feed). Total poultry meat in the EU reached 11.80 million tonnes in 2009, including 9.63 million tonnes of chicken meat.

France is responsible for most of the EU total production, accounting for 1.67 million tonnes (14.2%, share of the total poultry meat production in the EU),

followed by the UK - 1.65 million tonnes (14.0%) and Germany - 1.28 million tonnes (10.9%) (Table 2).

The dominant production of chicken meat production (tonnes) of total poultry meat production is coming from the UK - 1.46 million tonnes, Spain - 1.17 million tonnes, and Poland - 1.06 million tonnes (Table 2). In 2009, the level of self-sufficiency in the EU was 100%. Within this, there are significant country variations among the Netherlands (188%), Belgium-Luxembourg (165%), Hungary (124%), France (120%), and Poland (118%). The self-sufficiency levels in Latvia were 49% and Lithuania - 80%, which is by 31 percentage points more in comparison with Latvia (Table 2)

In Latvia, Estonia, and other EU countries, production of chicken meat in general statistics is not separated from the total numbers of poultry meat production.

The increase rates for poultry meat production will be calculated to study trends of the changes in the EU for the period of 2004-2009 (Table 3). The calculations are based on the time series analysis, i.e. statistical indicators in a successive weight row, which numerically display the process of changes of a phenomenon within a certain time period. Time series of mean values - their levels contain mean values (Balabka N., 2008). The present research focuses on the time series of relative values, which expressively depict the main changes, occurred in poultry meat production. According to the way of calculation, time series contain the following indicators: chain indicators show the rate of changes from one period to another period within the analysed period; and base indicators show the final results of all changes affecting the rows levels compared with the period assumed as a base period (Balabka N., 2008).

The increase rate shows a share by which the level of respective row has increased or decreased in relation to the previously achieved level. *Legend* - $t_{m(b,ch)}$. According to N. Balabka (2008), indicators may be calculated according to the following equations:

$$a) \text{ chain (\%)} \quad t_{m(ch)} = \left(\frac{\Delta_{m(ch)}}{Y_{m-1}} \right) \times 100 \quad (1);$$

$$b) \text{ base (\%)} \quad t_{m(b)} = \left(\frac{\Delta_{m(b)}}{Y_{y1}} \right) \times 100 \quad (2);$$

where:

$\Delta_{m(b,ch)}$ - absolute increase, characterising the increase (decrease) of a series level within a certain time period,

Y_{m-1} - previous level of a time series,

Y_1 - initial (first) level of a time series (Balabka N., 2008).

Chicken meat production in the EU was 8.5 million tonnes in 2004 and 9.6 million tonnes in 2009. Chicken meat production has increased by 12.7% in the analysed period. Production dynamics in different Member States are, however, relatively contrasted. The largest base increase rate was in Poland (50.4%), Germany (29.0%), and Italy (16.9%).

In 2009, France suffered the largest base decrease (-6.1%). Chicken meat production in the EU in 2009 increased by 10.6% on average compared with 2008 including the highest production increase of chicken meat in Poland 45.2%, the United Kingdom 16.2%, and France 11.5% (Table 3).

In the EU production of chicken meat decreased in 2006. Total chicken meat production in the EU decreased by 3.9% on average (France -25.9%, Italy -10.7%) due to the crisis brought about by the spread of Avian Flu (Table 3). The future development of poultry meat production and trade will depend on the development of feed costs and the prevention of Avian Influenza outbreaks (Windhorsts H.W., 2008, Magdelaine P., 2008). H.W. Windhorst (2011) considers that the dynamics of poultry meat trade in the EU was much slower than on the global level. Asia as well as the South and Central America gained market shares, while Europe and the North America lost its importance.

Production of poultry meat in the Baltic States from 82359 tonnes in 2004 has increased to 109487 tonnes in 2009, thus, increasing by 32.9%. Total poultry meat production in the Baltic States is increasing from 2004, the largest meat producer being Lithuania. Total poultry meat produced in Lithuania amounted to 71437 tonnes (65.2% of the total poultry meat in the Baltic States), followed by Latvia - 23168 tonnes (21.2%), and Estonia - 14882 tonnes (13.6%) in 2009 (Table 4).

Poultry meat consumption in the Baltic States was 20.6 kg per capita on average (in Latvia 20.2 kg per capita, in Estonia - 18.8 kg per capita, and Lithuania - 22.7 kg per capita).

Total poultry meat production levels in the Baltic States were smaller than consumption levels. The Baltic States poultry meat production self-sufficiency level has been ranging from 52% to 85% (in Latvia and Estonia - 52%, Lithuania - 85% in 2009) (AVEC Annual Report, 2010, 2011). K.Damme (2011) stating further investment in broiler growing capacity appears justified if domestic consumption continues to grow and/ or production cost remains competitive with other EU countries.

2. Trial results of innovative composition broiler chicken meat production

The development level of poultry industry in Latvia and the scale of production and technical base provide all the possibilities for producing a natural, innovative composition-based poultry for the future. The primary factor in poultry meat producing development is to increase poultry meat quality. Consumers demand is growing for quality poultry meat that is beneficial for health, i.e. poultry meat with increased omega group fatty acids (linolenic acid and linoleic acid) and antioxidants (carotenoids) and low level of cholesterol. Fatty acid profile of poultry meat can be altered depending on the fatty acid profile of food used in poultry nutrition (Qi et al., 2010). In this aspect, feeding trial was conducted with cross Ross 308 broiler chickens ($n = 200$) by applying composition of the spruce needles neutral extractives substances in broiler chickens diet. The basic diet composition was the same for control and trial broiler chicken groups. Costs for the production of enriched

Table 4

Indicators of poultry meat production in the Baltic States, 2004-2009

Member State	Unit of measurement	2004	2005	2006	2007	2008	2009
Estonia	tonnes	14816	13748	12353	11520	13181	14882
Chain increase rate	%	×	-7.2	-10.1	-6.7	14.4	12.9
Base increase rate	%	×	-7.2	-16.6	-22.2	-11.0	0.4
Latvia	tonnes	14265	17203	20608	20551	23077	23168
Chain increase rate	%	×	20.6	19.8	-0.3	12.3	0.4
Base increase rate	%	×	20.6	44.5	44.1	61.8	62.4
Lithuania	tonnes	53278	60475	65690	68163	70648	71437
Chain increase rate	%	×	13.5	8.6	3.8	3.6	1.1
Base increase rate	%	×	13.5	23.3	27.9	32.6	34.1
Total in the Baltic States	tonnes	82359	91426	98651	100234	106906	109487
Chain increase rate	%	×	11.0	7.9	1.6	6.7	2.4
Base increase rate	%	×	11.0	19.8	21.7	29.8	32.9

Source: author's calculations according to the data from FAOSTAT

Table 5

Productivity and quality of broiler chicken meat (average data)

Parameters	Group 1	Group 2
Live weight at the age of 42 days, g	3123.33 ± 51.15	3360.29 ± 57.25
Feed conversion, kg kg ⁻¹	1.91	1.79
Σ ω-3 fatty acid	5.31	5.88
Total carotenoids, mg kg ⁻¹	0.12	0.57
Cholesterol, mg 100g ⁻¹	72.32	61.16

*P < 0.05

Source: author's calculations based to the unpublished data of the Research Institute "Sigra"

composition meat were calculated to justify economically the developed alternatives of feed content enriched with fatty acids and carotenoids, and the profitability of their application. On average, broiler chicken live weight at the age of 42 days was within the limits from 3123.33 g to 3360.29 g and feed consumption for 1 kg living weight (feed conversion) obtained was within the limits 1.79–1.91 kg (Table 5).

By including spruce needles neutral extractives substances additives in broiler chickens diet composition, the chicken live weight for sales increased by 7.58% and feed conversion positively decreased by 6.28% in comparison with the control group ($P < 0.05$). Spruce needles neutral extractives substances applied in broiler chickens diet increased the total amount of ω-3 fatty acids by 0.57%, carotenoids - by 0.45 mg kg⁻¹, and decreased the cholesterol level by 11.16 mg 100g⁻¹ in

comparison with the control group in the muscle tissue ($P < 0.05$) (Table 5). Mentioned before, fatty acids have high significance for human health because they decrease risk factors of cardiovascular diseases (Connor W.E., 2002; Population Nutrient Intake..., 2003).

It is possible to improve broiler chickens meat quality significantly by using spruce needles neutral extractives substances in the broiler chickens diet.

The calculations included the productivity of the trial group broilers, average sales price of a broiler carcass, feed costs, and other costs in Latvia in 2010. By using feed enriched with spruce needles neutral extractives substances additive, the total carcass weight of innovative composition broilers was by 130.26 kg bigger (per 1,000 broilers) than the carcass weight of the control group broilers. Revenue for sales of carcass weight was by LVL 208.41 higher in comparison with

Revenues and expenses for breeding 1,000 broiler chickens for the production of innovative composition meat (according to the average trial data)

Parameters	Group 1 – control	Group 2 – trial
Broilers survival, %	98	99
Average live weight of broilers, kg	3.12	3.26
Total live weight of breeding broilers, kg	3060.54	3225.42
Total carcass weight of broilers, kg*	2417.83	2548.08
Price of 1 kg carcass weight, LVL	1.60	1.60
Revenues for sales of carcass weight, LVL	3868.52	4076.93
Feed costs for growing 1,000 broilers, LVL	1764.16	1800.69
Other costs (excluding feed costs), LVL	588.05	588.05
Total costs, LVL	2352.21	2388.74
Difference between revenues and expenses, LVL	1516.31	1688.19
Profit, LVL ±vs. Group 1, LVL	×	171.88
Profit, LVL % Group 1, LVL	×	11.34

Source: author's calculations based to the unpublished data of the Research Institute "Sigra"

the control group. Total costs for producing innovative composition meat (feed consumption etc.) was by LVL 36.53 higher than for the control group. Profit from sales of innovative composition meat was by LVL 171.88 or 11.34% larger (per 1,000 broilers) than from the sales of broiler chickens of the control group (Table 6).

These better financial results were obtained because of the low poultry feed conversion and the larger total carcass weight of trial broiler. The enrichment of poultry meat with health promoting substances for humans is an interesting future issue in poultry meat production. The importance of this issue will increase further due to the changing consumer behaviour (Qi K.K. et al., 2010).

In the perspective, the quality of poultry meat in Latvia should be increased by production of innovative poultry meat. With the production of this kind of meat, the production costs will increase but so will the productivity of the poultry.

Conclusions, proposals, recommendations

1. For the EU, the production and consumption is almost in balance. In 2009, the EU gross production was 11711 million tonnes and the consumption was 11630 million tonnes (self-sufficiency rate of 100.8%). Several Member States had to face decreases of their production volume (France, Italy, the UK, the Netherlands), on the contrary, production increased in Poland and Germany.
2. The total poultry meat production in the EU has steadily increased from 11.0 million tonnes in 2004 to 11.8 million tonnes in 2009, while consumption increased from 10.3 million tonnes in 2004 to 11.6 million tonnes in 2009.
3. Production of poultry meat in the Baltic States from 82359 tonnes in 2004 has increased to 109487 tonnes in 2009, thus, increasing by 32.9%. Total poultry meat production in the Baltic States

from 2004 is increasing, the largest meat producer being Lithuania.

4. Prospectively, in Latvia it is recommended to use natural phyto substances in broilers diet. By using spruce needles neutral extractives substances in the broiler chickens diet, it is possible to improve broiler chicken meat quality significantly: increased antioxidants carotenoids and decreased cholesterol levels in comparison with the commercial production.

Bibliography

1. *AVEC Annual Report 2010* (2010). Association of Poultry Processors and Poultry Trade in the EU Countries - ASBL, Belgium. p. 53.
2. *AVEC Annual Report 2011* (2011). Association of Poultry Processors and Poultry Trade in the EU Countries - ASBL, Belgium. p. 53.
3. Balabka, N. (2008). Prognozesanas iespējas uzņēmējdarbība (Forecasting Possibilities in Business). Retrieved: [http://www.balabka.lv/index.html/RVT/Ekonomikas%20nodalja/Uznjeemeejdarbiibas.kom.pak.maac/\(7.2.teema\)Prognozeeshanas_apreekjini.pdf](http://www.balabka.lv/index.html/RVT/Ekonomikas%20nodalja/Uznjeemeejdarbiibas.kom.pak.maac/(7.2.teema)Prognozeeshanas_apreekjini.pdf). Access: 16 November 2011.
4. Connor, W.E. (2002). Importance of n-3 Fatty Acids in Health and Disease. *American Journal of Clinical Nutrition*. 71 (1), pp. 171-175.
5. Damme, K. (2011). Economic Aspects of Poultry Meat Production in Germany. *Lohmann Information*, Vol. 46 (1), pp. 38-43.
6. FAOSTAT database. Livestock Primary. Retrieved: <http://faostat.fao.org/site/569/DesktopDefault.aspx?PageID=569#ancor>. Access: 16 November 2011.
7. Holub, B.J. (2002). Clinical Nutrition: 4. Omega – 3 Fatty Acids in Cardiovascular Care. In: *Can. Medical Assoc. I.*, pp. 608-615.
8. Magdelaine, P., Spiess, M.P., Valceschnini, E. (2008). Poultry Meat Consumption Trends in Europe.

- World's Poultry Science Journal*, Vol. 64 (1), pp. 53-63.
9. Michella, S.M. & Slauch, B.T. (2000). Producing and Marketing a Specialty Egg. In: *Poultry Science*, 79, (7), pp. 975-976.
 10. *Poultry Meat & Eggs* (2010). Agribusiness Handbook. Food and Agriculture Organisation of the United Nations, Rome. p. 77.
 11. Qi, K.K., Chen J.L., Zhao, G.P., Zheng, M.Q., Wen, J. (2010). Effect of Dietary ω_6/ω_3 on Growth Performance, Carcass Traits, Meat Quality and Fatty Acid Profiles of Beijing-you Chickens. *Journal of Animal Physiology and Animal Nutrition*. 94 (4), pp. 474-485.
 12. *Population Nutrient Intake Goals for Preventing Diet - Related Chronic Diseases* (2003) In: Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation. World Health Organisation Technical Report Series, 916. Genova, pp. 54-60.
 13. Windhorts, H.W. (2008). Changing Patterns of EU* Poultry Meat Production and Trade. Retrieved: <http://www.zootecnicainternational.com/article-archive/marketing/280-changing-patterns-of-eu-poultry-meat-production-and-trade.html>. Access: 16 December 2011.
 14. Windhorst, H.W. (2011). Patterns and Dynamics of Global and EU Poultry Meat Production and Trade. *Lohmann Information*, Vol. 46 (1), pp. 28-37.

Acknowledgements

The academic study and publication were financed by the project "Support for Doctoral Studies at Latvia University of Agriculture" /2009/0180/1DP/1.1.2.1.2/09/IPIA/VIAA/017/, Agreement No. 04.4-08/EF2.D1.01.

Development Assessment of the Beekeeping Industry in Latvia

Inese Dirina¹, Mg.oec.; Veronika Bugina², Dr.oec.
Faculty of Economics, Latvia University of Agriculture

Abstract. Beekeeping is a very important branch of production in agriculture, which is tightly connected with other industries. Bees not only collect natural resources from plants – nectar and pollen, which are used in making the direct output of beekeeping – honey, wax, pollen, ambrosia, propolis, royal jelly, and bee venom, but there is also indirect output – bees pollinate approximately 80% of the Earth's agricultural crops. Since 2007, the number of beekeeping households as well as earnings from direct products of beekeeping has fallen, imports of these products have sharply grown but their exports have practically faded. In case this situation continues, the Latvian beekeeping industry is threatened to reach total extinction, thus affecting other agricultural industries and ending in large financial losses. The aim of the paper is to evaluate the development of beekeeping industry and its role in the economy of Latvia as well as to appraise the development possibilities of beekeeping industry in Latvia.

Research methods: the monographic method, methods of statistical and economic analysis, methods of analysis and synthesis, the graphic and logically constructive methods.

Results of research: since 2007, the number of beekeeping households in Latvia has decreased, causing large financial losses; the existent output of beekeeping is able to satisfy only 80% of demand; there is practically no export of honey from Latvia, while the import volume is growing; factors, which are preventing the development of beekeeping industry are the disordered beekeeping product market, imports at very low prices as well as high production costs; intensive production is more profitable than the extensive one – income can cover the cost of production.

Key words: beekeeping industry, number of bee colonies, beekeeping products, honey.

JEL code: D24

Introduction

Beekeeping is a very important agricultural industry, which is closely associated with other agricultural industries. Bees collect nectar and pollen. Humans, in their turn, gain honey, wax, pollen, ambrosia, propolis, royal jelly, and bee venom or – as they all together are called – direct products of beekeeping. In addition to direct products provided by bees, there is also the indirect output of beekeeping – bees pollinate approximately 80% of the Earth's agricultural crops, and in the result, an increase in yields of crops accounts for 30-35%; it is a quantity that can be expressed in terms of money (Teivane, 2003). According to scientists, the value of indirect output of beekeeping is even 10 times larger than the value of direct output of beekeeping (Latvijas Biskopibas ..., 2010). Significant research in this field has been done by Peter Prokopovich (1775-1850), Lorenzo Langstroth (1810-1895), and Johannes Mering (1857).

Over the recent years, some kind of small stagnation prevailed in beekeeping in Latvia – the national economy developed; however, beekeeping had been stuck in the past and was not able to keep the pace of rapid modern progress. However, there are opportunities to keep successfully bees in Latvia if experience is available and if it is possible to harmonise the maintenance of beehives with the productivity of the natural environment. Beehives have to be exploited in a complex way – not only honey but also other products of beekeeping have to be produced; beekeeping has to be made as much income producing and profitable as possible.

Yet, over the recent years, a serious problem has arisen in the entire world and also in Latvia – the number

of bee colonies sharply declined due to unknown reasons. A physicist Albert Einstein has once said "if the bee disappeared off the surface of the globe, then man would have only four years of life left. No more bees, no more pollination, no more plants, no more animals, no more man". A massive disappearance of bees is observed all over the entire world and the first effect is noticeable – countries ask various foundations and governments for assistance to research the causes of disappearance of bees and to preserve them.

Research **hypothesis:** beekeeping can be a profitable industry of the national economy of Latvia.

Research object: beekeeping industry. Research subject: analysis of the beekeeping industry of Latvia.

Research **aim:** to evaluate the development of beekeeping industry and its role in the economy of Latvia as well as to appraise the development possibilities of beekeeping industry in Latvia.

The following research **tasks** were set to achieve the research aim:

- 1) to study and summarise the historical evolution of beekeeping in the world and Latvia;
- 2) to analyse the development trends of beekeeping industry and the honey market in the national economy of Latvia;
- 3) to assess the development prospects for beekeeping industry in Latvia.

Materials used in the research: special literature, data of the Central Statistical Bureau of Latvia, reports of the Ministry of Agriculture of the Republic of Latvia, financial statements, periodicals, resources of the Agricultural Data Centre (ADC), the EU regulations,

¹ E-mail address: inesedirina@inbox.lv

² E-mail address: Veronika.Bugina@llu.lv



Source: authors' construction based on the data by Steiselis J., 2000

Fig. 1. Changes in the number of bee colonies in Latvia in 1920-2000, thou.

laws of the Republic of Latvia, the Cabinet Regulations, resources of the Latvian Beekeeping Association, and available Internet resources.

Research **methods**: the monographic method, methods of statistical and economic analysis, methods of analysis and synthesis, the graphic and logically constructive methods.

Research results

1. Evolution of beekeeping in the world and Latvia

Nowadays, beekeeping is an integral part of agriculture but it originated in a distant past. According to palaeontologists, bees existed on the planet 55-60 million years before a primitive man appeared on the Earth (Ukuzis P., 1999; Ritmanis Z., 2004). According to scientists, already 2.5 million years ago the primitive man was able to use primitive tools to harvest honey. The historical evolution of beekeeping in Europe is classified into four periods: honey hunting, forest beekeeping, tree-trunk beekeeping, and hive beekeeping (Steiselis J., 2000, 2009; Prokopivics P.).

In Latvia, bees appeared by 6000 BC when climate in the territory around the Baltic Sea became warmer and suitable for bees and plants, the nectar of which bees used as a nutrient. Archaeological excavations proved that ancient Latvians knew how to hollow out trees and harvest honey from wild bees in AD 2nd - 4th century. By the 10th -12th century, as trade with neighbouring territories increased, honey and wax along with furs, amber, grain, and other goods became important means of exchange, while in the 13th - 14th century wax was the main export of Riga. In 1920, the Latvian Central Society of Beekeeping was established. It provided assistance in making decisions on beekeeping in Latvia, and in 1922, the Latvian Central Society of Beekeeping

opened a beekeeping and horticultural school in Vecbebri, where new beekeepers are still trained. Statistical data on beekeeping industry started to be collected after the establishment of Latvian Central Society of Beekeeping. The natural environment in Latvia allows increasing the number of bee colonies up to 200 thousand (Figure 1).

Figure 1 shows that the optimal number of bee colonies was exceeded in 1940, and there were even 222 thousand bee colonies in Latvia. Yet, during the next five years, this number decreased by 181 thousand or 342%. The main reasons for it were the World War II as well as the late spring of 1941; as a result, bee colonies lacked feed and approximately 20-30% of bee colonies perished. During the World War II, beekeeping along with the entire agriculture suffered huge losses. Almost all bee colonies were ruined in occupied territories (Malcenijs, 1985). During the next ten years until 1955, Latvian beekeepers managed to triple the number of bee colonies of 1945, and it continued to rise until 1977 when the bee disease *Varroa* spread. The number of bee colonies decreased again by 84 thousand or 52.5% due to the disease over the next years until 1985. After regaining the independence in 1990, the number of bee colonies rose to 175 thousand. During the next years – in the period until the year 2000 – the total number of bee colonies gradually declined by 136 thousand or 77.8%. During the first years of independence, the decrease might be explained by the fact that these years were a transitional period for the beekeeping of Latvia – the methods of business management of the Soviet period had to be abandoned and replaced by the methods of beekeeping management accepted in Europe. The decrease in the number of bee colonies was also affected by the privatisation of Soviet collective farms but not all farmers who privatised bee colonies were able to keep them. By integrating into the world market, Latvian beekeepers had to realise that



Source: authors' construction based on the ADC data, 2011

Fig. 2. Changes in the number of bee colonies in Latvia in 2001-2010, thou.

markets outside the former USSR were full of products of beekeeping and prices of many products were so low that Latvian products were not competitive. Beekeeping was also affected in a way that trade ties with the former Soviet republics were interrupted.

In the course of time, many factors have affected the development of beekeeping in both the world and Latvia. Presently, one of the biggest problems affecting beekeeping is that the size of territories suitable for beekeeping decreases and wild pollinators perish with the increase in agricultural output, monocrop growing, and use of pesticides. Hence, significantly increasing the role of bee colonies controlled by beekeepers not only in pollinating crops but also in maintaining the viability of the entire ecosystem.

2. Economic analysis of the beekeeping industry of Latvia

There are approximately 90 million bee colonies presently in the world (a bee colony has from 20 to 80 thousand bees), of which 49 million bee colonies are domesticated by humans and placed in various containers for bees or hives (Mizis, 2003). There are 13.6 million bee colonies in the EU Member States. Presently in the whole world, the number of bee colonies is decreasing at a fast rate due to unknown reasons. Since 2007 in Latvia, the number of bee colonies has declined by 26.5%, and in 2010, according to the ADC, there were only 37.8 thousand bee colonies (Figure 2). Yet, according to the Latvian Beekeeping Association, the number of bee colonies in Latvia was almost twice larger or 64.1 thousand in 2010. The number of beekeepers in the country totalled around 3 thousand, of which 1702 were registered with the Latvian Beekeeping Association.

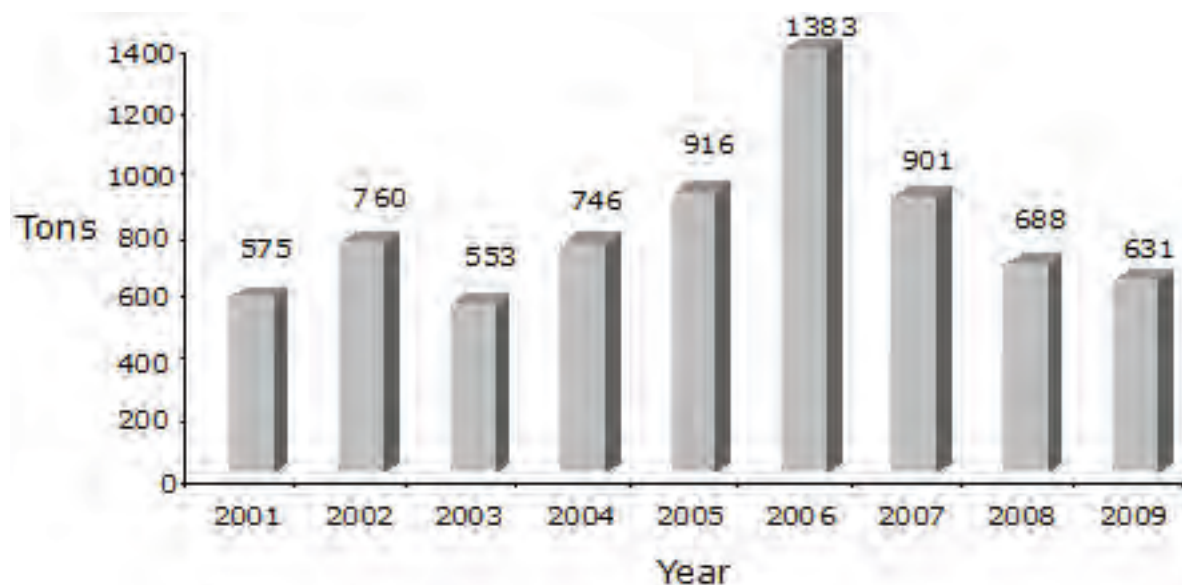
The average number of bee colonies in the country amounted to 39.5 thousand in the period of 2001-2010. In 2004, a sharp decrease in the number of bee colonies occurred compared with 2003; it decreased by 57.3% to 19.6 thousand. During the next years, their number increased, reaching 47.8 thousand in 2007.

In September 2010, the European Commission approved national programmes of 27 Member States for improving the production and sales of beekeeping products in 2011-2013. An amount of funding to be granted to every Member State was set based on the number of bee colonies, and Latvia would receive an annual support of LVL 270 thousand during the next three years. In comparison, 117.9 thousand bee colonies were registered in Lithuania, which would receive an annual support of EUR 1.1 million, while in Estonia, there were 24.8 thousand bee colonies, thus receiving EUR 99 thousand a year. The largest number of bee colonies or 2.459 million was registered in Spain, which accounted for 17.06% of the total number of bee colonies in the EU; there were 1.5 million bee colonies in Greece (10.8%), more than a million in France (10%), Italy, Poland, and Romania (8.5%).

The EU funding may be used to control the bee disease *Varroa destructor* and rationalise mobile apiaries and as financial support to laboratories, restoration of the number of bees in hives, applied research programmes, and technical support.

Statistical data indicate that around 40% of bee colonies in Latvia belong to household plots where beekeeping is very intensive and bee colonies are mostly kept for leisure and to make some additional income to their family budget. These apiaries are small, usually from five to nine bee colonies, and often their owners have no special education in beekeeping. The share of bee farms having a small number of bee colonies is very high – 83%. Of the total number of bee farms, 11% have bee colonies within an arrange of 50-99, and only 6% of bee farms have more than 100 bee colonies, which indicates that there are a few individuals in Latvia who can keep a large number of bee colonies and practise beekeeping professionally.

According to the Latvian Beekeeping Association, honey is the most produced product of beekeeping in Latvia, accounting for 91.8% of the total output, followed by wax with 4% (32.7 tons), pollen – 4%



Source: authors' construction based on data of the CSB, *Latvijas lauksaimniecība., 2009*, and *Biskopības sektora analīze, 2010*

Fig. 3. Output of honey in Latvia in 2001-2009, tons

(30.52 tons), and propolis – 0.2% (1.84 tons). Not only in Latvia but in the entire world as well, honey is the most produced product of beekeeping. Annually, 900-1100 thousand tons of honey on average is produced in the world. The largest output of honey is registered in China – around 300'000 tons, followed by the USA with 90,000 – 100,000 tons, Argentina – 70,000 tons, Mexico – 55,000 tons, and Canada – 31,000 tons (Steiselis, 2000). The EU is the second largest honey producer in the world, producing approximately 175,000 tons of honey, which accounts for 13% of the total world output of honey. The largest honey producers of the EU are Spain, Germany, and Hungary. Latvia produces 600-800 tons on average; however, its output changes from year to year (Figure 3).

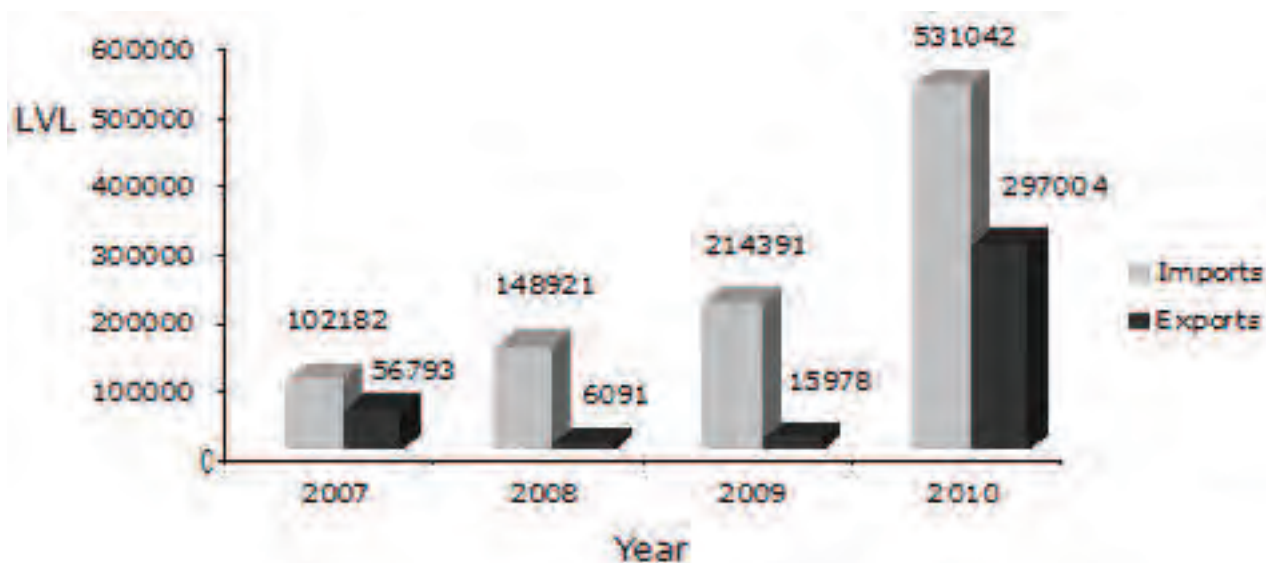
During this period, the lowest yield of honey was in 2003, the highest one – in 2006, and the high yield of this year might be explained by a warm and not very droughty summer, which was suitable for bees. Over the recent years, the output of honey has declined, and only 631 tons were produced in 2009, which was 8.3% less than in the previous year. In 2009, the yield of honey was affected by such factors as a dry spring, a rainy and cool period when meadows were blooming, intensity of bee swarming, and spread of *Varroa*. Yet, the output of honey depends not only on weather conditions but also on the size of bee colony and the number of bee colonies in an apiary – if they are too numerous, honey yield declines, but anyway weather conditions affect it the most. According to estimates, a bee colony produces 18-25 kg of honey on average in Latvia, while in some apiaries when weather is appropriate more than 100 kg per bee colony can be produced.

During the recent three years, honey consumption per capita has increased in Latvia, reaching 1.2 kg a year. Urban residents consume more honey than rural residents. The share of individuals consuming honey does not exceed 30% in the country; a large part of residents

does not consume honey at all. Yet, the situation in Latvia is that the quantity of honey supplied by local producers does not satisfy domestic demand. Especially it was observed during the recent years when the output of honey declined. The domestic supply meets about 80% of the domestic demand; thus, the honey market has some free capacity for imports from abroad. The total consumption of honey in Latvia is estimated at 1000 tons, of which 300 tons are honey imports. Honey imports are one of the key problems to the beekeeping industry in Latvia (Figure 4).

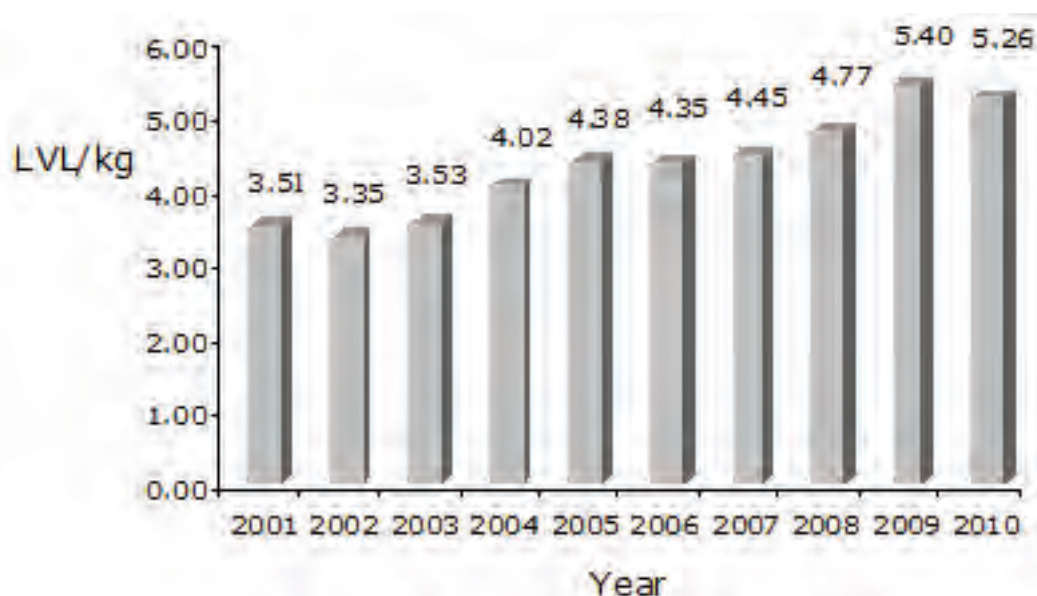
The value of honey imports rises from year to year. In the period of 2007-2008, the value of honey imports rose by 31.4%, while from 2008 to 2009 – by 44%. It totalled LVL 531 thousand in 2010, which was two times more than in 2009 when the value of honey imports amounted to LVL 214 thousand. There were almost no honey exports from Latvia, a considerable quantity of honey worth LVL 297 thousand was exported only in 2010. The reason for so small quantities of exports was the price of honey in Latvia – it was among the highest ones in Europe. Although, many foreign enterprises were ready to buy Latvian honey and export it, the situation was that Latvian beekeepers did not wish to sell their honey at a price of 60-80 santims per kg. Middlemen wished to sell honey further at a price of at least LVL 2 per kg and to keep the price difference for themselves. Besides, purchasers wanted homogenous honey in large quantities, so that a ship would be loaded full of cargo. Yet, not a single beekeeper was able to collect, mix, and fill honey in 200 litre barrels for a full ship (Pasaule liela interese..., 2010).

Prices of honey in the world market are mostly set by the main four exporting countries – Argentina, China, Russia, and Mexico. In Latvia, the price of honey is mainly determined by its domestic demand – the larger is the demand, the higher is the price. Only during a few years



Source: authors' construction based on the CSB data

Fig. 4. Value of honey imports and exports in Latvia in 2007-2010, LVL



Source: authors' construction based on the CSB data

Fig. 5. Average retail honey price in Latvia in 1997-2010, LVL

when the yield of honey was low, suppliers set their price regardless of demand; in such cases the prices of honey were quite equal in the entire Latvia, besides, they were very high (Figure 5).

During the recent years, the prices of honey have risen. From 2001 to 2003, the prices of honey stood at a level of LVL 3.50 per kg, while in 2004, they increased by LVL 0.50. In the period of 2005-2008, the prices of honey were almost stable –LVL 4.5 per kg on average, whereas in 2009, they sharply rose up to LVL 5.40. In 2010, the average price of honey slightly dropped by LVL 0.14 compared with the previous year. The prices of honey rose not only in retail trade, and a three-litre container

of honey could be nowhere bought for LVL 10 – neither on the agricultural market place nor from beekeepers themselves. Presently, a three-litre container of honey costs, within a range of LVL 12-15 on average, in Riga its price is LVL 18, while in Latgale – even LVL 20. Yet, irrespective of the price hike, beekeepers emphasise that their production cost is much higher than their income earned, and the situation in the beekeeping industry is quite problematic. Beekeepers are afraid to lose their customers by raising their price to the level that covers their production costs. Ratios of income to variable cost as well as gross margins per bee colony are presented in Table 1.

Table 1

Gross margins per bee colony in Latvia in 2009 and 2010

	2009						2010						± % 2010 against 2009	± % 2010 against 2009
	Extensive production			Intensive production (wholesale and retail sale)			Extensive production			Intensive production (wholesale and retail sale)			Ext.	Int.
	Quantity	Price, LVL	Total, LVL	Quantity	Price, LVL	Total, LVL	Quantity	Price, LVL	Total, LVL	Quantity	Price, LVL	Total, LVL	Total, LVL	Total, LVL
REVENUES, units of measure														
Honey, kg	10	3.00	30.00	30	4.00	120.00	15	3.00	45.00	40	3.50	140.00	50	16.7
Wax, kg	0.4	6.00	2.10	0.4	10.00	3.50	0.4	6.00	2.10	0.4	10.00	3.50	0	0
Pollen, kg	2	7.00	14.00	4	8.00	32.00				3	9.00	27.00	-	-15.6
Propolis, kg	0.1	20.00	2.00	0.1	20.00	2.00	0.1	20.00	2.00	0.1	20.00	2.00	0	0
Bee bread, kg				1	25.00	25.00				1	25.00	25.00		0
TOTAL: (1)			48.10			182.50			49.10			197.50	2.1	8.2
VARIABLE COSTS														
<i>Costs of inputs</i>														
Sugar, kg	10	0.70	7.00	12	0.72	8.64	8	0.70	5.60	12	0.70	8.40	-20	-2.8
Equipment			3.00			5.00			7.00			13.00	133.3	160
Bee queens, number	0.7	2.50	1.75	1	2.50	2.50	0.2	15.00	3.00	1	5.00	5.00	71.4	100
Medicines			3.00			1.20			1.00			1.20	-66.7	0
Veterinary costs			4.00			3.00			3.00			4.00	-25	33.3
Transport			12.00			27.00			12.00			37.00	0	37
Sales costs			4.00			20.00			3.00			18.00	-25	-10
TOTAL: (2)			34.75			67.34			34.60			86.60	-0.4	28.6
<i>Machine and manual operations</i>														
Paid labour, h	16	2.50	40.00	8	2.50	20.00	14	2.42	33.88	8	2.42	19.36	-15.3	-3.2
Total: (3)			40.00			20.00			33.88			19.36	-15.3	-3.2
TOTAL VARIABLE COSTS (4=2+3)			74.75			87.34			68.48			105.96	-8.4	21.3
GROSS MARGIN 1 (5=1-2)			13.35			115.16			14.50			110.90	8.6	-3\ .7
GROSS MARGIN 2 (6=1-4)			-26.65			95.16			-19.38			91.54	-27.3	-3.8

Source: authors' calculations based on data of the Latvian Rural Advisory and Training Centre

A given gross margin in beekeeping shows a particular technology, which, according to experts, has to be used to get a certain result on certain conditions and during a certain period. In extensive production, honey is sold in direct selling and to honey packing enterprises. In case of intensive production, producers themselves pack and offer their products in direct selling and retail sales.

Table 1 data present the average production costs and revenues of bee farms as well as a percentage change of these indicators in 2010 compared with 2009, depending on the type of production – whether it is extensive or intensive. Honey provided the largest revenues: in 2009, 62.4% of the total revenue in extensive production and 65.8% in intensive production, while in 2010 – 91.6% and 70.9%, respectively. In 2010, the revenues gained from honey produced extensively rose by 50%, while intensively – by 16.7% compared with 2009. The total revenues rose by 2.1% for extensive production and 8.2% for intensive production in 2010 compared with 2009.

The highest costs among inputs belonged to transport; if producing intensively – the highest costs were production costs. The largest increase of costs was observed for beekeeping equipment: 133.3% in extensive production and 160% in intensive production. The costs of medicines fell by 66.6% in extensive production. The total variable costs fell by 8.4% for extensive production and rose by 21.3% for intensive production in 2010 compared with 2009.

In extensive production, the gross margin was negative in both years – the costs exceeded the revenue, whereas the gross margin was positive for intensive production. Yet, in general, the gross margin declined by 27.3% for extensive production and 3.8% for intensive production in 2010 compared with 2009.

After analysing the gross margins, one can conclude that intensive production is more profitable than the extensive one.

3. Analysis of development possibilities for the beekeeping industry

Bees play a large role in agriculture and, thus, beekeeping plays an important role in both preserving bees and increasing their number as well as a significant industry of the national economy. Although, the direct contribution of beekeeping to the national economy is presently insignificant, there are possibilities to increase it several times in Latvia. To develop beekeeping as much as possible and gain the largest benefit from it, according to the analysis of data on the beekeeping industry, there are several development priorities:

- products of beekeeping as food and medicines;
- honey for beauty services and in cosmetics;
- organic beekeeping;
- advertising and marketing;
- beekeeping tourism;
- agricultural cooperation.

The increasing urbanisation and the alienation of humans from the natural environment raises demand for natural food products and medicine including products of beekeeping, containing no chemicals. Products of beekeeping are rich in nutrients that are necessary for the human organism, and they do not affect the central nerve system of humans unlike it occurs if using various

chemicals both in food and medicine. Esthetical medicine, too, and beauty industry actively exploits the wonderful properties of honey and other products of beekeeping. Science and high technologies allow development of new effective medicine to tackle various cosmetic problems. Cosmetology uses products of beekeeping both directly and as a component for cosmetic products. Sales of and demand for these products will rise if all the opportunities for products of beekeeping are used.

