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## **From the Editorial Committee**

We are giving you the next 27th (3/2020) issue of the Quarterly of the Faculty of Management of the Rzeszow University of Technology entitled "Modern Management Review".

The primary objective of the Quarterly is to promote publishing of the results of scientific research within economic and social issues in economics, law, finance, management, marketing, logistics, as well as politics, corporate history and social sciences.

Our aim is also to raise the merits and the international position of the Quarterly published by our Faculty. That is why we provided foreign Scientific Council, as well as an international team of Reviewers to increase the value of the scientific publications.

The works placed in this issue include many assumptions and decisions, theoretical solutions as well as research results, analyses, comparisons and reflections of the Authors.

We would like to thank all those who contributed to the issue of the Quarterly and we hope that you will enjoy reading this issue.

With compliments  
*Editorial Committee*



Tetyana KALNA-DUBINYUK<sup>1</sup>

## INTERACTIVE CONSULTING SYSTEMS FOR THE DEVELOPMENT OF DOMESTIC TOURISM

The article highlights the features of creating of tourist information and consulting centers with interactive systems in rural tourism. It is considered as an integral part of domestic tourism for the integrated socio-economic development of the village and its territories. The variety of types of rural tourism and the forms of accommodation of tourists complicate the search for a place of rest, indicating the need to improve the methods of information provision in this area. The use of integrated indicators of rural tourism improvement and the effectiveness of the organization of information and advisory support for the development of rural tourism show the need for computerization of rural areas, the formation of an electronic system of informational and consulting support for rural tourism development, the use of modern information technology. The importance of creating tourist information and consulting centers with the use of interactive systems in rural tourism with the provision of the necessary recommendations for prompt satisfaction of client's needs is emphasized.

**Keywords:** rural tourism, domestic tourism, interactive consulting

### 1. INTRODUCTION

Integration of Ukraine into the world economic space has led to the development of the tourism industry and its important component – rural tourism, which provides sustainable socio-economic development and the full existence of rural areas. A number of scientific studies of various aspects of rural tourism development point to the need to use modern information technology and consulting systems to promptly formulate the necessary recommendations for clients.

The modern concept of consulting systems and technologies is based on the optimal combination of computer equipment, computer networks, software, operating systems and databases that have their mission of accumulation, storage and transmission of large volumes of data in electronic form.

In Ukraine today there are a significant number of tourist information centers that provide information on tourist and recreational opportunities, including places, resources chosen by tourists in the region. However, the successful development of rural tourism in Ukraine is hampered by the imperfection of the process of providing information and consulting services.

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Information and consulting activity as an innovative component of the state's economic policy, combining science, education and production, acts as a catalyst for the scientific and technological process in agriculture, promotes the dissemination of new knowledge and is a well-founded and necessary component in the modern socio-economic conditions of the development of the agrarian sphere of production in Ukraine.

Having defined the main stages and positions that characterize the process of rural tourism, in particular, the regulatory and legal aspects, the features of different types of agro-homesteads and types of services in rural tourism, issues of categorization, etc., an interactive consulting system has been developed taking into account the specifics of the sector and trends in the development of information technology.

For operational satisfaction of clients' needs it is suggested to create tourist information and consulting centers using interactive consulting systems as a modern tool for cognitive and production activities with a significant arsenal of methods and programs for this purpose.

## **2. RESEARCH ANALYSIS AND PROBLEM STATEMENT**

Despite the increased attention of scientists to the development of rural tourism, the issues of its information support, connected with the application of innovative consulting using information technologies, have not been thoroughly studied. The study of these issues was dealt with by foreign and domestic scientists, including Van den Benn, S. Johnson, V. Rivier, P. Sabluk, M. Kropivko etc. However, some issues regarding the role, place and main components of tourist information and consultation centers for rural tourism remain insufficiently highlighted and require comprehensive research. Particular attention today needs aspects of the development and application of interactive consulting systems in rural tourism. This problem is a new direction of scientific research of domestic scientists and needs due attention.

The purpose of the study is to reveal the role of interactive consulting systems in the development of rural tourism, as well as the creation of tourist information and consultation centers.

## **3. RESEARCH RESULTS**

The development of Trism and the tourism industry in the world stimulates this process in Ukraine as well. "The tourism business is on the rise, indicators are the best in the last few decades, growth in 2018 – by 6.5% compared with last year (Statistical Yearbook of Ukraine, 2018). People travel the planet despite wars, natural disasters and threats of terrorism", said Beck Dzhequely, Coordinator of the World Tourism Organization (UNWTO). To date, in Ukraine there are already 111 higher educational institutions with specialty tourism, hotel and restaurant business. The emergence in recent years of such a number of academic and scientific institutions with educational in tourism reflects the global trends in the economic growth of the sector and its components.

Rural tourism is a popular form of recreation, an important component of the tourism industry and the market of services. In modern conditions, rural tourism in Ukraine is gaining increasing importance and is one of the promising directions for sustainable development of the Ukrainian village [Rural green tourism].

Rural tourism is considered in Ukraine, as in most countries of the world, as an integral part of the integrated socio-economic development of the countryside and as one



of the means for solving many rural problems. It broadens the employment of the rural population, especially women, and provides peasants with additional earnings, increases the opportunities for employment of the farmer not only in the production sector, but also in the service sector. The development of rural tourism provides benefits not only for the economy, environmental protection, improvement of the ecological situation, it is also important for the united territorial communities, stimulates the development of the territories and the creation of new jobs, which leads to the influx of young specialists into the countryside.

According to the Union for the Promotion of Rural Green Tourism Development in Ukraine, under the current economic conditions, about three thousand farms providing rural tourism services are registered. However, the potential of rural tourism development in Ukraine is much higher, since there are 6.3 million residential houses in Ukrainian villages, of which 98% are privately owned. Researches show that the average annual number of able-bodied population in rural Ukraine is 6.4 million people, a significant number of whom are not employed or partially occupied, as well as the fact that every ten private peasant farms have the opportunity to provide services in the field of rural tourism.

Each region of Ukraine is characterized by its unique and special direction of development of rural tourism. In particular, the most favorable regions for the development of rural tourism in Ukraine, such as the Carpathian region, Transcarpathia, Slobozhanshchyna, Polissya, Podillya, and Bukovina. In these regions, about 90% of rural tourist farms are concentrated. The most popular rural travel services for each of the regions. In particular, in Ivano-Frankivsk and Transcarpathian regions, tourists are most popular in public holidays and ceremonies, visiting folk craftsmen, horseback riding. In Lviv region and in Chernivtsi regions tourists often take part in winter entertainments and village evening parties, etc.

In Table 1 presents the most necessary information for successful promotion of services in the field of rural tourism and the fate of respondents in this.

Table 1. Information for the successful promotion of rural tourism services

Information	Male	%
Information about potential consumers of services	191	63.8
Information on collective customers	163	54.3
Creation of a single information Internet portal of rural tourism	163	54.3
Analytical information on the development of rural tourism	159	52.9
Internet marketing for promotion of rural tourism to the market of tourist services	155	51.6
About contests, fairs and other events	153	51.1
Information on standards and quality management services	132	43.9
Other information	24	8.1

Taking into account the probabilistic nature of the influence of various factors on the development of rural tourism by types of information and consulting services, and in order to determine the level of development of the studied conditions and the objective assessment, applied methods of data processing using correlation-regression analysis, which allowed to identify the most important factors and the degree of interdependence

between them. The most important among them is the integrated indicators: improvement of rural tourism in Ukraine ( $I_{rb}$ ) and the effectiveness of organizing information and advisory support for rural tourism development in Ukraine ( $I_{ef}$ ) (Pugach, 2014).

So, in order to calculate the improvement of rural tourism in Ukraine, the availability of heating, gasification, sewage, water supply, baths in buildings, hard-coated roads, connection of "station-terminal arrival point" and so on.

