



Agri-Food Logistics

3rd International Forum on Agri-Food Logistics

**4th National Scientific Conference
AGROLOGISTYKA**

***‘Towards the Sustainability of Logistics in
the Agri-Food Supply Chains’***

**Scientific editorial board by
Karol Wajszczuk
Magdalena Kozera-Kowalska**

**Poznań, Poland
June 26-28th, 2019**



Poznań University of Life Sciences



Honorable Patronage of
Minister Jan Krzysztof Ardanowski
(Ministry of Agriculture and Rural Development)



Polskie
Towarzystwo
Logistyczne



Rector of Poznań University of Life Sciences

3rd International Forum on Agri-Food Logistics

and

**IV National Scientific Conference
AGROLOGISTYKA**

***‘Towards the Sustainability of Logistics in
the Agri-Food Supply Chains’***

**Poznań, Poland
June 26th -28th, 2019**

Conference Venue:

Poznan University of Life Sciences

© Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu
International Forum on Agri-Food Logistics

ISBN 978-83-7160-946-6

Faculty of Economics and Social Sciences
Department of Law and Enterprise Management in Agribusiness
Wojska Polskiego 28
60-637 Poznań
Poland
e-mail: ifal@up.poznan.pl

Scientific Committee

Prof. dr hab. Bogdan Klepacki (Chair), Warsaw University of Life Sciences - SGGW, Warsaw, Poland

Dr Alfonz Antoni, Vice President of European Logistics Association, Hungary

Prof. Luis Miguel Albisu, Department of Agro-Food and Natural Resource Economics, Agro-Food Research and Technology Center of Aragón (CITA), Zaragoza, Spain

Prof. Richard R. Barichello, University of British Columbia, Vancouver, Canada

Dr hab. Rafał Baum, prof. UP, Poznan University of Life Sciences, Poznan, Poland

Prof. Michael Bourlakis, Cranfield School of Management, Great Britain

Prof. Anatolii Dibrova, National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine

Dr hab. Piotr Cyplik, prof. PSL, Vice-Rector Poznan School of Logistics, Poland

Dr Nouredin Driouech, Environmental Sciences CIHEAM-IAM of Bari, Italy

Dr Esbeth van Dyk, Director, iKhanyisa (Pty) Ltd, Stellenbosch, South Africa

Prof. Roberto Fanfani, The University of Bologna, Italy

Dr inż. Ireneusz Fechner, prof. PSL, Poznan School of Logistics, Polska

Prof. dr Christian Fischer, Free University of Bozen-Bolzano, Italy

Prof. dr Markus Hanisch, Humboldt University of Berlin, Germany

Prof. dr hab. Danuta Kisperska-Moroń, University of Economics in Katowice, Poland

Prof. dr hab. Michał Jerzak, Poznan University of Life Sciences, Poznan, Poland

Prof. dr hab. Danuta Kisperska-Moroń, University of Economics in Katowice, Poland

Prof. dr René de Koster, Rotterdam School of Management, Erasmus University, Rotterdam, Holandia

Dr hab. Magdalena Kozera-Kowalska, Poznan University of Life Sciences, Poznan, Poland

Dr inż. Stanisław Krzyżaniak, prof. ILW, Institute of Logistics and Warehousing, Poznan, Poland

Prof. Wojciech Lis, Poznan University of Life Sciences, Poznan, Poland

Prof Nelson Marmiroli, University of Parma, Italy

Dr Iwo Nowak, Institute of Logistics and Warehousing, Poznan, Poland

Dr hab. Karolina Pawlak, Poznan University of Life Sciences, Poznan, Poland

Prof. dr hab. Walenty Poczta, Poznan University of Life Sciences, Poznan, Poland

Dr Raffaello Prugger, Director of Tecnoalimenti S.C.p.A., Italy

Prof. dr Gerhard Schiefer, Center for Food Chain and Network Research, University of Bonn, Germany

Prof. dr hab. Maciej Szymczak, University of Economics in Poznan, Poland

Prof. dr Yasushi Sembokuya, Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Japan

Dr hab. Bogusława Śliwczyński prof. WSL, Institute of Logistics and Warehousing, Poznan, Poland

Prof. Danilo Tomić, President of Executive Board of Serbian Association of Agricultural Economics

Prof.dr.ir. J.G.A.J. (Jack) van der Vorst, Wageningen University & Research Centre, Wageningen, Holandia

Dr inż. Karol Wajszczuk, Poznan University of Life Sciences, Poznan, Poland

Prof. Dr. Justus Wesseler, Chair Agricultural Economics and Rural Policy Group Wageningen University, Netherlands

Prof.Dr. dr. h.c. Harald von Witzke, Humboldt University of Berlin, Germany

Prof. Jacek Żak, Ph. D., Logistics Division, Poznan University of Technology, Poznan; Poland

Organizing Committee

Dr inż. Karol Wajszczuk (Chair), Poznan University of Life Sciences, Poznan, Poland

Dr hab. Magdalena Kozera-Kowalska, (Vice Chair), Poznan University of Life Sciences, Poznan, Poland

M.Sc. Alina Nowotarska - Secretary of the Conference Poznan University of Life Sciences, Poznan, Poland

Dr hab. Rafał Baum, Poznan University of Life Sciences, Poznan, Poland

Dr Izabela Lipińska, Poznan University of Life Sciences, Poznan, Poland

Dr Dariusz Majchrzycki, Poznan University of Life Sciences, Poznan, Poland

Dr Benedykt Pepliński, Poznan University of Life Sciences, Poznan, Poland

Dr Damian Puślecki, Poznan University of Life Sciences, Poznan, Poland

Dr Izabela Hasińska, Poznan University of Life Sciences, Poznan, Poland

Dr Katarzyna Mydlarz, Poznan University of Life Sciences, Poznan, Poland

Dr Elżbieta Mikołajczak, Poznan University of Life Sciences, Poznan, Poland

Dr Karolina Jąder, Poznan University of Life Sciences, Poznan, Poland

Dr Sylwia Kierczyńska, Poznan University of Life Sciences, Poznan, Poland

Dr Olga Stefko, Poznan University of Life Sciences, Poznan, Poland

MSc. Krzysztof Różański, Poznan University of Life Sciences, Poznan, Poland

BSc. Norbert Garbarek, Poznan University of Life Sciences, Poznan, Poland

IFAL Secretariat

Poznań University of Life Sciences

Faculty of Economics and Social Sciences

Department of Law and Enterprise Management in Agribusiness,

Wojska Polskiego 28

60-637 Poznań

Poland

e-mail: ifal@up.poznan.pl

Reviewers

Dr hab. Rafał Baum, Poznan University of Life Sciences, Poznan, Poland

Dr Nouredin Driouech, Environmental Sciences CIHEAM-IAM of Bari, Italy

Dr inż. Ireneusz Fechner, prof. PSL, Poznan School of Logistics, Polska

Prof. dr Christian Fischer, Free University of Bozen-Bolzano, Italy

Dr inż. Stanisław Krzyżaniak, prof. ILW, Institute of Logistics and Warehousing, Poznan, Poland

Prof. dr hab. Maciej Szymczak, University of Economics in Poznan, Poland

Dr hab. Bogusława Śliwczyński prof. ILW, Institute of Logistics and Warehousing, Poznan, Poland

Dr inż. Karol Wajszczuk, Poznan University of Life Sciences, Poznan, Poland

Dr hab. Magdalena Kozera-Kowalska, Poznan University of Life Sciences, Poznan, Poland

Prof. Jacek Żak, Ph. D., Logistics Division, Poznan University of Technology, Poznan, Poland

Contents

Preface	10
Chapter I: Sustainability of Agri-Food Supply Chains. Today and Future perspective	11
1.1 <i>GSI standards in combating food waste (Aleksander Niemczyk).....</i>	<i>11</i>
1.2 <i>Determinants of food waste in the EU countries (Jakub Olipra)</i>	<i>15</i>
1.3 <i>Avoiding knowledge waste in the Mediterranean: case of food losses and waste (Noureddin Driouech, Hamid El Bilali)</i>	<i>21</i>
Chapter II: Agri-Food Supply Chains – Models and Legal aspects	32
2.1 <i>Short Food Supply Chains (SFSC) – Models and development perspectives (Sebastian Jarzębowski, Michael Bourlakis).....</i>	<i>32</i>
2.2 <i>EDI System in Logistic Management of an Enterprise. A Comparative Study (Leonid Shvartsburg, Tadeusz Zaborowski, Małgorzata Węgrzyńska).....</i>	<i>38</i>
2.3 <i>Assessment of Rural-Urban Vegetable Supply Chains in Nairobi (Bensolomon Baraka, Cormac O’Sullivan).....</i>	<i>41</i>
2.4 <i>A Brief Review of Selected Food Supply Chains in PNG (Passingham Buckley Igua)..</i>	<i>46</i>
Chapter III: Social Aspects in Agri-Food Supply Chains – World Case Studies.....	51
3.1 <i>Shellfish Collection Agribusiness in Ecuador. A Behavioral Economic Study (Eveligh Prado-Carpio, Cristhian Jover Castro-Armijos, Moisés Martínez-Soto, Carlos Rodríguez-Monroy).....</i>	<i>51</i>
3.2 <i>Creating Opportunities for Rural Youth (Mamadou Edrisa Njie¹, Cherno Jallow).....</i>	<i>56</i>
3.3 <i>CSR in the food industry: a comparative study for Poland and Brazil (Joanna Wiśniewska-Paluszak, Magdalena Kozera-Kowalska, Giana de Vargas Mores, Caroline Pauletto Spanhol Finocchio, Márcia Tibolla).....</i>	<i>58</i>
3.4 <i>Sustainable Energy Autarky and the Evolution of German Bioenergy Villages (Dariusz Pieńkowski, Wojciech Zbaraszewski)</i>	<i>62</i>
3.5 <i>Assessment of Post-Harvest Losses and Household Food Security in Kayonza District, Rwanda (Toyib Aremu, Olawale Olayide, Andre Ndagijimana, Jean Claude Mudahunga).....</i>	<i>68</i>
Chapter IV: Agri-Food Supply Chains – Challenges and Trends	74
4.1 <i>Business Model as a Path to Improve the Logic of Management in Agriculture – the Case of the Meat Market (Magdalena Kozera-Kowalska, Elżbieta Goryńska-Goldman, Peter Balog).....</i>	<i>74</i>
4.2 <i>Development of the CSR Concept in Selected Agribusiness Enterprises. Comparative Study (Małgorzata Węgrzyńska, Magdalena Śmiglak-Krajewska)</i>	<i>79</i>
4.3 <i>Selected Problems of Measuring CSR in Agribusiness (Alina Nowotarska, Magdalena Kozera-Kowalska).....</i>	<i>83</i>
4.3 <i>Nutritional habits among students of public universities in Poznań, Poland (Kalina Piwońska, Adriana Jakowicka).....</i>	<i>89</i>
Chapter V: Losses and Waste in Agri-Food Supply Chains – Innovations and Social Aspects	92

5.1 Mapping food wastage management innovations within supply chain (Ewa Żmieńka, Jakub Staniszewski)	92
5.2 Losses and waste in the agri-food chain (Małgorzata Górka, Bogusław Ślusarczyk, Stanisław Pigoń)	99
5.3 Quality in shaping the behavior of young consumers in the milk market (Paulina Luiza Wiza, Norbert Szalaty).....	105
5.4 Prevalence of <i>B. cereus</i> in Ivory Coast traditional produced flours (N'guessan E., Bakayoko S., Cissé M., Sindic M.)	110
5.5 Toxicity of filter cake and Triplex powders against <i>Sitophilus oryzae</i> (Tesfaye Melak Tadesse, Bhadriraju Subramanyam, Kun Yan Zhu, James F. Campbell)	111
5.6 Food quality as a determinant of flows into military supply chains (Marta Wincewicz – Bosa, Sławomir Paterak)	117
Chapter VI: The problems of cooperation in agri-foog supply chain.....	120
6.1 The potential of cooperation in agri-food supply chain - the case study of Georgia (Nino Rukhaia-Mosemgvdlshvili, Marta Raźniewska)	120
6.2 Strategic directions for development of transport and logistic infrastructure of grain exports from Ukraine (Anatolii Dibrova, Larysa Dibrova, Yaroslav Krylov, Maksym Dibrova).....	126
6.3 Price volatility in the milk supply chain in Poland in 2010 – 2018 (Agnieszka Tłuczak)	133
Signaling materials.....	139
1 Dealing with food waste and how we can make it waste work for us (Pasipanodya Mubaiwa).....	139
2 Do Mobile Phone Voice Message Reminders Reduce Crop Losses? Evidence from Mali (Louis Hodey).....	140
3 Microbial hazards and risks in industrial Eggs and Meat in Georgia (Kakha Nadiradze, Lamara Jikia, Nana Phirosmanashvili, Mariam Goginashvili)	141

Preface

Dear Forum Participants,

on behalf of the Department of Law and Enterprise Organisation in Agribusiness, Faculty Economics and Social Sciences at Poznań University of Life Sciences we have the honor to welcome you to the 3rd **International Forum on Agri-Food Logistics** and 4th National Scientific Conference **AGROLOGISTYKA**

The strategy of sustainable development, although widely accepted, still faces many emerging problems. This is particularly manifested in agri-food supply chains (AFSCs), that include many intermediaries using different norms and quality standards. Achieving sustainability for them, regardless of the country in which they are organized seems to be a priority. That is determined by following issues: ensuring food security for the country, production of healthy food and, often undervalued part of this type of production i.e. environmental impact. Scientific research indicates that logistics processes are a huge burden for environmental sustainability. This is confirmed, among others, by the report prepared during the World Economic Forum (2009), which shows that logistic processes generate annually about 2,800 megaton of CO₂, which is about 6% of the total CO₂ emissions produced by human activities. Other results, research conducted at Carnegie Mellon University in the United States, using the method of lifecycle assessment, show that transport processes related to food consumption are responsible for 11% of 8.1 million tons of greenhouse gases generated during the year. The presented facts imply the necessity to reorganize logistics processes in an environmentally friendly way, for example by reducing the number of journeys, planning shorter transport distances, more direct shipping routes, improving packaging quality, transparency in all processes "from farm to fork", as well as better use of existing resources. Therefore, the integration of the research community with the business community by presenting the results of scientific research and practical experience in the logistics of the agri- food chains is the aim of the Forum.

This book presents an exchange of views and proposals for solutions in the above mentioned issues presented in Poznań on June 26-28, 2019 at the **3rd International Forum on Agri-Food Logistics**, and **4th National Scientific Conference AGROLOGISTYKA**, titled: *Towards the Sustainability of Logistics in the Agri-Food Supply Chains*.

Karol Wajszczuk, PhD
Chairman of Organising Committee

Magdalena Kozera-Kowalska , PhD
Vice Chairman Organising Committee

3rd International Forum on Agri - Food Logistics
and the 4th National Scientific Conference AGROLOGISTYKA
Poznan, June 2019

Chapter I: Sustainability of Agri-Food Supply Chains. Today and Future perspective

1.1 GS1 standards in combating food waste

(*Aleksander Niemczyk*¹)

¹ GS1 Polska, Poland;

e-mail: Aleksander.Niemczyk@gs1pl.org

Keywords: food supply chains, GS1 standards

Introduction

The Polish Senate presented a project of an act on combating food waste (<http://www.sejm.gov.pl/sejm8.nsf/PrzebiegProc.xsp?id=A79BB8F3BD77126CC125826C0046205E> [access date: e.g. June 18, 2019]).

In 2018, Food Banks saved and distributed almost 10,000 tons of food from retail networks. Once the act is adopted, this volume may rise tenfold.

The project realized by the Federation of Polish Food Banks, GS1 Polska and the Auchan networks aims to standardize the generation and transfer of information about donations in Poland, with the use of the global GS1 standard.

Study methodology

With the topic in mind, this article is based on empirical studies conducted during a project realized by GS1 Polska together with the Federation of Polish Food Banks (FPFB), with special involvement of the Auchan network.

The results of the pilot studies will form the basis to implement the developed solutions among FMCG distributors¹.

The author has participated in numerous research and implementation works and uses his experience with regard to improving logistics processes and the application of GS1 standards.

Results

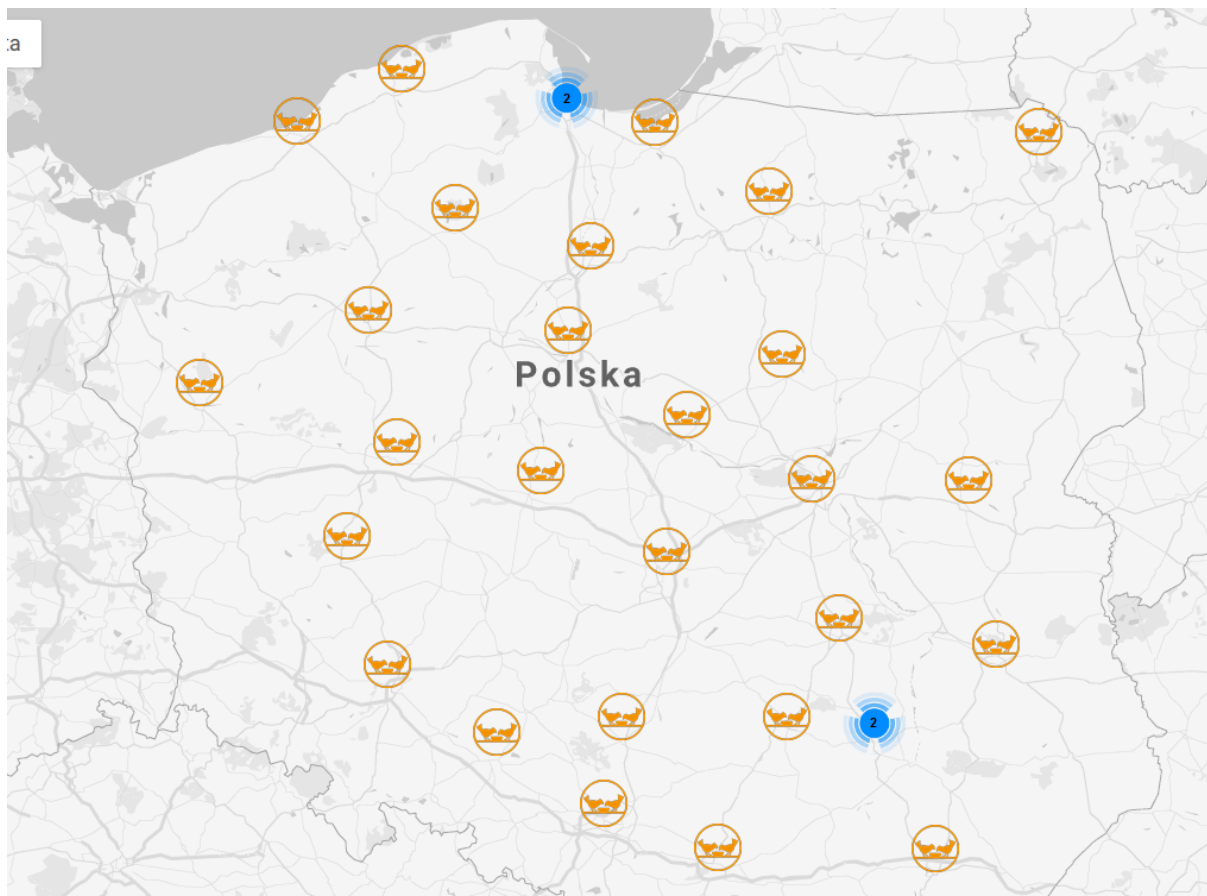
It is estimated that a significant amount of food is wasted in households (42%). Around 5% of food is wasted during the distribution phase (EU Fusions, 2016). The Polish Senate presented a project of a law on combating food waste. According to the project, food retailers whose sales area exceeds 250 m² will be required to conclude, with a non-governmental agency, an agreement for transferring food for social needs, free of charge. The organization's particular goal is to provide charity assistance by providing food or maintaining mass catering operations those in need.

¹ FMCG – fast-moving consumer goods

Currently, numerous organisations are involved in food distribution for such purposes in Poland, such as Food Banks, Caritas, the Polish Committee for Social Assistance, the Polish Red Cross, St. Albert’s Assistance Association, the Association of Children's Friends.

31 Food Banks are associated in the Federation of Polish Food Banks and cover entire Poland with their activity. Fig. 1 shows their locations.

Figure 1. Location of Food Banks.



Source: <https://bankizywnosci.pl/kontakt/banki-zywnosci> [accessed on: e.g. 18.06.2019]

The volume of food distributed by the Food Banks and the number of cooperating shops in 2016 - 2018 are shown in Table 1.

Table 1. The volume of food distributed by the Food Banks and the number of cooperating shops

Year	Volume of food distributed by Food Banks [tons]		Number of shops cooperating with Food Banks
	Total	Received from shops	
2016	circa 93,000	2,607	209
2017	circa 65,500	6,634	552
2018	circa 66,500	9,742	909

Source: FPBŻ data

In 2018, the Food Banks saved and distributed almost 10,000 tons of food received from trade networks. It is estimated that, once the act is adopted, this volume may rise tenfold.

The project realized by the Federation of Polish Food Banks, GS1 Polska and Auchan aims to standardize the generation and transfer of information about donations in Poland, with the use of the global GS1 standard. The main problems that have been identified are: documents in paper form, non-uniform scope of data, manual data entry, a large number of types of documents and their content (donation certificate, handing-over protocol, stock issue confirmation, VAT invoice, goods received note). The problems arise from the lack of clear regulations on the cooperation between individual Food Banks with tens of distribution networks operating in Poland.

The R&D project covers several elements:

- identification of the distributed food,
- documenting the process of making donations by the shops,
- providing information.

Identification of the distributed food,

The completed works have allowed the FPBŻ to identify 9 food groups. Each group is identified with the Global Trade Item Number (GTIN). These numbers were taken from a pool assigned to the FPBŻ, a member of the GS1 System in Poland.

Table 2 presents the food product groups and their assigned GTIN numbers (Hałas, et al., 2012) for variable quantity goods.

Table 2. Food groups and the assigned GTIN numbers

Group	Name	GTIN for variable q-ty
1	Fruit and vegetables (fresh, frozen, processed)	95907564654008
2	Baked goods and cakes	95907564654015
3	Dairy and eggs	95907564654022
4	Meat, fish, cold cuts, offal	95907564654039
5	Ready meals, gourmet foods, sandwiches	95907564654046
6	Dry products (groats, rice, pasta, etc.)	95907564654053
7	Sugar and sweets	95907564654060
8	Drinks, waters	95907564654077
9	Mix (all different or heavily mixed)	95907564654084

Source: materials from FPBŻ and GS1 Polska

During the process of making donations, it becomes important to be able to determine the gross mass of the donated food and its value, per individual group.

Documenting the process of making donations by the shops

The existing and the target process of making donations by the shops was modelled using BPMN (Business Process Model and Notation) graphical notations for describing business processes.

The handing-over protocol is the fundamental document created during this process. By way of mutual arrangements, a Uniform Handing-over / Acceptance Protocol was created. Among

others, it contains a list of donated food groups (designated as per Table 1) and the data of transaction parties, identified with Global Location Numbers (GLN).

Providing information

Several possible ways of transferring information about making / accepting donations were considered:

- generating a QR code on the paper on the donation document,
- generating a CSV or TXT file and e-mailing it (automatically, upon printing the donation document or manually), generating an XML file and sending it via EPCIS² (Electronic Product Code Information Services) upon printing the donation document.

For the pilot implementation, a decision was made to use EPCIS that conforms to GS1 standards (Niemczyk, 2015) for transferring the handing-over / acceptance protocol in XML. The protocol is generated by the shop and uploaded to enova, an IT system used by all Food Banks.

Summary and conclusions

The Polish Senate presented a project of a law on combating food waste. Once the act comes into force, the amount of food donated to the Food Banks may increase tenfold. The project realized by the Federation of Polish Food Banks, GS1 Polska and Auchan aims to standardize the generation and transfer of information about donations in Poland. GS1 standards are used to this end: a Global Trade Item Number (GTIN) to identify food product groups, a Global Location Number (GLN) to identify the shops and Food Banks, the EPCIS service to transfer Uniform Handing-over / Acceptance Protocols. The author believes that the pilot solution will facilitate and accelerate the processes of making food donations and the related information. A uniform system based on a GS1 standard will make the cooperation between all Food Banks and charity organizations with distribution networks in Poland easier.

References

- EU Fusions (2016). Food waste data set for EU-28.
- Hałas E. (et al., 2012) Kody kreskowe i inne globalne standardy w biznesie. Biblioteka Logistyka, ILiM. Poznań.
- Niemczyk A. (2015) Zarządzanie magazynem. Issue 2, updated. WSL. Poznań.

Internet sources

- <https://bankizywnosci.pl/kontakt/banki-zywnosci> [accessed on 18.06.2019]
- <http://www.sejm.gov.pl/sejm8.nsf/PrzebiegProc.xsp?id=A79BB8F3BD77126CC125826C0046205E> [accessed on 18.06.2019]

² EPCIS is a set of standards for building an online information service with answers to questions about any product identified by GTIN: what, where, when and why.

1.2 Determinants of food waste in the EU countries (*Jakub Olipra*¹)

¹ Credit Agricole Bank Polska S.A., Poland;
e-mail: jakub.olipra@credit-agricole.pl

Keywords: food waste, economic policy, consumer decisions

Introduction

Roughly one-third of the edible parts of food produced for human consumption is wasted (FAO, 2011). It means that every year a large part of resources used in food supply chain like labour, water, soil, fuels and other raw materials is unnecessarily exploited. Moreover, the utilization of uneaten food and its packaging generates additional costs. Therefore, food waste leads not only to misallocation of resources in global economy but also exerts serious detrimental impact on the natural environment, accelerating climate change (Thyberg and Tonjes, 2015). Despite the fact that food losses occur at all stages of food supply chain, a growing part of food in medium- and high-income countries is wasted at consumer level (FAO, 2011). It cannot be accepted, especially in situation when the global hunger is on the rise and about 821 million people (ca. 11% of global population) are suffering from chronic undernourishment (FAO et al., 2018). As a consequence in recent years the problem of food waste has become the subject of international debate and led to numerous policy actions aimed at minimizing the food waste at consumer level.

There is a vast literature on the determinants of food waste at consumer level. Majority of authors base on consumer survey data, while the literature which focus on international country level data is scarce. According to the current state of knowledge the following determinants of food waste at consumer level can be distinguished:

- **Income.** The majority of studies suggest that higher income results in higher food waste as more wealthy consumers can afford to waste food (Stuart, 2009; Parfitt, 2010; Stefan et al., 2013; Palatnik et al., 2014) while less affluent consumers tend to procure food in small, daily quantities minimizing losses (Gustavsson et al., 2011). Nevertheless, there are also studies stating that low-income families tend to waste more food (Cox and Downing 2007; Porpino et al.; 2015, Stancu et al. 2016). In turn Setti et al. (2016) suggest that the relation of income and food waste is much more complex and it can be explained by an inverse U-shaped curve. Finally, some authors found no relation between food waste and income (Koivupuro et al. 2012; Williams et al. 2012).
- **Education.** While the majority of studies states that there is no strong correlation between education level and food waste (Cecere et al., 2014, Neff et al., 2015), some authors suggest that a higher level of education is related to a higher awareness of food waste phenomena and consequently to a higher self-reported amount of food waste (Visschers et al. 2016; Secondi et al. 2015).

- **Age.** The vast majority of studies report a negative correlation between the amount of food wasted and age, with the lowest wastage rates in the immediate post-war age generation which have experienced food shortages (Parfitt, 2010; Quested et al. 2013; Secondi et al., 2015, Stancu et al. 2016). Elderly consumers may waste less food because they often have more time and are more skilled to prevent food waste (Quested and Luzecka, 2014). Nevertheless, there are also some studies stating that elderly people waste more food (Cecere et al., 2014).
- **Household size and composition.** There are some studies reporting that single households tend to waste more food per capita than other types of households which may be connected with the lifestyles of single persons (Koivupuro et al., 2012; Ganglbauer et al., 2013; Silvennoinen et al., 2014; Jörissen et al., 2015). Moreover, it is considered that the food waste per capita decreases with increasing household size. Simultaneously some authors suggest that households with children produce more food waste per capita due to time and money constraints (Parizeau et al., 2015), and paying more attention to food quality (Terpstra et al., 2005).
- **Urban population.** Some studies suggests that individuals living in urban areas tends to waste more food (Cecere et al., 2014, Secondi et al., 2015) while others find no correlation between place of residence and the food waste (Neff et al., 2015).

The aim of this paper is to test the hypothesis that the determinants of food waste at consumer level distinguished on the base of consumer surveys can be identified at the country level in the European Union (EU). Implications from the following research may be useful for developing common policy at the EU level targeted to minimizing consumer food waste.

Data and methodology

All data used in the research come from Eurostat. Due to the limitations connected with the availability of comparable data on food waste in particular EU countries the analysis was conducted only for the year 2016 (European Commission, 2014). Moreover, Latvia and Portugal were excluded from the sample as they reported no food waste per capita. The whole analysis was based on the reasoning on the basis of charts and Pearson correlation coefficients as available data do not allow to use more advance statistical and econometrical methods. As a consequence, the dependence between the particular variables cited in the literature and the level of food waste per capita was tested in pairs, which are listed in Table 1.

Table 1: Set of tested hypotheses with description of exogenous variables. Endogenous variable: food waste per capita in kg

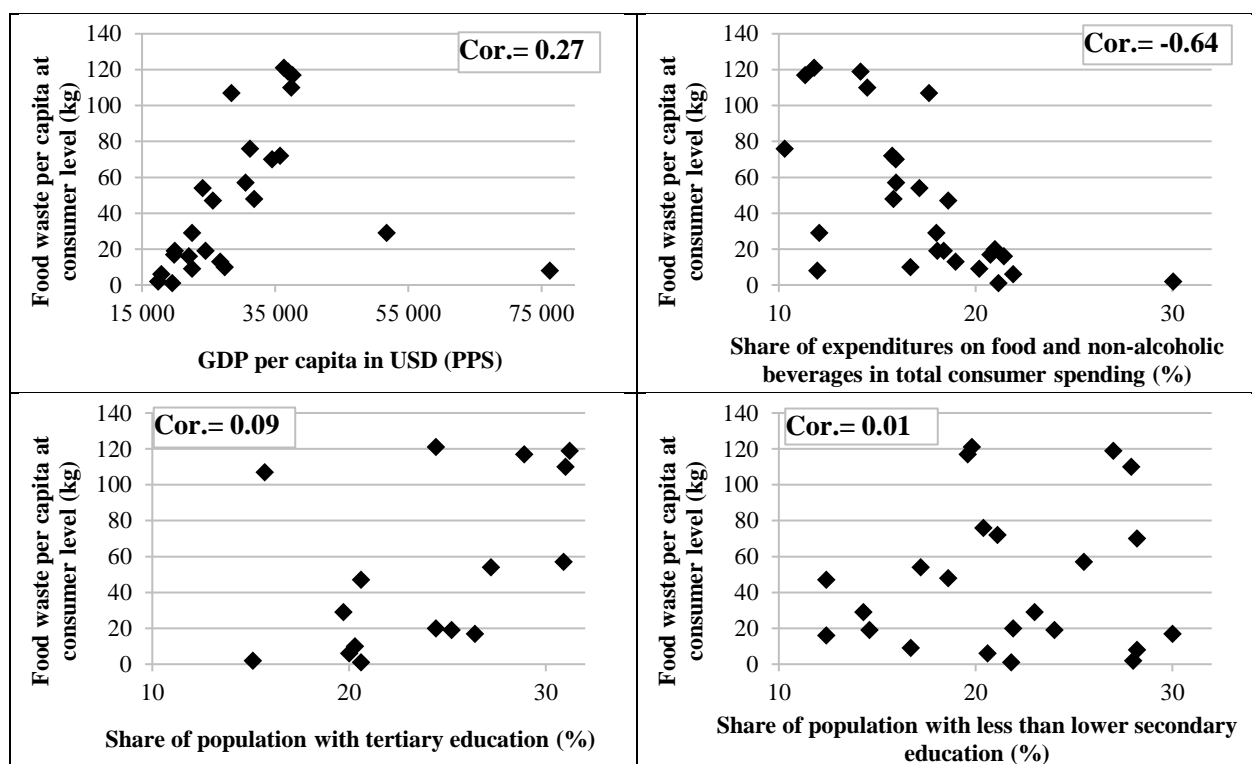
Hypothesis	Exogenous variable
Higher income results in higher food waste	<ul style="list-style-type: none"> • GDP per capita in USD in Purchasing Power Standard (PPS) • Share of expenditures on food and non-alcoholic beverages in total consumer spending.

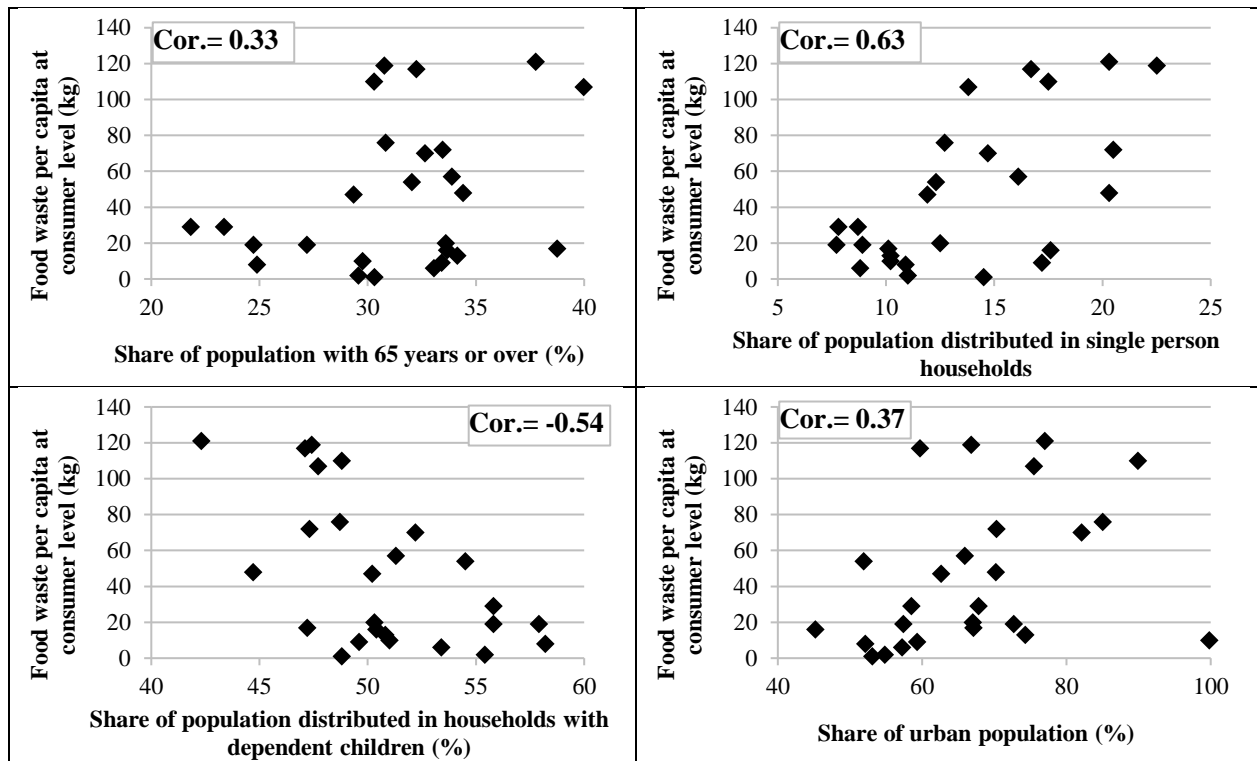
Higher level of education is related to a higher self-reported amount of food waste	<ul style="list-style-type: none"> • Share of population with tertiary education • Share of population with less than lower secondary education
Food waste decreases with age	Share of population with 65 years or over
<ul style="list-style-type: none"> • Single households tend to waste more food per capita • Households with children tend to waste more food per capita 	<ul style="list-style-type: none"> • Share of population distributed in single person households • Share of population distributed in households with dependent children
Food waste increases with the higher urban population	Share of urban population

Source: own elaboration

Results

Figure 1: Food waste per capita in EU countries vs. its determinants





Source: own elaboration *correlation coefficients in frames

Pearson correlation coefficients indicate that in EU countries there is a positive correlation between the GDP per capita and food waste per capita. Nevertheless, the scatter plot suggests that relation between these two variables may not be linear. High negative correlation was found in case of the share of expenditures on food and non-alcoholic beverages in total consumer spending. Strong correlation was recorded also in case of share of population distributed in single person households (positive) and households with dependent children (negative). Moderate positive correlation was found with regards to share of urban population and age. Results indicate that there is no correlation between level of education and food waste per capita.

Conclusions

The main target of the research was to test if factors determined as key drivers of food waste at microeconomic level like level of income, age, education, household composition, place of living are reflected also on country level data in EU countries. Results confirm strong positive correlation between the level of income and the food waste per capita, however, such relation may not be linear. It is consistent with the results of Setti et al. (2016). Similar degree of correlation was recorded also in case of variables representing the share of single person households (positive) and households with children (negative) in total population which is consistent with the results of Koivupuro et al. (2012), Ganglbauer et al. (2013), Silvennoinen et al. (2014) and Jörissen et al. (2015) and contradictory to findings of Parizeau et al. (2015) and Terpstra et al. (2005). A medium level of positive correlation was recorded in case of urban population which supports the findings of Cecere et al. (2014) and Secondi et al. (2015). Moderate level of positive dependence manifested

also in case of age with is consistent with results of Cecere et al. (2014) and contradictory to finds of Parfitt (2010), Quested et al. (2013), Secondi et al. (2015), Stancu et al. (2016) and Quested and Luzecka (2014). Furthermore, results suggest no correlation between level of education and food waste which is consistent with the majority of studies in this area (Cecere et al., 2014, Neff et al., 2015). Findings from this research may serve as a starting point for further analysis when comparable country level data on food waste become more available allowing to estimate panel regressions. Such an approach may be useful to catch country specific factors as model of capitalism (Borowski et al. 2015) or socio-cultural features with are considered as important determinants of food waste per capita (Thyberg and Tonjes, 2015). The opportunity to model food waste per capita in EU countries may enable to develop more precise and efficient polices aimed at decreasing the level of that phenomena.

References

- Borowski J., Maszczyk P. and Olipra J. (2015). Models of Capitalism and Growth Volatility in Selected OECD Countries, *Studia Ekonomiczne / Uniwersytet Ekonomiczny w Katowicach*, 213: 61-75.
- Cecere G., Mancinelli S. and Mazzanti M. (2014). Waste prevention and social preferences: the role of intrinsic and extrinsic motivations, *Ecol. Econ.*, 107:163-176
- Cox, J. and Downing, P. (2007). *Food Behaviour Consumer Research: Quantitative Phase*. Wrap, Banbury UK.
- European Commission. (2014). Report from the Commission to the European Parliament and the Council on statistics compiled pursuant to Regulation (EC) No 2150/2002 on waste statistics and their quality.
- FAO. 2011. *Global food losses and food waste – Extent, causes and prevention*. Rome
- FAO, IFAD, UNICEF, WFP and WHO. 2018. *The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition*. Rome, FAO.
- Ganglbauer E., Fitzpatrick G., Comber R. (2013). Negotiating food waste: using a practice lens to inform design *ACM Trans. Comput. Hum. Interact.*, 20:1-25.
- Gustavsson, J., Cederberg, C. and Sonesson, U. (2011). *Global Food Losses and Food Waste: Extent, Causes and Prevention*. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Jörissen J., Priefer C., Bräutigam K.-R. (2015). Food waste generation at household level: results of a survey among employees of two European research centers in Italy and Germany *Sustainability*, 7: 2695-2715.
- Koivupuro, H. et al.(2012). Influence of Socio-Demographical, Behavioural and Attitudinal Factors on the Amount of Avoidable Food Waste Generated in Finnish Households. *International Journal of Consumer Studies*, 36(2):183–191.
- Neff R.A., Spiker M.L., Truant P.L. (2015) Wasted food: US consumers' reported awareness, attitudes, and behaviors, *PLoS One*, 10.

- Palatnik, R. R. et al. (2014), Greening Household Behaviour and Waste, OECD Environment Working Papers, No. 76, OECD Publishing.
- Parfitt, J., Barthel, M. and Macnaughton, S. (2010). Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences.* 365: 3065-81.
- Parizeau K., Massow M., Martin R. (2015). Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario *Waste Manag.*, 35:207-217.
- Porpino, G., Parente, J. and Wansink, B. (2015). Food waste paradox: antecedents of food disposal in low income households. *International Journal of Consumer Studies*, 39: 619-629.
- Quested, T.E., Marsh, E., Stunell, D., Parry, A.D. (2013). Spaghetti soup: The complex world of food wastebaviours. *SI Resour. Behav.* 79:43–51.
- Quested, T.E. and Luzecka, P. (2014). Household food and drink waste: A people focus. WRAP, Banbury, UK.
- Secondi L., Principato L., Laureti T. (2015). Household food waste behaviour in EU-27 countries: a multilevel analysis *Food Pol.*, 56:25-40.
- Setti M. et al. (2016), Italian consumers' income and food waste behavior, *British Food Journal*, 118(7):1731 – 1746.
- Silvennoinen, K. et al. (2014). Food waste volume and composition in Finnish households *Br. Food J.*, 116:1058-1068.
- Stancu V., Haugaard P. and Lähteenmäki L. (2016). Determinants of consumer food waste behaviour: two routes to food waste, *Appetite*, 96:7-17.
- Stefan, V. et al. (2013) Avoiding food waste by Romanian consumers: The importance of planning and shopping routines. *Food Quality and Preference*, 28:375–381.
- Stuart, T. (2009). *Waste: Uncovering the Global Food Scandal*. W.W. Norton & Company, New York.
- Terpstra M., Steenbekkers L., Maertelaere N., Nijhuis S. (2005). Food storage and disposal: consumer practices and knowledge *Br. Food J.*, 107:526-533.
- Thyberg, K.L. and Tonjes, D.J. (2016). Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling*, 106:110–123.
- Visschers V.H., Wickli N., Siegrist M. (2016). Sorting out food waste behaviour: a survey on the motivators and barriers of self-reported amounts of food waste in households, *J. Environ. Psychol.*, 45:66-78.
- Williams, H., Wikström F., Otterbring T., Löfgren M., and Gustafsson A. (2012). Reasons for Household Food Waste with Special Attention to Packaging. *Journal of Cleaner Production* 24:141–148.