Organic beekeeping techniques are one of the ways of how beekeepers control the bee disease Varroa. New apparatuses and technologies have been developed to apply organic techniques, thus, they have to be tested on Latvian conditions in order to elaborate recommendations for beekeepers. Biological beekeeping expands in Latvia. To popularise it and to make beekeeping business profitable, it is required to develop beekeeping techniques that are friendlier to the environment, to provide consumers with safe and quality products of beekeeping, but techniques for preventing the bee disease Varroa have to be effective and efficient.

Marketing of products of beekeeping both in the world and Latvia is mainly based on good reputation and on how much honey and other products of beekeeping are worth as food, for cosmetics, pharmacy, and other industries. Advertising of beekeeping products is insufficient in Latvia. The beekeeping industry may be developed by increasing its advertising and marketing activities.

Rural tourism is one of the most popular kinds of tourism in Latvia. By promoting beekeeping tourism, it is possible to inform people about the significance of products of beekeeping in daily life as well as to increase sales of products of beekeepers.

Agricultural cooperatives are a well developed system in the entire world. Cooperatives are necessary also in beekeeping, as individual bee farmers of average size are almost unable to sell their products in a supermarket chain. It requires a lot of work, time, and stress even to large bee farmers. Therefore, a cooperative ensures the packing and sale of honey through various supermarkets, warehouses etc. By founding cooperatives, an opportunity emerges to sell products of beekeeping in large quantities to one buyer. By cooperating, beekeepers have a greater opportunity to make profit, as cooperation ensures greater opportunities for production and sales. By joining a cooperative, farmers reduce their production costs, thus, making their products more competitive on both domestic and world markets.

Conclusions

1. In Latvia, the number of bee colonies has declined by 26.5% since 2007 and in 2010, according to the ADC; there were only 37.8 thousand bee colonies.
2. Annually, Latvia produces 600-800 tons of honey on average; however, the existent supply of Latvian products is able to meet approximately 80% of the domestic demand; thus, the honey market has some free capacity for lower price imports.
3. There is practically no export of honey from Latvia but the import quantity, measured in tons, has risen 3.7 times since 2007. In terms of money, the imports of honey have risen 5.2 times and amounted to LVL 530 thousand in 2010.

4. The disordered market of beekeeping products, very low price imports as well as high production costs are the factors hindering the development of beekeeping industry.
5. The analysis of gross margins showed that intensive production was more profitable than the extensive one – its costs were higher, while revenues from intensive production were much larger, being able to cover its production cost.

Proposals

1. A natural and healthy lifestyle becomes more and more popular in the entire world and also in Latvia, thus, the demand for organic agricultural products is increasing. Transition of beekeepers from traditional to organic beekeeping is a step towards the successful development of beekeeping.
2. To make a situation in the beekeeping of Latvia considerably much better, domestic producers have to establish cooperatives and search for opportunities to sell their honey abroad, thus, promoting an increase in the output of beekeeping products, the market expansion, and an increase in the competitiveness of beekeeping industry.
3. To promote the popularity of beekeeping products in the market, it is necessary to develop and improve the advertising and marketing of beekeeping products as well as to use beekeeping products as food, in medicine, beauty industry, and cosmetics.
4. To make the beekeeping industry to take an important position in the national economy of Latvia and become one of the most significant income sources for many farms in Latvia, the use of national and the EU support payments is a prerequisite for increasing the competitiveness of the beekeeping industry of Latvia on the common EU market.

Bibliography

1. Latvijas Republikas Zemkopības ministrija (2010). Biskopības sektora analīze (*Ministry of Agriculture. Analysis of the Beekeeping Sector*). Retrieved: http://www.zm.gov.lv/doc_upl/Biskopibas_sektora_analize.pdf. Access: 10 March 2011.
2. Latvijas lauku konsultāciju un izglītības centrs (2010). Bruto segums uz vienu bišu saimi 2009 (*Latvian Rural Advisory and Training Centre. Gross*

Margin per Beehive in 2009). Retrieved: http://www.lkk.lv/upload_file/400459/bites2010.pdf. Access: 23 March 2011.

3. Latvijas biskopības programma 2011. – 2013. gadam. (2010). (*Latvian Beekeeping Programme 2011-2013*). Retrieved: http://www.zm.gov.lv/doc_upl/Biskopibas_programma_2011-2013_gadam.pdf. Access: 16 March 2011.
4. Latvijas Republikas Zemkopības ministrija (2010). Latvijas lauksaimniecība un lauki 2009 (*Ministry of Agriculture. Latvian Agriculture and Rural Areas 2009*). Retrieved: http://www.zm.gov.lv/doc_upl/GADA_ZINOJUMS_2009_v_docx_small.pdf. Access: 10 March 2011.
5. Latvijas lauku konsultāciju un izglītības centrs. Bruto segums 2008., 2009., 2010 (*Latvian Rural Advisory and Training Centre. Gross Margin 2008, 2009, 2010*). Retrieved: <http://www.lkk.lv/?id=400459>. Access: 25 March 2011.
6. Latvijas Republikas Centrālās Statistikas parvalde. (2011). (*Latvian Central Statistical Bureau*). Retrieved: www.csb.gov.lv. Access: 24 February 2011.
7. Lauksaimniecības datu centra publiska datu bāze. (2011). (*Public Database of the Agricultural Data Centre*). Retrieved: http://pub.ldc.gov.lv/pub_stat.php?lang=lv. Access: 18 March 2011.
8. Malcenijs, O. (1985). *Biskopja rokasgramata (Beekeeper's Manual)*. Rīga: Avots. 304 lpp.
9. Mizis, A. (2003). *Darbi bisu drava (Works at an Apiary)*. Rīga: Avots. 167 lpp.
10. Pasaule liela interese par Latvijas medu. (2010). (*The World is Very Interested in Latvian Honey*). Retrieved: <http://www.apollo.lv/portal/news/articles/209640>. Access: 26 February 2011.
11. Ritmanis, Z. (2004). *Medus un citi biskopības produkti (Honey and Other Beekeeping Products)*. Rīga: Nordik. 264 lpp.
12. Steiselis, J. (2000). *Biskopība (Beekeeping)*. Rīga: Junda tipogrāfija. 152 lpp.
13. Steiselis, J. (2009). *Biskopība iesācējiem (Beekeeping for Beginners)*. Rīga: Zvaigzne ABC. 148 lpp.
14. Teivane, R. (2003). *Saudzēsim bites un sevi! Agropols. (Let us Save Bees and Ourselves)* Retrieved: http://eiropa.lv/aei.lv/?menu=110&num_urs=181&newsid=58373. Access: 16 January 2011.
15. Ukuzis, P. (1999). *Medus maza ekcīklopedija (Small Encyclopaedia of Honey)*. Rīga: Jumava. 134 lpp.

Economic Effects of Raising Animal Welfare Standards of Broilers on Polish Farms

Monika Gebska¹, PhD

Warsaw University of Life Sciences

Abstract. The aim of the study was to determine the economic effects of raising animal welfare standards on Polish broiler farms. Two typical farms, specialising in broiler production, were selected for the case study. Source data came from production in 2010. The level of production on both farms was similar. Economic results of the two farms were compared, taking into account the different levels of animal welfare standards due to stocking density, mode of lighting of the livestock buildings, as well as the broiler house equipment. Research results demonstrate an increase of production costs, ranging from 5% to 31%. Due to the high costs of fodder in 2010, and, at the same time, low product prices, rising of the standards of animal welfare on the examined farms resulted in losses, mainly due to the reduction in stocking density. It was concluded that profitability of broiler farms was low (2-8%) and it was achieved only in flocks with higher stocking density – 42 kg m² or 39 kg m².

Key words: costs, economics, broilers, stocking density, animal welfare.

JEL code: Q12

Introduction

Production of broilers is distributed rather evenly throughout the territory of Poland. According to the Central Statistical Office, in the year 2010, there were around 94 thousand farms engaged in broiler production including 1794 farms growing more than 10 000 broilers.

According to the previous agricultural census of 2002, the number of farms growing broilers reached over 191 thousand. In the period of eight years, the number of these farms has decreased more than two times. At the same time, the broilers population has decreased by about 16% (Table 1). One of the factors that resulted in a decreased farmers' interest in broilers production was introduction of the European Union Council Directive No. 2007/43/EC of 7 May 2007. The Directive specifies the minimum conditions for growing poultry for meat on farms with more than 500 broilers (excluding breeding flocks, hatcheries, extensive indoor and free-range chickens, and organic broiler production).

The document came into force in June 2010, specifying the minimum requirements for broilers production, which allows for the stocking density of no more than 33 kg/m². The document provides specific requirements in terms of the broiler house equipment, ventilation, lighting, minimisation of noise, day-to-day owner supervision over animal welfare, cleaning of buildings and equipment as well as maintenance and storage of production documentation.

Producers may exceed the stocking density limit of 33 kg/m² reaching 39 kg/m² or 42 kg/m², if additional criteria are met. A producer, who wants to maintain the stocking density on the level of 39 kg/m², is obliged to notify the district veterinarian of such intention prior to the placement of chickens in the broiler house, and to monitor constantly the environmental parameters with regard to such factors as ammonia and CO₂ concentration, temperature and humidity. These requirements are met by many producers in Poland.

It is more difficult to obtain a permit to increase the maximum stocking density to 42 kg/m². It can only be obtained by those farmers who have not been registered by the Veterinary Inspection as violating the regulations specified in the Directive in any manner within the past 2 years. Moreover, in at least seven subsequent broiler flocks from a particular broiler house, the accumulated daily mortality rate may not exceed a specific limit value (1.06% multiplied by the flock age on the slaughter date, stated in days).

In several countries of Europe, internal regulations on animal welfare are much more restrictive than the applicable EU legislation. The leaders in this area are Sweden, Austria, Germany, and Finland (GAIN Report, 2011). In these countries, the minimum stocking density levels are much lower. Additional requirements have also been introduced with regard to natural lighting in the broiler house as well as perch availability.

The implementation of broiler directive went without a lot of disturbance for the EU poultry markets because it did not need major investments to comply on farm level (GAIN Report, 2011). However, the implementation of the EU directive was challenging and painful for many producers. The standards proposed by the European Commission resulted in a change of the level of revenues and costs (Blatchford R. et al., 2009). The necessity to invest in the broiler houses will appear if the tendency to increase broiler welfare standards is maintained.

The main aim of the study was to define the economic effects of higher animal welfare standards for Polish broiler producers.

The possibility of further raising of animal welfare standards is still discussed in Europe, also in terms of poultry production, a calculation for more restrictive standards, applicable in Austria and Sweden, has also been conducted to assess the potential consequences of their introduction. The description of five examined standards has been presented in Table 2.

¹ E-mail address: monika_gebska@sggw.pl

Table 1

Number of farms growing chicken broilers and their population in Poland in 2002 and 2010

No.	Specification	Year	
		2002	2010
1.	Number of farms growing broilers	191200	94082
2.	Percentage of farms growing chicken broilers at a varying production scale: 1-99	97.1	96.7
3.	100-499	1.4	0.7
4.	500-999	0.0	0.0
5.	1000-2999	0.1	0.1
6.	3000 and more	1.4	2.5
7.	Broiler population (thousand)	115676	96960
8.	Average (broilers/farm)	605	1030

Source: author's calculation based on the Statistical Yearbook of Agriculture 2002, 2010

Table 2

Chicken broiler welfare standards

No.	Norm	Standard				
		¹ EU 42	¹ EU 39	¹ EU 33	² A 30	² SW 20
1.	Housing system	Bedding	Bedding	Bedding	Bedding	Bedding
2.	Stocking density	42 kg/m ²	39 kg/m ²	33 kg/m ²	30 kg/m ²	20 kg/m ²
4.	Lighting	Minimum 20 lux. The system must ensure 8 hours of continuous lighting and at least 6 hours of darkness over the 24-hour cycle				
5.	Access to daylight	Not required	Not required	Not required	Required	Required
6.	Environmental enrichment material	Required 3 kg.m ²				
7.	Availability of perches	Not required	Not required	Not required	Required 15 cm/bird	Required 15 cm/bird

Source: ¹author's construction based on the EC Directive 2007/43/WE z 7 May 2007, ²GAIN Report (2011)

Table 3

Characteristics of the farms examined

Specification	Farm 1	Farm 2
Broiler house area (m ²)	1092	1092
Broiler house cubic capacity (m ³)	3057	3057
Fan power	5.6 kW	7.0 kW
Lighting type	Artificial, 20 lux	Artificial, 20 lux
Mortality rate (%)	4%	3.8%
Fodder consumption (kg/ kg growth)	1.90	1.83
Average broiler mass (kg)	2.58	2.85
Production cycle length (days)	48	44
Number of cycles per year	6	6
Number of employees	2	1

Source: author's construction

Three standards named: the EU 42, the EU 39, and the EU 33 resulted from implementation of the European Union directive 2007/43/EC of 7 May 2007, and the remaining two were constructed on the basis of domestic standards introduced in Austria (A 30) and Sweden (SW 20), and they are more difficult to introduce and closer to organic welfare standards.

The case study method was used in the research. Two typical farms, specialising in broiler production, located in Lodzkie province, were selected on the basis of specific criteria. The level of production on both farms was similar. Both farms grew broilers in houses of 1092 m² each. They were typical in size and structure (Dybowski G., 2005). On average, the space is sufficient for the production of about 180 - 220 tons of broilers per year, depending on stocking density. The producers who want to increase the broiler production, simply increase the number of such broiler houses. Source data were obtained based on the analysis of documents, observations, measurements, and guided interview, and it pertained to the year 2010.

Research results and discussion

1. Characteristics of farms examined

Each of the farms had a single poultry house of the area of 1092 m² in a good technical condition. Both buildings were of standard type, constructed in the late 1980s / early 1990s. The walls were made of hollow bricks with a 10 cm layer of Styrofoam. As the same technology was used on both farms, the heating costs were identical, amounting to PLN 7000 per cycle. Heating and ventilation ensured the adequate atmospheric conditions for the birds (Herbut E. et al., 2005, Tykadłowski A. et al., 2010).

A traditional housing system was applied – the broilers were grown on bedding material, consisting of oat straw. It was maintained clean and dry. The broilers had no access to daylight. The broiler houses were provided with artificial lighting, which met the requirement of the level of 20 lux. On the other farm, the broiler house building was equipped with windows, which were covered during the production cycle to reduce nervousness of the birds and the mortality rate (Blatchford R. et al., 2009, Olanrewaju H. et al. 2006). On both farms, feeding and

Table 4

Economic results per one cycle on Farm 1 at varying animal welfare standards

Farm 1	EU 42	EU 39	EU 33	A 30	SW 20
Data production					
Number of nestlings	18500	17110	14407	13007	8687
Stocking density (birds/m ²)	16.9	15.7	12.7	12.7	12.7
Stocking density (kg/m ²)	42.0	39.0	33.0	28.6	19.3
Mortality rate (%)	4.0	3.5	3.0	7.0	6.0
Fodder consumption (kg/1kg growth)	1.90	1.92	2.10	2.20	2.20
Production costs					
Nestlings (PLN)	25345	23441	19738	17820	11901
Fodder (PLN)	113177	106327	98430	89258	60254
Labour (PLN)	6400	6400	6400	6400	6400
Vaccines (PLN)	4500	4106	3458	3122	2085
Heating (PLN)	7000	7000	7000	9000	9000
Electricity (PLN)	3000	3000	3000	3000	3000
Water (PLN)	1000	925	779	703	470
Litter removal and washing (PLN)	1700	1700	1700	1700	1700
Disinfection (PLN)	1000	1000	1000	1000	1000
Broiler catching (PLN)	1500	1375	1250	750	750
Bedding material (PLN)	3000	3000	3000	3000	3000
Depreciation (PLN)	5160	5160	5160	6000	6000
Total costs (PLN)	172782	163433	150914	141752	105559
Livestock production (kg)	45821	42599	36055	31209	21068
Production value (PLN)	179618	166987	141335	122339	82585
Profit/ loss per production cycle (PLN)	6835	3554	-9579	-19413	-22974
Profitability (%)	4	2	-6	-14	-22

Source: author's calculations

watering were automatic. In terms of equipment, both broiler houses met the animal welfare requirements.

On the first farm, its owner employed two full-time employees to manage the farm. In the second case, the owner worked on the farm himself with the assistance of one employee. Nestlings were purchased from reliable hatcheries, cooperating with the farmers on regular basis. One of the farmers purchased 1-day-old nestlings and vaccinated them himself; the other farmer purchased slightly older ones, already vaccinated. On the examined farms, most (about 80%) mortality cases occurred during the first two weeks of life of the nestlings. The nestling mortality rate on the level of 3.8 – 4% may be regarded as satisfactory (De Baere K. et al., 2010, Buijs S. et al., 2009). The same may be said about fodder consumption (Swierczewska, 2008), which was on the level of about 1.83-1.9 kg fodder/1 kg growth (Table 3).

2. Economic results of broiler production at different standards of animal welfare

At both broiler houses, the stocking density was maintained on the maximum level, since both farmers obtained the permit of the Veterinary Inspection. The present stocking density of 42 kg/m² was assumed the

starting point for further calculations and comparisons. Tables 4 and 5 present the calculated economic results of the farms examined at various animal welfare standards.

The best economic results were achieved at the highest stocking density, when revenues per cycle on the farms examined amounted to PLN 6835 and PLN 13406, respectively. In addition, R. A. Blatchford et al. (2009) showed that the most important factor influencing economic results of broiler production was stocking density.

The reduction of the stocking density from 42 kg/m² to 39 kg m² resulted in 27% decrease of income recorded by Farm 1 and 48% decrease of income recorded by Farm 2. Further reduction of stock density on both examined farms is disadvantageous due to financial reasons. Upon application of the Austrian standard (A 30) with the stocking density of 30 kg/m², at the present production technology, loss per cycle would be PLN 15 012 (on Farm 2) or even PLN 18 413 (on Farm 1). These losses would be even higher in the case of application of the Swedish standard (SW 20), where the allowable stocking density is 20 kg/m².

This is mainly due to a dramatically reduced broiler stocking density, however, also due to the

Table 5

Economic results per one cycle on Farm 2 at varying animal welfare standards

Farm 2	EU 42	EU 39	EU 33	A 30	SW 20
Data production					
Number of nestlings	16750	15400	12950	11790	7867
Stocking density (birds/m ²)	15.3	14.1	12.7	12.7	12.7
Stocking density (kg/m ²)	42.1	39.0	33.0	28.9	19.5
Mortality rate (%)	3.8	3.0	2.5	6.0	5.0
Fodder consumption (kg/kg growth)	1.83	1.90	2.1	2.2	2.25
Production costs (PLN)					
Nestlings (PLN)	26800	24640	20720	18864	12587
Fodder (PLN)	113454	106327	102017	93809	64698
Labour (PLN)	3000	3000	3000	3000	3000
Heating (PLN)	7000	7000	7000	7000	7000
Electricity (PLN)	3000	3000	3000	3000	3000
Water (PLN)	1000	919	773	704	470
Litter removal and washing (PLN)	1700	1700	1700	1700	1700
Disinfection (PLN)	1000	1000	1000	1000	1000
Broiler catching (PLN)	1500	1375	1250	750	750
Bedding material (PLN)	3000	3000	3000	3000	3000
Depreciation (PLN)	5160	5160	5160	5600	5600
Total costs (PLN)	166614	157121	148620	138427	102805
Livestock production (kg)	45923	42573	35985	31585	21300
Production value (PLN)	180020	166887	141060	123815	83496
Profit/ loss per production cycle (PLN)	13406	9766	-7560	-14612	-19310
Profitability (%)	8	6	-5	-11	-19

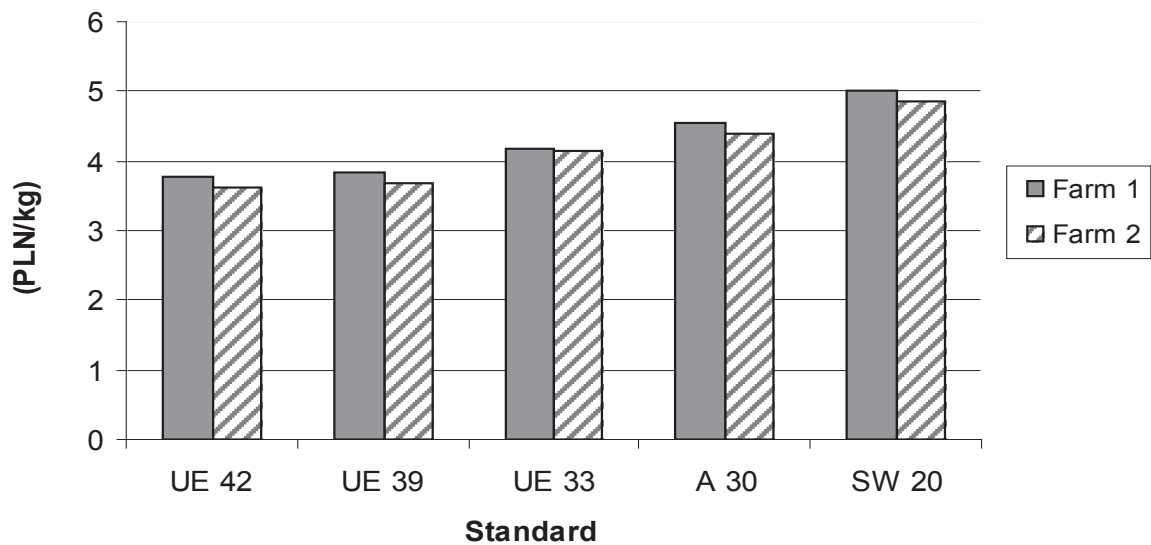
Source: author's calculations

necessity to install windows and perches at the broiler houses. These costs have been included in depreciation.

Examined farmers are able to lower some costs like costs of straw purchase and broiler litter removal. In the area, there is a demand for an excellent fertiliser, picked up readily by the local farmers or mushroom growers for the exchange of straw. This would allow farmers to save about PLN 3500 per cycle but it will not be enough to make a profit or to cover production costs at stocking density equal or below 33 kg/m². Results obtained from the study are consistent with the reports of other authors. K. De Baere et al. (2010) reported that as long as farmers were not paid extra for growing birds at higher welfare standards (lower stocking densities), it is important to

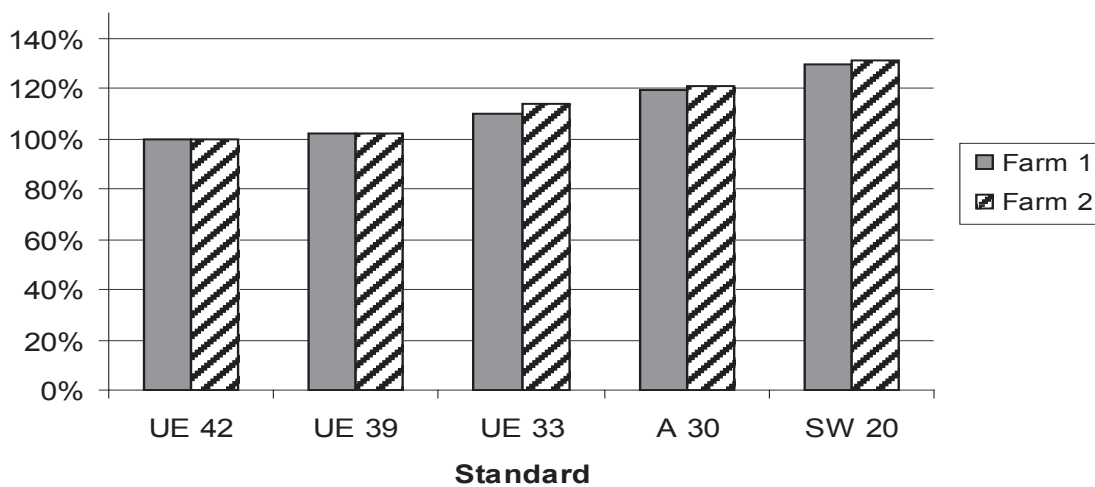
them to apply as high flock densities as legally allowed. For Belgian producers, the critical stocking density for maintaining profitability is even higher, the authors suggest 46 kg/m² (Verspecht A. et al. 2011).

Research results demonstrate that costs of feeding and nestlings were prevailing. Depending on animal welfare standard, the costs of feeding varied between 58% and 66% on Farm 1 and 68-69% on Farm 2. The costs of nestlings, ranged 11-15% and 14-16% respectively. A. Sheppard and S. Edge (2005) made similar observations concluding that feeding costs constituted 59.2% of total costs at maximum stocking density (42 kg/m²) and 54.9% at stocking density of 30 kg/m². The costs of nestlings were 20.3% and 18.8% of total costs respectively.



Source: author's construction based on own calculations

Fig. 1. Costs of broiler production under varying animal welfare standards (referring to the standard EU 42)



Source: author's construction based on own calculations

Fig. 2. Costs of production of one kilogram of livestock under varying animal welfare standards in % (referred to the standard EU 42)

Fixed costs and financial results at varying animal welfare standards

Specifications	Broiler welfare Standard				
	EU 42	EU 39	EU 33	A 30	SW 20
Rate of fixed costs in total costs (%)					
Farm 1	16	17	18	21	28
Farm 2	14	15	16	18	24
Fixed costs (PLN/ kg of broiler)					
Farm 1	0.52	0.56	0.66	0.77	1.14
Farm 2	0.59	0.64	0.73	0.93	1.38
Profit/loss (PLN/1 broiler)					
Farm 1	0.38	0.22	-0.61	-1.52	-2.69
Farm 2	0.83	0.65	-0.60	-1.32	-2.58

Source: author's calculations

At the highest stocking density of 42 kg/m², the cost of production of 1 kg of live broiler amounted to PLN 3.63 (Farm 1) and PLN 3.77 (Farm 2), and then it increased in animal welfare standard a reduction of the density, resulting in the following values on Farm 1: 3.84 PLN/kg, 4.16 PLN/kg, 4.51 PLN/kg, and 4.96 PLN/kg. On Farm 2, this increase was slower, costs amounted to 3.69 PLN/kg, 4.13 PLN/kg, 4.38 PLN/kg, and 4.83 PLN/kg (Figure 1).

The study indicates that in the case of the two farms examined, the total cost/kg increase in percentage ranged from 2% to 32% depending on a animal welfare standard (Figure 2). Numerous studies have confirmed that raising standards of animal welfare results in production costs increasing by 5% - 50% (Blatchford R. et al., 2009, De Baere K. et al., 2010).

Table 6 summarises the changes of economic results depending on broiler welfare standards. The study pointed out that the rate of fixed costs in total costs grew from 16% (EU 42) to 28% (SW 20) on Farm 1, and from 14% to 24% on Farm 2. At the same time, fixed costs calculated per kg of broiler reared in higher standard (SW 20) increased over two times in comparison with the basic standard (EU 42). Diego Puron and Raaul Santamaria (1995) reported that high stocking densities reduced the fixed costs of production per kilogram of broiler and increased profitability.

The study shows that profitability was lower on Farm 1 (4% in the present standard EU 42 and 2% in the standard EU 39) than on Farm 2 (8% and 6% respectively) because of costs of labour. Whereas, on Farm 1, there was only one employee, while on Farm 2 there were two permanent workers.

Based on the conducted study, it is possible to estimate costs of raising broiler welfare standards for the whole Polish broiler sector. Provided that 96 960 thousand birds are produced in Poland yearly, the costs of a raising broiler welfare standards from EU 42 to EU 39 (decreasing stocking rate from 42 kg to 39 kg live weight per square metre) would amount to PLN 17 278 thousand. Further raising standards from EU 39 to EU 33 would cost PLN 121 442 thousand, from EU 33 to A 30 would cost PLN 186 163 thousand, and from A 30 to SW 20 would cost PLN 378 144 thousand.

Summary and conclusions

1. Results obtained from the study show that increasing broiler welfare standards on the examined Polish farms resulted in rising production costs from 5% to 32%. It should be stated that the most significant factor influencing the production costs and the revenue level, was the broiler stocking density.
2. The consequences of activities aimed at increasing animal welfare affected the producers in the first place. Improving the broiler maintenance conditions, the farmers faced the loss of their revenues. It is difficult to maintain production profitability on the current market conditions - high costs of fodder and at the same time low prices for broilers meat.
3. On the examined farms, profitability was low (2-8%) and it was achieved only in flocks with lower standards (higher stocking density) - like EU 42 or EU 39. The research results show that in order to cope with the high costs, Polish producers are aiming at achieving higher stocking density at their broiler houses. Otherwise, producers may decide to terminate production.

Bibliography

1. Blatchford, R. A., Klasing, K. C., Shivaprasad, H. L., Wakenell, P. S., Archer, G. S., Mench, J.A. (2009). The Effect of Light Intensity on the Behaviour, Eye and Leg Health, and Immune Function of Broiler Chickens. *Poultry Science*, Volume 88, Issue 1, pp. 20-8.
2. Buijs, S., Keeling, L., Rettenbacher, S., Van Poucke, E., Tuytens, A.M. (2009). Stocking Density Effects on Broiler Welfare: Identifying Sensitive Ranges for Different Indicators. *Poultry Science*, Volume 88, pp. 1536-1543.
3. De Baere, K., Cox M., Zoons, J. (2010). Effect of Light Intensity and Stocking Density on Performance of Broilers and Cost Effectiveness. *Poultry Welfare, XIIIth European Poultry Conference*, pp. 193-198.
4. Dybowski, G. (2005). *Produkcja drobiu (Poultry Production)*. Seria Polska Wies w Europie. Warszawa:

- Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej, pp. 1-14.
5. GAIN Network Report. (2011). Number E60042, pp. 1-15. Retrieved: <http://www.globaltrade.net/f/market-research/pdf/Netherlands/Animal-Husbandry-and-Support-Services-Poultry-EU-Poultry-Production-and-Exports-to-Grow-Again.html>. Access: 12 January 2012.
 6. Herbut, E., Sosnowka-Czajka, E., Skoromucha, I. (2005). Rola mikroklimatu w kształtowaniu się poziomu dobrostanu drobiu; Warunki utrzymania drobiu – dobrostan zwierząt (The Role of Microclimate in Animal Welfare; Poultry Keeping Conditions); Krakow: Instytut Zootechniki, p. 96.
 7. Olanrewaju, H. A., Thaxton, J.P., Dozier, W.A., Purswell, J., Roush, W. B. Branton, S. L. (2006). A Review of Lighting Programmes for Broiler Production. *International Journal of Poultry Science*. Volume 5, Issue 4, pp. 301-308.
 8. Puron, D., Santamaria, R., Segura, J. C., Alamilla, J. L. (1995). Broiler Performance at Different Stocking Densities. *Journal Applied Poultry Research*. Volume 4, pp. 55-60.
 9. Sheppard, A., Edge, S. (2005). Economic and Operational Impacts of the Proposed EU Directive Laying Down Minimum Standards for the Protection of Chickens Kept for Meat Production. Research Report Number 13. Exeter: Centre for Rural Research University of Exeter. pp. 1-70.
 10. Statistical Yearbook of Agriculture (2002). Warsaw: GUS. p. 179.
 11. Statistical Yearbook of Agriculture (2010). Warsaw: GUS. p. 188.
 12. Statistical Yearbook of the Republic of Poland (2011). Warsaw: GUS. p. 465.
 13. Swierczewska E. (2008). *Chow drobiu (Poultry Raising)*, Warszawa: SGGW, p. 167.
 14. Tykadłowski, A., Stenzel, T., Mazur-Lech, B., Konicki, A. (2010). Niski poziom dobrostanu jako główna przyczyna występowania problemów zdrowotnych na fermach drobiu (Low Level of Animal Welfare as a Main Reason of Health Problems on Poultry Farms); *Polskie Drobiarstwo*; Volume 6, Supplement, pp. 32-35.
 15. Verspecht, A., Vanhonacker, F., Verbeke, W., Zoons, J., Van Huylenbroeck, G. (2011). Economic Impact of Decreasing Stocking Densities in Broiler Production in Belgium. *Poultry Science*. Volume 90, Issue 8, pp. 1844-1851.

Intensity of Production Organisation in Farms with Diversified Relations to Their Environment in Poland

Barbara Golebiewska¹, PhD hab.

Faculty of Economics, Warsaw University of Life Science, Poland

Abstract. The case study contains the changes that have occurred in the field of intensity of organisation in the farms in Poland with diversified relations to their environment. The aim of the study was to specify the changes that occurred in the range of intensity of organisation in the farms with diversified relations to the environment. The factor of intensity of production organisation has been pinpointed as well. Furthermore, the changes of intensity of organisation of agricultural production for the total number of farms in 2004-2009 have been presented. The evaluation has been done based on the regional division. The Kopec point method has been used for the evaluation of intensity of organisation of agricultural production. Calculations have been done based on the FADN and professional literature. The research has proved that the intensity of organisation of agricultural production, when explored in time and space, is diversified. It has also been presented that there is a link between a farm and its environment, which, consequently, is reflected in the economic results of agriculture.

The farms of the strongest connections to the environment were characterised; with regard to organisation, with the medium intensive production of lower labour intensity and cost intensity.

Key words: intensity of production organisation, stocking density, structure of crop production, connections to the environment.

JEL code: Q12

Introduction

The organisation of production processes in a farm is aimed to use the most economically effective ways of production. Due to this, the evaluation of farms' organisation is mostly done based on crop production and animal production. Farms in Poland are the units that combine both crop and animal production. They are mainly small holdings (9.5 ha² on average) with mixed production. Their share in total number of farms is about 65%. According to Klepacki (Klepacki B., 1997), a typical farm in Poland is rarely engaged in processing or providing services. After joining the EU, Poland has not faced any major changes (Zegar J., 2011).

Organisation of farms includes, among others, production factors, inputs improving and extending the current production capability as well as investments leading to the increase of equipping the basic production factors with resources (Reisch E., Zeddies J., 1987). Intensity, on the contrary, means the intensity of a phenomenon or human activity in a production process. The literature on agricultural economics uses the notion of intensity in various meanings. It is described as the farming intensity (Blohm G., 1965, Andreae B., 1974), real intensity (Manteuffel R., 1981, Kisiel R., 2001), or, in general, production intensity (true intensity) (Zietara W, Olko-Bagienska T., 1986). The intensity of economic activities in agriculture is settled as total data of amount of labour input and production resources, calculated per unit area (Manteuffel R., 1981).

Conducted in the period of 2004-2009, the research indicates that the intensity of production organisation is one of the elements having an important meaning for relations between farms and the environment (Golebiewska B., 2010), which, consequently, influences the economic results of the farms. It seems that due to this, it is an important issue, and conducting studies in this field is justified in terms of evaluating the ongoing processes inside farms and the research results.

The aim and method of the study

The aim of the study was to specify the changes that occurred in the range of intensity of production organisation in farms with diversified relations to the environment. Moreover, the meaningfulness of the factor of intensity of production organisation for the connections between farms and the market was pinpointed. Connections with the environment were specified using the correspondence index³.

The objects of research were units conducting agricultural production at least partially reserved for sale. The source of information was the data from farms maintaining accounting for the needs of FADN in 2004-2009. Furthermore, empirical studies were conducted directly on selected farms, which let to collect data not included in the FADN system.

The intensity of farm organisation is calculated in points. The percentage share of plants requiring particular costs in the structure of agricultural land, and a number

¹ E-mail address: Barbara_golebiewska@sggw.pl.

² The share of farms up to 5 ha of agricultural land in Poland makes about 70% of all the farms (Statistical Yearbook of the Republic of Poland 2010, pp. 91-92).

³ Precise construction of the correspondence index of farms and their environment is presented in the case study: Golebiewska, B. (2010). *Organizacyjno-ekonomiczne skutki powiazan gospodarstw rolniczych z otoczeniem*. Publication: SGGW. Warszawa. p. 187.

of animals (the factual or conversion number) per area unit are stipulated. The points are calculated using an adequate intensity index, which diversifies particular plants as well as activities of animal production in terms of labour consumption. The set of indexes sometimes differs depending on the author. The indexes according to Kopec (Kopec B., 1969) or Andreea (Andreea B., 1966) have been used up to now.

Specifying the intensity of production organisation, the project used the intensity indexes according to Kopec (Kopec B., 1969). In the researched farms, the intensity of production organisation was stipulated separately for crop and animal production. Intensity of organisation for the whole farm (IOZ) was specified by simulating the received results.

$$\text{IOR} = \sum R \times K_i, \quad (1)$$

where:

- IOR – intensity of organisation of crop production;
- R – share of particular groups of plants in the structure of area under crop: in plantations, orchards and permanent grassland;
- K_i – intensity index of farm organisation for particular plants, according to Kopec.

$$\text{IOZ} = \sum Z \times K_i, \quad (2)$$

where:

- IOZ – intensity of organisation of animal production;
- Z – number of animals of particular species or groups according to the age of each adult animal (SD) per 100 ha of cultivated land⁴;
- K_i – intensity index of farm organisation for particular animal species, according to Kopec.

$$\text{IOG} = \text{IOR} + \text{IOZ} \quad (3)$$

The analyses were also enriched with data from the primary research, conducted in 2008 on a group of 225 farms, which concerned the farms' connections with the environment.

Research results and discussion

1. The intensity of production organisation of farms in Poland

The intensity of production organisation in Poland has been shown through a division of intensity in terms of crop and animal production because of a meaningful regional diversification of Poland in this regard. The results have been presented using the arrangement of provinces. Such diversification proves that economic and organisation factors, and changes in the environment of farms have a considerable meaning.

The intensity of organisation of crop production differs from animal production. The changes took place also in the following years. As indicated in the studies (including Krasowicz S., 2006), the provinces with the total highest

intensity of organisation of agricultural production in 2003-2008 were the Wielkopolskie, Kujawsko-Pomorskie, Lodzkie, and Podlaskie provinces. On the contrary, in 2006-2008, the provinces with the highest index of intensity of production organisation of crop production were, similarly to the previous years: the Kujawsko-Pomorskie, Wielkopolskie and Lodzkie provinces, which this time were joined by the Lubelskie and Opolskie provinces (Kopinski J., 2009). Figure 1 presents regional diversification of intensity of production organisation of crop production in Poland, demonstrating its average level in 2006-2008.

Lowering the intensity index of production organisation is expressed in the decrease of stocking density and the increase of the share of grain in the structure of the area under crop. According to several pieces of research, the intensity of organisation of animal production is more diversified between provinces than the intensity of organisation of crop production (Krasowicz S., 2006, Kopinski J., 2009). Figure 2 presents the intensity of animal production in particular Polish provinces.

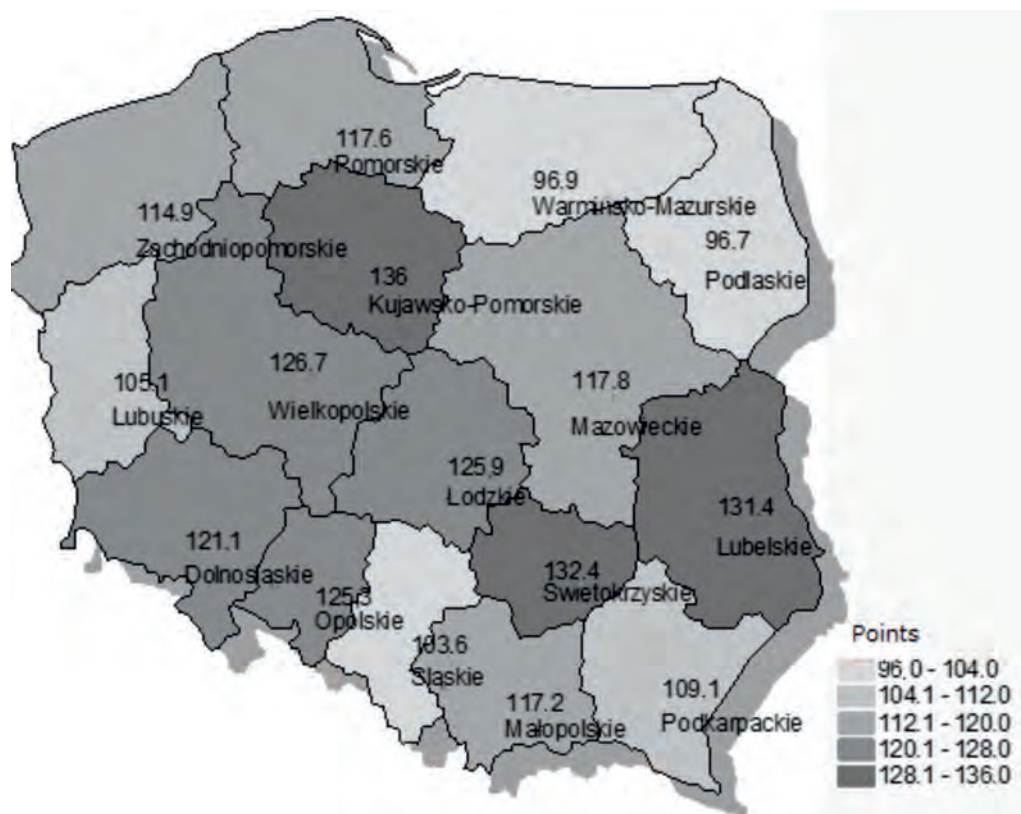
The Wielkopolskie, Podlaskie, and Kujawsko-Pomorskie provinces had the highest level of intensity of organisation of animal production. However, the Western and South-west regions, and the Lubelskie and Podkarpackie provinces had the lowest level of intensity.

2. Diversity of intensity of agricultural production organisation depending on connections to the environment

The most important factor in plant production is land; production organisation within this scope is of great significance to operation of the whole farm. Maintaining good quality of soil requires cultivation of sufficient number of plants, improving or keeping fertility on a constant level, and providing good positions. These kinds of plants are mainly non-cereal crops. Still, as it has been noticeable for a long time now, a dominating tendency of agriculture is growing share of cereals in a cropland structure. Cereals are considered as the basic raw materials and agri-food products of strategic significance, which determine food safety of the state (Urban S., 2008). Since 1990, there has been a gradual increase in cereal share in the cropland structure of Poland (in 2008 it was as much as 75.1 percent) (Agriculture in 2008 ..., 2009). Although, the cereal production is an important yardstick of Poland's position and competitiveness towards other Member States and it shows a level of taking advantage of the potential of Polish agricultural production area (Krasowicz S., 2006), this considerable increase in their share in the cropland structure is not advantageous. This causes, among others, one-sided use of soil as well as fungal disease spreading (Urban S. 2009). The intensity of plant production organisation is, among others, the result of the particular crop's share in the cropland.