The integrated indicator of the effectiveness of the organization of information and advisory support for the development of rural tourism in Ukraine is determined by the formula:

$$I_{ef} = \sum_{k=1}^n C_i(I_{rb}/C_5),$$

where:  $C_1$  – an increase in the volume of information and consulting services provided,  
 $C_2$  – increase of wages of consultants providing information and consulting agrotourist services,  
 $C_3$  – the amount of material assistance to consultants,  
 $C_4$  – growth of agro consulting structures that can provide services,  
 $C_5$  – the volume of services that do not meet the requirements and norms.

Forecast results of the integrated indicator of the effectiveness of the organization of information and consulting support for the development of rural tourism in Ukraine for the future are presented in table. 2 As can be seen from the table, there is an annual increase of this indicator.

Table 2. Integrated indicator of the effectiveness of organization of informational and consulting support for rural tourism development in Ukraine, 2005–2020

Years	Predictive evaluation of effectiveness*	Years	Predictive evaluation of effectiveness*
2005	0.33	2013	0,50
2006	0.40	2014	0.50
2007	0.41	2015	0.51
2008	0.42	2016	0.52
2009	0.45	2017	0.55
2010	0.45	2018	0.60
2011	0.47	2019	0.70
2012	0.50	2020	0.80

\* Corresponds to: a sufficient level of  $> 0.80$ ; unsatisfactory level of stability  $0.4-0.59$ ; a satisfactory level of  $0.6-0.79$ ; dangerous level  $0.2-0.39$ ; critical level  $<0.19$ .

In the assessment of effectiveness, the organization of information and consulting support for the development of rural tourism in Ukraine will approach a sufficient level in 2020, and in the current 2019 the level of 0.70 indicates its satisfactory level.

The effectiveness of the organization of information and advisory support for the development of rural tourism in Ukraine depends on various factors and conditions, in particular, the solvency of potential tourists, long-term expectations of socio-economic

and regulatory reforms in society, state support for rural tourism and the need for computerization of rural areas, formation of the electronic system of informational and consulting support for the development of rural tourism in Ukraine with the accumulation of databases, necessary for its effective functioning for making decisions both by tourists and consultants. Application of new information technologies – an interactive system of counseling on the development of rural tourism becomes of great importance.

The development of the globalization of economic relations and new ways of production based on the widespread use of information technologies, including the global Internet network, as well as the intensive formation of the information society, which is being realized on the total use and electronic exchange of information, require new methodological approaches to the organization of effective interaction, adequate to today's realities of life. At the same time, tasks in the agrarian sector usually do not remain constant, but vary depending on internal and external factors, and these changes lead to changes in management methods, etc.

According to the European Federation of Management Consulting Associations (FEACO), information technology is currently most demanded by the western market. In Europe, information technology accounts for more than 40% of revenue earned by consultants (Survey of the European Management Consultancy 2016/2017). In the world ranking of consulting companies, the companies that are the first to receive information technologies are the first places to go (Leading Companies, 2017).

Such dominance in information technology consulting is due to the flexible formulation of recommendations that will allow you to organize the consultation process with the help of a computer, or any device with Internet access. Counseling technology is a sequence of consulting processes or operations that allows the technical implementation of the procedure for forming recommendations for solving the problems of a given counseling problem.

The modern paradigm of information technology in agriculture is support for various agrarian issues at anytime and anywhere, by any means and in any applied agricultural sector (Shapoval, Bolotina, Kalna-Dubinyuk, 2018.)

Consequently, information technology for rural tourism will be able to support a single chain: information – consultation – recommendation – decision-making. Implementation of the effective functioning of such a chain leads to the description and solution of a complex of interrelated practical tasks implemented on the basis of the construction of an integrated information environment, which is: the information environment on the basis of data and knowledge base, elements of information and reference systems, expert systems, geographic information systems and decision-making systems that work in the network of personal and handheld computers, mobile phones and the Internet environment; printed publications and brochures; interactive applications on electronic media.

Continuing to consider the current state of informational and consulting support for rural tourism in Ukraine, one should pay attention to the fact that there is a significant number of tourist information centers in Ukraine (Tourist Information Center). Tourist Information Center is a place where information on tourist and recreational opportunities, including places, resources, chosen by the tourist of the region is given. A characteristic feature of all tourist information centers in Ukraine is a number of services for visitors to the center, namely: the whole range of reference information; Promotional and promotional materials (brochures, maps, directories); Wi-Fi, Internet; reservation of

places in hotels and private farmsteads within a certain area; order excursion services (city tours).

Consequently, in the field of information and consultation providing for the development of rural tourism in Ukraine, certain measures are taking place. However, the successful development of rural tourism in Ukraine is hampered by the imperfection of the process of providing information and consulting services. The imperfection of informational and consulting provision of rural tourism management in the present conditions is characterized, first of all, by the lack of reflection of indicators of development of the industry, both quantitative and qualitative. This, in turn, leads to the leveling of their influence in the overall economic development of the region and the country as a whole and requires the use of modern information technology with interactive consulting systems.

An important component of the further development of consulting activities in Ukraine is the organization of the introduction and use of innovative consulting systems and technologies. Foreign experience of leading countries of the world, such as USA, Canada, Germany, testifies to the efficiency of their functioning on the basis of innovative models of activity (Johnson, Kalna-Dubinyuk, 2018). At the same time, innovative consulting systems and technologies become the main tool for distributing market information among agricultural producers and the population.

The modern concept of consulting systems and technologies is based on the optimal combination of computer equipment, computer networks, software, operating systems and databases that have their mission of accumulation, storage and transmission of large volumes of data in electronic form.

Innovations change the conditions and forms of accumulation, processing and transfer of large volumes of electronic information.

The application of innovative telecommunication facilities, Internet technologies, and innovative computer programs based on digital technologies and distance education creates conditions for a significant expansion of specialists' audiences at the local, regional and national levels. In this case, there is an unlimited possibility of involving specialists in the use of information, which is a reflection of the results of scientific research and the accumulation of new knowledge (Kudin, Kalna-Dubinyuk, 2018).

The rapid development of information technology contributes to the continuous dissemination of knowledge and information in society. In order for the information to quickly find its user, there are consultants – specialists who form qualified recommendations for its application. Such people should have modern consulting technologies and systems.

Creation of new highly effective interactive consulting systems will help the consultant to develop optimal recommendations for making scientifically sound solutions in various areas of problem solving.

Interactive consulting system is a complex human-machine system, which should combine machine processing of information and automation of the formation of recommendations with the activities of the person acting as the operator, manager, and expert. The role of a person, even at a very high level of automation of consulting processes, is leading, since it will always perform the most important functions – the choice of purpose and criteria for the formulation of recommendations, the search for alternatives to achieve the objectives of substantiating the methods of forming recommendations, technical and economic analysis etc.

Having determined the main stages and positions that characterize the process of organization of rural tourism, in particular, the regulatory and legal aspects, the features of various types of objects and areas of activity in rural tourism, the issue of categorization etc., an algorithm is created that allows organizing an interactive user dialogue (persons interested in organization rural tourism) with a consultation system. Ultimately, the system should provide the user with a set of recommendations that correspond to the information entered by him.

In a market economy, it is necessary not only to have knowledge, but to continuously replenish them. An interactive consulting system will help you succeed in rural tourism, provide knowledge and interactively get the answer to the customer's questions. The effectiveness of the interactive consulting system, its reliability and practicality is supported by software, which is a set of programs – an orderly set of commands designed to solve tasks on a computer.

The software is divided into three classes: the system (the programs are supplied with the computer); Applied (accounting, teaching, modeling programs) and instrumental editors (text, graphic, music), table data processing systems (table processors), database management systems, etc.).

A direct example should be the development of information and consulting support for the organization of village homesteads using modern software and logistics of a highly effective interactive consulting system (Kalna-Dubinyuk, 2018). With the programming languages HTML, CSC, XML, PHP there is an interface programming (a set of tools for human interaction and computer system) of this software product and building a logical system for solving consulting problems for rural tourism.

Application of an interactive consulting system in rural tourism provides users with a modern tool for cognitive and production activities with a significant array of information and consulting methods and computer programs for their implementation to find the optimal solution for the client.