1.3 Avoiding knowledge waste in the Mediterranean: case of food losses and waste (*Noureddin Driouech¹, Hamid El Bilali¹*)

¹ International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM-Bari), Sustainable Agriculture, Food and Rural Development department; Valenzano (Bari), Italy
e-mail: driouech@iamb.it (corresponding author)

Keywords: Agricultural losses, Food wastage, Environment, Food security, SDSs, North Africa.

Introduction/background

Knowledge and know-how in agri-food sectors are resources that are valuable to any Research Institution/organization's ability to innovate and contribute to the sustainable development of local and regional territories. In fact, Food losses and food waste represent an emerging problem with enormous economic, environmental, and social implications. Therefore, reduction of food wastage is considered a promising strategy not only to achieve food security but also to improve the food system sustainability. Food wastage is a serious issue also in the Near East and North Africa region.

Aims

The paper casts light on research dealing with food losses and waste (FLW) in North Africa.

Methods

A systematic review was carried out in January February 2019 on Scopus using search query (food OR agri*) AND (wastage OR waste OR loss) AND (Algeria OR Egypt OR Libya OR Mauritania OR Morocco OR Tunisia). Issues addressed in the systematic review include geography of research on FLW in North Africa (i.e. countries considered or underserved), bibliometric parameters (e.g. journals, institutions) as well as thematic focus (agricultural loss, food waste). Selected records were also interrogated to see if they address extent of FLW, relation between food wastage and food security, economic implications of FLW, and environmental footprints of FLW.

Findings

Results show that research on FLW is still marginal in North Africa in general and in Libya and Mauritania in particular. Moreover, while there are some interesting pieces of research on the amount of FLW, environmental and economic implications of FLW as well as impacts in terms of food security are largely overlooked.

Conclusions and Implications

Therefore, North African researchers should pay more attention to food wastage issue. Such an endeavor should be supported by research policy in North Africa.

1. Introduction

Food losses and waste (FLW) are an emerging problem with enormous economic, environmental and social implications [1]. Food waste is one of the most severe social, economic, and ecological pathologies among those facing the planet [2]. FLW occur between the moment when a product is ready to be harvested or harvested, and the moment when it is consumed or removed from the food supply chain. Food losses take place at the production, post-harvest and processing stages in the food supply chain. Losses occurring at the end of the food chain - retail and consumption - are referred to as 'food waste' [1], [3], [4].

Today, about four billion metric tons of food are produced per annum worldwide. However, due to poor practices along the food chain (harvesting, storage and transportation), as well as market and consumer wastage, it is estimated that 1.2–2 billion tons of all food produced never reaches a human stomach [1], [4]. There are considerable variations from one country, commodity and season to another [5]. In developing countries, 40% of losses occurs at post-harvest and processing levels, while in industrialized countries more than 40% of losses happens at retail and consumer levels [1], [4].

In addition to general lack of data on food losses and waste [6] there are many inconsistencies [7]. This is, at least partly, attributable to the use in English of the term 'waste' both to refer to 'wastage/squander' and 'garbage/trash/rubbish'. Therefore, more focused terms such as 'food wastage' [e.g. 8] or 'waste of food' [9] appeared recently. The term 'food wastage' encompasses both food loss and food waste [8].

FLW undermine the very foundations of food and nutrition security. Therefore, the reduction of the amount of food lost or wasted is now presented as essential to achieve food security [1], [10], [11], [12]–[14] and improve the sustainability of the current food system [1]. When converted into calories, global FLW amount to approximately 24% of all food produced. Essentially, one out of every four food calories intended for people is not ultimately consumed by them [15], [16], [17]. Even if just one-fourth of the food currently lost or wasted globally could be saved, it would be enough to feed 870 million hungry people [18]. The world's nearly one billion hungry people could be fed on less than a quarter of the food that is wasted in the US and Europe [19]. Food wastage represents also a loss of valuable nutrients (both macro- and micro-nutrients) [20].

FLW reduction is now considered as essential also to reduce the environmental footprint of food systems [11], [12], [13], [15], [20], [21], [22], [23], [24]. In fact, this is presented as crucial for reducing the emission of greenhouse gases (GHG), thus slowing down the pace of climate change, and des-intensifying natural resources use. Food loss and wastage amount to major squandering of resources, including water, land, energy, labor and capital [4], [18]. FLW can be translated into direct and indirect environmental impacts. They have two major direct environmental impacts: waste of the resources used to produce the food lost and wasted and major source of negative impacts including emissions of GHG at disposal. Indirect environmental externalities include unnecessary water pollution caused by the intensive use of fertilizers in agriculture. FLW negative externalities include also those that mono-cropping and agriculture expansion into wild areas (e.g.

forests) create in terms of biodiversity loss [8]. FAO [8] showed that footprints of FLW include carbon footprint (greenhouse gas emissions), water footprint (consumption of surface and groundwater resources), ecological footprint (agricultural land use) as well as indirect impacts and externalities on biodiversity.

Food wastage also implies a considerable loss of money for both producers and consumers [1], [2], [4]. In fact, FLW represent a wasted investment that can reduce farmers' incomes and increase consumers' expenses [15] as food losses translate into lost income for farmers and into higher food prices for consumers [1], [18], [14].

Food wastage is a serious problem also in the Near East and North Africa (NENA) region. FLW in the NENA region are high [25], [26], [26], [27] and contribute to reduced food availability, aggravated water scarcity, adverse environmental impacts and increased food imports in a highly import-dependent region [25], [27]. It is estimated that 34% of food supplies suitable for human consumption are being lost or wasted in NENA region [4]. Generally speaking, it is estimated that only 32% of FLW in North Africa and West and Central Asia (cf. NENA region) occurs at the consumption stage (mostly in urban centers), while up to 68% of FLW occur during production, handling, processing and distribution [26]. Quantitative FLW in NENA region are estimated to be 45% of fruits and vegetables, 28% of fish and seafood, 26% of roots and tubers, 18% of dairy products, 16% of oilseeds and pulses, 14 to 19% of grains and 13% of meats [24], [26]. Not only food losses but also food waste, including household food waste, is a critical issue in NENA countries e.g. [27], [28], [31], [32]. However, all figures on FLW in NENA reported above are only estimates as accurate data on the magnitude, causes and stages of FLW in the region have not been systematically collected and included in national or international databases [24].

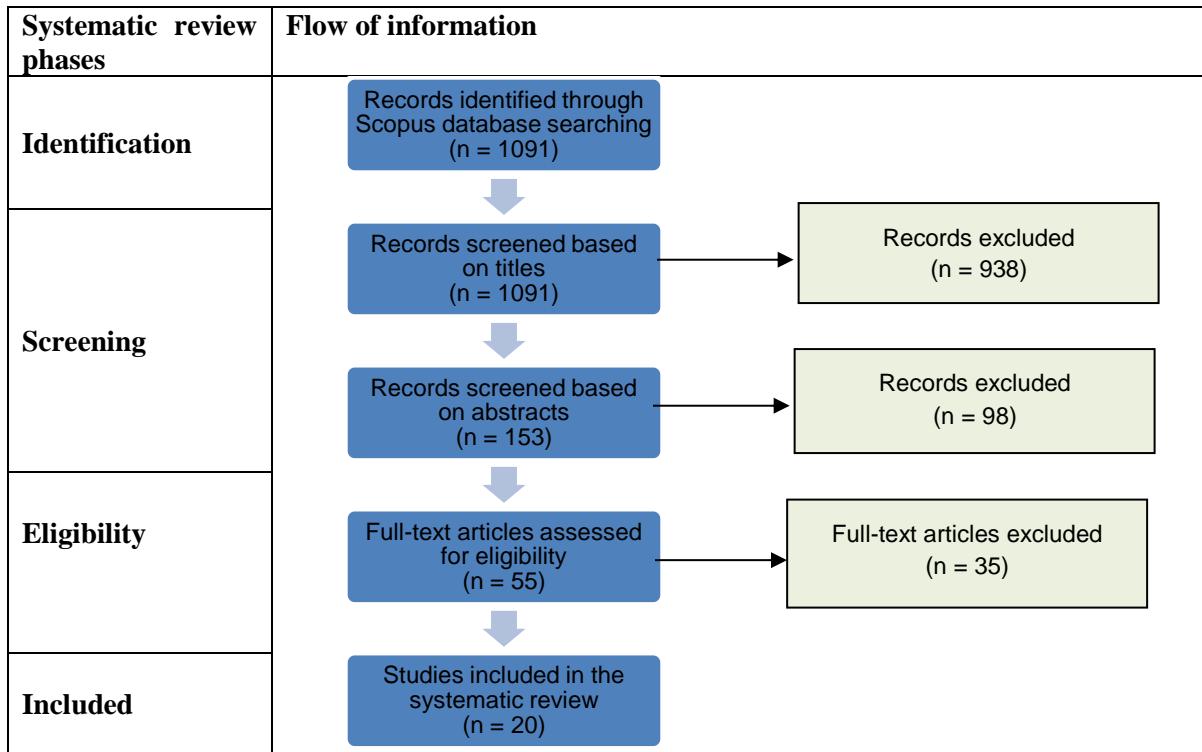
The present paper sheds light on research dealing with food wastage in North African countries namely Algeria, Egypt, Libya, Mauritania, Morocco and Tunisia.

2. Subjects and Methods

A systematic review [31] was carried out on February 8th, 2019, using Scopus database as shown in **Figure 1**.

The use of *Title-Abs-Key* search query – (*food OR agri**) AND (*wastage OR waste OR loss*) AND (*Algeria OR Egypt OR Libya OR Mauritania OR Morocco OR Tunisia*) - yielded 1091 documents. Following a deep scrutiny of titles, 938 documents were not considered for further analysis as they do not deal with food wastage in North Africa. In particular, were excluded documents that deal with sanitation, wastewater (cf. olive oil wastewater) and use of animal/agricultural waste as soil amendment/conditioner.

Figure 1. Systematic review process.



Source: Adapted from Moher [31].

Further 98 documents were excluded based on analysis of abstracts. At this step, were left out records that deal only with the reuse or recycling of by-products and ‘unavoidable food waste’ (e.g. [32], [33]) that’s to say non-edible agricultural and animal products parts that are, anyway, unsuitable for human consumption (e.g. date stones, shells, peels, animal bones or skin). Also documents that address only the use of agricultural waste for the production of energy or as raw material for building industry or animal feed were discarded. Furthermore, records that deal with non-food crops (e.g. cotton, ornamental plants) were not considered. Additional 35 documents were excluded based on reading of full texts.

Therefore, only 20 records (**Table 1**) were included in the systematic review and underwent a deeper analysis.

Table 1. Records considered in the systematic review on research dealing with food losses and waste in North Africa.

Year	Number of records	References
2018	2	Abdelradi [34]; Noutfia et al. (2018)
2017	1	Haouel Hamdi et al. [35]
2016	1	Shreen et al. [36]
2015	1	Trabelsi et al. [37]
2013	3	Helmy et al. [38]; Padilla [39]; Rady & Soliman [40]
2012	1	Qaryouti et al. [41]
2011	1	Kandil et al. [42]
2010	1	Harrak & Jaouan [43]

2006	1	El-Mobaidh et al. [44]
2000	2	Benkeblia [45]; Sharobeem & Radwan [46]
1996	2	Hussein et al. [47]; Hussein et al. [48]
1995	1	Fuglie [49]
1994	1	Bansal et al. [50]
1992	1	Bansal & Sakr [51]
1990	1	Fouad et al. [52]

Both issues regarding metrics and topical focus of research on FLW in North Africa were addressed in the analysis (**Table 2**).

Table 2. Issues and topics addressed in the systematic review.

Topic	Elements considered
Metrics and geography of research on food wastage in North Africa	Metrics: year of publication, source/journal, institution/affiliation, subject area Geography of research: North African countries considered or underserved
Topical focus of research on FLW in North African countries	Thematic focus (agricultural loss or food waste) Extent of food losses and food waste Food wastage and food security Economic implications of food wastage Environmental implications of FLW (carbon footprint; water footprint; ecological footprint; other environmental impacts such as deforestation, biodiversity loss and ecosystems disturbance)

3. Results and Discussion

3.1. Marginality of research on food losses and waste in North Africa

The main finding of the present systematic review is the marginality of research on FLW in North African countries (i.e. Algeria, Egypt, Libya, Mauritania, Morocco and Tunisia). In fact, a search with *Title-Abs-Key* query (*food OR agri**) AND (*wastage OR waste OR loss*) (so, without limiting the search to North Africa) yielded 166,273 documents; that is about 152 times the number of records yielded with the search on food wastage in North Africa. It is even worse when one considers that only 20 documents resulted dealing effectively with food wastage in North Africa. This result is rather surprising given the extent and magnitude of food wastage problem in the region. In fact, the 31st FAO regional conference in the Near East (FAO NERC-31, May 2012) recommended FAO to “[...] assist member countries in addressing the key challenges of reducing food waste and losses by conducting comprehensive studies on impact of food losses and waste on food security in the region and in establishing a plan to reduce food losses and waste in the region by 50% within 10 years” [26:V]. Probably, it is for this reason – i.e. awareness of the lack of studies on extent, origins, causes, and nature of FLW - that the Regional Strategic Framework on ‘Reducing Food Losses and Waste in the Near East & North Africa Region’ dedicated one of its four components to ‘Data gathering, analytical research and knowledge generation’ [26:4-5]. The need of further research on the issue of food wastage in North Africa was also highlighted by many other scholars (e.g. [34]).

3.2. Metrics of research on food wastage in North Africa

Metrics (sources / journals, affiliations / institutions, countries, subject areas) of research dealing with food wastage in North Africa are reported in **Table 3**.

Table 3. Metrics of research on food wastage in North Africa

Journal (*)	Subject area (**)	Affiliation / Institution (***)	Country (****)
Acta Horticulturae (5)	Agricultural and Biological Sciences (15)	Agricultural Research Center (3)	Egypt (11)
AMA Agricultural Mechanization in Asia Africa and Latin America (2)	Engineering (5)	Alexandria University (3)	Morocco (5)
Applied Engineering in Agriculture (2)	Environmental Science (3)	High Institute Agricultural Cooperation, Egypt (2)	United States (3)
Waste Management (2)	Chemical Engineering (2)	Institut National de la Recherche Agronomique de Tunisie (2)	Algeria (2)
Acta Agronomica Hungarica (1)	Earth and Planetary Sciences (1)	Universite de Carthage, Tunisia (2)	Tunisia (2)
Acta Scientiarum Polonorum Technologia Alimentaria (1)	Economics, Econometrics and Finance (1)	Centre Regional de la Recherche Agronomique, Morocco (1)	France (1)
Agricultural Engineering International CIGR Journal (1)	Energy (1)	Kafrelsheikh University, Egypt (1)	Israel (1)
American Journal of Agricultural Economics (1)	--	National Center for Agricultural Research and Extension (NCARE), Jordan (1)	Jordan (1)
Chilean Journal of Agricultural Research (1)	--	CIHEAM-IAMM, France (1)	Palestine (1)
International Agrophysics (1) Journal of Asia Pacific Entomology (1)	--	International Center for Agricultural Research in the Dry Areas – ICARDA, Morocco (1)	Romania (1)

Legend: Figures in brackets refer to number of documents by (*) Journal; (**) Subject area; (***) Affiliation; (****) Country.

The output of papers per year ranged from three (2013) to none in some years (e.g. 2014, 2009, 2008, 2007, 2005, 2003). Most of selected articles were published on *Acta Horticulturae*. Of course, there is a relation between subject areas and journals, so that it comes no surprise that most of the selected papers are related to the subject area of ‘Agricultural and Biological Sciences’.

However, selected papers can be categorized in many subject areas, which may explain difficulty to grasp the research field of food wastage, as it is rather multidisciplinary.

There are huge inter-country differences. In fact, it seems that Egypt performs better in research on food wastage than the other North African countries (Morocco, Tunisia, Algeria). However, one should consider with caution such a statement, as it does not take into consideration the different sizes of these countries and, consequently, their research systems (cf. research performance of North African countries on Elsevier's SciVal using as indicator number of scientific articles per million inhabitants). Meanwhile, it seems that no research institution in Mauritania and Libya published papers on food wastage. Research on food wastage in North Africa is performed also by other institutions outside the region (e.g. USA, France). Also the affiliations are dominated by Egyptian research institutions such as the Agricultural Research Center and Alexandria University.

3.3. Topical focus of research on food losses and waste in North African countries

Most of the selected documents deal with agricultural loss while food wastage in distribution and consumption is underserved. It should be also highlighted that while interest in agricultural losses (especially their causes) dates back to many decades, focus on food waste is rather recent in North Africa. It is also surprising that no paper refers explicitly to agricultural 'loss' (or losses) in the title. Meanwhile, only one article does so in the case of food 'waste' (e.g. [34]), with a particular reference to food waste behavior at household level in the metropolitan area of Cairo.

As for the *extent of food losses and food waste*, many papers analyzed the magnitude of food losses especially at harvest (e.g. due to traditional harvesting and impact of use of improved and modern harvesting machines [36], [46], [50]–[52]), during post-harvest / storage (e.g. because of some pests [35], but also inappropriate storage conditions [41], [45], [47], [48]), handling [40] or in processing [38] (Noutfia et al., 2018). Kandil et al. [42] highlighted that onion losses during storage depend on field agronomic management especially irrigation and mineral fertilization. According to Benkeblia [45], storage losses in Algeria range from 15 to 40% (in hot weather conditions) for potatoes, from 20 to 50% for onions (because of rotting and sprouting), from 10 to 20% for dates (because of insect infestation). In general, these analyses are context- and product-specific (e.g. chickpeas and lentils in Morocco; rice in Egypt; potatoes in Tunisia; chickpea in Tunisia; peanut in Egypt; cucumber, pepper and beans in Egypt; onion in Egypt).

There is in the selected documents no comprehensive analysis of the extent of food wastage in distribution and consumption in North Africa. Nevertheless, Abdelradi [34] showed that perception about food wastage was affected by quantities of household food waste. El-Mobaidh [44] classified in-flight catering wastes in Egypt Air flights and found that food waste represents 23% to 51.2% of total waste, depending on meal type; this corresponds to 284 tons per year in Egypt Air flights.

The *relation between food waste and food and nutrition security* is not directly addressed in the selected papers. However, many documents point out to the impacts of losses on yields and food

supply (e.g. [35], [37], [50]–[52]), so indirectly also on food security. Some articles referred also to ‘qualitative losses’ (loss of nutritional value of products, see vitamins, micronutrients, etc.) (e.g. [35], [43], (Noutfia et al., 2018)) and these results connect food losses with nutrition and nutrition security in North African countries. In fact, Haouel Hamdi et al. [35] showed a decrease of nutritional value of chickpea seeds infested by beetles. Padilla [39] pointed out that ambient temperature can alter nutrients during tomato processing.

Once again, only some papers dealt directly with the *economic implications of food wastage*. In fact, some documents analyzed the implications of agricultural losses in terms of yield reduction and this implies also economic losses for farmers. No paper analyzed the effects of food waste on consumer prices of agricultural products in North Africa. However, Fuglie (1995) referred to benefits for producers and consumers from the reduction of potatoes storage losses in Tunisia. Similarly, Haouel Hamdi et al. [35] refer to economic losses due to damage of beetles on chickpea seeds and flour in Tunisia. Abdelradi (2018) found that food price is among the major factors explaining food waste behaviour at household level in Cairo metropolitan area.

As for the *environmental implications of food losses and waste*, there is no analysis of the impacts of food wastage in terms of carbon footprint (energy losses and greenhouse gas emissions), water footprint and ecological footprint (land occupation and degradation). Moreover, no paper addresses neither the relation between food wastage and climate change nor the indirect impacts of food wastage such as pollution of underground and surface water resources as well as deforestation, biodiversity loss and ecosystems disturbance. Nevertheless, Abdelradi [34] highlighted the need to increase consumers’ knowledge and awareness about environmental implications of food wastage.

4. Conclusion

To the best of knowledge, this is the first paper to make a systematic review of research on food losses and waste in North Africa. It clearly shows the marginality of research on food wastage in the region. Although some interesting and promising activities have been carried out over last years, research is rather fragmented and still at an embryonal stage of development. In other words, research on food wastage in North Africa has still a long way to go in order to reach levels comparable to those in Europe. Therefore, more attention should be paid to the issue of food losses and waste in the research policies and strategies of North African countries. It is also recommended to have better collaborations between research teams in these countries. This is of paramount importance given the enormous environmental, economic and social impacts of food wastage as well as its implications in terms of food security and food system sustainability (environmental, social, economic) in North Africa.

It should be pointed out that the use of a single database (i.e. Scopus) might have omitted some other relevant articles published on journals that are not indexed in Scopus. The use of Scopus means also that the article focuses only on peer reviewed scientific literature, not grey literature (e.g. reports). Therefore, there is a need of a broader coverage of the literature in order to have a clearer picture about the contours of research on food losses and food waste in North Africa.

References

- [1] HLPE (2014). “Food Losses and Waste in the Context of Sustainable Food Systems,”.
- [2] WRAP (2008), “The food we waste,” Banbury (UK),.
- [3] J. Parfitt, M. Barthel, and S. Macnaughton (2010). “Food waste within food supply chains: quantification and potential for change to 2050,” *Philos. Trans. R. Soc. B Biol. Sci.*, vol. 365, no. 1554, pp. 3065–3081, 2010.
- [4] FAO (2011). “Global food losses and food waste: Extent, causes and prevention,”.
- [5] J. Lundqvist (2010). “Producing more or wasting less? Bracing the food security challenge of unpredictable rainfall,” in *Re-thinking Water and Food Security: Fourth Marcelino Botín Foundation Water Workshop*, L. Martínez-Cortina, G. Garrido, and L. López-Gunn, Eds. London: Taylor & Francis Group, 2010, pp. 75–92.
- [6] L. Xue, G. Liu, J. Parfitt, X. Liu, E. Van Herpen, Å. Stenmarck, C. O’Connor, K. Östergren, and S. Cheng (2017). “Missing Food, Missing Data? A Critical Review of Global Food Losses and Food Waste Data,” *Environ. Sci. Technol.*, vol. 51, no. 12, pp. 6618–6633, 2017.
- [7] G. Chaboud and B. Daviron (2017). “Food losses and waste: Navigating the inconsistencies,” *Glob. Food Sec.*, vol. 12, pp. 1–7, Mar. 2017.
- [8] FAO (2017). “Food wastage footprint. Impacts on natural resources. Summary Report,” 2013.
- [9] I. Gorski, S. Siddiqi, and R. Neff (2017). “Governmental Plans To Address Waste of Food,” John Hopkins Center for a livable future.,.
- [10] V. Smil (2004). “Improving Efficiency and Reducing Waste in Our Food System,” *Environ. Sci.*, vol. 1, no. 1, pp. 17–26, 2004.
- [11] HLPE (2011). “Price volatility and food security,” Rome, 2011.
- [12] FAO (2012). “Towards the future we want: End hunger and make the transition to sustainable agricultural and food systems,” Rome, 2012.
- [13] FAO (2012). “Greening the Economy with Agriculture,” Rome, 2012.
- [14] FAO (2017). “The future of food and agriculture: Trends and challenges,” 2017.
- [15] B. Lipinski, H. Craig, J. Lomax, K. Lisa, W. Richard, and T. Searchinger (2013). “Reducing Food Loss and Waste ,” Working Paper, Installment 2 of Creating a Sustainable Food Future. World Resources Institute (WRI), Washington DC, 2013.
- [16] WRI 82013). “Creating a Sustainable Food Future : A menu of solutions to sustainably feed more than 9 billion people by 2050,” World Resources Institute (WRI), Washington, D.C., 2013.
- [17] M. Kummu, H. de Moel, M. Porkka, S. Siebert, O. Varis, and P. J. J. Ward (2012). “Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use,” *Sci. Total Environ.*, vol. 438, pp. 477–489, 2012.
- [18] FAO (2018). “Key facts on food loss and waste you should know!,”. [Online]. Available: <http://www.fao.org/save-food/resources/keyfindings/en>.
- [19] T. Stuart (2009). *Waste: Uncovering the Global Food Scandal*. London: Penguin W.W. Norton Co.
- [20] M. L. Spiker, H. A. B. Hiza, S. M. Siddiqi, and R. A. Neff (2017). “Wasted Food, Wasted Nutrients: Nutrient Loss from Wasted Food in the United States and Comparison to Gaps in Dietary Intake,” *J. Acad. Nutr. Diet.*, vol. 117, no. 7, p. 1031–1040.
- [21] FAO (2012). “Food loss prevention for improving food security in the Near East,” . [Online]. Available: <http://www.fao.org/docrep/meeting/025/md457E.pdf>.
- [22] UNEP (2012). “Avoiding Future Famines: Strengthening the Ecological Foundations of Food Security through Sustainable Food Systems,” Nairobi.

- [23] UNEP (2012). “The Critical Role of Global Food Consumption Patterns in Achieving Sustainable Food Systems and Food for All,”. [Online]. Available: <http://fletcher.tufts.edu/CIERP/~media/Fletcher/Microsites/CIERP/Publications/2012/UNEPGlobalFoodConsumption.pdf>.
- [24] FAO (2014). “Reducing food loss and waste in the Near East and North Africa,” Fact sheet - Regional Conference for the Near East (NERC-32), February 2014.
- [25] FAO (2015). Regional Overview of Food Insecurity: Near East and North Africa. Cairo,.
- [26] FAO, “Regional Strategic Framework - Reducing Food Losses and Waste in the Near East and North Africa Region,” Cairo, 2015.
- [27] S. Ali Arous, R. Capone, P. Debs, Y. Haddadi, H. El Bilali, F. Bottalico, and M. Hamidouche (2017). “Exploring household food waste issue in Algeria,” *AgroFor*, vol. 2, no. 1, pp. 55–67.
- [28] G. Elmenofi, R. Capone, S. Waked, P. Debs, F. Bottalico, and H. El Bilali (2015). “An exploratory survey on household food waste in Egypt,” in *Book of Proceedings of the VI International Scientific Agriculture Symposium “Agrosym 2015”*; 15-18 October, 2015; Jahorina, Bosnia and Herzegovina, 2015, pp. 1298–1304.
- [29] A. Abouabdillah, R. Capone, L. El Youssfi, P. Debs, A. Harraq, H. El Bilali, M. El Amrani, F. Bottalico, and N. Driouech (2015). “Household food waste in Morocco: an exploratory survey,” in *Book of Proceedings - Sixth International Scientific Agricultural Symposium “Agrosym 2015”*, Jahorina, Bosnia and Herzegovina, October 15-18, 2015., 2015, pp. 1353–1360.
- [30] K. Sassi, R. Capone, G. Abid, P. Debs, H. El Bilali, O. Daaloul Bouacha, F. Bottalico, N. Driouech, and D. Sfayhi Terras (2016). “Food wastage by Tunisian households,” *Int. J. AgroFor*, vol. 1, no. 1, pp. 172–181, 2016.
- [31] D. Moher, A. Liberati, J. Tetzlaff, D. G. Altman, and The PRISMA Group (2009). “Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement,” *PLoS Med.*, vol. 6, no. 7, p. e1000097, 2009.
- [32] A. Bernstad Saraiva Schott, S. Vukicevic, I. Bohn, and T. Andersson (2013). “Potentials for food waste minimization and effects on potential biogas production through anaerobic digestion,” *Waste Manag. Res.*, vol. 31, no. 8, pp. 811–819.
- [33] WRAP (2013). “Household Food and Drink Waste in the UK 2012,” Banbury (UK).
- [34] F. Abdelradi (2018). “Food waste behaviour at the household level: A conceptual framework,” *Waste Manag.*, vol. 71, pp. 485–493.
- [35] S. Haouel Hamdi, S. Abidi, D. Sfayhi, M. Z. Dhraief, M. Amri, E. Boushah, M. Hedjal-Chebheb, K. M. Larbi, and J. Mediouni Ben Jemâa (2017). “Nutritional alterations and damages to stored chickpea in relation with the pest status of *Callosobruchus maculatus* (Chrysomelidae),” *J. Asia. Pac. Entomol.*, vol. 20, no. 4, pp. 1067–1076,
- [36] F. A. Shreen, S. E. Badr, and M. M. Morad(2016). “Maximizing wheat crop yield using a mobile thresher at small holdings” *Agric. Eng. Int. CIGR J.*, vol. 18, no. 3, pp. 63–73.
- [37] I. Trabelsi, Z. Abbes, M. Amri, and M. Kharrat (2015). “Performance of faba bean genotypes with *Orobanche foetida* Poir. and *Orobanche crenata* Forsk. Infestation in Tunisia,” *Chil. J. Agric. Res.*, vol. 75, no. 1, pp. 27–34.
- [38] M. A. Helmy, S. E. Abdallah, A. Mitroi, and M. A. Basiouny (2013). “Modification and performance evaluation of a reciprocating machine for shelling peanut,” *AMA, Agric. Mech. Asia, Africa Lat. Am.*, vol. 44, no. 3, pp. 18–24.
- [39] M. Padilla (2013). “The new challenges of processing tomatoes: Life cycle assessment, a relevant approach from the field to end use,” *Acta Horticulturae*, vol. 971, pp. 23–34.

- [40] A. M. Rady and S. N. Soliman (2013). "Evaluation of surface effect, on mechanical damage of potato tubers using different methods," in American Society of Agricultural and Biological Engineers Annual International Meeting, ASABE 2013, vol. 6, pp. 5074–5097.
- [41] M. Qaryouti, O. Nijdawi, A. Al-Abed, Z. Naser, M. Abdel Wali, A. Musalam, M. Rawashdeh, S. Arabiat, E. Shnikat, A. Mohammad, R. Basheer-Salimia, H. Allam, S. Farag, S. Zakaria, E. Fallik, I. Prigojin, S. Alkalai-Tuvia, Y. Perzelan, and Z. Aharon (2012), "Regional studies of pathogens development on stored tomato cultivars in the Middle East (Egypt, Jordan, Palestine and Israel)," *Acta Hort.*, vol. 934, pp. 363–370, 2012.
- [42] A. Kandil, A. Attia, A. Sharief, and A. Leilh (2011). "Response of onion (*Allium cepa* L.) yield to water stress and mineral biofertilization," *Acta Agron. Hungarica*, vol. 59, no. 4, pp. 361–370.
- [43] H. Harrak and F. Jaouan (2010). "Processing dates of low market value into flour: evaluation of quality and storage stability," *Acta Hort.*, vol. 882, pp. 593–602.
- [44] A. M. El-Mobaidh, M. A. Razek Taha, and N. K. Lassheen (2006). "Classification of in-flight catering wastes in Egypt air flights and its potential as energy source (chemical approach)," *Waste Manag.*, vol. 26, no. 6, pp. 587–591.
- [45] N. Benkeblia (2000). "Food irradiation of agricultural products in Algeria. Present situation and future developments (a short communication)," *Int. Agrophysics*, vol. 14, no. 2, pp. 259–261.
- [46] Y. F. Sharobeem and S. M. Radwan (2000). "Evaluation and modification of the multi-crop combine harvester," in 2000 ASAE Annual International Meeting, Technical Papers: Engineering Solutions for a New Century, pp. 2501–2512.
- [47] A. M. Hussein, F. I. El-Adgham, M. B. El-Migid, and A. A. Omar (1996). "Postharvest handling and temperature management of chilling sensitive vegetables produced under protected agriculture in Egypt.II. Bean (*Phaseolus vulgaris* L.)," *Acta Horticulturae*, vol. 434, pp. 257–264.
- [48] A. M. Hussein, F. I. El-Adgham, M. B. El-Migid, and A. A. Omar (1996). "Postharvest handling and temperature management of chilling sensitive vegetables produced under protected agriculture in Egypt.II. Bean (*Phaseolus vulgaris* L.)," *Acta Horticulturae*, vol. 434, pp. 265–270.
- [49] K. O. Fuglie (1995). "Measuring welfare benefits from improvements in storage technology with an application to Tunisian potatoes," *Am. J. Agric. Econ.*, vol. 77, no. 1, pp. 162–173.
- [50] R. K. Bansal, G. E. Monroe, R. Dahan, O. El Gharras, and A. Bahri (1994). "Mechanization of lentil harvesting in Morocco," *Appl. Eng. Agric.*, vol. 10, no. 5, pp. 641–646.
- [51] R. K. Bansal and B. Sakr (1992). "Development of a vertical conveyor reaper for harvesting chickpeas and lentils in Morocco," *Appl. Eng. Agric.*, vol. 8, no. 4, pp. 425–428.
- [52] H. A. Fouad, S. A. Tayel, Z. El-Hadad, and H. Abdel-Mawia (1990). "Performance of two different types of combines in harvesting rice in Egypt," *AMA, Agric. Mech. Asia, Africa Lat. Am.*, vol. 21, no. 3, pp. 17–22.
- [53] Noutfia, Y., Benali, A., Alem, C., Zegzouti, Y.F. (2018). Design of a solar dryer for small-farm level use and studying fig quality. *Acta Scientiarum Polonorum, Technologia Alimentaria* 17 (4): 359-365. DOI: 10.17306/J.AFS.2018.0599.

Chapter II: Agri-Food Supply Chains – Models and Legal aspects

2.1 Short Food Supply Chains (SFSC) – Models and development perspectives

(Sebastian Jarzębowski¹, Michael Bourlakis²)

¹ Prof. Kozminski University, Logistics & Procurement Centre, Warsaw, PL;
e-mail: sjarzebowski@kozminski.edu.pl

² Prof. Cranfield University, Centre of Logistics & Supply Chain Management, Cranfield, UK

Research granted by European Commission within Horizon 2020 Programme as a project no 728055 „Short supply chain Knowledge and Innovation Network - SKIN”.

Abstract

There are many different forms of SFSC, but they share a common characteristic of reduced numbers of intermediaries between the farmer or food producer, and the consumer. The growing interest in SFSCs reflects the consumer demand for quality and traceability. In this paper, the authors highlight the development perspectives of SFSC including following points of refer: **Short Food Supply Chains** as Local Food Systems, **Barriers to growth** - the problem with small producers, challenges faced by local food systems. **Scenarios for Future Growth** - Retail experience, Multichannel sales and distribution, Relationship with the consumer, Economies of scale and efficiencies.

Keywords: short supply chain, local food systems, scenarios for future growth

Introduction

Agribusiness and food supply chains are transforming from the commodity system into a coordinated food system [Jarzębowski, 2013]. This leads to competition between various supply chains and networks, and not only to competition between individual companies [Lambert and Cooper, 2000; Christopher, 1998]. However, these trends of change require research to adapt old or develop new models of food business and food markets. Representatives of science recognized the importance of the supply chain management process in the agri-food sector primarily due to the instability of products and the need to improve product flow tracking [Hobbs and Young, 2000].

Consumers continuously increase their demand on food safety and its functionality, product diversity, packaging quality, and the quality of services and products [van der Vorst, 2000]. The issue of environmental protection and the economy of sustainable development is also now more important. Sustainable development is a resource and society dependent [World Commission on Environment and Development, 1987]. In the literature dealing with the issues of sustainable development, more and more attention is paid to the relationship between supply chains and sustainable development of the economy. For example, Kashmanian, Keenan and Wells (2010)

found that leading companies are systematically increasing their activities in the field of environmental protection.

An increasing number of consumers are looking for alternative sources of food produced near their place of residence [Cicia et al., 2010; Nie and Zepeda, 2015]. The dissemination of new forms of food distribution organization in recent years, called short supply chains, can be linked to the increasingly important role played by credibility-based goods in shaping consumer preferences. Indeed, the growing popularity of short supply chains should be attributed to the distribution model, which allows consumers to support local agriculture while adding fresh products to their diet [Uribe et al., 2012].

Development of short supply chains in Europe

The success factors and barriers that may arise in several areas related to short supply chains were identified. Above all, they refer to the key process of creating supply chains in the agri-food sector. Other areas are logistics and infrastructure, product development and access to markets and consumers. Selected success factors and related barriers of SFSC development in terms of access to market and consumer are presented below (Figure 1).

Figure 1. Factors of success and barriers in terms of access to markets and consumers

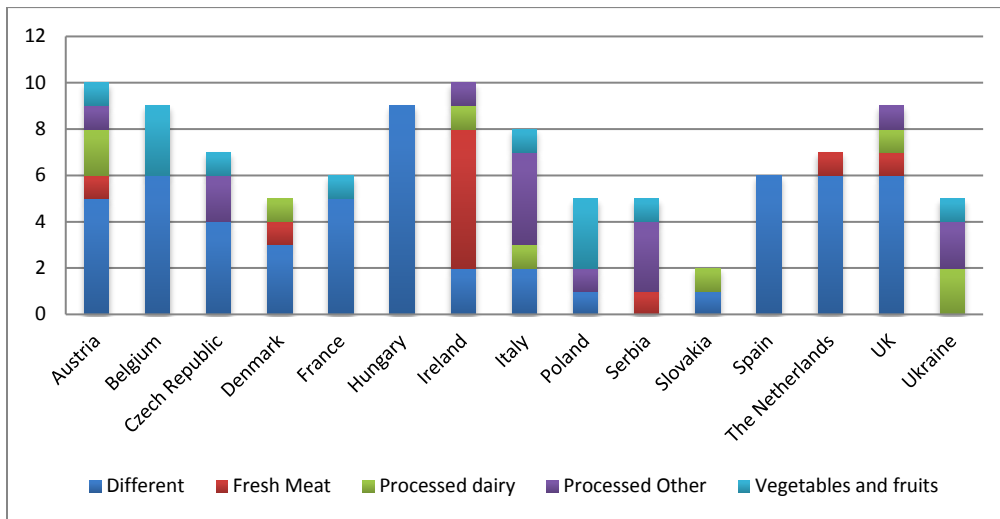
Success factors	Barriers
On-line sales: reliable internet network, effective online store, ordering system and payment system, use of social media, reliable distribution.	Poor Internet network, weak IT systems, lack of affordable technical support, lack of knowledge on how to use social media, unreliable distribution.
Sales in the local community: key products that attract consumers, good interpersonal and communication skills required in dealing with consumers, variety of sales points and sales channels to increase access and convenience of shopping	Farmers may lack communication skills in sales. The costs of stalls and cooling systems on the market, the cost of owning or renting store space.
Public procurement: Application of social and environmental criteria in tenders for public procurement. Public authorities ask for potential suppliers before the offer is prepared. The division of orders into smaller parts increases the chance of local producers to obtain a contract.	A general lack of awareness of the flexibility and possibilities under the EU public procurement rules on the part of public authorities and potential suppliers. Farmers often do not have the skills and resources to submit an offer and meet the requirements (eg continuity of supply, consistency in quality).
Supermarkets: Cooperation centers gathering many small suppliers. Strong and distinctive products in the niche of premium products.	Small producers lack bargaining power to challenge supermarkets in trade negotiations. Supermarkets may require exclusive supplies, which increases the risk of suppliers and limits sales to other customers.
HoReCa: Specjalne wydarzenia promujące typu „spotkaj się z producentem”.	Poor organization on the part of farmers compared to the professionalism expected by hotels.

Source: Own work

Currently in Europe as well as around the world there are many examples and types of short food supply chains. Usually these are small enterprises with limited local impact. However, these small initiatives indicate that these enterprises are able to provide solutions to improve the profitability and stability of agricultural producers. Therefore, there is a great need to identify, synthesize, exchange and present good practices in the short food supply chains management. These arguments were the basis for identifying examples of such chains in Europe. For this purpose, good practices regarding short chains in 15 European Union countries were analyzed. As part of

the study, over 100 examples of initiatives were described and classified in specific sectors (Figure 2).

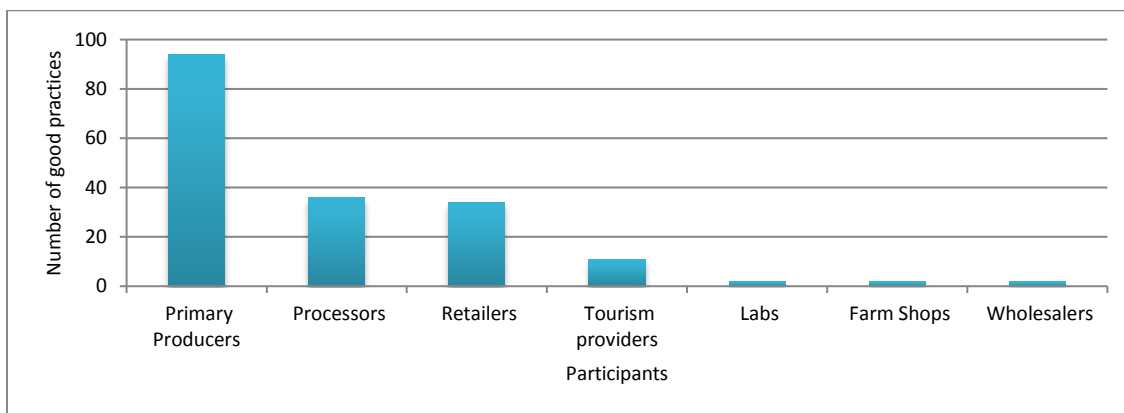
Figure 2. Good practices of SFSC in EU by sector



Source: Own work based on results of project SKIN, Horizon 2020.

The majority of good practices for short chains have been identified in Austria, Ireland, the United Kingdom and Hungary. In the analyzed examples, there is a tendency to include more than one agri-food sector within a single enterprise. These practices include, for example, distribution solutions for agri-food products, such as on-line sales with home delivery or collection at designated places or inviting consumers to farms to make a purchase. In Poland, the most practices related to the fruit and vegetable sector have been identified, while in Ireland - with the meat sector. The concept of short supply chains concerns many of its participants who can benefit from shortening the path to the consumer (Figure 3). Almost all identified good practices include a link of producers. In the case of one third of the analyzed examples, there are processors of agri-food products and retailers. Labs, agricultural stores and wholesalers play a marginal role in the case of short chains.

Figure 3. Participants of SFSC



Source: Own work based on results of project SKIN, Horizon 2020.