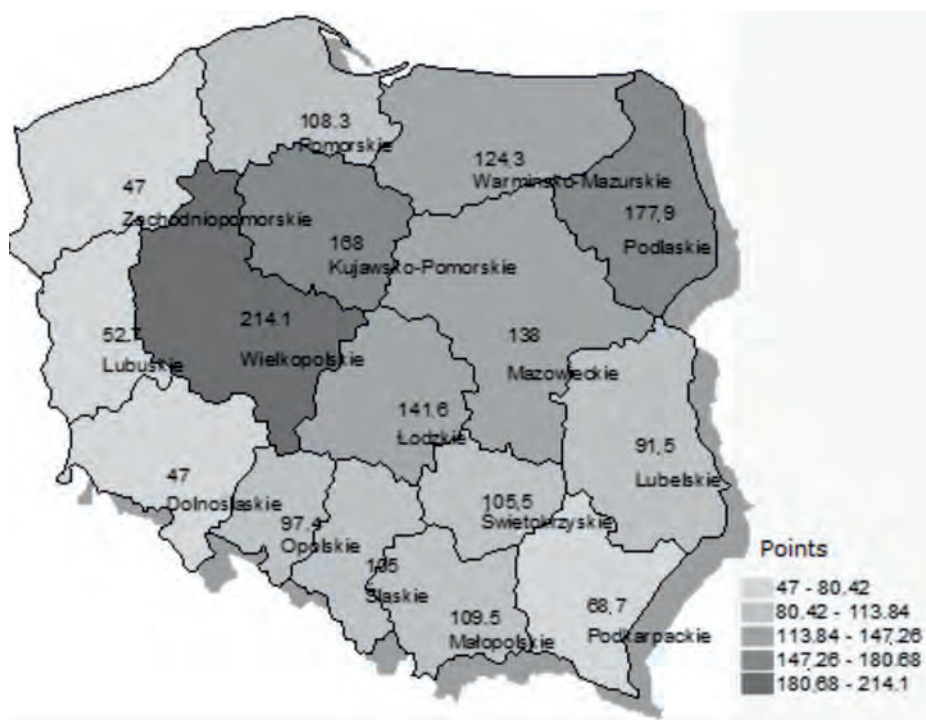
The intensity of organisation of agricultural plant production in Poland has been increasing throughout the past 70 years. In 1938, it was 112.7 points and only the period of war caused its lowering. Between 1946 and 1975, the intensity of organisation of plant production was gradually increasing. In 1975, it reached the highest value – 144.6 points. The following years brought

⁴ Conversion factors to conversion units of animals [LU] according to the FADN have been used in the research.



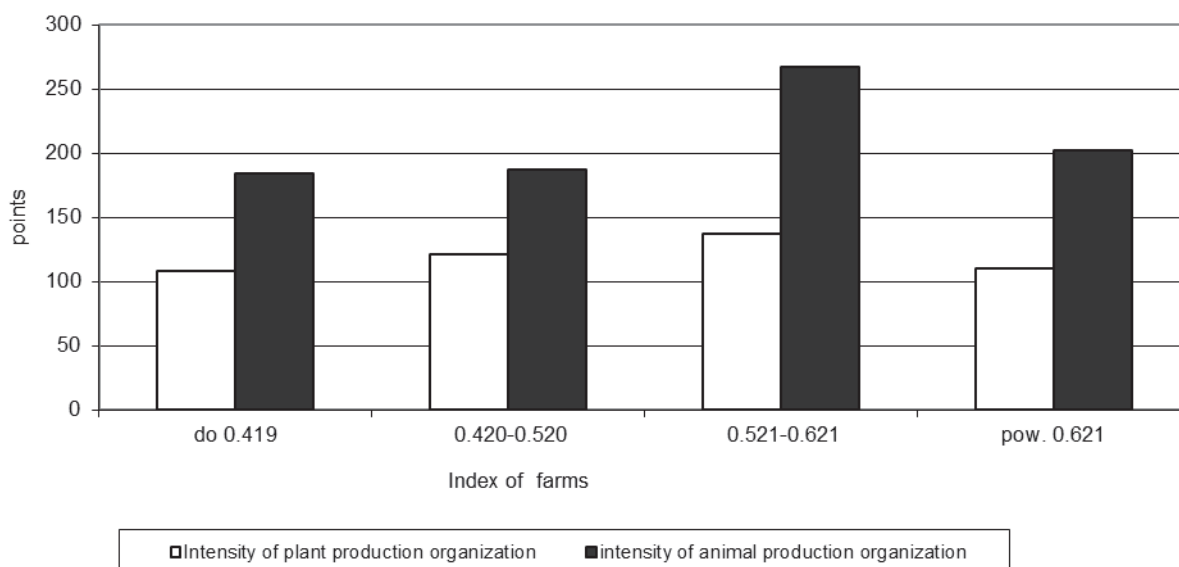
Source: author's calculations based on Kopinski J., 2009

Fig. 1. The regional diversification of intensity of organisation of crop production (the average for 2006-2008)



Source: author's calculations based on Kopinski J., 2009

Fig. 2. Regional diversity of the intensity of animal production organisation (average level between 2006 and 2008)



Source: author's construction

Fig. 3. Intensity of organisation of animal and plant production in farms of various connections to the environment (average level between 2004 and 2009)

its decrease, and in 2007, it was only 115.3 points (Urban S., 2009).

In the examined farms, the intensity of production organisation changed together with changing farms' connections to the environment (Figure 3).

The lowest level of intensity of organisation characterised the farms of the lowest and the highest index of connections. In two middle groups, the intensity was higher than the country's average (115.3 points in 2007); additionally, it was considerably diversified in the subsequent years. There was a decrease experienced only in the group of the highest connections. It was connected with the increasing share of cereal crop, and simultaneous decreasing share of highly labour-consuming plants, as bulb and root plants, in the cereal cropland structure.

In order to examine the statistically significant dependencies between the particular variables determining connections to the environment⁵ and intensity of organisation of plant production, Spearman's rank correlation analysis was conducted. The analysis showed a significant relation between the level of intensity of plant production organisation and the following variables:

- inputs of purchase current assets (0.194 correlation coefficient);
- use of production services (-0.186 correlation coefficient);
- hired labour (0.264 correlation coefficient);
- use of regular buyers' services (-0.262 correlation coefficient).

The following factors had a favourable influence on the increase in the intensity of crop production organisation: the increase in inputs of current assets and the use of hired labour. It is understandable since the level of laid-in cost (e.g. mineral fertilisation or use of pesticides) is directly dependent on a farmer's decision and it

contributes to gained efficiency (e.g. harvested plant crop). Obviously, the higher intensity of organisation is connected with more considerable labour input. On the contrary, both the use of regular buyers' services and cooperation with them had a negative impact on the level of intensity of crop production organisation.

In case of animal production one can confirm that, in general, it is higher than plant production; most of all, it requires greater labour input. Reinforcing farms' connections to the environment was characterised with the increase in the intensity of animal production organisation, still only to a certain degree. In the group of farms of the highest index of connections, the intensity of organisation was higher than in the first and second group; still, it was lower than in the third group.

As in case of the crop production, the statistically significant dependencies between variables determining farms' connections to the environment and intensity of organisation of animal production were verified. With the use of Spearman's rank correlation analysis, the significant relation between the level of intensity of animal production organisation and the following variables was indicated:

- inputs of external current assets ($r = 0.196$ correlation coefficient);
- hired labour ($r = 0.377$);
- regular buyers ($r = 0.389$).

In case of the intensity of animal production organisation; similarly to the crop production, the use of hired labour as well as, purchase of the production materials outside the farm were favourable for its growth. Still, in this case, the cooperation with regular clients (probably in connection with sale of milk and livestock) had a positive impact on the increase in the intensity of animal production organisation.

⁵ The set of all variables determining the connections of farms to the environment can be found in the following study: Golebiewska B. (2010).

Conclusions

The level of intensity of production organisation in Poland is diversified spatially. This indicates the significance of economic and organisational conditionings as well as changes in the environment of the farms. Therefore, it can be stated that the environment has an indirect impact on the internal processes of the farms. Undoubtedly, the intensity of animal production organisation was higher and more diverse than the one concerning crop production. The conducted analysis of the intensity of production organisation showed that its growth took place together with reinforcement of connections to the environment but only to a certain degree. Still, the statistical significance between the variables determining connections to the environment and the intensity of production organisation was shown. This was positively influenced by inputs of current assets and the use of hired labour.

The intensity of production organisation decreased in the group of farms of the lowest index of connections to the environment. This was the result of a smaller number of points in both crop production and animal production. Therefore, one can affirm that the farms of the strongest connections to the environment were characterised; with regard to organisation, with the medium intensive production of lower labour intensity and cost intensity.

Bibliography

1. *Agriculture in 2008 Year*. Statistical Publishing Establishment. GUS 2009, Warszawa. Retrieved: <http://www.stat.gov.pl>. Access: 15 January 2012.
2. Andreae, B. (1966). *Sposoby prowadzenia gospodarstw rolniczych (Ways of Keeping Agricultural Farms)*. PWRiL, Warszawa. p. 89.
3. Andreae, B. (1974). *Ekstensywnie organizowac – intensywnie gospodarowac (Extensively to Organize - Manage Intensively)*. PWRiL, Warszawa. p. 78 (974).
4. Blohm, G. (1965). *Ogólna ekonomika i organizacja gospodarstwa rolniczego (Economics and Organisation of Agricultural Farms)*. PWRiL, Warszawa. p. 365.
5. Golebiewska, B. (2010). *Organizacyjno-ekonomiczne skutki powiazan gospodarstw rolniczych z otoczeniem (The Organisation and Economic Results of Relations between Farms and the Environment)*. Wyd. SGGW. Warszawa. p. 187.
6. Kisiel, R. (2001). *Zastosowanie wybranych metod rachunku ekonomicznego w optymalizacji produkcji rolniczej (Selected Methods of Economic Calculation in the Optimization of Agricultural Production)*. Wyd. UW-M, Olsztyn. p. 200.
7. Klepacki, B. (1997). *Produkcyjne i ekonomiczne przystosowania gospodarstw prywatnych do zmian warunkow gospodarowania (Productive and Economic Adjustment of Agriculture Farms to Changes in Economic Conditions)*. Wyd. SGGW. Warszawa. p. 217.
8. Kopec, B. (1969). *Ekonomika i organizacja gospodarstw rolnych w zarysie (Economics and Organisation of Farms)*. PWRiL, Warszawa. p. 359.
9. Kopinski, J. (2009). Zmiany intensywnosci organizacji produkcji rolniczej w Polsce (Changes in Intensity of Agricultural Production Organisation in Poland). *Journal of Agribusiness and Rural Development*. Volume 2(12). pp. 85-92.
10. Krasowicz, S. (2006). Możliwości dostosowania produkcji roślinnej w różnych regionach Polski do wymogów Unii Europejskiej (Adaptation of Crop Production in Various Polish Regions to the European Union). *Roczniki Naukowe SERiA*, t. VIII, z. 4. pp. 187-192.
11. Manteuffel, R. (1981). *Ekonomika i organizacja gospodarstwa rolniczego (Economics and Organisation of Farms. Warsaw)*. PWRiL, Warszawa. p. 328.
12. Reisch, E., Zeddies, J. (1995). *Einfeuerung in die landwirtschaftliche Betriebslehre. T. 2*, Wyd. AR w Poznaniu. Wydanie III. p. 503.
13. *Statistical Yearbook of Agriculture 2010*. Central Statistical Office. Warszawa. p. 305.
14. Urban, S. (2008). Wybrane rynki branżowe produktów rolno-spożywczych. Wyd. UE Wrocław. p. 189.
15. Urban, S. (2009). Zmiany w użytkowaniu ziemi rolniczej w Polsce. *Journal of Agribusiness and Rural Development*. Volume 2(12). Retrieved: <http://www.jard.edu.pl>. Access: 15 January 2012. pp. 257-267.
16. Zegar, J. (2011). Struktura obszarowa gospodarstw rolnych w Polsce (Area Structure of Agricultural Farms in Poland). Stan i perspektywa zmian. *Studia i Materiały. Realia i co dalej*. Nr 4 (25). Retrieved: <http://www.realia.com.pl>. Access: 15 January 2012.
17. Zietara, W., Olko-Bagienska, T. (1986). Zadania z analizy działalności gospodarczej i planowania w gospodarstwie rolniczym (Tasks of the Business Analysis and Planning in a Farm). PWRiL, Warszawa. p. 168.

Latvian-Turkish Economic Cooperation: Future Perspectives for Business Extension

Danute Jasjko¹, Dr.oec., assoc. prof.,
Zane Kantane², Student,
Erika Pancenko³, Dr.ing.sc., assist. prof.,
Tatjana Ivanova⁴, Dr.oec., assist. prof.

Abstract. Successful overcoming of Latvian economy the consequences of financial and economic world crises is closely related to enhancing of the national export potential and further development of national business activities on the domestic and foreign markets.

In the mentioned context, Turkey as associate member of the European Union and the country with great production potential should be considered as attractive business partner on the field of trade, investments, and business cooperation. The experience of Latvian companies cooperating with Turkish entrepreneurs is analysed in the present article. The main factors encouraging and impeding further economic cooperation of both countries in the sphere of trade and joint businesses are qualitatively assessed on the base of survey carried out among Latvian companies.

Key words: Latvian-Turkish economic cooperation, international trade, trade policy, export and import potential, enterprises.

JEL code: M16, F10

Introduction

Success in overcoming the consequences of the financial and economic crisis in the economy of Latvia depends on the increase of national export potential and further development of trade relations, both with the EU partners and with other countries. Therefore, the necessary conditions for further economic development of the economy of Latvia are the development of foreign trade relations, attraction of new economic and trade partners, and the increase of transit through Latvia.

In this connection, Turkey as the country having large industrial potential and striving to join the European community can be regarded as an attractive partner in the field of trade and economic cooperation not only for Latvia but also for the Baltic region.

The present article was written within the framework of the scientific project "Potentials for Latvian – Turkish Cooperation in the Fields of Economic Development and Trade: Feasibility of Transport Routes and Latvian Transit Capability", requested by the Turkish Institute of Business, Commerce and Culture (TBCCI).

Within the project research (RISEBA, 2011), the qualitative analysis of basic directions in Latvian-Turkish cooperation was carried out with the aim to identify the list of main sectors and enterprises, carrying out actual cooperation with Turkish entrepreneurs, and to reveal the existing obstacles and perspectives for further development of Latvian-Turkish economic relations.

The following tasks have been set for the achievement of the research aim:

- to analyse the basic directions in Latvian-Turkish cooperation on the basis of the statistical data and

data from the Register of Enterprises of the Republic of Latvia;

- to define the list of enterprises, carrying out actual cooperation with Turkish entrepreneurs in various sectors of the national economy;
- to estimate the further cooperation perspectives between Latvia and Turkey in the context of EU trading policy;
- to reveal the existing obstacles and possibilities for Latvian -Turkish cooperation based on the results of the survey of representatives of Latvian enterprises working with Turkish partners in various areas of economic activity.

In the present article, Latvian-Turkish cooperation was analysed in the sphere of trade, investments, and development of joint businesses.

Qualitative methods of data acquisition and analysis based on the questionnaire and results of the sampling were used for the purpose of research. The special questionnaire was developed for the assessment of obstacles and potential possibilities of Latvian-Turkish trade cooperation and creation of joint businesses. The representatives of Latvian enterprises were interviewed face-to-face.

1. Theoretical background of the research

International trade exists between two or more countries that are engaged in the exchange of goods, services or money (Hill, 2005). The literature, empirical analysis and models designed to analyse and to describe patterns and developments of international trade are

¹ E-mail address: danute.jasjko@riseba.lv

² E-mail address: zazis@cepums.com

³ E-mail address: erika.pancencko@riseba.lv

⁴ E-mail address: tatjana.ivanova@riseba.lv

Table 1

Turkey's share of total FDI accrued volumes in Latvia

Years	Total FDI volumes accrued, LVL thou.	Turkey FDI volumes accrued, LVL thou.	Turkey's share of total FDI, %
2007	12408489.9	733.3	0.03
2008	2701989.3	743.6	0.03
2009	3428760.2	360.8	0.01
2010	3969875.0	753.9	0.02
2011 (until 6 July 2011)	4074763.6	2868.6	0.07

Source: Lursoft database, 2011

numerous (Yarbrough and Yarbrough, 2000), (Olevskis, 2003), (Morgan and Katsikeas, 1997). However, the main implication for all of them are that countries should export the goods they are the most efficient or they have some observable advantage, making a country import such goods that are not efficient to produce domestically (Albaum et al, 1995). Basically, trade implies export and import as well as the exchange of investments between businesses operating in different markets. All these three aspects should be overviewed from the perspective of a nation and from a perspective of business, meaning, from macro and micro levels.

The barriers for trade will slightly vary from the barriers affecting FDI. However, tangible and intangible factors that affect the cooperation can be distinguished for all these aspects. Tangible factors are those that can be easily measured such as transportation costs, effects of trade policy, and economic indicators (Linders, 2005). On the contrary, intangible factors are such factors that cannot be evaluated quantitatively but they will either affect the cooperation.

In order to minimise the effect of trade barriers on trade, currently economic science strongly leans towards the idea of trade liberalisation (Low, 2004). Abolishment of trade barriers and formation of regional economic blocks are closely related to globalisation trend, which has emerged as a global production and borderless market.

International trade is carried out by international businesses that have to make several strategically important questions. One of the most important issues is the choice of foreign market. The decision where to expand the international business activities depends on several internal, mixed, and external factors (Koch, 2001).

2. Main directions in Latvian -Turkish cooperation

Turkey is a challenging foreign partner for Latvia to develop successful economic relations. Constructive bi-lateral relations between Latvia and Turkey are continually developing. According to the data from the Ministry of Economics of Latvia, in 2010, Turkey occupied the 21st place in volume of Latvian exports, and the 26th place - in import.

Constant growth of export volume to Turkey has been observed for the past four years. In 2010, exports have increased significantly to LVL 37.3 mln, which was by 179.4% more than in 2009. Moreover, for the first time

since the early 1990s a positive balance of foreign trade of Latvia and the Republic of Turkey had been achieved in 2010.

Imports from Turkey show volatile changes. During the economic crisis, there was a reduction in import volume (4% in 2008 and 50% in 2009). Yet, in 2010, the import volume grew by 26% reaching LVL 33.9 mln.

The most important goods exported to Turkey in 2010, were scrap metal and metal wares (61.4%), wheat and rye (14.4%), and wood and woodworking products (8.7%). The share of other goods does not exceed 3% (Ministry of Economics of Latvia, 2011).

The greatest volumes of import from Turkey were transport vehicles (17%), crop products - mostly fruit and vegetables (16.5%), articles of jewellery and components of precious metals (10.4%), mechanisms and electrical goods (5.0%), textiles (4.6%), and plumbing fixtures (4.3%) (Central Statistic Bureau of Latvia, 2011).

In 2010, the greatest share of export and import services between Latvia and Turkey belonged to the tourist services, which export, was 47%, and import - 41%. However, it is necessary to note that the volume of tourist services import in the period of 2008 - 2010 has reduced almost 6 times, from LVL 23.3 mln to LVL 3.9 mln.

In 2010, in export of transport services transportation by sea prevailed, accounting for 4%. In import services, transportation by air amounted to 37% of all imported services (Ministry of Economics of Latvia, 2011). Among other exported services in 2010, it is necessary to specify technical engineering and design services, which made LVL 425.9 thousand.

When analysing the flows of Turkish FDI, it is important to stress that currently Turkey occupies the 44th place among the countries investing in the economy of Latvia. Since 1991, Turkey has accrued foreign direct investments in Latvia accounts for LVL 18.0 mln (Lursoft Database, 2011). During the years from 2007 to 2011, more than 50 different Latvian registered companies have received investments from Turkish legal entities or private persons. Turkish investments have tended to grow over the past two decades, while Turkish capital accounts for a very small portion of Latvia's total FDI volumes. In 2007 and 2008, there was a minor increase in investment flow from Turkey (Table 1).

However, in the year 2009, the volume of investments plummeted substantially, which can also be attributed to the negative effects of the economic slowdown.

After negative growth in 2009, the investment flow in 2010 recovered and reached the level of investment volumes during the years 2007 and 2008. This happened in 2010 mostly due to a Turkish company "Havas Ground Handling Services Co", a group venture of a Turkish airport operator "TAV Airports Holding", which was one of the major current Turkish investors in Latvia. "Havas Ground Handling Services Co" made two essential investment tranches (LVL 351.4 thousand each) into the development of the Latvian company "North Hub Services Ltd" during 2010 and 2011. "North Hub Services Ltd" provides a full spectrum of surface services at Riga airport including services for passengers, luggage treatment, operational services for flights and crews, aircraft maintenance, and ticket sales.

The most essential financial inflows from Turkey were done during 2010 and 2011. Majority of Turkish investments went to the development of infrastructure of Riga Airport. Other important directions of usage of Turkish capital include operations on Latvian real estate market, teaching and education, public catering, and tourism services.

Business activity cooperation of Latvia with partners in other countries can be characterised by the number of joint ventures operating in Latvia. The Ministry of Foreign Affairs of the Republic of Latvia reports on 63 registered Latvian-Turkish joint venture enterprises in January, 2011.

According to the most recently available Central Statistical Bureau (CSB) data, in 2009, eight Turkish affiliates operated in Latvia. The enterprises were distributed among the eight main Latvian industries, mostly related to business activities in construction and real estate activities, transportation and warehousing, wholesale and retail trade, accommodation and public catering as well as professional, scientific and technical activities.

In all the eight enterprises mentioned, more than 50% of eligible voting power (decision-making power) belongs to Turkish entrepreneurs. However, investments made in the companies in Latvia were done through foreign direct investments or indirectly through the engagement of foreign companies holding Turkish capital and located in the territories abroad.

3. Involvement of Turkey in the EU trade policy

The EU established a Customs Union with Turkey in 1995. The scope of the Customs Union covers trade in manufactured products between Turkey and the EU, and also entails alignment by Turkey with certain EU policies such as technical regulation of products, competition, and Intellectual Property Law.

The Customs Union has significantly increased the volume of trade between Turkey and the EU Member States. Today, more than half of Turkey's trade is with the EU (European Commission, 2011).

This Customs Union implies the status of goods in free circulation between Turkey and any Member State but it is limited to industrial products and processed agricultural produce, and does not cover agricultural produce, as defined in Annex I of the Amsterdam Treaty of 1997 as well as coal and steel products. These two categories are

subject only to preferential agreements based on their originating status.

Zero custom tariff is applicable for "Top10" goods imported from Turkey to Latvia. The exception exists only for agricultural produce (tomatoes and pickles), which are subject of additional regulation and import requirements.

For the majority of goods exported to Turkey from Latvia, the significant items include industrial goods, which are subject of zero custom tariffs. The exception exists for some goods and agricultural produce (such as wheat and cheese), which have wide range of tariffs applicable depending on specific characteristics of goods described in the CN code system.

Additional technical requirements still exist in the Turkish legislation concerning the pharmaceutical products imported to Turkey from the EU (and Latvia). As it is stressed in "Turkey 2010, Progress Report" (European Commission, 2011), a new requirement calling for good manufacturing practice certificates for registration of pharmaceutical products for human use resulted in a de facto ban on imports from Europe causing long delays in the registration process.

The particular rules are also applicable in Turkey for the EU export of alcoholic beverages and tobacco. It is quite difficult and cumbersome to get the control certificate required by the Turkish State Regulator – Ministry of Agriculture and Rural Affairs. In addition, it is necessary for each importer to have a Certificate of Compliance issued by TAPDK (Tobacco and Alcoholic Board).

As mentioned in "Turkey 2010 Progress Report", no progress can be reported towards alignment with the general principles applicable to free movement of goods. The legislation on standardisation in foreign trade marginally reduced the list of items subject to conformity assessment upon import in 2010. Restrictions applicable from 2009 on goods from the non-EU countries in free circulation in the EU were not abolished in 2010. Such goods are still subject to conformity assessment procedures based on documentation accompanied, if necessary, by physical checks at the customs posts, thus, delaying and sometimes inhibiting access to the Turkish market.

4. Methodology applied in the research

In view of the lack of information characterising real cooperation between Latvia and Turkey on the fields of trade (export and import) and joint business activities, the method of surveying experts was used developing the questionnaires for the interviews.

The primary list of Latvian enterprises-respondents exporting and importing goods to/from Turkey was made, using the 2009 data from the Investment and Development Agency of Latvia (LIAA) and the CSB. The choice of enterprises for the interview was guided by the necessity to interview the biggest exporters and importers of the main commodities of Latvian export and import to Turkey. In total, eight companies were invited to the interview, of which four interviews were with the representatives of the following companies "Latvijas Finieris" JSC (plywood export), "Grenardi" Ltd (export/import of gold and jewellery), "Santehkomplekts" Ltd (export/import of sanitary production and plumbing

Table 2

The main sectors of Latvian-Turkish cooperation and companies currently operating

Sector	Company
Export	
Production and processing of metal scrap	Tolments Ltd, Kuusakoski Ltd
Agriculture and food industry	Genova Ltd, Agro Trade Latvija Ltd
Wood products	Latvijas Finieris JSC, Osukalns Ltd, Vika Wood SIA
Peat, petroleum oils, other minerals	Nordtorf Ltd, Olaines kudra JSC, Latvijas Statoil Ltd, Pindstrup Ltd, Kaviars Ltd
Glass fibre	Valmieras stikla skiedra JSC, Padtex insulation Ltd
Production of metal manufactures	Anima Libra Ltd
Gold and articles of jewellery	Falla Ltd, Baltic Jewellery Store Ltd, Freeman Ltd, Grenardi Ltd, Kolenzo Ltd
Furniture production	Atec JSC, Avoti SWF Ltd
Import	
Articles of jewellery	Baltic Jewellery Store Ltd, Passion & Fashion Ltd, Grenardi Ltd, Jahonts Ltd, Dikta RA Ltd
Fruit, vegetables and nuts	Blik-M Ltd, Spilva Ltd, Daneks Ltd, Elbi Ltd, ALis Co Ltd, Elmirs Ltd, Latbana Baltic Ltd, Novita Ltd
Radiators, other heaters, non-electric domestic appliances, and sanitary ware	Santehkomplekts Ltd, Konstanta TVIS Ltd, Areva T&D Ltd, Depo DIY Ltd, Prodex Ltd,
Food	Spilva Ltd, Blik-M Ltd, RIMI Latvija Ltd
Textiles and articles of apparel clothing accessories	Anpa Ltd, Pick-up Ltd, Lagra Ltd, Pamava Ltd, Varner Baltija Ltd, Elize G Ltd, Solutions razosanas komercfirma, Ltd
Electrical equipment	Konstanta TVIS Ltd, Recept-Holding Lifts Ltd, Schneider Electric Baltic distribution Centr Ltd, Telekons Ltd

Source: LIAA unpublished data (2011), CSB (2011), results of the research

products), and "Pick-up" Ltd (import of fabrics and sewing accessories). The representative of Riga International School of Economics and Business Administration (RISEBA) successfully cooperating with Bahceshehir University in the sphere of education took part in the survey as well.

At the same time, Latvian enterprises using Turkish investments were identified on the basis of information from the Register of Enterprises, published by the company Lursoft Ltd. However, the unwillingness of potential respondents to take part in the survey has not allowed deeper analysis of Turkish capital investment within the frame of the research done.

Senior executives and managers of producing and trading companies mainly participated in the interviews.

Table 2 indicates the list of enterprises, carrying out actual cooperation with Turkish entrepreneurs in various sectors of the national economy. Potential respondents of the survey were identified within each sector.

5. Analysis of the main factors impacting Latvian-Turkish cooperation in the field of business

Characteristics of enterprises engaged in the survey

The companies that participated in the survey differ according to their size, business activities, ownership structure, and market share.

Three of the observed companies are engaged in wholesale and retail sales of goods imported from Turkey. The shares these companies occupied on their domestic industry markets varied from 10% to 30% in 2010. All these companies have one or two owners, and all enterprises have their own retail shop chains.

All companies supporting the research have relatively long experience in cooperation with Turkey. However, the ways that cooperation has been established differ from company to company. There were different modes of starting the cooperation with Turkish partners. Importing businesses might engage in purposeful and targeted search for partners, by traveling to Turkey and looking for an appropriate offer and price. Also international exhibitions and personal contacts have been employed by Latvian entrepreneurs in order to start joint business. All respondents without exception left an impression that Latvian – Turkish cooperation, once it has been established, will be quite persistent and stable. Most of the companies have not changed their business partners in Turkey since the beginning of cooperation. Furthermore, among the majority of companies that have been interviewed, Turkey was considered as a significant partner, placed among the "TOP10" and, in case of two companies, even among the "TOP3" of the most important business partners from abroad. Majority of representatives admitted that the crisis has affected joint cooperation with Turkey. For instance, two companies

stated that their business, including imports from Turkey, was heavily affected by the crisis due to the dramatic downturn in the Latvian construction sector.

During the interviews, the companies-importers identified Turkey as an important supplier of goods on the external market. The major supply areas were compared by themselves. For instance, China was mentioned as one of the most similar nations regarding its production and profile. Therefore, Turkey and China were considered in similar positions regarding the level of cooperation. In a few interviews, Turkey and China were compared as major suppliers. Several respondents stated that production from China is cheaper than that of Turkey; however, they have also emphasised the negative effect of the policy of strengthening the Yuan. For some smaller-size entrepreneurs, it is more viable to import goods from Turkey as transportation costs from China are usually higher. Moreover, Turkey, if compared with China, has more favourable terms for volumes bought at once. In China, the volumes of the product required as minimum are larger than in Turkey. Taking into account that the Latvian market capacity is quite limited; the volume requirements of a transaction in Turkey might be more acceptable for Latvian entrepreneurs. In addition, managers of all three importing companies interviewed, viewed Turkey as a more viable trade partner than China due to the fact that business practice in Turkey often excludes any kind of intermediaries. Thus, many businesses stressed that Turkey is a feasible partner when talking about the necessary production and volumes required.

The main factors impeding and encouraging the Latvian-Turkish cooperation

The companies interviewed generally evaluate cooperation with their Turkish business partners as highly positive and state that there are no particular problems faced with the cooperation. However, several factors have been highlighted that influence the cooperation.

The opinion expressed was that administrative barriers have an impact on business cooperation with Turkey. However, as long as all the documents such as certificates, packaging lists and invoices are appropriately formed, there are no specific problems caused by the administrative pressure. Moreover, the Customs Union established between Turkey and the EU in 1995 has reduced the required formalities to the minimum.

One of companies interviewed also identified the obstacle related to VAT taxpaying practices, exporting goods to Turkey. As customs valuations applicable to goods exported is based on indicative price instead of the market price of the goods, such a discrepancy between the two types of prices can essentially increase the value of exported goods and automatically lead to an essential increase of VAT.

The opinions were diametrically opposite when talking about currency and commercial risks. A manager of one company dealing with imports of goods expressed that currency fluctuations are an essential aspect of importing activities especially from Turkey. The representative of the company stated that in the most cases, the payment was carried out either in Euros or Dollars, thus, it is of high importance to evaluate the availability of making the payment in one or the other currency, carefully following their fluctuations. However, other importing companies asked about the influence of currency risks on their

transactions, did not count currency and commercial risk as considerable hindering aspects. They stated that the changes were too small to affect the business between them and their Turkish partners.

One of the interviewees admitted that the shadow economy also had an impact on business cooperation. This would mainly impede the competitiveness on the market, as companies avoid some of the official procedures and requirements, and might sell the products cheaper and might transport them more quickly.

Mentality and cultural differences also can have an effect on business practice and collaboration with foreign countries. One of the interviewees mentioned that Turks sometimes had a tendency to slow down the process. It can be explained by the role of the family in every sphere of life and their consultation practices with their family or business members. As a lot of businesses are family owned, none of the decision can be taken by a single person. There were also opinions that Turkish business people had a tendency to speak indirectly that can lead to inconsistencies in the opinions of both negotiating parties.

An interesting comment was provided by one interviewer during the survey. She stated that the role of women did not coincide with the one currently existing in Latvia and Europe. She had the experience that Turkish businessmen refused to make a deal with a woman. Yet, because it was clear that a deal might fail due to the reluctance to communicate with women, the agreement was concluded successfully.

A different opinion on this issue was presented by the representative of RISEBA. She argued that the situation is different in the field of education. She also pointed out that the Turkish ambassador to Latvia was a woman and that there was significant proportion of women in leading positions in Turkish universities.

However, all respondents agreed that being familiar with national traditions, habits, public and religious holidays was an essential prerequisite for making contacts and successful cooperation in the business sphere as well.

Language differences are also mentioned as factor that influences the business cooperation. However, it can be concluded that linguistic differences form a minor problem for Latvian - Turkish cooperation. It was stated that Turkish business people recognised the importance of language skills, thus, the English or Russian language is widely used. The representatives of all importing companies stated that the main business language used was Russian. This detail can be evaluated as an advantage for Latvian entrepreneurs due to the fact that the knowledge of Russian is widely spread among them. However, the representative of RISEBA stated that the main language in the sector of education was English. She also adds that the use of interpreters complicates communication between the partners.

Another interesting opinion on the factors that influence cooperation was provided by the representative of RISEBA. She stated that the stereotypes existing in customers and clients minds about the Turkish production and Turkish culture were obsolete and not precise. This factor can have an influence on the demand for imported goods on Latvian market as well as services provided.

A representative of Santehkomplekts Ltd highly supported the idea that the physical distance between Latvia and Turkey was a crucial aspect of the current

economic cooperation. He stated that the distance could be evaluated as quite long, thus, increasing the total costs and diminishing the economic viability of such transactions. On the contrary, other representatives argued that the negative impact of the geographical factor had diminished since the introduction of direct flights from Riga to Istanbul and other cities of Turkey. It was also noted that the direct flights highly facilitated cooperation making barriers insignificant.

The proportion of transport costs of the total costs highly depends on the product being transported. Importing companies indicated that 6% - 8% was the average portion of transport costs that were justified. However, if the transportation costs exceed 10%, the economic viability of such deal should be considered carefully. Grenardi Ltd stated that the transportation costs they had were always constant, and in the cases where they exceeded the usual level, the order should be reconsidered.

An opinion expressed by representative of RISEBA indicated that the residence permit either for Latvian or Turkish citizens might be classified as a hindering aspect of the business. The complicated and lengthy process of acquiring it might slow down potential cooperation.

Future perspectives for business extension

All the companies interviewed recognised Turkey as a favourable and advantageous partner for business. The main idea expressed by all interviewees, is that cooperation is stable, reliable and with high potential thanks to long-term cooperative experience. Grenardi Ltd pointed out that they were not planning to increase the volumes of product imported from Turkey, as the demand for this specific product category was quite stable but without any real perspective to extend the domestic market share. Similarly Latvijas Finieris JSC does not plan to increase their export to Turkey. Their prospects mostly are limited by maintaining the existing market share. Santehkomplekts Ltd plans to increase its range of imported products from Turkey and their sales on the domestic market. The next product category imported from Turkey by Santehkomplekts Ltd are planned to be heating appliances. Pick-up Ltd also plans to diversify its domestic product range imported from Turkey. Pick-up Ltd adds that the volumes of products imported from Turkey will be definitely increased as soon as negative effects on the business climate arising from the economic downturn will be over.

There is a strong predominance of opinion that Turkey's accession to the EU would facilitate the trade even more. This statement implies even greater flow of goods and migration of people between Latvia and Turkey. As the representative of RISEBA mentioned, an inflow of Turkish people might trigger the economic development.

In order to foster economic cooperation between both countries interviewees suggested accumulating and sharing experiences gained making joint business. Among the essential prerequisite, which might facilitate further cooperation, the experts mentioned also the necessity to improve the transport infrastructure and construction of modern distribution terminals in Latvia to attract foreign clients to be more active in the use of Latvian transit potential.

It was also stated that the creation of profession associations or communities, which could bring together

entrepreneurs of both countries, would be helpful in fostering cooperation.

The role of the State could also not be neglected. The majority of interviewees stated that the government support was definitely required. However, support not in terms of subsidies paid but in terms of political will to create a business-friendly economic environment with stable fiscal policy and the creation of a favourable investment climate in order to formulate and pursue the strategic economic objectives and to provide its dominance in comparison with private interests of politicians and policy makers.

Conclusions

The results of the research provide an opportunity to draw the following conclusions.

1. At present, Turkey as a trade partner of Latvia has a modest position in the rating the states that are actively trading with Latvia. Thus, in 2010, in terms of the volume of export Turkey ranked only in the 21st, while in terms of the volume of import - only in the 26th position. Nevertheless, over the past four years, there has been a steady increase of Latvian goods export to Turkey, and for the first time since the early 1990s, a positive balance of foreign trade of Latvia and the Republic of Turkey has been achieved in 2010.
2. In 2011, totally 63 Latvian-Turkish companies were registered in the territory of Latvia. However, the number of enterprises, where Turkish entrepreneurs possess more than 50% of votes in decision-making process, is low. The main fields of activities pursued by the representatives of Turkish business in Latvia are construction, air transport, wholesale and retail trade as well as public catering.
3. Currently, Turkey ranks only the 44th in terms of foreign direct investment among countries investing in the economy of Latvia and this position can be easily influenced by one particular transaction. During the first half of 2011, Turkish companies and private investors had invested LVL 2.9 million into enterprises operating in the territory of Latvia. That same year, the major investment projects were implemented in the field of the airport "Riga" modernisation.
4. Creation of a single Customs Union between Turkey and the European Union in 1995, gave a powerful impetus to the development of trade relations between Turkey and the EU countries (including Latvia), making the EU the number one trade partner of Turkey. Trade regime between Turkey and the EU was significantly simplified, facilitating free trade in industrial goods and processed agricultural produce. Most types of goods imported from Turkey to Latvia or exported from Latvia to Turkey are not subjected to customs duties and quotas.
5. Among the factors impeding further economic cooperation between two countries, the companies interviewed during the survey specified administrative barriers, negative impact of shadow economies, and physical distance between the countries, essentially increasing the transportation costs of transactions as well as the stereotypes existing in customers and clients minds about the Turkish production

and Turkish culture, which were obsolete and not precise.

6. Latvian companies, that are actively cooperating with Turkish partners in the export-import field, responding to questionnaire in the framework of the research, expressed huge interest in further development of joint business activities. This interest might be attributed, first of all, to stable and reliable partnership, the proximity of the two countries in comparison with China, uniqueness of goods produced in Turkey as well as to competitive price-quality ratio of Turkish products. According to the experts' opinion, Turkey's accession to the EU would significantly contribute to the development of joint cooperation.

Bibliography

1. Albaum, G., Strandkov J., Duerr E., Dowd, L. (1995). *International Marketing and Export Management*, Addison-Wesley.
2. Central Statistic Bureau of Latvia, Database. Retrieved: <http://data.csb.gov.lv/DATABASEEN/atirdz/Short%20term%20statistical%20data/Foreign%20trade/Foreign%20trade.asp>. Access: 28 June 2011.
3. European Commission, Webpage. Enlargement: EU-Turkey relations. Retrieved: http://ec.europa.eu/enlargement/candidatecountries/turkey/eu_turkey_relations_en.htm. Access: 23 August 2011.
4. European Commission. (2011). Turkey 2010. Progress Report Accompanying the Communication from the Commission to the European Parliament and the Council Enlargement Strategy and Main Challenges 2010-2011. *Commission Staff Working Document. Commission 9.11.2010, SEC (2010) 1327* Retrieved: http://ec.europa.eu/enlargement/pdf/key_documents/2010/package/tr_rapport_2010_en.pdf. Access: 22 August 2011.
5. Hill, C. W. L. (2005). *International Business*, 5th edition, McGraw Hill Irwin.
6. Koch, A. J., (2001). *Factors Influencing Market and Entry Mode Selection: Developing the MEMS Model*, Journal of Marketing Intelligence and Planning, Vol. 19, 5.
7. Linders. G. J (2005). Intangible Barriers to Trade: The Impact of Institutions, Culture, and Distance on Patterns of Trade, Digital Academic Repository of Vrije Universiteit Amsterdam, Dissertation paper, <http://dare.uvu.nl/bitstream/1871/18967/1/dissertation.pdf>. Access: 17 March 2011.
8. Low, L., (2004). The Political Economy of Trade Liberalisation. *Asia-Pacific Development journal*, Vol. 11, 1.
9. Lursoft Database. Retrieved: <http://www.lursoft.lv/lursoft-statistika/Arvalstu-tieso-investiciju-sadalijums-pa-valstim&id=501>. Access: 6 July 2011.
10. Ministry of Economics of Latvia, webpage. Section "Latvijas arejas tirdzniecibas statistika ar valstim". Retrieved: <http://www.em.gov.lv/em/2nd/?cat=30288&eng=lv>. Access: 5 July 2011.
11. Morgan, E. R., Katsikeas S. C., (1997). Theories of International Trade, Foreign Direct Investment and Firm Internationalisation: a Critique. *Journal of Management History*, Vol. 35, 1.
12. Olevskis, G. (2003). *Starptaustiska tirdznieciba*. RSEBAA.
13. RISEBA Project Report (2011). *Potentials for Latvian – Turkish Cooperation in the Fields of Economic Development and Trade: Feasibility of Transport Routes and Latvian Transit Capability*, Riga: RISEBA. p. 107.
14. Yarbrough, B. V., Yarbrough, R. M. (2000). *The World Economy. Trade and Finance*, 5th edition, Harcourt College Publishers?

Modelling Distribution of Winter Wheat Yield in Poland

Pawel Kobus, PhD

Faculty of Economics, Warsaw University of Life Sciences

Abstract. The paper deals with the problem of probability distribution selection for modelling winter wheat yields in Poland. The research is based on yields time series aggregated at the NUTS 0 and NUTS 2 level, years 1995 – 2009. Four parametric probability distribution, normal, gamma, Burr, and generalised beta were compared in the research. Additionally kernel density estimator was evaluated. One measure of predictive quality, i.e. the log likelihood based cross validation measure was proposed besides two measures of fit quality.

Research results show that although, the kernel density estimator displayed the best fit to the data, the better predictive quality was offered by parametric models, especially normal and Burr distributions. Therefore, it was concluded that normal distribution should still be considered when modelling crop plants yield as one of the possible choices.