It is suggested to create tourist information and consulting centers using interactive consulting systems. In Fig. 1 presents the structure of the tourist information and consulting center.

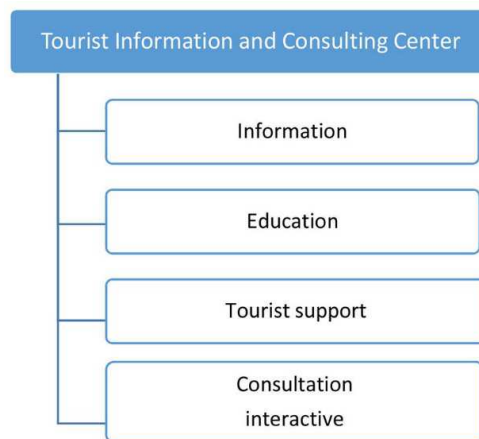


Fig. 1. The structure of the tourist information and consulting center

As can be seen from the figure, the tourist information and consultation center provides for the provision of various tourist information (from advertising to routes and accommodation), consultations (from selection of rest, creation of agro-homesteads, categorization to the use of alternative energy sources, etc.) with the use of interactive consulting systems, organization of trainings on active tourism and travel guided tours.

Such kind of centers is supposed to be organized at the regional, regional and local levels by creating so-called state tourist information and consulting network.

#### 4. CONCLUSIONS

Thus, the creation of tourist information and consulting centers with interactive consulting systems for rural tourism is relevant in the market conditions. At the same time, it is necessary to apply modern information technologies based on the optimal combination of computer equipment, computer networks, software, operating systems and databases that have their mission of accumulation, storage and transmission of large volumes of data in electronic form.

The basis of such activities is emerging rural tourism and a consultant who needs to promptly provide recommendations to clients using it for: a person with her needs, interests, opportunities; information support with databases and knowledge bases; technical support with modern computer equipment and the Internet; mathematical support with its methods and models and software – that is, all modern tools of cognitive and production activities with a significant arsenal of methods and programs for this.

To summarize, we can conclude that the creation of a network of tourist information and consultation centers will ensure sustainable rural development and well-being of the united territorial communities.

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## CASCADE PHOTOBIOREACTOR FOR WASTE WATER TREATMENT BY MICROALGAE

In this paper, we consider the design of an open bioreactor for the cultivation of microalgae. The main feature of this design is a cascade type of tank, which allows you to satisfy parameters such as lightness, mixing, energy efficiency, and economical. The proposed methodology can help to assess all types of bioreactors for microalgae cultivation applying on the waste water treatment. Based on the previous researches, statistical data, modeling and requirement to the bioreactor parameters the construction of cascade bioreactor was proposed. According to proposed methodology of efficiency estimation received that this bioreactor construction is efficient on 85% and offset during the year is positive. The main advantages of the proposed technology and bioreactor construction are environmental, economic and energy-efficient features. These three directions are main proposal to sustainable development which modern world strive for.

**Keywords:** waste water treatment; energy-efficient benefit; microalgae; bioreactor; economic benefit; biofuel

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## **1. INTRODUCTION**

The high content of biogenic elements, first of all phosphorous and nitrogen compounds, can lead to a decrease of dissolved oxygen, has a toxicological effect on fish, affects the increasing of bioavailable that cause corrosion of water supply systems.

The microalgae treatment of waste water can be a good solution for biogenic elements transferring from water to biomass, and further extraction. That's why the suitable equipment is required (Geider, Delucia, Falkowski, Finzi, Grime, Grace et al., 2001; Boichenko, Boichenko, Shamanskyi, 2020).

## **2. PROBLEM STATEMENT**

The main problems in the use of microalgae are, first of all, the cost of installation, maintaining the conditions for the growth of culture, the most effective design of tanks. The land resources for tanks are also limited.

The use of wastewater as a substrate for microalgae, and the farthest use of biomass for the production of fertilizers and biofuels, is still at the stage of theory and laboratory research in Ukraine.

## **3. ANALYSIS OF THE LATEST RESEARCH AND PUBLICATIONS**

Significant concentrations of nutrients in reservoirs lead to a decrease in the content of dissolved oxygen, have a toxicological effect on fish, affect the increase of bioavailables that cause corrosion of water supply systems, accelerated growth of water biota and phytoplankton, which, in turn, affects the quality of water. It becomes cloudy, the color changes to green, yellow, brown or red. This prevents its use for recreation, fishing, recreation and domestic needs. The production of phytoplankton toxins, which can cause health problems through exposure to the human body after contact with the skin or the use of contaminated water for drinking, is also a hazard.

Nitrogen, which belongs to biogenic elements, is most needed for the growth of living organisms. An excessive increase in the concentration of nutrients (mainly nitrogen and phosphorus compounds) in water bodies is known as eutrophication. It can be caused by natural processes, when surface waters carry a considerable amount of organic material and nutrients in lakes and oceans, however, this process is mainly caused by a human activity (Ongley, 1996).

The treatment of wastewater subsequent to the removal of suspended solids by microorganisms such as algae, fungi, or bacteria under aerobic or anaerobic conditions during which organic matter in wastewater is oxidized or incorporated into cells that can be eliminated by removal process or sedimentation is termed biological treatment (Fluence news team, Feb 12, 2020). The goal of biological wastewater treatment is to create a system in which the results of decomposition are easily collected for proper disposal. Scientists have been able to control and refine both aerobic and anaerobic biological processes to achieve the optimal removal of organic substances from wastewater (Samer, 2015).

The topic of microalgae treatment was first uncovered in the early 70s of the 20th century, but still remains relevant and requires innovation. For microalgae treatment as biological stage of purification must carry out pre-treatment (mechanical), primary (physical) and secondary (if needed chemical) treatment.

The production of biomass in biotechnological production takes place in special capacities of so-called fermenters or bioreactors whose design ensures compliance with the optimal temperature regime for the introduction and removal of gas and liquid streams, control of the composition of the nutrient substrate and conditions inside the reactor.

The bioreactor commonly used for micro or macro algae cultivation. Algae may be cultivated for the purposes of biomass production (as in a seaweed cultivator), wastewater treatment, CO<sub>2</sub> fixation, or aquarium/pond filtration in the form of an algae scrubber (Morrissey, Jones, Harriott, 1988). Algae bioreactors vary widely in design, and can be distinguished into two categories: open reactors and enclosed reactors. Open reactors are exposed to the atmosphere while enclosed reactors, also commonly called photobioreactors, are isolated to varying exposure from the atmosphere. Also bioreactors can be intensive and extensive according to the biomass production purpose.

#### 4. PURPOSE AND OBJECTIVES OF THE WORK

The aim of this scientific investigation is:

- to improve the sewage purification technology from biogenic compounds by microalgae culture.
- to analyze the sewage treatment issues and classic methods of wastewater treatment;
- to estimate bioreactor parameters for waste water treatment;
- to develop ecologically and economically expedient wastewater treatment technology.

Methods of research: analysis, data comparison, statistical data processing, mathematical modeling.

#### 5. RESEARCH RESULTS

In this point we gain an understanding of the bioreactor requirements and factors which influenced on the microalgae production.

##### ***The bioreactor requirements for waste water treatment:***

1. Speed of biomass production/ biogenic compounds consumption;
2. Ratio between volume of cultivation reservoir and volume of input waste water;
3. Occupied area;
4. Process operation complicity;
5. Purification system for equipment;
6. Ratio between the cost of installation and benefit.

##### ***Factors influencing on the biomass production speed:***

###### ***1. Lighting (L)***

Reviewing the previous research of ultrasound on biological effects, Wang et al. (Hsia, Yang, 2014). cultivated *Chlorella* cells in Petri dishes under ultraviolet irradiation for 0, 20, 40, 60, 80, 100, and 120 sec. in order to study the effects of ultraviolet irradiation on *Chlorella* growth, reproduction, and chlorophyll content, finding that irradiation for 20–60 sec appeared to stimulate mono-cell division and enhance cell growth. Nevertheless, when ultraviolet irradiation was prolonged for more than 80 sec., cell density was sharply reduced. Ultraviolet irradiation for 20–80 sec did not reveal obvious effects on the

Chlorella chlorophyll content, but obvious and reduced effects did occur after 100 sec. Increasing the solar ultraviolet irradiation time apparently directly affects algal growth, reproduction, and chlorophyll content and indirectly influences photosynthetic efficiency.