Within the framework of the project, topics that emerged in the researched good practices were classified into 4 main groups (products, organizational / institutional / systems, governance and sales).

Conclusions

Short Food Supply Chains (SFSCs) have established in parallel to conventional food chains, playing a key role in the emerging food networks that are continuously arising as an alternative to the globalized agri-food model. Due to the benefits of SFSCs, an increase in the number of initiatives supporting the development of such activities in the agri-food sector is noticeable. These models have become an alternative to the globalized structure of the agri-food sector, enabling "bringing together" the two extreme links of the supply chain and satisfying the needs of both the consumption and production side, while affecting the well-established concept of sustainable development. Although short supply chain practices are becoming increasingly common across Europe, their impact on economic sustainability seems limited by lack of experience and knowledge, which hinders the dissemination of this distribution model and the dissemination of innovation.

The exchange of information and knowledge as well as cooperation between actors involved in the agri-food network are therefore the main factors supporting the competitiveness and sustainable development of SFSCs. It is necessary for small farms and agricultural producers to cooperate within integrated short chains in order to produce a sufficient number of products and to create a common approach regarding the attributes and quality of products. The concept of SFSC might have also global aspects. The ongoing liberalization of trade in agri-food products and the growth in the volume of exchange might also create opportunities for development of European short food supply chains.

References

- Aichele, R., Heiland, I., Felbermayr, G. (2016): TTIP and intra-European trade: boon or bane? München. Ifo Institute. Ifo working paper No. 220.
- Altenberg, P., Grünewald, O. (2013): Global Value Chains and the Transatlantic Trade and Investment Partnership. Kammerskollegium.ational Board of Trade. ISBN 978-91-86575-61-8
- Cicia, G., Cembalo L., Del Giudice, T. (2010). Consumer preferences and customer satisfaction analysis: A new method proposal. *Journal of Food Products Marketing* 17 (1). Taylor & Francis, pp. 79–90.
- Chaffotte, L., Chiffolleau, Y. (2007) Vente directe et circuits courts: évaluations, définitions et typologie, Les cahiers de l'observatoire CROC, n 1.
- Christopher, M. (1998). *Logistics and supply chain management: strategies for reducing cost and improving service*. London: Financial Times Pitman Publishing.
- Czyżewski A., Poczta A., Wawrzyniak Ł. (2006): Interesy europejskiego rolnictwa w świetle globalnych uwarunkowań polityki gospodarczej. *Ekonomista*, nr 3, 350-351.

Kowalski A., Rembisz W. (2005): Rynek rolny i interwencjonizm a efektywność i sprawiedliwość społeczna, Wyd. IERiGŻ-PIB, Warszawa.

EIP-AGRI Report 2015 - ec.europa.eu/eip/agriculture/sites/agri-eip/files/eip-agri_fg_innovative_food_supply_chain_management_final_report_2015_en.pdf

Galli, F., Brunori, G. (2013). Short Food Supply Chains as drivers of sustainable development. Evidence Document. Document developed in the framework of the FP7 project FOODLINKS (GA No. 265287).

Goodman, D. (2003). The quality 'turn' and alternative food practices: reflections and agenda. *Journal of Rural Studies* 19 (1), pp. 1–7.

Hobb, J.E., Young L.M. (2000). Closer vertical co-ordination in agri-food supply chains: a conceptual framework and some preliminary evidence. *Supply Chain Management: An International Journal*, 5 (3), pp. 131-143.

Ilbery, B., Maye, D. (2005). Alternative (shorter) food supply chains and specialist livestock products in the Scottish–English borders, *Environment and Planning A*, 37, pp. 823–844.

Jarzębowski, S. (2013). Integracja łańcucha dostaw jako element kształtowania efektywności sektora przetwórstwa rolno-spożywczego. Warszawa: Szkoła Główna Gospodarstwa Wiejskiego w Warszawie.

Jarzębowski, S., Klepacki, B. (2013). Łańcuchy dostaw w gospodarce żywnościowej. *Zeszyty Naukowe SGGW w Warszawie, Ekonomia i Organizacja Gospodarki Żywnościowej*, nr 102, s. 107-117.

Kashmania, R., Keenan, C., Wells, R. (2010). Corporate environmental leadership: Drivers, characteristics, and examples. *Environmental Quality Management* 19 (4), pp. 1-20.

Marsden T.K., Banks J., Bristow G. (2000). Food supply chain approaches: exploring their role in rural development. *Sociologia Ruralis* 40, pp. 424-438.

Mundubat (2012). Circuitos Cortos de comercialización en Euskal Herria. pp. 64.

Nie, C., Zepeda, L. (2011). Lifestyle segmentation of US food shoppers to examine organic and local food consumption. *Appetite* 57 (1). Elsevier, pp. 28–37.

Parker, G. (2005). Sustainable Food? Teikei, co-operatives and food citizenship in Japan and in the UK. Working Paper in Real Estate and Planning. 11/05.

Peters, R. (2012). Local Food and Short Supply Chains, *EU Rural Review* N°12.

Lambert, D.M., Cooper, M.C. (2000). Issues in supply chain management. *Industrial marketing management*, 29 (1), pp. 65-83.

Renting, H., Marsden, T.K., Banks J. (2003) Understanding alternative food networks: exploring the role of short food supply chains in rural development. *Environment and Planning*, 35(3), pp. 393-411.

Slow Food - http://www.earthmarkets.net/pagine/eng/pagina.lasso?-id_pg=2

Stadtler H., Kilger Ch. (2008): *Supply Chain Management and Advanced Planning, Concepts, Models, Software and Case Studies*, Springer, Berlin, Heidelberg.

Uribe, A., Winham, D., Wharton, C. (2012). Community supported agriculture membership in Arizona. An exploratory study of food and sustainability behaviours. *Appetite* 59 (2). Elsevier, pp. 431–36.

van der Vorst, J. (2000). *Effective food supply chains; generating, modelling and evaluating supply chain scenarios*. Wageningen: Wageningen Univ.

World Commission on Environment and Development (1987). *Our Common Future*.

World Economic Forum (2013). *Enabling Trade - Valuing Growth Opportunities*. In collaboration with Bain & Company and the World Bank. Geneva. ISBN 978-92-95044-64-7

2.2 EDI System in Logistic Management of an Enterprise. A Comparative Study (Leonid Shvartsburg¹, Tadeusz Zaborowski², Małgorzata Węgrzyńska³)

¹ Moscow State University of Technology STANKIN, Moscow, Russia)

² Poznań School of Logistics, Poznan, Poland)

³ Poznan University of Life Sciences);

e-mail: mwegrzyn@up.poznan.pl

Key words: EDI, IT, IT tools, IT solutions, logistic applications, financial statements, financial costs.

Introduction

The EDI system is necessary to achieve the set goals, as it allows shortening the time of customer service completion. It is well known that the longer the customer service time, the longer it takes to freeze the company's financial resources [Cyplik, et al., 2017]. As a consequence, it may result in a lack of financial liquidity and lead to perturbation in the company's operations. For this reason, it is important to analyze the EDI system in an enterprise that produces goods [Naraynan, et al., 2009; Cyplik, et al., 2017]. It is therefore necessary to test the EDI system used in business management. It improves customer service and significantly improves the quality of this service [Cadle and Paul, 2010; Nour, et al., 2016]. These activities can significantly help Computer Science. It should be remembered that an IT system is a tool used to integrate data from multiple sources and which are distinguished by identifiers and transformed into a specific stream of information [Naraynan, et al., 2018; Hoc-Hai, et al., 2017; Matthew, et al. 2016]. This information is then collected in the database and is the result of the implementation of the main planning processes and implementation of processes [Palacias, et al., 2016; Fareh and Penha, 2015]. An interesting solution is the integration of the IT system with the telecommunications system leading to the creation of an ICT system, which allows access to the computer system of every enterprise to the telecommunications network [Vesela, 2017; Musawe and Wahab, 2012; Gengeswari and Abu Bahar, 2010]. This leads to integration between the IT and ICT systems, enabling the processing of information and placing them in the cloud, which becomes a place and computing power related to enterprise servers [Gengeswari and Abu Bahar, 2010; Fiaidhi, et al., 2017]. Thanks to this solution, every employee can work on documents in real time [24]. This enables electronic data exchange (EDI) in a closed group of users [Gengeswari and Abu Bahar, 2010] and allows you to use its main advantages. They are also the basis for carrying out tests of the occurrence of these elements in individual enterprises. In this way, it is possible to assess to what extent the EDI system or its components are installed and used in the surveyed enterprises to influence the effectiveness of their functioning.

Materials and test methods

The research covered small enterprises in Poland and Russia, while for comparisons, a random sample of 100 enterprises, i.e. 50 enterprises in Poland and 50 enterprises in Russia, which deal

with the production of machinery and equipment was established. Selected companies were directed to specially developed questionnaires in which they explained what they are used for and what is the purpose of the research. Responses were received from 24 enterprises, in 12 enterprises from Poland and 12 companies from Russia, which accounts for 24% of the surveyed enterprises. The results of the obtained tests were subjected to statistical analysis using the Statistica program for this purpose. Respondents answered questions related to the EDI system and the use of individual elements of this system.

Findings

Research on using the advantages of the EDI system showed that cost minimization is used in Polish enterprises in 18% more than in Russian enterprises, while the optimization of inventory management is 33% higher than in Russian enterprises. However, quality activities in Russian enterprises are higher by 7.3% than in Polish enterprises and the improvement in relations with partners is higher by 21% in Russian enterprises.

Comparing individual elements within the productivity of enterprises, it can be seen that the following elements dominate in Polish enterprises: promoting open communication 8.4%, optimal organization of meetings 9.67%, request for help 24.42% they are bigger than in Russian companies. On the other hand, Russian companies have an advantage in setting standards by 37.25%, setting goals by 61.9%, specifying expectations by 13.2%, ensuring independence by 14.6% and booking time off from work by 68.51%.

The research results indicate a different approach in the surveyed enterprises towards the EDI system. Skillful use of setting standards and setting goals gives the Russian company a greater perspective in the area of EDI production and use.

Summary

The conducted research has shown that the EDI system is used in both Polish and Russian enterprises. The scope of application of this system varies and depends on the concept of its use by the management of enterprises. Using the advantages of the EDI system by Polish enterprises is mainly focused on the optimization of inventory management, minimization of costs and productivity of the enterprise, while in the case of Russian enterprises, activities are aimed at improving relationships with partners, the quality of the company's operations and productivity. A comprehensive assessment of Polish and Russian enterprises requires further research including assessment of business management through integrated logistics systems.

Literature

Naraynan S., Marycheck A.S., Handfield R.B. (2009). Electronic Data Interchange, Research Review and Future Directions. Decision Sciences Vol.40, no 1.

Cadle J., Paul D.(2010). Business analysis techniques 72 essential tools for success, BCS London, 2010.

Naraynan S., Maruchek A.S., Handfield R.B. (2018). Electronic Data Interchange, Research Review and Future Directions. DSI Wiley.

- Hoc-Hai T., Bernard C.Y.T., Kwak-Kee W. (2017). Organizational Transformation using Electronic Data Interchange, The Case of TradeNet in Singapur. *MIS Quarterly*.
- Matthew M.N., Lisa E., David N., Carhart-Harris R.L. (2016). Ego-Dissolution and Psychedelics, Validation of the Ego-Dissolution Inventory (EDI). University Vincennes Saint Deris Paris.
- Palacias R.M., Mendes T.S., Sano R.Y., Wu D.Ch., Akihara T., de Almedia Mazano R.P. (2016). Choroidal thickness using EDI-OCT in adult-onset vitelliform macular dystrophy, *IJR* no 12.
- Fareh M.E., Penha F.M. (2015). Tomografia de coerencia optica-OCT-dominio spectral e novas technologies. 3 rd ed. Rio de Janeiro, Cultura Medica.
- Vesela L.(2017). Factors Affecting the Adoption of Electronic Data Interchange, *Acta Universitatis Agriculturae et Silviculturae Mendeliana Brunensis* 65(6).
- Musawe M.S., Wahab E. (2012). The adaption of electronic data interchange (EDI) technology by Nigerian SMEs, A conceptual framework. *JBME* Vol 3(2), pp. 055-068.
- Fiaidhi J., Mohammed S., Mohammed S. (2017). EDI with Blockchain as an Enabler for Extreme Automation. *Browse Journals & Magazines. IT Professional* Vol.20,4,pp.66-72.
- Cyplik P., Zaborowski T., Shvartsburg L. (2017). Situation of costs in the logistic process of enterprises. *LogForum*.
- Nour M.M., Evans L., Nutt D., Carhart-Harris R.L. (2016). Ego-Dissolution and Psychedelics: Validation of the Ego-Dissolution Inventory (EDI). *Front, Hum. Neurosci.* zVol. 6.
- Gengeswari K., Abu Bahar A.H. (2010). Integration of electronic data interchange: a review, *Journal Kemanssanean bil.* Vol. 6, pp.63-69.

2.3 Assessment of Rural-Urban Vegetable Supply Chains in Nairobi (*Bensolomon Baraka¹, Cormac O'Sullivan²*)

¹ HELP Logistics (program of the Kuehne Foundation);
e-mail: bensolomon.baraka@kuehne-stiftung.org (corresponding author)

² HELP Logistics (program of the Kuehne Foundation);
e-mail: cormac.osullivan@kuehne-stiftung.org

Keywords: Supply Chain, Smallholder farmers, Institutions, Social capital, Markets.

1. Introduction

Kenya has recorded increasing economic growth over the past decade with its capital Nairobi, being considered the hub of commercial and industrial enterprises in the region. This has resulted to an increasing rate of rural-urban migration. In Nairobi, there are approximately 2.5 million residents living in informal settlements (slums) with a high number of them suffering from micronutrient deficiency. Thus, ensuring the food and nutritional needs of these residents is met is of critical importance.

The Kenyan agricultural supply chain faces several risks which include; information asymmetry, difficulty in contract enforcement, poor infrastructure and technical capacity of actors (Alene et al., 2008). These risks play a major role in: determining the participation of smallholder farmers in specific supply chains, farmer productivity levels and they influence the affordability of agricultural produce on poor urban consumers. In that regard, this study examined the flow of vegetables to Nairobi's informal settlements in order to develop policy recommendations to promote the interests of smallholder producers and poor consumers in this supply-chain. The outputs gathered are expected to inform decision makers on necessary investments to alleviate the poverty of rural farmers and households and improve the food security status of poor urban dwellers.

Therefore, the study objectives put forth were:

1. Assess the flow of fresh foods from rural and/or peri-urban to urban regions.
2. Identify causes that foster or hinder improvement of the linkages between actors at various levels.
3. Propose sustainable investments for improvement of the efficiency and effectiveness of the supply chain.

2. Methodology

2.1 Study Areas

The study was carried out in Nairobi and its peri-urban farm areas. The sample population from the informal settlements came from; Kibera, Mathare and Kangemi where vegetable vendors in these locations were interviewed. Additionally, the central urban markets in Nairobi of Wakulima, Gikomba and Kangemi formed part of the sample area. Lari and Juja regions which were identified as the main vegetable production sources by the wholesale-traders in the central urban market also formed part of the sample.

2.2 Sampling procedure and size

For vendors in the informal settlements (neighborhood markets), a transect sampling technique was used where the main road in the specific informal settlement acted as the baseline (starting point). Afterwards, 3 transects were chosen purposively from the baseline based on the vegetable vendors density along it. Subsequently, ten randomly selected vegetable vendors along that transect were included to the sample. Thus, based on the above outlined procedure, 90 vendors were included in the sample size.

In the central urban markets, a random survey of vegetable traders in the central business district proved extremely difficult. Therefore, a two-stage clustered survey of randomly chosen traders was used within the three central urban markets being surveyed as it was much more practical. Further, incorporated in this two-stage procedure, a proportional-to-size random sampling was done with a sample of 40 percent of the various traders being taken in each of the three markets. This proportional to size random sampling technique helped to reduce overestimation, inter-cluster correlation and improve statistical efficiency that may have been lost due to clustering. In the central urban markets, a market trader headcount was adopted and used as the estimated trader population from which the sample size was arrived at. Therefore by using the randomly chosen 40 percent, the total sample size from those markets was 60 traders.

Finally, a purposive random sampling technique was adopted for smallholder farmers in the peri-urban and rural farming regions. It was purposive since only farmers who produce vegetables for commercial purposes were interviewed. These farmers were identified with the help of Kiambu County agricultural extension officers in the respective sub-counties of interest. These sub-counties were Lari and Juja. For the smallholder farmers, 60 randomly selected farmers in each of the outlined regions were interviewed thus making up a sample size of 120 smallholder farmers.

2.3 Data collection & Analysis

Data collection involved use of semi-structured questionnaires and focus group discussions. Data analysis for this survey was conducted using the Statistical Package for Social Science (SPSS) for the quantitative data. For the qualitative data sourced from focus group discussions and some variables in the data collection tool, analysis of recurring themes was conducted. To facilitate this thematic analysis, these recurrent themes were coded accordingly and introduced into the SPSS templates as quantitative data.

3. Findings

3.1 Overview of the flow of vegetables in the rural-urban supply chain

3.1.1 Rural and Peri-Urban Areas

In terms of the demographics of those surveyed, at the Peri-urban level, male farmers made up nearly 69 % of all farmers interviewed. The average farmer was 44 years old, had 2 years of experience in vegetable farming and selling and less than 2 acres of land with the share under vegetable crop production at 1 acre.

In terms of farmer engagement with different distribution channel strategies, most of the farmgate transactions involved male farmers, estimated at 81%. Among those farmers that sold to local producer markets, the most predominant were female at 58 %. Farmers that predominantly sold to urban markets were mostly male (81%). In terms of the final category of farmers; those that sold to producer associations / marketing NGOs, 75% were male.

3.1.2. Central Urban Markets

In these markets, the survey estimated size of female traders (58%) was higher than that of the male (42%). For most traders, 89%, they asserted that their decision to participate in these markets was based on the high number of buyers and sellers. Further, with regards to knowing sale prices of vegetables in other markets, most traders, 58 percent, did not. For those respondents who claimed to know (majority were male traders, 80 percent), they alluded getting this information from market /rural brokers and other traders who they have good relations with (trusted to relay reliable information). This knowledge was essential to facilitate searching for better markets.

3.1.3 Neighborhood Markets (Informal settlement markets)

The majority of traders in neighborhood markets were female (85%). Certain variables played essential roles in influencing their choice of markets when sourcing for vegetables. Freshness of produce (92%), adequate quantities of vegetable (83%) and price of the vegetables (80%). Further, most traders (61 %) asserted they had informal contractual arrangements with traders in central markets to allow them get vegetables on credit. This was due to the low income status of their customers; there were high rates of default among those who buy on credit. Therefore, traders would also be forced to purchase vegetables on credit to allow them have enough time to recoup the lost capital.

3.1.4 Transportation, Storage and Packaging

Most farmers did not own any means of transport³ and likewise claimed cost of transportation as being the biggest determinant of the mode of transport chosen (60%). For most traders in the neighborhood informal settlement markets, they relied on hired transportation (67%). Cost of mode of transport (71%) was also the most important determinant of mode of transport chosen.

Based on the above finding, cost of transportation, high hiring costs can be postulated to result in a decline in vegetable supply to the city and informal settlements. Moreover, it's important to note that through the whole supply chain these means of transport do have competing needs as they are not specifically meant to transport vegetables. In that regard, their unreliability has already led to revenue and produce losses for some of the respondents interviewed. This affirmation of loss is observed where 67% of respondents in the Peri-urban areas, 42% in central markets, and 43% in neighborhood markets claimed to have incurred varying degrees of economic and food loss due to this unreliability.

A lack of formal or standardized storage space was noted as common throughout the network. However, as these commodities are fast moving, this is not as much of an issue unless during periods of glut as the packaging material used is inadequate. In terms of storage, 84 % of Peri-urban respondents declared they had no access to a formal/closed storage space for their commodities. In central markets, 79% of storage space was considered informal/open. In neighborhood markets, no access to formal/closed storage was noted. However, 63% did note access to informal but closed storage (in their houses).

In relation to packaging, it was observed that it was described as varied, non-uniform and non-standardized. To ensure cleanliness and freshness, packaging can be seen as a mobile form of storage to guard against dirt and pollutants. In Peri-urban areas, 69% of packaging was described as being in a gunny bag while 31% was described as other. In central markets, 74% of produce was reported to be packed in sacks, 16% plastic and 10% none. In the neighborhood market, 85%

³ Only 15% of them claimed to own their personal means of transport and of this the majority (40%) owned motorcycles

of the traders reported using gunny bags as the packaging material of preference to allow for air circulation.

3.2 Factors that foster and hinder improvement of supply chain linkages.

3.2.1 Social capital

Collective action arises when people with the same purpose come together to achieve certain shared objectives that mainly involve improvement of their well-being (Kirsten et al., 2009). Strong collective action results from cohesive social systems i.e. high social capital among actors. Actors in this supply chain did exhibit high social capital as shown in *Table 1*

Table 1: Social capital levels. (Y: Yes, N: No)

	Member of any trader group/producer group	Interaction with other farmer/trader	Influenced another person to participate in this supply chain
Peri-urban regions	Y: 60% N: 40%	Y: 91% N: 9%	Y: 90% N: 10%
Central markets	Y: 68% N: 32%	Y: 78% N: 22%	-
Neighborhood markets	Y: 77% N: 23%	Y: 71% N: 29%	-

Source: Own research.

This high social capital has been used by actors to know prevailing market prices and know where to source for vegetables among neighborhood traders. For central market traders, this high social capital is used to; know prevailing prices, negotiate for supplies of produce, strengthen informal insurance and credit mechanisms, use common transport method and discuss new areas to source for produce. Among farmers in the peri-urban regions, the high social capital was leveraged in; enhancing information sharing on prices and markets and improved diffusion of technology especially seed varieties.

3.2.2 Supply chain coordination

Researchers have claimed coordination failures arise due to information asymmetry among actors (Kirsten et al., 2009). From the Focus Group Discussions, reasons why coordination failure was a common occurrence in this supply chain were; prices are never announced publicly, goods are highly differentiated with no formal standardization or classification system and contracts are oral and unstandardized with virtually no recourse to legal action for contract enforcement.

As a result of these coordination failures and weak institutions in the supply chain, actors employed coping mechanisms to reduce risks in their marketing activities. These mechanisms included; performing thorough physical inspection at the aggregation point before purchase, transporting produce at night and early morning, selling their produce at low prices, selling their old stock first before selling the most recent, mixing their old stock with their new stock and re-division of bunches to smaller quantities among others.

Similarly, some coordination risks in this supply chain that act as a hindrance to its development were identified. This risks mainly involved unwillingness of farmers to invest in output enhancing inputs due to lack of information on market demand, cold chain storage or driers among others. Further, as most farmers have inadequate capital and credit facilities, they rely on the private sector

and the government to provide this complimentary investment as a key incentive for them to increase participation in the urban food supply chain.

4. Conclusions and Implications

Proposed interventions in this supply chain are pegged on reliable institutional arrangements. Institutions will reduce transaction costs and improve supply chain coordination through information sharing, leveraging on economies of scale (for transportation), improving farmer bargaining power, reduction in occurrence of opportunistic behavior among actors and finally reduction of coordination failure.

In this supply chain, the most essential institutional arrangements to bring in benefits to actors and are easy to implement will rely on social capital as it facilitates contract enforcement in both cases of high and low information and where collective action is high. As all groups of actors in the three survey areas exhibited high bonding capital among themselves, their ability for collective action is high. Therefore, by introducing contractual arrangements with other actors like transporters, marketing NGOs, government marketing agencies and extension services this will provide a conducive environment for supply chain integration. Further, in this proposed arrangements, transaction cost reducing structures will be essential depending on the goodwill and investment capacity of the different actors e.g. In the provision of communication infrastructure, trading standards, and bridging capital among the groups of actors among many more. Moreover, this high collective action can be essential in designing basic financial and credit services for the actors in these supply chain. This can be done through contractual arrangements with financial service providers.

Finally, improved technology i.e. communication infrastructure would improve farmer market intelligence. Similarly, cold chain storage and vegetable solar driers would preserve their vegetables and prevent farmers from being exploited by brokers and improve their ability to absorb any demand-supply related shock.

References

Alene, A.D., Manyong, V.M., Omany, G., Mignouma, H.D., Bokanga, M., and Odhiambo, G (2008). Smallholder market participation under transactions costs: Maize supply and fertilizer demand in Kenya. *Food Policy* 33: 318-328.

Kirsten, J.F., Mohammed. A.S.K., and Dorward, A., (2009). Introduction to the economics of institutions. In Kirsten, JF., Dorward, A.R., Poulton, C., and Vink, N., *Institutions Economics Perspectives on African Agricultural Development*. IFPRI. pp 3-34.

Poulton, C., Kydd, J., and Dorward, A., (2006). Overcoming market constraints on pro-poor agricultural growth in Sub-Saharan Africa. *Development Policy Review* (2006), 24 (3): 243-277.

2.4A Brief Review of Selected Food Supply Chains in PNG (*Passingham Buckley Iguá*¹)

¹ Tigak Sustainable Development Foundation, 56 Patiah Beach Drive, Kavieng, New Ireland Province, Papua New Guinea,
e-mail: igua.buckley@gmail.com

Key Words: Logistics, food supply chain, sustainability, transport

Introduction

A food supply chain refers to the processes that describes how food from a garden or farm ends up on dining tables. The processes include production, processing, distribution, retailing, consumption and disposal. The food we consume reaches the table via food supply chains through which food moves systematically in a domino-like motion from producers to consumers while the money consumers pay for food goes to people who work at the various stages along the food supply chain in reverse direction. Every step of the supply chain requires human or natural resources. The food supply chain is domino like, when one part of the food supply chain is affected, the whole food supply chain is affected, which is often manifested through changes in price. As the food supply decrease, demand increases and price increases. Thus, the two-sided causality that connects farmers and consumers is mediated by these two sets of domino causalities (Figure 1).

Figure 1. Movements of food and money in a simple food supply chain

Farmer .>>> Processor >>> Distributor >>> Retailer >>> Consumer

Farmer .<<< Processor <<< Distributor <<< Retailer <<< Consumer

>>> Movement of food

<<< Movement of money

In addition, both movements of food and money are facilitated by “pulls” and “pushes”. In a food supply chain, producers and processors push or supply food and consumers pull or demand food thereby facilitating the dominoes (food) to fall (move) towards the consumer. Similarly, producers and processors pull money and consumers push money to facilitate the movement of money from consumers to producers. Thus if consumers pull for food or push for money is weak or absent, the producers' push for food or pull for money would have to be strong in order to keep the food supply chain moving.

Papua New Guinea has a population of 7.3 million people spread across diverse geographical terrain. The nation faces formidable development challenges, ranking 176 of 186 countries on the Human Development Index (a composite measure of health, education, and income.) PNG has a gender equality index of 133 out of 149 countries (UNDP, 2014).. The formal sector of PNG's economy is focused on export while subsistence and semi-subsistence activities make up the informal sector. The mining sector is making leaps and bounds but the rural communities still languishing in poverty. As a developing county, PNG lacks adequate infrastructure, limited power,

poor communications networks and problems of security and safety. Studies by Bourke and Harwood (2009) reported that health and education services are generally poor, and as a result life expectancy is short and all measures of health, education and literacy is the worst in the Asia-Pacific region.

Method

A brief review of available literature of the food supply chains in Papua New Guinea was carried out for a period of two weeks. It must be noted at this juncture that the time period of two weeks of literature review can not do justice to the purpose of this paper however, at least a glimpse of the situation in Papua New Guinea can be appreciated. Examples discussed in this paper include sweet potato supply chain and vegetables supply chain. The coffee supply chain and cocoa supply chain will also be discussed later in the main paper.

Findings

Sweet Potato Supply Chain - Sweet potato is grown all throughout Papua New Guinea and is an important staple food crop providing a significant portion (40%) of all food energy. More than 70 % of sweet potato is produced in the highlands whilst the balance is grown on the coast. Sweet potato is increasing in importance as a cash crop for the small village farmer to generate income in a market economy that is slowing but surely modernizing. Estimation by Bourke and Vlassek (2004) put total sweet potato production in PNG around 3 million tonnes. Other studies (Spriggs, 2005) have reported that the proportion of sweet potato production sold has been estimated at approximately 60,000 tonnes annually (or 2% of total production of around 3 million tonnes). The mining boom and urbanization have given rise to the market potential of sweet potato. The coastal cities of Lae and Port Moresby have significantly increased their demand as a result of these factors. Chang and Irving (2013) reported that the quantity of sweet potato shipped from Lae to Port Moresby has more than doubled since late 2010. However, expanded marketing opportunities, and potential crop profitability, have been constrained by the high cost of marketing, as well as by product losses. Studies by Irving et al.,(2011) have reported that marketing costs can account for 75% of the total costs while post harvest losses can be as high as 30-50%.

Vegetable Supply Chain - Vegetable farmers in highlands, for example Goroka, in the Eastern Highlands Province are faced with high transport and storage costs and logistical complexities. Most farmers in Goroka transport their produce to market in the major coastal port of Lae, approximately a six hour trip. There is a complete lack of refrigerated road transport available, resulting in high losses. Farmers resort to transporting their produce in the cool of the night despite safety and security concerns. Hardier vegetables such as onions, carrot, potato, sweet potato, English cabbage, avocado, are taken to Lae via the Highlands Highway, either packed into 20-foot containers, 3-6 tonne trucks, or in public motor vehicles (PMV). Road transport of fresh produce from the Highlands to Lae takes at least 2-3 days, depending on what form of transport is used. These are then transferred to shipping containers and moved to Port Moresby by sea. The whole journey from the highlands to Port Moresby usually takes 7-10 days, taking into account the

weather and other factors (Bonney et al. 2012). Highly perishable and higher value vegetable are flown from the highlands to Port Moresby on regular passenger flights. The flight takes an hour. These include tomato, broccoli, cauliflower, capsicum, spring onion, French beans, sugar fruit, wombok and lettuce. In some cases, they are transported by road to Lae, without refrigeration and then put into chiller containers from Lae to Port Moresby by sea. Mixed container loads of vegetables are problematic for post harvest quality because of a lack of understanding of differential ethylene production by different vegetables and fruits, as well as inadequate packaging and rough loading into containers (Bonney et.al, 2012).

Against the backdrop of this complex logistics network and limited key transport infrastructure – considering that fresh produce are highly perishable – timing and coordination between different actors in the fresh produce supply chain are crucial. If farmers, traders and processors seek positive returns from fresh produce, they must either pay the cost of air transport, or rely on a highly coordinated value chain.

Constraints -The constraints facing the agricultural sector and hence food supply chains have been the subject of much analysis, and many of these constraints have remained unchanged for decades as reported by Iguia (2001). These constraints include:

- Negative effective rates of protection – The negative rates of protection arise from moderate to high tariffs on transportation equipment, fuel and other industrial products. Effective rates of protection were in the order of 30 to 50%. Anticipated tariff reductions on the part of Government will lessen and ease the problem. Our smaller and vulnerable communities which play important roles in global value and supply chains must not become collateral damage. The government and business must be responsible in their role to restore confidence in the contribution that trade and investment make to improving living standards and creating employment.
- The poor quality of extension services – Under the Organic Law, agricultural extension was a devolved function, but it was frequently accorded little priority by provincial governments. The Coffee Industry Corporation is the only industry association with a comprehensive extension process. Palm Oil is also relatively well catered for within the industry through services provided by large holder estates. Some extension services are also made available through various donor-funded project such as the Productive Partnerships in Agriculture Project (PPAP) Cocoa Component and Coffee Component funded by the World Bank. The poor quality of extension services arises from a low level of funding and a fragmentation of support services across a growing number of institutions that make coordination difficult. The National Department of Agriculture and Livestock (DAL), provincial governments, autonomous corporations, statutory bodies are mandated entities responsible for the provision of extension services. The poor quality of extension is particularly a constraint for smallholders who tend to have low productivity levels. In line with the general direction of fiscal reforms, a range of measures has already been taken to bring agricultural support closer to farmers. DAL has decentralized some of its functions to regional offices, community and NGO participation in the provision of support services is to be encouraged, and local communities are to receive for small-scale communal development.(e.g. irrigation, agro-processing etc.). Under the provincial government reforms, the effectiveness of extension services will depend heavily on the development of capabilities at the local level. Given the existing weakness and the fragmentation in lines

of authority inherent in the provincial government system, the development of these system will be a significant challenge.

- A shortage of credit for smallholders - In the late 1990s pressure was on the government to empower the smallholders with loans or credit facilities. Despite the provision of government-subsidized finance from the Rural Development Bank and commercial banks, the needs of smallholders are widely believed to be unattractive to the banks, constraining their growth. Land tenure system has often been blamed for slow pace of development of agriculture. Customary ownership of land bestows ownership of land on the clan and legislation prevents sale of customary land unless it has been converted first to leasehold land. Since most lands are not registered, it is difficult to get agricultural loans from the banks which requires collateral.
- High debt level in the plantation sector - The Rural Development Bank of Papua New Guinea was restructured to address the large accumulated debt in agriculture, particularly the coconut plantation sector. The poor and unscrupulous management has given rise to numerous run down coconut plantations in the country. It is most likely that all the debt have been written off by the government.
- Poor infrastructure, particularly transport -The poor state and high costs of transport and communications are major impediments to food supply chains and hence agricultural development and improved livelihood. Good transportation network is imperative for development in PNG, which is dissected by numerous river systems, mountain ranges, and many islands. In this era of information technology, internet, telephone and mass media are important for timely information between the buyers and sellers for sustainable food supply chains.
- Difficulty in obtaining secure access to land - The difficulty in obtaining secure access to land in Papua New Guinea is particularly important to the agriculture sector. The problem is largely due to the customary ownership of land (97%) which does not provide individual land titles. Only 3% is under leasehold or freehold title.

Conclusions

A reliable and sustainable food supply chain is needed in Papua New Guinea. It is possible to achieve this utopia providing all the logistical constraints are minimized and or removed, to ensure a smooth flow of food from the producer to the table. PNG stands at the crossroads. One road takes us towards open markets, dynamic flows of goods and services, investment, and people, and inclusive growth. The other leads us backwards towards protectionism, exclusion and regional economic slowdown. Holding back progress in PNG is detrimental to our livelihood. If the government truly desires inclusive growth for our communities, small business and those impacted by technological change, we must continue to reduce barriers to trade and investment, and not to introduce new restrictions. There is real concern at the escalation of protectionist rhetoric and action in PNG and the region as a whole. In terms of extension services, the provincial governments must increase funding along with increased skilled and qualified manpower to carry out extension duties. Field days and promotion of new agricultural technologies should vigorously be encouraged.

With respect to land access, the government has attempted to address the issue through the development of legislative strategy for customary land registration, including national

framework legislation, land dispute resolution and the alienation of land for use, in this case, agricultural development. Improvements to the existing cumbersome land administration system are also pursued with the assistance of donors. Little progress has been made and the World Bank financed land mobilization project was canceled. The prospect for a resolution of these constraints is very small, given the importance of land to the country's culture.. However for genuine farmers, the only way forward is for the conversion of customary land to lease hold land, enabling access to credit facilities. In order for rural communities to participate meaningfully in the cash economy transport infrastructure must be built. Farmers in the most remote regions are encouraged to grow cash crops on the assumption that the government will provide a market and transportation for their produce. The government's promise to built roads, bridges, wharves and jetties to connect the producers to markets to ensure a smooth and sustainable flow of food supply chains, has been mere rhetoric. The onus is on the government to come good and built the promised transport infrastructure.

References

- Bonney, L.B., Worinu, M. And Muscat, P. (2012). Yu tokim long planim kaikai na maket we? A feasibility study study for a whole new wholesale fresh produce market in Port Moresby. New Zealand and Ministry of Foreign Affairs and Trade, Wellington, NZ.
- Bourke, R.M. and Vlassak, V. (2004). Estimates of food production in Papua New Guinea. Land Management Group, Australian National University, Canberra
- Bourke, M. And Harwood, T. (2009). Food and agriculture in PNG. Canberra: ANU Press.
- Chang, H.S. and Irving, D. (2013). Improving marketing efficiency, post harvest management and value addition of sweet potato in Papua New Guinea. Final Report to ACIAR.
- Igua, P.B.K. 2001. Food Security Strategies for Papua New Guinea. Working Paper 56. CGPRT Centre. Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific. Bogor, Indonesia.
- Irving, D.E., Newman, S.M. and Ramita, I. (2011). Sweet potato varieties for the Papua New Guinea Highlands – A post harvest perspective. Steward Post Harvest Review 7(2), 1-9.
- Spriggs, J. 2005. Towards a research agenda for improving consumer demand and marketing of sweet mpotato in PNG. A report to the Australian Centre for International Agricultural Research.
- United Nations Development Program.(2014). Papua New Guinea National Human Development Report. Retrieved from <http://hdr.undp.org/en/content/papua-new-guinea-national-human-developmentreport-2014>.

Chapter III: Social Aspects in Agri-Food Supply Chains – World Case Studies

3.1 Shellfish Collection Agribusiness in Ecuador. A Behavioral Economic Study (Eveligh Prado-Carpio¹, Cristhian Jover Castro-Armijos¹, Moisés Martínez- Soto², Carlos Rodríguez-Monroy³)

¹ Universidad Técnica de Machala, Ecuador,
e-mail: [eprado@utmachala.edu.ec](mailto: Prado-Carpio@utmachala.edu.ec) / [ccastro@utmachala.edu.ec](mailto: ccastro@utmachala.edu.ec)

² Universidad del Zulia, Venezuela,
e-mail: [moisesenriquemartinezsoto@fa.luz.edu.ve](mailto: moisesenriquemartinezsoto@fa.luz.edu.ve)

³ Universidad Politécnica de Madrid, Spain,
e-mail: [crmonroy@etsii.upm.es](mailto: crmonroy@etsii.upm.es) (corresponding author)

Keywords: Bivalve mollusk Concha Prieta (*Anadara tuberculosa*), Demographic studies, Public services, Behavioral economics, Ecuador.

Introduction:

The demographic aspects and provision of public services are fundamental for the development of agribusiness and the economic behavior of those who participate in them. Behavioral economics and its strategies allow us to take advantage of predictable patterns in human decision making in order to overcome the barriers to behavioral change. Behavioral economics tries to incorporate ideas from other social sciences, especially psychology, to enrich the standard model. Interest in the psychology of human behavior is a return of the economy to its origins. Adam Smith alluded to key concepts such as aversion to loss, overconfidence and self-control. The objective of this research is to diagnose the situation of the demographic aspects and provision of public services in the agribusiness of the bivalve mollusk Concha Prieta "*Anadara tuberculosa*" (Sowberry) and the possible strategies to formulate to obtain the necessary improvements, in the framework of behavioral economics.

Methods

The quantitative study carried out was descriptive, not experimental, field, ex post facto and cross-sectional. It includes a prospective approach. It was developed in the Jambelí Archipelago, located southwest of the province of El Oro, south coast of the Republic of Ecuador, specifically in the commune of Las Huacas, which has the responsibility of guarding 1,070 hectares of mangrove ecosystem.

The population studied was made up of 68 members of the Association of Artisanal Shellfish Farmers, through a census. The registration was obtained from the parish council of Jambelí.

A questionnaire structured in categorical and quantitative variables, consisting of open and closed questions, was designed and validated. The validation was carried out by a panel of 5 experts, and its reliability was determined using the Cronbach's Alpha technique, of which a value of 0.88 was obtained. In research works related to qualitative data similar to the study, Sánchez (2018) obtained an Alpha of 0.87 and (Alonso et al., 2017) ≥ 0.75 recommending the use of values higher than 0.70 which enables the acceptance of the survey model.

The information obtained through the structured survey method was tabulated in a database in Excel, then processed through the statistical program SPSS version 24 for its descriptive analysis and applying a Chi square test. Based on the results obtained, graphs and tables were prepared for their respective interpretation.

Findings

It was evidenced that the majority of inhabitants of the commune of Las Huacas are men (57%), while women represent 43%. Likewise, it was obtained that the predominant ages in the population under study were in the range of 26-33 years, which represented 33.33% of the total age distribution of the collectors of the Las Huacas site, of which 13.3% are men and 20.0% are women of said subtotal, followed by age groups from 34 to 41 years, 42 to 49 years and from 50 to 57 years, in the same order of proportionality.

Regarding the educational level, it was found that 76.30% of the population under study has completed primary school studies and only 2.60% completed high school studies, finding no evidence of a relationship between the variables of gender and instruction level.

Regarding the social variables and public services, it was found that only 2% of the bivalve mollusk collectors have social security. Sewage and fixed telephone services coverage is 0%, that is, they are non-existent in the community. On the contrary, in a positive sense, it was evident that the electricity and potable water service has a coverage of 100% in this community, reaching a range from intermediate value to high the coverage of mobile telephony services with 72.72%, Internet with 60.50% and TV-Radio with 82%.

Based on these findings, the application of the following key strategies for the development of behavioral economics is suggested prospectively: framing of messages, behavior and choice are dependent on the context, effect of similar people or partners, use of the default values, active option improved and finally, taking advantage of social forces.

Conclusions and consequences

It is concluded that the shellfish collector population in the island of Las Huacas is young, with a predominance of males and a completed primary school level. In terms of public services, there is a moderate to high coverage in most of the services, especially mobile telephony, Internet and TV-radio, which can serve as a means of transmitting messages and information that can positively transform the economic behavior of shellfish collectors, based on theories related to behavioral economics.