Key words: yield distribution, production risk, risk measures

JEL code: Q10, C46

Introduction

Production risk is one of the risks most specific to the agricultural sector. It is especially true for plant production. Yields of crop plants are influenced by many factors like weather conditions, pests, and diseases to name just the most important. Variability of crop plants yield together with prices instability is the main factor of farmers' income volatility. The most popular way for income stabilisation is crop insurance but according to the data of the Polish Ministry of Agriculture and Rural Development, only 11% of farmers applying for direct payments are buying such contracts. Although crop insurance contracts are obligatory for at least 50% of farm crop area and are subsidised by the government.

Even though farmers' decisions seem to be irrational, it all depends on yields variability. In case of small variability of yields, there is no reason to buy crop insurance. However, in the case of high yield variability, buying insurance contract seems very reasonable.

Typically, only the variation or standard deviation of yields is considered and thought to be an adequate measure of production risk in agricultural risk analysis. It is not necessarily true. There are numbers of others risk measures, some proposed by the author (Kobus P., 2009), which could be used; although, in case of normal distribution yields, it is usually possible to derivate them from the standard deviation. Yet, in case of non-normal distribution, it is generally not possible to calculate other risk measures using only the standard deviation. It is especially not true for skewed distributions.

The aim of this paper is to present methods for choosing best distribution from the considered set of candidates and present consequences of distribution choice on the values of risk measures.

Yields of winter wheat in Poland are investigated for that purpose. The statistical data used in the analysis consist of the average yields of wheat in Polish voivodeships in the years 1995 – 2009 and the average yield on national level; all the data are available from Eurostat (Eurostat, 2011). The data used in this study

are aggregated for voivodeships and hence, used only for illustration purpose.

While it is a stylised fact that yields are not normally distributed, the normal distribution is still used in practical risk analysis because of its relative simplicity. In literature of the subject, most researchers choose beta distribution, see, for example Hennessy D. et al. (1997), and Coble K. et al. (1996). In most cases, it was assumed that support for the distribution is known, and thus, only two parameters were estimated similarly to standard beta distribution. There are also examples of using other distribution, for example, gamma (Gallagher P., 1987) or Burr distribution to name one more exotic (Zhang Q., Wang K., 2010). Some researchers (Just R., Weninger Q., 1999) advocate using normal distribution for aggregated data. One of the reasons they give is the central limit theorem, while it is valid remark, there is still problem with the observed spatial dependency.

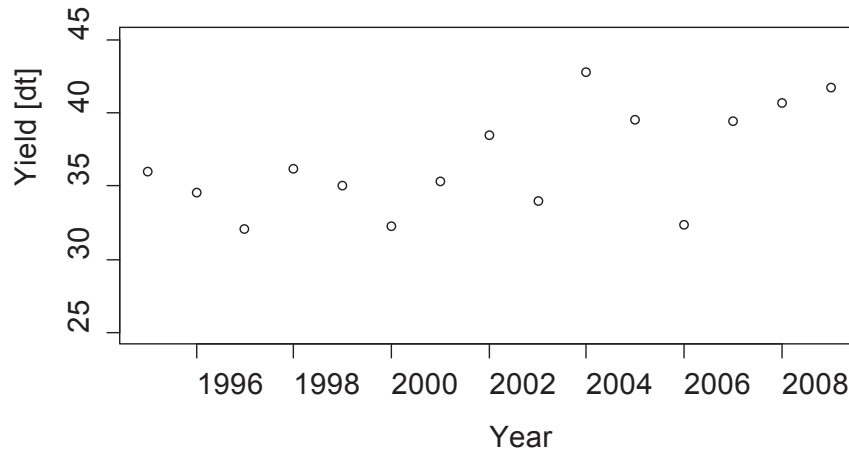
Beside parametric attempts at yields distribution modelling, there is an increasing share of papers, which suggest using nonparametric methods, see for example (Goodwin B., Ker A., 1998). One of the interesting qualities of nonparametric methods is ease of modelling bi or even multimodality observed frequently in empirical distribution of yields.

The main aim of this paper is selection of the best distributions for modelling winter wheat yields in Polish voivodeships and their comparison with kernel density estimator. The secondary aim is the evaluation of various measures of quality models for the purpose of yields prediction.

Research results and discussion

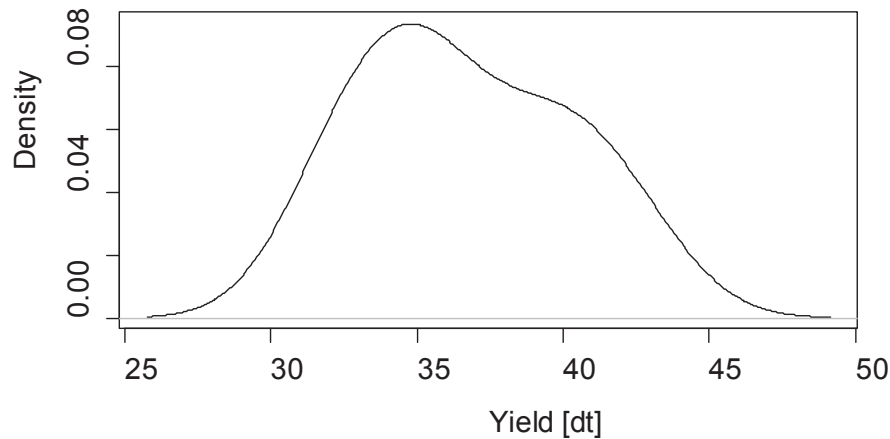
Yields of winter wheat in Poland presented in Figure 1 exhibit an ascending trend. This trend can be explained by the biological progress and the technological advancement.

While this trend does not seem very steep, there exists a significant linear relation between years and yields with determination coefficient equalling to 35%



Source: author's construction based on the Eurostat data

Fig. 1. Winter wheat yield in Poland, years 1995 2009



Source: author's construction based on the Eurostat data

Fig. 2. Kernel density estimator of winter wheat yield in Poland, years 1995 2009

and regression coefficient 0.47. It means that each year the yield has increased by 0.47 dt on average.

Figure 2 is presented only for illustrating a fairly common mistake in the analysis of yields distribution, i.e. treating yields observations as independent, even though they are not. As it was shown in Figure 1, there is a linear trend, which shall be taken into account. One way of doing it is the calculation of residuals from linear model according to Formula 1:

$$e_i = y_i - (\hat{\beta}_0 + \hat{\beta}_1 t_i), \quad (1)$$

where:

- y_i – yield in year i , t_i year i ,
- $\hat{\beta}_0, \hat{\beta}_1$ – estimators of linear trend function parameters.

It may be observed that the shape of kernel estimate of density function of residuals is totally different from the density function of yield values. It confirms that, in

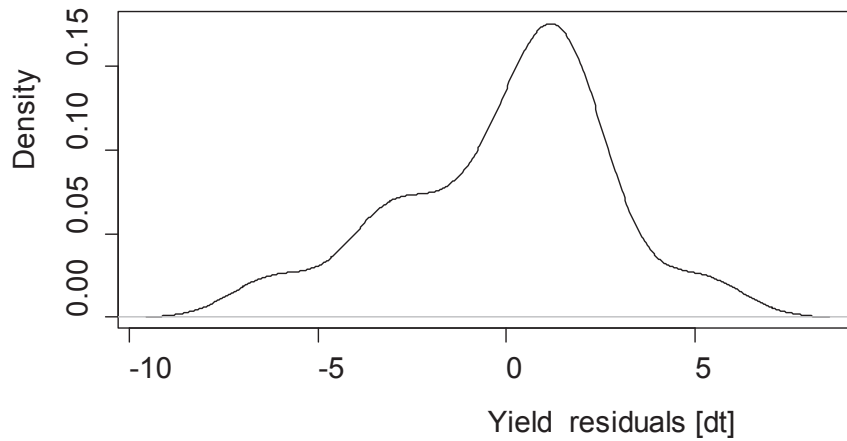
the presence of significant trend, the distribution, on which risk measures calculation is based, cannot be the unconditional distribution of yields. Before the distribution presented in Figure 3 can be used, its average should be shifted to the predicted yield for the next year. Such shift is presented in Figure 4. The values on which this figure is based were calculated according to the following formula:

$$\tilde{y}_i = (\hat{\beta}_0 + \hat{\beta}_1 t_{n+1}) + e_i, \quad (2)$$

The following distributions: normal, gamma, Burr, and generalised beta were fitted to the predicted values. Density functions of the abovementioned distributions are given below.

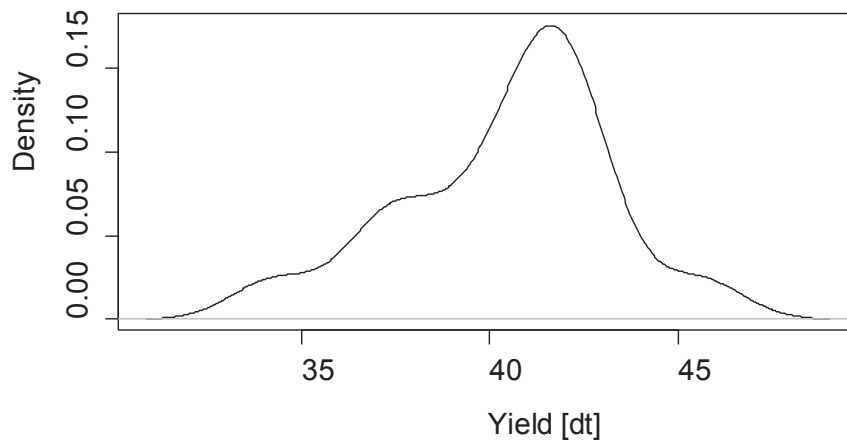
Density function of normal distribution:

$$f(y; \mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{y-\mu}{\sigma}\right)^2} \quad (3)$$



Source: author's construction based on the Eurostat data

Fig. 3. Kernel density estimator of residuals



Source: author's construction based on the Eurostat data

Fig. 4. Kernel density estimator of yield predicted for the year 2010

Density function of gamma distribution:

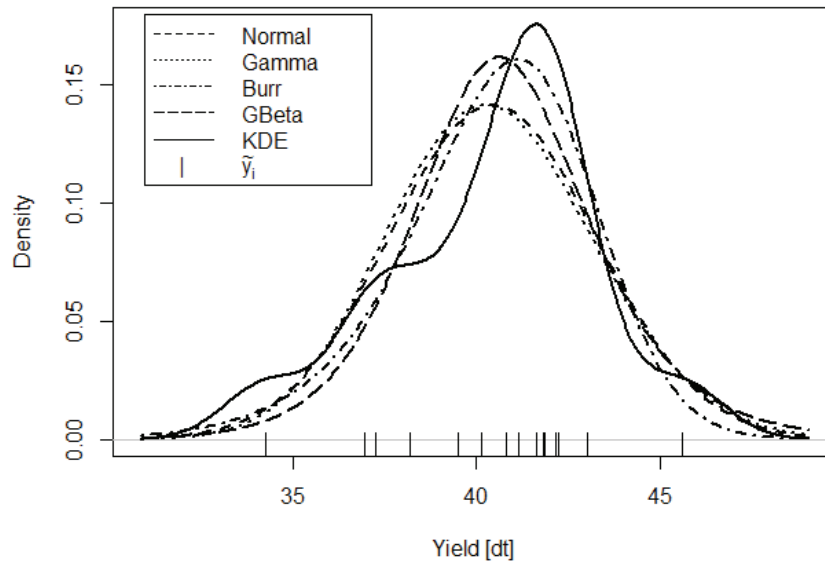
$$f(y; \alpha, \theta) = \frac{1}{\Gamma(\alpha)\theta^\alpha} y^{\alpha-1} e^{-\frac{y}{\theta}} \quad (4)$$

Density function of Burr type XII distribution:

$$f(y; \alpha, \tau, \varphi) = \left(\frac{\alpha \tau \left(\frac{y}{\varphi}\right)^\tau}{y \left(1 + \left(\frac{y}{\varphi}\right)^\tau\right)^{\alpha+1}} \right) \quad (5)$$

Density function of generalised beta (GBeta) distribution:

$$f(y; \lambda, \varphi, \alpha, \beta) = \frac{\lambda \left(\frac{y}{\varphi}\right)^{\lambda\alpha-1}}{\varphi B(\alpha, \beta) \left(1 + \left(\frac{y}{\varphi}\right)^\lambda\right)^{\alpha+\beta}} \quad (6)$$



Source: author's construction based on the Eurostat data

Fig. 5. Density functions fitted to yield predictions for the year 2010

Table 1

Measures of quality models for winter wheat yield in Poland

No.	Distribution	LLF	AIC	LCV
1.	Normal	-36.35243	76.70486	-2.60578
2.	Gamma	-36.52941	77.05881	-2.62854
3.	Burr	-35.95259	77.90518	-2.86786
4.	GBeta	-36.59971	81.19942	-2.59064
5.	KDE	-34.56303	-	-2.90856

Source: author's calculations based on the Eurostat data

Besides those 4 parametric models, kernel density estimator (KDE) was used:

$$\hat{f}_h(y) = \frac{1}{nh} \sum_{i=1}^n K\left(\frac{y - y_i}{h}\right) \quad (7)$$

As a kernel standard normal density function was used, the bandwidth h was chosen with Sheather and Jones's bandwidth selector, direct-plug-in version (Sheather S., Jones M., 1991).

Figure 5 presents the results of fitting the abovementioned models to the predictions of the average winter wheat yield in Poland for the year 2010. The ticks above the horizontal axis represent predictions, with the concentration around 40 dt. It may be that the observed kernel density estimator is the most flexible and reflects very well the distribution of \hat{y}_i values. However, too much flexibility could sometimes be a liability rather than an asset, especially if the sample size is small.

The research considered two measures of fitting quality: log likelihood function (LLF) and Akaike information criterion (AIC), and one measure of prediction

quality, i.e. leave-one-out cross validation method based on log likelihood (LCV) calculated according to the following formula:

$$LCV = \frac{1}{n} \sum_{i=1}^n \log(\tilde{f}_{[-i]}(y_i)), \quad (8)$$

where: $\tilde{f}_{[-i]}$ is density function estimated with exclusion of \hat{y}_i observation.

Values of the calculated measures for density function estimates for yield in the year $n+1$, i.e. the year 2010 are presented in Table 1. All those measures were calculated using values $(\hat{y}_1, \dots, \hat{y}_n)$, see Formula 2.

Although, it is possible to calculate the value of LLF for kernel density estimator, its interpretation should be done with an extreme caution. The reason for that is strong dependency between a bandwidth of kernel estimator and its likelihood function; each decrease of the bandwidth results in the increase of likelihood function but it does not mean that the model is better fitted. It is similar to the situation of using a regression function polynomial of high degree. Such model fits sample data very well but

it is completely useless for prediction. As for the AIC in the case of kernel density estimator, there is a problem with the number of parameters; hence, there are no parameters. Although, one could argue that if bandwidth

was selected on the base of sample data it could be treated like a parameter.

Besides LLF for KDE, the highest value of log likelihood function is observed for Burr distribution, while

Table 2

Measures (LCV) of models quality for winter wheat yield in Poland

No.	Voivodeships	Normal	Gamma	Burr	GBeta	KDE
1.	Lodzkie	-2.666	-2.681	-2.643	-2.752	-2.665
2.	Mazowieckie	-2.496	-2.547	-2.551	-2.439	-2.468
3.	Malopolskie	-2.67	-2.76	-2.352	-2.566	-2.540
4.	Slaskie	-2.902	-2.956	-3.006	-2.883	-2.736
5.	Lubelskie	-2.804	-2.916	-2.722	-2.579	-2.493
6.	Podkarpackie	-2.242	-2.262	-2.296	-2.249	-2.300
7.	Swietokrzyskie	-2.881	-2.992	-2.708	-2.852	-2.915
8.	Podlaskie	-3.330	-3.681	-2.592	-3.080	-4.061
9.	Wielkopolskie	-3.022	-3.038	-3.059	-3.086	-3.065
10.	Zachodniopomorskie	-3.008	-3.025	-3.060	-3.050	-3.118
11.	Lubuskie	-3.252	-3.302	-3.292	-3.298	-3.342
12.	Dolnoslaskie	-2.937	-2.964	-2.982	-2.961	-3.041
13.	Opolskie	-3.018	-3.04	-3.015	-3.068	-3.056
14.	Kujawsko-Pomorskie	-2.752	-2.776	-2.782	-2.777	-2.854
15.	Warminsko-Mazurskie	-2.297	-2.293	-2.519	-2.288	-2.367
16.	Pomorskie	-2.788	-2.762	-3.282	-2.713	-2.917
17.	Average values of LCV	-2.817	-2.875	-2.804	-2.790	-2,871
18.	Number of highest LCV	6	0	5	3	2

Source: author's calculations based on the Eurostat data

Table 3

Probability of yield lower than 90% of yield predicted for the year 2010

No.	Voivodeships	Normal	Gamma	Burr	GBeta	KDE
1.	Lodzkie	0.139	0.137	<u>0.133</u>	0.100	0.192
2.	Mazowieckie	0.076	0.072	0.071	<u>0.048</u>	0.125
3.	Malopolskie	0.097	0.094	<u>0.079</u>	0.066	0.108
4.	Slaskie	0.142	0.140	0.123	0.095	<u>0.139</u>
5.	Lubelskie	0.087	0.083	0.081	0.052	<u>0.074</u>
6.	Podkarpackie	<u>0.047</u>	0.043	0.067	0.036	0.077
7.	Swietokrzyskie	0.170	0.170	<u>0.131</u>	0.106	0.161
8.	Podlaskie	0.157	0.170	<u>0.062</u>	0.048	0.133
9.	Wielkopolskie	<u>0.176</u>	0.177	0.166	0.136	0.215
10.	Zachodniopomorskie	<u>0.156</u>	0.156	0.148	0.121	0.179
11.	Lubuskie	<u>0.258</u>	0.268	0.235	0.216	0.218
12.	Dolnoslaskie	<u>0.133</u>	0.132	0.129	0.097	0.165
13.	Opolskie	0.108	0.105	<u>0.111</u>	0.069	0.153
14.	Kujawsko-Pomorskie	<u>0.101</u>	0.098	0.107	0.068	0.137
15.	Warminsko-Mazurskie	0.021	0.018	0.022	<u>0.018</u>	0.037
16.	Pomorskie	0.077	0.073	0.059	<u>0.058</u>	0.087

Source: author's calculations based on the Eurostat data

the lowest is reserved for generalised beta distribution. Consequently, using the LLF criterion, Burr distribution should be chosen as the best for modelling yield of winter wheat in Poland. If one takes into account the number of parameters, i.e. one uses AIC as base of comparison, quite unexpectedly, the best is normal distribution and the worst is generalised beta. It would support the opinion of Just and Weninger that in the case of aggregated data one should use normal distribution for yield modelling. The only problem is that a good performance in data fitting does not necessarily mean a good quality of prediction. For assessing the quality of prediction, the author recommends the cross validation method, at least in the case of small sample size, which is a typical problem of yields time series. This time, the best one is the generalised beta distribution but the normal distribution possesses almost the same predictive quality, the LVC for normal distribution is only 0.6% lower than for the generalised beta distribution. The real surprise is the worst predictive quality of kernel density estimator, at least for average yields of winter wheat in Poland. It is possible that it will change with lower level of data aggregation.

All models were fitted to yields from 16 voivodeships of Poland to examine how well the considered models perform on this lower level of data aggregation. Table 2 presents only the LCV values as this measure was judged the most informative for the prediction purpose.

In general, the generalised beta distribution is still the best choice but looking at individual cases one sees that in most cases, i.e. six out of sixteen, the best quality of prediction was offered by the normal distribution model. The author does not want to concentrate on formal testing of statistical hypothesis of winter wheat yield following any specific distribution, because in the case of small sample, the departure from the theoretical distribution must be truly substantial to reject the null hypothesis about theoretical distribution. Yet, just for the curiosity sake, the hypotheses of normality were rejected at 0.05 significance level only in the cases of Swietokrzyskie and Podlaskie voivodeships.

Burr distribution was working almost as well as normal distribution. Kernel density estimator was only two times on the first place, and gamma distribution not even once. Summing up, values in Table 2 support the use of parametric models, especially normal and Burr distributions. The kernel density estimator was best only in cases of obvious bimodality, and thus, should be preferred under such circumstances.

The selection of distribution may have very practical implications. For most risks, except drought, the limiting decrease of yield entitling to compensation in Poland is 10% of the average yield of that specific crop in a region. Table 3 presents the values of probability of such crop reduction in the year 2010, the only difference is that prediction are used instead of averages as points of reference. Of course, in the case of ascending trend, the average yield of region would be lower than predicted for the next year, and consequently, the probability of being entitled to compensation lower. The values coming from the best model for each of voivodeships were underlined to simplify the comparison of probabilities. It is important to notice relatively large differences between considered models, for example in Podlaskie voivodeship

the probability for the best model is about 6% while for the normal distribution it is almost 16%. It confirms that conclusions about rationality of buying insurance contract are strongly dependent on the chosen probability model.

Although the author agrees with Goodwin and Ker (Goodwin B., Ker A., 2002) that the inability to reject normal distribution, or other parametric family, in a small sample cannot be used as justification for normality assumption. It does not imply that non-parametric methods like, for example, kernel density estimator shall be better choice. The greater flexibility of some parametric families or especially kernel density estimator could lead to very high quality of fitting but similarly in case of small sample result in poor predictive quality.

Despite the stylised fact that yields are not normally distributed, it was found in this study that not only the hypotheses of normal distribution were not rejected in 14 out of 16 cases but also in 6 cases the normal distribution had the best predictive quality.

Conclusions

1. It is not possible to select the best distribution family for the average yields of wheat in all Polish voivodeships. Each case should be considered individually.
2. In case of small sample size, there is a considerable divergence between the quality of fit and the quality of prediction. Hence, the selection of the model should not be based on the models fit measures.
3. Cross validation methods allow an assessment of models predictive quality, and thus, should be preferred as a model selection tool.
4. Kernel density estimator usually offers the best-fit but rather poor predictive quality.
5. Despite the stylised fact that yields are not normally distributed, it was found in this study that in six cases the normal distribution had the best predictive quality.

Bibliography

1. Coble, K.H., Knight, T.O., Pope, R. D., Williams J.R., (1996). Modelling Farm-Level Crop Insurance Demand with Panel Data. *American Journal of Agricultural Economics*, Volume 78, Issue 2, pp. 439-447.
2. Gallagher, P., (1987). U.S. Soybean Yields: Estimation and Forecasting with Nonsymmetric Disturbances. *American Journal of Agricultural Economics*, Volume 69, Issue 4, pp. 796-803.
3. Eurostat, (2011). Statistical Office of the European Communities. Data retrieved: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database. Access: 10 December 2011.
4. Goodwin, B., Ker, A., (1998). Nonparametric Estimation of Crop Yield Distributions: Implications for Rating Group-Risk Crop Insurance Contracts. *American Journal of Agricultural Economics*, Volume 80, Issue 1, pp. 287-304.
5. Goodwin, B., Ker, A., (2002). Modelling Price and Yield Risk. Chapter 14 in Just et Pope, editors, *A comprehensive Assessment of the Role of Risk in U.S. Agriculture*, Kluwer Academic Publishers, pp. 289-324.

6. Hennessy, D.A., Babcock, B.A. Hayes, D.J. (1997). Budgetary and Producer Welfare Effects of Revenue Insurance. *American Journal of Agricultural Economics*, Volume 79, Issue 3, pp. 1024-1034.
7. Just, R.E., Weninger, Q., (1999). Are Crop Yields Normally Distributed? *American Journal of Agricultural Economics*, Volume 81, Issue 2, pp. 287-304.
8. Kobus, P., (2009). Wheat Yields Variability in Poland at NUTS 2 Level in Context of Production Risk. *Scientific Journal Warsaw University of Life Sciences - SGGW. Problems of World Agriculture*. 2009, Volume 6, pp. 51-58.
9. Sheather, S. J. and Jones, M. C. (1991). A Reliable Data-Based Bandwidth Selection Method for Kernel Density Estimation. *Journal of the Royal Statistical Society series B*, Volume 53, pp. 683-690.
10. Zhang, Q., Wang, K., (2010). Evaluating Production Risks for Wheat Producers in Beijing. *China Agricultural Economic Review*, Volume 2 Number 2, pp. 200-211.

Dairy Processing Development Scenarios in The Baltic States

Janis Ozolins¹, M.Sc. in management
Latvia University of Agriculture

Abstract. Dairy sector is strategically important for all the Baltic States. The sector faces significant problems largely attributable to the legacy of command economy. Fragmentation, low productivity, outdated technologies, and reliance on industrial dairy processing products in exports are among the major problems. Fragmented dairy processing industry largely pursues obscure strategies, which do not result in creation of sufficient value added that could be partially redistributed to facilitate crude milk production.

The aim of the paper is to explore the most probable scenarios of dairy processing development in the period up to the year 2020. The author has developed three dairy processing scenarios, using the available secondary data and data obtained by analysing financial reports of dairy processing companies covering the period of 1996-2010. An evaluation framework was set up to analyse the utility of these scenarios in achieving the goal *economically sustainable development of dairy processing*. Eight dairy sector experts from all the Baltic States representing various stakeholders evaluated the scenarios using the analytical hierarchy process methodology.

Experts considered efficiency as the most important key criterion, the next criterion being stability and growth, while externalities were deemed the least important criterion. In the experts' view, the highest utility was in case of a scenario, which presumed active government policies in all the Baltic States, which would allow further concentration of dairy processing companies and support R&D and production of high value added products.

Key words: Dairy sector, scenarios, Baltic States.

JEL code: L22, L66, Q13, Q18.

Introduction

The Baltic States have appropriate natural resources, developed infrastructure, experienced personnel, long-standing dairy farming traditions and favourable geographical position, which determine dairy sector's strategic importance in the economies of Latvia, Lithuania, and Estonia. In 2008, the Latvian dairy sector including dairy farming and processing, used approximately 3.6% of the country's total labour units in full time equivalents (in Lithuania – 6.7%). Weight of the dairy sector in structure of the Baltic States economies has decreased in the years 2004-2008 but is still significant (Ozolins J. and Veveris A., 2009).

While the Baltic States dairy sectors are operating on conditions of the common EU market in an increasingly liberalised global dairy market environment, many of the problems largely attributable to the legacy of command economy and unsuccessful transformation policies in some areas still remain. The sector in Latvia faces significant economic problems, which affect its exports competitiveness, inter alia, fragmented milk production and processing, milk processing is dominated by mass products, the price of which cannot be influenced by the producers (Leimane I. et al., 2006). Major Lithuanian dairy sector problems are the prevalence of small-scale farms in milk production and low productivity due to outdated technologies (Zemeckis R. et al., 2009), and local market orientation (Glinskiene R. et al, 2006). Lack of investments and low labour productivity are identified as major weaknesses of the Estonian dairy sector (Sepp M. and Ohvril T., 2009). According to the Eurostat data, milk production in the Baltic States in the period from 1996 to 2010 has not increased; lack of crude milk resources has restricted the growth of dairy processing. Fragmented

dairy processing industry and obscure strategies pursued by many of its participants do not allow for creating sufficient and reasonably stable flow of value added.

Integration among dairy processing companies has been the main way to improve the structure of the dairy processing, thus contributing to solving a number of the identified dairy sector's problems. Integration processes in Latvia and Estonia had been slow and gradual until the year 2010, whereas, the most active integration in Lithuania took place during the second half of the 1990s. The processes of vertical and horizontal integration have substantially intensified in 2011. They will create upward pressure on crude milk prices and, thus, contribute to the increase in milk production. The inefficient processing companies will be forced to pursue strategies, which allow covering the higher input costs.

It is necessary to research the possible approaches, which the Baltic countries may take to attain higher economic effect from the dairy sector and evaluate their expected effect on achieving the chosen goals. As the sector was subjected to significant changes at the moment of conducting the research, the author considered scenario and analytic hierarchy process **methods** to be most appropriate. There exist three main schools of scenario techniques (Bradfield R. et al., 2005). In view of the changes in dairy processing structure that started in 2011, intuitive logical approach is the most appropriate. It involves mostly subjective and qualitative approach, which is based on disciplined intuition, available latest data on changes in the sector and data obtained by analysing financial reports of dairy processing companies covering the period of 1996-2010.

The author has set the following research **hypothesis:** the implementation of justified dairy

¹ E-mail address: janiso@koks.lv

Table 1

Experts involved in the evaluation of the Baltic States dairy processing development scenarios

Expert, country	Organisation, position	Main expert qualification aspects
Aivars Lapins, Latvia	Ministry of Agriculture of the Republic of Latvia, Deputy State Secretary	High level agricultural policy expert who supervises strategic management of agricultural and rural development in Latvia
Janis Solks, Latvia	Latvian Dairy Committee, Head of the Board	Manages organisation, which represents key dairy processing companies of Latvia. Experience in higher management positions of large dairy companies
Uldis Krievars, Latvia	LPKS "Trikata KS", Head of the Board	Head of a dairy cooperative, which owns a dairy processing company and is engaged in start-up of a larger cooperative owning a dairy processing plant
Agnese Krievina, Latvia	Latvian State Institute of Agrarian Economics, Economist	Researcher with extensive experience in agrarian economics who has written a PhD thesis <i>Value Added Problems and Possibilities in Dairy Sector</i>
Tiina Saron, Estonia	Estonian Dairy Board, Managing Director	Head of organisation, which represents major Estonian dairy processing companies, experienced in milk processing
Piret Hein, Estonia	Independent researcher	Researcher who has defended a PhD thesis <i>Competitiveness and Comparative Advantage in the Estonian Dairy Sector</i>
Rimantas Krasuckis, Lithuania	Ministry of Agriculture of the Republic of Lithuania, Head, Agriculture and Food Department	High level policy expert who supervises strategic management of agricultural policy in Lithuania
Dalius Trumpa, Lithuania	AB "Rokiskio suris", Deputy Director; UAB "Rokiskio pienas", Director	Long-standing manager and co-owner of the largest Baltic dairy processing company

Source: author's construction

processing development policies in all the Baltic States will have the highest effect on the sector. The **aim** of this paper is to evaluate the most probable scenarios of dairy processing development in the period up to the year 2020. The following **tasks** had been set to reach the aim: 1) formulation of dairy processing development scenarios; 2) development of scenario evaluation framework; and 3) evaluation of scenarios.

Research results and discussion

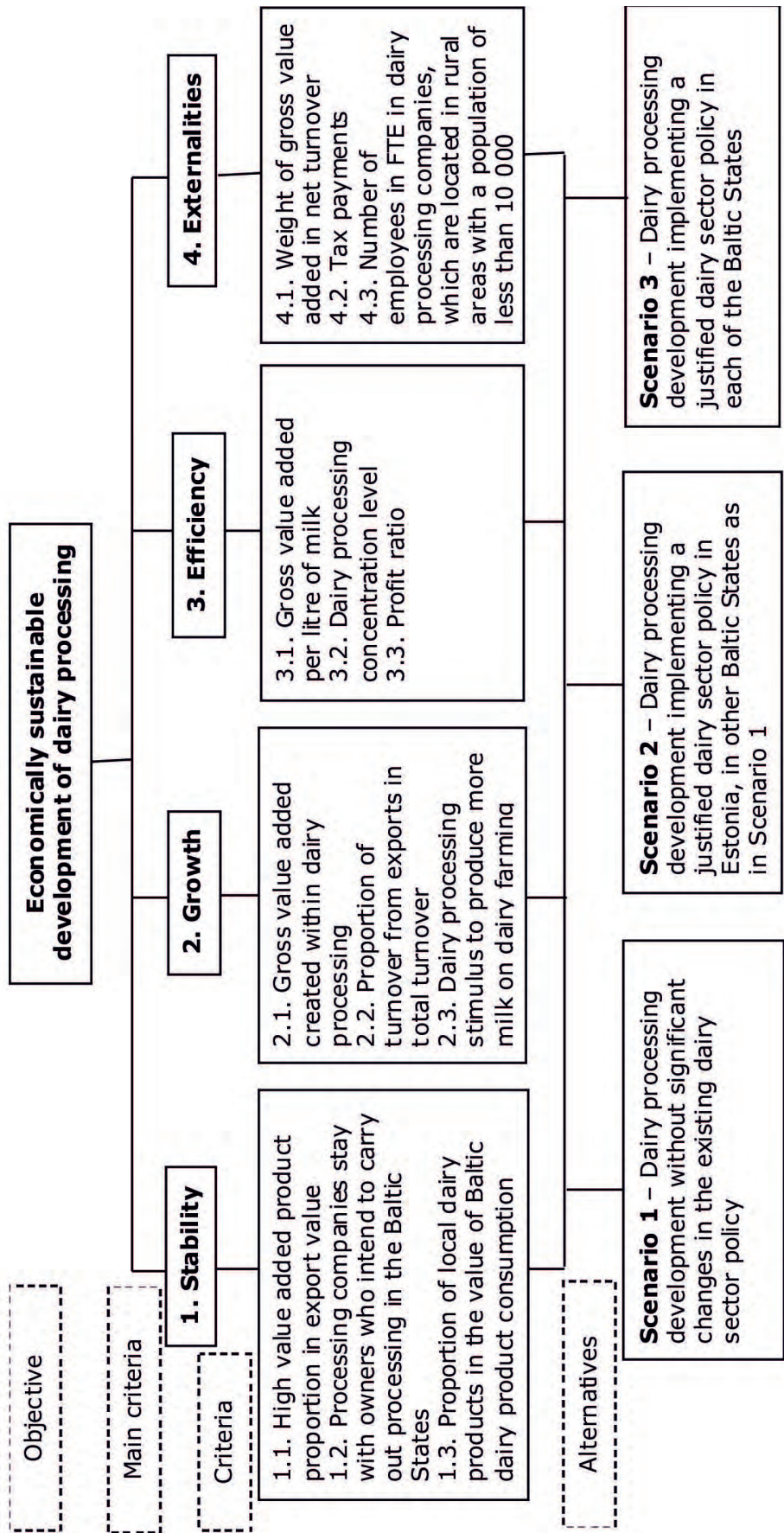
1. The Baltic States dairy processing development scenarios

Three Baltic States dairy processing development scenarios have been formulated for the period of 2010-2020 using the previous period data from 1996 to 2010 and operative information on dairy sector in 2011. Integration processes and changes in the secondary level structure of dairy sector in Latvia and Estonia until the year 2010 had been slow and gradual; the most active integration processes in Lithuanian dairy processing took place during the second half of the 1990s (Kedaitiene A. and Hockmann H., 2002). In 2011, the state institutions of Lithuania and Latvia supported the establishment of vertically integrated dairy processing plants, which were expected to result in approximately 25% of each country's crude milk being processed in cooperative-owned facilities. In 2011, Russian investors acquired the 1st and 3rd largest Latvian dairy processing companies according to the net turnover of 2010.

Investor interest was facilitated by external factors - exodus of Russian capital on the grounds of fear for personal safety and security of capital in this country of restricted democracy (The Democracy..., 2011) prior to the presidential elections. Russia, a number of its most affluent regions being located next to the Baltic States, is the world's second largest country importing dairy products.

Scenario 1: state aid and the EU support in agriculture continues without prioritising sectors - impact is higher in the sectors and product chain levels, which happen to better uptake the support; the CIS investors buy 3 largest Latvian companies, invest up to EUR 70 million, and significantly increase the production and exports; vertically integrated companies in Latvia and Lithuania process up to 25% of crude milk produced in these countries; milk production in Estonia increases by 5-10%, in Lithuania by 10-15%, and in Latvia by 15-25%; and fierce competition among dairy processing companies for crude milk resources results in more favourable sales terms and higher prices for the dairy farmers, forming a stimulus to increase milk production.

Scenario 2 (as scenario 1 apart from the listed differences): Estonia implements a dairy sector policy supporting concentration, R&D and high value added production; milk production in Estonia and Lithuania increases by 10-15%, and 15-25% in Latvia; a number of Estonian dairy processing SMEs are better able to maintain efficiency than in Scenario 1, while the efficiency of largest companies increases.



Source: author's construction

Fig. 1. The evaluation hierarchy of the Baltic States dairy processing sector

Scenario 3 (as scenario 1 apart from the listed differences): each Baltic State implements dairy industry priority support policy focusing on concentration, R&D and high value added products; concentration level increases in all the countries; in Lithuania, 2 companies process 90% of crude milk – one of them is taken over by a transnational food industry group with a goal to acquire the Baltic market and produce for exports to the CIS; milk production increases by 10-15% in Estonia, by 15-20% in Lithuania, and by 15-25% in Latvia; economic efficiency of some largest dairy processing companies increases; a number of SMEs, particularly in Estonia, maintain efficiency at the year 2010 level by focusing on high value added products – efficiency of other companies decreases; only in some milk processing establishments R&D expenditures exceed 1% of net turnover.

The author evaluated an option to offer Scenario 4, which would include coordinated action among the Baltic States. The author shares scepticism about the pan-Baltic cooperation expressed by Melnikas B. (2008) and draws a conclusion that this scenario would be least probable because there have been very few successful cooperation precedents among the Baltic States. Similarities of the Baltic States economic development, capital and work relationships, and level of qualification determine the increase of intra-industry trade as opposed to inter-industry trade (Bernatonyte D., Normantiene A., 2009). Each of the countries is capable of producing a wide range of dairy products and selling it in the other Baltic States. They view each other as competitors and with suspicion. Therefore, Scenario 4 was not expanded and analysed in the research.

2. Scenario evaluation framework

The author carried out a comparative analysis of dairy sector secondary level development scenarios using Analytical Hierarchy Process (Saaty T. L., 1980; Saaty T. L., 1990). This is an appropriate method, since it allows objectively analysing various subjective evaluations of stakeholders on the subject of fast changing dairy sector secondary level, thus, obtaining quantitative and interpretable results. In order to increase the quality of expert evaluation, the author printed alternatives to be rated on paper cards. Experts were asked to arrange the alternatives on a rating scale by moving physically the cards. This hands-on approach proved to involve the experts better and save time. The author immediately analysed the consistency ratios (CRs) and discussed contradictions with experts ensuring that in all cases the CRs were less than 0.06, below the maximum threshold of 0.1 (Saaty T. L., 1990).

The main criterion *stability* is established to evaluate the ability of dairy sector secondary level to soften the impact of global dairy products market price level fluctuations. The level of stability obtained in case of a specific scenario affects the attractiveness of dairy sector on the whole, inter alia, decisions of dairy farmers regarding production capacity and output levels. The main criterion *growth* is set up to evaluate the impact of scenarios on the economic effect of the sector. An important lower level criterion is dairy processing stimulus to produce more milk on dairy sector farming level. Researchers have come to conclusion that price is the main stimulus that can lead to higher crude milk production volumes

(Miglavs A. et al., 2008). After abandoning the milk quota mechanism, it is believed that obstacles to increase production and exports will be removed (Jasjko D. et al., 2007). The main criterion *efficiency* characterises dairy processing economic performance ratios taking into account the contributed inputs. The main criterion *externalities* has been formulated to measure external effects of dairy processing development, which influence development of the country.

3. Hierarchy analysis results

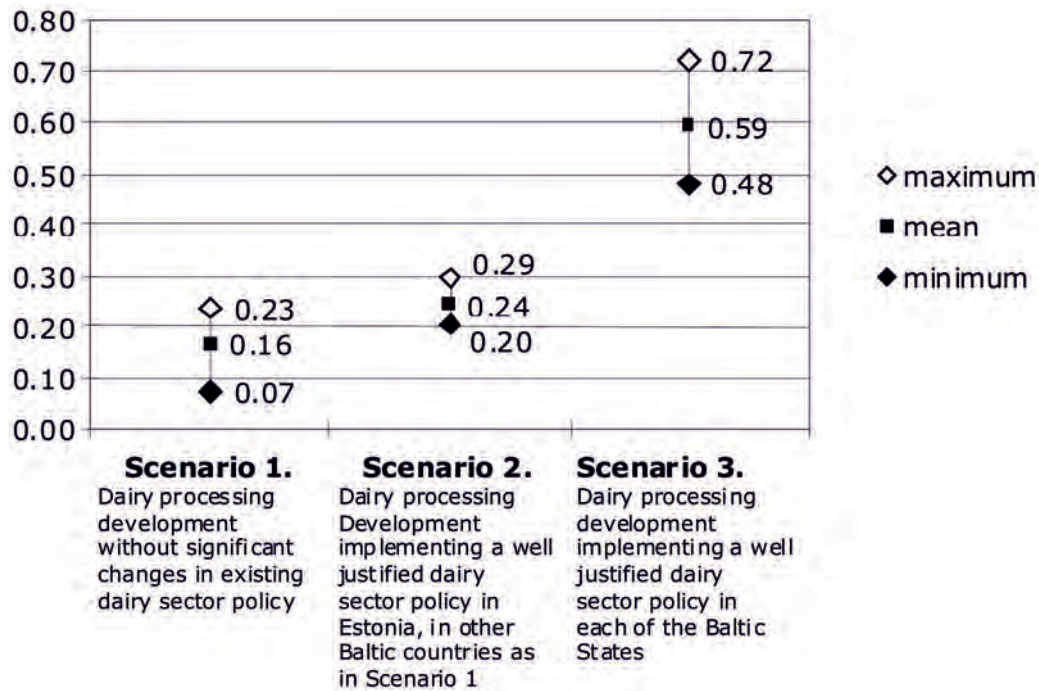
In expert evaluation, the main criterion *efficiency* was considered the most important with the highest global eigenvector value 0.46. The main criteria *stability* and *growth* were considered equally important (both 0.22); while the lowest significance was assigned to the *externalities* (0.09). Highest range of variation around the mean value was for the criteria *stability* and *efficiency*; whereas, the smallest range was for *externalities*. Highest importance to the main criterion *stability* was assigned by expert who represents vertically integrated companies; while, the lowest evaluations were provided by two experts who represent large dairy processing companies. Most experts considered *efficiency* very important; however, the lowest evaluation in respect to this criterion was given by the expert representing vertically integrated companies.

In accordance with the evaluation criteria, the least valuable in relation to the objective was the first development scenario of the Baltic States dairy processing (Figure 2). The second scenario was considered more valuable, however, due to the weight of Estonian dairy processing in the Baltic States the effect was not expected to be high. The third scenario was expected to bring most benefit to the achievement of economically sustainable development of dairy processing in the Baltic States.