Optimal culture conditions, based on Taguchi methods, are 25°C, 8000 lux LED irradiation intensity, 24h LED irradiation time, 2000cc/min pumping intensity, 1 MHz ultrasound frequency, 5.5v ultrasound exposure intensity, and ultrasound exposure time of 10 s every 8h (Hsia, Yang, 2014).

#### 2. *Water temperature (t).*

Microalgae growth efficiency depends on temperature of environment and water in reservoir. Indeed, most microalgae species are capable of carrying out photosynthesis and cellular division over a wide range of temperatures generally stated between 15 and 30°C but optimal conditions between 20°C and 25°C (Ras, Steyer, Bernard, 2013).

Below optimal growth temperatures, an increase in temperature has a positive effect on photosynthesis and cell division. This trend is explained by the enhancement of enzymatic activities related to the Calvi cycle (Falkowski, Owens, 1980). The relation between growth rate and below-optimal temperatures has been extensively studied and even modeled, most commonly with the Arrhenius equation (Ahlgren, 1987).

#### 3. *Concentration of phosphorus and nitrogen compounds (Cbio).*

An adequate supply of nitrogen and phosphorus is imperative to ensure high production rates in mass microalgae cultures. High yield coefficients, low crude protein contents and low productivities were measured at low supplies of these nutrients. The highest production rates were measured at N and P concentrations exceeding 25 and 2 mg litre<sup>-1</sup> respectively, at which supply the highest crude protein contents were measured. Although the carbohydrate content followed, under certain N supply conditions, an inverse relationship with the crude protein content, it was generally not affected by changes in N and P concentrations (Mostert, Grobbelaar, 1987).

#### 4. *CO<sub>2</sub> concentration (Cco<sub>2</sub>).*

Some green algae are reported to easily grown at very high CO<sub>2</sub> concentration. Chlorella species is very common to be used as carbon sequestration. It is fresh water, single cell organism containing chlorophyll a and b and has high photosynthetic efficiency to convert CO<sub>2</sub> to O<sub>2</sub>. Chlorella species belong to the Phylum Chlorophyta. *C. vulgaris* strain was studied under ambient CO<sub>2</sub> concentration (0.036%) and elevated CO<sub>2</sub> concentration (20%) (Mostert, Grobbelaar, 1987).

#### 5. *Concentration of algae (Calgae).*

On the concentration of algae culture in the reservoir depend the lightning capacity, reservoir structure, technological processes, concentration of nutrient and its absorption efficiency.

Maximum growth and nitrate removal rates were 3.6 g L<sup>-1</sup> and 16.4 mg L<sup>-1</sup> h<sup>-1</sup> respectively at a nitrate concentration of 2400 mg L<sup>-1</sup> while 3000 mg L<sup>-1</sup> nitrate appeared to inhibit growth yield but not nitrate uptake (S.P. Singh, P. Singh, 2014). Nitrite as the sole N source (400 mg L<sup>-1</sup>) resulted in optimal growth of *Chlorella vulgaris* with a maximum biomass of 3.16 g L<sup>-1</sup>. Nitrate and nitrite concentrations of 800 and 150 mg L<sup>-1</sup> produced maximum growth rate and biomass production of 7.8 g L<sup>-1</sup> biomass (Taziki, Ahmadzadeh, Murry, 2015).

### 6. pH of water (pH).

The pH level can be changing during different phase of microalgae growth, and can influence on the microalgae metabolism.

According to the all above data we prepared the methodology to the bioreactor effectiveness estimation (formula 1):

$$E = v + V + s + O + P + B \quad (1)$$

where: E – effectiveness; v – speed of biomass production/ biogenic compounds consumption; V – ratio between volume of cultivation reservoir and volume of input waste water; s – occupied area; O – process operation complicity; P – purification system for equipment; B – ratio between the cost of installation and benefit.

Maximal effectiveness estimation 60, and refer to the most effective microalgae treatment.

Speed of biomass production is a set of influencing factors (formula 2):

$$v = L + t + C_{bio} + C_{CO_2} + C_{algae} + pH \quad (2)$$

where: L – lightning; t – water temperature, C<sub>bio</sub> – concentration of phosphorous and nitrogen compounds; C<sub>CO<sub>2</sub></sub> – concentration of carbon dioxide; C<sub>algae</sub> – concentration of microalgae in the water; pH – acidity/alkalinity of water.

Estimation of influencing factors you can find in the Table 1.

Table 1. Influencing factors on biomass production speed

<b>Lightning (L)</b>		
24 hour of artificial lightning	12 hour of artificial lightning	Without artificial lightning
2	1.5	1
<b>Water temperature (t)</b>		
15°C – 20°C	20°C – 25°C	25°C – 30°C
1	2	1.5
<b>Concentration of biogenic compounds (C<sub>bio</sub>)</b>		
N > 25 mg/l and P > 2 mg/l	N = 25 mg/l and P = 2 mg/l	N < 25 mg/l and P < 2 mg/l
2	1	0
<b>Concentration of carbon dioxide (C<sub>CO<sub>2</sub></sub>)</b>		
20% and more	20% – 10%	Less than 10%
1.5	1	0
<b>Concentration of microalgae in the water (C<sub>algae</sub>)</b>		
From 3 to 4 g/l	More than 4 g/l	Less than 1 g/l
1.5	0.5	0.5
<b>Acidity/alkalinity of water (pH)</b>		
Less than 6	6–8	More than 8
0	1	0

Volume of reservoir must satisfy the amount of input waste water on the sewage treatment plant. The reservoir can be flow type and with periodical work.

If the volume of reservoir  $\geq$  than amount of input waste water the volume ratio (V) equals 10. And if meets the condition: volume of reservoir  $\leq$  amount of input waste water, that is volume ratio (V) equals 0.

For the area estimation by the formula 3:

$$S = \frac{S_e}{S_t} \cdot 100\% \quad (3)$$

where: S – percentage of occupied area from the total area,  $S_e$  – area for microalgae treatment equipment;  $S_t$  – area of all treatment complex.

For the occupied area estimation (s) use the Table 2.

Table 2. Occupied area estimation (s)

№	S	s
1	More than 50%	1
2	50–40%	2
3	40–35%	3
4	35–30%	4
5	30–25%	5
6	25–20%	6
7	20–15%	7
8	15–10%	8
9	10–5%	9
10	Less than 5%	10

Process operation complicity (O) depends on the parameters and construction features of equipment for treatment. For this estimation use the Table 3.

Table 3. Process operation complicity (O)

Don't require special personnel	Don't require special personnel, but needed training for correct working	Require special personnel
10	9	5

Table 4. Purification system for equipment (P)

Simple system and easy operation	Medium complicity system and needed special devices	Complex system and needed special devices
10	5	0

Purification system for equipment (P) can be installed and improved the system in a whole because of the longer exploitation time period. This an important issue for the bioreactors with transparent walls because of growing turbid with time and losing the light carrying capacity. For the open bioreactors with no-transparent walls the cleaning system for equipment is easy to apply and not require special devices. Use table 4 for P estimation.

Benefit ratio (B) between installation cost and offset can be calculated according to the cost of all equipment, energy expense, wage costs and costs to other needs, in the relation to the benefits which received after installation (like benefits from the biomass selling to the biofuel of biofertilizers production). This ratio very depends on the cost of materials which were used in the equipment, and amount of energy which needed on the operation.

For the assessment of profit must meet a condition (formula 4):

$$I - E_n + M \leq P_r \quad (4)$$

where: I – investments per year,  $E_n$  – energy explicit cost per year, M – material explicit cost,  $P_r$  – profit cost per year.

Table 5 present the value for benefit ratio (B).