References

- Adam, A., Prosteian, G., Badea, A., & Prosteian, O. (2015). Knowledge Transfer in Educational Projects. *Procedia - Social and Behavioral Sciences*, 191, 1460–1466. <https://doi.org/10.1016/j.sbspro.2015.04.346>
- Alonso, Á. V., Díaz, J. A. A., & Mas, M. A. M. (2017). Aplicación del cuestionario de opiniones CTS con una nueva metodología en la evaluación de un curso de formación CTS del profesorado. *Tarbiya, Revista de Investigación E.* Retrieved from <https://revistas.uam.es/tarbiya/article/view/7216>.
- Ángel, Fernández; Rogelio, De Guevara; Rosa, M. (2017). Las finanzas conductuales en la toma de decisiones. *Fides Et Ratio*, 13(2), 199–213. Retrieved from http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S2071-081X2017000100009
- Arellano, D., & Barreto, F. (2016). Gobierno Conductual: Nudges, cambio de comportamiento inconsciente y opacidad. *Foro Internacional*, 226(4), 903–940. Retrieved from <http://www.scielo.org.mx/pdf/fi/v56n4/0185-013X-fi-56-04-00903.pdf>
- Cahaya, A. (2015). Fishermen Community in the Coastal Area: A Note from Indonesian Poor Family. *Procedia Economics and Finance*, 26(15), 29–33. [https://doi.org/10.1016/S2212-5671\(15\)00801-1](https://doi.org/10.1016/S2212-5671(15)00801-1)
- Camerer, C. (2014). Behavioral Economics. *Current Biology*, 24(18), 867–871. <https://doi.org/10.1016/B978-0-08-097086-8.71007-5>
- Dean, A., Fielding, K., & Wilson, K. (2019). Building community support for coastal management —What types of messages are most effective? *Environmental Science & Policy*, 92(October 2018), 161–169. <https://doi.org/10.1016/j.envsci.2018.11.026>
- Domínguez, Y. M., Gutiérrez-Barroso, J., & Gómez-Galdona, N. (2017). Equidad, Género Y Diversidad En Educación. *European Scientific Journal*, ESJ, 13(7). <https://doi.org/10.19044/esj.2017.v13n7p%p>
- Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015). Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour. *Renewable and Sustainable Energy Reviews*, 41, 1385–1394. <https://doi.org/10.1016/j.rser.2014.09.026>
- Giuri, P., Munari, F., Scandura, A., & Toschi, L. (2019). The strategic orientation of universities in knowledge transfer activities. *Technological Forecasting and Social Change*, 138(June 2018), 261–278. <https://doi.org/10.1016/j.techfore.2018.09.030>
- Gradinaru, A. (2014). The Contribution of Behavioral Economics in Explaining the Decisional Process. *Procedia Economics and Finance*, 16, 417–426. Retrieved from <https://www.sciencedirect.com/science/article/pii/S2212567114008211>
- Hernández, A. (2014). Recuperación e importancia de la pesca y los pescadores del lago de Chapala. *Culturales*, IV(1), 237–240. Retrieved from http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1870-11912016000100237

- Hoff, K., & Stiglitz, J. E. (2016). Striving for balance in economics: Towards a theory of the social determination of behavior. *Journal of Economic Behavior and Organization*, 126, 25–57. <https://doi.org/10.1016/j.jebo.2016.01.005>
- Hoshino, E., van Putten, E. I., Girsang, W., Resosudarmo, B. P., & Yamazaki, S. (2017). Fishers' Perceived Objectives of Community-Based Coastal Resource Management in the Kei Islands, Indonesia. *Frontiers in Marine Science*, 4(May), 1–11. <https://doi.org/10.3389/fmars.2017.00141>
- Jenssen, B. P., Bутtenheim, A. M., & Fiks, A. G. (2018). Using Behavioral Economics to Encourage Parent Behavior Change: Opportunities to Improve Clinical Effectiveness. *Academic Pediatrics*, 19(1), 4–10. <https://doi.org/10.1016/j.acap.2018.08.010>
- Kapeliushnikov, R. (2015). Behavioral economics and the 'new' paternalism. *Russian Journal of Economics*, 1(1), 81–107. <https://doi.org/10.1016/j.ruje.2015.05.004>
- Koch, A., Nafziger, J., & Nielsen, H. (2015). Behavioral economics of education. *Journal of Economic Behavior and Organization*, 115, 3–17. <https://doi.org/10.1016/j.jebo.2014.09.005>
- Long, S., Jones, P., Randriana, Z., & Hadj, J. (2017). Governance analysis of a community managed small-scale crab fishery in Madagascar: Novel use of an empirical framework. *Marine Policy*, (November), 1–12. <https://doi.org/10.1016/j.marpol.2017.11.022>
- López, S., Benítez, L., & Sánchez, J. M. (2015). Social Knowledge Management from the Social Responsibility of the University for the Promotion of Sustainable Development. *Procedia - Social and Behavioral Sciences*, 191, 2112–2116. <https://doi.org/10.1016/j.sbspro.2015.04.327>
- Mendoza, J. (2015). Evaluación de la pesquería de la concha prieta (*Anadara tuberculosa*) y de la concha mica (*Anadara similis*) en la Provincia de El Oro, Ecuador. Machala. Retrieved from <https://www.utmachala.edu.ec/archivos/planificacion/2014/prometeos/Dr. Jeremy Mendoza/FIN VINCULACION Dr. Mendoza/Informe Final Dr. Jeremy Mendoza.pdf>
- Neamtu, D. M. (2015). Education, the Economic Development Pillar. *Procedia - Social and Behavioral Sciences*, 180(November 2014), 413–420. <https://doi.org/10.1016/j.sbspro.2015.02.138>
- Rehman, T. ur. (2016). Historical context of behavioral economics. *Intellectual Economics*, 10(2), 128–132. <https://doi.org/10.1016/j.intele.2017.03.006>
- Ribero Salazar, F. A. (2016). La construcción de mensajes en la sociedad del conocimiento, y la formación de ciudadanía para la paz en Colombia. *Dixit*, (25), 64. <https://doi.org/10.22235/d.v0i25.1274>
- Sánchez, E. R., & Pedreño, M. H. (2018). Análisis de las causas endógenas y exógenas del abandono escolar temprano: una investigación cualitativa. *Educación XX1*, 0(0). <https://doi.org/10.5944/educxx1.21351>
- Steeves, L. E., Filgueira, R., Guyondet, T., Chassé, J., & Comeau, L. (2018). Past, Present, and Future: Performance of Two Bivalve Species Under Changing Environmental Conditions. *Frontiers in Marine Science*, 5(May 2018), 1–14. <https://doi.org/10.3389/fmars.2018.00184>
- Thaler, R., & Sunstein, C. (2008). *Nudge: Improving decisions, about health, wealth, and happiness*. (Y. University, Ed.), 感染症誌(Vol. 91). Michigan. Retrieved from file:///C:/Users/Usuario/Downloads/Richard_H._Thaler_Cass_R._Sunstein_Nudge_Improv..pdf

Valero, A., & Van, J. (2019). The Economic Impact of Universities: Evidence from Across the Globe. *Economics of Education Review*, 68(September 2018), 53–67.
<https://doi.org/10.1016/j.econedurev.2018.09.001>

Véliz, A., Dörner, A., & Ripoll, M. (2017). Bienestar psicológico y nivel de sedentarismo de pescadores artesanales de la Región de Los Lagos, Chile. *Humanidades Médicas*, 17(2), 323–337. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1727-81202017000200006

3.2 Creating Opportunities for Rural Youth

(Mamadou Edrisa Njie¹, Cherno Jallow²)

¹ African Virtual University, Employer Institution: Global Youth Innovation Network Gambia Chapter (GYIN Gambia Chapter);

e-mail: edrissanjie@gyin.org, office: gambia@gyin.org

² Institute of Professional Administration, Employer Institution: Global Youth Innovation Network Gambia Chapter (GYIN Gambia Chapter);

e-mail: chernoms209@hotmail.co.uk, office: gambia@gyin.org

Key words: Youths, Entrepreneurship, Rural, Logistic, Financial

Introduction:

The economic crisis has been adversely impacting three key issues associated with the sustainable development of young people across the world: employment, enterprise, and development funding. African youth, who comprise nearly 70 per cent of the region's population, are feeling the impact of the crisis as they face numerous challenges in their attempt to find decent employment, gain access to credit and create businesses. This represents quite a paradox, as a high proportion of these young people have vision and ideas that could provide them with employment through enterprise development.

Creating Opportunities for Rural Youth (CORY) is based on to promote immersion of the rural poor young women and men in the principles and ideas around the character, psychological and attitudinal demands of entrepreneurship, as well as the provision of technical assistance such as basic skills training on entrepreneurship development and other management efficiency enhancement modules. By making entrepreneurship, business management, and technical trainings available to rural poor young men and women, this objective will provide services that will reduce poverty and raise incomes.

Methods:

Group discussion's, Face-to-Face meetings, Presentations, Question and Answers

Findings:

In West and Central Africa (WCA), agriculture accounts for 30 per cent of the economic activity and employs 60 per cent of the region's economically active population. There is a need for further investment in the agriculture sector to allow rural entrepreneurs to take advantage of new and emerging market structures and to have access to the latest in agricultural technology and livestock production systems - and thus meet the needs of both the rural and urban populations of the region. Young rural entrepreneurs need support to sustain and grow their enterprises, and more young people need to be encouraged to get involved in the agriculture sector.

Conclusions and Implications:

As bottom-up entrepreneurship becomes a popular paradigm to foster economic growth in emerging economies and especially in West and Central Africa, attention is now being focused on rural youth entrepreneurship. This is driven partly by growing national and international recognitions of the need to address youth development challenges especially the alarming youth un- and under-employment rates in sharp contrast to the high opportunities not yet fully tapped in farm and non-farm business in developing countries. There are number of evidences to support this argument⁶. The recent UN survey on the development of a System Wide Action Plan on Youth identifies three key factors that affect youth employment: lack of entrepreneurship and vocational education; lack of financial literacy and business skills, and lack of access to financial services, including loans, savings, equity, and youth friendly financial products. As stated in a report in the Stanford Social Innovation Review, the lack of appropriate training and lack of experience renders rural African youth entrepreneurs as risky investments from a financial point of view and the lack of finances implies that rural youth entrepreneurs don't get the opportunity to employ the "fail often and fail fast" approach that is often associated with entrepreneurial learning in the developed world.

To successfully develop adapted financial products targeting rural youth, the methodology will special attention to the following operational mechanism: 1) ensure coordination and communication between Banks; and rural Micro Finance Institutions. Banking will allow the rural youth to have reliable and secure access to financial services and products on their mobile phone to transfer or save money, pay bills or make purchases.

References:

http://www.ifad.org/pub/ruralyouth/youth_policybrief.pdf

<http://www.ifpri.org/gfpr/2012/employment-agriculture#fn10back>

<http://www.ifpri.org/blog/farming-key-solvingyouth-unemployment-africa>

3.3 CSR in the food industry: a comparative study for Poland and Brazil

(Joanna Wiśniewska-Paluszak, Magdalena Kozera-Kowalska, Giana de Vargas Mores, Caroline Pauletto Spanhol Finocchio, Márcia Tibolla)

¹ Poznan University of Life Sciences, Department of Economics, Poland,
e-mail: joanna.wisniewska-paluszak@up.poznan.pl

² Poznan University of Life Sciences, Department of Law and Organization of Agribusiness Enterprises, Poland,
e-mail: magdalena.kozera@up.poznan.pl

³ IMED Business School, Brazil,
e-mail: gimores@gmail.com

⁴ Federal University of Mato Grosso do Sul, Brazil,
e-mail: caroline.spanhol@ufms.br

⁵ IMED Business School, Brazil,
e-mail: mtibolla5@gmail.com

Key words: sustainability, natural resources, health nutrition, corporate governance

Introduction

Poland and Brazil are countries where the introduction of corporate social responsibility (CSR) has had a recent history (Stehr, et al. 2019, Długopolska-Mikonowicz, et al. 2019). They are also economies where the food industry has an impact and a high dependence on the economy, environment and society. The food industry in both countries is one of the largest manufacturing sectors in terms of output value, employment and international trade. As expected, in Poland and Brazil, CSR is quickly gaining importance in the food industry's practice and research.

In food industry practice, the pressure of more environmentally and nutritionally mindful consumers has led the food transnational corporations to make more endeavours towards restoring their reputation and legitimacy (Mohr, et al. 2001, Lerro, et al. 2018). Both transnational corporations as well as small and medium-sized enterprises (SMEs) are looking for ways to create value and competitive advantages. Consequently, social responsibility has become an urgent topic for all food industry organizations' practice. All of them, in a way, are concerned with the CSR challenges and project implementation as well as with the communication of social responsibility results to their stakeholders.

In both the food and fuel industry, recently researchers have become more engaged in defining and describing CSR aspects (Hartman 2011, Formans-Hugg, et al. 2013, Poetz, et al. 2013, Luhmann and Theuvsen 2016, Luhmann and Theuvsen 2017, Benites-Lazaro, Giatti and Giarolla 2018). Industry-specific and industry-related CSR are being discussed, and researchers are challenging the legitimacy of food industry CSR. Firstly, they underline that food production concerns every individual, as it satisfies basic human needs. Hence, the main reasons for its determining are specific societal concerns such as securing sufficient quantity and quality of food, healthy nutrition, preservation of natural resources, traceability in food supply chains and networks, responsibility of food transnational corporations, animal welfare, and fair trade.

Some of the societal concerns towards the food industry are more apparent in developed countries, like the U.S (Rankin et al. 2011, Ross et al., 2015). Other specific problems are being challenged in countries like Poland (Kozera-Kowalska and Gołaś 2017, Wiśniewska-Paluszak and Paluszak 2017) and Brazil (Araujo and Mendonça 2009, Liboni and Cezarino 2012, Breitenbach, Rodrigues and Brandão 2018). Based on this, it is preponderant to research and compare different cases to legitimize the notion of food industry CSR as well as to discuss specific reasons for its implementation and to think of the most effective ways of creating shared value for the food industry and society at the same time.

In our research we assumed a special position of social responsibility and the existence of food industry specific aspects of CSR, in particular in emerging economies like Poland and Brazil. In the example of Poland and Brazil, we research the specific problems of CSR in the food industry, compare them and reach a conclusion on the notion of food industry CSR. The aim of the research is to compare CSR activities of food companies in Poland and Brazil and discuss the current status of food-related CSR. The research contributes to the ongoing discussion on a social responsibility framework for the food industry.

Methods

This study is based on summative content analysis, one of the techniques used in qualitative research. It is particularly useful for identifying and gaining insight into general trends followed by the surveyed entities. The content analysis covered the CSR reports made by food companies in Poland and in Brazil in the 2007-2018 period. Social responsibility measures were classified and coded by predefined categories of relevance for the food industry. The following specification of food industry social responsibility categories was used in this study: preservation of natural resources; healthy nutrition; food supply chains and networks; animal welfare; corporate governance; labour; and community development.

Findings

The study led to a comparison of specific measures for the food industry implemented in socially responsible food companies in Poland and Brazil. The main outcome of the research is the ranking of the covered initiatives and programs reported by food companies in both countries, the recognition of CSR leaders within the food industry and their main areas of responsibility.

Conclusions and implications

The paper discusses the current status of food-related CSR in Poland and Brazil. It shows the current need for discussing a CSR framework for the food industry in general as well as in regards to transnationals and SMEs separately.

The results show that transnational food companies focus on philanthropy measures linked particularly to consumers, local communities and workers' conditions. In this case, philanthropy is used as a form of public relations or advertising, promoting a company's image or brand through cause-related marketing or other profile sponsorships. These remarks apply also to corporate

environmental protection measures, mostly oriented towards benefits, which in this case mean the economies resulting from reduced consumption of raw materials and favourable impacts for the company's reputation, brand, image and consumer perception.

In the case of food SMEs, the most important institutional challenge is enhancing their sustainable competitive advantage. For that reason, they are implementing activities aimed at creating sustainable value food chains and networks providing sustainable products and services. The companies quite often totally redefine their missions, visions, products, markets and value chains to be more integrated with society. They seek to implement new business models in which fulfilling social needs guarantees social value and a competitive advantage.

References

- Araujo G.C., Mendonça P.S.M. (2009). Análise do processo de implantação das normas de sustentabilidade empresarial: um estudo de caso em uma agroindústria frigorífica de bovinos. *Revista de Administração Mackenzie*, vol. 10(2): 31-56.
- Benites-Lazaro L.L., Giatti L., Giarolla A. (2018). Sustainability and governance of sugarcane ethanol companies in Brazil: topic modeling analysis of CSR reporting. *Journal of Cleaner Production*, vol. 197(1): 583-591.
- Breitenbach R., Rodrigues H., Brandão J.B. (2018). Whose fault is it? Fraud scandal in the milk industry and its impact on product image and consumption - the case of Brazil. *Food Research International*, vol. 108: 475-481.
- Długopolska-Mikonowicz A., Przytula S., Stehr C. (2019). Corporate social responsibility in poland. Strategies, Opportunities and Challenges. Springer International Publishing, Switzerland.
- Forsman-Hugg S., Katajajuuri J., Riipi I., Mäkelä J., Järvelä K., Timonen P. (2013). Key CSR dimensions for the food chain. *British Food Journal*, 115(1): 30-47.
- Hartmann M. (2011). Corporate social responsibility in the food sector. *European Review of Agricultural Economics*, vol. 36(3): 297-324.
- Kozera-Kowalska M., Gołaś Z. (2017). Corporate social responsibility in agribusiness: the ASF case. *Journal of Agribusiness and Rural Development*, 3(45): 583-590.
- Lerro M., Vecchio R., Caracciolo F., Pascucci S., Cembalo L. (2018). Consumers' heterogeneous preferences for corporate social responsibility in the food industry. *Corporate Social Responsibility and Environmental Management*, vol. 25(6): 1050-1061.
- Liboni L.B., Cezarino L.O. (2012). Impactos sociais e ambientais da indústria de cana-de-açúcar. *Future Studies Research Journal*, vol. 4(1): 202-230.
- Luhmann H., Theuvsen L. (2016). Corporate social responsibility in agribusiness: literature review and future research directions. *Journal of Agricultural and Environmental Ethics*, vol. 29: 673-696.

- Luhmann H., Theuvsen L. (2017). Corporate social responsibility: exploring a framework for the agribusiness sector. *Journal of Agricultural and Environmental Ethics*, vol. 30: 241-253.
- Mohr L.A., Webb D.J., Harris K.E. (2001). Do consumers expect companies to be socially responsible? the impact of corporate social responsibility on buying behavior. *The Journal of Consumer Affairs*, vol. 35(1): 45-72.
- Poetz K., Hass R., Balzarova M. (2013). CSR schemes in agribusiness: opening the black box. *British Food Journal*, 115 (1): 47-74.
- Rankin A., Gray W., Boehlje M.D., Alexander C. (2011). Sustainability strategies in U.S. agribusiness: understanding key drivers, objectives, and actions. *International Food and Agribusiness Management Review*, vol. 14(4): 1-19.
- Ross R.B., Pandey V., Ross K.L. (2015). Sustainability and strategy in U.S. agri-food firms: an assessment of current practices. *International Food and Agribusiness Management Review*, vol. 18 (1): 17-48.
- Stehr C., Dziatzzko N., Struve F. (2019). *Corporate social responsibility in Brazil: the future is now*. Springer International Publishing, Switzerland.
- Wiśniewska-Paluszak J., Paluszak G. (2017). Social responsibility of Polish food industry leaders. *Journal of Agribusiness and Rural Development*, vol. 3(45): 693-704.

3.4 Sustainable Energy Autarky and the Evolution of German Bioenergy Villages (*Dariusz Pieńkowski¹, Wojciech Zbaraszewski²*)

¹ Poznań University of Life Sciences, Department of Social Sciences and Pedagogy, Poland,
e-mail: dariusz.pienkowski@up.poznan.pl)

² West Pomeranian University of Technology in Szczecin, Department of System Analysis and
Finance, Poland,
e-mail: wzbaraszewski@zut.edu.pl)

Key words: autarky, sustainable development, German bioenergy villages

Introduction

The idea of autarky has a long history and many facets. There have been fierce economic and political debates on autarky even in recent history, leading to the negation and unpopularity of this idea. The present policy follows the concept of sustainable development, and it has gained a new meaning as the local utilisation of renewable energy resources from the perspective of their inter- and intragenerational distribution; the local action is shaped by the global perspective. In liberal schools of economics (i.e. classical or neoclassical), autarky is usually considered from the perspectives of economic trade protectionism, closed economies, and threats to welfare (Amir et al., 2017; Kareken and Wallace, 1977; Vousden, 1990). Moreover, the term was vastly developed by the planners of centralized economies in Germany and socialistic countries (Brown and Neuberger, 1968; Carr, 1972; Saraiva and Wise, 2010). These analyses usually pointed out the economic inefficiency and authoritarianism (autarchy) of these economic and social orders. Therefore, the concept of autarky in terms of freedom, paradoxically, has a bad reputation in liberal economics.

However, the concept of energy autarky related to the idea of sustainable development has different origins from the liberal economic debate (Dincer, 2000; Jenssen et al., 2014; Klein and Coffey, 2016; Müller et al., 2011; Omer, 2008; Rae and Bradley, 2012; Renn and Marshall, 2016). Self-reliance is perceived as an element of the global climate mitigation policy and the way of allocating social, economic, and natural resources from the inter- and intragenerational perspectives. Energy autarky is not a concept of isolation but an idea of using global resources locally. In other words, unlike in the economic debate, the circles of energy are locally locked to secure resources for a local community in terms of the postulates of sustainable development, that is, to secure them for other societies and future generations. However, energy autarky itself does not have to meet the postulates of sustainable development. This paper shows the relationships between the autarky concept and the sustainable development postulates at the example of the evolution of the approaches to bioenergy villages in Germany.

Methods

The research consists of three steps. Firstly, a model of energy autarky has been offered based on the system theory originally described in science by Bertalanffy (1968). A system is an entity that

consists of functional interrelated elements demarcated from its environment. The structure of the system's elements is determined by its goals. The model shows the variety of the structures and features of energy systems offered in today's debates on energy autarky. Secondly, the key postulates of sustainable development have been presented to define an autarkical sustainable energy system. Finally, the presentation of the evolution of the concept of bioenergy villages in Germany has been offered to illustrate the narrow approach to energy autarky resulted in the extensive production of biomass for power installations resulting in monocultures of energy crops, soil sterilization, and severe water shortages. The problems related with the first bioenergy villages challenged the sustainability postulates. Therefore, the idea has evolved into the new concept of smart or resilient villages and autarky at higher spatial levels.

Results

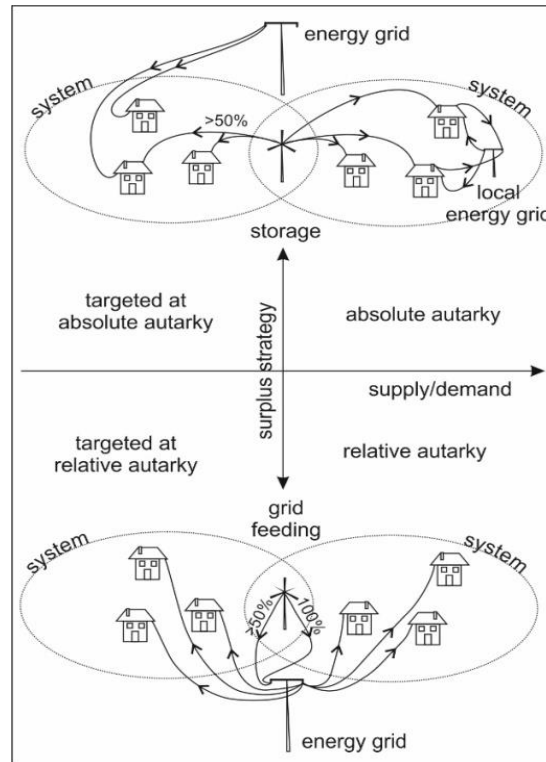
The approaches to autarky consist of many assumptions that should be clarified and interrelated in a consistent model of autarky. Figure 1 plots the key characteristics of energy self-sufficiency. The X axis presents the relationship between the supply of local energy sources and the local demand for energy in a system, while the Y axis reflects the strategies to deal with surpluses. The axes cross in equilibrium (i.e. the ratio of supply to demand equals 1) on the X axis and the point of a lack of grid feeding on the Y axis. The values of the X axis range between zero and infinity (i.e. $<0, \infty>$). The Y axis represents two extremes as follows: the local storage capacities and the degree of grid feeding.

The model is founded on the following assumptions:

- a system can be analysed at different levels of its functional (e.g. in terms of energy carriers or economic sectors) and spatial characteristics;
- energy is a means for the socio-economic functions of a system, and the criteria for its boundaries are defined by the functions;
- all energy sources (i.e. nuclear energy carriers, fossil fuels, as well as renewable energy resources) are included;
- an energy grid is an energy infrastructure in the environment of a system with outside management of the system;
- a local energy grid is an energy infrastructure fed only by local energy producers, and it is considered as a local storage system (the potential exchange between the parts of the system or storage in a locally provided infrastructure);
- an energy grid has unlimited capacity for energy feeding;
- local energy storage capacity occurs, although it is temporarily limited;
- the storage of energy in a relative autarkical system is marginal and economically unreasonable;
- the surplus beyond the storage capacity of an absolute autarkical system is marginal (it will generate a demand or not be produced);
- there is a contractual assumption about the time horizon of relative autarky (usually one year);
- a system is autarkical when the ratio between the locally generated supply and the local demand is greater than or equal to 1;
- the degree of autarky starts from zero (i.e. a continuous scale);

- the system targeted at autarky is defined by a contractual assumption about the minimum ratio between the locally generated supply and the local demand;
- an autarkical system is possible with the degree of each autarky (relative and absolute) above zero and with the mixed strategy of dealing with surpluses (i.e. certain degrees of both grid feeding and storage).

Figure 1. The model of energy self-sufficiency.



Source: own elaboration.

Müller et al. (2011), referring to the original definition presented in the Brundtland Report in 1987, defined a sustainable energy system as follows: ‘it must be capable of providing the energy services demanded by the current population, whilst ensuring that future generations find the economic, social and ecological resources they require’ (Müller et al., 2011, p. 5800). In turn, Lund (2007) pointed out three main strategies of sustainable energy development: (1) energy savings (consumption), (2) energy efficiency (production), and (3) transition to renewable energy sources. Dincer (2000) also included the political problems of the growing demand for energy that followed the population growth, while Deutschle et al. (2015) refined the main strategies into an open-ended list of the goals of energy sustainable systems, including autarky, among others, such as energy, resource and cost efficiency, climate change neutrality, and renewable energy sources.

A sustainable energy village should be evaluated with all these criteria and the degree to which it meets the requirements defined by its goals. Therefore, an energy autarkical village with efficient technologies based on fossil energy sources can be less sustainable than a village that is dependent on the solar energy provided by a neighbouring village. Similarly, an autarkical village with

efficient energy grid services, which invests in a costly, expensive to maintain, and resource-intensive energy storage infrastructure, fails to satisfy the sustainability criteria in terms of resource and cost efficiency.

The term bioenergy village has evolved in Germany since the first village was created in 2005, although it is firmly rooted in three ideas:

- energy autarky;
- bioenergy (i.e. energy produced from biomass);
- rural areas and agriculture.

The first criterion assumes that biomass has to cover fully the local demand for electricity and a minimum of 50 per cent of the local demand for heating; additionally, over 50 per cent of the heating infrastructure should be owned by the local consumers of heat energy and local farmers (Ruppert et al., 2010). In turn, the definition by the FNR⁴ due to the share of renewables accepts a minimum of 50 per cent of the demand for energy being covered by the regional bioenergy supply (FNR, 2017). However, the updated criteria weaken the share and importance of biomass in energy production, assuming as previously autarky in electricity and the coverage of a minimum of 75 per cent of local heat energy, both entirely from renewables; additionally, the focus is on raising the efficiency of energy use and production (Heck et al., 2014). The transformation has been described semantically by a prefix in brackets: (bio)energy villages (Heck, 2015, 2014). Finally, the concept of bioenergy villages has been transformed into a new idea of smart villages, which widely includes the following sustainability factors: (1) electricity, (2) heating, (3) land protection, (4) efficiency, (5) innovation, and (6) social participation (Heck, 2015; see also Heap, 2015; Hogan et al., 2017). The transition was mostly forced by the problems resulting from the biomass footprint (Anton and Steinicke, 2012; Hadian and Madani, 2015; Jenssen et al., 2014; Jering et al., 2012).

Conclusions

The concept of autarky (self-sufficiency and self-reliance) has returned to the economic debate with a new face of sustainable energy production and consumption. However, it is misleading to assume that energy autarky, as well as renewable energy resources themselves, are sustainable. There are additional criteria that should be met to achieve the goals postulated by the concept of sustainable development, such as efficiency or just distribution.

There is no universal sustainable energy system in terms of time and space; for example, relative autarky is often the optimal solution in developed countries and absolute autarky in developing ones (Hiremath et al., 2007). Moreover, there are annual variations of the energy supply from renewables, different conditions for their use, and diverse intuitional and cultural patterns of consumption. Provided that all these elements are taken into account, that is, social, economic, and environmental, energy autarky will meet the postulates of sustainable development. The German energy policy, particularly intensively developed since the 1990s, has aimed at the concepts of local, regional, and national autarky related to renewable resources. The current position of the

⁴ *Fachagentur Nachhaltende Rohstoffe e. V* – Agency for Renewable Resources, financed by the German Federal Ministry of Food and Agriculture.

German policy assumes that it is mostly applicable at the higher levels (i.e. regional or national). The concept of local energy autarky is recommended for some small and specific communities.

References

Agora Energiewende (2016). 2015 was a Record Year for Renewable Energies, Power Production and Power Exports in Germany. <https://www.agora-energiewende.de/en/press/agoranews/news-detail/news/2015-was-a-record-year-for-renewable-energies-power-production-and-power-exports-in-germany/News/detail> [accessed 12.06.2017].

Amir R., Jin J.Y., Tröge M. (2017). Free Trade versus Autarky under Asymmetric Cournot Oligopoly. *Review of International Economics*, vol. 25: 98–107.

Anton C., Steinicke H. (2012). *Bioenergie: Möglichkeiten und Grenzen, Empfehlungen*. Deutsche Akademie der Naturforscher Leopoldina – Nationale Akademie der Wissenschaften, Halle.

Bertalanffy L. V. (1968). *General System Theory: Foundations, Development, Applications*. George Braziller Inc., New York.

Brown A.A., Neuberger E. (1968). *International Trade and Central Planning: An Analysis of Economic Interactions*. University of California Press, Berkeley-Los Angeles.

Carr W. (1972). *Arms, Autarky and Aggression: A Study in German Foreign Policy, 1933–1939*. Edward Arnold, London.

Clifton-Brown J.C., Breuer J., Jones M.B. (2007). Carbon Mitigation by the Energy Crop, *Miscanthus*. *Global Change Biology*, vol. 13: 2296–2307.

Deuschle J., Hauser W., Sonnberger M., Tomaschek J., Brodecki L., Fahl U. (2015). Energie-Autarkie und Energie-Autonomie in Theorie und Praxis. *Zeitschrift Für Energiewirtschaft*, vol. 39: 151–162.

Dincer I. (2000). Renewable Energy and Sustainable Development: A Crucial Review. *Renewable Sustainable Energy Review*, vol. 4: 157–175.

FNR (2017). Bioenergiedörfer. <https://bioenergiedorf.fnr.de> [accessed 07.06.2017].

Hadian S., Madani K. (2015). A System of Systems Approach to Energy Sustainability Assessment: Are All Renewables Really Green? *Ecological Indicators*, vol. 52: 194–206.

Heck P., Anton T., Böhmer J., Meisberger J., Menze S., Pietz C., Reis A., Schierz S. (2014). *Bioenergiedörfer - Leitfaden für eine praxisnahe Umsetzung*, 1. überarb. Aufl. ed. Fachagentur Nachwachsende Rohstoffe e.V. (FNR), Gülzow-Prüzen.

Hiremath R. B., Shikha S., Ravindranath N. H. (2007). Decentralized Energy Planning. Modelling and Application - A Review. *Renewable Sustainable Energy Review*, vol. 11: 729–752.

Hogan P., Crețu C., Bulc V. (2017). *EU Action for Smart Villages*. Luxembourg.

Jenssen T., König A., Eltrop L. (2014). Bioenergy Villages in Germany: Bringing a Low Carbon Energy Supply for Rural Areas into Practice. *Renewable Energy, World Renewable Energy Congress – Sweden*, 8–13 May, 2011, Linköping, Sweden, vol. 61: 74–80.

- Jering A., Klatt A., Seven J., Ehlers K., Günther J., Ostermeier A., Mönch L. (2012). Globale Landflächen und Biomasse nachhaltig und ressourcenschonend nutzen, Positionen. Umweltbundesamt, Dessau-Roßlau.
- Kareken J., Wallace N. (1977). Portfolio Autarky: A Welfare Analysis. *Journal International Economics*, vol. 7: 19–43.
- Klein S. J. W., Coffey S. (2016). Building a Sustainable Energy Future, One Community at a Time. *Renewable Sustainable Energy Review*, vol. 60: 867–880.
- Lund H. (2007). Renewable Energy Strategies for Sustainable Development. *Energy, Third Dubrovnik Conference on Sustainable Development of Energy, Water and Environment Systems*, vol. 32: 912–919.
- Müller M. O., Stämpfli A., Dold U., Hammer T. (2011). Energy Autarky: A Conceptual Framework for Sustainable Regional Development. *Energy Policy, Sustainability of Biofuels*, vol. 39: 5800–5810.
- Omer A. M. (2008). Energy, Environment and Sustainable Development. *Renewable Sustainable Energy Review*, vol. 12: 2265–2300.
- Pieńkowski D. (2012). Paradoxs Jevons’a a konsumpcja energii w Unii Europejskiej. *Problemy Ekorozwoju*, vol. 7: 105–116.
- Rae C., Bradley F. (2012). Energy Autonomy in Sustainable Communities—A Review of Key Issues. *Renewable Sustainable Energy Review*, vol. 16: 6497–6506.
- Renn O., Marshall J. P. (2016). Coal, Nuclear and Renewable Energy Policies in Germany: From the 1950s to the “Energiewende.” *Energy Policy*, vol. 99: 224–232.
- Ruppert H., Eigner-Thiel S., Girschner W., Karpenstein-Machan M., Folker R., Ruwisch V., Sauer B., Schmuck P. (2010). *Wege zum Bioenergiedorf: Leitfaden*, 3. Aufl. ed. Fachagentur Nachwachsende Rohstoffe e.V. (FNR), Gülzow.
- Saraiva T., Wise M. N. (2010). Autarky/Autarchy: Genetics, Food Production, and the Building of Fascism. *Historical Studies in Natural Sciences*, vol. 40: 419–428.
- Vousden N. (1990). *The Economics of Trade Protection*. Cambridge University Press, Cambridge.

3.5 Assessment of Post-Harvest Losses and Household Food Security in Kayonza District, Rwanda

(*Toyib Aremu¹, Olawale Olayide¹, Andre Ndagijimana², Jean Claude Mudahunga²*)

¹ Centre for Sustainable Development, University of Ibadan, Ibadan, Nigeria;
e-mail: aremutoyib@gmail.com (corresponding author)

² Ministry of Agriculture and Animal Resources, Kigali, Rwanda

Keywords: Postharvest losses, Food security, Adaptation, Rwanda.

Introduction

Attention shifted to addressing the challenge of postharvest losses after the 1970s food crisis. But once food commodity prices started to fall, no one seemed to care anymore. Now postharvest loss is gaining attention again because of the blow that climate change is dealing with farmers' harvests across regions of the world. Through impacts like shifting and unpredictable rainfall patterns, prolonged drought events, flooding, bush fires, desertification and losses that occur during postharvest handling, climate change causes serious loss of agricultural harvests leading to economic loss and threatening food security of smallholders.

Sub-Saharan Africa is said to be the only developing region in the world where food insecurity has worsened in recent decades (Ringler et al., 2010 and FARA, 2014). Due to their limited economic development and institutional capacity, African countries are among the most vulnerable to the impacts of climate change (FARA, 2014). This situation is particularly more prominent in the rural areas with more poverty, food insecurity and malnutrition. Yet Africa's population continues to grow at an estimated annual rate of 2.4%. The population is predicted to double its current 0.9 billion people by 2050. In order to feed this population, crop production will have to increase by 260% by 2050 (Bernard et al., 2015). To meet the Sustainable Development Goals on sustainable agriculture and food security by 2030 will mean having a system in place that is efficient enough to combat climate change in all its impacts. This is where postharvest handling and management becomes important since when postharvest losses are reduced, incomes can be increased and food security and nutrition improved.

Rwanda is largely an agrarian country with about 85% of the people living in rural areas. Although poverty is said to have declined from 57% in 2005 to 45% in 2011 (IFAD, 2013), 43% of the country's population are in extreme poverty and 66% of the poor population reside in the rural areas (Msaki et al., 2015). Rwanda has the highest population density in Africa. Moreover, the country is characterised by agro-ecological diversity, with 12 agro-ecological zones (KIPPRA, 2017). The agricultural sector contributed 43% to the GDP in 2002, sustains 90% of the population (REMA, 2011 in Msaki et al., 2015), employs 80% of the labour force and is responsible for 45% of the country's export revenues (IFAD, 2013). Agricultural production is predominantly at a subsistence level because a large number of rural household's farm plots are too small to support commercial production (KIPPRA, 2017). Since Rwanda's agriculture depends on the quality of

rainfall, it is very vulnerable to the impacts of climate change. Also, the increased frequency of droughts period, floods, landslides and erosion that are observed considerably in the country decrease food productivity (REMA, 2011).

The United Nations International Fund for Agriculture Development (IFAD) in March 2014 agreed to fund a Climate Resilient Post-harvest and Agribusiness Support project (PASP) with support from the Government of Rwanda and other players. This project, which has three components, has the overall goal of alleviating poverty, increasing rural income and contributing to overall economic development of Rwanda. One of these components is the post-harvest climate resilient agri-business investment support that involves supporting farmers with the acquisition of relevant low-carbon postharvest infrastructures that can reduce postharvest losses and increase smallholders' incomes.

Methods

This study assesses PASP with particular focus on current state of losses, adoption of climate resilience methods and technologies, and the impacts of these on food security for maize, beans and dairy farmers in Kayonza District. Kayonza District was chosen out of the twelve districts in Rwanda where PASP operates. This is because of its peculiar climate change vulnerability. Three hundred and fifty-six (356) farmers were sampled from thirteen PASP-beneficiary cooperatives in this district. Out of these cooperative members, 57 were from dairy cooperatives and the rest 299 were farmers in maize and beans cooperatives. To assess the impact of the US\$ 83.35 million project, the following research questions were to be answered using structured questionnaires shared amongst farmers in maize, beans and dairy cooperatives:

1. What are the current level and causes of post-harvest losses in Kayonza?
2. To what extent have the smallholder beneficiaries adopted post-harvest management and technologies?
3. What is the nature of food security of smallholder farmer beneficiaries at the household level?

Analysing Food Security

In the current study, the questions in the original USDA Methodology were modified and expanded from 18 to 22 for easy coding in SPSS. For the questions in the original scale that included more than two options (such as those with Never true, Sometimes and Often), they were first recoded as a YES (for those who chose “sometimes” or “often”)/NO (for those who chose “never true”) question then a follow up to separate “sometimes” and “often” for those coded as “YES”. Similarly, questions that included follow up questions like “almost every month, some months but not every month, or in only one or two months” are simplified into often and sometimes, again for easy coding in SPSS. Having done this, we ended up with 22 questions. This also meant that the scale of analysing had to change. The new scale developed is shown in Box 2 below.

Table 2. Box 2 Modified categorisation of Food Security

Categorization of Food Security Status of Households According to the Number of Affirmed Items on the Food Security Scale (Modified)	
<i>1. Households without children (based on responses to the 11 adult and household items):</i>	
Food secure	= households that denied all items or affirmed 1 to 3 items
Food insecure without hunger	= households that affirmed 4 to 6 items
Food insecure with hunger	= households that affirmed 7 or more items
<i>2. Households with children (based on responses to all 22 items):</i>	
Food secure	= households that denied all items or affirmed 1 to 4 items
Food insecure without hunger	= households that affirmed 5 to 9 items
Food insecure with hunger	= households that affirmed 10 or more items

Source: Adapted and modified from USDA (2000); Nord et al. (2005)

Findings

The household size of the respondents ranges from 1 to 12 members with an average of 5.3 which is modestly close to 4.7 reported by the country's institute of statistics. One hundred and eighty-one (equivalent to 51%) of the respondents are females. Majority (46.9%) belong to the 31-45 years age bracket followed by 46-60 years age bracket (29.2%). Out of 335 respondents, only 7.5% own land that is over 2 ha in size; 9.3% own between 1 and 2 ha of land; 45.6% have between 0.5 and 1 ha and 37.6% own less than 0.5 ha of land meaning majority of the farmers are between very small cultivators (under 0.3 ha) and medium cultivators (0.9 to 3.0 ha) according to the National Institute of Statistics Rwanda. We found that females own smaller lands than male: the females own more of the less than 0.5 ha and between 0.5 and 1 ha while the males own more of 1-2 ha and greater than 2 ha lands. The dairy farmers have between 2 and 30 cows and produce between 5 and 60 litres of milk per day. Majority of the farmers (88.2%) depend solely on farming as their source of income while only 11.8% engage in other economic activities not related to farming. However, many of the farmers diversify their agricultural production. Out of five groups of agricultural activities (growing maize, growing beans, rearing cows, rearing small domestic animals like goats, fowls and pigs, and growing other crops than maize and beans), only 11.8% of the sampled population are involved in just one, 14.3% engage in two, 31.2% engage in three, 26.1% engage in four and 16.6% engage in all five activities. They also cultivate on personal and consolidated farmlands.

Table 3. Summary of Socio-economic Characteristics

Characteristics	Frequency	Percentage (%)
Gender		
Male	175	49.2
Female	181	50.8
Age range		
15-30 years	42	11.8

31-45 years	167	46.9
46-60 years	104	29.2
Over 60 years	43	12.1
Marital Status		
Divorced	11	3.1
Married	295	82.9
Single	12	3.4
Widowed	38	10.7
Type of crop grown		
Maize	325	91.3
Beans	282	79.2
Cows	172	48.3
Small domestic animals (fowls, goats, pigs etc.)	151	42.4
Other crops than maize and beans	214	60.1
Total size of Farmland		
Less than 0.5 ha	126	37.6
Between 0.5 – 1.0 ha	153	45.7
Between 1.0 – 2.0 ha	31	9.3
More than 2.0 ha	25	7.5
Level of Education		
No formal education	78	21.9
Primary education	224	62.9
Junior high	47	13.2
Higher school	6	1.7
University	1	0.3
Do you engage in any other economic activities than farming?		
Yes	42	11.8
No	314	88.2

Source: own research

The production of maize is in the range of 20-3000 kg and beans in the range of 10-1000 kg. This production quantity represents what is realised by the farmers after subtracting quantity lost. The quantity lost, both on the farm and out of farm, is captured separately. 92.5% of the maize farmers reported that they lost their maize during the last season while 80.6% of beans farmers experienced loss of their crop. The dairy farmers sampled reported they produce between 5- 60 litres of milk per day and lose between 1-25 litres of milk. 98.6% of the farmers that lost their crops reported that it occurred on the field while 40.6% of them reported that it occurred during harvesting or handling (drying, winnowing and storage). The major causes are drought, damage by pests and diseases, strong winds and inadequate postharvest handling and storage (PHHS) infrastructure. The most serious cause of the loss are pests and diseases.