Several experts believed that in case of Scenarios 2 and 3, a side effect of milk processing efficiency increase will be lower labour usage in the rural areas as well as a decrease of weight of personnel remuneration and related taxes in the structure of expenditures. They assumed that a tendency to optimise taxes will continue as well. Part of the experts were optimistic because in their opinion expansion of the sector would allow not to decrease the labour usage significantly as many SMEs would be able to develop high value added production and as a result total tax revenues for the States would increase.

In relation to the main criterion *externalities*, it was not possible to make an unambiguous conclusion about higher value of either scenario. It must be taken into account that in view of the experts, this main criterion was the least important and, therefore, did not have a major effect on global evaluation of scenarios.

As pointed out by experts, the highest growth in the dairy sector can be achieved in case the largest Baltic dairy processing companies are sold to powerful multinational groups, which expand their capacity and use them to produce for the CIS market. The author, however, draws attention in this context to the views of Cowen D. and Smith N. (2009) who believe that geoeconomics has become the new disciplining architecture instead of former geopolitical colonial mechanisms. It is the post cold war rivalry system between countries, which presumes action in the economic area and not between countries or



Source: author's calculations and construction

Fig. 2. Global eigenvector values in the evaluation of the Baltic States dairy processing scenarios

economic blocks (Sparke M., 2007). The Baltic States are in the sphere of interest of both Russia and the Western countries. In case the Baltic dairy sector becomes largely dependent on Russian capital and market, it will decrease the level of the Baltic States geoeconomic independence.

In producer-led accumulation of capital at the dairy sector secondary level, returns are maximised to the dairy producer through milk price (Enright P. and Bowler I., 2006). However, an opposite opinion is supported by other researchers that dairy processing cooperatives pay lower prices than other types of processing companies, which takes place due to risk aversion, limited access to capital, weak R&D function, and obligation to purchase members' crude milk (Current Issues..., 2009). The author's own research identified cases in Latvia when companies indeed paid lower price for milk in order to accumulate the necessary funds for investment needs due to limited external financing. Therefore, the government policies (including credit guarantees to ensure access to private financing) to counter-balance large foreign-owned dairy processing companies' economic power are needed. Vertically integrated dairy processing plants' owners would be unlikely to sell their income-guaranteeing instrument.

Conclusions, proposals, recommendations

1. Experts evaluating the three Baltic dairy sector secondary level development scenarios considered all of them to be realistic. The first scenario foresees development of dairy processing sector without significant changes in the state policy. The second scenario foresees development of dairy sector being

affected by justified policy in Estonia but for the other Baltic States, conditions are as in the first scenario. The third scenario includes dairy processing sector development based on justified policy, pursuing concentration and high value added products production in all the Baltic States.

2. Most important main criterion for evaluation of scenarios in view of experts was *efficiency*. Criteria used to evaluate *stability* and *growth* of the dairy processing were similarly but less essentially important than *efficiency*. Least importance was assigned to the main criterion *externalities*, which was used to evaluate the external economic effects of dairy sector development.
3. In relation to the set objective to achieve *economically sustainable development of dairy processing*, the first scenario in experts' opinion had the least utility. The second scenario was considered as superior to the first; however, to a small extent because Estonian dairy sector's weight on the Baltic scale is relatively small. Highest utility in experts' evaluation was assigned to the third scenario, which presumes implementation of justified dairy processing policy in all the Baltic States. Therefore, it can be concluded that the research hypothesis has been proved.
4. It can be recommended to the government institutions in the Baltic States to implement policies allowing further concentration of dairy processing, which will enable the largest companies to achieve higher economies of scale. State support to development of vertically integrated dairy processing plants needs to be continued to promote geoeconomic stability and increase crude milk production. In addition it is highly advised that powerful incentives are provided

to engage in R&D and, especially for the SMEs, production of high value added products.

Bibliography

- Bernatonyte, D., Normantiene, A. (2009). Estimation of Trade Specialisation: the Case of Baltic States. *Engineering Economics*, Volume 2, pp. 7-17.
- Bradfield, R., Wright, G., Burt, G., Cairns, G., Heijden, K. (2005). The Origins and Evolution of Scenario Techniques in Long Range Business Planning. *Futures*, Volume 37, pp. 795-812.
- Cowen, D., Smith, N. (2009). After Geopolitics? From the Geopolitical Social to Geoeconomics. *Antipode*, Volume 41, Issue 1, pp. 22-48.
- Current Issues Regarding Arrangements for the EU Dairy Sector (2009). Retrieved: http://ec.europa.eu/agriculture/markets/milk/hlg/acadbl12_burrell_doc_en.pdf. Access: 2 December 2011.
- Enright, P., Bowler, I. (2006). Theorizing "Producer-led" versus "Investor led" Dairy Cooperatives: A Regulationist Perspective. *Journal of Rural Cooperation*, Volume 34, pp. 159-178.
- Gliniskiene, R., Daraskeviciute, B., Lipinskiene, D. (2006). The Tendencies of Strategic Industry Development in Lithuania. *Engineering Economics*, Volume 2, pp. 38-44.
- Jasjko, D., Frolova, L., Dobeles, A., Pancenko, E., Ivanova, T., Radionova, A. (2007). Pienisaimniecibas nozares attistibas analize un konkuretspejas novertejums Latvija un Eiropas Savienibas tirgu (Dairy Sector Development Analysis and Competitiveness Evaluation in Latvia and the European Union Market). Retrieved: http://www.llu.lv/?mi=81&projekti_id=497. Access: 11 February 2009.
- Kedaitiene, A., Hockmann, H. (2002). *Milk and Milk Processing Industry in Lithuania: an Analysis of Horizontal and Vertical Integration*. Discussion Paper No. 44. Halle: Institute of Agricultural Development in the Central and Eastern Europe, pp. 1-34.
- Leimane, I., Miglavs, A., Krievina, A., Iesalnieks, I., Veveris, A., Golovcenko, A. (2006). *Lauksaimniecibas izcelsmes produktu pievienotas vertibas kezu ekonomiska analize (Economic Analysis of Agricultural Products Value Added Chains)*. Retrieved: http://www.zm.gov.lv/doc_upl/petijums.pdf. Access: 20 June 2010.
- Melnikas, B. (2008). Integration Processes in the Baltic Region: the New Form of Regional Transformations in the European Union. *Engineering Economics*, Volume 60, pp. 54-64.
- Miglavs, A., Salputra, G., Krievina, A., Veveris, A., Stonkute, E., Ribasauskiene, E., Varnik, R., Viira, A. (2008). Eiropas Savienibas lauksaimniecibas un lauku attistibas politikas sagaidamas parmainas – perspektivais novertejums Latvijai un Baltijas valstim (Expected Changes of the EU Agricultural and Rural Development Policy – Prospects Evaluation for Latvia and the Baltic States). Retrieved: <http://www.lvaei.lv/?lang=1&menu=51&itemid=171>. Access: 29 May 2009.
- Ozolins, J., Veveris, A. (2009). Gross Economic Effect of Dairy Sector in Latvia and the Other Baltic States. *Proceedings of International Scientific Conference Research for Rural Development 2009*, Latvia University of Agriculture. Jelgava. pp. 248-255.
- Saaty, T. L. (1980) *The Analytic Hierarchy Process*. New York: Mc.Graw-Hill International. p. 287.
- Saaty, T. L. (1990). How to Make a Decision: The Analytic Hierarchy Process. *European Journal of Operational Research*, Volume 48, pp. 9-26.
- Sepp, M., Ohvril, T. (2009). An Assessment of the Competitiveness of the Dairy Food Chain in Estonia. Retrieved: <http://www.euroqualityfiles.net/AgriPolicy/Report%202.1/Estonia%20Agripolicy%20D2-1.pdf>. Access: 25 September 2011.
- Sparke, M. (2007). Geopolitical Fears, Geoeconomic Hopes, and the Responsibilities of Geography. *Annals of the Association of American Geographers*, Volume 97, Issue 2, pp. 338-349.
- The Democracy Index 2010: Democracy in Retreat (2011). Retrieved: http://www.eiu.com/public/topical_report.aspx?campaignid=demo2010. Access: 15 October 2011.
- Zemeckis, R., Gapsys, A., Mikelionyte, D., Eicaite, O., Girgzdiene, V. (2009). An Assessment of the Competitiveness of the Dairy Food Chain in Lithuania. Retrieved: <http://www.euroqualityfiles.net/AgriPolicy/Report%202.1/Lithuania%20Agripolicy%20D2-1.pdf>. Access: 25 September 2011.

The paper has been supported by the European Social Fund within the project "Support for the Implementation of Doctoral Studies at Latvia University of Agriculture" (sub-activity 1.1.2.1.2. Support for the Implementation of Doctoral Studies), Agreement No. 2009/0180/1DP/1.1.2.1.2/ 09/IPIA/VIAA/017, Contract No. 04.4-08/EF2.D2.19'.

Organic Livestock Industry and Its Development Possibilities in Latvia

Irina Pilvere¹, Dr.oec; Inga Sikunova², Master student
Faculty of Economics, Latvia University of Agriculture

Abstract. Organic agriculture as an independent industry had existed in Latvia since the beginning of the 1990s. It developed relatively fast after Latvia's accession to the European Union (EU), however, a decrease in the number of farms engaged in this industry is observed over the recent years. In Latvia, totally 1400 farms raising 73000 cattle, 10000 pigs, 39000 sheep, 7000 goats, and 38000 poultry were engaged in organic livestock farming in 2011. Yet, their share in the total number of livestock is insignificant, the industry is fragmented, and organic meat processing does not exist. Therefore, cooperation among farms is required, so that organic meat reaches consumers. Organisation of farmers in agricultural service cooperatives (ASCs) may contribute to tackling this problem. In 2011, totally 115 ASCs existed in Latvia, of which only 6 were certified as organic, but not a single ASC that would be engaged in the organic livestock industry was among them, which hinders the processing of organic meat and its promotion on the market.

Key words: organic agriculture, livestock farming, agricultural service cooperative.

JEL code: Q13, Q18

Introduction

The number of breakouts of animal diseases and scandals regarding food safety has increased over the recent years. The increasing interest of consumers in quality products has aroused consumers' understanding on the significance and value of organic agriculture. It has changed their priorities towards purchasing and consuming organic products, thus, sharply increasing the demand for food produced according to organic farming methods. Organic farming is an agricultural method, which provides the production of biologically pure products based on natural self-regulation processes and environmentally friendly techniques. Thus, ensuring the observation of public economic interests and fostering the solution of ecological, social, and ethical problems for sustainable development of rural areas.

Scientists of various countries permanently pay their research attention to organic agriculture and different aspects related to it. A.Buceniece (2010) researched these issues in the Baltic Sea region and found out that the organically certified area in 9 countries of this region had increased and reached 6.1% of agricultural land, while the fastest increase was observed in the Baltic States. L.Melece and Z.Zaharova (2010), in their turn, state that "biodiversity is a key environmental priority of the EU and its objectives are integrated in the EU Sustainable Development Strategy". J.Brizga (2010) concludes that "the current unsustainable consumption and production patterns in the developed countries are responsible for many environmental problems...". However, A.Borowska (2010) forecasts that "further increase of the area of organic crops can be expected in Poland in the near future, which will be facilitated by the legislation on organic farming providing the framework for the activities of organic farmers". A.K. Løes and B.Nölting (2011) emphasise that it is necessary "to maximise the share of organic food in school meals...". M.Janssen and U.Hamm (2010) point to "particular on the phenomenon

that consumers buy organic products despite their limited knowledge on organic production and certification".

Yet, organic management in livestock farming has been little researched. Such research is very important, as the market of organic meat products develops slowly in Latvia. The high fragmentation of organic farms, small quantities of their output, and an insufficient assortment of their products have to be stressed considering the wish of certified organic livestock farms to produce organic meat products for broad consumption as well as the demand for such products on the market. Founding agricultural cooperatives could be one of the solutions to develop the market of organic meat products. Therefore, the **research aim** is defined as follows: to characterise the organic livestock industry and determine its development possibilities in Latvia.

The following **research tasks** were set based on the research aim:

- 1) to characterise the organic livestock industry in Latvia;
- 2) to investigate the development of cooperation in organic livestock farming;
- 3) to analyse market opportunities for meat products produced organically.

Analysis and synthesis, the logical and constructive method, as well as statistical analysis methods were used to perform the research tasks. Research materials of scientists from various countries, information of the Ministry of Agriculture of the Republic of Latvia, the Central Statistical Bureau, the Association of Latvian Agricultural Cooperatives etc. were used to investigate the topic.

Research results and discussion

1. Organic livestock industry in Latvia

Organic agriculture as an independent industry has existed in Latvia since the beginning of the 1990s. Organic agriculture features clear basic principles and

¹ E-mail address: irina.pilvere@llu.lv

² E-mail address: i-sik@inbox.lv

Table 1

Numbers of livestock in Latvia in 2006-2010 (thou.)

Year	Type of breeding	Cattle	Dairy cows	Pigs	Sheep	Goats	Poultry
2006	Conventional	377	182	417	41	14	4488
	Organic	55	3	9	23	5	17
	Organic, as % of total	13	2	2	36	26	0
2007	Conventional	399	180	414	54	13	4757
	Organic	50	4	6	15	3	16
	Organic, as % of total	11	2	1	22	19	0
2008	Conventional	380	170	384	67	13	4621
	Organic	41	4	6	14	3	16
	Organic, as % of total	10	2	2	17	19	0
2009	Conventional	378	166	377	71	13	4829
	Organic	54	*	10	31	7	33
	Organic, as % of total	13	*	3	30	35	1
2010	Conventional	379	164	390	77	13	4949
	Organic	73	*	10	39	7	38
	Organic, as % of total	16	*	3	34	35	1

Source: authors' calculations based on the LR Zemkopibas ministrija, 2011b and the CSP, 2011

transparency concerning the origin, production, and processing of products. It means that products of organic agriculture have a certificate of compliance with organic farming issued by an accredited institution. It certifies that organic products comply with the EU requirements and legislation of Latvia. In Latvia, the number of farms engaged in organic agriculture has annually increased in the period before 2008, but then it decreased to 3593 farms at the end of 2010 (10.2% less than in 2009 and 14% less than in 2008). An increase in the number of these farms after Latvia's accession to the EU is related with the introduction of specific support measures for organic farming financed from the EU Funds within the Common Agricultural Policy. A decrease in the number of organic farms during the recent years is associated with the lack of wish to undertake a five-year responsibility for obtaining support under agro-environmental measure "Development of Organic Farming" of the Rural Development Programme 2007-2013. In 2010, the organic certified agricultural area was 166 338 ha or approximately 9% of the total area of agricultural land in the country (LR Zemkopibas ministrija, 2011a).

Organic livestock farming is one of the industries of organic agriculture, the basic purpose of which is the production of not only safe and healthy but also high-quality agricultural commodities of livestock origin, which can be achieved by ensuring that the conditions of animal raising and feeding are appropriate for physiological needs of livestock, thus, making the conditions as much natural as possible, and by observing the principles of organic farming. Organic agriculture is also part of a broader chain of food supply, which includes production, processing, distribution, retailing, and finally the consumer as well. Each link of the chain plays a significant role in producing organic products in various fields (Eiropas Komisija, 2011).

Although, organic agriculture tries to keep its traditional techniques and reduce its intervention into natural rhythms as much as possible, organic processing reflects the modern tastes of consumers and the variety of culinary skills. The safety and quality of food is a good motivation for developing organic agriculture in Latvia, since all the necessary prerequisites - labour, land, and several herds of local livestock breeds, which are able to adapt to Latvian conditions - are available in order to produce quality organic agricultural products for the domestic and international markets (Lauksaimniecibas dzivnieki ..., 2006).

However, the processing of organic agricultural produce is not developed in Latvia, as organic farms are scattered across regions and their quantities of products produced are insignificant. According to the Food and Veterinary Service, in 2011, totally 1400 organic farms of various sizes, which can be suppliers of produce to organic meat processing enterprises, were certified in Latvia. The distribution of organic farms by agricultural industry was as follows: 491 (35% of total) poultry farms, 363 (26%) meat cattle farms, 264 (19%) pig farms, 262 (19%) sheep farms, and 20 rabbit farms (LR PVD, s.y.). The number of livestock indicates the possible market potential of organic farms (Table 1).

The following conclusions can be drawn from the information summarised in Table 1.

- The total number of cattle has been relatively stable in Latvia over the recent five years, the number of cows, pigs, and goats has declined, and only sheep and poultry have become more numerous. Whereas, the number of livestock raised organically has grown for all the types: poultry - 2.2 times, sheep - 1.7 times, goats 1.5 times, and cattle - 1.3 times, which indicates that there are prospects for livestock raised organically in the future.

Table 2

Characteristics of ASCs in Latvia as of 31 December 2010

Industry/ Type of activity	ASCs		ASC membership		Net turnover		Average membership per ASC	Net turnover per ASC, mln LVL
	Number	Share, %	Number	Share, %	mln LVL	Share, %		
Grain farming	40	35	2265	25	105362.00	69	57	2634.00
Milk production	33	29	4120	45	47433.00	31	125	1437.00
Fruit and vegetable production	13	11	264	3	0.71	0	30	0.05
Meat production	12	10	1574	17	4.01	0	131	0.33
Agricultural services	10	9	635	6	0.07	0	64	0.01
Multi-industrial production	5	4	270	3	1.44	0	54	0.28
Honey production	2	2	22	1	0.02	0	11	0.01
Total/on average	115	100	9150	100	152801.00	100	80	1329.00

Source: authors' calculations based on LLKA, 2011

- The share of organically raised livestock in their total number is quite significant only for sheep and goats – 33 and 36% of their total number, respectively. However, since the number of sheep and goats is insignificant in Latvia, the total number of livestock raised organically is not significant for the further development of livestock farming.
- An increase in the number of cattle over the period of analysis – approximately by 18 thousand – is a positive trend, yet, their share is less than 1/5 in the total number.
- In Latvia, organic livestock farms have performed more efficiently than farms of the corresponding type of livestock, on average, in 2010. It is proved by the fact that there are 200 cattle, 147 sheep, and 36 pigs per organic farm on average, which is 20, 7.3, and 1.9 times, respectively, more than per farm on average. Only the average number of poultry per organic farm is 2.2 times smaller than per farm on average in Latvia.
- One can forecast that approximately 15-17 thousand tons of meat can be produced a year based on the number of livestock raised organically. Therefore, it is necessary to develop cooperation in the industry, so that meat produced this way reaches consumers, as organic livestock farms are located in all the regions of Latvia, and this industry is still quite fragmented.

The development of the organic livestock industry is limited by the lack of cooperation between producers and processors of organic meat. To develop the organic livestock industry and foster its growth potential, coordinated and targeted activities of cooperation are needed, so that the organic livestock industry becomes more competitive on the food and agricultural market. Hence, Latvia could integrate into the international supply chain of organic food.

2. Cooperation development prospects for the organic livestock industry

Cooperation is regarded as mutual activity to achieve common goals and is one of the most efficient ways of improving the economic condition of farms and ensuring their viability in rural areas (Cobia, 1989).

In a modern sense, cooperation is defined as "an independent union, which was joined by individuals voluntarily to fulfil their common economic, social, and cultural needs and wishes by exploiting a jointly-owned enterprise managed in a democratic way". Therefore, cooperation assists in gaining a greater market power, at the same time reducing production costs owing to economies of scale caused by integration (Kooperacija Aleksandra ..., 2001).

The term "cooperative society" usually relates to the forms of cooperation registered in compliance with the procedure stipulated by the law of the corresponding country. Cooperatives differ from each other by the economic development level (for instance, horizontal and vertical cooperation), the function to be performed (for instance, production, supply, sales etc.), the direction of activity, and the market segment represented by them (Cooperative, 2011).

The "Cooperative Societies Law" of the Republic of Latvia stipulates two types of cooperatives – producer cooperatives (PCs) that are engaged in producing agricultural products and ASCs that provide services to producers of agricultural products but are not engaged in producing agricultural products, however, such a cooperative is allowed to pre-process products produced by farmers. An ASC may be founded by not less than five individuals or legal entities producing agricultural products as well as other ASCs (Kooperatīvo sabiedrību likums, 1998).

The authors believe that an ASC is a prospective model of cooperation for organic livestock farms; its purpose is to provide possibilities for its members to sell

Table 3

Certified organic ASCs and their characteristics in Latvia in 2011

ASC	Location		Type of processing/activity
	unicipality	parish	
LPKS "Keipenes pagasta piensaimnieku sabiedriba"	Ogre	Madliena	Production of dairy products
LPKS "Latgales Ekoprodukti"	Varkava	Rozkalni	Packing of fruit and vegetables Processing and packing of grain and flour, packing of herbs
LPKS "Zalais grozs"	Amata	Nitaure	Repacking and processing of products of plant origin
LPKS "Daiva"	Rujiena	Jeri	Grain dry-house, grain warehouse
LPKS "Trikata KS"	Valmiera		Collection and transportation of raw milk
LPKS "Baltic meat standard"	Kuldiga	Snepele	Slaughterhouse

Source: authors' construction based on LR PVD, 2011

their farm products based on cooperation and to support its members in ensuring an efficient production process, in preparing sales of products, and in the sales process. Thus, reducing their production costs regarding delivery of products to consumers and selling at profitable prices in both the local and EU markets.

Presently, the majority of ASCs in Latvia are established in the dairy and grain industries, fewer ones are in the industries of fruit and vegetables, meat, and agricultural services, while multi-industrial and honey producers do not want to cooperate. According to the Association of Agricultural Cooperatives, 115 ASCs were registered in the territory of Latvia in the beginning of 2011; their distribution by industry and other characteristics is presented in Table 2.

After analysing the information summarised in Table 2, one can conclude that:

- totally 9150 farms are members of ASCs, which accounts for only 11% of the total number of farms in Latvia (CSP, 2011b). Of these farms, 87% are engaged in 85 cooperatives of three industries (grain, milk, and meat production), which accounts for 74% of the total number of ASCs;
- the net turnover of the mentioned cooperatives of three industries accounts for 99.9% of the total net turnover of all the 115 ASCs, which indicates their significance and potential in the market;
- the number of members in ASCs of all industries, except milk and meat industries, has to be increased to concentrate the output of their products, thus, strengthening their position on the market.

Of the total number of ASCs in 2011, there were only six certified organic ASCs with processing enterprises belonging to them (Table 3).

Not a single ASC existed in the organic livestock industry in Latvia at the end of 2011. Although, the number of certified organic livestock farms is sufficient, the development of the industry and ASCs is hindered by many specific requirements related with organic livestock farms. For instance, to sell products as organic, an animal has to be slaughtered and its carcass has to be processed only at a registered and certified organic slaughterhouse. Presently, not many certified organic slaughterhouses are available in Latvia: nine for cattle, sheep, goats, and pigs; two for rabbits; and one mobile slaughterhouse (LR PVD, 2011). The ASCs are able to provide to their members

not only such services as processing, marking, and sales of organic food products but also sales of organic meat products, focusing mostly on logistics and marketing activities.

The development of ASCs in the organic livestock industry could foster the establishment of meat pre-processing and processing enterprises in which modern technologies can be used for processing products and formatting packages. Larger economic gains may be obtained if organic meat is further processed. Further processing (for instance, production of semi-finished goods, drying, smoking etc.) is one of the most expensive but also the most profitable ways of creating higher value added. Large-scale economic activities, which are not possible on micro- and small individual organic livestock farms, are performed by processing products in ASCs. Further processing may also be a prerequisite for getting and stabilising high market prices, and it allows saving significantly on transportation costs as well. It has to be emphasised that the establishment of cooperatives in the organic livestock industry would reduce the number of transactions done by market participants. Thus, decreasing costs in the food supply chain and ensuring the control of participants of demand and supply side over the market, and it would increase competition advantages for organic meat products by creating an additional value (Baraskina, 2010). There are prospects for the organic livestock industry in Latvia, as the output of it is insufficient and does not make the market fully self-sufficient. At the same time, the organic livestock industry can provide competitive export products in the future.

3. Market opportunities for organic meat products

Presently, low efficiency is characteristic of organic product supply chains in Latvia, as every producer mostly him/herself organises sales of its products; besides, products in small quantities are supplied every time. This, in its turn, determines relatively high prices on domestic organic products available on the Latvian market.

After analysing the most popular sale sites of organic products in Latvia, one can see that mostly unprocessed and unpacked products are sold on regional markets, on the spot on farms, and from 2002 – at the "Green Marketplace of Organic Farmers". There are also special

eco-stores selling organic products, and such products are ordered online and delivered (food baskets are delivered to customers at home or to another certain site). Only several organic products are sold in supermarket chains, of which organic meat products make up the smallest proportion (Baraskina, 2002).

Although, supermarkets offer farms an opportunity for regular supplies, setting a constant quantity and quality of organic products, not every farm is able to ensure such supplies to supermarkets. The situation on the market might significantly change if various processing enterprises are founded in the result of cooperation. If organic meat products are sold using one brand name, it is possible to both increase sales quantities of meat produced organically, to make a price policy, and to ensure regular supplies of organic meat products and a necessary assortment of these products in compliance with the quality standard for food sales sites.

If a cooperative establishes an effective channel of distribution, one possibility is to sell organic meat products to its restaurants and cafes, and public catering enterprises, for instance, catering facilities in both governmental institutions (schools, old people's homes etc.) and private enterprises as it is practised in European countries (Bille, 2009).

When selling organic meat products on the local market and performing the function of a middleman moving products from the producer to the consumer, a cooperative can organise direct selling as well. Several advantages, from the viewpoint of both farmers (cooperative members) and consumers, belong to direct selling, as buyers may express their wishes and needs but producers increase their profit. A cooperative has a possibility to offer its organic meat products in the virtual environment. E-commerce offers two possibilities – to represent its website and open an e-store. Commerce through the Internet has become a considerable alternative for traditional methods of commerce for many enterprises that do not wish to sell their products on the local market and actively extend their sales market (Ekonomika un marketings..., 2006).

Conclusions, proposals, recommendations

1. Organic livestock farming is the supplier of safe, healthy, and high-quality agricultural produce of livestock origin to organic meat processing enterprises. This industry is at the initial stage of development in Latvia, as in 2011 only 1400 organic livestock farms of various sizes were certified in Latvia.
2. The existing number of livestock on farms determines the possible potential of the organic livestock industry. In the period of 2006-2010, the number of livestock raised organically has grown for all their types: poultry – 2.2 times, sheep – 1.7 times, goats 1.5 times, and cattle – 1.3 times.
3. The share of organically raised cattle in their total number has to be increased. It would allow significantly increasing the market size of organic meat, which presently is estimated at 15-17 thousand tons a year.

4. A higher concentration of livestock than it is on average in the industry is observed on organic livestock farms. Yet, irrespective of this fact, cooperation among farms is required to increase the economic condition of farms and ensure their viability and compositeness.
5. An ASC is the most appropriate model of cooperation for organic livestock farms, as it provides services to producers of agricultural products but is not engaged in producing agricultural products. Yet, an ASC is allowed to pre-process, process, and transport products produced by farmers to sales sites.
6. In the beginning of 2011, totally 115 ASCs, engaged in various agricultural industries, were registered in Latvia. Only 12 of them were engaged in meat processing industry, reaching a membership of 1.6 thousand farms and a net turnover of LVL 4 million in 2010, which is the third best result after the indicators of grain and dairy cooperatives.
7. Of the 115 ASCs in Latvia, only six were certified as organic, and not a single ASC, which would be engaged in the organic livestock industry, was among them. It prevents meat products produced by means of organic techniques from reaching customers on the market, thus, not using quality food of animal origin produced in this industry according to the purpose of its production.

Bibliography

1. Baraskina, I. (2002). Development and Marketing Initiatives of Organic Production in Latvia. In: *Scientific Aspects of Organic Farming*. Proceedings of the Conference held in Latvia March 21-22. Jelgava. pp. 26-29.
2. Baraskina, I. (2010). Biologiskas lauksaimniecibas precu tirgus un konkuretspeja: promocijas darbs (Organic Agricultural Product Markets and Competitiveness: the Thesis). Jelgava. 168 lpp.
3. Bille, L. (2009). Kooperacija biologiski razotas produkcijas tirgus veicinasanai (Cooperation for Promotion of Organically Produced Products Market). Jelgava: Latvijas Biologiskas lauksaimniecibas asociacija, 64 lpp.
4. Borowska, A. (2010). Ecological Farming in Poland Before and After Joining the European Union. In: *Economic Science for Rural Development 2010: Proceedings of the International Scientific Conference*, No. 21. Jelgava: LLU, pp. 32-38.
5. Brizga, J. (2010). Ecological Footprint: Sustainable Development Indicator of Consumption and Production. In: *Economic Science for Rural Development 2010: Proceedings of the International Scientific Conference*, No. 23. Jelgava: LLU, pp. 184-190.
6. Buciene, A. (2010). The Trends of Sustainable Development in the Regions. In: *Human Resources – the Main Factor of Regional Development*, No. 3. Klaipeda, Klaipeda University Social Science Faculty, pp. 7-14.
7. Eiropas Komisija (2011). Biologiska lauksaimnieciba (Organic Farming). Retrieved: <http://ec.europa.eu/>

- agriculture/organic/home_lv. Access: 2 December 2011.
8. Cobia, D. (1989). *Cooperatives in Agriculture*. Englewood Cliffs, New Jersey: By Prentice-Hall. p. 50.
 9. Cooperative: New World Encyclopedia (2011). Retrieved: <http://www.newworldencyclopedia.org/entry/Cooperative>. Access: 2 December 2011.
 10. *Ekonomika un marketings biologiskaja lauksaimnieciba (2007) (Economics and Marketing of Organic Agriculture)*. Profesionalas apmacibas studiju līdzeklis biologiskas lauksaimniecibas konsultantiem Baltijas valstis. Latvijas Lauksaimniecibas universitate; sast., Baraskina I, Kreismane Dz. Jelgava: Jelgavas tipografija, 64 lpp.
 11. Janssen, M., Hamm U. (2010). Consumer Perception of Different Organic Certification Schemes in Five European Countries. Retrieved: <http://www.springerlink.com/content/51n4h18617j92g16/fulltext.pdf>. Access: 18 December 2011.
 12. *Lauksaimniecibas dzivnieki un to produkcija biologiskaja lauksaimnieciba: monografija (2006) (Livestock and their Products in Organic Farming: a Monograph)*. LLU Biotehnologijas un veterinarmedicinas zinatniskais instituts "Sigra"; sast., red. Jemeljanovs A. Sigulda: Sigra, 295 lpp.
 13. LR CSP (2011 a). LAUKSAIMNIECIBAS DZIVNIEKU SKAITS GADA BEIGAS (tukstos) (Number of Livestock at the End of the Year) Retrieved: <http://data.csb.gov.lv/Dialog/varval.asp?ma=LL0220&ti=LLG022%2E+LAUKSAIMNIEC%CEBAS+DZ%CEVNIEKU+SKAITS+GADA+BEIG%C2S+%28t%FBksto%F0os%29&path=../DATABASE/lauks/Ikgad%E7jie%20statistikas%20dati/05Lopk/&lang=16>. Access: 16 December 2011.
 14. LR CSP (2011b). LAUKU SAIMNIECIBU SKAITS UN ZEMES PLATIBAS REGIONOS (Number of Farms and Land in Regions). Retrieved: http://data.csb.gov.lv/Dialog/varval.asp?ma=LSK10-I01&ti=LSK10%2DI01%2E+LAUKU+SAIMNIEC%CEBU+SKAITS+UN+ZEMES+PLAT%CEBAS+RE%CCIONOS&path=../DATABASE/laukskait_10/I%20EKONOMISKI%20AKT%CEVO%20LAUKU%20SAIMNIEC%CEBU%20RAKSTUROJUMS/&lang=16. Access: 17 December 2011.
 15. LR PVD (Partikas un veterinara dienests (Food and Veterinary Service)) (2011). Retrieved: http://www.pvd.gov.lv/lat/lab_izvlne/registri/atzto_un_reistrto_uzmumu_sarak/kontroles_institcijas_reistrti. Access: 6 December 2011.
 16. LR Zemkopibas ministrija (2011a). Latvijas lauksaimnieciba un lauki 2010 (Agriculture and Rural Areas of Latvia 2010). RIGA, 148 lpp.
 17. LR Zemkopibas ministrija (2011b). Organic Livestock and Organic Livestock Products. ZM statistikas dati, ko iesniedz ES, Riga, 2 lpp.
 18. LLKA (Latvijas Lauksaimniecibas kooperativu asociacija (Association of Agricultural Cooperatives in Latvia)) (2011). Retrieved: <http://www.llka.lv/lv/top-noderigainfo/22-kooperacijas-attistiba/750-2010gada-statistik-informacija-par-lpks-attstbu-latvij.html>. Access: 2 December 2011.
 19. Løes, A.K., Nölting, B (2011). Increasing Organic Consumption through School Meals—Lessons Learned in the iPOPY Project. Retrieved: <http://www.springerlink.com/content/6q0374031xq82321/fulltext.pdf>. Access: 18 December 2011.
 20. *Kooperacija Aleksandra Cajanova un musdienu redzejuma (2001) (Cooperation in Alexander Cajanovs and Modern Vision)*. Zinatniski red., tulkots no krievu valodas, Karnite, R. Riga: BO SIA "Zinatnu akademijas Ekonomikas instituts", 65 lpp.
 21. Kooperativo sabiedribu likums (1998) (Cooperative Societies Law). LR likums. Retrieved: <http://www.likumi.lv/doc.php?id=47009>. Access: 2 December 2011.
 22. Melece, L., Zaharova, Z. (2010). Sustainable Rural Development: Some Agri-Environmental Issues in Latvia. In: *Human resources – the Main Factor of Regional Development*, No. 3. Klaipeda, Klaipeda University Social Science Faculty, pp. 23-28.

Milk Quotas: an Instrument of the EU Common Agricultural Policy for Market Stabilisation

Irina Pilvere¹, Dr.oec.; Dzesija Zeiferte², Mg.oec.
Faculty of Economics, Latvia University of Agriculture

Abstract. The Common Agricultural Policy (CAP) of the European Union (EU) as a market-stabilising instrument was introduced in 1984 to prevent overproduction. The dairy industry plays an important role in agriculture in both the EU and Latvia, as this industry has provided 14% and 22%, respectively, of the total value of final agricultural products, measured at base prices, in 2010. The total milk quota is almost 146 million tons a year, and 70% of it is allocated to six EU Member States; Latvia's milk quota accounts for only 0.5% of the total EU quota. After the accession to the EU, the milk quota in Latvia was implemented by 85% on average and it was not fully implemented in any quota year, which points to unused opportunities for the industry. Milk producers have to be prepared for the abolishment of milk quotas in 2015 to be able to compete on a free market.

Key words: European Union, Common Agricultural Policy, milk quotas.

JEL code: Q13, Q18

Introduction

Europe is the second smallest part of the world, which occupies almost 5% of the land area of our planet. Rural areas and forests occupy the largest part of it. Latvia, after its accession to the EU on 1 May 2004, became one of the members of the largest world market, and it had to comply with terms of the EU CAP in agriculture. The EU CAP is a basis for the development and competitiveness of not only agriculture but also the agricultural food industry with more than 19 million jobs. The CAP ensures the coordination of preservation of agriculture and the environment. It assists in shaping the economic and social structure of rural society. It plays a significant role in facing such challenges as climate change, management of water resources, biodiversity etc. Presently, the EU CAP pursues two main goals – to assist European farmers to compete on the world market and to promote rural development, especially in the poorest municipalities where GDP per capita does not reach 75% of the EU average (EUR-Lex, no year).

It is envisaged to abolish milk quotas in 2015, thus, the EU scientists conduct extensive research on changes in the CAP and their effects on the further development of the industry. For instance, in Germany, B.Brummer, J.P. Loy, and T.Requate T. (2011) emphasise that "the main features of the German milk quota exchanges are the state reserves that cover excess demands free of charge". In Belgium, H.De Frahan, A.Baudry, R.De Blander, P.Polome, and R. Howitt (2011) point that "a quota removal with a 20% reduction in milk prices keeps aggregate milk supply and farm income at about the same level of the 2006 reference year". After completing a research on the dairy industry in individual EU Member States, C.Wieck and T.Heckelei (2007) concluded that "milk output, milk yield, herd size, labour input, and fodder production could be attributed to significant marginal cost differentiation of

farms, whereas, for crop and animal output, grassland, stock of other animals, and depreciation only minor differentiation could be found".

In Latvia, J.Ozolins (2010, 2011), A.Krievina (2010), A.Krievina and A.Miglavs (2011), D.Jasjko, L.Frolova, A.Dobele, E. Pancenko, T.Ivanova, A.Radionova (2007) et al. researched various economic aspects of the dairy industry. Yet, due to changes in the market situation and considering the expected CAP reforms, it is necessary to conduct new research. Therefore, the **research aim** is to analyse milk quotas of the EU CAP in the EU and Latvia. The following **research tasks** were set based on the research aim:

- 1) to assess the milk quota mechanism in the EU;
- 2) to analyse milk quotas in Latvia after its accession to the EU;
- 3) to investigate the possible development of milk quotas in the future.

Analysis and synthesis, the logical and constructive method as well as statistical analysis and PESTEL analysis (effects of political, economic, sociological, technological, legal, and environmental factors on the further development of the dairy industry in Latvia and the EU) methods were exploited to perform the research tasks. Research materials of scientists from various countries, information of the Ministry of Agriculture of Latvia (MoA), the Central Statistical Bureau (CSB), the Rural Support Service (RSS), and the state agency Agricultural Data Centre (SA ADC) etc. were used to investigate the topic.

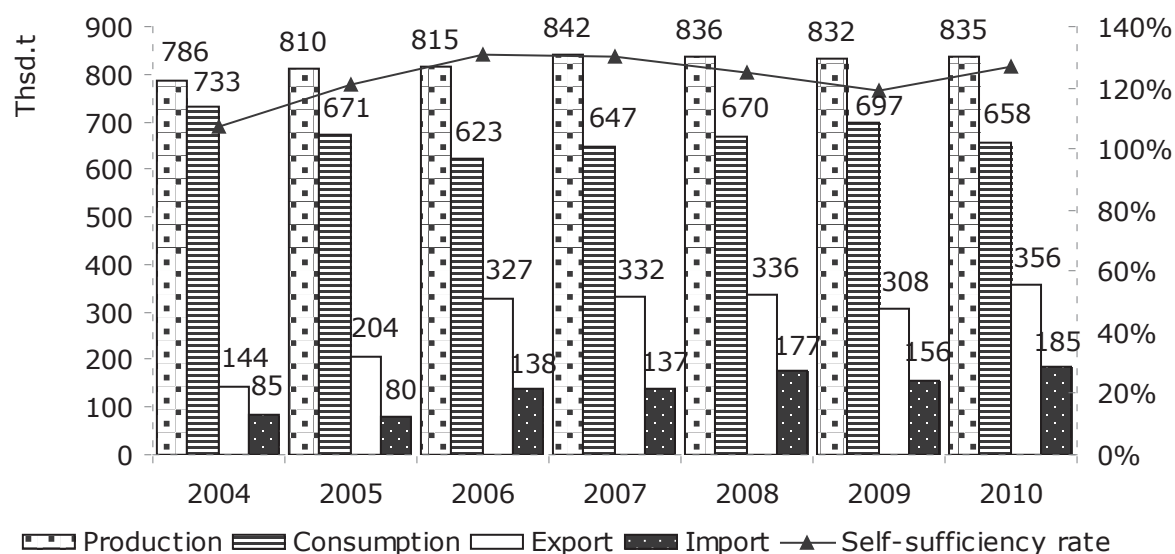
Research results and discussion

1. Milk quotas in the European Union

The dairy industry takes a significant position in the EU agriculture. More than a million dairy farmers annually produce 148 million tons of milk, the value of which amounts to EUR 41 billion (in direct producer prices). Approximately 400 000 individuals are engaged

¹ E-mail address: irina.pilvere@llu.lv

² E-mail address: dzesija.zeiferte@llu.lv



Source: authors' construction based on the CSB, the SA ADC, no year

Fig. 1. Milk balance, thou t and the self-sufficiency rate, % in Latvia in 2004-2010

in milk processing, and the turnover of this industry totals EUR 120 billion a year. Milk fats and proteins are used in cheese and butter production. The EU implements a dairy policy that is mostly oriented towards market balancing, price stabilisation, providing a sufficiently high standard of living to producers, and increasing the competitiveness of producers (European Court of Auditors, 2009). It is provided by the CAP's Common Market Organisations (CMO), which integrate various agricultural policy instruments, to regulate the price of some product or group of products and the market balance, and to provide a free flow of goods in the entire EU (Council Regulation ..., 2007). The CMO's measures include intervention purchases or product storage measures, export refunds, a production-limiting system (quotas), and market support measures. Quotas of the EU CAP are applied to reduce disparities between supply of and demand for agricultural products and improve market balance, i.e. by quantitatively limiting the output of a certain agricultural product. Quotas are the right of milk producers to sell their milk within the quotas allocated, actually the limit imposed by quotas relates only to milk sales (Orlova I., 2009). Higher prices on milk and dairy products may be kept by limiting milk sales. Thus, surplus stocks of dairy products (butter, cheese, milk powder), price falls, and producer (farmer) income decreases may be efficiently avoided.

The purpose of the milk quota system is to stabilise the market, thus, providing precise accounting and control of milk output and sales from both quantitative and qualitative aspects and prerequisites for restructuring milk production. A milk quota (national milk quota) is a quantity of milk set for each EU Member State on which a levy has to be paid if the quota is exceeded. The total national quota consists of two types of quotas: *wholesale quotas* for raw milk sold to a buyer that is usually a processing enterprise, and *direct sales quotas* for raw milk, milk and/or dairy products sold to a direct consumer (hospital, school, kindergarten, local marketplace etc.).

A milk quota year is a period from 1 April to 31 March of the next year.

The EU milk quota system has been functioning since 1984, maintaining stability in the milk market. The European Union is the world's leading milk-producing region, with just under 23 million dairy cattle in 2005 (Oliver E., Caspari C., 2008). The wholesale quota for the quota year 2009/2010, which was allocated to all the EU Member States, totalled 144 921 617 tons. Of the total quota, 70% was allocated to six EU Member States: Germany (20%), France (17.2%), the United Kingdom (10.5%), the Netherlands (7.9%), Italy (7.6%), and Poland (6.6%), while Latvia's milk quota accounted for only 0.5% of the total EU quota (European Commission, 2011).