Table 5. Benefit ratio (B)

$I - E_n + M < P_r$	$I - E_n + M = P_r$	$I - E_n + M > P_r$
10	5	0

In the first situation the profit from the technology applying more than input investments, and equals the highest value. Second situation shows the zero profit, that means the input investments equal output profit. Third situation means the profit less than input investment, and has negative economic effect.

The proposed methodology can help to assess all types of bioreactors for microalgae cultivation applying on the waste water treatment.

After consideration the influencing factors and requirements for bioreactor we proposed the design of an open bioreactor for the cultivation of microalgae. The main feature of this design is a cascade type of tank, which allows you to satisfy parameters such as lightness, mixing, energy efficiency, and economical.

The cascade type of a tank implies a certain number of tanks of small diameter and height of the walls, which are arranged on top of each other in such way as to cover the area of the reflecting surface of the lower tank as little as possible.

Let's consider the construction of open cascade bioreactor for microalgae cultivation. The graphical material presented in Fig. 1–3.

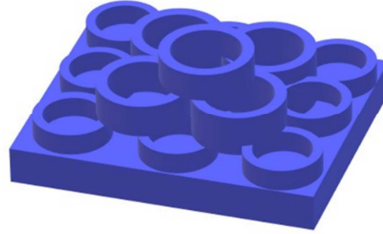


Fig. 1. Cascade reservoir for microalgae cultivation on the sewage treatment plant

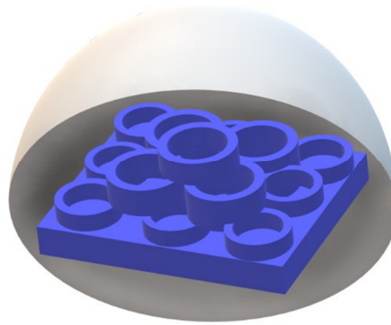


Fig. 2. Proposed bioreactor construction with round-arch greenhouse

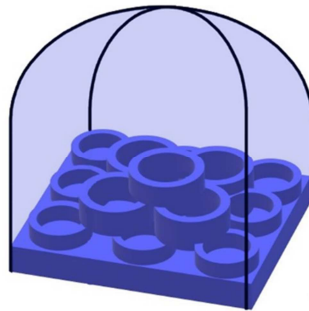


Fig. 3. Proposed bioreactor construction with trapezium greenhouse

**Basic features:**

1. Small occupied area in comparison with relatively big volume which satisfy the condition of high light reflection area.
2. This is flow-type bioreactor. Water circulate from the bottom to the top and then freely flow down. For this process needed just a pump. The necessary movement and lightning for microalgae metabolism are satisfy.
3. The material from which reservoir building can be concrete or other non-transparent material for the investment economy, and this is no effected on the efficiency because of high reflection area and low height of walls.



4. The greenhouse plays the role of heat accumulator and can be two types as on Figure 2 or Figure 3 depending on the territory. The waste water average temperature on the summer is 20–25°C, in winter 15–20°C and because of that the greenhouse installation is effective. Although, microalgae needed the dispersed light and this condition can be satisfied with a greenhouse.
5. On the beam of the greenhouse can be installed the lighting for increasing algae growth speed in the night time and in the cloudy days.

It should also be noted that the proposed technology is the next stage after mechanical and biological purification, that is, pre-treatment of wastewater. After rough cleaning (pre-treatment), the concentration of phosphorus and nitrogen compounds is equal to that found in the primary contaminated wastewater.

## 6. DISCUSSION

According to the proposed methodology of the effectiveness estimation of a bioreactor was calculated by the formula 1. Estimation of speed of biomass production/biogenic compounds consumption:

$$v_1 = 1.5 + 2 + 2 + 1 + 1.5 + 1 = 9, \text{ (in summer)} \quad (5)$$

$$v_2 = 1.5 + 1 + 2 + 1 + 0.5 + 1 = 7, \text{ (in winter)} \quad (6)$$

$$v = \frac{v_1 + v_2}{2} = 8. \quad (7)$$

Ratio between volume of cultivation reservoir and volume of input waste water equal 10, because of the flow type reservoir and high volume according to small occupied area (V).

Area estimation calculated according to formula 3. If the  $S_e = 108\,000 \text{ m}^2$ ,  $S_r = 1\,200\,000 \text{ m}^2$  (data about area of treatment complex was retrieved from the Bortnychy aeration station).

$$S = \frac{108\,000}{1\,200\,000} \cdot 100\% = 9\% \quad (8)$$

Value of the occupied area estimation (s) was retrieved from Table 2.

The values process operation complicity (O) and purification system for equipment (P) were retrieved from Tables 3 and 4 respectively.

For the assessment of benefit ratio will need the future practical data and because of that we calculate two variants of future events, when the profit is equal 0 and profit is more than investments.

In Tables 6–8 present the effectiveness estimation for the proposed technology.

Summarizing, the effectiveness estimation is equal 46 that means 76% efficiency of technology applying with zero profit and the effectiveness estimation is equal 51 or 85% efficiency of technology applying with positive profit, and 68% efficiency in the situation with negative profit.

Table 6. Effectiveness estimation with positive profit

Variable	Value
<i>v</i>	8
<i>V</i>	10
<i>s</i>	9
<i>O</i>	9
<i>P</i>	5
<i>B</i>	10
<i>E</i>	$\Sigma=51$

Table 7. Effectiveness estimation with zero profit

Variable	Value
<i>v</i>	8
<i>V</i>	10
<i>s</i>	9
<i>O</i>	9
<i>P</i>	5
<i>B</i>	5
<i>E</i>	$\Sigma=46$

Table 8. Effectiveness estimation with negative profit

Variable	Value
<i>v</i>	8
<i>V</i>	10
<i>s</i>	9
<i>O</i>	9
<i>P</i>	5
<i>B</i>	0
<i>E</i>	$\Sigma=41$

Micro-algae wastewater treatment is a method that allows waste processing to be separated into clean liquid and solid fractions. The hard part contains a significant amount of pollutants, therefore it is disposed of, and in the case of microalgae (after purification), the latter can be used as biofuel (phosphate) and biofuels raw material.

We have proposed list of recommendations for technology applying concerning needed material, equipment and initial data.

Set of initial data:

- Volume of waste water discharge on the sewage treatment plant;
- Occupied area of sewage treatment plant;
- Initial concentration of biogenic elements;
- Temperature before treatment and temperature during microalgae cultivation;
- pH level before treatment.

Needed equipment for process monitoring:

- Equipment for temperature monitoring;
- Equipment for microalgae concentration monitoring;
- Equipment for biogenic elements concentration monitoring;
- Equipment for CO<sub>2</sub> concentration monitoring;
- Equipment for pH monitoring.

Needed materials and means for construction:

- Money investment;
- Building materials (choosing according to correlation of money investment and microalgae growth speed);
- Pump;
- Lightning system;
- Biomass separation system (we recommended hydrocyclones, but it can other separation technology).

We recommended application of this technology because of (Table 9):

Table 9. Advantages of proposed technology

Environmental benefit	Economic benefit	Energy-efficient benefit
No chemicals	Without the additional nutrient environment	More cheaper biomass for biofuel production
Oxygen production	Efficient economic using of remain biomass	Usage the minimal energy-consuming equipment
Biogenic elements bounding and decreasing eutrophication potential	Open reservoir bioreactor cheaper than closed bioreactor	The greenhouse on the top of proposed reservoir save the heat and energy on the additional heating

## 7. CONCLUSIONS

After analysis of the problems of sewage treatment and classic methods of wastewater treatment, we can conclude that the main problems in the use of microalgae are, first of all, the cost of installation, maintaining the conditions for the growth of culture, the most effective design of tanks. The land resources for tanks are also limited. The use of wastewater as a substrate for microalgae, and the farthest use of biomass for the production of fertilizers and biofuels, is still at the stage of theory and laboratory research in Ukraine.

After the bioreactors parameters defining and proposing the effectiveness estimation methodology we can say that this methodology can help to assess all types of bioreactors for microalgae cultivation applying on the waste water treatment.