We found that out of 299 members of the maize and beans farmers, 43.1% of them do not currently have drying facilities (which means they have to dry using tarpaulins or temporary hangers) and 56.9% responded that they do. Some 50.9% of those who have the drying facility do not use it at all. 63.2% of the dairy farmers experienced loss of their milk. The most serious cause of this loss

has to do with milk handling equipment followed by transporting over long distance and milk handling skills. Only 48.5% of the dairy farmers use the milk cans while the rest use jerricans. This may prompt loss of dairy product since the jerricans cannot be cleaned easily leaving milk from previous use and contaminating their subsequent milk collected. Heavy weight of milk cans, ease of transporting and possibility of traveling with more litres of milk using jerricans, and high cost of milk cans compared to the plastic containers are reasons for the use of jerricans. Majority of the respondents (99.4%) access climate information mostly from radios and mobile phones. Only 24.7% of the respondents have adopted the use of irrigation system in case of droughts. The crop farmers stored 0 – 700 kg of maize and 0 – 500 kg of beans for their personal consumption. The dairy farmers stored between 1- 8 litres of milk for household consumption. For many of the cooperatives, it was learnt, they encourage their members to not sell what is left of their harvest in a season that they experience loss.

Using the USDA method for assessing food security, we found that 50% of the farmers are food secure; 16.3% are food insecure although without hunger and 33.7% are food insecure with hunger. While this figures may differ in a way from what is known of food security in Rwanda (In 2009, the World Food Programme had reported that 21% of Rwandans were food insecure, 22% in 2012 and 19.4% in 2015), it should not be seen as raising force alarms. This study is being carried out at a time after the most serious drought event in 60 years so a different figure like this is anticipated. It shows perhaps the impact of the drought resulting from climate change on food insecurity. Also, only few of the farmers have adopted irrigation facilities against flooding despite that the major cause loss is drought. Similarly, majority of the famers (80.6%) have not received training in non-agricultural activities and 85.9% of them have not received training on irrigation or natural resource management.

Table 4. Food Security Status of Respondents

	Frequency	Percentage
Food Secure	178	50.0
Food Insecure without Hunger	58	16.3
Food Insecure with hunger	120	33.7
Total	356	100

Source: own research

Conclusion and Implication

We conclude by saying that climate change is a multifaceted problem and will require multiple approaches to solve. Even though PASP may have achieved its aim to a large extent cutting *postharvest losses* as confirmed by the beneficiaries assessed, there is still a lot to do. Agricultural losses due to climate change is still a problem especially in Kayonza where drought events are witnessed. Perhaps this is why out of all the questions asked under the assessment of the project by beneficiaries, only the one on satisfaction on production level is widely rejected. Many of the farmers say they are not satisfied with the current quantity of production they end up with. This may be as a result of the quantity that they lose to drought. We advise that it is necessary to

implement a project that focuses on finding alternatives to water needs of crops especially through irrigation.

References

Bernard James, Manyire Henry, Tambi Emmanuel and Bangali Solomon (2015). Barriers to Scaling-Up/Out Climate Smart Agriculture and Strategies to Enhance Adoption in Africa. *Forum for Agricultural Research in Africa, Accra, Ghana*.

FARA (2014). Report on Climate Smart Agriculture Orientation and Scaling-Up Workshop 31st March – 4th April, 2014 at the *ICRAF Conference Centre, Nairobi, Kenya*.

IFAD (2013). Climate Resilient Post-Harvest and Agribusiness Support Project (PASP) including blended Adaptation for Smallholder Agriculture Programme Grant (ASAP). *International Fund for Agricultural Research*.

KIPPRA (2017), “An Assessment of Rwanda’s Agricultural Production, Climate Change, Agricultural Trade and Food Security”, Kenyan Institute for Public Policy Research and Analysis and UN Economic Commission for Africa Working Paper No. 23, 2017

Msaki Mark M., Tambi Emmanuel and Bangali Solomon (2015). State of Knowledge on CSA in Africa, Case Studies from Rwanda, Tanzania and Zambia. *Forum for Agricultural Research in Africa, Accra, Ghana*.

Nord, Andrews, and Carlson (2005). History of the Development of Food Insecurity and Hunger Measures .” National Research Council. 2006. Food Insecurity and Hunger in the United States: An Assessment of the Measure. Washington, DC: The National Academies Press. doi: 10.17226/11578.

REMA (2011). Guidelines for Mainstreaming Climate Change Adaptation and Mitigation in the Agricultural Sector - *Rwanda Environmental Management Authority*.

Ringler C. et al. (2010). Climate Change Impacts on Food Security in Sub-Saharan Africa: Insights from Comp. Climate Change Scenarios – *IFPRI Discussion Paper 01042*.

USDA (2000). Measuring Food Security in the United States: Guide to Measuring Food Security. Revised Edition. United States Department of Agriculture.

Chapter IV: Agri-Food Supply Chains – Challenges and Trends

4.1 Business Model as a Path to Improve the Logic of Management in Agriculture – the Case of the Meat Market

(Magdalena Kozera-Kowalska¹, Elżbieta Goryńska-Goldman², Peter Balogh³)

¹ Poznan University of Life Sciences, Faculty of Economics and Social Sciences, Department of Economics and Economics Policy in Agribusiness, Poland,
e-mail: mkozera@up.poznan.pl (corresponding author)

² Poznan University of Life Sciences, Faculty of Economics and Social Sciences, Department of Economics and Economics Policy in Agribusiness, Poland,
e-mail: gorynska-goldmann@up.poznan.pl

³ Faculty of Economics and Business, Department of Research Methodology and Statistics, University of Debrecen, Hungary,
e-mail: balogh.peter@econ.unideb.hu

Key words: business model, logic of management, meat supply chain, customer value added

Introduction

A business model is the way to present one's idea for a business, prepared with the use of graphic and descriptive methods (Baden-Fuller and Mangematin, 2013, p. 418-427), or a way to present an idea for making money to potential investors (Koźmiński, 2004). Nevertheless, a business model is first and foremost a modern tool, used for finding the way of internal organization and building a long-lasting relationship with the company's surrounding (Goryńska-Goldmann and Gazdecki, 2018), including above else its customers (Klang et al., 2010). On the one hand, a business model is the symbol of creativity and intellectual capital of different entities that create it, on the other hand, it is a form which importance and effectiveness may raise objections, coming from, for example, the so-called effect of newness.

Changes in our socioeconomic reality, trigger the need to constantly adjust the well-known and widely accepted by farmers business model. It is being more and more influenced by both global and local processes, which are connected inter alia, with a paradigm shift from industrial to socially sustainable agriculture. (Czyżewski and Klepacki, 2015, p. 17).

The aim of this paper is to present the possibilities of using a business model (i.e. Business Model Canvas), as a modern tool for planning and managing processes in logistics, as well as pointing out potential benefits from its implementation in agriculture. The research was carried out in reference to the meat market, where one of the essential problems is the identification of the origin of food and its connections to the standards of quality, that beside price are the key criteria in creating value for customers.

Methodology of research

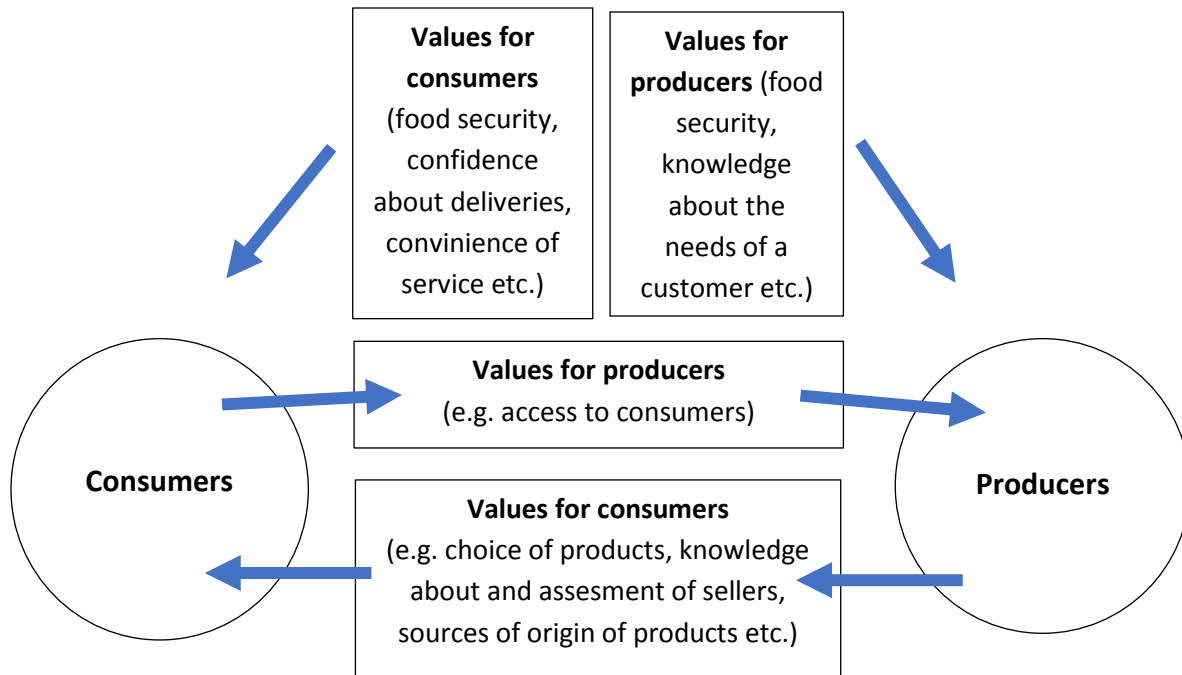
While we were researching into the possible ways of improving business logic used by entities operating in the meat market, especially within the supply chain of pork, we thoroughly familiarized ourselves with both the Polish and foreign literature that is focused on the agriculture economics, management economics, application of logistics solutions inside and outside companies, as well as with management and decision-making tools in the presence of risk. The descriptive conclusions were verified by the results of a current research focused on the problems of the pork market and its networks of connections (marketing chains, commercial relationships and integration processes). The characteristics of the meat market were prepared with the available data from official statistics (Central Statistical Office), industry reports and materials gained from the entities operating in the production, distribution and trade of meat sectors. The paper and its conclusions are of a contributing character. In the research, we assumed that:

- The business model, which is possible to be implemented in farming, will be considered as a management tool which allows to present in a logical way the procedures of running a production company, aimed at satisfying customer's needs, and which at the same time is difficult to copy and strongly based on the agricultural company's operating realities (Morris et al, 2005, p. 726-735),
- The value added in agriculture will be process-oriented, i.e. it will be a set of agricultural practices which help to provide products to final customers and thus bring some measurable benefits to a farmer (Kania and Musiał 2018, p. 117–129),
- The value added for a customer will be the sum of all benefits that he may gain through buying and using a specific product or service (Kotler 2005).

Results

The meat market in Poland, analyzed from the consumer's perspective, is developing relatively fast. However, from the producer's perspective the pace of changes is much slower and determined mostly by economical factors (inter alia by the production profitability which has been decreasing for many years), as well as organizational factors, i.e. unfavourable structure of entities and production (Kozera-Kowalska, 2017, p. 95-102; Pepliński, 2019). Regardless those conditions, the determination and engagement of food supply chain participators are increasing, especially among farmers and producers of livestock, who are interested in actions aimed at gaining and sustaining the interest of processors and consumers, in particular those from their countries. Such actions are of an innovative character and are directed at, inter alia, promoting the health benefits of Polish meat, its quality and food security with the use of some modern information channels (Goryńska-Goldmann and Kozera-Kowalska, 2018a, p.139-147, Goryńska-Goldmann and Kozera-Kowalska, 2018b, p. 151-161), as well as at increasing the level of care for the environment, vitality of rural areas and their cultural heritage.

Figure 1. The sources of value generated in a simplified business model



Source: Own study.

The specific nature of the meat market comes from the fact that it is one of the most important sources of providing animal protein to consumers, while offering a wide choice and easy access to products at a different level of processing. For its functioning more and more significant problem becomes the economic sustainability of the supply chain. It results in increasing the share of a producer in the margin generated by the chain. Because of some objective reasons, i.e. natural competitiveness in the market, it cannot be expected that the processors will freely resign from part of their margin for the benefit of farmers, especially when they do not have the sufficient negotiation strength, because of their dispersion (Szelağ-Sikora and Oleksy-Gębczyk, 2013, p.291-301). In such situation, an interesting solution may be the implementation of a business model adjusted to the needs of that sector, where the sources of gaining possible added value for both sides of the sales process – the producer and the consumer – may be highlighted (Fig.1). Such attitude broadens the traditional perception of the agricultural sector and of a farmer who is not only a food producer, but also a supplier of new and previously underestimated values for a customer.

The analyses of cases and sources showed that the traditional approach to creating business models for the meat market in Poland, from the producer's point of view, is connected with long and ineffective supply chains. As a result, such models raise dissatisfaction among farmers and create conflicts with other participants. They also reflect too traditional approach to the issue of creating value added in which the category of value added for a customer is ignored. It results in the need to look for some new ways to increase profitability and margin, and thus to change the perception of the business model used.

The new business model for production and sales of pork should be based on the three laws of creating value for customers defined by Doyle:

- 1) A customer always seeks a supplier that, in his opinion, will offer him the highest value.
- 2) The force driving a customer to buy a specific product is the ability to satisfy a particular need, not the product itself.
- 3) For both the customer and the producer better than a single transaction is always building a long-lasting relationship.

It means that the value for a customer is always determined by a subjective assessment which at the same time is the main factor on which the decision to choose a particular supplier is made. (Doyle, 2003). Such approach to the understanding of value added in agriculture is still not very popular. Application of the new business model in production and distribution of meat, apart from putting in order the internal logic of the processes in agricultural companies, may also improve information flow about offered and needed benefits, described as value added for customers and producers.

Conclusions

The right business model for agriculture, which will bring benefits for both sides of the process, is an interesting management tool and allows to improve decision-making processes in the increasing presence of risk. It is also the way to educate participants of the whole food distribution chain. From the producer's perspective, it allows to identify the final customer and his needs, and, most of all, it makes us aware about the need to shorten chains which connect them. Such solutions demand favourable conditions of the institutional environment that should be interested in building consistent, long-lasting relationships, aimed at generating new value added – differently defined by producers and customers.

Meat producers operating on the basis of the new business model, apart from a direct economic advantage, may also gain better recognizability, loyalty of the other food distribution chain participants cooperating with them, and, most of all, increase the number of target recipients. Building a network of connections around the proposed agricultural business model limits significantly the level of operational risk for farmers. It should be noted that the abovementioned effects are in fact the result of changing the way of thinking about food production. At the same time, it is the way to improve producers stability and even to open for them new possibilities of economic expansion.

Literature:

1. Baden-Fuller, Ch., Mangematin V. (2013). Business models: A challenging agenda. *Strategic Organisation*, 11(4), 418–42.
2. Czyżewski, A., Klepacki, B. (2015): Problemy rozwoju rolnictwa i gospodarki żywnościowej w pierwszej dekadzie członkostwa Polski w Unii Europejskiej, *Polskie Wydawnictwo Ekonomiczne*, Warszawa, p. 17.
3. Doyle, P., (2003): *Marketing wartości*, Felberg SJA, Warszawa, p. 85.

4. Goryńska-Goldmann, E., Gazdecki, M. (2018): Relationships on food markets. Consumers' perspectives, Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu.
5. Goryńska-Goldmann, E., Kozera-Kowalska, M. (2018a). Innowacje w zakresie komunikacji marketingowej na rynku produktów rolnych. *Handel Wewnętrzny*, (2 (373)), 139-147.
6. Goryńska-Goldmann, E., Kozera-Kowalska, M. (2018b). Innowacje w zakresie promocji na przykładzie rynku mięsa wieprzowego. *Handel Wewnętrzny*, (3 (374)), 151-161.
7. Klang, D.J.H., Wallnofer, M., Hacklin, M. (2010). The anatomy of the business model: Asyntactical review and research agenda. W: *Opening up innovation: Strategy, organization and technology* (p. 2–32). London: Imperial College Business School
8. Kotler Ph., (2005): *Marketing*, Rebis, Poznań, p. 8.
9. Kozera-Kowalska, M. (2017). The changes in the pigs and pork supply chain in the contest of food security and food safety in Poland, *Journal of Agribusiness and Rural Development* (1 (43), 95-102.
10. Koźmiński, A.K. (2004). *Zarządzanie w warunkach niepewności. Podręcznik dla zaawansowanych*. Warszawa: Wydawnictwo Naukowe PWN.
11. Morris, M., Schindehutte, M., Allen, J. (2005). The entrepreneur's business model: toward a unified perspective. *Journal of Business Research*, 58, p. 726–735.
12. Pepliński, B. (2019): Determinanty regionalnych zmian w sektorze produkcji trzody chlewnej w Polsce, *Rozprawy Naukowe 510*, Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu.
13. Szelaż-Sikora, A., Oleksy-Gębczyk, A. (2013). Rola marketingu w stabilizacji rynkowej podmiotów rolnych zrzeszonych w grupie producenckiej. *Zarządzanie i Finanse*, 4(4), 291-301.

4.2 Development of the CSR Concept in Selected Agribusiness Enterprises. Comparative Study

(*Małgorzata Węgrzyńska¹, Magdalena Śmiglak-Krajewska²*)

¹ Poznan University of Life Sciences;

e-mail: malgorzata.wegrzynska@up.poznan.pl

² Poznan University of Life Sciences;

e-mail: smiglak@up.poznan.pl

Key words: CSR, agriculture, financial statements, agricultural accounting.

Introduction

Corporate social responsibility (CSR) is connected with voluntary commitment to activities, which are considered to promote public good and which extend beyond the interests of a given economic entity or imposed legal requirements (McWilliams and Siegel, 2001, 2006; Huang and Watson 2015]. This results in the incorporation of economic, legal, ethical and philanthropic responsibility into the corporate decision making processes (Węgrzyńska, 2015). For this reason Corporate Social Responsibility (CSR) is increasingly often the object of operations in economic entities as an aspect potentially increasing their competitive edge. The percentage of economic entities, which voluntarily publish CSR reports, has increased considerably (Nazari, et al., 2017). For this reason the release of CSR reports, particularly their scope, have become the subject of research in the last decade. Studies conducted on various groups of economic entities in different branches of the economy have provided conflicting results. However, it is assumed that CSR provides the competitive advantage of economic entities (Margolis, et al., 2009; Maqbool and Zameer, 2017). The primary premise stating that CSR improves the financial results is related with the theory of stakeholders (Freeman, 1984). This theory indicates that success of an economic entity is dependent on permanent relationships with stakeholders, while management of these relationships has become a significant tool in the formation of value (Hammann, et al., 2009; Maqbool and Zameer, 2017). Obligatory publication of financial information is strictly regulated by legal acts and international recommendations (e.g. MSR/MSSF, GAAP UK, GAAP US), but the arbitrary character of CSR reporting provides managers of such entities with the motivation to modify their effectiveness in terms of CSR (Leung et al., 2015; Mahoney et al., 2013). At present corporate social responsibility of business organisations is closely related to sustainable development of a given economic entity. KPMG (2013) reports that 14% of the 100 largest companies in the world use the term "corporate responsibility", 25% companies refer to "social business responsibility", while 43% firms talk about "sustainable development", while in papers contained in this review "corporate social responsibility" is the dominant term (Huang and Watson, 2015). Independently of CSR another approach is related with Integrated reporting (IR), i.e. a concept also referring to CSR. An integrated report "is a cohesive statement on the manner, in which strategy, management, results and prospects of an organisation with respect to the external environment lead to the development of value in a short-, medium- and long-term scale" (IIRC, 2013). Thus a natural

relationship is observed between CSR and financial reporting, since financial reporting carries the general liability for the measurement, publication and provision of information, including information concerning CSR. Expert accountants may participate in the formation, provision, release and analysis of CSR reports. Moreover, CSR was initiated as a form of self-regulation, while in some cases even at present there is no formal regulatory structure, responsibility for CSR reporting is partly imposed on specialists in accounting. Thus accounting plays an important role in corporate social responsibility of business entities.

In this paper the main research hypothesis (the research aim) stated that Polish companies in the agricultural sector voluntarily release information concerning CSR and their presentation in company financial reports is a determinant of social responsibility, the so-called corporate responsibility.

Materials and Methods

The subject of the study constituting the basis for the verification of the research hypothesis includes:

1. Polish and foreign literature
2. Polish and foreign legal regulations
3. CSR reports
4. Financial reports for the years 2012-2017.

Objects of this study conducted to verify the research hypothesis included economic entities operating in the agricultural sector. Investigations were carried out on over 100 companies from the agricultural sector active in the Republic of Poland.

Research method:

The research hypothesis was verified using modified econometric modelling, which has not been used to investigate CSR in Polish economic entities (Nazari, et al., 2017).

$$RepCompln_{it} = \beta_0 + \beta_1 CSRPer_{it} + \beta_2 INST_{it} + \beta_3 SIZE_{it-1} + \beta_4 ROA_{it} + \beta_5 CURRAT_{it} + \beta_6 CAPSP_{it-1} + \beta_7 PNEW_{it-1} + \beta_8 LEV_{it-1} + \sum_{k=1}^n \lambda_k YEAR + \varepsilon_{it}$$

Where:

1. RepCompInit (Sustainability Reporting Complexity Index) denotes various measures of the narrative complexity in the CSR disclosure (defined later) of firm i in year t;
2. CSRPerit (CSR performance) is the total ESG (Environmental, Social, and Governance) strengths less the total ESG concerns of firm i in year t;
3. INSTit is measured by the percentage of equity shares owned by institutional investors of firm i in year t;
4. SIZEit-1 is measured by the natural logarithm of the total assets as of the end of fiscal year t1;
5. ROAit (Return on Assets) is income before extraordinary items in year t divided by the total assets at the end of fiscal year t1;

6. CURRATit (Current ratio) is the total current assets divided by the total current liabilities of firm *i* in year *t*;
7. CAPSPit-1 (Capital Spending Intensity) is the capital spending in year *t*1 divided by the total sales revenues in the same year;
8. PNEWit-1 (Plant Newness) is net properties, plant and equipment divided by gross properties, plant and equipment at the end of fiscal year *t*1;
9. LEV it-1 (Leverage) is the total debt at the end of fiscal year *t*1 divided by total assets at the end of the same fiscal year.

Additionally, a review of literature (Nazari, et al., 2017) was the basis for the identification of international methods used to investigate readability and scope of released data concerning CSR in reports of economic entities, which have not been applied in Polish literature. It was attempted to determine the extent of release and readability as well as proxy for the complexity of CSR communications. These indexes include the Flesch-Kincaid Reading Ease (FRE), Flesch-Kincaid Grade Level (FGL), FOG, Coleman Liau (CLI) and SMOG (SMOG) (Smith and Taffler, 1992; Courtis, 1998).

Findings

Preliminary pilot research results indicate that:

1. Better presentation of the CSR concept in corporate reports is closely related to greater reading ease and longer CSR disclosure time frame. These results tend to be the same for each of the investigated social and environmental aspects of CSR.
2. Shorter and less readable CSR reports indicate attempts to present the image of a socially responsible economic entity; however, this is inconsistent with actual social and environmental results), its perception may affect decisions undertaken by consumers and investors.

Summary

This study aimed at the identification of the relationship between CSR efficiency and complexity of voluntary disclosure of CSR, measured by readability of CSR disclosure and the volume of CSR reports in economic entities within the agricultural sector in the years 2012-2017. It was preliminarily assumed that shorter and less readable CSR disclosure documents indicate inferior efficiency of CSR, while increased disclosure and more readable CSR reports indicate better efficiency of CSR. Moreover, it was assumed that CSR efficiency, as well as each of its social and environmental aspects are positively related with the scope of CSR disclosure. Based on these findings it was stated that longer CSR disclosure enhances their transparency and reliability.

Literature

1. Courtis, J. K. (1998). Annual report readability variability: tests of the obfuscation hypothesis. *Account. Audit. Account. J.* vol. 11 (4):459–472.
2. Freeman R.E. (1984). *Strategic Management: A Stakeholder Approach*. Marshfield, MA: Pitman.

3. Hammann E. M., Habisch A., Pechlaner, H. (2009). Values that create value: Socially responsible business practices in SMEs—empirical evidence from German companies. *Business Ethics: A European Review*, vol. 18(1): 37–51.
4. Huang X. B., Watson L. (2015). Corporate social responsibility research in accounting, *Journal of Accounting Literature*, vol. 34: 1–16.
5. International Integrated Reporting Committee (IIRC) (2013). The international IR framework. Available at: www.theiirc.org
6. Leung S., Parker L., Curtis J. (2015). Impression management through minimal narrative disclosure in annual reports. *Brit. Account. Review*, vol. 47 (3): 275–289.
7. Mahoney L.S., Thorne L., Cecil L., LaGore W. (2013). A research note on standalone corporate social responsibility reports: signaling or greenwashing? *Crit. Perspect. Account*, vol. 24 (4–5): 350–359.
8. Margolis J. D., Elfenbein H. A., Walsh J. P. (2009). Does it pay to be good. and does it matter? A meta-analysis of the relationship between corporate social and financial performance.
9. Shafat M., Nasir Z. (2018). Corporate social responsibility and financial performance: An empirical analysis of Indian banks, *Future Business Journal*, vol. 4:84–93.
10. McWilliams A., Siegel D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, vol. 26(1): 117–127.
11. McWilliams A., Siegel D. (2006). Corporate social responsibility: Strategic implications. *Journal of Management Studies*, 43(1): 1–18.
12. Nazari J. A., Hrazdil K., Mahmoudian F. (2017). Assessing social and environmental performance through narrative complexity in CSR reports, *Journal of Contemporary Accounting & Economics*, vol. 13:166–178.
13. Smith M., Taffler R. (1992). Readability and understandability: different measures of the textual complexity of accounting narrative. *Account. Audit. Account. Journal*, vo. 5 (4): 84–98.
14. Węgrzyńska M. (2015). Zielona rachunkowość, Wyższa Szkoła Bankowa w Poznaniu.

4.3. Selected Problems of Measuring CSR in Agribusiness (*Alina Nowotarska¹, Magdalena Kozera-Kowalska²*)

¹ Poznan University of Life Sciences, Faculty of Economics and Social Sciences, Department of Economics and Economics Policy in Agribusiness, Poland,
e-mail: alina.nowotarska@up.poznan.pl (corresponding author)

² Poznan University of Life Sciences, Faculty of Economics and Social Sciences, Department of Economics and Economics Policy in Agribusiness, Poland,
e-mail: mkozera@up.poznan.pl

Key words: CSR, Corporate Social Responsibility, CSR indicators, Agribusiness

Introduction

The concept of Corporate Social Responsibility (CSR), and more broadly understood Social Responsibility (SR), originates from the concept of sustainable development created at the turn of the 1960's and 1970's. Its current scope was modified by previous economic and political events. It was also connected with technological progress and its impact on social life. At present increasingly often the need is being stressed to balance the three areas of activity pursued by enterprises, i.e. economic – generating profits for their owners, social – respecting the rights of employees and external stakeholders, as well as ecological – manifested in the concern for the present and future natural environment (Wołoszyn, et al., 2012). As a result the new paradigm of activity is being developed for 21st century enterprises, according to which business activity while focused on people should also be friendly to the environment, in which they live. Many enterprises in various branches voluntarily undertake to implement the CSR concept. They are purposeful actions, resulting from the application of long-term costing of losses and benefits generated by the implementation of socially responsible actions. However, it is crucial to acknowledge that incurred financial outlays will be returned thanks to the generation of new values added for the customers. Increasingly often when making decisions on the place of purchase or the producer of a specific good the customers are motivated by information on actions benefiting the environment or the society. More and more frequently these aspects constitute a factor influencing the construction of a long-term relationship between the entities on the market and buyers. The channel of communication for the enterprise's attitude to CSR includes, among other things, annual reports on social responsibility released by economic entities.

The aim of this study is to present the areas of monitoring corporate social responsibility in agri-food enterprises. Measures typical of individual areas will be indicated as potentially applicable in agri-business subsectors other than industrial processing, particularly agriculture, which operation is inseparably connected with the natural environment.

Methods

When realising tasks proposed as the aims of this study first the desk research method was used to collect and evaluate documents, data and expert knowledge, thus providing information on the development of interest in problems related to CSR both in Poland and abroad, on the potential

tools of its monitoring and reporting, as well as sites and forms, in which reports on the subject are published.

As the empirical basis for the study it was decided to adopt existing compact data accessible from traditional and electronic data bases. Such data bases as Biblioteka Raportów Społecznej Odpowiedzialności (<http://raportyspoleczne.pl>), the CSRinfo data base of non-financial reports (<http://www.csrinfo.org>) and information of the Forum Odpowiedzialnego Biznesu (<http://odpowiedzialnybiznes.pl>). Moreover, reports of Global Reporting Initiative (GRI) were also used. The obtained information was subjected to critical analysis in view of the proposed aim, while the results are presented in the descriptive form also using diagrams

Findings

In 2010 the broadly understood subject of social responsibility was standardised in the Guidance on social responsibility standard (PN-ISO 26000) (<https://www.iso.org/standard>). According to that document the impact of a socially responsible organisation on the society and the environment should be manifested in its transparent and ethical operations, covering seven core areas, i.e. organisational governance, human rights, labour practices, the environment, fair operating practices, consumer issues, community involvement and development (<https://www.parp.gov.pl/csr#csr>). Based on the standard enterprises are obliged to specifically monitor operations in the specified areas. As a consequence, reports have been submitted containing numerous partial measures, while economic entities have developed appropriate CSR implementation patterns. The starting point for these practices typically involves the identification of strengths and weaknesses, involvement of stakeholders in CSR implementation processes, and following an in-depth analysis the next step consists in management of individual areas of internal or external operations of a given organisation. The next stage involves market analysis and finally – the stage of implementation (Gasiński, Piskalski, 2007, p. 61).

In the case of agribusiness an area of particular interest is connected with the implementation of social responsibility over the entire supply chain, while the role of the concept promoter should be served by processing enterprises.

The analysis of literature indicated that there is no universal, generally accepted method to measure CSR effects for all enterprises. For this reason operators within individual branches while using written reports on their activity illustrate it applying a specifically constructed group of measures. Typically the reports refer to qualitative characteristics and they are descriptive in character. However, increasingly often it is attempted to relate CSR to business results of entities using selected financial measures (<https://www.pi.gov.pl/PARP>). Reports usually refer to qualitative features and are descriptive. Increasingly, however, it seeks to link CSR with business results of entities, using selected financial measures for this purpose. Among the practical solutions in the field of CSR reporting, integrated reporting, which is an example of the evolution of the financial report towards a business report, deserves special attention (Świdorska G. K., 2007).

In Poland the implementation of CSR has been promoted by the amended Act on accounting binding since 2018 (Journal of Laws 2018 item 395), which imposes on large enterprises the

obligation of social reporting. In Poland this pertains to approx. 300 large enterprises. They are obliged to publicise their actions in such areas as ethics and human rights, prevention of corruption, labour issues or environmental protection. To facilitate such reporting the European Commission in June 2107 released specific guidelines for enterprises to follow when preparing non-financial reports (Official Journal of the European Union, Reporting on non-financial information (non-financial reporting methodology) (2017 / C 215/01)). Social reporting guidelines and measures were also specified by an international organisation, Global Reporting Initiative (GRI). The latest standard is labelled GRI G4 and specifies how to prepare a report on CSR activity (<https://www.globalreporting.org/standards/>).). In Poland special guidelines were also published by the Ministry of Finance, which supervises the implementation of new regulations (<https://www.gov.pl/web/inwestycje-rozwoj/raportowanie-spoeczne>).

Referring to the guidelines presented above we need to indicate two types of indexes used in social responsibility reporting. They are profile measures and specific indexes (LOTOS, Zasady raportowania i wskaźniki GRI G4). The former are related to the entity's strategy and the organization profile being created and implemented, identifying relevant aspects and the corresponding boundaries, as well as the involvement of stakeholders, the profile of the report and the so-called organizational order. The latter group comprises indexes containing detailed information concerning:

- the adopted approach to management,
- economic aspects (economic results, presence on the market, indirect economic impact, purchasing practices, etc.),
- environmental aspects (materials and raw materials, water, energy, biodiversity, emissions, sewage and waste, etc.),
- social aspects (employment, relations between employees and the management, occupational safety and hygiene, training and education, diversity and equality, the equal pay principle, etc.),
- employment practices and decent work (evaluation of suppliers in terms of employment, complaint mechanisms concerning employment practices),
- human rights (investments, absence of discrimination, freedom of association and collective bargaining, child labour, forced or compulsory labour, safety practices, rights of indigenous peoples, evaluation, evaluation of observance of human rights, complaint mechanisms concerning human rights),
- social aspects (local communities, prevention of corruption, principles of participation in public life, anti-competitive behaviour, compliance with legal regulations, the evaluation of suppliers in terms of social issues, complaint mechanisms concerning social impact),
- responsibility for products (consumer health and safety, labelling of products and services, marketing communication, customer privacy, compliance with legal regulations).

In order to clarify differences between the specific character of broadly understood business and agri-business a comparison of measures used in the business sector was conducted and next their

applicability in agri-business enterprises was evaluated in view of the specific character of this branch of economy (Table 1.)

Table 1. A comparison of applicability of selected CSR measures

CSR indicator category	Area monitored by CSR indicator	Application in industrial entities	Application in small and medium-sized agribusiness entities, including agriculture
Profile indicators	Establishment of strategy and management analysis	Applicable	Difficult or impossible to apply
	Determination of the organisation's profile	Applicable	Difficult to apply, but applicable
	Identified significant aspects and corresponding boundaries	Applicable	Difficult or impossible to apply
	Involvement of stakeholders	Applicable	Difficult or impossible to apply
	Report profile	Applicable	Difficult to apply, but applicable
	Organisational governance	Applicable	Difficult or impossible to apply
Specific indexes	Information concerning approach to management,	Applicable	Difficult or impossible to apply
	Economic aspect	Applicable	Difficult to apply and applicable only in some entities
	Practices of employment and decent work	Applicable	Impossible to apply
	Human rights	Applicable	Impossible to apply
	Society	Applicable	Difficult to apply, but applicable
	Responsibility for product	Applicable	Applicable

Source: own study based on Wytuczne raportowania GRI.G4, Available on: https://www2.deloitte.com/content/dam/Deloitte/pl/Documents/Reports/pl_GRI_G4_zasady_raportowania_i_wskazniki.pdf [19-06-2019]

In view of the specific character of the agricultural sector (e.g. seasonality, biodiversity, environmental conditions), applicability of some of the CSR measures in the evaluation may not be reliably determined, particularly in the entities not keeping accounting records and the related financial reporting. This pertains particularly to the basic link in the supply chain, i.e. agriculture and entities operating in this sector. Nevertheless, in the changing agribusiness sector the leading driver for the CSR concept is connected with the relations within the supply chain, frequently initiated by agri-food processing enterprises. However, the degree of commitment to implement

CSR would depend on the initiated form of cooperation, primarily the stability and quality of established cooperation ties (Kozera-Kowalska, Gołaś, 2017).

Conclusions and Implications

The application of CSR measures in the agribusiness sector, particularly its subsectors directly connected with food production, is an important challenge for the entire sector. In the near future socially responsible actions may play a significant role in the establishment and strengthening of competitive advantage for enterprises in that sector at the level of each link in the food supply chain, particularly enterprises and farms. This requires especially from industrial processing entities involvement in the transfer of knowledge concerning CSR to cooperating links, combined with continuous indication of economic benefits at the simultaneous involvement in socially responsible actions for the benefit of the society and the natural environment. The measures and indexes listed and analysed in relation to entities operating in the agri-food production sector indicate the general scope of differences and the specific character of the agricultural sector. Nevertheless, problems encountered in their application do not mean that CSR should no longer be promoted in agriculture. Instead, effective ways to transfer knowledge and educate farmers in this respect need to be searched for, while on the other hand applicable measures, considered acceptable by farmers, need to be investigated and constructed. This is an important premise for further, thorough and in-depth studies in this area.

Literature:

1. <https://www.biostat.com.pl/desk-research.php>
2. <https://www.wirtualnemedi.pl/artykul/od-nowego-roku-duze-firmy-musza-sporzadzac-raporty-spoleczne-w-polsce-ten-obowiazek-obejme-okolo-300-przedsiębiorstw>
3. Adamczyk. (2009), Społeczna odpowiedzialność przedsiębiorstw, Polskie Wydawnictwo Ekonomiczne S.A., Warszawa
4. Bek-Gaik B., Rymkiewicz B. (2014), Społeczna odpowiedzialność przedsiębiorstw a finansowe miary dokonań, *Finanse, Rynki Finansowe, Ubezpieczenia*, nr 67, s. 137-151
5. Bartkowiak G. (2011), Społeczna odpowiedzialność biznesu w aspekcie teoretycznym i empirycznym. Difin S.A, Warszawa.
6. Baum R. (2011), Ocena zrównoważonego rozwoju w rolnictwie (studium metodyczne), Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu.
7. Dymowski J. (2012), Zmierzyć niemierzalne, w: *Mierzenie efektywności i wpływu społecznego działań CSR*. FOB, Warszawa.
8. Gasiński T. Piskalski G. (2007), *Podręcznik małych i średnich przedsiębiorstw*, s. 61.

9. Gołębiowski J. (2010), Efektywność systemów marketingowych w gospodarce żywnościowej. Wydawnictwo SGGW, Warszawa.
10. Elkington J., Cannibals with Forks (1997), The Triple Bottom Line of 21st Century Business.
11. Kemper A. Martin R. L. (2011), The Global Financial Crisis as a Test of Corporate social Responsibility Theories, After the Fall, European Management Review, vol. 7.
12. Kozera-Kowalska M. Gołaś Z. (2017), Corporate Social Responsibility in Agribusiness – the ASF Case, YARD, s. 583–590
13. Obłój K. (2010), Pasja I dyscyplina strategii. Jak z marzeń i dyscypliny zbudować sukces firmy. Poltext, Warszawa.
14. Rok B. (2004), Odpowiedzialny biznes w nieodpowiedzialnym świecie. Akademia Rozwoju Filantropii w Polsce i Forum Odpowiedzialnego Biznesu, Warszawa.
15. Sobczyk M. (2016), W poszukiwaniu wpływu dokonań CSR na wyniki finansowe, Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, 261-269
16. Świdarska G. K. (2007), Wyzwania dla ekspertów rachunkowości wobec nowych koncepcji raportowania, rachunkowość, wczoraj, dziś i jutro, SKwP, s. 330
17. Wołoszyn J., Stawicka E., Ratajczak M. (2012), Społeczna odpowiedzialność małych i średnich przedsiębiorstw agrobiznesu z obszarów wiejskich. Wydawnictwo SGGW, Warszawa.

4.3 Nutritional habits among students of public universities in Poznań, Poland (*Kalina Piwońska¹, Adriana Jakowicka²*)

¹ student at Poznań University of Economics and Business, Poland;
e-mail: piwonska.kalina@gmail.com (corresponding author)

² student at Poznań University of Economics and Business, Poland

Key words: superfoods, nutrition, obesity, healthy lifestyle, research

Background

As the times change, so are the nutritional habits. In an era of a domination of high-processed meals, fast-food or poor quality food, which goes along with a lack of time and motion, it's simple to disregard self and own health. Fact, that people nourish themselves in a certain ways depends on many factors: trends, lifestyle, ingrown habits, disposable income. Obesity is a big current problem in the United States (Mokhad, Ford, Bowman, 2001) and Europe (World Health Organisation Regional Office for Europe, 2019). As a matter of fact obesity is not a disease itself, it may cause a lot of health problems such as cardiovascular diseases, diabetes, musculoskeletal disorders and many types of cancers (Ibidem). It is of course crucial to separate terms „obesity” and „overweight” as a two different conditions, but it also should be kept in mind that one is a natural aftereffect of the other. Still, as the problem increases, increases also an awareness of a problem and its scale. People try to change their lifestyle in order to become or maintain fit or to lead changes in their life. They realise that health issues can only intensify if habits remain unchanged.

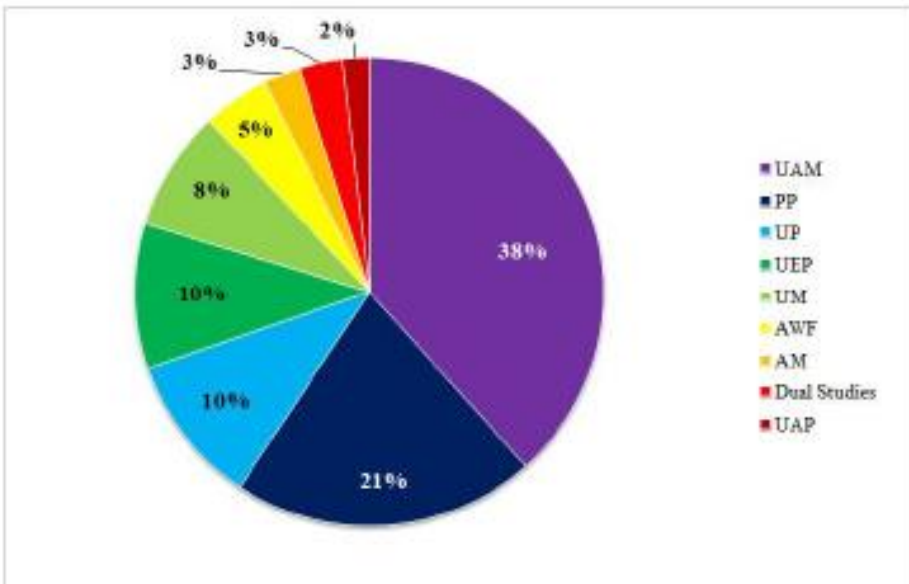
According to SENECA study (Annemien Haveman-Nies Lisette C.P.G.M., de Groot Wija, A. van Staveren, 2003), maintaining healthy lifestyle reduces mortality risk. The aim of this research paper is to compare nutritional habits among students of public universities in Poznan, Poland and to show differences based on various factors like disposable income, country of origin or simply gender. Since BMI indicator is a conclusion, the aim was to answer the question why. Authors chose as their research sample group of students inbetween their 20s. The fact that this group has still some ingrown habits brought out from their family homes but also that tries to develop their own based on their – usually –low resources.