In the quota year 2010/2011, the following five EU Member States exceeded their total milk quota by almost 200 thousand tons of milk: Denmark, the Netherlands, Austria, Cyprus, and Luxembourg. Irrespective of over-implementation of the quota in these EU Member States, the EU total output of milk did not exceed the total milk quota. Denmark and the Netherlands both exceeded their wholesale quotas for dairy processing enterprises and direct sales quotas, whereas, the other EU Member States exceeded only their wholesale quotas (Waite R., Reyniers J., 2011). Those farmers who exceeded their milk quotas by more than 6% had to pay a levy that was 50% higher than a regular levy in the quota years 2009/2010 and 2010/2011. The EU legislation stipulates that if a Member State exceeds its quota, producers that made this over-implementation have to pay a levy. The size of levy is 27.83 EUR/100 kg or 0.19 LVL/100 kg (Eiropas Ekonomikas un..., 2011), which significantly exceeds a milk purchase price not only in Latvia but also in the EU countries. It indicates that irrespective of a common use of CAP instruments in the EU-27; there are significant differences among their dairy industries, which can affect the development of these industries in the future.

2. Milk quotas in Latvia

In Latvia, dairy farming is a traditional agricultural industry, which developed very fast in the second half of the 19th century, becoming a significant exporting industry. After the accession to the EU, any milk producer needed a milk quota to sell the milk produced. The purpose of the milk quota system is to provide precise accounting and control of milk output and sales from both quantitative and qualitative aspects and prerequisites for restructuring milk production (MoA, 2011a).

The dairy industry is one of the most important industries in Latvia, as it accounted for 22.1% of the total value of final agricultural products measured at base prices (on average 14% in the EU) in 2010. Compared with 2009, the proportion of this industry in the output of goods rose by 5.4 percentage points (owing to increases in price and quantity) (MoA, 2011a).

Since the accession to the EU, the output of milk has had a stable upward trend, slightly decreasing due to the global economic crisis (Figure 1). However, in case the domestic consumption of milk decreases, the dairy industry can grow only owing to an increase in exports. Over the period of analysis, the exports of milk have increased 2.2 times, yet, it still lagged behind the increase rate of imports, which was 2.5 times. Owing to an increase in output, the self-sufficiency rate was steadily high. Other characteristics of the dairy industry in Latvia for 2010 – the number of cows (164 thousand), the number of herds (approximately 30 thousand), and the average milk yield per cow (approximately 5000 kg) (SA ADC, no year) – point at concentration and an efficiency increase in the primary production of milk. The introduction of milk quotas in Latvia

indisputably contributed to the growth of the dairy industry, providing stability, and growth opportunities for it.

One can draw the following conclusions from the information summarised in Table 1.

- After the accession to the EU, Latvia's milk quota increased by 55.3 thousand tons or 8%; the wholesale quota was the most significant quota, as it accounted for 96% of the total milk quota.
- There are development opportunities for the dairy industry in Latvia, as the total milk quota allocated to the country was not implemented. The highest quota implementation rate or 92.2% was registered in the quota year 2007/2008. In the quota year 2009/2010, a quota reserve of 115.3 thousand tons was available for the industry's growth.
- The number of milk quota owners has declined almost by half over the period of analysis, and every quota owner had a milk quota of 47 tons on average in the quota year 2009/2010, while the real quota implementation was even smaller – 40 tons on average.
- An analysis of the percentage distribution of milk quota owners points to problems in the primary production of milk in Latvia. Regardless of a decrease in the number of quota owners over the recent years, almost 95% of milk quotas belonged to dairy farms having less than 29 cows, while only 2.8% of quota owners had more than 50 cows.

3. Development of the milk quota system

Overproductions of milk were observed in the EU before the introduction of milk quotas (until the middle

Table 1

Characteristics of milk quotas in Latvia in 2004-2009

Indicators/ Quota year	2004/ 2005	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	Structure of quotas/ owners, %
Wholesale quota, thou. t	631.9	677.6	715.4	717.3	725.5	719.7	95.9
Wholesale quota implementation, thou. t	460.0	567.6	637	661.8	661.1	609	95.8
Quota implementation rate, %	72.8	83.8	89.0	92.3	91.1	84.6	x
Direct sales quota, thou. t	63.5	17.8	13.2	11.3	17.7	31.0	4.1
Direct sales quota implementation, thou. t	10.4	10.7	10.5	10.3	12.9	26.4	4.2
Quota implementation rate, %	16.4	60.1	79.5	91.2	72.9	85.2	x
Total milk quota, thou. t	695.4	695.4	728.6	728.6	743.2	750.7	100
Total milk quota implementation, thou. t	470.4	578.3	647.5	672.1	674	635.4	100
Quota implementation rate, %	67.6	83.2	88.9	92.2	90.7	84.6	x
Number of quota owners	x	30855	30068	20620	18417	16033	100
incl. less than 9 cows	x	28547	27565	17696	15468	13162	82.1
incl. 10-29 cows		1773	1898	2151	2129	2024	12.6
incl. 30-49 cows	x	249	276	359	389	394	2.5
incl. 50 and more cows	x	286	329	414	431	453	2.8

Source: authors' calculations based on the SA ADC, no year

Table 2

Characteristics of special support for milk in Latvia in 2010

Quota	Rate, LVL*/t	Tons confirmed	Number of applicants	Sum paid out, LVL	On average, LVL per farm
30-79 t of milk sold within a quota of at least 30 t	7.63	90092	1899	686071	361
80 t of milk sold within a quota of at least 80 t	6.87	428829	1343	2940953	2190
Total	x	518921	3242	3627024	1119

* Latvian lats

Source: authors' calculations based on *Ipasais atbalsts par...*, 2010

of the 1980s); however, after the introduction of milk quotas, the EU could get rid of intervention stocks, thus, proving that the initial goal of introducing milk quotas was achieved. Therefore, the abolishment of milk quotas is envisaged from April 2015, and milk producers will have to assess seriously their competitiveness and ability to continue a profitable business, as a guaranteed maximum quantity of milk purchased in every country would not be ensured due to the abolishment of milk quotas. Milk processors, too, will have to search for the best option for purchasing milk; it is possible that the number of cases when enterprises purchase raw milk in another EU Member State increases. E. Oliver and C. Caspari (2008) emphasise that regardless of the abolishment of milk quotas, it is necessary, at the same time, to maintain the industry's strategic place in the EU's rural economy as a whole and the local socio-economic fabric of many of its regions.

The EU ensures a gradual adaptation to the new conditions by increasing quotas by 1% within the period from 2009/2010 to 2013/2014 to get prepared for free competition in the primary production of milk.

To ensure this transition and gradual adaptation to the new market conditions, and activity in the dairy industry after milk quotas are abolished, a new type of support is available to farmers from 2010 – special support for milk. The legal framework for special support for milk is stipulated in Article 68 of Regulation 73/2009 (Padomes Regula ..., 2009). The purpose of granting this support is to provide financial support to milk producers in order to ensure a transition and gradual adaptation to the new market conditions and activity in the dairy industry after the abolishment of milk quotas. This support is available to economically vulnerable dairy farms, which sell more than 30 tons of milk a year to the market and can develop and continue operating in the EU dairy industry in a long-term and which will be directly affected by the abolishment of milk quotas (MoA, 2011). In 2010, any milk producer could receive special support for milk within the available quota for the previous quota year (in the period from 1 April 2009 to 31 March 2010) if:

- 1) the available quota of milk producers was 30 or more tons of milk and the milk producer had sold at least 30 tons of milk in the period from 1 April 2009 to 31 March 2010;
- 2) the milk producer had submitted an area payment application to a Regional Agricultural Board of the RSS, stating that s/he had applied for special support for milk.

Table 2 shows that totally 3242 applicants have applied for special support for milk in 2010 and they were paid LVL 36 million, of which 19% was received by farmers having a quota within 30-79 t of milk, while 81% was paid to farmers having a quota of more than 80 t of milk. Thus, the amount of support paid to relatively stronger farmers exceeded that paid to small farmers 4.3 times on average regardless of the fact that the support rate for small farmers was 11% higher. Besides, only approximately 5% of the total number of milk quota owners received this special support, which may be explained by the high proportion of small milk quota holders (milch cow owners) in their total number.

To identify the most significant and influential factors affecting the dairy industry in the future, a factor ranking assessment based on PESTEL analysis was performed in November-December of 2011. A questionnaire, which included the most significant factors of the respective field, was developed, and four experts of the industry were interviewed thereof. One of the experts represented the Ministry of Agriculture of Latvia – the director of the Department of Agriculture, the second one – the SA ADC – the director of the Department for Milk Quotas, the third one – the Latvian Rural Advisory and Training Centre (LLKC) – a specialist of the Livestock Department, and the fourth one – X Ltd, which had specialised in milk production (its herd consisted of 700 cattle, including 350 milch cows) – the chairman of the executive board of this enterprise.

Two questionnaires were developed – one on the factors affecting the dairy industry in Latvia, the second one – on the factors affecting the dairy industry in the EU. The experts had to assess whether a particular factor promoted and affected the development of the dairy industry and to what extent it was exploited. The following ranks were assigned to the factor rating scale: 1 – a factor affects minimally, 2 – a factor affects partially, it has a medium effect, and 3 – a factor affects maximally. In the result, several indicators were obtained; their use allowed comparing and identifying the factors affecting the dairy industry:

- a score of ranks for each factor – to assess the most significant factors of each category (PESTEL) for the dairy industry;
- a sum of ranks for the effects on the dairy industry – to assess, which effect (maximal, medium, minimal) on the dairy industry is the most significant;
- a normalised score of ranks for the factors affecting the dairy industry as a percentage of total value of ranks for a particular effect (maximal, medium, minimal).

Table 3

Summary of the ranking of the factors affecting the dairy industry in Latvia and the EU

LV / EU	Experts	SA ADC	LLKC	Ltd	MoA
Sum of ranks					
LV	Factor developing dairy industry	69	70	71	72
LV	Factor hindering dairy industry	34	39	46	56
LV	Factor having no effect on dairy industry	28	27	45	34
EU	Factor developing dairy industry	69	67	68	72
EU	Factor hindering dairy industry	34	45	39	56
EU	Factor having no effect on dairy industry	28	27	55	34
Total sum of ranks					
	LV	131	136	162	162
	EU	131	139	162	162
Normalised score, %					
LV	Factor developing dairy industry	52.7	51.5	43.8	44.4
LV	Factor hindering dairy industry	26.0	28.7	28.4	34.6
LV	Factor having no effect on dairy industry	21.4	19.9	27.8	21.0
EU	Factor developing dairy industry	52.7	48.2	42.0	44.4
EU	Factor hindering dairy industry	26.0	32.4	24.1	34.6
EU	Factor having no effect on dairy industry	21.4	19.4	34.0	21.0
Scattering, %					
LV	Factor developing dairy industry	0.24	0.24	0.28	0.28
LV	Factor hindering dairy industry	0.37	0.36	0.36	0.33
LV	Factor having no effect on dairy industry	0.39	0.40	0.36	0.40
EU	Factor developing dairy industry	0.24	0.26	0.29	0.28
EU	Factor hindering dairy industry	0.37	0.34	0.38	0.33
EU	Factor having no effect on dairy industry	0.39	0.40	0.33	0.40

Source: authors' calculations based on expert questionnaires, 2011

$$\text{normalised score} = \frac{\text{sum}}{\text{total sum}} \cdot 100, \quad (1)$$

where:

sum – sum of ranks for the effects on the dairy industry;

total sum – total sum of ranks for the effects on the dairy industry.

A scattering of ranks for the dairy industry is a free component, which is changeable; it assesses the effect power of the factors and determines the free area for unused opportunities for the dairy industry (maximal, average, minimal) and their effect:

$$\text{scattering} = \frac{1}{2} \left(1 - \frac{\text{sum}}{\text{total sum}} \right), \quad (2)$$

where:

sum – sum of ranks for an alternative (dairy industry);

total sum – total sum of all alternative ranks (Radzele-Sulce A., 2011).

The result of the analysis is summarised in Table 3.

Table 3 shows that the experts gave 69-72 points to the factors that developed the dairy industry in Latvia and 67-72 points to the factors promoting the dairy industry in the EU, 34-56 points to the factors hindering the dairy industry in Latvia and the EU. However, the greatest range of points (27-55) was given to the factors having no effect on the dairy industry in Latvia and the EU.

A normalised score shows that the experts rated 44.4-52.7% of the factors as the ones promoting development in Latvia and the EU. Of the factors, 26-34.6% did not promote (hindered) development, while 21.4-34.0% of the factors were neutral (had no effect) both for Latvia and the EU.

After assessing the most significant factors of each category (PESTEL), according to the experts for the dairy industry, and based on a normalised score of ranks, which assesses the effect power of the factors and determines the free area for unused factors, for the factors affecting the dairy industry, one can conclude that the factors affecting the dairy industry function at a capacity of 77.3% in Latvia and 75.8% in the EU, which means that presently 22.7% of the factors promoting development in the dairy industry are not exploited in Latvia and 24.2% - in the EU. This means that approximately a third of the factors promoting the dairy industry are not

exploited and, thus, the dairy industry has a 23% extra capacity for its development on average.

The experts pointed that the factors hindering the dairy industry in Latvia and the EU were quite similar. The main such factors were as follows: more attention had to be paid to financial support for agricultural infrastructure and business development, political support for the market and the elaboration of an agricultural strategy for at least 5 years, establishment of strong milk producer organisations or inter-industry organisations, development and availability of information and communication technologies in agriculture, development of milk-processing technologies, reduction of effects of climatic conditions, regulation of the consumption and prices of electrical energy as well as oil products, stability and predictability of Latvian and EU legal acts as well as tackling of employment problems.

Conclusions

1. Quotas of the EU CAP are applied to reduce disparities between supply of and demand for agricultural products and improve market balance. The CMOs of the EU guarantee that quotas are the right of milk producers to sell their milk within the quotas allocated. The EU milk quota system has been functioning since 1984, while in Latvia – since 1 May 2004.
2. The wholesale quota for the quota year 2009/2010 in the 27 EU Member States totalled 144 921 617 tons. Of the total quota, 70% was allocated to six EU Member States: Germany, France, the United Kingdom, the Netherlands, Italy, and Poland, while Latvia's milk quota accounted for only 0.5% of the total EU quota.
3. In the period of 2004-2010, the milk quota was implemented by 85% on average in Latvia, and it has not been fully implemented in any quota year, which pointed to unused opportunities for the industry to increase both the output and sales of milk. A reserve for development was approximately 115 thousand tons a year.
4. Regardless of the process of concentration in the primary production of milk in Latvia after its accession to the EU, the stabilisation of quantities of milk produced and domestically consumed as well as an increase in dairy exports. Totally, 95% of milk quotas still belonged to dairy farms having less than 29 cows and only 453 dairy farms with more than 50 cows were in the country.
5. Preparing for the abolishment of milk quotas in the EU in 2015, which means free competition in the primary production of milk, a gradual adaptation to the new conditions is provided by annual increasing quotas by 1% and paying special support for milk to farmers if their milk quota is at least 30 tons. Milk quota owners do not exploit these measures sufficiently intensive.
6. According to a survey of competent experts, the factors affecting the dairy industry function at a capacity of 77.3% in Latvia and 75.8% in the EU. Thus, presently 22.7% of the factors promoting development in the dairy industry are not exploited in Latvia and 24.2% – in the EU, which means that the dairy industry has a 23% extra capacity for its development on average.

Proposals and recommendations

- The Ministry of Agriculture of Latvia and the Latvian Rural Advisory and Training Centre have to expand informative and explanatory activities, so that farmers apply for eligible special support for milk, thus, preparing for free competition and potential threats on the dairy market after abolishing milk quotas in 2015.
- Farmers, especially owners of small herds of cows, have to use opportunities for joining various cooperatives to increase their market potential and prepare for free competition in milk production after abolishing milk quotas.
- Farmers have to intensify milk production by exploiting the funding of support measures allocated to the Rural Development Programme 2007-2013.

Bibliography

1. Brummer, B., Loy, J.P., Requate, T. (2011). Auction Experiments and Simulations of Milk Quota Exchanges. Paper Prepared for Presentation at the EAAE 2011 Congress. Retrieved: http://ageconsearch.umn.edu/bitstream/114377/2/Loy_Jens-Peter%20_340.pdf. Access: 3 February 2012.
2. De Frahan, H., Baudry, A., De Blander, R., Polome, P., Howitt, R. (2011). Dairy Farms without Quotas in Belgium: Estimation and Simulation with a Flexible Cost Function. *European Review of Agricultural Economics*, Vol. 38, No. 4, pp. 469 - 495.
3. EUR-Lex (b.g.). Kopeja Lauksaimniecības politika (*Common Agricultural Policy*). Retrieved: http://eur-lex.europa.eu/lv/dossier/dossier_42.htm. Access: 7 October 2011.
4. European Commission. (2011). Agriculture in the European Union - Statistical and Economic Information. Milk and Milk Products. Agriculture and Rural Development, 2006-2010. Retrieved: <http://ec.europa.eu/agriculture/agrista/>. Access: 1 October 2011.
5. Eiropas Ekonomikas un sociālo lietu komitejas atzinums par tematu Priekšlikums Eiropas Parlamenta un Padomes Regulai Nr. .../..., ar ko izveido lauksaimniecības tirgu kopīgu organizāciju un paredz ipasus noteikumus dažiem lauksaimniecības produktiem (Regula par vienotu TKO). COM (2010) 799 galīgā redakcija – 2010/0385 galīgā redakcija (2011/C 132/17) (*Resolution of the European Economic and Social Committee on the Proposal for European Parliament and Council Regulation No. .../... which Establishes a Single Organisation for Agricultural Markets and Provides Special Terms for Several Agricultural Products*). Retrieved: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2011:132:0089:0091:LV:PDF>. Access: 1 October 2011.
6. Ipasais atbalsts par pienu (IPKV) (*Special Support for Milk*) (2010). Retrieved: <http://www.lad.gov.lv/lv/es-atbalsts/tiesie-maksajumi/ipasais-atbalsts-par-pienu-%28ipkv%29/>. Access: 19 October 2011.
7. Jasko, D., Frolova, L., Dobeles, A., Pancenko, E., Ivanova, T., Radionova, A. (2007). Pilsaimniecības nozares attīstības analīze un konkurencespejas novērtējums Latvijā un Eiropas Savienības tirgū

- (*Development Analysis and Competitiveness Assessment for the Dairy Industry in Latvia and the European Union Market*). Retrieved: http://www.llu.lv/?mi=81&projekti_id=497. Access: 1 February, 2012.
8. Krievina, A. (2010). Evaluation of Resource Price Preferences and Resource Utilisation Efficiency in Dairy Sector. *Research for Rural Development: Annual 16th International Scientific Conference Proceedings*, Jelgava: LLU, pp. 84-91.
 9. Krievina, A., Miglavs, A. (2011). Comparative Strategy and Efficiency Analysis of Milk Production Chains in Different EU Countries. In: Traditions, Innovations, Sustainability. X. Wellmann International Scientific Conference, Hodmezovasarhely: University of Szeged, pp. 66-72.
 10. LR Zemkopības ministrija (ZM) (2011a). Latvijas lauksaimniecība un lauki 2010.gada (*Latvian Agriculture and Rural Areas in 2010*). Rīga, 148 lpp.
 11. LR Zemkopības ministrija (ZM) (2011b). Piena kvotas Latvija – informācija (*Milk Quotas in Latvia*). Retrieved: <http://www.zm.gov.lv/?sadala=1798>. Access: 5 October 2011.
 12. Orlova, I. Cīņa ar pārprodukciju – kvotas (*Struggle against Overproduction: Quotas*). *Saimnieks LV*, Nr.3 (57), 2009, 80.-82. lpp.
 13. Ozolins, J. (2010). Baltic States Dairy Sector Integration Sustainable Development Aspects. *Journal of Social Sciences: Human Resources – the Main Factor of Regional Development*, No. 3, pp. 134-142.
 14. Ozolins, J. (2011). Economic Effect of Latvian Dairy Sector Secondary-level Integration. *Economic Science for Rural Development: Proceedings of the International Scientific Conference*, No. 24. Jelgava: LLU, pp. 92-99.
 15. Oliver, E., Caspari, C. (2008). The Future of Milk Quota: Different Scenarios. Policy Department Structural and Cohesion Policies Agriculture and Rural Development Study. Retrieved: <http://www.ceasc.com/Images/Content/2355%20final%20report.pdf>. Access: 30 October 2011.
 16. Padomes Regula (EK) Nr. 1234/2007 ar ko izveido lauksaimniecības tirgu kopīgu organizāciju un paredz ipasus noteikumus dažiem lauksaimniecības produktiem (2007) (*European Council Regulation (EC) No. 1234/2007 Establishing a Common Organisation of Agricultural Markets and on Specific Provisions for Certain Agricultural Products*). Retrieved: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:299:0001:0149:LV:PDF>. Access: 1 October 2011.
 17. Radzele-Sulce, A. (2011). Logistikas pielietojuma ekonomiskie ieguvumi agrarajā sfērā. Promocijas darbs (*Economic Benefits of Logistics Application in the Agriculture Sector. PhD paper*). Jelgava: LLU, 236 lpp.
 18. VA Lauksaimniecības datu centrs (VA LDC) (s.y.). VA LDC portāls (*State Agency Agricultural Data Centre (SAADC). SAADC portal*). Retrieved: <http://www.ldc.gov.lv/> Access: 13 October 2011.
 19. Eiropas Revīzijas Palāta (2009). Ipasais ziņojums. Vai piena un piena produktu tirgus parvaldības instrumenti ir sasnieguši galvenos mērķus? Nr. 14 (*European Court of Auditors. Special Report. Have the Management Instruments of Dairy and Dairy Product Markets Achieved the Main Goals? No. 14*). Retrieved: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SRCA:2009:14:FIN:LV:PDF>. Access: 15 October 2011.
 20. Waite, R., Reyniers, J. (2011) Quota year 2010/11: Five Member States have Exceeded their Milk Quota. European Commission - Press release, 18 October 2011. Retrieved: <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/1204&format=HTML&aged=0&language=EN&guiLanguage=en>. Access: 30 October 2011.
 21. Wieck, C., Heckeley, T. (2007). Determinants, Differentiation, and Development of Short-term Marginal Costs in Dairy Production: An Empirical Analysis for Selected Regions of the EU. *Agricultural Economics*, 36, pp. 203-220.

Assessment of Deer Breeding Industry from the Viewpoint of Producers

Liga Proskina¹, Mg.oec., PhD student
Faculty of Economics, Latvia University of Agriculture

Abstract. A survey of producers engaged in deer-breeding industry was conducted to assess the present situation in deer-breeding industry in Latvia and to determine whether it is a prospective industry along with traditional agricultural industries in the future. The research aim was to ascertain the opinion of deer breeders on the factors affecting the development of deer-breeding industry in Latvia. The survey was performed in 2011. A sample population consisted of farms rearing red deer (*cervus elaphus*) or fallow deer (*dama dama*) for meat, animal selection, reproduction, or recreation. Totally, 86% of deer farms in Latvia were questioned in the survey. The data obtained were processed by employing Microsoft Excel statistical methods.

One can conclude from information gained from the respondents that there are significant differences in the areas of deer farms and the number of animals. Of total farms, 50% had a fenced area of less than 99 ha, 40% - had a fenced area within a range from 100 ha to 350 ha, and only 10% or 4 farms had a fenced area of more than 350 ha. The number of deer ranged within 1-100 on 60% of the farms, on 28% of the farms it was within 101-350, and on 12% of the farms the number of red deer and fallow deer exceeded 350 animals. In the group of medium and large farms, the largest income (56% and 70%, respectively) was gained from meat production, while the main source of income of small farms was sales of live animals (37%). As regards sales possibilities of products of deer farming, the respondents view the domestic market as significant (8.9 ± 1.56), at the same time they point that the sales possibilities for deer meat are limited (7.80 ± 2.10), and deer meat processing possibilities (7.70 ± 1.42) and the market of deer meat are not sufficiently developed (8.30 ± 1.34). According to them, the main factors hindering the development of the industry are product quality (8.90 ± 0.88), development of the market of deer meat (8.30 ± 1.34), availability of financial resources (8.10 ± 0.88), and herd size on farms (8.1 ± 1.20).

Key words: deer farming, market, produce.

JEL code: O 13

Introduction

An increased interest of both producers and consumers has been observed for several years for a non-traditional agricultural industry – deer farming, which supplies meat of hunted animals to the Latvian market. The number of farms, on which red deer or fallow deer are registered, has risen 2.3 times during the recent ten years. In 2010, the State Forest Service granted 70 permits for keeping red deer and fallow deer on farms (VMD, 2011; LDC, 2011). As regards the existing deer farms, which intensively farm red deer, fallow deer, and other wild animals, at the end of 2010, there were 42 such farms, of which 26 were members of the Latvian Wild Animal Breeders Association (SDAA, 2011). The total fenced area of deer farms was approximately 8000 ha. The basic species kept on these farms were red deer – 66% and fallow deer – 12%, among other species were moufflons – 6% and wild boars – 6%, while other species accounted for 10% of their total number (SDAA, 2011).

In the context of the Baltic States, it has to be noted that published information on deer farms in Estonia is not available. The first deer farms and deer breeders associations were founded in Latvia and Lithuania in the 1990s (FEDFA, 2011). In 2010, totally 150 deer farms were registered in Lithuania (Deer Farmers Association ..., 2011), which exceeded the number of farms registered in Latvia several times. Yet, the average number of deer per farm in Latvia indicates that its deer-breeding

industry is purposefully developed. In 2010, the average number of deer per farm in Latvia was 169 (SDAA, 2011; LDC, 2011), while in Lithuania, the respective indicator was only 26.7 in 2010 (Deer Farmers Association ..., 2011). Besides, it has to be emphasised that 62% of the functioning deer farms in Latvia are members of the Latvian Wild Animals Breeding Association (SDAA, 2011), whereas only 29 deer farms in Lithuania or 19% of their total number have joined their deer breeders association (Elniu augintoju asociacija - *in Lithuanian*).

These facts indicate the development of a new industry in Latvia, which causes many questions concerning production, production and processing efficiency, sales market size and assortment, expected domestic and foreign demand for deer meat etc. Studies on biological aspects of deer farming are available in literature including animal health, feeding, welfare, in both Latvian publications (Jemeljanovs, Miculis, 1998; Paeglitis et al., 2006; Skriba, 2011) and research papers of foreign scientists (Fletcher, 1989; Tuckwel, 2003), but there are a few studies on economic aspects of deer farming and market issues on Latvian conditions.

In the leading deer-breeding countries – New Zealand, Australia etc. – deer farming is one of the traditional agricultural industries, at the same time it has to be taken into consideration that climatic conditions in these countries significantly differ from those in Latvia. Therefore, studies in these countries may not

¹ E-mail address: liigaproskina@inbox.lv

often be applied to a respective development stage of deer farming in Latvia. The situation in deer farming in the nearest neighbouring countries – Lithuania and Estonia – is similar to that in Latvia. Studies on deer farming are fragmented and unsystematic in these countries (Baltrunaite, 1999), and in Latvia, the situation is also the same. Such a situation hinders the development of the deer-breeding industry. It means that Latvia has to implement consistently its own policy in deer farming and raise the professional level in it.

Therefore, it is necessary to ascertain the present situation in this industry and to determine whether it might be prospective in the future along with non-traditional agricultural industries, mainly, from the viewpoint of producers engaged in deer-breeding industry.

The research aim is to ascertain the opinion of deer breeders on the factors affecting the development of deer-breeding industry in Latvia.

The following research tasks are set to achieve the research aim:

- 1) to assess the key physical indicators of deer farms (area, number of animals etc.);
- 2) to analyse the financial performance indicators of deer farms;
- 3) to investigate the factors promoting and hindering the development of deer-breeding industry in the future.

Materials and methods

Within the present research, deer farming is defined as a multifunctional non-traditional agricultural industry oriented towards animal selection and rearing, meat production, hunting and tourism, thus, increasing the economic return of the industry. Unpublished information of the Latvian Wild Animal Breeders Association, research papers and conference materials of Latvian and foreign scientists, and interviews with the industry's experts were used in the present research. Information on traditional agricultural industries, quantities produced, and market volumes is regularly compiled, summarised, and published by various institutions, while information on non-traditional agricultural industries and their product market is not published. Therefore, published information on non-traditional agricultural industries, including problems of and studies on deer farming, is actually not available. Since the deer-breeding industry is a relatively new industry not only in Latvia but also in the world, the primary data were obtained by employing a quantitative research method – structured individual interviewing to achieve the research aim. A questionnaire was developed to survey businessmen engaged in deer-breeding industry according to Churchill et al, 2010 and Aaker et al, 2007.

The survey was conducted in the summer-autumn period of 2011. Both open and closed questions on the economic and financial performance of deer farms and development of the industry were included in it. The sample population included farms that reared red deer (*cervus elaphus*) or fallow deer (*dama dama*) for meat, animal selection, reproduction, or recreation. The survey covered 36 deer farmers, i.e. 86% of intensive deer farms in Latvia in 2010. The data obtained were processed by employing Microsoft Excel statistical methods.

Results and discussion

1. Characteristics of deer farms

During the research, it was ascertained that 40% of respondents had been engaged in deer farming for a period of 9-18 years, while the majority or 60% of respondents pointed that this had been their business for as many as 3-8 years.

A significant characteristic indicator of any farm is its area, while a significant indicator of a deer farm is a fenced area for deer. In terms of area of deer farms, huge differences are observed among such farms in Latvia. A fenced area of a deer farm is on average 156 ha. By constructing a percentile distribution, percentages of all values below the value of sample were determined (Arhipova et al., 1997; Arhipova, Balina, 2006). By calculating the median (Me) and percentile P_{50} of the sample, it was determined that 50% of farms had a fenced area of less than 99 ha ($P_{50}=Me=99$); 40% of farms had a fenced area within a range of 100 to 350 ha, and only 10% or 4 farms had a fenced area of more than 350 ha ($P_{90}=350$).

After analysing the herd size of respondents' farms, one could conclude that this indicator, too, significantly differed among the farms. On average, there were 192 animals per farm. After constructing the percentile distribution, one could conclude that the number of deer ranged within 1-100 ($P_{60}=100$) on 60% of farms. In total, there were 791 animals in this farm group or 11% of the total number of animals. Yet, on 28% of the farms, the number of deer was within 101-350 with a total number of 2138 animals in this farm group or 29% of the total number of animals. Only on 12% or 5 farms, the herd size of red deer and fallow deer exceeded 350 animals ($P_{88}=350$) with a total number of 4363 animals in this farm group or 60% of the total number of animals.

Further, in the research, considering the area of fenced pastures and the number of animals, the farms were conditionally classified into three groups: small (pasture area from 1 to 99 ha), medium (pasture area from 100 to 350 ha) and large (pasture area of more than 350 ha). The total fenced area of small farms totalled 965 ha or 16% of the total fenced area, in the group of medium farms this area amounted to 2829 ha or 48% of the total fenced area, and the total fenced area of large farms was 2136 ha or 36% of the total fenced area for deer.

To assess the development trends in the industry in general, it was important to find out why the respondents were engaged in such a non-traditional agricultural industry. The reasons for it were very diverse, yet, there were several reasons given by the respondents most often: 28% of respondents believed that deer farming was a potentially profitable kind of business, 8% - pointed to risk reduction in the result of diversifying their business, 12% - kept deer with the purpose of preserving the species, while aesthetic satisfaction for themselves and their family was mentioned in 15% of questionnaires. Part of the respondents mentioned that their establishment of a deer garden related to enhancing the landscape value of their rural real estate, small labour investments, a sportsmanlike lifestyle, an aristocratic lifestyle, and the majesty of animals.

As regards the specifics of this agricultural activity, it was found out that part of the respondents related their

activity to farming animals for meat (63%), selection (55%), trophy hunting (66%), sale of live animals (50%), and tourism and recreation (63%). It has to be noted that the mentioned indicators did not sum up, as the largest part of these farms specialised in several activities.

2. Financial performance indicators of deer farms

Since the respondents pointed to several specialisations of their farms: meat production, selection, trophy hunting etc., it was found out which specialisation contributes most to gross revenues of deer farming.

As one can see in Table 1, the share of revenues gained from various specialisations differs among the farm groups. The highest share of revenues from meat production is observed for the groups of medium and large farms, 56% and 70% of total gross revenues from deer farming, respectively. For these farm groups, sales of live animals produce 20% and 15% of their total income, respectively; whereas, income from trophy hunting (8% and 5%, respectively) and tourism (16%

and 10%, respectively) make the smallest contributions to their total income.

Income gained from farming animals for trophy hunting is presently quite insignificant, since on average these farms do this business for 9 years. In the process of selecting animals for hunting, only those animals, which can produce a valuable trophy, i.e. beautiful horns at the age of 7-9 years, after being hunted are selected and reared. Yet, the small farms gain their main income from selling live animals (37%) and meat (28%), and tourism (21%). The insignificant share of income from sales of meat relates to the fact that only prospectless and defective animals are sold for meat in this farm group.

The industry's viability, to a great extent, depends on the wish of businessmen themselves to expand their existing specialisation. Opinions of the respondents on possibilities for increasing their herd size and pasture area were found out in the present research.

Increasing the herd size of deer by means of high quality breeding animals is a significant factor for the economic growth of a farm. Reproducing and increasing a

Table 1

Share of gross revenues by type of deer-breeding industry products (%)

Production specialisation	Small farm group	Medium farm group	Large farm group
Meat production	28	56	70
Sale of live animals	37	20	15
Recreation/tourism	21	16	10
Trophy hunting	4	8	5
Other	10	0	0

Source: author's calculations

Table 2

Ratings of the deer-breeding industry and deer meat production

Assertion	Average	min	max	SD*
Deer farming may be regarded as a profitable industry	6.70	4	10	1.89
Deer farming is a significant non-traditional agricultural industry	7.30	5	9	1.57
Deer farming may become a traditional agricultural industry	3.90	1	8	2.23
Deer meat may become an available alternative to traditional meat in the near future	5.50	2	8	2.22
Deer meat prices have to be equal to beef prices	3.20	1	7	2.04
Deer meat prices have to be lower than beef prices	1.90	1	4	1.10
Deer meat products have to be a special type of products (niche products)	6.20	4	9	1.48
Production of deer meat ensures the viability of farms	5.90	3	8	1.60
Deer meat market prices ensure sufficient interest of consumers in these products	5.70	2	9	2.50
Sales possibilities for deer meat are limited	7.80	4	10	2.10
Majority of deer products are sold on the Latvian market	8.60	6	10	1.56
Deer meat and products are sold directly to consumers	7.90	3	10	2.08
Deer meat and products are sold by means of retailers	5.80	1	9	2.26
Deer meat and products are sold to restaurants	7.60	5	9	1.69

* Standard Deviation

Source: author's calculations.

herd also depends, to a great extent, on the specialisation of a deer farm – rearing pedigree animals, meat production etc. It was found out that over the recent 5 years, for the reproduction of a herd, breeding animals were purchased from other deer farms in Latvia in 45% cases and from abroad in 33% cases. However, during the recent year, breeding animals available on one's own farm were mostly (69%) used for the reproduction of herds. It allows concluding that presently deer farms are provided with breeding animals of sufficient quality to reproduce their herds.

3. Development possibilities for deer farms in the future

Since the majority of deer farms were small, it was found out whether the respondents planned to increase their farm size and/or herd over the next 5 years. Thus, whether the farms would develop further and the entire industry would grow. Increasing a herd is affected by a rational proportion of deer of various ages and both genders in the total number of herd animals.

The largest share of the respondents or 52% planned to increase their fenced area and number of animals, while 36% - planned to manage their farms as before, but 4% - planned to stop this business or had already

stopped farming deer. It is worth mentioning that 8% of respondents said that due to various reasons, they were not able to increase the size of their herd in the near future, but on favourable conditions, they believed it was possible.

It has to be noted that the medium and large deer farms planned to increase significantly the size of their business, the main purpose of which was meat production and rearing of animals for trophy hunting. Yet, the small deer farms wished to keep their business at the same level, as their priority specialisations were animal selection and tourism.

At the end of the survey, the respondents were asked to rate assertions on deer-breeding industry. The results are summarised in Table 2.

Their rating scale ranged from 1 to 10, where 1 meant "I absolutely disagree" and 10 meant "I absolutely agree". The respondents' opinions on the given assertions were quite diverse, and the range of ratings proved it (see min and max ratings in Table 3). A general trend indicated that the respondents agreed with an assertion that deer farming was a significant non-traditional agricultural industry (7.30 ± 1.57), besides, they believed that deer farming might be regarded as a profitable industry (6.70 ± 1.89). A possibility of deer-breeding industry to

Table 3

Ratings of the factors affecting deer-breeding industry

Factors	Average	min	max	SD*
Climate	5.80	3	9	1.81
Costs of fencing	6.90	4	9	1.66
Costs of product processing	5.30	3	8	1.49
Costs of labour	5.60	2	9	2.37
Veterinary cost	5.00	2	8	2.26
Costs of feed	5.60	3	8	1.58
Construction of place for animal pre-processing	6.40	4	9	2.01
Costs of purchase of breeding animals	7.90	5	10	1.45
Farm expansion possibilities (purchase or rent of land)	7.60	5	10	1.65
Herd size	8.10	6	10	1.20
Deer meat processing possibilities	7.70	5	9	1.42
Location of place of product processing (distance)	5.30	2	9	2.06
Product quality	8.90	8	10	0.88
Deer meat price	7.50	4	10	1.72
Market of deer meat and other products is not developed	8.30	6	10	1.34
Animal welfare standard	6.60	4	9	1.90
Insufficient cooperation between deer meat producers	6.80	3	10	2.25
Vandalism	2.60	1	5	1.43
National and the EU support policies	7.50	5	10	1.58
Availability of labour	5.70	4	9	1.70
Insufficient knowledge on specifics of the industry	7.10	5	9	1.45
Entrepreneurial ability	7.30	5	9	1.42
Availability of financial resources	8.10	7	10	0.88

*Standard Deviation

Source: author's calculations

become a traditional agricultural industry was rated low (3.90 ± 2.23).

As regards deer meat production, the respondents believed deer meat products had to be niche products on the market (6.20 ± 1.48). It was, in its turn, related to the respondents' opinion on possible deer meat market prices. The respondents quite unanimously disagreed with an assertion that deer meat prices had to be lower than beef prices (1.90 ± 1.10) and partially disagreed with an assertion that deer meat prices had to be equal to beef prices (3.20 ± 2.04).

The respondents' opinions were different regarding the interest of consumers in deer meat products (see min, max ratings in Table 3). Yet, in general, one can say that the respondents believed that deer meat prices were sufficiently attractive to consumers (5.70 ± 2.50).

The deer-breeding industry is presently at the stage of growth. Therefore, the market of products of deer farming is not developed as well. The respondents pointed that sales possibilities for deer meat were limited (7.80 ± 2.10).

According to the respondents, one can conclude that Latvian products of deer farming are oriented towards the domestic market (8.9 ± 1.56) and mostly sold to restaurants and in direct selling – from the producer to the consumer. In direct selling, to some extent, deer meat producers can guarantee high quality for their products. The extension of direct selling channels is necessary to sell deer meat, as a large number of middlemen slow down the movement of products from the producer to the consumer (Praude, Belcikovs, 1999). It means, the more middlemen are in business, the smaller is the control of producers over the quality of products reaching their consumers. However, such an approach hinders the development of the industry in general. It is required to extend the sales channels, as part of consumers are insufficiently informed about possibilities to buy deer meat, prices of deer meat and its products are quite high, and sales of these products are not well-organised in retailing. Yet, at the same time, consumers are interested in knowing where to buy deer meat, visiting animals, and trophy hunting.

During the survey, the respondents rated the factors hindering the development of deer-breeding industry in the scale from 1 meaning "I absolutely disagree" to 10 – "I absolutely agree". After summarising the ratings provided by the respondents, the most significant factors affecting the deer-breeding industry are presented in Table 3.

The ratings provided by the respondents and analytical calculations indicated that the most significant factors affecting the development of deer farming were product quality (8.90 ± 0.88) and undeveloped market of deer meat (8.30 ± 1.34). The ratings on these factors were quite unanimous, and the small range of ratings in the respective items proved it (see min, max ratings in Table 3).

The respondents regarded the following factors as significant for the development of the industry: availability of financial resources (8.10 ± 0.88), herd size on a farm (8.1 ± 1.20), cost of purchase of breeding animals (7.90 ± 1.45), deer meat processing possibilities (7.70 ± 1.42), farm expansion possibilities (7.60 ± 1.65), national and the EU support policies (7.50 ± 1.58), and deer meat prices on the market (7.50 ± 1.72).

The respondents regarded various costs related to business activity, except the construction and maintenance costs of fenced area, as less significant problems. A medium significant problem, according to the respondents, was the availability of labour (5.70 ± 1.70), which was a problem in rural areas where low economic activity had caused the outflow of labour from rural areas. It has to be noted that the respondents regarded the insufficient knowledge of businessmen and experts engaged in the industry on the specifics of deer-breeding industry as a significant factor affecting the development of this industry (7.10 ± 1.45).

The account and ratings of problems indicate that systematic processing and sales of deer meat are not developed in Latvia. Therefore, it is necessary to establish a deer meat processing company. The development and expansion possibilities for the market of products of deer farming and on assuring the quality of products in the entire food chain from the production, processing, and delivery of deer meat to the consumer as well as educational seminars on deer farming require further studies.

Conclusions

1. In terms of area of deer farms and number of animals, huge differences were observed among these farms. Of total farms, 50% had a fenced area of less than 99 ha, 40% – had a fenced area within a range from 100 ha to 350 ha, and only 10% or 4 farms had a fenced area of more than 350 ha. The number of deer was 100 on 60% of farms, on 28% of the farms it was within 101-350 with a total number of 2138 animals in this farm group. The herd size of red deer and fallow deer exceeded 350 animals on 12% of the farms.
2. In the group of medium and large farms, the largest income (56% and 70%, respectively) was gained from meat production, while the main source of income of small farms was sales of live animals (37%).
3. As regards the market situation for products of deer farming, the respondents believed that Latvian products of deer farming were mostly oriented towards the domestic market (8.9 ± 1.56), at the same time they pointed that the sales possibilities for deer meat were limited (7.80 ± 2.10) and deer meat processing possibilities (7.70 ± 1.42) and the market of deer meat were not sufficiently developed (8.30 ± 1.34).
4. The most significant factors affecting the development of deer farming are: product quality (8.90 ± 0.88), development of the market of deer meat (8.30 ± 1.34), availability of financial resources (8.10 ± 0.88), and herd size on farms (8.1 ± 1.20).
5. It is necessary to establish a deer meat processing company and conduct studies on the market volumes and assortments for the market of products of deer farming to provide the systematic processing and sales of deer meat.