Based on the previous researches, statistical data, modeling and requirement to the bioreactor parameters the construction of cascade bioreactor was proposed. The cascade type bioreactor means that the reservoir implies a certain number of tanks with small diameter and height of the walls, which are arranged on top of each other in such way as to cover the area of the reflecting surface of the lower tank as little as possible.

The main advantages of the proposed technology and bioreactor construction are environmental, economic and energy-efficient features. These three directions are main proposal to sustainable development which our country strive for.

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## HUMAN RESOURCES MANAGEMENT AT THE STAGE OF FORMATION OF CREATIVE ECONOMY

The paper considers some approaches to human resources management in the conditions of formation of creative economy at micro and macro levels. At the micro level, the human resources management system is a reproducible process of forecasting, planning, formation, development, and use of human resources to ensure the innovation process of the organization. The system of human resources management at the macro level is greatly influenced by a set of institutions: political, legal, social, and economic. The institute of education plays a key role in the process of human resources management at the micro and macro levels. New institutions in human resources management include urban development institutions with appropriate infrastructure and e-government institutions.

**Keywords:** Creative economy, human resources management, intellectual and creative resources

### 1. INTRODUCTION

Creative economy is a completely new type of social production, where innovation and creativity become the main factor of production, shifting traditional factors to the secondary place. In this case, one of the most important carriers of information and its converter is a human. The strengthening of the role of human resources in the creative economy is a natural result of the formation of a new type of social production. Thus, the problem of human resources management in order to form a creative economy comes to the fore.

The current stage of development of human civilization can be interpreted as a creative economy, whose main characteristics are the changes in the content of factors of production, where the key factors are human resources and their creative component. The formation of the creative economy is expressed in the acquisition by creative human

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resources of a priority role in the formation of total income, in revolutionary changes in professional qualifications, in the transformation of the requirements for the level of knowledge and skills of workers and the nature of social values. In such conditions, one of the main key factors for labour productivity growth and the efficiency of innovation is a creative human resources. In the terms of post-industrial economy, this is caused by the dominant character of creative and dynamic capabilities of employees, which are possessed by them and implemented in the production process.

Creative dynamic capabilities of employees form the basis of the company potential in creating, integrating, and reconfiguring competencies in accordance with the requirements of a changing environment.

## 2. LITERATURE REVIEW

The fundamentals of human resources management were given in the last century by such scientists by A. Bakker, W. Taylor, M. Armstrong, A. Fayol and others. Thus, W. Taylor developed a system that is a set of methods of organization and rationing of labor and management of production processes, selection, workforce placement and payment of labor, aimed at increasing labor intensity and productivity. The system provides a detailed study of labor processes and the strictest regulation of their implementation, as well as modes of operation of the equipment (Taylor, 1984).

A. Fayol studied the content and relationship of managerial functions among managers of different levels and identified a set of qualities and knowledge through the prism of which the content of the work of managers at different levels should be considered. These qualities, according to the scientist, should be reduced to the following groups: physical qualities, mental qualities, moral qualities, general development, special knowledge, and experience (Fayol, 1923).

M. Armstrong and S. Taylor in their joint work *Practice of human resources management* consider such issues as: the practice of human resources management; strategic human resources management; personnel management strategies; human capital management; role and organization of HR-function; the role of a practicing personnel specialist; the impact of HRM on performance; international HRM; corporate social responsibility; human resources management research methods; the essence of organizational behavior; organizational culture, design and development; talent management; career management; efficiency management etc. (Armstrong, 2004).

In the article by A.V. Bakker and E. Demerouti it is said about the methodological approach to determining the strengths and weaknesses of the model of demand control and the model of balance and rewards for the predicted value for employee welfare. Their paper presents a more flexible JD-R model and discusses its main points, namely: the JD-R model can be used as a tool for human resources management. The two-step approach can highlight the strengths and weaknesses of individuals, working groups, departments and organizations as a whole (Bakker, & Demerouti, 2007).

Salikhov B. in his monograph *Creative Capital in the Knowledge Economy* explores the key problems of formation, development and improving the quality of the creative capital use in the knowledge economy. In this regard, the ontological role of the system of implicit knowledge in the expanded reproduction of creative capital as a system of unique creative and labor competencies is substantiated. The system-integration forms of corporate creative capital are studied, the critical role of implicit knowledge in the form of



a socio-economic genotype in the expanded reproduction of corporate innovations is revealed and proved. Within the framework of the system paradigm, a mechanism for improving the quality of creative capital management of individuals and corporations in the context of increasing intensification of cognitive space is developed (Salikhov, 2018).

M. Veld in his paper suggests that the growing number of studies investigating the relationship between HRM and employee well-being, largely supports a positive view on HRM (HRM has a positive effect on employee well-being). There is only a limited amount of empirical evidence to support a critical view (HRM negatively affects well-being) or a combination of both. This paper helps to understand the relationship between HRM and well-being by simultaneously testing both points of view. Taking a positive view, they explored how HRM can improve employee well-being through a favorable climate. From a more critical perspective, we explore how HRM can negatively affect employee well-being through a climate of efficiency (Veld, 2017).

In her article, A. Raczek addresses issues related to human resources management in multinational companies. She made attempts to define the role of human resources departments now, as they often have to show more initiative and flexibility in their daily activities to play the role not only of a personal and salary data controller, but also an important role of a strategic business partner. Theoretical considerations were supplemented by a case studies, which present the main problems in the HR department of an international company (Raczek, 2016).

A. Zalesna and B. Wyrzykowska in their article consider the concept of balanced human resources management, which is a consequence of the interest of theorists and practitioners in sustainable development issues. Sustainable human resources management should help not only to achieve the company's economic goals, but also to balance the needs of generations and, consequently, to prevent serious environmental and social problems in the future. These are qualified employees who understand and apply the principles of sustainable development in their work, play an important role in the transformation of the enterprise into a sustainable organization (Zaleśna, Wyrzykowska, 2017).

Tadeusz Oleksyn says in his work that human resources management should not be overly unified. It should differ in one organization from others, depending on many factors presented in his paper (Oleksyn, 2016).

The issues of the creative economy are considered by many scientists around the world. The paper of J. Howkins *The Creative Economy* is a comprehensive guide to the use of creative energy in the new economic environment, as the creative economy will be the predominant form of economy in the XXI century. The author sets the task for the managerial, economic and creative communities to create such an intellectual environment, in which it would be possible to give to the creativity a social and economic dimension and turn dreams into powerful projects (Howkins, 2001).

R. Florida introduces the concept of "creative class", which includes workers in the fields of employment associated with the creation of new forms and production of ideas. The creative class, according to R. Florida, includes actors, designers, architects, but also "thought leaders", scientists, engineers and even specialists in the field of entertainment. That is, these are people who constantly have to solve non-standard problems in their work, analyze circumstances and risks, and offer new ways of development (Florida, 2005).

K. Szara in her paper notes that the development of creative capital is influenced by various determinants, the strength, directions, and the degree of influence of which change over time. Creative capital is considered a variable that affects the development of countries and cities. The author's concept of creative capital follows from the theory of R. Florida, which defines them as technologies, talent, and tolerance that are the factors that affect local development, but according to the above concept, they also stimulate the development of creative abilities of the human capital (Szara, 2019).

Steven Jay Tepper believes that knowledge employees, the growing role of intellectual property, changes in consumption and leisure have a direct impact on art and culture. In particular, art is proclaimed as the driver of economic growth and development. He emphasizes the crucial role of creative cities, creative clusters, the creative economy and the "rise of the creative class". Governments have begun to measure the size and scale of the creative economy as an important indicator of economic health. As a result, changes in the economy have pushed creative assets to the center of economic life (Tepper, 2002).

Japanese researchers Emiko Kakiuchi and Kiyoshi Takeuchi note that due to socio-economic changes and globalization much attention has recently been paid to the importance of creativity and the creative industries. In their paper, they used official statistics to estimate the actual size of Japan's creative industries and believe that most industries are classified as creative (Kakiuchi, Emiko & Takeuchi, Kiyoshi, 2014).