Method

This study is based on the results of a questionnaire created in cooperation with students of the Poznan University of Life Sciences, Poznań University of Economics and Business and Poznan Medical University. For data analysis was used SPSS program, in particular standard descriptive statistics, and in the further part of the study also tests for any significant statistical differences. The study was attended by 433 students of selected universities located in Poznań, where: 166 people, or 38% of the total surveyed were Adam Mickiewicz University students, 91 people, or 21% of the total were Poznań University of Technology students, successively 45 people from Poznan University of Life Sciences and 43 people from Poznań University of Economics and

Business, which accounted for 10% of the total, 36 people (8% of the total), students of the Medical University, 20 people (5%) of the Poznań University of Physical Education, 13 people study simultaneously at two different universities (3%), 11 people were from the Music Academy and 8 people from University of the Arts Poznan (2% of the total number of respondents).

Figure 1. Percentage share of respondents' universities.



Source: Own study

The age of the surveyed students was on average 22 years, whereas students of AM, UAP and UM average were older by one year. The average BMI was 22.87, with the highest BMI being marked by PP students, while the lowest by AM students. These results are within the upper range of the correct weight. Variables that may affect the eating habits of students in Poznań are also the size of the place of origin of individual students, their average physical activity, the way of managing the home budget, and the amount allocated to expenses related to food and non-alcoholic beverages. Looking at physical activity, 1 in 10 students do not do any sports, almost ¼ do sports several times a month, almost 20% at least once a week, 40% a few times a week and almost 7% of respondents are physically active every day. The diversity in the size of the city of origin was as follows: 1 in 5 students came from towns over 500,000 residents, also every fifth student came from the town from 10 to 50 thousand, and every fifth came from the village. Nearly half of the respondents stay within the home budget, and every third student is able to postpone part of the income to savings. Only 5% of students regularly lack funds to survive. Every third student spent less than PLN 500 per month on food and non-alcoholic beverages per month, and more than 40% of students spent between PLN 500 and 750 on these expenses. Every fifth student spent funds on these expenses above this amount.

Results

Variables regarding the quality of the diet used, the type of diet, as well as the frequency of ingestion superfoods, were considered variables representing dietary habits. As a result of the study, it turned out that in general 355 people (82.6%) are on a classic diet, 26 people are vegetarian (6%), 19 people are on vegan diet (4.4%) and 14 people are on meatless diet (3.3%). On average, most people doing the classic diet study at UP, as many as 98%, the most vegetarians study at AM (almost one in five people), every fourth person at UAP is a vegan. As a result of the analysis, it turned out that the probability of not consuming meat by all students of Poznań students increases along with the size of the town of origin. Superfoods is extremely popular among students of Poznań universities, on average over 87% of respondents are using in the diet superfoods. The least frequent superfoods are students of PP and UM, most often students of UP, AM and UAP. On average, students most often indicated that they eat moderately soundly (over 62% of respondents), while only 3% of students rated their diet for unhealthy. UAP students most often indicated unhealthy diet (up to 12%), while students of the University of Physical Education believe that they feed the healthiest of all Poznań students, almost every sixth indicated that they eat healthy and almost 80% of them considered that they were eating a moderately healthy diet. These are interesting foundations for further analysis.

Conclusion

General conclusion which can be carried out is that the type of a public university has a minor connection with type of diet, ingredients used or, more broadly speaking, no significant impact on their diet. The nutritional habits of students at Poznań universities are highly uniform. Foregoing research can be a useful interpretation for local entrepreneurs in Poznań, where it was originally carried out. As the research accentuate directions, certain conclusions in context of local product launch and development

Bibliography

1. Mokdad AH, Ford ES, Bowman BA, et al., (2001). Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk Factors. *JAMA*. 2003;289(1):76–79. doi:10.1001/jama.289.1.76
2. The challenge of obesity. Data and Statistics. World Health Organisation Regional Office for Europe <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/obesity/data-and-statistics> 20.03.2019
3. Annemien Haveman-Nies Lisette C.P.G.M., de Groot Wija, A. van Staveren. (2003). Dietary quality, lifestyle factors and healthy ageing in Europe: the SENECAs study, Age and Ageing, Volume 32, Issue 4, (427–434)

Chapter V: Losses and Waste in Agri-Food Supply Chains – Innovations and Social Aspects

5.1 Mapping food wastage management innovations within supply chain

(Ewa Żmieńka¹, Jakub Staniszewski²)

¹ SKN Ekonomii Zrównoważonego Rozwoju, Uniwersytet Ekonomiczny w Poznaniu,
e-mail: ezmienka@yahoo.com

² Katedra Makroekonomii i Gospodarki Żywnościowej, Uniwersytet Ekonomiczny w Poznaniu,
e-mail: jakub.staniszewski@ue.poznan.pl

Key words: food wastage, innovation, food supply chain, systematic literature review, food waste

Introduction

With the beginning of the 21st century we face a great challenge of increasing the global food supply. A massive growth in population, resulting in growing demand for food, requires new methods of intensifying food production. Although there are areas in the world still lacking in food supply, increasing competition for the use of energy, water and land, combined with a growing consumption of animal products, may limit further increase in food production (Godfray et al., 2010). What is more, a sufficient amount of food produced globally does not equal reducing world hunger and the problem only deepens. Although the problem has been stressed by the international community in 1999, since then, the number of undernourished people had been consistently increasing (FAO 2018, p.1). It means that problem lies in distribution and global inequalities. While in some countries (mostly of Global South) millions of people suffer from hunger, in other parts of the world dramatic amounts of produced food are being lost and wasted. According to FAO (2013, p.6), each year 1.3 billion tonnes of food (about a third of all that is produced) is either lost or wasted. As follows, 1.4 billion hectares - 28% of the world's agricultural land area is used to produce this food.

Scientists still work on finding solutions to reduce the global food wastage. A number of research is being conducted globally to deal with this problem among all science disciplines, including social sciences. The goal of this paper is to assess the current trends of research in food wastage management innovations in social sciences and mapping them. Different amount of food is wasted at different parts of supply chain. It is rational to expect that researchers' efforts will be concentrated on the stages of production and processing, where losses are the greatest (FAO 2018, p.7). We test this hypothesis with the method of systematic literature review. We extracted 107 articles from the Web of Science database with the keywords food wastage and innovations/technologies. Later on we systematise them in accordance with part of supply chain

they concern and type of innovation they include and compare our results with data on food wastage.

Research method

Basing on the division proposed by Jacobs (2009), we decided to group solutions (innovations) in 2 dimensions: by their type and part of the supply chain. However, to add more precision, we decided to extend division of innovations to three categories:

- Technology-based innovations,
- Expanding the use of existing technologies,
- Strategic planning, policy and social practices - regarding actions of producers and retailers, as well as consumer behaviour.

The research was based on Web Of Science database, and the articles with phrases: TS=("food wast*" and (technolog* or innovat*)). Results were taken from all years and limited to social science databases: SSCI (Social Sciences Citation), CPCI-SSH (Conference Proceedings Citation Index - Social Science & Humanities) and BKCI-SSH (Book citation index – Social sciences & humanities).

Given phrase resulted in the query of 107 articles which has been analysed. Among them, 24 were rejected for the following reasons:

- they concentrated on food wastage, but no solutions were presented (11 articles). Some articles gave comprehensive background on the problem of food wastage, but without mentioning concrete solutions.
- they were not relevant (13 articles). Articles concerning malnutrition, sustainable diet or observations of food wastage in particular world regions did not cover the key topic.

In other 83 articles, at least one solution, technology and practice has been identified and grouped by the part of the supply chain and type of innovation it involves. Brief review of our results is presented in Table 1. Numbers on the left show the number of times the innovation was named in the articles. Numbers in brackets that were added to some innovations give more detailed information about the number of articles where it was mentioned – from the total number on the left. Many articles addressed the importance of strategic planning, improving the flow of information or political incentives generally and on each level. However, it was not counted unless the article didn't refer to any more specific solution. If the importance of particular solutions was a highlight of the article, but still none was named, it falls under a more general category, e.g. "policies impacting consumer behaviour". Also, some articles pointed at such techniques as vertical farming, drip irrigation or even anaerobic digestion which are known and commonly used in agriculture and utilisation of biomass for biogas. In this sense, the techniques have been exemplified as ways to making the production systems more efficient. Some of the articles did not address food waste directly, but had to do with municipal waste disposal, which is also a part of waste management. As most of the organic municipal waste is biomass, a significant part of which

is coming from food waste, it has also been included. The organic fraction of municipal food waste can be used for energy recovery and was included in the final level of food chain (utilisation).

Results

Different amounts of food and resources are wasted at different parts of the supply chain. At the consumer stage the wastages are the highest in countries of medium/high income. In countries with low GDP, where poverty is more common, the loss usually occurs at the distribution and storage stages (FAO 2011, p.5). This polarisation of problems between different countries and continents adds to the complexity of food wastage dilemma. The countries of higher GDP must concentrate on reducing qualitative losses (result of consumer preference and behaviour), while in low-GDP countries the quantitative losses are of higher priority (Kader, 2005). Therefore, different stages of distribution need to be improved or even re-designed. It is, however, in the general interest of entities at each part of the chain, to avoid any loss or waste. For this reason, a lot of time and resources is invested in search for innovations that can reduce food wastage. The result of literature review in this topic is presented in table 1.

The greatest concentration can be observed at the last later of the chain: 5 – retail (22), 6 - households (27) and 7 - utilisation (43). 23,3% of innovations were classified as technology-based (24 out of 103), 45,6% involved expanding the use of existing technologies (47 out of 103) and remaining 31% included solutions other than technological (32 out of 103). The most interesting of proposed solutions will be mentioned below.

Firstly, let us consider solutions on the second part of supply chain. Kouwenhoven, et al. (2012) presented a case of profitable business based on converting the horticulture waste into fresh vegetable juices and natural food colours. It enables reprocessing class 3 greenhouse vegetables into consumer products. McDowall, et al. (2017) mention an Eco-design directive and Action Plan, both created by European Union to implement circular economy policies. The directive sets minimum energy efficiency standards for different products to reduce their impact on the environment. The Action Plan proposes extending produce responsibility rules. It is set to reward products that are designed for easier repair, remanufacture, or recycling. This way, food producers may be encouraged to make their products easier to utilise or remanufacture.

Parts involving storage and transportation did not present any innovation concentrated strictly on their operations. Much more articles were dedicated to improvements at retail and restaurants' stage. At this stage a lot can be achieved through strategic planning and marketing. There is also an example of a policy called The Protecting Americans from Tax Hikes (PATH) Act. It allows American food businesses to receive tax benefits when donating food to charitable organizations (Evans and Nagele, 2018). Donors can deduct the cost of production and half the difference between the cost and full fair market value of the donated food from their taxable income. Such tax incentives, if popularised, could motivate retailers to foster more of the actions.

Food waste in households showed the biggest potential for improvements through technology-based innovations (10 articles). It can start from monitoring customer's choices while shopping, e.g. through In-Store Tracking System. Observing shopper's journey through the store and further behavioural

analysis allow to assess customer routines and what triggers them to buy excess food (Larsen, et al., 2017). Other articles involve financial penalties. For instance, two types of food waste charging systems: household-based and community-based were implemented in district of Seoul in South Korea. It is designed to electronically charge every household depending on the weight of biomass they disposed through Radio Frequency Identification. That requires regulations forcing citizens to separate their trash. Although the policies may work well in the Korean society, introducing it in other countries could start society's protests. Evans and Nagele (2018) from USA note that more politically conservative societies may resist heavy-handed governmental involvement due to their privacy concerns. For instance, The Universal Recycling Law requires all state residents in Vermont to separate food waste from trash may be impossible to introduce in other states.

Table 1. Map of innovations supporting food wastage reduction

	1 - Aricultural production	2 - Processing & packaging	3 - Storage	4 - Transport	5 - Retail & restaurants	6 - Households	7 - Utilisation
Technology-based innovations		4 innovative food packaging			1 robotics technologies (automating quick-service operations: in fast foods)	3 weight-based system to quantify the amounts of food waste (1), e.g. Household-Based Food Waste Charging System (RHWC) through RFID (2)	1 new techniques of valorising biomass: valorisation of Forage Opuntia
		1 biopolymers as food packaging (seafood by-product)				2 smartphone applications	1 refuse paper and plastic fuel (RPF)
		1 packaging that absorbs ethylene (a hormone that speeds fruit ripening)				1 Time and Temperature Indicator Labels	1 insects bred on organic waste as animal feed
		1 converting horticulture waste into fresh vegetable juices and natural food colors				1 observational technology to study In-Store Behavior: Shopper Flow Tracking System	
						1 smart fridges and smart shopping trolleys	
Expanding the use of existing technologies	1 drip irrigation	1 heat transfer, cleaning and sanitation improvements			6 food donating channels		11 composting
	2 vertical farming technology	2 real-time temperature monitoring with wireless networks			1 improving operative conditions of refrigerators		11 technologies in anaerobic digestion: to get the energy
	2	IT - integrating information for improving efficiency of resources				1 Design for Sustainable Behavior (DSB);	3 networks of waste by-products, electricity and heat (waste-to-energy (WtE) technologies)
						1 food waste grinders	3 incineration (1), methane fermentation and feedstock recycling
							3 anaerobic digesters given to households
Strategic planning, policy and social practices	1	system dynamics model for energy use					2 producing fertilizers
	2 change of policies for donating surpluses	1	supplier - retailer take-back practices: policy improvement			6 policies impacting consumer behaviour	4 food waste as animal feed
		1 rewarding products that are designed for easier remanufacture, or recycling (Eco-design directive)			2 marketing physically unappealing food (1) or crops of low demand (1)	5 alternative distribution systems, food sharing systems	1 strengthening decomposition of recycling centres
					2 marketing food of higher value, such as fruit, vegetables and other nutrient-dense crops (1) or long-lasting food (1)	1 contractor's submission of an annual report detailing the weight of food donated, composted or discarded	
					1 discounts and secondary discount markets	1 experiments done to raise consumer awareness	
				1 date labeling standard that eliminates disparate and unclear labeling standards			
				1 doggy bags in restaurants			
				2 CSR practices (1) and sponsorships (1)			
				1 policies impacting producer's behaviour			
				1 internal distribution to employees			
				1 remanufacturing and repackaging			
	1 EU funded projects for sharing knowledge such as Engage 2020,2 RRI Tools,3, INPROFOOD4 or CIMULACT,5 the RRI European Technology Platform (ETP) "Food for Life." 2016						

Source: own study

Another technology-based solutions were mentioned by Tu, et al. (2018). They proposed effective product design programs that promotes sustainable behaviour of the customers during product use (Design for Sustainable Behavior). Repertory Grid Technology, which takes from theory of personal construction, is used to establish human behaviour that can be then used to design home appliances in a more “smart” way. Using them was proven to significantly reduce food wastage. That can be achieved for instance through the use of refrigerators designed via eco-information and eco-technology, that are be able to print expiry date alerts or shopping lists and send them by text or email. However, improvements don’t necessarily need to be technology-based. The authors mention that even a small intervention such as resizing plates can significantly reduce household food waste.

A great part of articles were dealing with wasted food, proposing or promoting ways of utilising or recycling the biomass. This includes different usages of anaerobic digestion. The variety of food processes used in the food globally each year generate waste on a multi tonne scale. A lot of the lost material represent a biomass being a valuable resource for biorefineries. One of the proposals is also to provide households with home digesters and encourage domestic composting (Nandhivarman, et al., 2015). Another field of study are combined recovery systems, which allow an efficient recovery of the resources. A great example is refuse paper and plastic fuel (RPF) system, in which separated paper, plastic, and RPF is incinerated and used for wet methane fermentation. In a conducted study, the amounts of energy recovered from the system was 54.5 kWh/t, and the efficiency reached 33.4%. The technology may improve efficient waste management systems that is particularly important in the transition to low-carbon cities (Ohnishi, et al., 2018).

Summary

The problem of food waste and food loss affect all parts of the world and require integrated global solutions. In spite of growing interest among scientists in this area, in the last years the amount of waste still gradually increases. The goal of the research was to map food wastage management innovations and to assess the current trends in developments at different parts of the supply chain. Basing on systematic review, following conclusions are justified:

- there is a noticeable disproportion between research activities at first and last parts of the supply chain. It is even more surprising, knowing that wastage at earliest stages is common in lower GDP countries, and therefore, well addressed innovations may help fighting the hunger problem;
- apart from integrated systems that engage the whole supply chain, not much attention is given to transport or storage, meaning there is possibly potential for further improvement;
- most of the studies concern the topic of utilising waste by, for example, converting it to energy. Not much is still said about reducing wastage at earlier parts of the chain.

The results of presented review may contribute to better understanding of the current scientific work in the area of food waste and food loss. It also points at crucial elements of food supply chain that could require further research. Its main goal will be to improve food production and management systems in order to reduce massive wastage of resources and eliminate global hunger.

Literature

Evans, A., Nagele, N. (2018). A Lot to Digest: Advancing Food Waste Policy in the United States, *Natural Resources Journal*, vol: 58(1), 175-249.

FAO (2011). *Global food losses and food waste. Extent, causes and prevention*, FAO, Rome.

FAO (2013). *Food wastage footprint. Impact on natural resources. Summary Report*, FAO.

FAO (2018). *Food loss and waste and the right to adequate food: Making the connection*, FAO, Rome.

Godfray, H.C., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., Toulmin, C. (2010). Food security: the challenge of feeding 9 billion people. *Science*, vol: 327(5967), 812-818.

Hospers, G.J. (2005). Joseph Schumpeter and his legacy in innovation studies. *Knowledge, Technology & Policy*, vol: 18(3), 20–37.

Jacobs, D. (2009). *Adding values: the cultural side of innovation*. WBOOKS, Zwolle.

Kader, A. A. (2005). Increasing Food Availability by Reducing Postharvest Losses of Fresh Produce. *Acta horticulturae*, vol: 682, 2169-2175.

Kouwenhoven, G., Reddy Nalla, V., Lossonczy von Losoncz, T. (2012). Creating Sustainable Businesses by Reducing Food Waste: A Value Chain Framework for Eliminating Inefficiencies. *International Food and Agribusiness Management Review*, vol: 15(3), 119-137.

Larsen, N., Sigurdsson, V., Breivik, J. (2017). The Use of Observational Technology to Study In-Store Behavior: Consumer Choice, Video Surveillance, and Retail Analytics. *The Behavior Analyst*, vol: 40(1), 309-313.

Dorward, L.J. (2012). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? A comment, *Food Policy*, vol: 37(4), 463-466.

McDowall, W., Geng, Y., Huang, B., Barteková, E., Bleischwitz, R., Türkeli, S., Kemp, R. and Doménech, T. (2017). Circular Economy Policies in China and Europe. *Journal of Industrial Ecology*, vol: 21, 651-661.

Nandhivarman, M, Gopalsamy, P., A. Edwin, G., Ramaswamy, A.P., Boruah, D. (2015). Evolving and Implementing Energy Recovering Strategy from Food Wastes at Jawahar Navodaya Vidhyalaya (JNV) Fostering Campus Sustainability. In: *Implementing Campus Greening Initiatives: Approaches, Methods and Perspectives* (pp.1-12).

Ohnishi, S., Fujii, M., Ohata, M., Rokuta, I., Fujita, T. (2018). Efficient energy recovery through a combination of waste-to-energy systems for a low-carbon city. *Resources, Conservation and Recycling*, vol: 128, p. 394-405.

Scialabba, N.E. (2011). *Food Availability and Natural Resource Use*, FAO@RIO 20, Paris. Retrieved from:

http://www.fao.org/fileadmin/user_upload/sustainability/Presentations/Availability.pdf Tu, J.-C., Nagai, Y., Shih, M.-C. (2018). Establishing Design Strategies and an Assessment Tool of Home Appliances to Promote Sustainable Behavior for the New Poor. *Sustainability*, vol: 10(5), 1507.

Weltin, M, Zasada, I., Piorr, A., Debolini, M., Geniaux, G., Moreno Perez, O., Scherer, L., Marco, L.T., Schulp, C.J.E. (2018). Conceptualising fields of action for sustainable intensification – A systematic literature review and application to regional case studies. *Agriculture, Ecosystems & Environment*, vol: 257, 68-80.

5.2 Losses and waste in the agri-food chain

(*Małgorzata Górka¹, Bogusław Ślusarczyk², Stanisław Pigoń³*)

¹ PhD Eng, State Higher Vocational School in Krosno, Krosno State College;
e-mail: malgosiagorka@poczta.onet.pl

² Prof. UR, State Higher Vocational School in Krosno, Krosno State College

³ PhD, State Higher Vocational School in Krosno, Krosno State College

Key words: loss of food, wastage of food, agro-food chain

Introduction

The increasing phenomena at the turn of the 20th and 21st century, such as globalization of food trade, commercialization of food systems, the progressing process of urbanization or changes in the eating habits of the world's population, resulted in a change in the way food is produced, processed, distributed and consumed, influencing, among others, the generation of food losses and wastage (). Losses and wastage of food are the result of economic, technical, social and cultural factors that affect the functioning of food systems ().

Food losses constitute a global problem. According to report by the Food and Agriculture Organization of the United Nations, 1.3 billion tons of food are thrown away every year worldwide. In Europe alone, losses amount to 20 to 30 % of the total volume, 2/3 of which could still be consumed. It is estimated that 9 million tons of food is wasted in Poland annually, which places our country in fifth position among the European Union countries (89 million tons), just behind the United Kingdom, Germany, France and the Netherlands. In developed countries the food supply exceeds demand, there are also changes in the lifestyle towards spreading idea of consumerism and propagation of unreasonable dietary behavior. Excess food on the market leads to waste of food products and raw materials that could be used for consumption purposes. In Europe, on average, about 179 kg of food is thrown away per capita per year. It is estimated that approximately 235 kg per capita per year is wasted in Poland (). Due to the complexity of factors determining the process of food losses and waste, such as the length of agri-food chain or the variety of food products, it is very difficult to quantify the scale of wasted food. Therefore, so far there has been little research in this area.

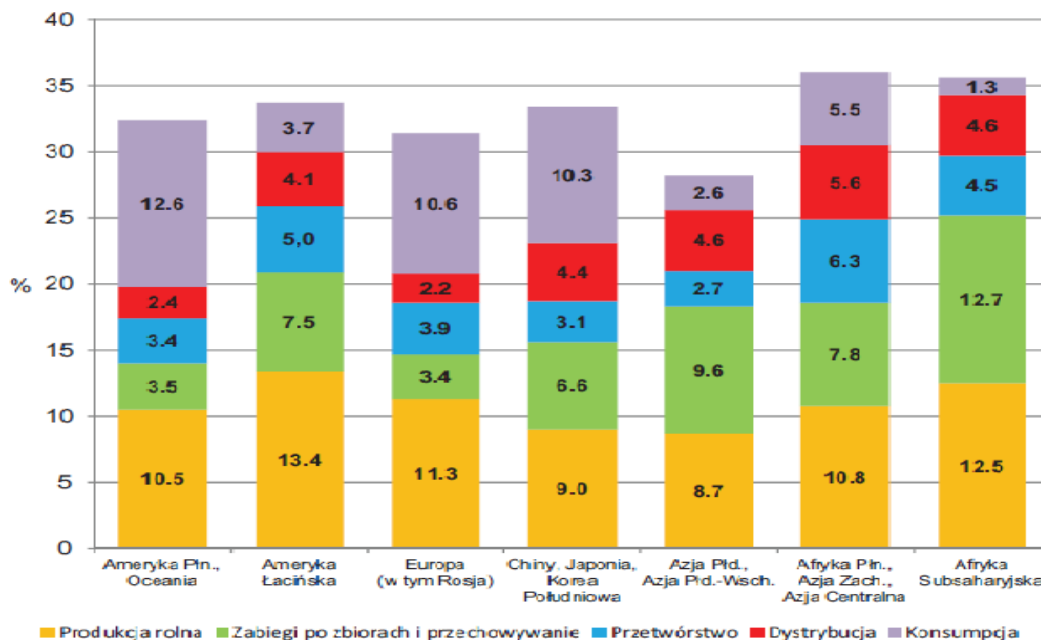
The aim of this paper was to analyze the scale and causes of losses and waste in the agri-food chain in Poland, the European Union and the world. This article is a review. In order to achieve this objective, the review of literature and available statistical data from the Institute of Agricultural Economics and Food Economy – National Research Institute in Warsaw was used.

Losses and waste of food in the agri-food chain in the world

In the agri-food chain, food is wasted or lost on the way from agricultural production, through post-harvest treatment and storage, processing, distribution and consumption. In case of developing countries, shortages of food products are recorded as the most frequent consequence of insufficient resources at an early stage of the agri-food chain development (agricultural

production, including processing and storage), mainly due to the lack of development of technologically advanced agricultural production, use and storage of preservatives, inability to efficiently store food products, inefficient infrastructure and insufficient capacity to store food as to ensure sustainable development (Figure 1). The greatest damage in the agricultural production phases was recorded in Latin America (13.4%) and sub-Saharan Africa (12.5%), in the final processing and storage of crops grown in sub-Saharan Africa (12.7%), South Asia and South-East Asia (9.6%). Most food in industrialized countries is wasted at the consumption and distribution level. In North America and Oceania, the largest amounts of food waste were recorded at the consumption level (12.6%), which is related, among others, to food overproduction, market price mechanisms and the administrative and legal framework, non-compliance with these due to poor consumer eating habits and disrespect for food.

Figure 1. Food waste and losses in the whole agri-food chain by world regions (%)



Source: Study based on Borowski et al. (2016) and Gustavsson et al. (2011).

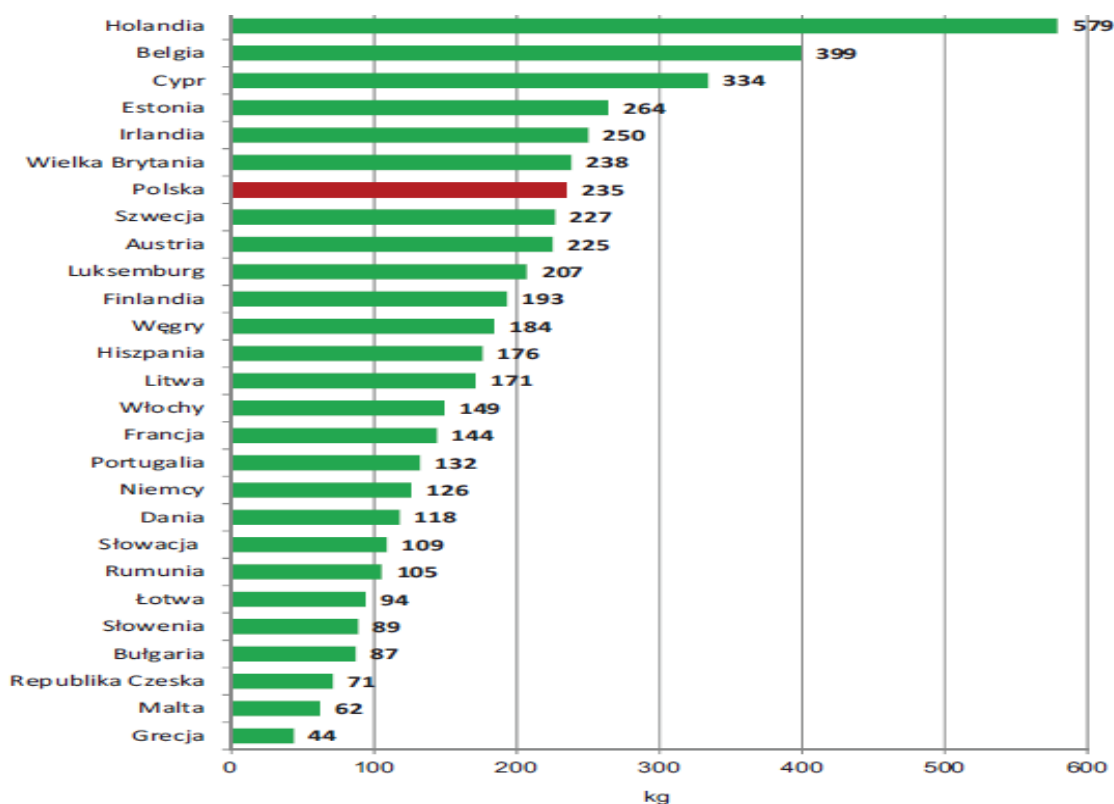
North Africa, West Asia and Central Asia (36.0%) and Sub-Saharan Africa (35.6%) suffered the greatest losses in food production and food waste throughout the agri-food chain, followed by Latin America (33.7%), China, Japan and South Korea (33.4%), North America and Oceania (32.4%), Europe, including Russia (31.4%) and the smallest North America and Oceania (32.4%), as well as South-East Asia and South Asia (28.2%).

Food losses in the European Union

Research commissioned by the European Commission shows that around 89 million tons of food are wasted in the EU countries annually and around 180 kg per capita (Barilla Center for Food and Nutrition, 2012). By comparison, in sub-Saharan Africa, food thrown out per capita per year is 6-11 kg. The largest amount of food is wasted by British people – as much as 14 million tons, in

households – as much as 8.3 million tons. Poles waste about 9 million tons of food, where about 6.6 million tons of food waste is responsible for its production, then households – for about 2 million tons and other sectors – for about 0.4 million tons (Borowski et.al., 2016). In the EU Member States, the degree of food waste per capita varies greatly. The smallest amount of food is thrown away by the Greeks only 44 kg a year, and the largest amount of food is thrown away by the Dutch as much as 579 kg (Figure 2). The degree of food wastage above 100 kg per capita distinguishes as many as eleven EU countries: Romania, Slovakia, Denmark, Germany, Portugal, France, Italy, Lithuania, Spain, Hungary and Finland (from 105 kg in Romania to 193 kg in Finland).

Figure 2. Food losses in the European Union (1 inhabitant/kg/year)



Source: Study based on Borowski et al. (2016) and Gustavsson et al. (2011).

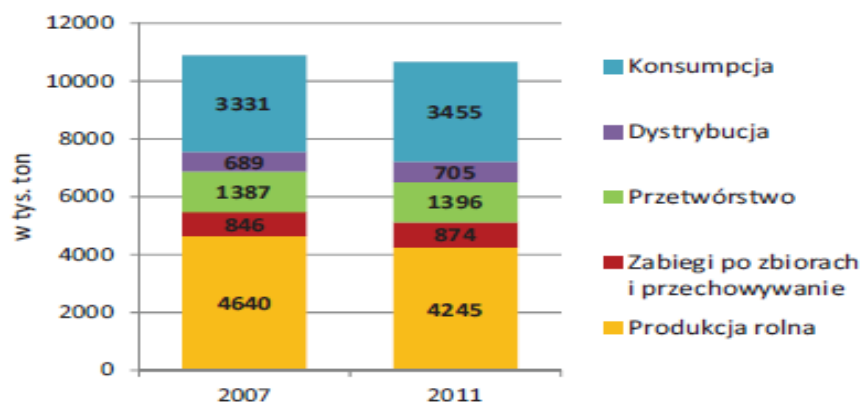
The scale of food wastage in Poland was estimated at 235 kg per capita per year. In terms of food waste, Poland is seventh after Great Britain, Ireland, Estonia, Cyprus, Belgium and the Netherlands. The highest amounts of wasted food are in the household sector – 42%, of which 2/3 were avoided, i.e. about 76 kg per capita per year. The complexity of factors influencing the level of food wastage in households is responsible for 39% of the total amount of wasted food, the food supplier, including restaurants and catering chains (14%), as well as retailers and retail chains (European Commission 2011) (5%).

Losses and waste in the agri-food chain in Poland

Every year 9 million tons of food is wasted in Poland. The Polish Parliament has been working on a draft law to reduce the scale of waste, following the example of other EU countries. In Poland, there is no comprehensive scientific research on food waste and wastage covering all groups of food products and every stage of the agri-food chain. General estimates for the European Union can only be found in foreign publications (Bräutigam, Jörissen, Priefer 2014).

The research methodology enabled identification of those points where in Poland in 2007 and 2011 the greatest losses and food waste took place. The analysis of estimations concerning losses and wastage of particular groups of food products in relation to the stages of agri-food chain showed that about 40% of losses and wastage arise from agricultural production. In the analyzed period, the share of agricultural production in the generation of food losses and waste decreased by 2.8 percentage points in favor of the remaining stages of agri-food chain, i.e. consumption, processing, post-harvest processing, storage and distribution (Borowski et al., 2016). Taking into account the amount of food losses and wastage in Poland as a whole, 10 893 thousand tons were produced in 2007, 10 675 thousand tons in 2011, i.e. 2% less. In quantitative terms, food waste and losses decreased in the analyzed period only at the stage of agrarian production – from 4640 thousand tons in 2007 to 4245 thousand tons in 2011, i.e. by 8.5%.

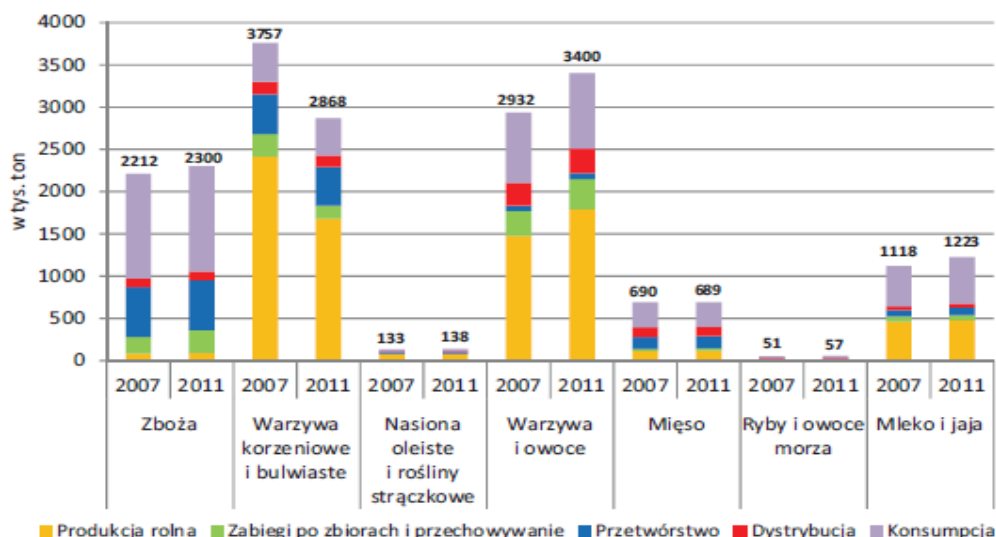
Figure 3. Percentage of a part of the agri-food chain in the generation of food waste and losses in Poland in 2007 and 2011 (thousand tons)



Source: Study based on Borowski et al. (2016) and Gustavsson et al. (2011).

In all other phases of the agri-food chain, food losses and waste increased: in the consumption phase (by 3.7%), post-harvest treatment and storage (by 3.3%), distribution (by 2.3%) and processing (by 0.6%).

Figure 4. Percentage share of subsequent stages of the agri-food chain in the formation of losses and wastage of food groups in Poland in 2007 and 2011 (thousand tons)



Source: Study based on Borowski et al. (2016) and Gustavsson et al. (2011).

The analysis of losses and wastage among specific groups of food products in Poland showed that the highest losses and wastage in 2007 affected root and tuber vegetables – 3757 thousand tons (in 2011 – 2868 thousand tons), as well as fruit and vegetables – 3400 thousand tons in 2011 (2932 thousand tons in 2007), the smallest sum of the fish and seafood bill (51 and 57 thousand tons) (Borowski et.al. 2016).

Summary and conclusions

The scale of losses, waste and food wastage is enormous and should therefore be treated as a global problem. It occurs along the entire length of agri-food chain, i.e. “from field to consumer’s table. In view of these huge food losses, every effort must be made to reduce food waste, including implementation of coordinated strategy combining European and national action to improve efficiency along the entire supply and consumption chain in the various sectors. The European Union should support food distribution activities for people in financial difficulties, as well as aid to supply schoolchildren with milk and milk products, and a program to promote the consumption of fruit in schools. Information campaigns to raise public awareness of the consequences of food waste should be carried out in all the countries of the European Union. Consumer education in food and nutrition. The promotion and development of consumer education causes consumers to become demanding and able to make a rational choice of consumer goods and services. Reduced food waste and wastage throughout the agri-food chain and sustainable food choices by consumers can contribute to greater resource efficiency, increased land use efficiency, improved water management, global agricultural sector benefits, and reduced hunger in developing countries, thereby contributing to global food security.

Literature

1. Barilla Center For Food and Nutrition. 2012. Food waste: causes, impacts and proposals, Parma, s. 30.
2. Borowski M., Kowalewska M., Kwasek M., Obiedzińska A. (2016). From research on socially sustainable agriculture (37) Analysis of losses and food waste in the world and in Poland, (ed.) Kwasek M. Institute of Agricultural Economics and Food Economy – National Research Institute, Warsaw, s. 43.
3. Bräutigam K-R., Jörisen J., Priefer C. 2014. The extent of food waste generation across EU-27: Different calculation methods and the reliability of their results. *Waste Management & Research*, 32(8), s. 683 – 694, 691.
4. European Commission. 2011. Preparatory study on food waste across EU-27, Final Report, Paris, s. 15.
5. FAO. Global food losses and food waste. Extent, causes and prevention. Study conducted for the International Congress Save food at Interpack, Düsseldorf 2011.
6. Gustavsson J., Cederberg C., Sonesson U., Van Otterdijk R., Meybeck A. 2011. Global Food Losses and Food Waste: Extent, Causes and Prevention, FAO, Rome, Italy.
7. HLPE (2014). Food losses and waste in the context of sustainable food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
8. Obiedzińska A. (2017). The impact of food waste and wastage on food security. *Scientific Journals of the Warsaw University of Life Sciences*, Volume 17 (XXXII), notebook 1, 2017: 125–141.

5.3 Quality in shaping the behavior of young consumers in the milk market (*Paulina Luiza Wiza¹, Norbert Szalaty²*)

¹ M.Sc., University of Life Science in Poznań, Department of Economics and Economic Policy in Agribusiness, Poland;
e-mail: paulina.wiza@up.poznan.pl

² M.Sc., University of Life Science in Poznań, Department of Economics and Economic Policy in Agribusiness, Poland;
e-mail: norbert.szalaty@up.poznan.pl

Key words: quality, food safety, milk market, consumer behavior

Introduction:

The dairy sector in Poland belongs to the intensively developing market of food products. Currently, milk and dairy products are gaining wide popularity among Polish consumers, including the young generation. Dairy products are eagerly consumed due to such features as: sensory values, nutritional values and health values (Grębowiec and Korytkowska, 2017). Currently, in order to be able to compete effectively on a given market, it is necessary to examine and define consumer preferences and requirements based on marketing mix elements (i.e. product, price, promotion, distribution) that shape the overall quality of products on the market (Grębowiec, 2015). One of the elements of the competitiveness of food industry enterprises is the offered food and the quality of products. Food is one of the most important goods and basic needs for humans, due to their nutritional and health value (Kraciuk, 2017 and Kowalczyk, 2016). Consumers when buying dairy products are guided by economic, psychological and social factors. In order to be able to compete in the market and generate profits in its operations, the company's task is to create products based on the requirements of potential buyers. The company should focus on continuous improvement and analyze the products offered to consumers. Manufacturers convince potential consumers to buy products using a variety of methods, such as advertising, price promotions and extending / modifying existing products. The impact on consumer behavior in the dairy sector has been the subject of many studies, but research has not been carried out among consumers of the young generation. The following conditions may influence the creation of the basics among consumers in the food industry: concerning the consumer, i.e. age, gender, education, place of residence:

- regarding the product, i.e. taste, smell, color, price, brand;
- social, which include such components as: family, reference group;
- market conditions, i.e. legal regulations and the economic situation in the region (Jeżewska-Zychowicz and Pilska, 2007).

Currently, it is observed that consumers are increasingly shopping with increased awareness. This is due to the fact that among Polish society in recent years we have been observing the growing level of affluence, and consumers, in addition to the price in purchasing decisions, are more and more often guided by the quality of products (Cyrek et al., 2016).

In the literature on the subject, quality was defined in a multifaceted manner. Quality is perceived in the technical, commodity and consumer aspects (Kwasek, 2011). According to Juran, quality was defined as "a trait or set of features that are relevant to a given product, identifiable, which include the manner of execution, appearance, consistency, taste and smell" (Juran, 1962). From the consumer's perspective, quality is understood as meeting expectations in relation to individual food products or their groups (Piotrowska-Puchała, 2018, Baryłko-Pikielna, 1995). The components of quality are: sensory characteristics, healthiness (including nutritional value, health value, dietary value) and availability (i.e. ease of storage, time to eat, storage conditions) (Piotrowska-Puchała, 2018).

The concept of food safety is closely related to the concept of quality. The quality and safety of food products should be ensured at every stage of the food chain (Kwasek, 2011). The most important quality feature from the point of view of the consumer is food safety, which is regulated by the European Union law (Kwasek, 2011). Ensuring food safety is a priority for food producers to shape high-quality products for consumers. It is important to define aspects of public health, food quality and economic security in defining food safety (Piotrowska and Cymanow, 2010). Ensuring high quality food, especially health safety, is a more complex problem than ensuring the quality of products belonging to other product groups. With regard to food, quality is inextricably linked to its safety, and hence with health quality, i.e. compliance with legal regulations, standards, specification and quality level acceptable by the purchaser (Jasiulewicz-Kaczmarek and Wieczorek, 2008)

In order to shape high-quality food products at the same time with regard to food and health security, a number of quality management systems and quality labels have been developed that are in force among food producers in the European Union. In the opinion of quality management systems, it is necessary to guarantee food health safety through such tools as monitoring and management of food hazards (Piotrowska - Puchała, 2018, Grębowiec, 2010). Quality management systems can be divided into obligatory ones, which include such systems as: Hazard Analysis and Critical Checkpoint (HACCP), Good Hygienic Practice (GHP), or Good Manufacturing Practice (GMP), and non-obligatory, to which in the dairy sector we can distinguish such signs of quality such as: "Quality Tradition", "Guaranteed Traditional Specialty", Protected Geographical Indication, as well as Protected Designation of Origin.