Bibliography

1. Aaker, D.A., Kumar, V., Day, G.S., Lawley, M., Stewart, D. (2007). *Marketing Research*. The Second

- Pacific Rim Edition. John Wiley and Sons Australia, Limited. p. 601.
2. Arhipova, I., Balina, S. (2006). *Statistika ekonomika un biznesa. Risinājumi ar SPSS un Microsoft Excel. (Statistics for Economics and Business. Solutions with SPSS and Microsoft Excel)* 2.izdevums. Rīga: Datorzinību centrs. p. 364. (in Latvian).
 3. Arhipova, I., Ramute, L., Zuka, L. (1997). *Matematiskās statistikas uzdevumu risināšana ar MS Excel (1.dala) (Solving Mathematical Statistics Problems with MS Excel (Part 1))*. Macību līdzeklis. Jelgava: LLU. pp. 7-31. (in Latvian).
 4. Baltrunaite, L. (1999). State and Prospects of Ungulate Animals Breeding in Enclosures in Lithuania. *Acta Zoologica Lituanica*, Volume 9, Number 1. pp. 55-60.
 5. Churchill, G. A., Brown, T. J., Suter, T.A. (2010). *Basic Marketing Research*. 7th Edition. South Western Educational Publisher. p. 640.
 6. Deer Farmers Association in Lithuania (2011). Retrieved: <http://elniai.lt/dokumentai/>. Access: 12 October 2011. (in Lithuanian).
 7. Fletcher, J. (1989). Deer Farming in Europe. In: Hudson R.J., Drew K.R. and Baskin L.M. (eds) *Wildlife Production Systems*. Cambridge University Press, pp. 323-334.
 8. Jemeljanovs, A., Miculis, J. (1998) Feedstuff Chemical Composition and Separate Biochemical Indices of Deer Blood in Latvia Gauja National Park. In: Zomborszky Z. (ed) *Advances in Deer Biology*. Proceedings of the 4th International Deer Biology Congress. Kaposvar, Hungary. pp. 253-256.
 9. LDC, Lauksaimniecības datu centrs (Agricultural Data Centre) (2011) On-line resource. Retrieved: http://pub.ldc.gov.lv/pub_stat.php. Access: 12 October 2011.
 10. Paeglītis, D., Dusaliņeva, I., Flecers, Dz., Skriba, G. (2006). *Staltbriežu audzēšana un selekcija (Breeding and Selection of Red Deer)*. Rīga: SDAA. p. 50. (in Latvian).
 11. Praude, V., Belcikovs, J. (1999) *Marketings (Marketing)*. Rīga: Vaidelote. p. 559. (in Latvian).
 12. SDAA, Savvalas dzīvnieku audzētāju asociācija (Wild Animals Breeding Association) (2011). Npublicēta informācija (unpublished data).
 13. Skriba, G. (2011). *Staltbriežu izcelsme, izplatība un audzēšana Latvijā. (Deer Origin, Habitat and Breeding in Latvia)*. Author's edition. p. 624. (in Latvian).
 14. Tuckwell, C. (2003). *The Deer Farming Handbook*. Australian Government, Rural Industries Research and Development Corporation, RIRDC Publication No. 03/029, Canberra, 2003.
 15. VMD, Valsts meža dienests (State Forest Service) (2011). Npublicēta informācija (unpublished data).
 16. FEDFA, The Federation of European Deer Farmers Associations (2011). Member States. Retrieved: <http://www.fedfa.com/germany.htm>. Access: 12 December 2011.

Acknowledgements

The academic study and publication were financed by the project "Support for Doctoral Studies at Latvia University of Agriculture" / 2009/0180/1DP/1.1.2.1.2/09/IPIA/VIAA/017/, Agreement No. 04.4-08/EF2.D1.03.

Assessment of Fruit-Growing Industry in Latvia

Linda Silina¹, Dr. oec., assistant professor; Dzesija Zeiferte², Mg. oec.

Abstract. Crop and livestock industries have a significant position in the world national economies, yet fruit-growing industry products are no less important for ensuring the wellbeing of population, and popularising and providing healthy nutrition. To disclose the situation in Latvia, the fruit-growing industry was assessed by analysing changes in the planted area of fruit trees and berry bushes, average yields, and total output as well as indicators of imports and exports of fruit and berries. Time series analysis, inductive and deductive methods, analysis and synthesis as well as the graphical method were used in the present research. The area of fruit and berry plantations in Latvia has been volatile over a ten-year period, reaching the highest level in 2006 and decreasing afterwards. The average yields of berries and fruit differ; thus, apples showing the highest yields, while cherries – the lowest ones.

Key words: fruit-growing, yield, crop.

JEL code: A11

Introduction

Agriculture is one of the leading industries of the national economy in Latvia; however, in-depth studies cover only grain and vegetable production, and production of livestock products as well as factors affecting production and production development trends.

The role of fruit and vegetables in diets, especially during the recent decades, has significantly increased due to a sharp decrease in physical activity of individuals and a considerable decline in the daily consumption of energy. These factors may cause various health problems in the future. Therefore, worldwide more and more attention is paid to physical activities and healthy diets.

During the overall organisational reforms of fruit and vegetable markets in 2007, the EU Council pointed to a decrease in the consumption of fruit and vegetables in diets of the EU inhabitants, especially schoolchildren.

The present research is based on the wish of Latvia's population to consume domestic (not imported) fresh fruit and berries that are necessary for ensuring daily balanced diets.

The whole territory of Latvia is appropriate for growing fruit and berries, although agricultural and climatic conditions greatly differ by various regions of Latvia.

Therefore, the present scope of studies on fruit growing industry does not create a basis for performing further economic studies.

Skriverle M. with co-authors (2008) based on the performed analysis on the production of fruit and berries in Latvia have concluded that fruit growing takes a stable position in the national economy of Latvia; however, the local market demand is insufficient.

Analytical research results are disclosed in publications by J. Hazners (2008, 2009, 2010), where he has analysed the market of strawberries in the European Union as well as peach and apple markets. Gailite's (2008) publications

dwell upon the production of fruit and vegetables in Latvia and in Europe.

There are many studies on biological properties of fruit and berries, related technological processes, possibilities of their use, specifics of their storage etc. Yet, there are a few studies on the current situation in the fruit growing industry in Latvia in general (Kampus, Strautina, Laugale, 2009; Kampuse, Volkova, Seglina, Krasnova, 2009; Morocko, Fatehi, 2009; Dimza, Gross, Rubauskis, 2008).

It is not possible to determine the development priorities for the industry without evaluation of the present situation in the production of fruit and berries in Latvia.

The research aim is to assess the fruit-growing industry in Latvia.

Three research tasks are set forth to achieve the aim:

- to analyse changes in the area of fruit and berry plantations in Latvia;
- to assess the output of fruit and berries, and trends in the average yields in Latvia;
- to assess import and export indicators for fruit and berries in Latvia.

Since the present research is carried out within a project³, the main emphasis, when assessing the indicators, is placed on apples, pears, and strawberries that are intended for use as a raw material in producing fruit salads.

Qualitative and quantitative methods - time series analysis, the graphical method, analysis and synthesis, and induction and deduction methods - were used to provide the present research.

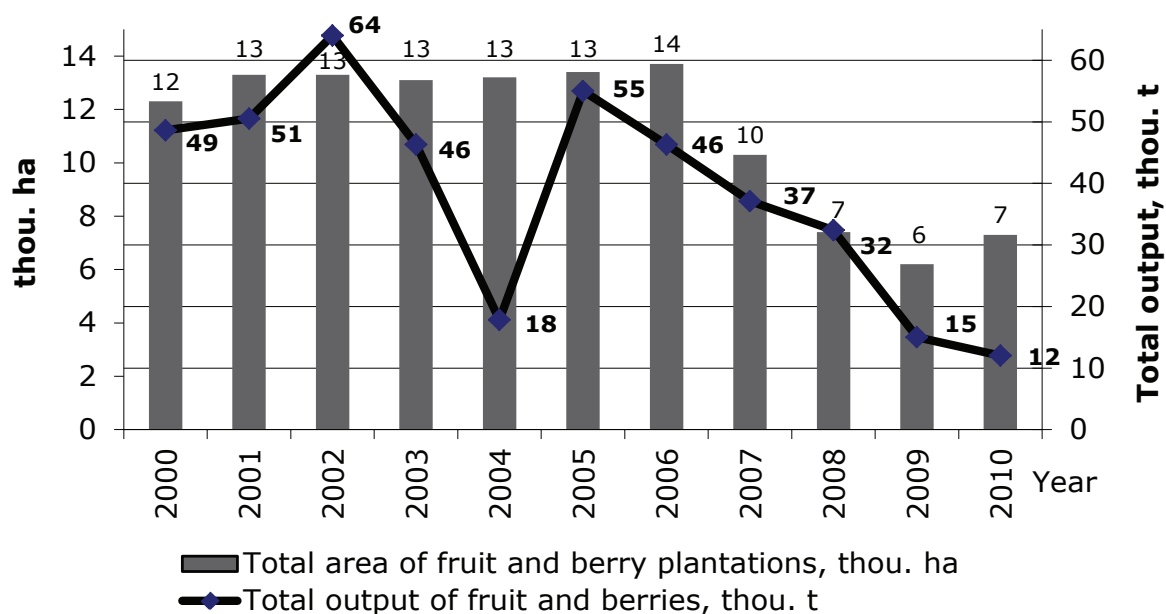
Research results

The planted area of fruit and berry plantations is one of the most significant indicators in assessing fruit growing industry in Latvia.

¹ E-mail address: Linda.Silina@llu.lv

² E-mail address: Dzesija.Zeiferte@llu.lv.

³ Acknowledgements: the experiments are carried out within the ESF financed project "Scientific Capacity Building in Fruit-growing, Forestry and Information Technology Sectors, Providing Research on Environmentally Friendly Growing Strategies, Product Development and Introduction Aided by Computer Technologies", No.2009/0228/1DP/1.1.1.2.0/09/APIA/VIAA/035



Source: authors' construction based on the Central Statistical Bureau (CSB) data

Fig. 1. The area of fruit and berry plantations in Latvia between 2000 and 2010, thou. ha

Table 1

The area of fruit and berry plantations broken down by crops, thou. ha between 2006 and 2009

Crop	2006	2007	2008	2009
Fruit and berries in total	13.7	10.3	7.4	6.2
Apples	9.5	7.3	5.1	4.1
Pears	0.7	0.6	0.3	0.2
Strawberries	0.5	0.3	0.4	0.3
Plums	0.7	0.4	0.2	0.1
Cherries	0.8	0.7	0.2	0.1
Red and black currants	1.1	0.6	0.9	0.7
Other crops	0.4	0.1	0.3	0.7

Source: authors' construction

From 2000 to 2010, the largest planted area equalling to 13.7 thousand hectares was registered in 2006, while the smallest planted area was registered in 2009. The decrease amounted to 6.2 thousand hectares, which is 7.5 thousand hectares or 55% less than in 2006.

The large decrease in the total area of plantations occurred due to the decline of the planted area of apple trees resulting from aging of plantations.

However, in 2010, the planted area increased by 1100 hectares or 18% compared with the previous year. It may be explained by the use of various European Union funds for introducing perennial plantations, which allowed expansion of the existing plantations and introduction of new ones.

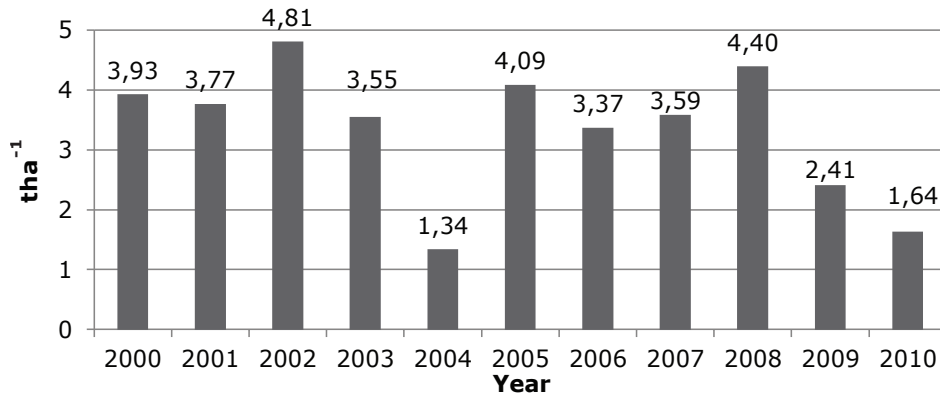
Data arranged in Table 1 show the changes in the planted area broken down by groups of crops.

The largest decrease in the total planted area has resulted from liquidated apple plantations, since in 2009 only 4100 hectares of orchards were planted in Latvia, i.e. 5.4 thousand hectares or 57% less than

in 2006. A gradual decrease in apple plantations can be explained by the aging process of plantations, as orchards planted in the 1990s are not productive anymore.

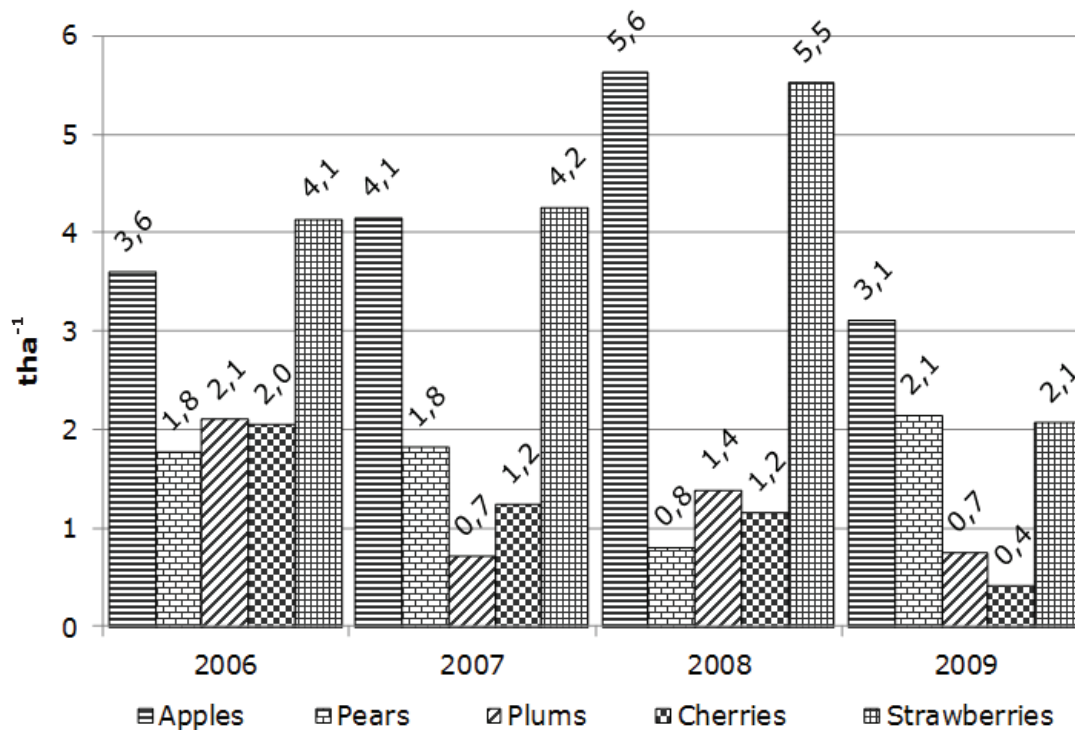
In terms of registered area, the largest area is occupied by orchards where apples of the variety 'Antonovka' dominate; yet, the second largest area belongs to the variety 'Auksis'. According to a summary of information, 98 thousand apple trees of the variety 'Auksis' are grown in Latvia. The second most popular is the variety 'Antai' accounting for 7% of the total number of apple trees. The share of the variety 'Sinap Orlovski' is 6.6% of the total number of apple trees. The least popular are the varieties 'Lobo', 'Saltanat', and 'Kovalenovskaya'.

A similar situation exists for pear plantations. In 2006, pear plantations occupied 700 hectares, while in 2009 - only 200 hectares, which is by 71% less. Such a decrease can be explained by the fact that pear varieties are not suited for commercial purposes in Latvia, as storage of



Source: authors' construction based on the CSB data

Fig. 2. Average yield of fruit and berries in Latvia between 2000 and 2010, tha⁻¹



Source: authors' construction based on the CSB data

Fig. 3. Average yields of fruit and berries broken down by crops in Latvia between 2006 and 2009, tha⁻¹

this fruit causes additional costs to producers in order to make pears available beyond their harvest season. Based on these aspects, the introduction of new pear plantations is not a priority of business people.

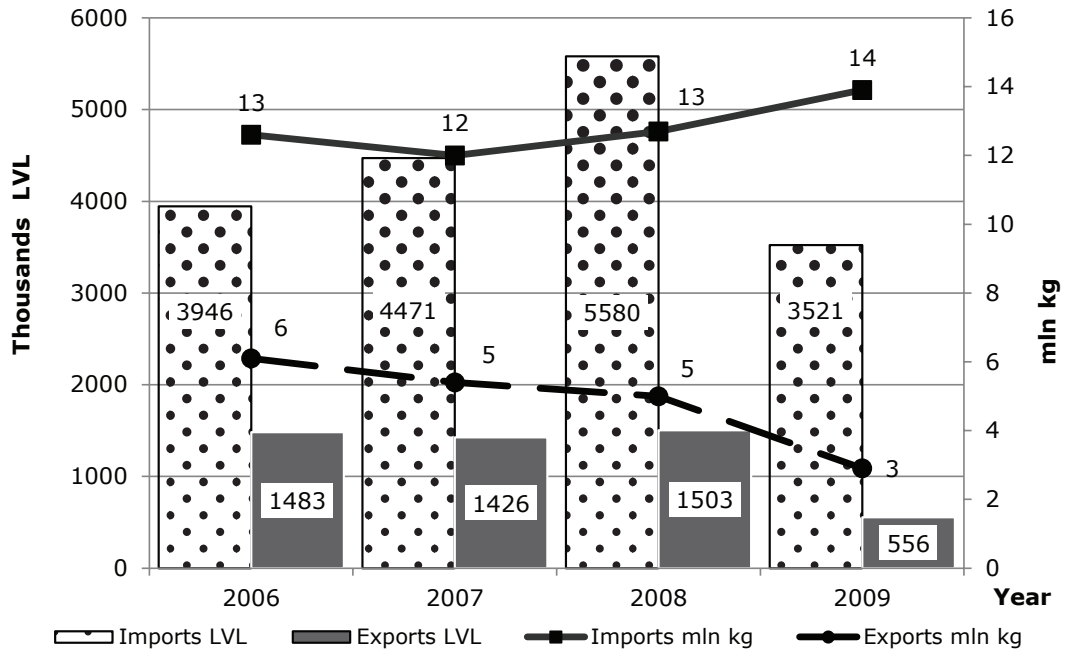
The largest planted area in Latvia belongs to the pear variety 'Belorusskaya Pozdnaya', which plantations occupy 45.9 hectares or 30% of the total area of pear plantations. The second largest plantation area belongs to the variety 'Souvenir' – 16.1 hectares or 10.4% of the total area. In terms of number of trees, the pear variety 'Belorusskaya Pozdnaya' is the most popular, accounting for 37% of the total number of pear trees, followed by the variety 'Souvenir' with 12%.

A significant indicator is the average yields (Figure 2).

Changes in the planted area of strawberries occur every year, since part of these plantations has to be replanted; thus, changing the total area as well. Often business people do not replant the whole area – only part of it – to make a decision on expanding their plantations of strawberries next year.

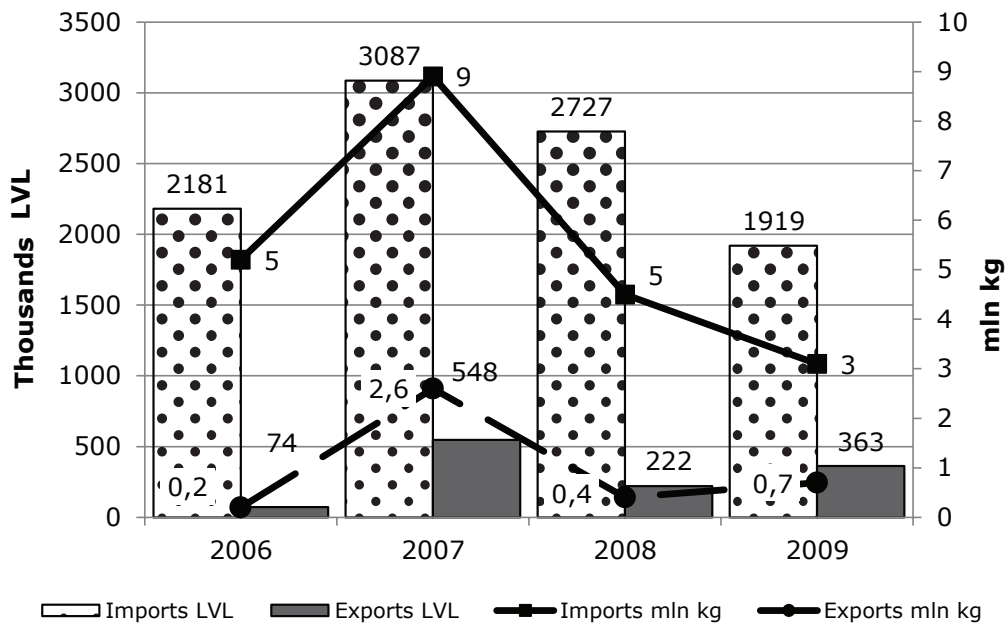
In relation to changes in the planted area of fruit and berries, the total output of these products has also to be considered.

A decline in total output of fruit and berries was observed along with a decrease in the planted area.



Source: authors' construction based on the data of Latvian State Institute of Agrarian Economics (LVAEI)

Fig. 4. Value (LVL) and volume (mln kg) of imports and exports of apples in Latvia between 2006 and 2009



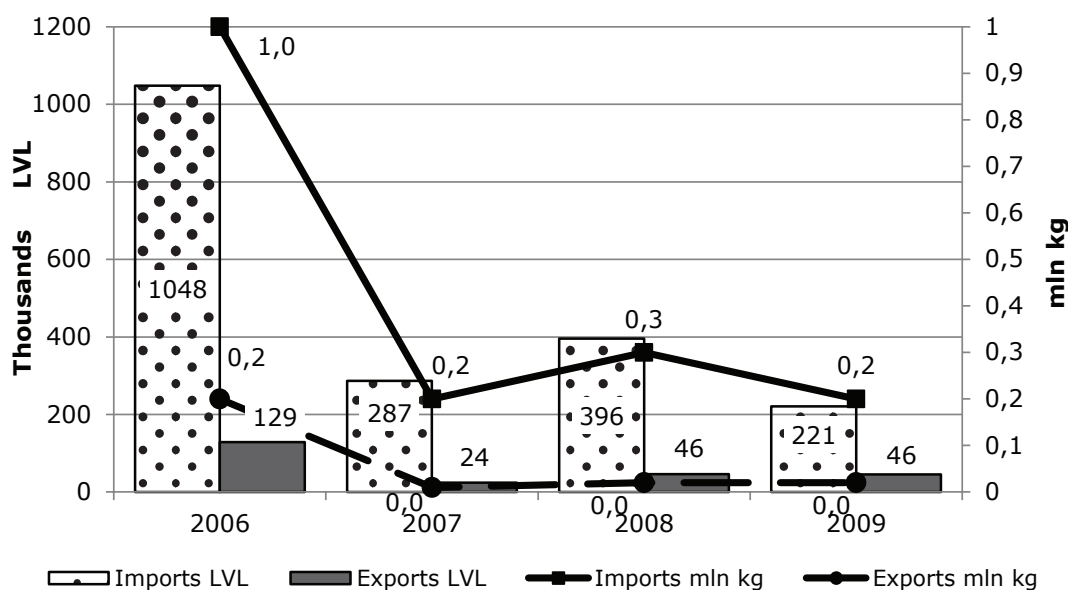
Source: authors' construction based on the LVAEI data

Fig. 5. Value (LVL) and volume (mln kg) of imports and exports of pears in Latvia between 2006 and 2009

Although a quite stable trend was observed in the planted area of fruit and berries from 2000 to 2006, it cannot be attributed to total output. Over the observed period, the year 2002 was the most favourable one, when the total output reached 64 thousand tons, while in 2010, this indicator was the lowest; but it has to be taken into consideration that the planted area decreased by 46%.

The year 2004 was a lean year, and the total output decreased to 17.8 thousand tons.

The highest average yield of fruit and berries was registered in 2002, when 4.8 tons were harvested per hectare, whereas in 2004, the average yield decreased to 1.4 tons per hectare due to unfavourable weather conditions. During the period of 2006-2010, the highest yield was registered in 2008, when 4.4 tons of fruit and



Source: authors' construction based on the LVAEI data

Fig. 6. Value (LVL) and volume (mln kg) of imports and exports of strawberries in Latvia between 2006 and 2009

berries on average were harvested per hectare, while in 2010, a decrease of 64% was observed compared with 2008. The change was caused by the weather conditions in 2010, as there was a draught and, therefore, the yields of fruit and berries were lower.

Yet, this indicator has to be analysed not only within the overall trend, but broken down by crops.

The average yield of apples tended to increase until 2008, reaching 5.6 metric tons per hectare, while in 2009, the yield declined by 45%, which can be explained by a decrease in the planted area by a fifth in the corresponding period as well as by the impact of weather conditions.

Yet, an increase in the average yield of pears 2.6 times in 2009 compared with 2008 indicates on better management of pear plantations, since the planted area of pears decreased by 100 hectares in 2009.

The highest average yield of strawberries was registered in 2008, i.e. 5.5 tons per hectare, while a 100 hectare decrease in the planted area in 2009 caused a decline in the average yield by 63%; thus, reaching 2.1 tons per hectare.

Considering the percentage distribution of the planted area of fruit and berries, it is understandable that in the period of 2006-2009 apples accounted for 73-89% of the total output of fruit and berries, while the share of pears was 3%. The share of strawberries was 5% in 2006, while in 2009, it decreased by 1-4 percentage points.

Among other crops of berries, a large share belonged to red and black currants – 11% in 2006, while in 2009, it was only 0.2%, which shows a small demand for this crop on the market; resulting in liquidation of these plantations.

It is important to identify potential sales markets and the present situation on the market for development studies of the industry.

From 2006 to 2009, the imports of apples tended to increase in Latvia; yet, the beginning of the economic

crisis brought a decrease in this indicator. In 2009, the value of imported apples exceeded the indicator of exports 6.3 times, indicating that local apple producers do not meet the local market demand. It is an interesting fact that since 2007 the value of imported products has declined, while their volume has grown, indicating that products are supplied to consumers at lower prices.

Apples are mainly imported from Poland, Italy, Spain and other countries but exported to Estonia and Russia.

The imports of pears have decreased since 2007. In 2009, there was a decrease of LVL 808 thousand in the value of pear imports compared with 2008, while the value of pear exports rose by LVL 140 thousand or 39%. The volume of sold pears also increased by 0.3 million kilograms.

The overall trends indicate that the volumes of imported products decrease; whereas their exports increase. It is viewed positively, as local producers become integrated on the world market.

Pears are mostly imported from Lithuania, Poland, and Germany; while the most important indicators of exports are related to the Baltic States.

A different situation was observed for the indicators of exports and imports of strawberries in the period of 2006-2009.

The largest decrease in imports of strawberries in terms of volume by 0.19 million kilograms and in terms of value by 73% was observed in 2007 compared with 2006. In 2008, the indicators increased and the value of imported strawberries rose by 38%. Yet, due to the crisis, demand decreased, and the value and volume of exported strawberries declined as well.

In general, one can conclude that the imports of apples, pears, and strawberries significantly exceed the exports of these products in Latvia, which justifies a need for further studies in this field and an assertion that Latvia's business people engaged in growing these

fruit and berries have potential possibilities to increase their production; thus, improving the export indicators.

Conclusions

1. The area of fruit and berry plantations in Latvia has been volatile over a ten-year period, reaching the highest level in 2006, while a significant decrease in the area of plantations was observed until 2009; the most essential factor was the liquidation of plantations due to their old age without restoring them.
2. The total output of fruit and berry has declined since 2005 due to a decrease in the area of their plantations; the lowest production being observed in 2004 due to unfavourable weather conditions.
3. Yet, the average yields of fruit and berries are different; the highest average yield was obtained for apples; whereas cherries had the lowest average yield.
4. The volumes of import of fruit and berries significantly exceed those of exports in Latvia, which points at the possible development perspectives of the fruit-growing industry in the future.

Bibliography

1. Dimza, I., Gross, A., Rubauskis, E. (2008). Soil Management System Including the Use of Simazine and Nitrogen Fertiliser in Orchard. *Proceedings of the International Scientific Conference "Sustainable Fruit Growing: From Plant to Product"*, pp. 178-187.
2. Gailite, M. (2008). Augļu un dārzeņu ražošana ES valstīs (Fruit and Vegetable Production in the EU Countries). *Agropols*, Nr. 14, 32.-33. lpp.
3. Hazners, J. (2009). ES-27 zemēņu tīrgus (Strawberry Market in the EU-27). *Agropols*, Nr.10, 21.-22. lpp.
4. Hazners, J. (2008). Pasaules un Latvijas abulu un bumbieru tīrgus (Market of Apples and Pears in the World and Latvia). *Agropols*, Nr. 7, 23.-24. lpp.
5. Hazners, J. (2009). Zemenes – paterins, tirdzniecība, politika (Strawberries - Consumption, Trade, Politics). *Agropols*, Nr. 11, 21.-22. lpp.
6. Juhnevica, K., Seglina, D., Krasnova, I., Skudra, G., Klava, D., Skudra, L. (2009). The Evaluation of Apple Quality during Storage at Modified Atmosphere. *Journal Chemine Technologija*, 3 (52), Kaunas, Lithuania, pp. 30–37.
7. Kampuss, K., Strautina, S., Laugale, V. (2009). Influence of Climate Change on Berry Crop Growing in Latvia. *Acta Horticulturae*, 838, pp. 45-49.
8. Morocko, I., Fatehi, J. (2009). Transformation of *Gnomonia Fragariae*, the Cause of Strawberry Root Rot and Petiole Blight, with GFP Gene and the Study of Host Infection and Colonisation. *IOBC/WPRS Bulletin*, 42, pp. 127-130.
9. Skrīvele, M., Kaufmane, E., Rubauskis, E., Ikase, L., Strautina, S., Ruisa, S., Blukmanis, M. (2008). Overview of Fruit and Berry Growing in Latvia. *Proceedings of the International Scientific Conference "Sustainable Fruit Growing: From Plant to Product"*, pp. 5-14.

Optimisation of Grain Farms in Latvia

Oskars Valainis, MBA; **Andra Zvirbule-Berzina**, Dr.oec., associate professor
Faculty of Economics, Latvia University of Agriculture

Abstract. The aim is to create an economic optimisation model - a computer program that can be used to improve the work of grain farms. This model uses mathematical equations to calculate the most optimal technology, which needs to be used to maximise the farms profits. The data on grain farms machinery and equipment are inserted into the program, adding the data on the machinery and equipment value, maintenance costs, depreciation costs, usability term, and the average fuel consumption in kilograms per hour. When an agricultural machine is paired with equipment the working width of which is known, the program calculates the productivity of this unit in hectares per hour depending on the working speed. It is possible to calculate the costs of one particular agricultural action per hectare based on these data. The cost of seeds, herbicides, fungicides, and fertilisers are also taken into consideration. Depending on the technology, the costs of the whole grain growing process differ from each other and they are connected with the agricultural land that is used for grain production. It is also possible to use this economic optimisation model to plan an additional field area increase and probable influence on the farm profit. It also lets the user see the field area at which the technology, that is being used now, becomes less efficient than another, if the field area is increased. As a result, this model gives any grain farm the possibility to analyse the current situation on the farm and see the results produced by the currently chosen technology as well as to plan the future and see how a field area change affects the farm economic situation and which technology would be better to use. After the input of the data into the model, the three technologies chosen proved that each one is effective only in a certain range.

Key words: grain production, economic optimisation model of grain farms, agricultural technologies.

JEL code: Q12

Introduction

Agricultural sector has always been one of the important sectors in Latvia's economy constituting 1.7% of the Gross Domestic Product on average or LVL 216 million in 2010 and, most importantly, employing one tenth of Latvia's workforce. The aim of this paper is to show a way to improve and rationalise the work of every grain farm in Latvia, showing how to use the available resources (agricultural machinery, seeds, workforce, chemicals, land etc.) more efficiently. It is essential that every grain farm uses its resources efficiently to maximise the profits and grain output of the farm, and improve the quality of grain. To analyse every grain farm, an economic optimisation model is used to calculate the most efficient way of working that produces the highest income and least costs per hectare.

The hypothesis is that the work of every grain farm can be improved using this economic optimisation model. The aim of this thesis is to build a working economic optimisation model for grain farms in Latvia. There are several tasks that had been set in order to build a working optimisation model: to analyse the grain production sector in Latvia; to describe the technologies and machinery used in grain production; to analyse the work of grain farms in Latvia; and to build a working economic optimisation model of Latvian grain farms. Research methods applied: monographic, data grouping, analysis, synthesis, graphic, and optimisation. The main information sources used in this thesis are: annual reports and reviews of the Ministry of Agriculture of Latvia; database information on agricultural sector in Latvia of the Central Statistical Bureau of Latvia; scientific literature and consultations with the Research Institute of Agricultural Machinery

of Latvia University of Agriculture agency; laws and regulations of the Republic of Latvia, publicly available documentation and information available at Latvian Rural Advisory and Training Centre, information on grain prices from Elagro Ltd and Latraps Ltd, and technical description and prices in 2011 of agricultural machinery from Latvia agricultural machinery trade companies.

Research results and discussion

There have been several studies in the recent years regarding the farm optimisation and they have concentrated only on specific types of work or equipment. In 2010, Nikolajs Kopiks and Dainis Viesturs have published an article "Research into Models of Choice of Tractor Aggregates" where the main focus is laid on finding the most efficient tractor for a specific type of work. The authors have developed an economic-mathematical model for choosing the most efficient aggregate and tractor combination. In other articles, they have concentrated on tractor fleet changes over the years (2000-2007) and meeting the existing agricultural requirements. There have been no studies in Latvia, which integrate all of the processes that any agricultural enterprise shall deal with in one optimisation model for the grain production process. The economic optimisation model of grain farms incorporates all the machinery, fixed and variable costs, and material costs, thus allowing the owner of the farm to calculate the future expenses and profits.

Using conventional technology, crop production begins in the autumn with soil preparation, which helps combat weeds, followed by ploughing, which helps improve soil fertility, and thus it is easier to provide water, air, and

nutrients access and flow. Depending on soil composition and characteristics, every 3 -5 years sub-soiling should be done, if necessary. In spring, the field should be treated with the cultivator and if contaminated with perennial weeds, there is a need of pre-cultivation with a paw or spring cultivator. During field fertilisation, it is necessary to choose a combination of agricultural machinery, which has the least impact on soil, doing so it is less compacted and the fertiliser is given in the optimum depth of soil. Intensive technologies (fertilisation, direct seeding with fertilisation, spraying, grain harvesting, grain cleaning, and drying) and combined agricultural units are economically viable for use only in large volume areas and powerful tractors are required in order to be able to work effectively with this machinery.

Note that the selected technology shall be such as to maximise the use of farm machinery, carry out all the work and respect all agro terms. Agro terms are very important in agriculture because they determine when the best conditions would be to do a certain type of work, and the quality of the work would be the highest, increasing the grain productivity per hectare. For example, being late for one day in respect with the set agro term for seeding will reduce the productivity per hectare for about 0.05%, and being late for one day for harvest, it reduces the mass of grain harvested per hectare for about 1.68%. For this reason, technology and machinery should be chosen according to the area of cultivation and crop type; the greater the area of cultivation, the more powerful tractors and agricultural machinery - with a larger working width is needed. If the farm has limited tractor units, there is a danger that the agro terms would not be met or soil treatment would not be carried out sufficiently using conventional tillage and sowing technology because the tractor has a greater load when compared with the use of intensive technologies, where the number of passes of a tractor is smaller and several agricultural works can be combined and done in the same pass.

The use of combined machinery is friendlier to the environment in terms of a number of ways:

- 1) technological process efficiency reduces the fuel consumption, and thus, lowers the amount of harmful emissions into the atmosphere;
- 2) the merging of technological processes reduces the passes of the tractor, and the associated adverse soil compaction and structural damage. Soil compaction negatively affects crop yields and the grain harvest is 15-20% less in compaction places of tractor and agricultural machinery wheels. When using a combination of agricultural machinery, it is possible to increase crop yields, as the number of passes is reduced;
- 3) accurate fertilisation and seeding ensure the fullest material use and smaller losses by leakage with water and less pollution of water bodies;
- 4) with preserving tillage (without ploughing) using the combined machinery as well as direct seeding, the natural surface of the soil is maintained, and the natural fertility of the soil-forming processes (organic matter content increases, increase in the number of worms) would reduce water and wind-induced soil erosion, thus, increasing its water capacity.

Grain farms optimal economic model enables one to view currently the most popular Latvian agricultural

technologies of grain-growing and machinery used, and shows the possibility of their use in the most rational way, depending on land area, thus, providing a detailed overview of each farm operating costs as well as providing recommendations for improvement. This model can be used to understand, whether the technology used is the most effective as well as how the costs would change if the land area were increased by one hectare. The model could also be used to see when one technology becomes more profitable than the other does, and at what land area the applied technology has to be changed to have the lowest costs.

Information on agricultural machinery required for each of the selected technologies was collected in order to develop a universal grain farm economic model. This technical information (machinery working width, working speed etc.) was obtained from a number of agricultural machinery sales companies in Latvia as well as using the LLU RIAM data. The agricultural machinery trading company data for each type of machinery were used to calculate the average sales prices. The prices used in the calculations refer to the machinery produced in the European Union and deserving a valid EU Certificate of Conformity.

An algorithm has been used to design the grain farms optimal economic model, which connects the characteristics of tractor and the attached machinery, and automatically calculates the aggregate productivity, fuel consumption, depreciation, and maintenance costs per hectare. Knowing the total costs and summing them, one can calculate the costs per hectare for every type of work. Costs of materials such as seeds, fertilisers, herbicides, pesticides, and insecticides are calculated separately by selecting specific technology and they are calculated in Latvian lats per hectare. Having obtained these costs, they are summed together and divided by the average productivity of the usable land (t/ha), thus, one gets variable costs in lats per tonne of grain produced. In addition, it allows following whether it is possible to meet the agro terms. Agro terms are compared with the seasonal aggregate load, which is calculated with respect to the agro terms. Depending on the result obtained, the computer model shows if the agro term is exceeded and by what percentage. In addition, there are four colour indicators, where the bright red colour indicates that the agro term is significantly exceeded, light red - exceeded but in the permissible limits (10%), grey - unit fits into the optimum load range (80% - 100% load), and black - load is below 80%. The user should pay very close attention to these indicators, because there is a risk of reduced crop yields or increased costs if the agro terms are not met.

The agricultural machinery needs to be paired to a tractor with enough power to be able to reach the best performance and to work within its optimal power range. For this purpose, the model includes a system that does not allow the cost calculation (in addition, notifying with red coloured cell and an exclamation mark), if the tractor does not meet the power needs of the machinery.

It is also possible to change these variables manually: the hourly rates of workforce, fuel price, grain price per tonne, the working width of the plough, tractor seasonal workload, working speed of the combine, the number of

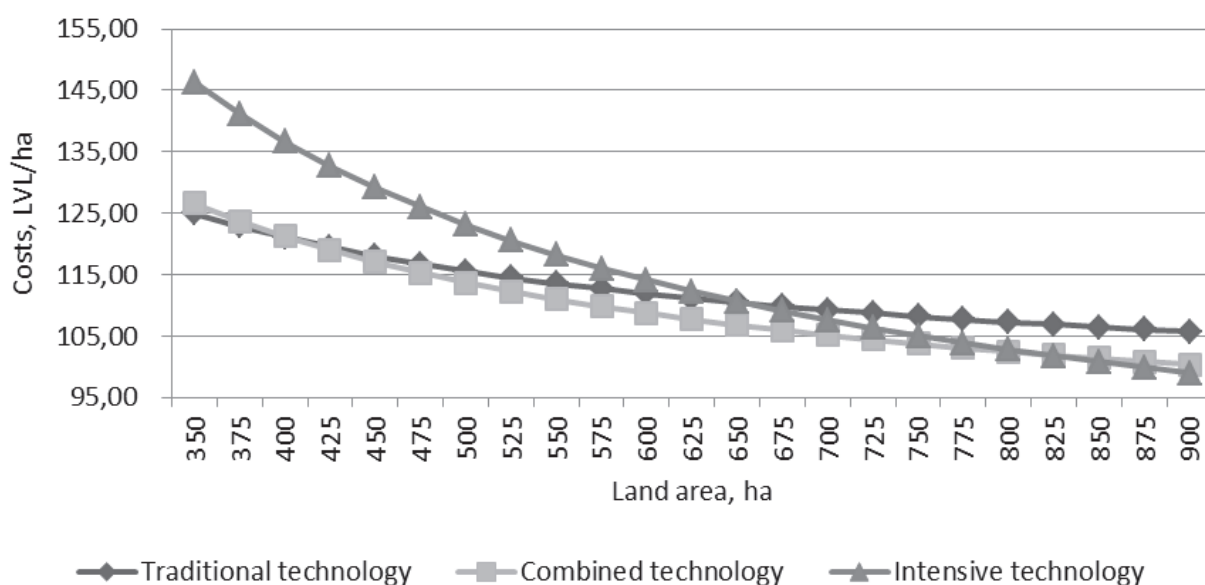


Fig. 1. Grain production costs of one ton compared with the land area for each technology, LVL/ha

working hours per day, and grain yield, thus, making the economic modelling as precise as possible.