A.A. Stepanov in his work (Stepanov, 2014) reflects the author's point of view on the essence and meaning of the term of "creative economy"; the peculiarities of its formation in the conditions of scientific and technical progress and post-industrial society are specified; identified the main directions and trends of its development: progress and regress; the directions of formation of the management system adequate to the peculiarities of the creative economy are substantiated.

The phenomenon of creative economy and its role in the economic and social development of the state has been studied for more than a year. In 2015, Ernst & Young analyzed 11 sectors of the creative economy around the world. Research has shown that revenue from the creative industries worldwide exceeds revenue from telecommunications services; the leading sectors are television, print media and the fine arts. In addition, the creative industries create nearly 30 million jobs worldwide; for comparison, this is more than the total number of jobs in the automotive industry in the United States, Europe and Japan (Ernst & Young, 2016). According to a 2016 study, the creative industries bring in more than £ 84 billion a year to the UK economy.

In May 2017, there were presented the *Doctrine of Balanced Development "Ukraine-2030"*, which is based on the development of the creative economy and innovations. The *Doctrine* provides for the creation of conditions for achieving economic growth of at least 10–15% per year, so that by 2030 Ukraine will enter the TOP-30 most economically developed countries with a GDP of \$ 710 – \$ 750 billion (*Ukraina-2030*, 2017). Thus, it is the creative approach and creativity that will become the leading and decisive factors of economic development in the XXI century.

## 2.1. The objectives of the investigation

The objectives are:

- investigation of the essence and features of human resources management at the micro and macro levels at the stage of formation of the creative economy;

- identification of the characteristics of the concepts of “creative and intellectual resources” and “creative and intellectual activity”;
- considering the role in the innovation management of the synectics that is the science of motivating creative activity by creating special conditions, which stimulate the emergence of unexpected and non-stereotyped analogies and associations in solving the problem;
- identification of new promising areas of state activities for training and retraining of personnel;
- considering the role of new institutions in the human resources management in terms of the creative economy formation, such as urban development institutions, regional development agencies, the professional and entrepreneurial communities; IT incubators, knowledge bases, e-selfgovernment institutes etc.

### 3. METHODOLOGY

In writing this paper, the International economic ratings were used including the National Report “Innovative Ukraine 2020”, data from *The International Innovation Index, Ernst & Young, Topuniversities*, as well as scientific works of foreign and domestic economists in the field of interaction and development of human resources and creative economy.

### 4. RESULTS

Creative economy is an economy based on intellectual activity and creativity. It is based on the following key principles:

- dominance of intellectual (intangible) economic products;
- the main asset at enterprises of any form of ownership are intellectual and creative resources, the rational management of which ensures the efficient use of material and financial resources;
- profit is made by realizing the consumer value of economic products, in which the main value is their intellectual component rather than material one;
- human supremacy in the development of management systems as a source of intellectual and creative resources operating in the conditions of human-machine, human-information, human-communication and other similar systems.

It is becoming clear that the main factor of economic development in the XXI century should be creative human resources, which have an increasing ability of creative thinking in making and implementing economic decisions in all fields of social production. Creativity will be the main potential and tool along with traditional ways of thinking and managing the economy. Leaders of socio-economic and scientific and technological progress will be only those companies that master the science of creative management of socio-economic development in conditions of economic turbulence.

Human resources are understood as the whole set of resources represented in the labor market, including human potential. Note that the talents of human resources, their ability to perform a certain work are summarized in the abilities that allow the implementation of a particular activity and achieving its specific goals. And, in turn, the human capital, that is a reserve of knowledge, skills, motivation, health, which are an integral personal property of each individual being accumulated as a result of investment, is used in social

production and contributes to productivity, economic and social efficiency financial and economic processes.

The approach to human resources management in the creative economy is based on constant improvement and search for new management methods, creating conditions that ensure development of a human's intellectual and creative abilities, the introduction of management technologies, research of new forms of communication with external and internal environment.

The methodology of human resources management in the formation of a creative economy should be considered at the micro and macro levels.

Creative and intellectual human resources at the micro level are a set of mental abilities of employees, which are used by them to generate ideas that allow organizations to innovate.

It is worth noting that the level and degree of development of creative and intellectual resources used by the organization largely influence the economic performance of all other types of resources used. Therefore, it is necessary to distinguish between the essence of intellectual and creative resources.

The meaning and characteristics of the concept of "creative and intellectual resources" and "creative and intellectual activity" are as follows:

1. The intellect of the social subject (person) and his intellectual activity in terms of innovative development, acquire a new meaning. The process is transformed from the socio-psychological sphere to the economic one, as they create an economic product, as well as form the intellectual capital of the organization. Intellectual activity is seen as the main productive force, not as an auxiliary.
2. In modern economic conditions, intellectual activity has a greater impact on the result than the production or commercial activities of the organization. Such activities determine how other activities will function, as well as their quantitative and qualitative indicators.
3. Working conditions of employees are changing, as many types of intellectual activities emerge. In modern economic conditions, there are changes in the nature of work, such as the transition from unskilled labor to intellectual, from solving standard problems to innovations, from individual work to teamwork, from functional activities to project ones.
4. The immateriality of intellectual activity and its results create difficulties in its formalization and are difficult to external influence. Mental processes and models that determine it exist in the consciousness and subconscious of a human, and in many are determined by his natural abilities, creative energy that are independent from himself.
5. The relationship and interaction of creativity and intelligence are the basis of the innovative activity. Innovations are impossible without intellectual activities and especially its creative component, creative energy of employees. Human capital management of an innovative organization can be represented as a complex system that includes interconnected and interdependent subsystems of forecasting, planning, formation, development, and use of human capital.

However, the human resources management system cannot be considered separately from the entire management system. The purpose of such a system is to timely provide innovation processes with the staff of necessary qualifications, necessary knowledge, skills, intellectual and creative abilities. As the needs of an innovation organization are

constantly growing, the quality and volume of human capital must also be constantly growing to meet the necessary requirements of innovative development. At the same time, the human capital management system cannot be considered separately from the production process in the organization. After all, it is human capital that ensures the implementation of the innovation process, and the human capital management system must be included in the innovation cycle of the organization as a creative and intellectual support of the innovation process.

Thus, to ensure the development of the creative economy at the micro level, the human resources management is a reproducible process of forecasting, planning, formation, and organization of development and use of creative and intellectual human capital.

Currently, many companies are paying more and more attention to the training and retraining of creative and intellectual staff engaged in human resources management, who are able to effectively solve the problems of personnel management through the formation of a creative economy. Such managers, as a rule, are able to show flexibility, creativity, tolerance, to find non-standard management solutions in the field of personnel management.

As a result of the increasing level of requirements for modern management staff in the creative economy, the structure of tangible and intangible assets of companies that operate successfully and occupy leading positions in domestic and foreign markets should change significantly.

In the future, in a creative economy, the share of creative and intellectual costs of enterprises will increase significantly. According to the experts of the International Analytical Bureau, the professional portrait of a manager in the creative economy should be characterized by the following parameters:

- high level of creative and intellectual training;
- analytical and prognostic non-standard thinking;
- the ability to identify the essence of problems that do not lie on the surface and adequately assess the possibilities to solve them;
- high level of professional training and a decent higher education;
- ability to use modern tools and methods (including information and communication technologies);
- high level of sociability;
- ability to use the tools of socio-psychological management of people in the creative economy conditions and so on.

At the stage of the creative economy formation, we'll constantly face the need to develop new theoretical, methodological, methodological and practical methods and approaches to activation, rational and effective use of creative and intellectual human potential as the main source and the strategic tool for effective use of the main productive force in the post-industrial society.

These circumstances determine the fact that it is impossible to manage creative intellectual workers by traditional methods. Therefore, today we are talking about the formation of a system of innovative labor management, the most adequate to the current stage of development of the creative economy.