It is worth emphasizing that consumers quickly change their preferences and shopping tastes. Currently, the consumer choosing food products, including dairy products, is guided by such aspects as the benefit from the purchase of a given product, and the need to meet needs. Therefore, the quality of the product (including dairy products) in the meaning of the consumer can be distinguished into:

- real quality, characterizing the practical state (*effective quality*),
- the quality expected by consumers in relation to the products concerned (*expected quality*),

- quality induced, characterizing customer expectations based on his experience in relation to a specific brand (*induced quality*),
- total quality being the sum of the evoked and real quality, which is lower or higher than expected (*overall quality*),
- potential quality determining the level of improvement of the product (*potential quality*) (Illy i Viani, 1995).

Research methodology:

The research was conducted using a questionnaire interview using the research tool which is the questionnaire. The study was conducted among young consumers (respondents in the 18-25 age group) who consume dairy products and are residents of the Poznań powiat, as well as among students of the University of Life Sciences in Poznań. About 300 young consumers were examined. The research was aimed at identifying the key factors that affect the perception of the quality of milk and dairy products among young consumers. In order to conduct the study, an anonymous questionnaire was used, in which respondents were asked about the following: the place of shopping of dairy products, perception of the quality of dairy products purchased in supermarkets and hypermarkets, criteria for selecting dairy products, the importance of quality for shopping and knowledge of existing quality systems and quality marks. The questionnaire also included information about who and for what purpose it conducts research, all information on how to answer the right questions (closed and open), added questionnaire and information about the anonymity of the responses.

Results:

Among young consumers who were students of the University of Life Sciences in Poznań, research was conducted on preferences for purchasing dairy products. Based on the data collected at the moment, it has been shown that young consumers are eager to consume dairy products several times a day and once a day. Young consumers prefer to consume milk and yoghurts from dairy products. Products such as buttermilk, kefir and blue cheese are less popular. For young consumers, the important factors that guide you when shopping are sensory characteristics and the expiration date. Almost 50% of respondents do not pay attention to information about certificates received by the producer, confirming the application of quality management and safety systems in dairy production.

Summary / conclusions:

Making purchase decisions of dairy products is directed by many factors, both external and internal. Systematic observation of changes taking place in consumer behavior is extremely important from the perspective of adapting the offers of enterprises to the expectations of buyers. Based on the completed research, it was found that for young consumers, the product brand and the form of advertising for a dairy product are less important. Respondents are satisfied with the quality of Polish dairy products. Most respondents associate an innovative dairy product with a

new taste and an additional health-promoting effect. The respondents are willing to buy new products, but mainly after trying them out and recommending them to friends. Therefore, one should constantly pay attention to the still changing purchasing preferences, which are the resultant of many different factors, not only economic, but also non-economic factors.

Literature

Baryłko-Pikielna N. (1995). Konsument a jakość żywności. *Żywność. Technologia. Jakość*. nr 4 (5): 3-10.

Cyrek P., Grzybek M., Makarski S. (2016). Kreowanie jakości handlowej artykułów żywnościowych. Wyd. Uniwersytetu Rzeszowskiego, Rzeszów, ss. 203 (r. 4 s. 89-124).

Grębowiec M., Korytkowska A. (2017). Zachowania konsumenckie na rynku wyrobów mleczarskich. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu. SGGW. Warszawa. Tom XIX. Zeszyt 4*: 79-85.

Grębowiec M. (2015). Rola jakości w podejmowaniu decyzji nabywczych przez konsumentów, na przykładzie rynku mięsa i wędlin. *Journal of Agribusiness and Rural Development. SGGW. Warszawa. 1 (35)*: 39-47.

Grębowiec M. (2010). Czynniki warunkujące jakość oraz ich wpływ na podejmowanie decyzji nabywczych na rynku gastronomicznym. *Ekonomika i Organizacja Gospodarki Żywnościowej. Nr 80. Wydawnictwo SGGW. Warszawa*: 117-132.

Illy A., Viani R. (1995). *Espresso Coffee*. Academic Press Limited. London: 30.

Jasiulewicz-Kaczmarek M., Wieczorek R. (2008). Eksploatacja systemu zarządzania bezpieczeństwem żywności warunkiem satysfakcji klienta, (w:) T. Sikora (red.), *Koncepcje zarządzania jakością. Doświadczenia i perspektywy*. Wydawnictwo Naukowe PTTŻ. Kraków: 617.

Jeżewska-Zychowicz M., Pilska M. (2007). *Postawy względem żywności i żywienia – wybrane aspekty teoretyczne i metodologiczne*. Warszawa. Wydawnictwo SGGW.

Juran J. M. (1962), *Quality control handbook*, New York-Toronto-London.

Kowalczyk S. (2016). *Bezpieczeństwo i jakość żywności (Food safety and quality)*. Warszawa: PWN.

Kraciuk J. (2017). Bezpieczeństwo żywnościowe krajów Unii Europejskiej. *SGGW. Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu. Tom XIX. Zeszyt 3*: 150 – 155.

Kwasek M. (2011): *Jakość i bezpieczeństwo żywności*. Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej – Państwowy Instytut Badawczy. Warszawa: 17-30.

Piotrowska-Puchała A.(2018). Preferencje konsumentów, jakość i bezpieczeństwo nabywanej przez nich żywności, [w:] E. Czernyszewicz, E. Kołodziej (red.), *Jakość i zarządzanie w agrobiznesie. Wybrane aspekty*. Lublin: 84-93.

Piotrowska A., Cymanow P. (2010). Zarządzanie jakością w oparciu o system HACCP na przykładzie przedsiębiorstwa owocowo – warzywnego – studium przypadku. Logistyka. nr 4/12: 1206-1215, <https://www.czasopismologistyka.pl/artykuly-naukowe/send/244-artykuly-na-plycie-cd-2/2991-artykul>, [data dostępu: 23.04.2019].

5.4 Prevalence of *B. cereus* in Ivory Coast traditional produced flours

(*N'guessan E.¹, Bakayoko S.¹, Cissé M.², Sindic M.²*)

¹ University Peleforo Gon Coulibaly Korhogo. BP, 1328 Korhogo (Ivory Coast). Department of Biochemistry. Research of Biological Sciences
e-mail: enguessan@upgc.edu.ci

² University of Liege - Gembloux Agro-Bio Tech. Laboratory of Agro-food Quality and Safety Analysis, Quality and Risk Unit. Passage des Déportés, 2. BE-5030 Gembloux (Belgium).

Introduction

In Côte d'Ivoire, current dietary habits involve an increase in the consumption of traditionally produced flours. Unfortunately, there is little data on pathogenic microorganisms such as *B. cereus* on this commodity. In this study, we investigated the prevalence of *Bacillus cereus* in traditional flours, collected in several communes of Abidjan (Ivory Coast) followed by the detection for emetic *B. cereus* strains, which are potentially dangerous.

Material and methods

Maize, millet and cassava flour, traditionally produced were used in this work. A state of contamination level of these products, relative to *B. cereus* was first assessed. Microbiological analyses were performed according to the EN ISO 7932: 2004 (and FCD microbiological criteria, 2016), then *Bacillus cereus* isolates from above cited flours were screened by PCR for the presence of cereulide-producing strains.

Results

It was noted a variation in the presence of *B. cereus* by types of flour and by commune. The level of samples contamination differ from each other, within a same commune. The *B. cereus* contamination level being between ≤ 10 to 4×10^2 . Furthermore, no emetic strain was detected at this stage of the work.

Discussion

The most flours samples analyzed were found to be within microbiologically satisfactory limits defined by the FCD microbiology criteria 2016. High moisture content of insufficiently dried flours and artisanal production process could explain the presence of *B. cereus* beyond the defined criteria in certain samples (FAO, 1994; Berghofer *et al.*, 2003 ; N'goran-AW, 2018).

References

Berghofer *et al.*, (2003). *Int. J. Food Microbiol*, 85:137-49.

FAO, (1994). *Codex alimentarius*, Rome, 7: 1-54

N'goran-aw *et al.*, (2018). *Rev. Mar. Sci. Agron. Vét*, 6 : 476-482

5.5 Toxicity of filter cake and Triplex powders against *Sitophilus oryzae*

(*Tesfaye Melak Tadesse*¹, *Bhadriraju Subramanyam*², *Kun Yan Zhu*³, *James F. Campbell*⁴)

¹ Department of Grain Science and Industry, Kansas State University, Manhattan, Kansas, USA;
e-mail: tesfayet@ksu.edu (corresponding author)

² Department of Grain Science and Industry, Kansas State University, Manhattan, Kansas, USA;
e-mail: sbhadrir@ksu.edu

³ Department of Entomology, Kansas State University, Manhattan, Kansas, USA;
e-mail: kzhu@ksu.edu

⁴ USDA-ARS, Center for Grain and Animal Health Research, Manhattan, KS 66502, USA;
e-mail: james.campbell@ars.usda.gov

Keywords: Filter cake, Triplex, *Sitophilus oryzae*, Contact toxicity

Introduction:

Most of the chemical pesticides used by Ethiopia smallholder farmers for protecting stored grains are organophosphates, carbamates, and to some extent organochlorines (Mengistie et al., 2016). Pesticide usage by smallholder farmers in Ethiopia was frequently accompanied by poisoning of users and caused chronic health effects (Mekonnen and Agonafir, 2002). Exploring products that are safe to humans and effective against stored-product insects in smallholder farmer's traditional storages in Ethiopia is necessary. Filter cake and Triplex are two such products found in Ethiopia as by-products of aluminum sulfate and soap factories, respectively (Girma et al., 2008a,b; Tadesse and Subramanyam, 2018a,b). Contact toxicity of filter cake and Triplex powders from Ethiopia were evaluated against the rice weevil, *Sitophilus oryzae* (Linnaeus), a common pest in stored grains. The study was aimed at determining the lethal and effective concentrations and times for both powders against *S. oryzae*.

Methods:

The lethal concentrations for 50 and 99% mortality (LC₅₀ and LC₉₉) of filter cake and Triplex against *S. oryzae* were determined at 14 d after exposing 10 adults for 12 h to concrete arenas inside Petri dishes treated with filter cake concentrations of 0.5-8 g/m² and Triplex concentrations of 1-9 g/m². Lethal times for 50 and 99% mortality (LT₅₀ and LT₉₉) were determined at 14 d after exposing adults for 1-24 h to 3 g/m² of filter cake and 9 g/m² of Triplex. Effective concentrations (EC₅₀ and EC₉₉) and times (ET₅₀ and ET₉₉) for 50 and 99% reduction of adult progeny production were determined from reduction in adult progeny production relative to production in control treatments at 42 d after exposure to filter cake and Triplex.

Findings:

LC₅₀ and LC₉₉ values for *S. oryzae* adults were 0.70 and 8.49 g/m², respectively, when exposed to filter cake and 2.27 and 21.38 g/m², respectively, when exposed to Triplex (Table 1). The corresponding LT₅₀ and LT₉₉ values were 3.13 and 27.21 h, respectively, for filter cake and 4.72 and 38.60 h, respectively, for Triplex (Table 2). EC₅₀ and EC₉₉ values for progeny reduction were 0.57 and 7.95 g/m², respectively, for filter cake and 2.77 and 18.82 g/m², respectively, for Triplex (Table 3). The corresponding ET₅₀ and ET₉₉ values were 2.57 and 17.73 h, respectively for filter cake and 3.39 and 24.74 h, respectively, for Triplex (Table 4).

Table 1. Probit regression estimates and concentrations required for 50 and 99% mortality for *S. oryzae* adults based on mortality assessments made 14 d after exposure for 12 h to concrete arenas treated with various concentrations of filter cake and Triplex.

Powder	N ^a	Mean ± SE		LC (95% CI) (g/m ²)		χ ² (df) ^b	P-value
		Intercept	Slope	LC ₅₀	LC ₉₉		
Filter cake	180	0.33 ± 0.13	2.15 ± 0.34	0.70 (0.45 – 0.93)	8.49 (5.24 – 20.45)	8.57(16)	0.9300
Triplex	270	-0.85 ± 0.19	2.38 ± 0.31	2.27 (1.77 – 2.72)	21.38 (14.49 – 40.28)	20.31 (25)	0.7302

^aN = Total number of adults used to generate the probit regression estimates

^bχ² values for goodness-of-fit were not significant (*P* > 0.05), indicating good fit of probit model to data.

Table 2. Probit regression estimates and times required for 50 and 99% mortality for *S. oryzae* adults based on mortality assessment made 14 d after exposure to concrete arenas treated with 3 g/m² of filter cake and 9 g/m² of Triplex for various time periods.

Powder	N ^a	Mean ± SE		LT (95% CI) (h)		χ ² (df) ^b	P-value
		Intercept	Slope	LT ₅₀	LT ₉₉		
Filter cake	240	-1.37 ± 0.25	2.02 ± 0.29	3.13 (2.16 – 3.99)	27.21 (18.83 – 50.94)	17.57 (22)	0.7311
Triplex	390	-1.76 ± 0.25	2.07 ± 0.23	4.72 (3.54 – 5.79)	38.60 (29.53 – 57.23)	20.54 (37)	0.9870

^aN = Total number of adults used to generate the probit regression estimates.

^bχ² value for goodness-of-fit were not significant (*P* > 0.05), indicating good fit of probit model to data.

Table 3. Probit regression estimates and concentrations required for 50 and 99% reduction of *S. oryzae* adult progeny production at 42 d after exposure for 12 h to concrete arenas treated with various concentrations of filter cake and Triplex.

Powder	N ^a	Mean ± SE		EC (95% CI) (g/m ²)		χ ² (df) ^b	P-value
		Intercept	Slope	EC ₅₀	EC ₉₉		
Filter cake	120	0.49 ± 0.10	2.03 ± 0.36	0.57 (0.34 – 0.76)	7.95 (4.31 – 31.56)	60.48 (10)	<0.0001
Triplex	270	-1.24 ± 0.19	2.80 ± 0.30	2.77 (2.33 – 3.19)	18.82 (13.79 – 30.12)	199.97 (25)	<0.0001

^aN = Total number of adults used to generate the probit regression estimates

^bχ² values for goodness-of-fit were significant (*P* < 0.0001), indicating poor fit of probit model to data.

Table 4. Probit regression estimates and times required for 50 and 99% reduction of *S. zeamais* adult progeny production 42 d after exposure to concrete arenas treated with 3 g/m² of filter cake and 9 g/m² of Triplex for various time periods.

Powder	N ^a	Mean ± SE		ET (95% CI) (h)		χ ² (df) ^b	P-value
		Intercept	Slope	ET ₅₀	ET ₉₉		
Filter cake	210	-1.29 ± 0.18	2.26 ± 0.24	2.57 (1.98 – 3.11)	17.73 (13.72 – 25.87)	97.12 (19)	<0.0001
Triplex	390	-1.53 ± 0.20	2.19 ± 0.20	3.39 (2.61 – 4.12)	24.74 (20.23 – 32.48)	257.13 (37)	<0.0001

^aN = Total number of adults used to generate the probit regression estimates

^bχ² values for goodness-of-fit were significant (*P* < 0.0001), indicating poor fit of probit model to data.

S. oryzae exposed to filter cake produced significantly less number of insect damaged kernels and grain weight loss than those exposed to Triplex (Figures 1 and 2).

Figure 1. Percentage of kernels damaged (A) and percentage of grain weight loss (B) by *S. oryzae* at 42 d after a 12 h exposure to various concentrations of filter cake and Triplex treated concrete arenas.

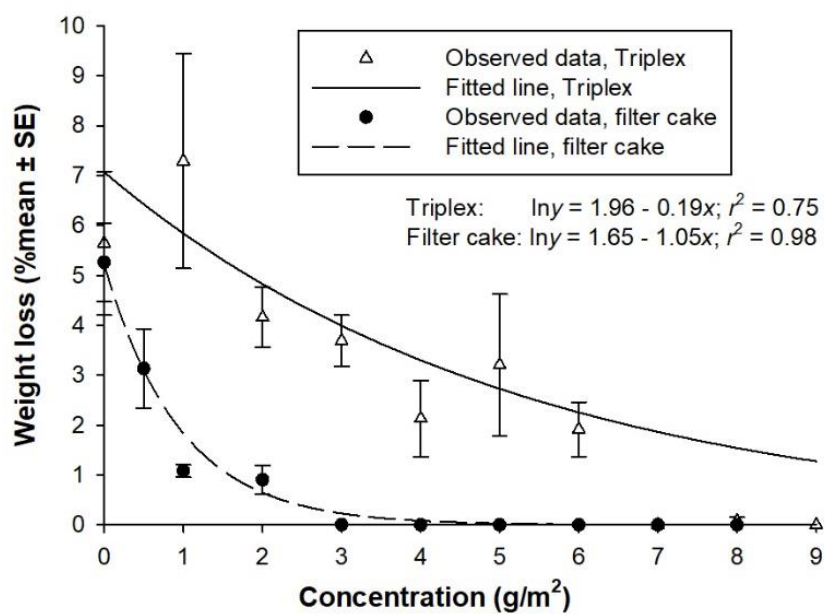
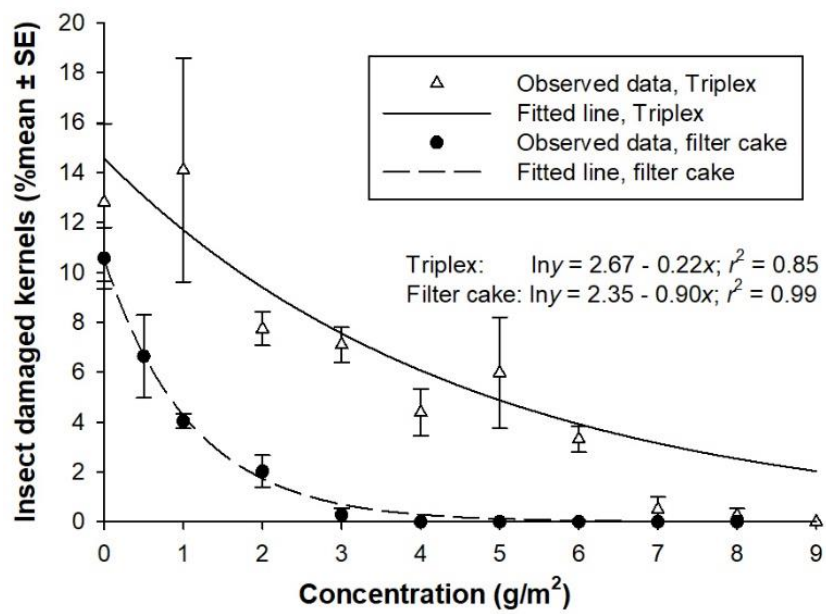
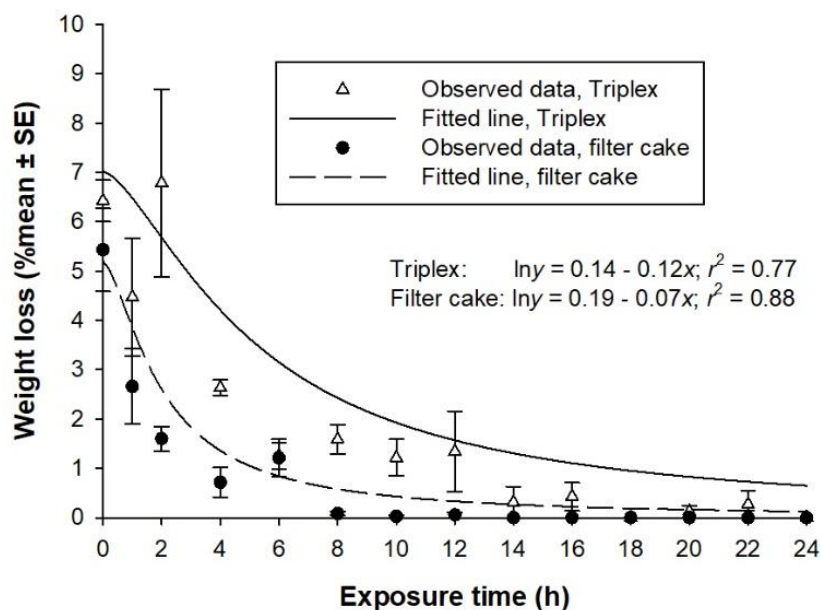
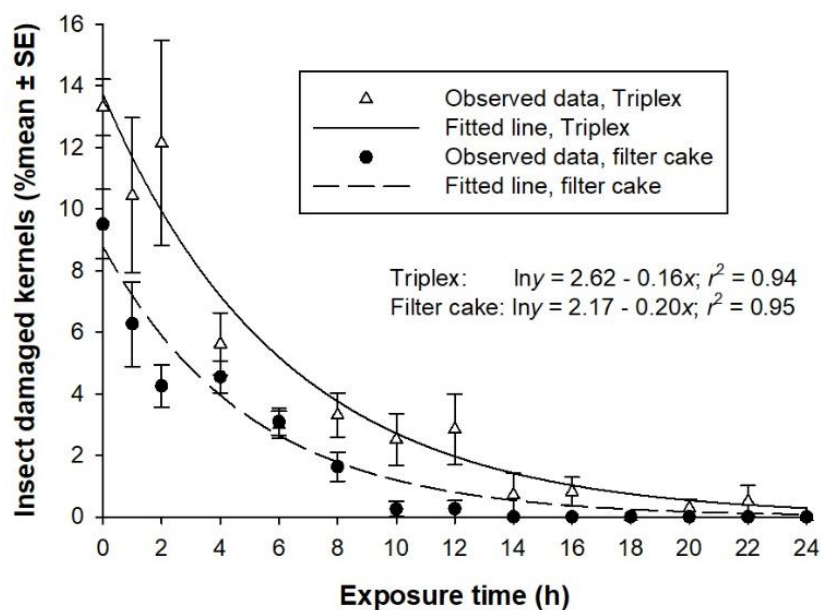


Figure 2. Percentage of kernels damaged (C) and percentage of grain weight loss (D) by *S. oryzae* at 42 d after exposure to concrete arenas treated at 3 g/m² of filter cake and 9 g/m² of Triplex for various time periods.



Conclusions and Implications:

Although both powders were effective by contact against *S. oryzae* when applied to concrete surfaces, filter cake was more efficacious against *S. oryzae* than Triplex. Therefore, our overall result implies that filter cake could be potential alternative to synthetic pesticides. However, studies on real field situation should be conducted before incorporating filter cake to the existing integrated pest management program.

References

- Girma, D., Tadele, T., Abraham, T. (2008a). Efficacy of Silicosec, filter cake and wood ash against the maize weevil, *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae) on three maize genotypes. *J. Stored Prod. Res.* 44, 227-231.
- Girma, D., Addis, T., Demissew, A., and Abraham, T. (2008b). Cooking oils and “Triplex” in the control of *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae) in farm-stored maize. *J. Stored Prod. Res.* 44, 173-178.
- Mekonnen, Y., Agonafir, T. (2002). Pesticide sprayers' knowledge, attitude and practice of pesticide use on agricultural farms of Ethiopia. *Occ. Med.* 52, 311-315.
- Mengistie, B. T., Mol, A. P., Oosterveer, P. (2016). Private environmental governance in the Ethiopian pesticide supply chain: Importation, distribution and use. *NJAS-Wageningen J. Life Sci.* 76, 65-73.
- Tadesse, T. M., Subramanyam, Bh. (2018a). Efficacy of filter cake and Triplex powders from Ethiopia applied to concrete arenas against *Sitophilus zeamais*. *J. Stored Prod. Res.* 76, 140-150.
- Tadesse, T. M., Subramanyam, Bh. (2018b). Efficacy of filter cake and Triplex powders from Ethiopia applied to wheat against *Sitophilus zeamais* and *Sitophilus oryzae*. *J. Stored Prod. Res.* 79, 40-52.

5.6 Food quality as a determinant of flows into military supply chains

(*Marta Wincewicz – Bosy¹, Sławomir Paterak²*)

¹ Phd., Military University of Land Forces, Management Faculty, Poland;
e-mail: marta.wincewicz-bosy@awl.edu.pl

² Phd., eng., Military University of Land Forces, Management Faculty, Poland;
e-mail: slawomir.paterak@awl.edu.pl, (corresponding author)

Keywords: logistics, food supply chains, food quality, military supply chain

The development of industry and trade and migration of people caused changes in the way of nutrition influencing the eating habits of the society. The production and sale of food has always been susceptible to physical, chemical or microbiological hazards. The consumer, when buying a specific food product, has certain expectations regarding its quality. When the quality of the product meets these expectations, the consumer feels satisfaction. That's why traders and producers of food products have to carry out new tasks to ensure the right food, the quality required by the consumer.

The attractiveness of the subject matter gives the opportunity to bring their own achievements to the knowledge resources related to the functioning of the military food supply chain. For the analysis of issues related to the problems of food goods in modern military supply chains, the authors decided to use IGRAFIX - a tool for mapping and modeling of business processes in the standard BPMN 2.0.

The modern consumer with a huge mass of goods at his disposal faces a difficult task, choosing the right product. Dilemmas when making purchasing decisions include, among others, such issues as the quality of the product, its composition, features and appearance of the packaging and many other additional factors. The process - to meet expectations - is characteristic of the consumer's perception in terms of the quality of the purchased goods. One of the basic criteria for the selection of goods, not only food, is the price.

The military recipient in the form of the Military Economic Department when purchasing food products in a tender form, in addition to the price ratio, will be particularly sensitive to the so-called authenticity of the product. This is not a new issue in commodity issues. There are known attempts at adulteration of food, and the product adulterated was one that misled the consumer by the hidden exchange of a value component into a less valuable or worthless one (Krauze 1975). Food is a very special commodity because of its primary role as a source of energy and nutrients, having a direct impact on human health. A soldier is not only the ultimate recipient of food, which he chooses and pays for, but also the one who bears the entire risk of health consequences associated with its consumption.

Among other reasons, the price criterion cannot be the key determinant of the purchase decision. Although in economic practice it is widely used as an element of competitive and market play by companies in the same industry. Consumers who have the same goods to choose from, but from different producers, which differ quite significantly in price, starts to wonder whether these products are of qualitative quality?

Food can also be the subject of hostile actions. This can be seen as a deterioration of premeditated quality that results in a lowering of the condition of the organisms that use it. Changes in the composition of products causing their transformation into poisons. This threat causes food safety to be the first and main focus of interest when it comes to food quality, combining it with Good Manufacture Practice and strategy for the operation of security.

With regard to Good Manufacturing Practice, numerous definitions highlighting various aspects of this undoubtedly comprehensive concept can be found in the literature on the subject. R.L.Hall (Hall 1981) defined the quality of food as "a variable share of costs, risk, nutritional value and desirability", where "desirability" means positive sensory characteristics. The definition implies that food quality is a positive combination of nutritional value and sensory attractiveness, taking into account the risk as to the safety and price of a specific food product.

Supervision over authenticity is a difficult and expensive task. Just as the methods of detecting adulteration are improved, the methods used by counterfeiters are also being improved. The methods used in the identification of food can be divided into physical, physicochemical, chemical, biological. Another division of the methods of detecting adulteration distinguishes four basic groups (Targoński 2000):

1. methods based on the assessment of the basic characteristics of the product (density, extract content);
2. methods comparing the content of product components with standard values;
3. methods for determining the level of compounds that should not be in the product,
4. isotopic methods that determine the isotopic composition of molecules of particular compounds.

The issue of authenticity may concern not only the change in the composition of a food product, but also the placing of incorrect and false information on the packaging and labels of products. Even after fully explaining what the difference is, the question arises: "Is it really necessary to add chemical food additives?" The declaration "without artificial colors and aromas" is a kind of advertising of the product and is positively perceived by the consumer. On the other hand, consumers expect foods with attractive sensory characteristics, such as color, smell and taste. It is known that these properties are achieved in many cases by food additives. The solution to this dilemma is a constant challenge for the modern food technologist (Giese 1994).

Summarizing the above considerations, it can be concluded that in the current situation, consumers have an increasingly stronger influence on creating qualitative changes in food. Food quality is understood here as a comprehensive concept that includes aspects of safety, nutritional value and sometimes the convenience of using it. The problem of food falsification is still an issue. The task of military institutions supervising the supply chain of food products is the elimination of such phenomena. In order to counteract unfair practices, legal provisions and procedures were created to detect non-authentic food, which resulted in the detection of counterfeits.

The article presents the problems of food flow in the military supply chain and the elimination of food products that do not meet the criteria set by military entities such as the Military Food Service Implementation Center, the Military Center for Preventive Medicine and others by means of applicable laws and internal procedures. Detection of this type of crime is important not only from an economic point of view, but also because of the soldier's safety.

Literature:

- 1) Giese J.: Modern Alchemy: Use of Flavours in Food, „Food Technology”, 1994, 48, 2.
- 2) Hall R.L.: Closing Remarks, in: Criteria of Food Acceptance, Foster-Verlag, Zurich 1981.
- 3) Krauze S.: Zarys nauki o środkach żywności. Wyd. 2. Warszawa : PZWL, 1975.
- 4) Nowak S.(1965). Studia z metodologii nauk społecznych , Warszawa 1965
- 5) Targoński Z.: Zafałszowania żywności i metody ich wykrywania. Przem. Spoż. 2000, 54, 6-9.

Chapter VI:

The problems of cooperation in agri-food supply chain

6.1 The potential of cooperation in agri-food supply chain - the case study of Georgia

(Nino Rukhaia-Mosemgvdlshvili¹, Marta Raźniewska²)

¹ David Agmashenebeli National Defence Academy, Gori, Georgia;
e-mail: ninorukhaia@gmail.com

² University of Lodz, Faculty of Management, Logistics Department, Poland;
e-mail: marta.razniewska@uni.lodz.pl

Key words: agri-food sector, cooperation in supply chains, cluster, developing country

Introduction

The domain of the 21st century is competition not between individual enterprises but entire supply chains, including agri-food sector. According to M. Christopher, the supply chain can be treated as a network of organizations that engage both entities - suppliers and recipients - to be active in various processes and activities, where the role of different stakeholders has been prominent (Christopher, 2011). The profound collaboration and relationship management among these stakeholders is essential for achieving sustainability in agri-food supply chains (Dania et al., 2018; Gold et al, 2010; Carter and Rogers 2008), which refers to the three dimensions: profit (economic dimension), planet (environmental dimension), and people (social dimension) (Elkington, 1997). Moreover, according to the concept of the value networks, the co-operative relations between two market players result in the creation of added value by both parties involved, with the co-generated value shared on the basis of competition (Brandenburger, Nalebuff, 1996). Farmers could for example use cooperation to redress the power imbalances, enhance viability, promote values of equity, sustainability, fair pricing and transparency (Hooks et al., 2017). Insight into organizational operations, needs and capacities may enhance the market performance of the companies in supply chains (Dangelico and Pontrandolfo, 2013). Moreover it can facilitate information sharing and promote trust among partners (Soler et al, 2010) and facilitate product innovation for sustainability (De Marchi et al, 2013; Lee and Kim, 2011). Increasing customer expectations and legal regulations result in the improvement of business activities regarding the environment, including those involving cooperation and collaboration with suppliers and customers in the supply chain (Kłosińska et al, 2018).

The aim of this article is to identify the potential role of the cooperation on the developing market of Georgia.

Methods

The paper is based on a theoretical and an empirical investigation. Firstly, the desk research of three international research bases (Web of Science, Emerald and EBSCO) has been conducted.

Secondly, the case study, presenting the situation in agri-food sector in Georgia, has been written. The research or theory problems in the agricultural sector were done by analysis, synthesis and comparison, as well as with other methods of empirical social research. Also, the quantitative marketing research was held examining such large audiences as small farmers and peasants living in the region. And with the help of in-depth qualitative research interviews, we asked representatives of the agricultural cooperatives, large scale farmers and the farmers' associations in the sector. At least the focus group had been conducted on Organic food producer Farmer's group.

Findings

Georgia is a net importer of agricultural products (including primary commodities and processed food products), having run a net agricultural trade deficit in each of the last 10 years. However, many analyses have shown that Georgia has a comparative advantage in agricultural production. This suggests there is a large potential for expanding agricultural exports from Georgia. This is surprising: According to a recent OECD study, Georgia's revealed comparative advantage in agriculture ranks 15th out of 193 countries (Liapis, 2011). In a study of global wine markets (Anderson and Nelgen, 2011), Georgia's revealed comparative advantage in wine ranks second on a list of 13 major wine exporting countries. Hence, there is considerable potential for increasing agricultural exports and agriculture's contribution to economic development in Georgia. (Stephan von Cramon-Taubadel 2014). But major part of Georgian farmers cannot use this opportunity, because of few reasons and one of the major problems is supply chain.

Many economists have argued that the international fragmentation of production should bring significant benefits to developing countries. When production of a good is split globally, tasks within the supply chain are dispersed across countries based (in part) on comparative advantage. This should promote trade between industrial and developing countries, since comparative advantage differs more between these groups than between industrial countries. The gains from trade should expand for all countries, since tasks within the production process are allocated more efficiently. For developing countries, the scope of production should also expand to include relatively high tech- or high skill intensive products, since they can specialize in specific tasks within the production chain. But in Georgia small entrepreneurs and peasants are unable to sell their own harvest; they do not have the appropriate knowledge and experience, and do not have enough money to market their goods on the market. In most cases, they even do not have the equipment to store and save their harvest, so most of the rural population will only get a small amount of harvest, which is often not enough to meet their personal needs.

For developing countries it is very important to have an agro-production, but for further development of economics is more convenient to produce and export not only primary products (fruit, vegetables) but already processed and manufactured products (juices, canned products and ets). An important characteristic of the Georgian agricultural sector is the relative lack of vertical integration and the pre-eminence of small-scale production. The largest share of products, used by producers is bought from independent, small farmers on the market at the time of harvest. This gives rise to a range of problems:

1. As long-term delivery contracts are still highly infrequent, prices are quite volatile. This can reinforce the lock-in on the current market; particularly prices are significantly higher when agricultural products can be sold in Russia – to the detriment of those producers attempting to enter the more price-competitive markets of the future.

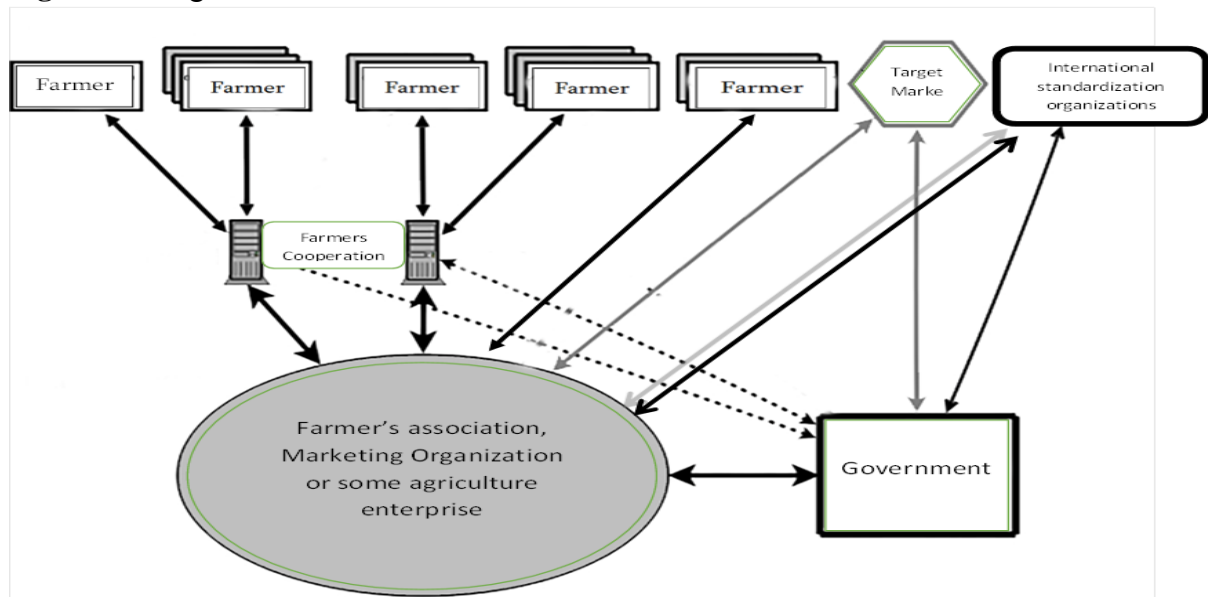
2. Small farmers are often unable to invest in more modern production methods, leading to outdated, inefficient and labor intensive cultivation techniques and prices that are relatively high for a country with low wages and good natural conditions for plant growing.

3. Quality control over the plants is very hard to establish in a market with hundreds of thousands of producers and little vertical integration. Small agro-producers are very reluctant to allow factories and other producers to influence the varieties that they grow, their production techniques and harvest times, etc. While some small farmers do produce excellent homemade, but the resulting quantities are too small for commercial export. A consolidation of such little farmers is unrealistic in the short run and would lead to difficult social considerations, although some larger exporters are gradually attempting to increase their own land production and should be encouraged to do so or they can initiate the regional cluster, to achieve more considerations, best quality product from suppliers and a big quantities of production for export. To resolve these problems, it's important from government to make some actions for raising public awareness and participation in reform process. Farmers must be learned, how important is cooperation with each other and how many profit will take each of them with consideration of their resources.

In the paper the model of “Regional Clusters” has been presented (see the figure 1), which will give farmers the opportunity to find resources for the measures, such as:

- diversification of markets in abroad,
- planning the production process according to the world market demands,
- raising awareness in the field,
- finding new investments for further development,
- finding new technologies and innovative methods.

Figure 1. “Regional Cluster” ’s model.



Source: own research

In the figure 1, Association is a farmer’s union with pay method. But the money, they will collect, must not be the major investment for this union. These payments are for salary of few basic employees. The goals of the union, will contain but not limited by:

- increasing of member’s list,
- finding new markets for export,
- writing recommendations for the members about market changes,
- finding sources for making trainings and researches about newest ways of agriculture, study new technologies and methods,
- finding finances and other resources for resolving the problems of members,
- writing projects and receive grants for implementation of ISO, HASSP and other international standards in the member organizations,
- finding international partners and investors, for further development,
- helping members and increase the coordination for collecting big batch of products for export, saving the quality and quantity of supply.

Farmers and Cooperatives in the cluster don’t have mutual obligation other then they will agree with each other. But the association must become the place of finding common interests with all or part of its members in the issues, such as:

- forming a large batch for export and solve the logistical problems,
- obtain the quality certificate,
- invite the experts of the field,
- implementation of new technics and technologies,
- work to strengthen the members on different steps of supply chain.

Conclusions and Implications

As the researches show, clusters are good (maybe the best) solution especially in poor countries, but in such rural areas, little farmers do not have the knowledge needed to establish and manage

a cluster. (Nino Rukhaia-Mosemgvdlshvili 2018). But to start such cooperation can only marketing or farming associations, which have qualified labor. While the “Regional Clusters” are going to be successful, they would not be developed without government protection. Farmers should be convinced of the need to cooperate and to shape the forms and means of the unions. However, in the focus group research has shown that farmers are not nearly ready to participate in similar "experiments". But government should stimulate those people to get involved in modern Supply chain system, which at the end will play substantial role in boosting Georgia’s economy.

Finally, the cooperation in agri-food sector will remain in the sphere of interests and further empirical research of both authors. This international knowledge exchange will hopefully also strengthen the Polish-Georgian collaboration in the field of agri-food sector development.

References

- Anderson K., Nelgen S. (2011). *Global Wine Markets, 1961 to 2009: A Statistical Compendium*. www.adelaide.edu.au/press/titles/global-wine. Adelaide University Press, Adelaide.
- Brandenburger A. M., Nalebuff B. J. (1996). *Co-opetition. 1 Revolutionary Mindset that Combines Competition and Cooperation. 2. The Game Theory Strategy That’s Changing the Game of Business*, New York, Doubleday.
- Carter C.R., Rogers D.S. (2008). A framework of sustainability supply chain management: moving towards new theory. *International Journal of Physical Distribution and Logistics Management*, vol. 38(5): 360-387.
- Christopher M. (2011). *Logistics & Supply Chain Management*, Pearson Education Limited, Harlow: 13-16.
- Cramon-Taubadel von S. (2014). *Georgia’s agricultural exports*, German Economic Team Georgia, ISET Policy Institute; http://iset-pi.ge/images/Projects_of_APRC/Georgias_agriculture_exports.pdf
- Dangelico R.M., Pontrandolfo P. (2013). Being “green and competitive”: the impact of environmental actions and collaborations on firm performance. *Business Strategy and the Environment*.
- Dania W., Xing K., Amer Y. (2018). Collaboration behavioural factors for sustainable agri-food supply chains: A systematic review, *Journal of Cleaner Production*, vol. 186: 851-864.
- De Marchi V., Di Maria E., Micelli S. (2013). Environmental strategies, upgrading and competitive advantage in global value chains. *Business Strategy and the Environment* 22: 62-72.
- Elkington J. (1997). *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, Capstone, Oxford.
- Gold S., Seuring S., Beske P. (2010). Sustainable supply chain management and inter-organizational resources: a literature review. *Corporate Social Responsibility and Environmental Management*, vol. 17(4): 230-245.
- Hooks T., McCarthy O., Power C., Macken-Walsch A. (2017). A co-operative business approach in a values-based supply chain: A case study of a beef co-operative, *Journal of Co-operative Organization and Management*, vol. 5: 65-72.