This economic model allows calculating the most feasible technology for a particular grain farm for the actual used land area and machinery as well as planning the grain production costs if there are any changes (new machinery, increase of the land area) planned in the future. For example, what effect a purchase of a more powerful tractor leaves on agro terms and costs or what impact the increase of the land area leaves on the costs as well as whether the use of the available machinery will be sufficient to comply with the agro terms if the used agricultural land is increased. This model gives a choice of three different technologies and a comparison among them, based on the machinery available and the land area. The model can be adapted to a wide range of crops.

Three different technologies were chosen for this model. Each of these technologies requires a different type of machinery, tractor power as well as the type and number of operations. For example, the traditional technology, which includes both the soil peeling, and ploughing and cultivating is more suitable for smaller farms with less land area, while intensive technologies, where large combined aggregates are used, require much higher power tractors and a much larger land area to be sufficient. Note that it is possible to increase the crop yield per hectare using intensive farming techniques compared with traditional. In the economic optimisation model, there are three technologies used, which include the following technological processes and machinery:

1. Traditional technology (yield of 3.5 t/ha): shelling (disc harrows), ploughing (reversible plough), cultivation (spring tine cultivator), seeding (mechanical seeding drill), fertilisation (centrifugal fertiliser spreader), spraying (tractor mounted sprayer), harvesting (contractor), grain cleaning and drying (service from outside), handling (front loader for tractor), and transportation (farm trailer).

2. Combined technology (yield of 4.5 t/ha): ploughing (reversible plough with soil packer), seeding (combined seeding drill), fertilisation (centrifugal fertiliser spreader), spraying (tractor mounted sprayer), harvesting (contractor), grain cleaning and drying (service from outside), handling (front loader for tractor), and transportation (farm trailer).
3. Intensive technology (yield of 6 t/ha): fertilisation (centrifugal fertiliser spreader), direct seeding (direct seed drill), spraying (trailed sprayer), harvesting (grain harvesting combine), grain cleaning and drying (service from outside), handling (front loader for tractor), and transportation (farm trailer).

The material costs (seeds, fertilisers, herbicides, pesticides, and insecticides) for each technology per hectare are different. Using the above-mentioned technologies, the material costs per hectare of the combined technology are 14% higher and 41% higher for the intensive technology if compared with the traditional technology. However, if the costs are compared with one ton of grain produced, then, with respect to traditional technology, the combined technology uses 12% less and the intensive technology - 18% less materials per one grain ton produced.

When the data (necessary machinery for each technology, the price of materials and the required quantity per hectare, the employee hourly rate, the estimated average grain yield for each technology, fuel price) is entered into the model, the farm economic optimisation model calculates grain production cost per ton for each technology, with respect to the size of the land area. This information is outlined in Figure 1, where it is possible to compare all three technologies.

The following machinery was used in this calculation:

1. Traditional technology: 60 HP tractor with a front loader; 110 HP tractor; disc harrow with a working width of 3 m; 3 furrow reversible plough with inter-furrow distance - 45 cm; spring tine cultivator with a working width of 4 m; centrifugal fertiliser spreader;

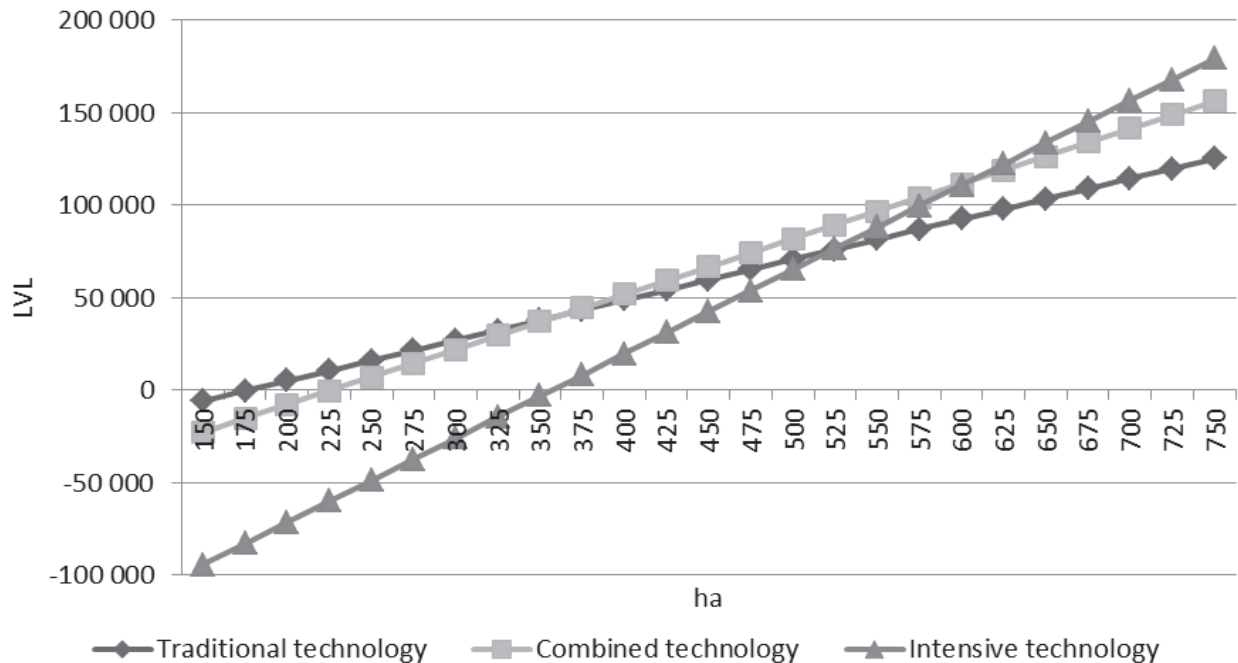


Fig. 2. Profit compared with land area for each technology, LVL

mechanical seed drill with working width of 4 m; tractor mounted sprayer with a 12 meter working width; two axle farm trailer with 15 tonnes capacity; contractors and services from outside - harvesting, grain cleaning and drying.

2. Combined technology: 100 HP tractor with a front loader; 185 HP tractor; 5 furrow reversible plough with inter-furrow distance of 50 cm and a soil packer; centrifugal fertiliser spreader; combined mechanical seed drill with a working width of 5 m; tractor mounted sprayer with a 12 m working width; three axle farm trailer with 17 tonnes capacity; contractors and services from outside - harvesting, grain cleaning and drying.
3. Intensive technology: 135 HP tractor with a front loader; 185 HP tractor; 4 furrow reversible plough with inter-furrow distance of 45 cm (used once every four years, to improve soil fertility and for perennial weed control); a centrifugal fertiliser spreader; direct seeding mechanical drill with working width of 4 m; trailed sprayer with a 24 m working width; grain harvester with header width of 6 m; three axle farm trailer with 23 tonnes capacity; contractors and services from outside - grain cleaning and drying.

In the technology comparison, one can see which technology has the lowest costs for every land area. Using the traditional technology, grain production generates the lowest costs up to 415 ha. Combined technology costs are the lowest compared with other technologies if the land area ranges from 415 to 825 ha, and the intensive technology becomes cost effective at higher land areas - starting from 825 hectares. The use of traditional technology in agricultural grain production is beneficial for only relatively small-cultivated land areas, and intensive technology is most beneficial if the

agricultural land area is greater, because it needs more expensive and more powerful machinery.

The economic model gives the user the possibility to calculate the potential future profits of each of the three selected technologies, if one can predict the future grain price per ton, and to see at what area of land which technology would be the most profitable. It is also possible to model future situations if new machinery would be purchased. By changing the machinery type (replacing the old with a new one), the model calculates the profit to be expected, if the farm decides to purchase a new agricultural unit.

It is possible to predict the theoretical future profit for each technology using the three technologies and machinery mentioned before.

The traditional technology generates the most profit from 160 to 360 ha, the combined technology - from 360 to 605 ha, and the intensive technology - starting from 605 ha. Although, the traditional technology had the lowest costs up to 415 ha, the greatest financial benefits can be acquired only up to 360 ha; by further increasing the cultivated land area it is possible to obtain a higher profit, if the combined technology is chosen. However, the combined technology provides the maximum profit only up to 605 ha and the intensive technology becomes more profitable. Although, the intensive technology production costs per one ton of grain are the lowest just starting with 815 hectares of land area, it provides the highest profit at 605 ha of the land area and can be explained by the fact that the use of this agricultural technology allows achieving the highest grain yield from one hectare of land - 6 t/ha, and the grain sales volumes are significantly higher than for the combined technology where the grain yield is 4.5 t/ha.

Each year, the average grain yield is different and the economic model gives the farmer a possibility to calculate

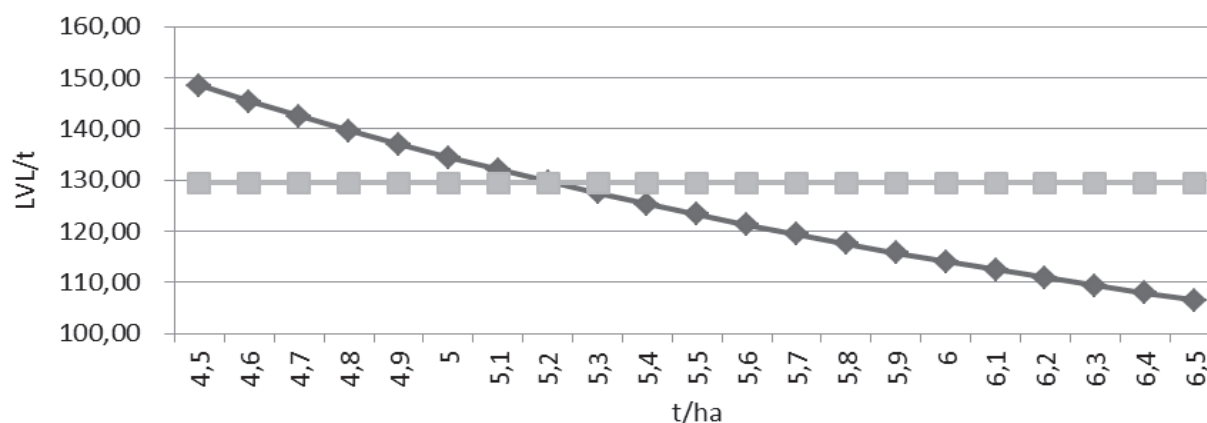


Fig. 3. Production costs per one grain ton at different yields, LVL/ha

the production costs per one ton of grain in the event of changes in grain productivity, which can be caused, e.g. by bad weather or missed agro terms. These changes may be calculated at a particular land area, so this option is intended for both the farm's future cost volatility forecasting and risk assessment of the farm future plans to acquire additional agricultural land, equipment, or buildings. It is possible to predict if it is possible to repay the purchased equipment, land, or buildings in the event of lower yields knowing the farm modernisation or expansion costs.

This example uses the intensive technology as well as the machinery used in the previous examples and the land area of 600 ha. Optimum yield, with this technology is 6 t/ha. Productivity changes affect the production costs per one grain ton. If the average grain price is 129.50 LVL/t, then the break-even point has been reached at a yield of 5.2 t/ha. Such method allows the farm to predict potential risks and plan future farm modernisation.

To find the break-even point at which the farm does not have profit nor suffer losses, it is possible to use the goal seek function (Microsoft Excel - Goal Seek), which finds the land area at which the profit of the farm is equal to zero. It possible to see the theoretical minimal land area required for grain production to make the farm feasible and profitable. For each of the three technologies, the break-even point was calculated using the average price of wheat – 129.50 LVL/t. The traditional technology with the necessary equipment reaches the break-even point at 176,8 hectares, the combined technology reaches this point at 226.1 ha of land, and the intensive technology - at 356.7 ha of land.

Conclusions

1. It is possible to choose a number of agricultural technologies for grain production, depending on the land area, the financial resources available, and the desired yield.
2. The machinery necessary for the traditional technology is simpler, less powerful and less expensive; the combined technology equipment costs are moderate and productivity - higher than the traditional technology equipment, while the

intensive technology requires powerful and expensive agricultural machinery with high productivity.

3. The grain farm economic optimisation model could be applicable for any crop growing farm evaluation and optimisation as well as future planning. This model allows comparing different agricultural technology advantages using the machinery in possession.
4. The model could be used to compare a number of new machinery options and determine the most cost-effective options and those complying with the optimal agro terms.
5. To find out whether the existing technology used on the farm guarantees the maximum profit, if an increase of the land area is planned, the model can be used to evaluate this technology taking into account the projected area in the future.
6. Intensive farming technology provides the maximum profit if the farm has large areas of land as well as grain production costs are the lowest; besides, the use of intensive farming technology reduces the amount of used chemicals, the use of machinery, and fuel per one ton of grain produced.

Proposals

1. Small grain production farms in Latvia should amalgamate with other similar farms, re-specialise to some other types of agricultural production, or sell or lend the land in their ownership to larger farms, thus, making the grain production become more efficient and improve the yield of grain per hectare. Large farms are economically beneficial to use the intensive farming technologies, which ensure the highest productivity rates.
2. A special adapted version of this model has to be put in the Latvia Rural Support agency website, allowing each farmer to plan simply, quickly, and easily his or her economic development and future opportunities of the farm.
3. Latvia Rural Support Service should do a voluntary assessment of Latvia grain farms with the help of the economic optimisation model, and draw recommendations for their improvement – showing technology that is best suited for a particular farm, changes to be made for technical provision, required

improvements to achieve maximum profits and minimum costs, and material use per ton of grain produced as well as attract specialists to draw recommendations for the correct use of materials and providing advice to the farm owners on ways to increase grain yields. This voluntary assessment should be done with the help of the European Union funding, and this task could be entrusted to Latvia's universities and their students.

4. The economic optimisation model of grain farms should be further developed to be able to incorporate more variables such as the possibility of dividing the area of the land by its fertility. Such a model should be made as software that can be distributed to the public and private institutions engaged in agricultural consultancy. Funding for this project would have to come from the private sector such as agricultural machinery trade companies.

Bibliography

1. Arvids Vilde, Dr. habil. sc. ing., Adolfs Rucins, Dr. sc. ing. (2009). *Arklu izvele (Choice of Ploughs)*. Retrieved: http://www.armuss.lv/resources/files/noderinfo/arkla_izvele.pdf. Access: 17 October 2011.
2. BASF (2009). *Augu aizsardzibas lidzeklu rokasgramata (Manual of Herb Protection Materials)*, 128 lpp.
3. Boruks, A. (1999). *Graudi: daudzumi, izmaksas, cenas (Grain: Volumes, Costs, Prices)*. Latvijas Lauksaimniecibas universitates Skriveru zinatnes centrs, 202 lpp.
4. Central Statistical Bureau of Latvia. (2011). CSB databases. Retrieved: <http://data.csb.gov.lv/dialog/statfile16.asp>.
5. Kopiks, N., Viesturs, D. (2008). The Choice of an Optimum Ploughing and Sowing Aggregate for Different Amounts of Work. *Engineering for Rural Development. Proceedings of the 7th International Scientific Conference*, pp. 118-123.
6. Kopiks, N., Viesturs, D. (2010). Research into Models of Choice of Tractor Aggregates. *Engineering for Rural Development. Proceedings of the 9th International Scientific Conference*, pp. 139-143.
7. Lacgalvis, E. (1996). *Augkopibas tehnologiju masinu sistema (Machinery System of Crop Production Technologies)*. Epro V, 37 lpp.
8. Latvian Rural Advisory and Training Centre (2010). *Laukaugu razas prognozesanas rezultati 2011. gada (Estimated Crop Yields in 2011)*. Retrieved: http://www.llkc.lv/upload_file/400304/Laukaugu%20ra%C5%BEas%20prognoz%C4%93%C5%A1anas%20rezult%C4%81ti%202011.pdf. Access: 17 October 2011.
9. Latvian Rural Advisory and Training Centre (2010). *Tehnisko pakalpojumu cenas Latvija 2010. gada, Ls (Contractor Prices in Latvia, 2010)*. Retrieved: http://www.llkc.lv/upload_file/400458/Tehnikas_pak_cenu_apkopojums_2010.pdf. Access: 17 October 2011.
10. Latvijas Lauksaimniecibas konsultaciju un izglitiba atbalsta centrs (2001). *Smidzinataju rokasgramata (Field Sprayer Guide)*, 144 lpp.
11. Ministry of Agriculture of the Republic of Latvia (2010). *Kopeja lauksaimniecibas politika 2020 perspektiva (Agricultural Policy in Perspective of 2020)*. Retrieved: http://www.zm.gov.lv/doc_upl/ZMPoz_Nr1_KLP%282%29.pdf. Access: 3 October 2011.
12. Ministry of Agriculture of the Republic of Latvia (2010). *Latvijas lauksaimnieciba un lauki 2011 (Latvian Agriculture and Rural Areas 2011)*. Retrieved: http://www.zm.gov.lv/doc_upl/LS_gada_zinojums_2011.pdf. Access: 13 October 2011.
13. Ministry of Agriculture of the Republic of Latvia (2010). *Zemkopibas ministrijas 2010. gada publiskais parskats. (Ministry of Agriculture Public Review 2010)*. Retrieved: http://www.zm.gov.lv/doc_upl/ZM_publ_parsk_2010.pdf. Access: 3 October 2011.
14. SUDAT Information System. (2011). *Latvijas lauku saimniecibu uzskaites datu tikls*. Retrieved: <https://sudat.lvaei.lv/Login.aspx?ReturnUrl=%2fDefault.aspx>.
15. TEKA Kom. Mot. Energ. Roln. (2009). *Optimisation of Fuel Consumption during the Harvest of Wheat*. Retrieved: <http://www.pan-ol.lublin.pl/wydawnictwa/TMot9/Spokas.pdf>. Access: 13 October 2011.
16. Vilde, A. Pirs, E. (2008). Criteria for the Estimation of the Efficiency of Agricultural Tractors in Field Crop Cultivation. *Engineering for Rural Development. Proceedings of the 7th International Scientific Conference*, pp. 147-153.

Polish Agriculture Against Selected States of the European Union¹

Aleksandra Wicka², PhD

Faculty of Economics, Warsaw University of Life Science-SGGW, Poland

Abstract. The aim of the article is to present selected issues concerning the economic situation of Polish agriculture against other countries of the European Union. A comparative study of the statistical data was conducted for the years 2005-2010. The importance of agriculture in the Polish economy is still significant but decreasing. The contribution of agriculture in generating value added in 2009 amounted to 3.3%. This is by 0.9 percentage points less than in 2005. This sector of economy has a greater significance when one takes employment into account. Agriculture is the basic source of income for 15% of workers, and considering agriculture as an additional source of income, the contribution amounts to almost 28%. Polish agriculture is still characterised by a significant farm fragmentation and high employment in agriculture. It hinders accumulation of capital and investing in agriculture. The agricultural model of the European Union's highly developed states does not seem achievable in Poland earlier than in the next 30 years.

Key words: agriculture, resources, marketable value.

JEL code: Q10

Introduction

The aim of the article is to present selected issues concerning the economic situation of Polish agriculture against other states of the European Union with special consideration of:

- changes in resources of farms during the years in question,
- comparing the size and structure of production in farms,
- presenting the variability of prices of basic agricultural products and determining the share of commercialised production.

An analytical study of the available literature, review and analysis of secondary source data (the Central Statistical Office of Poland, Eurostat) were the main methods used in the study.

It has been concluded that Polish agriculture is characterised by a significant farm fragmentation. High employment in agriculture is closely connected with the fragmentation. The small average farm area and a relatively large number of people who shall live from working on such farms hinder accumulation of capital and investing in agriculture. More significant changes in that area will happen slowly, along with the process of generation exchange. Many of the farm owners will not find successors willing to keep a farm, which does not provide maintenance. Furthermore, small farms react weakly to market stimuli, because the majority of production is intended for own needs.

The significance of agriculture in Polish economy

The importance of agriculture in the Polish economy, as mentioned at the beginning of this treatise, is still significant but decreasing. The contribution of agriculture in generating value added in 2009 amounted to 3.3%. This is by 0.9 percentage points less than in 2005. The contribution of agriculture in generating national income

has not changed significantly from the year 2000. This sector of economy has a greater significance when one considers employment. Agriculture is the basic source of income for 15% of workers, and considering agriculture as an additional source of income, the contribution amounts to almost 28%. This indicates that the average productivity of working in agriculture amounts to only 22% of the average productivity achieved in the Polish economy, hence, the available income in agriculture per person is lower.

Because of the significant fragmentation and the related low profitability of an average farm, the level of technical equipment is lower than in the other sectors. The contribution of net fixed assets engaged in agriculture amounted to 5.5% (Table 1) of net assets in the economy. This remains in a visible disproportion with the number of employees and indicates an excess of workers on farms, and the resulting weak technical infrastructure of the work. This causes low work productivity in agriculture. One should note that the level of resource utilisation in agriculture exceeds 70%.

The process of technical farming equipment modernisation, largely co-financed by the EU resources, will not contribute to changing the proportions between the work and the capital in agriculture, because it only concerns farms that are larger and economically stronger. The number of such farms in Poland is estimated at 400-500 thousand.

Comparison of Polish agriculture and selected states of the European Union

Poland is one of the largest states among the 27 members of the European Union. It is difficult to compare all of these states, be it because of the size, differences in production structure, or different climates. A full comparison would exceed the available scope of the research, and would not generate useful conclusions for the issue in question. The comparison concerns four

¹ Publication financed from the resources of the Ministry of Science and Higher Education No. NN 310105239 ("Conditioning of Plant Cultivation Risk Limiting with the Use of Insurance")

² E-mail address: wicka@op.pl.

Table 1

Basic information on the significance of agriculture in the Polish economy

Specification	UOM	Year				
		2005	2006	2007	2008	2009
Contribution of agriculture in generating GVA	%	4.2	4.3	4.3	3.4	3.3
Contribution of employment in agriculture	%	16.1	15.7	15.0	14.7	15.0
Contribution of net fixed assets in agriculture	%	6.8	6.5	6.1	5.8	5.5

UOM-unit of measurement

Source: author's calculations based on the statistical data published in Statistical Yearbook of Poland 2010, GUS Warszawa

Table 2

Gross value added and agricultural contribution to generating gross value added in economy in the selected states of the EU

Country	UOM	Year				
		2005	2006	2007	2008	2009
France	million EUR	33818	32524	36060	34429	28911
Spain	million EUR	24423	22894	25490	24976	24292
Germany	million EUR	17290	17500	20700	19730	:
Great Britain	million EUR	14462	:	:	:	:
Poland	million EUR	9707	10193	11729	11832	10016
Agricultural contribution to generating values added in economy						
France	%	2.18	2.01	2.12	1.97	1.68
Spain	%	3.00	2.61	2.70	2.51	2.48
Germany	%	0.85	0.83	0.95	0.89	:
Great Britain	%	0.91	:	:	0.80%	:
Poland	%	4.51	4.26	4.31	3.72	3.63

": means no data

Source: Eurostat database

countries France, Spain, Germany, and Great Britain. Data from the Eurostat database have been used according to their availability. For certain values, the latest publications concern the year 2007. The Eurostat and national statistics data were excluded from the comparison because of the occurring differences.

Agricultural contribution to generating value added was the lowest in Germany and Great Britain, namely, 0.9%, followed by France – 2% and Spain – 2.5% (Table 2). Poland has the largest contribution rate of agriculture in economy among the presented states – approx. 4%. In the EU-27 as well as the euro zone, the agricultural contribution to generating gross value added in the economy amounted to 0.8% on average. In Poland, as the economy develops, agricultural contribution to generating value added will decrease to approx. 2.0-2.5%.

Farming land resources in Poland are comparable with the resources of Germany and Great Britain. France and Spain have approx. 10 million ha more. In Great Britain, meadows and pastures constitute 62% of agricultural lands, a majority of which is extensively located in the mountains. In Spain, the percentage of such lands reaches 52%. Agricultural land structure of France

and Germany is similar to the one observed in Poland (Table 3). The area of arable lands, on which the majority of agricultural production is conducted, amounts to approx. 12 million ha in Poland, Spain, and Germany. France, with almost 18 million ha of arable lands, is a definite potentate in this aspect; Great Britain has 6 million ha.

While land area is similar, employment in agriculture differs greatly. In Germany, the employment in agriculture is fourfold less than in Poland, sevenfold less in Great Britain, and twofold less in Spain (Table 4). The reasons for such significant differences in agriculture employment shall be searched in the history of its development. A significant amount of small farms was preserved due to the lack of jobs outside of agriculture in Poland, the state observed 50 years ago. In 2007, there were only 527 thousand farms in France, and their average area amounted to 52 ha. Similarly, in Great Britain, the number of farms amounted to only 249 thousand and their average area to 64 ha. Smaller farms can be found in Germany (46 ha) and Spain (24 ha) but still this is much more than in Poland, where with the applied calculation methodology, an average size of a farm amounted to 6.5 ha.

Table 3

Area of agricultural lands and arable lands in the selected states of the EU

Specification	UOM	Year		% of arable lands in agricultural lands
		2005	2007	
Area of agricultural lands				
France	thousand ha	27591	27477	
Spain	thousand ha	24855	24893	
Germany	thousand ha	17035	16932	
Great Britain	thousand ha	16130	15957	
Poland	thousand ha	14755	15477	
Area of arable lands				
France	thousand ha	18339	18302	67%
Spain	thousand ha	11937	11883	48%
Germany	thousand ha	11903	11890	70%
Great Britain	thousand ha	6114	6018	38%
Poland	thousand ha	11308	11756	76%

Source: Eurostat database

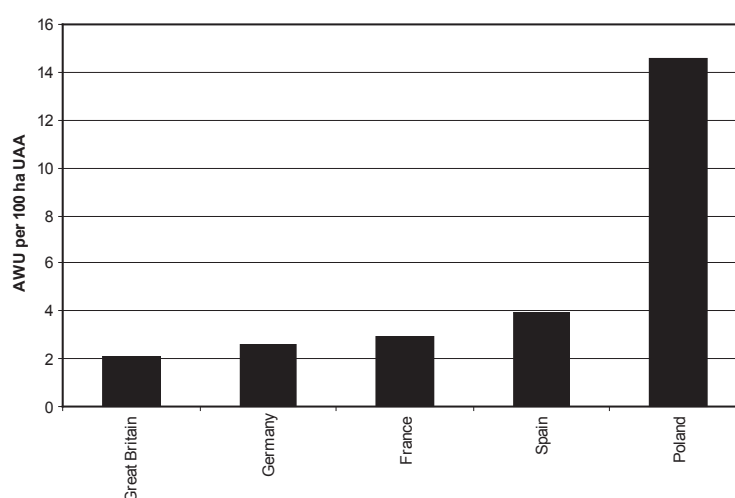
Table 4

Number of persons working in agriculture in the selected states of the EU

Specification	UOM	Year	
		2005	2007
France	thousand AWU*	855	805
Spain	thousand AWU	993	968
Germany	thousand AWU	643	609
Great Britain	thousand AWU	339	341
Poland	thousand AWU	2274	2263

* AWU – Agricultural work unit corresponding to work expense of 2120 h/year /in Poland/, in some countries different calculation basis is used

Source: Eurostat database



Source: author's calculations based on the Eurostat database data

Fig. 1. Employment level in agriculture in the selected states of the European Union

Table 5

Number of farms in the selected states of the EU and the percentage of farms with an area over 20 ha

Specification	UOM	Year		% of farms with an area of over 20 ha during	
		2005	2007	2005	2007
Number of farms					
France	thousand	567	527		
Spain	thousand	1079	1044		
Germany	thousand	390	370		
Great Britain	thousand	248	249		
Poland	thousand	2476	2391		
Number of farms over 20 ha					
France	thousand	309.31	296.28	54.5	56.2
Spain	thousand	211.10	212.85	19.6	20.4
Germany	thousand	173.06	167.30	44.4	45.2
Great Britain	thousand	121.16	120.48	48.8	48.4
Poland	thousand	117.48	125.01	4.7	5.2

Source: Eurostat database

Table 6

Average area of farms in the selected states of the EU and their average economic size

State	Average area (ha) during		Average economic size in ESU during	
	2005	2007	2005	2007
France	48.6	52.1	53.6	50.4
Spain	23.0	23.8	20.6	18.5
Germany	43.7	45.7	49.5	49.7
Great Britain	64.9	64.1	31.4	36.9
Poland	6.0	6.5	3.6	3.3

Source: Eurostat database

The level of employment presents the number of persons engaged in agriculture per 100 ha of agricultural lands. The higher the average employment level in agriculture, the harder it is to obtain a satisfactory level of income.

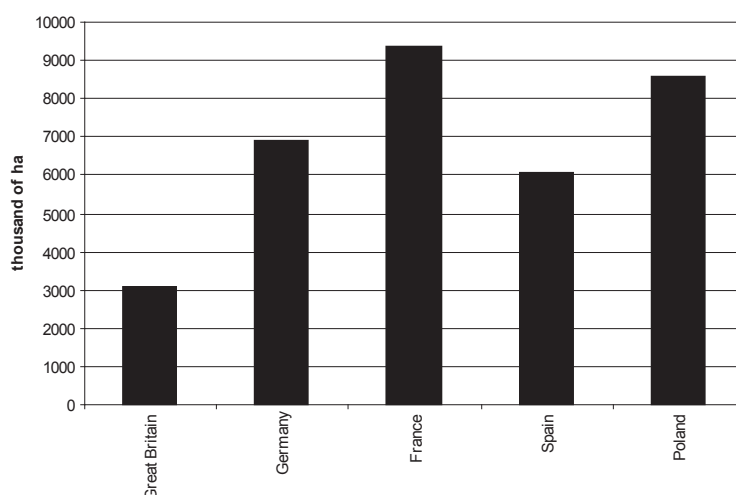
The average level of employment in Polish agriculture exceeded 14 persons (AWU) per 100 ha of agricultural lands, while in France, Great Britain, Germany, and Spain, the level of employment did not exceed 4 AWU/100 ha (Figure 1).

Larger farms, in which the percentage of production used for self-supply is very low, are the main suppliers of resources for processing and consumption. Table 5 presents the percentage of farms with an area exceeding 20 ha in the countries in question. In Poland, the percentage amounts to only 5.2%, while in Germany, Great Britain, and France, it exceeded or approached 50%. In Spain, where the acceleration of the economic modernisation process started after the accession to the EU in 1985, the percentage amounts to approx. 20%. In this context, one should note that the largest

farms create the demand for investment in agriculture, and the relatively large scale of activity often requires more external financial resources. Price and income risk insurance becomes an important issue under these circumstances. It is usually achieved through concluding agreements but insurances can also be applied (especially asset and production insurance). The development of contract and insurance market will influence the increase of large, highly productive farms.

Production

The magnitude of plant cultivation in the states in question was closely correlated with arable lands resources. Figure 2 presents the cultivation area for the most significant species of plants. France is the largest producer of cereal among these states with an area of 9.3 million ha. Poland is on the second place with 8.5 billion ha of cereal cultivation area. The smallest acreage of plant cultivation has been observed in Great Britain – approx. 3 million ha.



Source: author's calculation based on the Eurostat database data

Fig. 2. Cereal cultivation area in the selected states of the European Union

Table 7

Harvest of selected plants in the selected states of the EU

Specification	UOM	Year					
		2005	2006	2007	2008	2009	2010
Total cereal harvest							
France	dt/ha	70	68	65	73	75	71
Spain	dt/ha	22	30	39	36	29	33
Germany	dt/ha	67	65	62	71	72	67
Great Britain	dt/ha	72	73	66	74	70	:
Poland	dt/ha	32	26	33	32	35	32
Potato harvest							
France	dt/ha	422	402	454	436	438	398
Spain	dt/ha	259	288	282	262	312	289
Germany	dt/ha	420	366	424	438	443	400
Great Britain	dt/ha	437	408	397	428	444	:
Poland	dt/ha	176	150	215	198	192	179

": " means no data

Source: Eurostat database

France and Germany are potentates in sugar beet and rape cultivation. The cultivation area of these species is twice as large as in Poland (810 thousand ha). Spanish climatic conditions are not favourable for rape cultivation. Poland dominates in rye cultivation area, this is due to the fact that Poland utilises over 3 million ha of weak and very weak soil with a minor production potential. Rye, as the least demanding species, grows well on such soil, although the crops are low. These soils, however, are not suitable for cultivating more demanding species such as rape, sugar beet, or wheat.

Agriculture in the states in question, with the exception of Spanish agriculture, is much more productive concerning plant cultivation. The average cereal harvest in France, Great Britain, and Germany usually exceeded 7 tons per hectare, while in Poland and Spain around

3 t/ha (Table 3). Similarly, almost twofold differences were observed in cultivating potatoes. Poland usually obtained 20 t/ha on average, while in Germany, for instance, these harvests significantly exceeded 40 t/ha.

As to plants growing on better types of soil, i.e. sugar beet or rape, the differences in harvest in Poland and other countries were not as significant as observed for cereal or potatoes. In case of sugar beets, the harvest in Germany was by 30% on average larger than in Poland and in case of rape, it was 38%.

The harvest in France, Great Britain, and Germany was closely correlated. For instance, in 2007, in each of these countries, a decrease in cereal harvest occurred, while an increase was observed in Poland and Spain. These relations indicate that with a free flow of goods within the EU, lower crops and the resulting lower

Harvest of selected plant species in the selected states of the EU

Specification	UOM	Year					
		2005	2006	2007	2008	2009	2010
Total cereal harvest							
France	thousand t	64 080	61 708	59 470	70 246	70 000	65 533
Spain	thousand t	14 325	19 092	24 544	24 180	17 827	19 642
Germany	thousand t	45 980	43 475	40 632	50 105	49 748	44 293
Great Britain	thousand t	21 025	20 805	19 045	24 282	21 618	23 387
Poland	thousand t	26 928	21 776	27 143	27 664	29 827	27 299
Potato harvest							
France	thousand t	6 605	6 363	7 206	6 808	7 164	6 323
Spain	thousand t	2 604	2 515	2 518	2 147	2 660	2 234
Germany	thousand t	11 624	10 031	11 644	11 369	11 683	10 202
Great Britain	thousand t	5 979	5 727	5 564	6 145	6 399	6 045
Poland	thousand t	10 369	8 982	11 791	10 462	9 380	:
Sugar beet harvest							
France	thousand t	31 150	29 871	33 213	30 306	34 913	31 723
Spain	thousand t	7 276	5 827	5 315	4 171	4 226	3 401
Germany	thousand t	25 285	20 647	25 139	23 003	25 919	23 858
Great Britain	thousand t	8 687	7 400	6 733	7 641	8 457	7 384
Poland	thousand t	11 912	11 475	12 682	8 715	10 849	:
Rape harvest							
France	thousand t	4 533	4 145	4 684	4 719	5 584	:
Spain	thousand t	5	8	33	21	35	:
Germany	thousand t	5 052	5 337	5 321	5 155	6 307	:
Great Britain	thousand t	1 706	1 674	2 108	1 973	1 912	:
Poland	thousand t	1 450	1 652	2 130	2 106	2 497	:

Source: Eurostat database

harvest in one country will not always cause resource shortage and price increase, especially when the crop failure occurs in a country, in which the production of a particular plant is relatively small. In this context, one may conclude that the crop failure in France, Germany, and Great Britain may cause a price increase in the EU, while a similar situation in Poland may at the most cause a certain increase in national prices. A natural mechanism of equalising farmers' income may function only in a limited range in Poland.

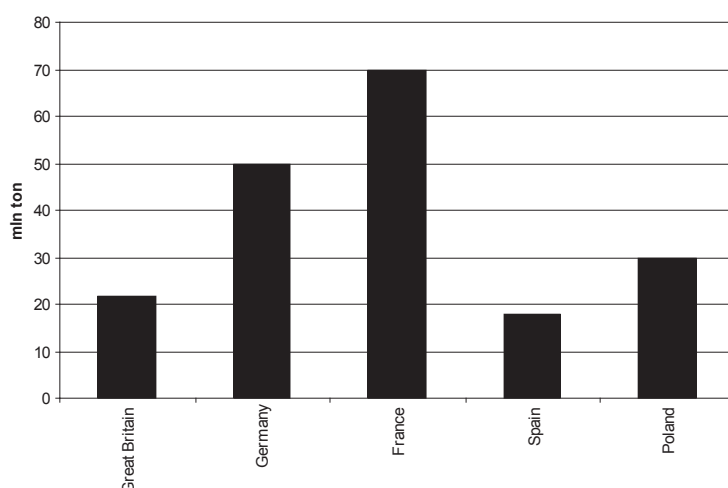
One shall remember that the situation discussed above concerns a case when the decrease in harvest occurs only in a group of countries and not in most of them.

The harvest of the basic plant species in the countries in question are derivatives of cultivation area and the achieved productivity. With the largest cereal cultivation area and high crops, France is the most important producer of cereal, especially wheat, in the European Union. Cereal harvest in France amounts to 65 million tons on average, although harvest spread amounted to 10 million tons in the presented period. Germany is the next cereal producer with harvest amounting to approx.

50 million tons. Poland takes the third place in the list with 27 million tons.

The presented harvest levels indicate the production of which countries influences the production and price levels in the entire EU. Hence, cereal prices are dependent on the harvest in France and Germany, and rape prices - on the harvest in Germany. Here in Poland, one may experience negative as well as positive results of the changes in production levels of the leading producers. For instance, good harvest in France will cause a decrease of prices in Poland, even if the weather conditions in Poland cause a decrease in harvest. In other words, within the free market, one is exposed to price risk, besides the production risk occurring in a particular country. France and Germany also dominate in the production of other plant species such as sugar beet or rape. France produces triple the amount of sugar beets and double the amount of rape produced in Poland.

Prices of plant products in the EU are shaped by global prices as well as the level of harvest in the Member States with the most contribution to the production of a particular product. The influence of global prices increases in subsequent years due to the decrease in protectionism



Source: author's calculations based on the Eurostat database data

Fig. 3. Cereal harvest in the selected states of the European Union

Table 9

Population of cattle and swine in the selected states of the EU

Specification	UOM	Year					
		2005	2006	2007	2008	2009	2010
Cattle							
France	m head	18.9	18.9	19.1	19.4	19.2	19.0
Spain	m head	6.5	6.2	6.6	6.0	6.1	6.1
Germany	m head	12.9	12.7	12.7	13.0	12.9	12.7
Great Britain	m head	10.5	10.3	10.1	9.9	9.9	9.9
Poland	m head	5.4	5.3	5.4	5.6	5.6	5.6
Swine							
France	m head	15.1	15.0	15.0	14.8	14.6	14.5
Spain	m head	24.9	26.2	26.1	26.3	25.3	25.8
Germany	m head	27.0	26.8	27.1	26.7	26.8	26.9
Great Britain	m head	4.7	4.7	4.7	4.6	4.4	4.4
Poland	m head	18.7	18.8	17.6	14.2	14.3	14.8

Source: Eurostat database

on the Union market. Limiting intervention and lowering minimal cereal prices almost to the levels of global prices cause price fluctuations within the EU to reflect global market price fluctuations more and more due to a lack of stabilising mechanism.

The highest population of cattle was observed in France – approx. 19 million head, followed by Germany – 13 million head. There were only 5.6 million cattle heads in Poland, which is less than in Spain (Table 8). Cattle production in France, Great Britain, and Germany is oriented on dairy production as well as slaughter cattle production. The percentage of dairy cows in the cattle population does not exceed 40%. The percentage of dairy cows in cattle population in Poland amounted even up to 52%, which indicates that dairy production is the main intent.

Spain and Germany are the leading producers of swine. In each of these states, the population of swine amounts

to over 25 million heads. In France and Poland, swine population is similar and amounts to 14 million heads, whereas, a significant decrease in swine population has been observed in Poland since 2005.

Conclusions

The executed comparison of selected countries allows concluding that Polish agriculture is characterised by a significant farm fragmentation. High employment in agriculture is closely connected with the fragmentation. The small average farm area and a relatively large number of people who shall live from working on such farms hinder accumulation of capital and investing in agriculture. More significant changes in that area will happen slowly, along with the process of generation exchange. Many of the farm owners will not find successors willing to keep a farm, which does not provide living. Furthermore, small

farms react weakly to market stimuli because the majority of production is intended for own needs.

The agricultural model of the European Union highly developed states does not seem achievable in Poland within the next 30 years. Poland will most likely experience farm polarisation manifested by formulation of a group of 300-500 thousand farms, which manage a majority of agricultural lands and produce total goods output. The remaining farms will be self-supply oriented or will constitute an additional source of income, other than the income from work outside of agriculture. Acceleration of the concentration process in Polish agriculture could occur, if the farmers were included in a social insurance system in a manner that other professions. This solution, however, is too expensive, because it would require including owners of small, unprofitable farms in the social support system.

The productivity of agricultural production in Poland should be increasing. It could reach 60-65% of productivity of e.g. France. This would result from the constant process of modernising best farms, and a simultaneous exclusion of the weakest soils from agricultural lands. The total agricultural production could increase as well.

Future directions of agricultural changes will depend in the most part on the shape of Common Agricultural

Policy after 2013; whether it is oriented more on farm development, as struggled for by Poland, or on environmental services and environmental protection, as struggled for by several more developed states of the EU. Receiving support in exchange for protecting soil, water, and the landscape as public goods may preserve the current agrarian structure, because land ownership and not production generates profit in agriculture.

Bibliography

1. Eurostat database. Retrieved: <http://epp.eurostat.ec.europa.eu>. Access: 20 October 2011.
2. Kapusta, F.(2003) *Teoria Agrobiznesu (Agribusiness Theory)*. Wydawnictwo Akademii Ekonomicznej im. O. Langego we Wrocławiu, Wrocław, p 363.
3. Roczniki Statystyczne GUS for Years 2005-2010 (Statistical Yearbook of Poland for Years 2005-2010). GUS, Warszawa.
4. Sikorska, A (red.) (2010). *Zroźnicowanie regionalne w rozwoju rolnictwa oraz jego wpływ na problemy ekonomiczne i społeczne obszarów wiejskich (synteza) (Regional Disparities in Agricultural Development and its Impact on Economic and Social Problems of Rural Areas (Synthesis))*. IERiGZ – PIB, Warszawa, p. 166.

ECONOMIC SCIENCE FOR RURAL DEVELOPMENT Nr. 29
Editor – in-chief Andra Zvirbule-Berzina
Printed and bound in Drukatava Ltd.
Liliju street 95/1, Marupe,
Latvia