- Kłosińska J., Raźniewska M., Sosnowski P. (2018). Greening the organic supply chains in the context of relationship management, *Studia Oeconomica Posnaniensia*, vol. 6, no. 12: 42-54.
- Lee K-H, Kim J-W. (2011). Integrating suppliers into green product innovation development: an empirical case study in the semiconductor industry. *Business Strategy and the Environment* 20: 527-538.
- Liapis P. (2011). Changing Patterns of Trade in Processed Agricultural Products. OECD Food, Agriculture and Fisheries Papers, No. 47. <http://dx.doi.org/10.1787/5kgc3mq19s6d-en>. OECD, Paris.
- Soler C., Bergstrom K., Shanahan H. (2010). Green supply chains and the missing link between environmental information and practice. *Business Strategy and the Environment*, vol. 19: 14-25.
- Rukhaia-Mosemgvdlishvili N. (2015). Regional Clusters -The Best Way for Georgian Farmers to adapt the Requirements of the European Market, *ECONOMICS*, 5-6.
- Rukhaia-Mosemgvdlishvili N. (2017). The Ways of Increasing Profitability and Competitiveness of Farming in The Caucasus Region on Example of Georgia Republic. Prague International Academic Conference May 7-10
- Rukhaia-Mosemgvdlishvili N. (2018). The effectiveness of agrarian cooperation in the issues of food safety and economic growth in the country, Proceedings of The 8th international conference on Management, Economics and Humanities on 7th - 9th December, Barcelona, Spain.

6.2 Strategic directions for development of transport and logistic infrastructure of grain exports from Ukraine

(Anatolii Dibrova¹, Larysa Dibrova², Yaroslav Krylov³, Maksym Dibrova⁴)

¹ Professor of the department global economy at National University of Life and Environmental Sciences of Ukraine Kyiv, Ukraine;

e-mail: dibrova@nubip.edu.ua

² PhD, associate professor, the department of the Administrative Management and Foreign Economic Activity, NULES;

e-mail: dibrova_larisa@ukr.net

³ Postgraduate student of NULE;

e-mail: ykrylov@ukr.net

⁴ Postgraduate student of NULES;

e-mail: max_dibrova@ukr.net

Key words: grain market, logistics, infrastructure, regulation, export.

Introduction

In recent years, Ukraine has significantly increased grain production and entered to the cohort of its major producers and exporters. Despite the positive dynamics, a number of problems that have appeared and hinder its further development. In particular, infrastructure costs for grain exports remain at a rather high level, which reduces the competitiveness of domestic grain in the foreign market. The transport infrastructure does not quite meet the needs of the grain market due to the operation of the railway transport, the unpredicted increase in tariffs for the transportation of grain by rail, mainly the unsatisfactory state of highways, the lack of development of river transport. To date, the problem with logistics was less felt, since export volumes were significantly lower, and high grain prices with surplus blocked additional logistics costs. However, in the context of lower world prices observed during 2013-2017, the ineffectiveness of transport and logistics infrastructure on the grain market was significantly affected by the incomes of agricultural producers.

Positive tendencies of increasing the production volume and grain export, accompanied by prices instability and incomes of commodity producers, monopolization of the market and over concentration of production by large companies, it is not always possible to balance the interests of the main market participants (producers, consumers and the state).

Practice shows that due to insufficient quality, Ukraine exports mostly cheap feed grain, while it is forced to import meat and dairy products, and animal feed. From this point of view, the preservation of such trends shows that our state can remain an appendage of raw materials of developed countries, giving them added value and creating new jobs for them. In this case, without structural changes in the agriculture sector of the domestic economy, in our opinion, it will be quite difficult to solve the problems of poverty, unemployment in the countryside and the revival and development of rural areas.

Methods

During the research, the following methods were used: comparative analysis and expert assessments - for the analysis of quantitative and qualitative indicators of development of the domestic grain market in the conditions of globalization; statistical-economic - for the collection and processing of statistical data, studying the dynamics of exports and imports of grain; economics and mathematics - to predict the impact of demand factors (consumption on food and feed purposes, exports and stocks) and supply (yield, area, production, imports and stocks) on the grain market for the period up to 2025.

In order to evaluate the effectiveness of agricultural policy and the level of domestic support of agriculture there was used the methodology which is applied in the country-members of OECD. The methodology of the quantitative estimation of the state support is substantiated in the works of such famous scientists as Josling (1988), I.Tsakok (1990), A.J.Webb (1990), M.Lopes (1990), R.Penn (1990).

Findings

Ukrainian grain market is one of the main segments of the agro-food market, which determines the country's food security, the results of economic activity of agricultural producers and, in general, the welfare of the Ukrainian people.

The analysis shows that the gross grain production in Ukraine on average in the years 2015-2017 has almost doubled in comparison with 2000-2002, mainly due to an increase in average yield from 24.6 centners per hectare to 43.2 centners per hectare.

Among the main grain crops, the largest increase in gross volumes was achieved by corn. Thus, during the research period, it increased by 6.5 times, having overcome a 30-millionth cut in individual harvest years. This was facilitated by the expansion of the collected area from an average of 1.2 million hectares in 2000-2002 to 4.3 million hectares in 2015-2017, with an increase of almost twice the average yield. Moreover, the range of corn spreading through the development of breeding and the introduction of new technologies now covers virtually all natural and climatic zones of Ukraine.

Gross collections of wheat in Ukraine also increased by an average by 1.5 times in 2015-2017 compared with 2000-2002 due to an increase in average yield from 27.1 centners per hectare to 40.7 centners per hectare or 66,6%. However, during the analyzed period, there is not stability of gross barley collections, in particular, its production in 2015-2017 decreased by almost 500 thousand tons or 5.2% compared to 2000-2002, due to reduction of the collected area by 40% . At the same time, barley yield increased by 37.5%.

In the structure of grain and legume production in Ukraine over the analyzed period, agricultural enterprises produce about 80% of the total volume, including farms - 12-13%, respectively, 20% belong to households, which mainly grow a considerable part of oats, millet and rye and buckwheat.

At the same time, large enterprises are oriented mainly on export types of grain crops (corn, wheat), which are more profitable from the point of view of profit and accordingly require more investment of resources per hectare of area (Kozak and Grinchenko,2016).

Analyzing the current grain market, it is necessary to pay attention to the uneven development and imbalance of demand and supply in the context of individual grain crops. In particular, if in the last 5 marketing years in Ukraine the supply of wheat and corn has a tendency to increase, then rye - decreased by almost half, oats - by 25%.

In the structure of grain consumption, the largest share is feed and food consumption. The decline in livestock in Ukraine in recent years is offset by an increase in the number of poultry. Given the above, feed is used in absolute values at the level of 11-15 million tons, but relative - we tend to reduce. In particular, in 2017, it was 17.3%, compared to 2016 - 19.1%, in 2015 - 22.3%. Food consumption of grain is relatively stable, although in recent years there has been a tendency to decrease it. The main reasons include: reduction of the population; leaving a significant number of our citizens to work abroad; more economical attitude to bakery products; change in diet.

The analysis shows that an increase in grain production is accompanied by an increase in its export potential. Over the past two years, Ukraine has been exporting record grain volumes - more than 40 million tons. However, this is not always reflected in the increase in currency earnings. For example, in 2016, Ukraine exported a record volume of grain crops - 41.5 million tons, which is almost 8% higher than exports in 2015. But due to lower world prices for raw materials, record volumes of grain exports from Ukraine in 2016 did not bring record earnings. It remained at almost the same level of 2015 - about \$ 6.1 billion. The quality of products is also a major problem in exporting grain crops. According to the results of 2016, 57.0% of the wheat sold outside the state is feed. That is, the share of non-food grain, which is reflected in the price and accordingly export earnings, is increasing

The research has shown that price instability in the grain market indicates a lack of effective state regulation. In particular, the following manifestations of such imperfection include: instability of prices and incomes of commodity producers; not entirely predictable state policy; it is not always possible to balance the interests of the main market participants (producers, consumers and the state).

Therefore, in a market economy, for the development of a balanced agrarian policy, it is very important to correctly determine its effectiveness, directly for those who produce agricultural products. With the methodology of the Organization for Economic Cooperation and Development (OECD), the indicator "Market price support" (MPS) is calculated, which determines the monetary value of gross transfers to producers from consumers and taxpayers for the year that arose as a result of state policy measures that create a gap between prices for a certain kind of grain in the domestic and foreign markets (OECD, 2019, p.22) (Figure 1).

Indicator of MPS is determined in producer prices and is calculated by the formula:

$$MPS = (P_p - P_w) * S_1 \quad (1)$$

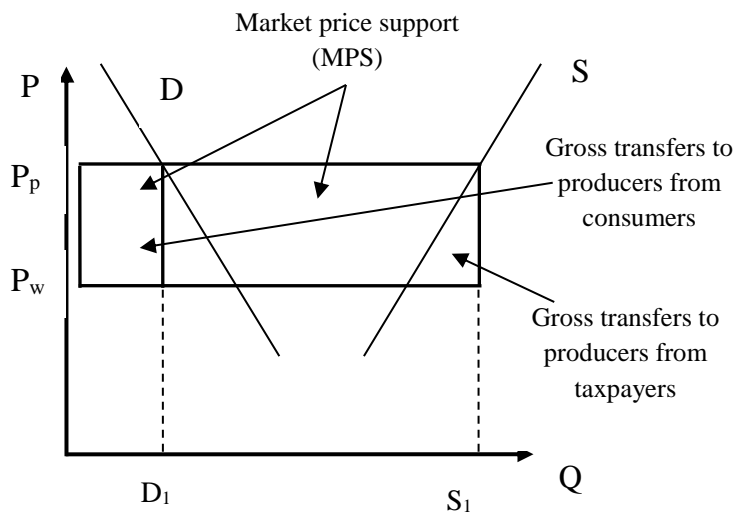
Where:

P_p - internal price per unit of output;

P_w - world price per unit of output;

S_1 - the offer of the domestic market D_1 - the demand of the domestic market (OECD 2019, p.22).

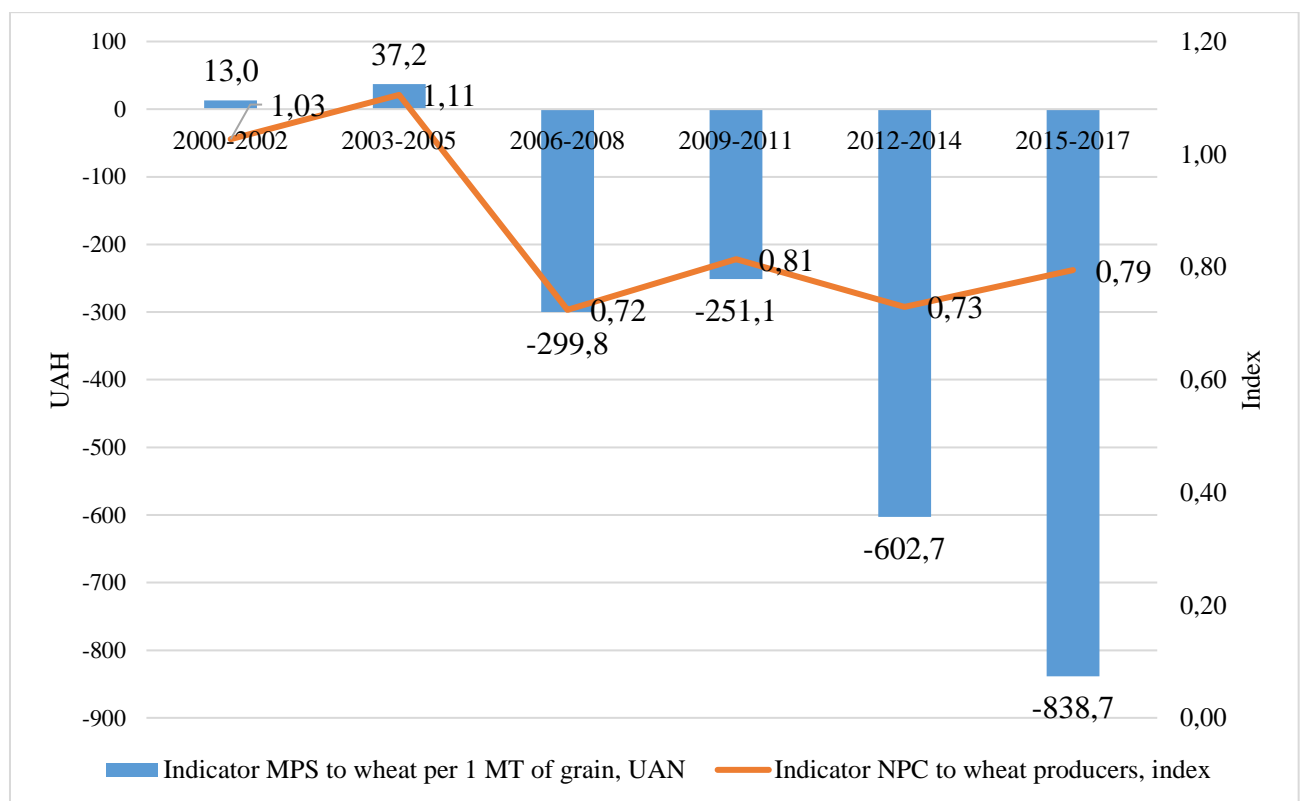
Figure 1. Market price support (MPS) for agricultural products



Source: own research

The value of the "Market price support" indicator for wheat growers in Ukraine for 2000-2017 indicates a significant amount of shortfall in gross transfers from consumers and taxpayers (Figure 2).

Figure 2. Indicators "Nominal producer protection coefficient" and "Market price support" of wheat producers in Ukraine per 1 ton of grain per average period, UAH



Source: own calculation Prokopenko O., (2017)

The received values of NPC index for wheat producers (as a ratio of average prices farmers receive in the domestic market to world market prices expressed in producer prices) confirms price instability and lack of an efficient mechanism for regulating the grain market in Ukraine. In particular, as the competitiveness of domestic grain on the world market is ensured by lower grain prices, wheat exporters (grain traders) compensate for their price losses due to lower grain quality and logistic costs due to low purchasing prices. According to the calculations, wheat purchasing prices at the enterprise level on average for 2015-2017 in Ukraine were 21% lower than the world average. At the same time, agricultural commodity producers in turn compensate for price losses due to the low cost of land lease and wages of employees. Therefore, further increase in grain production in Ukraine needs a reduction in logistics costs due to the development of transport and logistics infrastructure of the grain market in the medium and long term.

Taking into account the increase of export volumes of grain in recent years and the export orientation of the Ukrainian grain market in general, port grain terminals have become the key subject of the transport and logistics system. The analysis shows that the transport infrastructure does not meet the needs of the domestic market due to the operation of the railway transport, the unsatisfactory condition of individual sections of the connecting roads of the regions with the Black Sea ports, undeveloped river transport. This can be accompanied by high tariffs for transportation, in particular, the level of costs for agrarian logistics in Ukraine far exceeds the relevant indicators in developed countries exporting grain. In particular, calculations of infrastructure costs for the export of grain from Ukraine amounted to about 600 UAH per 1 tonne, or about 15% of all costs (Table 1).

Table 1. Infrastructure costs for grain exports (FOB terms) as of June 2017

№	Costs	Standard (methodology) of calculation	Cost per 1 ton of grain, UAH	%
1	Transportation costs * (by rail to the seaport)	489 km at the tariff of Ukrzaliznytsia with VAT	256, 80	42,7
2	Ship loading on port	12 dollars US \$ 1 / t	322,56	53,6
3	Total cost of certificates, total, including:		17,06	2,8
	certificate of origin	is included in the cost of loading services	-	-
	quality certificate (including cost of analyzes and work of survereur)	0.3 dollars US / tonne	1,43	-
	fumigation certificate	0.5 dollars US / tonne	0,63	-
	non-radioactive certificate	is included in the cost of loading services	15,00	-
	phytosanitary certificate	is included in the cost of loading services	-	-
4	Cargo customs declaration	150 dollars USA	5,58	0,9
Total cost			602,0	100,00

Source: Calculated according to the data

In order to increase the efficiency of transport and logistics infrastructure, it is necessary to establish clear and transparent "rules of the game" in the market, which will stimulate competition and attract private investments to develop the objects of logistic infrastructure, development of river transport infrastructure. It is also necessary to establish clear rules and tariffs for the use of railway infrastructure, stimulate investment attraction for the renewal of grain storage and transshipment capacities, automation of transport and logistics processes, which will allow not only to improve the efficiency of the logistics system, but also to provide the necessary speed of transportation of significant volumes of grain.

Conclusions and Implications

Positive tendencies to increase the volumes of production and export of grain observed in recent years in Ukraine are accompanied by instability of commodity producers' prices and revenues, monopolization of the market and over-concentration of production by large companies, uneven distribution of market gain, it is not always possible to balance the interests of the main market participants (producers, consumers and the state) poses a threat to food security and negatively affects the development of the grain market..

Taking into account the increase of export volumes of grain in recent years and the export orientation of the Ukrainian grain market in general, port grain terminals have become the key subject of the transport and logistics system. The analysis shows that the transport infrastructure does not meet the needs of the domestic market due to the operation of the railway transport, the unsatisfactory condition of individual sections of the connecting roads of the regions with the Black Sea ports, undeveloped river transport. This can be accompanied by high tariffs for transportation, in particular, the level of costs for agrarian logistics in Ukraine far exceeds the relevant indicators in developed countries exporting grain. In particular, the cost of grain logistics from the producer in Ukraine to the ports in the Black Sea is approximately 40% higher than the cost of similar costs in France or Germany, and 30% - than in the United States. Therefore, the contradiction between the rates of development of the grain industry and transport and logistics infrastructure becomes an urgent problem and needs to be solved at the state level through the improvement of the mechanism of regulation of the grain market.

In addition, the development of grain logistics infrastructure provides job creation, added value of products, which contributes to increasing revenues in the state and local budgets. Consequently, the reform of state regulation should be comprehensive and aimed at eliminating the barriers to private companies operating in the market of agrarian logistics and having the desire to invest in infrastructure upgrades.

References

- Zhemoida O. V. (2014) Areas of formation of supply in the market of agro-food products of Ukraine: monograph. Kyiv, 376 p.
- Kvasha S.M. (2013). Methodological basis for making public decisions in agrarian policy. *Ekonomika APK*. №8, P.12-21.

Kobuta I. V. (2011) An assessment of the consequences of state regulation of grain exports in Ukraine. *Economics and Forecasting*. № 4. P. 139-147.

Kovalova O.M. Capacity assessment of grain subcomplex in the economy of Ukraine. Retrieved from: <http://global-national.in.ua/issue-7-2015/15-vipusk-7-veresen-2015-r/1203-kovalova-o-m-otsinka-potentsialu-rozvitku-zernovogo-pidkompleksu-ekonomiki-ukrajini> (date of access: 1.03.2019 p.)

Kyrylenko I.H. (2009). Formation of the grain market in Ukraine: development strategy. *Economyka APK*. № 9. P. 79-84.

Kozak O. A., Hryshchenko O. Y. (2016). Development of the grain industry of Ukraine at the present stage. *Economyka APK*. № 1. P.39.

Shpichak O.M. (2014) The potential of the grain market in Ukraine: problems and prospects. *Economyka APK*. № 7. P. 83.

Messel-Veselyak V.Y. (2018). Cereal Crop Production in Ukraine: Potential possibility. *Economyka APK*. № 5. P. 5-14.

Dibrova A., Andrievsky V. (2014). Regulation of the agrarian sector of Ukraine's economy in the conditions of European integration: monograph. Kyiv. P. 572.

Shpiculyak O.G., Materskaya O. A. (2014). Efficiency of grain production by agricultural enterprises: theoretical and methodological aspect. *Economyka APK*. № 12. P. 42-49.

Kvasha SM, Il'chuk M. M. (2013) Economic justification of wheat grain production program in Ukraine. *Economyka APK*. № 3. P. 16-24.

Golosha N., Dziadikevich O. (2016). Prospects for the global grain market. *Economyka APK*. №8. P. 49-52.

Dibrova A., Dibrova L., Krylov Y. (2012). Regulation of the wheat market: domestic and foreign experience. *Economyka APK*. № 5. P. 60-68.

<http://ukrstat.gov.ua> (date of access: 5.03.2019).

Prokopenko O.M. (2018). Balance and consumption of basic food products by the population of Ukraine. Kyiv. P. 40.

Prokopenko O.M. (2017). Ukraine's crop in 2017. Kyiv. P.222

<http://www.oecd.org/dataoecd/36/47/1937457.pdf> (date of access 4.03.2019).

<http://www.oecd.org> (date of access 4.03.2019).

<http://www.uspa.gov.ua>. (date of access 4.03.2019).

6.3 Price volatility in the milk supply chain in Poland in 2010 – 2018

(Agnieszka Thuczak¹)

¹ Phd., Opole University, Faculty of Economics;
e-mail: atluczak@uni.opole.pl

Keywords: prices, supply chain, milk market, long-term dependencies

Abstract

The milk supply chain combines activities related to the flow of products and services from the sphere of primary agricultural production (farmer) to the consumer. It includes producers, suppliers, transport companies, warehouses, wholesale and retailers, service organizations and consumers. Price levels in individual links of the supply chain in the milk market, but not only, are characterized by cyclicity, the volatility of these prices can be considered a source of market risk. This risk is closely related to the risk, which is burdened with the level of income achieved by entities participating in the supply chain. The aim of the article is to examine, on the basis of data from the Central Statistical Office, the occurrence of long-term dependencies between prices on the milk market in individual parts of the supply chain. In studies of these relationships, the Engle-Granger cointegration test will be helpful. The time range of analyzes covers the years 2010-2018.

Introduction

The milk market covers all commercial transactions with milk and its products. Its scope includes the milk market purchased by the dairy industry from farmers, the dairy market and the milk market bought by consumers directly from producers. The largest group of producers of this agricultural product in the world is created by EU countries. After accession to EU the Polish market of milk and dairy products has undergone significant changes. According to SO⁵ data, from 2010 to 2018, milk purchase in Poland increased by 1.38 billion liters, or 12%, while the number of dairy cows decreased by 1/5⁶.

Milk production is very costly due to the need to adapt production to the high sanitary requirements. The supply logistics is very important because it is connected with the timely delivery of milk from the collection point to the processing plant and finally to retail establishments (Parzonko, 2014). An efficient supply chain combines operations in the flow of products and services from the sphere of primary agricultural production (farmer) to the consumer. It should be noted that the milk supply chain, especially in Poland, is characterized by a large diversity of entities comprising it (Morkis, et al. 2010). The dairy product supply chain it can be seen as a complete value chain starting from the production of primary products, followed by milk production, processing and retail sales, ending with the consumer. Due to the growing pressure to reduce costs and the emergence of new, wider markets, as well as new production technologies and information exchange, it is quite a challenge to satisfy growing

⁵ Statistical Office

⁶ W dłuższej perspektywie czasowej wielkość zmian jest jeszcze bardziej zauważalna i znacząca.

customer expectations (Promoting positioning, 2019). Producers make every effort to ensure product differentiation in terms of quality and price in accordance with individual customer requirements (Smolnik, 2016). The volatility of prices can be considered as the primary source of market risk. This risk is closely related to the risk, which is burdened with the level of income achieved by producers participating in the supply chain. The analysis of the development and diversification of prices in individual parts of the supply chain is very important (Kołacz, 2018).

Data and methodology

The object of the analysis were the monthly ones published by the Central Statistical Office for the period from 1.2010 to 12.2018:

- milk price in the purchase [PLN / l] (mleko_skup);
- prices of cow's milk producers with a fat content of 3-3.5% [PLN / l] (mleko_prod);
- retail prices of cow's milk milk with a fat content of 3-3.5% sterilized [PLN / l] (mleko_detal).

The analysis started with the determination of basic statistical parameters determining the average level and variability of the analyzed prices, additionally, return rates of price were analyzed. This analysis was supplemented with a graph of changes in the variables under study, which allowed to show outliers (atypical observation).

The verification of the hypothesis regarding the occurrence of long-term relationships between variables it was the final step of the analysis. Consideration was given to both milk prices and the rate of return of prices in individual links of the supply chain. For this purpose, the concept of cointegration of time series introduced by Engle-Granger was used, which allows to determine a long-term equilibrium path, independent of time, between the variables studied (Przekota, Rembeza, 2016). If there exists a stationary linear combination of nonstationary random variables, the variables combined are said to be cointegrated (Mikołajczyk, Wyrobek, 2006).

Cointegration of time series of two variables (x_t, y_t) occurs when they are integrated in rank d and their linear combination of $-\beta_1 x_t + \beta_2 y_t$, is integrated in rank $d-b$ ($d \geq b \geq 0$). Vector $[\beta_1, \beta_2]$ is a cointegration vector and its components determine long-term relationships between variables (Batóg, 2016). For testing cointegration, a two-step rule of Engle' - Granger is recommended. In the first step, using the augmented Dickey-Fuller test, the stationarity of the time series is evaluated, then the stationarity of the rest of the model of the cointegrating equation. The augmented Dickey-Fuller test is used to study the stationarity of time series, in which the occurrence of the uni root (Tłuczak, 2016; Borzyszkowska, 2007):

Next the stationarity of the residuals of model:

$$y_t = \beta_0 + \beta_2 x_t + \varepsilon_t \quad (1)$$

is examined,

where:

x_t and y_t - the variables whose integration rank is examined,

β_0, β_2 - are the structural parameters,

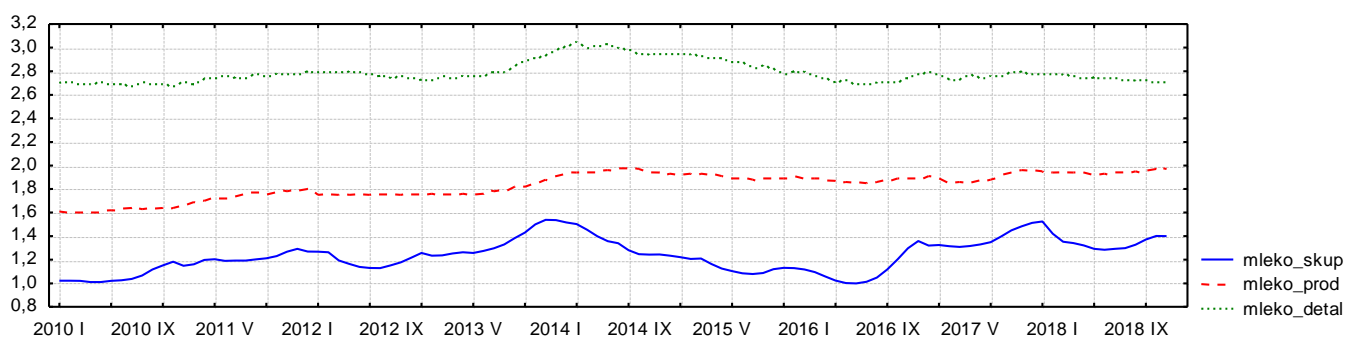
ε_t - the random component.

In the case of stationary residuals of the model, it is stated that the variables x_t and y_t are cointegrated. The existence of cointegration confirms the existence of a lasting, long-term relationship between the analyzed time series (Tatarczak, 2007).

The results of research

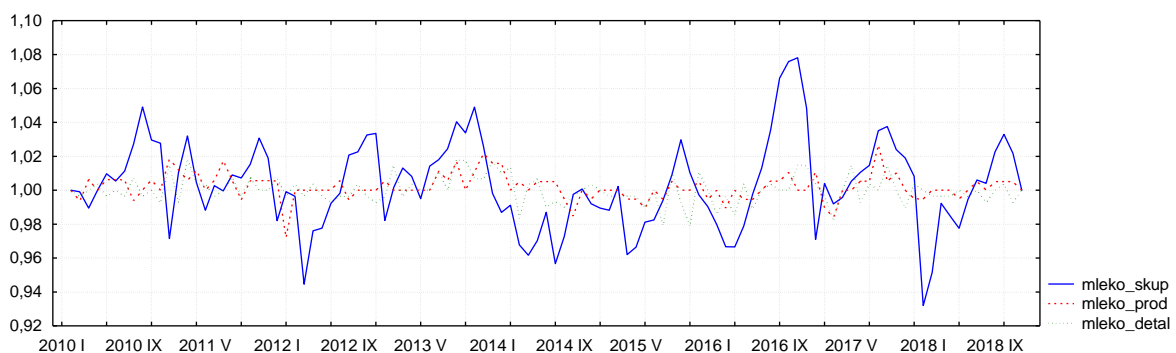
The differences between the average price level in individual links of supply chain are significant (Fig.1, Tab. 2, 3). The highest values are taken by retail prices of milk representing the last link in the milk supply chain. The average retail price of milk in the period of 1st 2010 - 12 2018 it was at the level of 2.79 PLN / l, which is more than twice the average level of milk prices in purchasing. At the same time, the prices of milk in procurement are the most diversified (co-variable 11.2%).

Figure 1. Monthly prices of milk in procurement, prices of cow's milk producers with a fat content of 3-3.5%, retail prices of cow's milk with a fat content of 3-3.5% sterilized in the period 1. 2010 - 12. 2018



Source: own study based on SO data (<https://bdl.stat.gov.pl/>).

Figure 2. Monthly return rates of milk prices at purchase, prices of cow's milk producers with a fat content of 3-3.5%, retail prices of cow's milk with a fat content of 3-3.5% sterilized in the period 1. 2010 - 12. 2018 .



Source: own study based on SO data (<https://bdl.stat.gov.pl/>).

Analysing the return rates of milk prices there is the opposite situation. The highest return rates reach the prices of milk in procurement (the first link of the supply chain). At the same time, it is evident that the highest risk also occurs in this link of milk supply chain. The coefficient of variation of these milk price returns is the highest and it is 260%

Table 1. Basic statistics for monthly prices of milk in procurement, prices of cow's milk producers with a fat content of 3-3.5%, retail prices of cow's milk with a fat content of 3-3.5% sterilized in the period 1.2010 - 12. 2018.

	mean	median	minimum	maximum	Standard deviation
mleko_skup	1,238	1,236	1,000	1,539	0,139
mleko_prod	1,832	1,865	1,600	1,980	0,109
mleko_detal	2,791	2,760	2,670	3,050	0,093

Source: own study based on SO data (<https://bdl.stat.gov.pl>).

Table 2. Basic statistics for monthly return rates of milk prices at purchase, prices of cow's milk producers with a fat content of 3-3.5%, retail prices of cow's milk with a fat content of 3-3.5% sterilized in the period 1. 2010 - 12. 2018.

	mean	median	minimum	maximum	Standard deviation
mleko_skup	1,003	1,002	0,932	1,078	0,026
mleko_prod	1,002	1,000	0,972	1,027	0,008
mleko_detal	1,000	1,000	0,979	1,019	0,008

Source: own study based on SO data (<https://bdl.stat.gov.pl>).

Next step of the analysis was to examine the occurrence of long-term dependencies between the considered prices representing individual links in the supply chain.

That's why the stationarity of the analyzed variables was checked first. The obtained results allowed to state that there is no reason to reject the null hypothesis that the unit root exist. This means that the analyzed variables are characterized by a lack of stationarity. However, the results of the *augmented* Dickey-Fuller test for the first variable differences indicate that the examined time series are integrated in the first rank (Table 3).

Table 3. Results of the augmented Dickey-Fuller test for variables and for the first differences.

Variable	Test statistics	p-value
mleko_skup	-4,265	0,349
mleko_prod	-2,353	0,405
mleko_detal	-2,469	0,344
d_mleko_skup	-5,434	0,000
d_mleko_prod	-5,316	0,000
d_mleko_detal	-4,526	0,001
st_zw_mleko_skup	-2,618	0,272
st_zw_mleko_prod	-5,284	0,062
st_zw_mleko_detal	-10,195	0,084
d_st_zw_mleko_skup	0,258	0,022
d_st_zw_mleko_prod	-7,528	0,000
d_st_zw_mleko_detal	-9,184	0,000

Source: own study based on SO data (<https://bdl.stat.gov.pl>).

Next, the parameters of cointegrating equations were estimated (Table 4), the parameters are statistical significance at the significance level of $\alpha = 0.05$. In the next step, the null hypothesis

regarding the occurrence of the unit root in the residual process from the obtained equations was verified again using the *augmented* Dickey-Fuller test.

Table 4. Engle-Granger test results.

Lp.	Cointegrating equation	Test statistics	p-value
1	$mleko_skup = -0,476 + 0,964 mleko_prod + \varepsilon_t$	-3,486	0,102
2	$mleko_prod = 0,153 + 0,546 mleko_detal + \varepsilon_t$	-3,883	0,048
3	$mleko_skup = -0,529 + 0,598 mleko_detal + \varepsilon_t$	-3,607	0,077
4	$st_zw_mleko_skup = 0,001 + 0,914 st_zw_mleko_prod + \varepsilon_t$	-5,050	0,000
5	$st_zw_mleko_skup = 0,002 + 0,868 st_zw_mleko_detal + \varepsilon_t$	-2,051	0,501
6	$st_zw_mleko_prod = 0,001 + 0,334 st_zw_mleko_detal + \varepsilon_t$	-2,690	0,203

Source: own study based on SO data (<https://bdl.stat.gov.pl>).

On the basis of test results Engle-Granger (tab.4) ($\alpha = 0.05$), it can be concluded that there is no evidence to reject the null hypothesis in the case of equations 1,3, 5 and 6, therefore, the residuals of these equations aren't stationary. Which means that there is no co-integration between milk purchase prices and milk producer prices, milk purchase prices and milk retail prices, milk price returns rate and retail milk price returns rate, milk producer price return rate and milk retail price returns rates. In the case of producer prices and retail prices as well as rates of return of purchase milk prices and rates of return of milk producer prices, the stationarity of the residual of the cointegration equation (equations 2 and 4) is stated, thus the pairs of these variables represents cointegrated time series. The existence of a long-term dependence between variables can be stated. The simultaneous observation of prices and return rates in all links of the milk supply chain may create the possibility of reducing costs production and increasing profits by the all entities participating in the milk supply chain.

Summary

The aim of this study was to analyze price's volatility in the milk supply chain in Poland in 2010-2018. A short characterization of the time series consisting of milk prices at purchase, milk producer prices and milk retail prices and the rates of return of these prices was made. The obtained results show the occurrence of long-term relations between milk producer prices and retail prices as well as return rates purchase prices and return rates of the milk producer prices. Cointegration of these variables means the existence of long-term adjustment mechanisms leading to the achievement of the state of dynamic balance. The conclusion of the obtained results is the statement that the producer's market and the dairy retail market are cointegrated with each other, which results in a growing price linkage.

Bibliografia

- Batóg B., 2016: Badanie kointegracji wybranych zmiennych ekonomiczno-finansowych w województwie zachodniopomorskim, *Studia i Prace WNEiZ US*, nr 45/2, 133-141
- Borzyszkowska M., 2019: Analiza empiryczna wybranych zmiennych wchodzących w skład funkcji popytu na pieniądź, *Dynamiczne Modele Ekonometryczne*, X Ogólnopolskie

Seminarium Naukowe, Uniwersytet Mikołaja Kopernika w Toruniu, <http://www.dem.umk.pl/DME/2007/borzyszkowska.pdf>

Dickey, D. A., Fuller W. A., 1979: Distribution of the Estimators for Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association*, 74, s. 427–431

Kończak B., 2018: Zarządzanie ryzykiem produkcyjnym i rynkowym w gospodarstwie, CDR w Briwnowie, O. w Radomiu,

Mikołajczyk K., Wyrobek J., 2006: Możliwość wykorzystania metody autoregresji wektorowej w polityce pieniężnej, *Zeszyty Naukowe Akademii Ekonomicznej w Krakowie*, nr 683, s. 63 – 87.

Morkis G., Nosecka B., Seremak-Bulge J., 2010: Monitorowanie oraz analiza zmian polskiego łańcucha dostaw żywnościowego. Synteza z realizacji tematu III, Warszawa

Parzonko A., 2013: Konkurencyjność kosztowa polskich gospodarstw mlecznych na arenie europejskiej w perspektywie zmian polityki rolnej UE po 2014 roku, *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego*, 13(8), z. 3, s. 192-202

Promowanie pozycjonowania rolników i spółdzielni w łańcuchu dostaw żywności, 2019: www.eurodetachment-travail.eu/datas/files/EUR/gopa%20pol.pdf

Przekota G., Rembeza J., 2016: Powiązania dynamiki wzrostu gospodarczego pomiędzy krajami Europ Środkowo-Wschodniej i Europy Zachodniej, *Roczniki Ekonomiczne Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy*, nr 9, 123-140.

Smolnik P., 2016: Jakość logistycznej obsługi klienta na przykładzie wybranego przedsiębiorstwa, *Autobusy*, 6/2016, s. 1546.

Tatańczak E., 2007: Badanie stacjonarności oraz kointegracji kursów walutowych, *Roczniki Nauk Rolniczych, Seria G, T. 94*, z. 1, 149-156

Tłuczak A., 2016: Analiza zmian cen w łańcuchach dostaw żywności na przykładzie rynku mięsa wołowego w Polsce, *Ekonomika i Organizacja Logistyki*, nr 1/2016 (1).

Signaling materials

1 Dealing with food waste and how we can make it waste work for us
(*Pasipanodya Mubaiwa*¹)

¹ SELF, South Africa;
e-mail: pasi.mubaiwa@gmail.com

In South Africa, a lot of food is wasted and yet the have-nots are hungry. This note will seek to show how the waste is taking place and how we can make use it to our advantage. South Africa is classified as a middle-income country and yet it has one of the greatest gaps in terms of inequality. It is a country full of contrast so to speak. On the one hand, we have some of the richest individuals who are citizens of this country. And yet millions of South Africans mostly black live in squalid conditions which are commonly known as informal settlements. They are hungry and more often are unemployed and are victims of crimes. Big supermarket chains which dominate the retail sector. These retail outlets create demand by advertising what they call food combos. They encourage consumers to buy goods in bulk. They often say buy the two and get one free. Due to the greedy element that is inherent in humans, we go for the hook line and sinker. After buying the stuff you will find that you did not really need the three heads of cabbage or the 10 kg of carrot. What do you do? It gets rotten and you throw it away. Sometimes the supermarket chains place food items on “special” when they are nearing expiry dates. It still ends in the bin. With new thinking. I argue that we can actually take this waste and use it as compost and put it back to the spoils where it came from. You can use it in the vegetable garden or on your lawn. If we can do that for plastic, metals, and paper what should stop us? I ask. The poster will show some newspaper cuttings to this effect and the residences of the rich and the squalid conditions of the marginalized.

2 Do Mobile Phone Voice Message Reminders Reduce Crop Losses? Evidence from Mali

(*Louis Hodey*¹)

¹ Ph.D.;

e-mail: hsitso@gmail.com

Cereal crops are important for food security of farm households in rural sub-Saharan Africa (SSA) and have the potential to contribute to farm incomes. Yet, several problems militate against the full realization of this potential in Mali. Among these are low productivity, which is further exacerbated by pre- and post-harvest losses. There are also issues of poor organization of farmers, and underdeveloped output markets. The Alliance for a Green Revolution in Africa (AGRA) funded a programme to address these problems with the aim to enhance cereal marketing, increase farmer incomes and reduce household food insecurity. This programme was implemented by an NGO between 2014 and 2017 in three “Cercles” (sub-regions) of the Sikasso region of Mali. From the programme implementers perspective, part of the solution to the problems in the cereal sector is the capacity strengthening of aggregators (i.e., farmer cooperatives and private aggregators) to provide adapted services to smallholder cereal farmers and to link them to bulk output buyers through contracts. Capacity strengthening was done by training aggregators and farmers, providing infrastructure, and linking them with financial institutions. An important component of the training was aimed at improving farmers’ knowledge and application of appropriate pre- and post-harvest handling practices. Farmers in all programme villages (99) were trained using the Training-of-Trainers (ToT) approach, but this was a one-time face-toface training. Yet, it is known from the theory of learning that repetition is important for knowledge retention and application. Therefore, we hypothesize that post-training reminders at specific periods when such knowledge should be applied has an impact on outcomes over and above a one-off training event. To test this hypothesis, farmers in 44 villages were randomly assigned to receive post-training mobile phone voice message reminders. In this article, we analyse the impact of the reminders on selected outcomes (cereal harvesting time and costs, selling through an aggregator, adoption of improved storage methods, pre- and post-harvest grain losses, grain commercialization, cereal revenue and household food security) using the difference in differences (DID) estimation technique. We find that the reminders had significant impact on four out of the 10 outcomes evaluated: harvesting time, pre-harvest losses.

3 Microbial hazards and risks in industrial Eggs and Meat in Georgia (*Kakha Nadiradze*¹, *Lamara Jikia*², *Nana Phirosmanashvili*³, *Mariam Goginashvili*⁴)

¹ Phd., President of the World Poultry Science Association, WPSA Georgian Branch

² Prof., Phd. Honorable President of the World Poultry Science Association, WPSA Georgian Branch

³ Association for Farmers Rights Defense, AFRD Executive Director Georgia

⁴ Tbilisi State University, MBA Student

This abstract aimed to identify the most relevant microbial hazards and risks for human health in the egg and meat production in Georgia in full production chain. The presence of microbial risks and hazards at different stages in this chain was evaluated as well as potential health effects on consumers related to the major hazards. Poultry production is one of the fastest growing livestock industries because of its advantages in terms of land use and improvements in the food conversion rate of genetically superior poultry breeds. Among the major concerns related to this development are health issues threatening not only animal production, but also the people using the products derived from these animals. Food safety can be defined as the system that keeps food and food products free from substances hazardous to human health. Food safety should be a part of governments' strategies to ensure secure food for the consumers. In this context, a "hazard" refers to any biological, chemical or physical property that may cause unacceptable risk (FAO, 1998). The emergence and discovery of new food-borne pathogens and other food-related hazards has increased the need for food-safety measures. The intensification of food production has also changed food processing and handling systems and raised new challenges for food safety institutions. Microbiological risks, such as salmonella-related food poisoning, pesticide residues from feed production, and resistance problems following the use of antibiotics in animal production have become the focus of attention. In the industrial world, legislation and regulations have been implemented, involving both the public and the private sectors. Furthermore, prevention and control measures to reduce the presence of contaminants at different stages in the egg production chain were identified, as well as future developments related to the egg production chain. Some poultry products can pose a higher risk of causing foodborne illness and need to be handled with special care to manage food safety risks. During our researches must be underlines, that *Listeria monocytogenes* has been recognized as a harmful human pathogen for decades and is known to be an important foodborne pathogen. There have been no documented foodborne *L. monocytogenes* illnesses due to the consumption of eggs or egg products, even though the bacterium has been isolated from faces, body fluid, and oviducts of asymptomatic laying hens.

Media



Sponsors



ISBN 978-83-7160-946-6
Editor: Magdalena Kozera-Kowalska