The object of innovative labor management is the human resources of the organization, and the subject is increasing the level of creative potential and development of innovative behavior of employees, which are an intellectual and creative resources of

modern organizations. It should be noted that innovative labor management, on the one hand, is most inherent to the innovative organizations operating in high-tech sectors of the economy, but, on the other hand, any modern organization that wants to compete successfully in a market environment must implement innovative principles and management methods.

An important role in innovation management is to be played by synectics that is the science of motivating creative activity by forming special conditions that stimulate the promotion of unexpected and non-stereotypical analogies and associations in solving the problem. Synectics defines the creative process as mental activity in situations of problem formulation and solving, where the result is scientific or technical discoveries (inventions). Synectics operators are specific psychological tools that support and lead the entire creative process (Gorelov, Litun, Melnikov, 2007).

Ukraine is one of the countries with highly developed human capital and a well-trained workforce. This is mainly due to the existence in previous years of well-established vocational training system, which included labor skills training in secondary school, a developed complex of primary vocational education, as well as a system of training, retraining and advanced training of workers directly on enterprises.

Today, among the new promising areas of staff training is coaching, the technology that moves the staff from the problem area to the effective solution area; it is a system allowing you to see and feel new approaches and opportunities, allowing one to unleash the potential of the employee and “to bring order” in many areas of life.

At the macro level, the institute of education plays a key role in human resources management. It is clear that education is an element of the management system of intellectual and creative human resources, and it participates in the social accumulation of intellectual and creative components and their use in the interests of innovative development. The accumulation of intellectual and creative abilities by the subject is associated with the increase of general cultural, educational and professional level, as well as the increase of culture, spirituality, and morality. But it is necessary to distinguish between continuous self-education, which has always been inherent in people, and continuous professional education, which is a public institution. Continuing professional education is a certain social norm that dictates to the subjects a certain type of behavior, the performance of certain social roles.

The solution of this problem is reflected in the strategic documents adopted by the EU Council, including the *Strategic Program for European Cooperation in Education and Training 2020*, aimed at promoting the development of education and training through the implementation of the *Growth Strategy 2020*. This program aims to achieve such strategic goals as ensuring the personal, social and professional realization of all citizens, as well as sustainable economic prosperity and employment opportunities through the development of education and training systems in EU member states (Innovatsiyna Ukrayina 2020: natsionalna dopovid 2015).

In order to form creative human capital, the world's leading universities successfully implement specialized MBA programs as follows: business creativity (University of the West of Scotland, Paisley, Scotland); creativity and modern entrepreneurship prospects (Illinois Institute of Technology, Chicago, USA); system creativity in business (Columbia Business School, New York, USA); innovation and creativity: the path of development (Toulouse Business School, Toulouse, France); creativity and organizational management

(Globis University, Tokyo, Japan); sustainable creative management (Open University Business School, London, UK), strategic marketing in the creative industries (Harvard Business School, Boston, USA), leadership and change management (De Paul University, Chicago, USA) (Lukyanenko, Burmaka, Halakhova, 2016).

In countries that implement an innovation and technology type of development, knowledge becomes the main intangible asset, as well as affects the growth of production, improvement of the quality of products and services, and ensuring the country's competitiveness and accelerating social progress. Therefore, the formation of human creative potential, which is provided by the system of education and training, must be effectively implemented in the innovation mechanisms. Ukraine has a significant educational and qualification potential for innovative development, which confirms the significant contribution of the educational component to the high ranking positions of Ukraine in the human development index. In 2018, Ukraine received a HDI value of 0.750, which puts it in a high category of human development: Ukraine is 88th out of 189 countries and territories.

Ukraine ranks 43rd out of 126 countries in *The Global Innovation Index 2018*. According to the sub-index "Creativity" Ukraine has improved its position, moving from 49th place to 45th, including the index of intangible assets, by which Ukraine is ranked 13th, by the index of creative goods and services the place is 86th, by the index of online creativity the place is 43th.

The basis of Ukrainian innovative competitiveness is human capital and researches, as well as knowledge and research results. Their effective implementation is the main competitive advantage. However, in 2018, compared to 2017, Ukraine lost 2 positions in the sub-index "Human Capital and Research", moving from 41st to 43rd place. This was due to a reduction in education expenditures as a percentage of GDP (22nd place in 2017, 26th place in 2018) and research and development expenditures as a percentage of GDP (54th in 2017, 62nd in 2018).

According to the ranking of global competitiveness in 2019, Ukraine was ranked 11th among 140 countries in terms of the number of citizens receiving higher education. In 2020, 6 Ukrainian universities were included in *The QS World University Rankings*. The best position among Ukrainian universities was taken by Karazin Kharkiv National University. It is ranked 477th (Topuniversities, 2018).

Thus, Ukraine's rather high ratings indicate the existence of reserves to ensure the country's innovative development in the future.

In the system of mechanisms stimulating the development of the creative economy, the income policy is no less important, because it forms the motivating factors of innovative activity among all actors, and therefore determines the success of achieving the desired results. The result of the balanced and innovative oriented income policy is the success of modern economic development and the development of society as a whole.

In terms of the creative economy formation, among the new institutions of human resources management, we can also identify the institutions as follows: institutions of urban development, regional development agencies, communities founded on the basis of professional and entrepreneurial activities; IT incubators, knowledge bases, e-government institutes, etc. The development of such institutions is conditioned by the intensification of the creative economy development and problems in the dynamic update of the information and knowledge.

## 5. CONCLUSION

Human resources management needs to be explored at the micro and macro levels. Thus, at the micro level, the human resources management system is a reproducible process of forecasting, planning, formation, development, and use of human capital to ensure the innovation process in the innovation cycle of the organization. The system of human resources management at the macro level is greatly influenced by a set of institutions: political, legal, social, and economic. But the key role in the process of human resources management at the micro and macro levels is played by the institute of education. Under the influence of the institutional system there are being formed the conditions that can either stimulate the positive dynamics of the formation and improvement of intellectual and creative human resources, or have a negative impact. Thus, the institutional conditions determine the direction and speed of the creative economy development in the long run.

For effective management of human resources in the conditions of formation of creative economy, the state should develop normative-legal base in the field of support of the creative potential development; to stimulate the development of human resources and resources provision of creative fields, which includes the development and implementation of educational programs in creative fields in the training of higher and middle levels professionals, to conduct startup tours for representatives of creative professions together with leading institutes of creativity development, to create basic university departments, to assist in internships and professional development of teachers in the world's leading universities, which are leaders in the field of creative industries; to form mechanisms of financial support for entrepreneurs engaged in the creative fields providing the grants and financial support for startups, IT incubators, as well as subsidies for rent of non-commercial premises for creative entrepreneurs; to create institutions of urban development and e-government; to create a market of investment and export-oriented projects within the framework of a public-private partnership in the creative fields; to support and promote the creative resources of Ukraine at the international level through the organization and holding of events in this direction.

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## MARKETING ANALYSIS OF THE GLOBAL ORGANIC PRODUCTS MARKET

The article deals with the theoretical and practical aspects of the development of the organic market in Ukraine in view of the retrospective dynamics and current trends of the world and domestic markets. The conducted analysis of the world and European markets for organic agricultural products shows the significant dynamics and prospects of realization of a wide range of products. Due to the fact that Ukraine has low logistical costs for the potential export of products to the European market and low cost of organic products due to low labor costs, as well as the potential of land resources, we consider that the export of organic products is promising. The analysis of the internal market for organic products shows little dynamics due to low purchasing power. Therefore, the development of the domestic organic agricultural sector is seen in the study of the foreign market and export orientation.

The results of the study may be of practical value to producers and other participants in the Ukrainian organic market for forming their own production program, adjusting the production orientation and the range of products produced.

**Keywords:** Organic market, organic production, organic agriculture, world market, marketing research, conjuncture, export, import

### 1. INTRODUCTION

The dynamic development of organic production is due to global changes in the environment. The process of intensive agriculture with the use of chemical fertilizers and synthetic plant protection products has led to deterioration of soils, loss of its useful properties and fertility, as well as oversaturation of agricultural land with pesticides and various chemicals.

As a result of active use of mineral fertilizers in agriculture, there is a reduction in natural minerals reserves, from which chemical elements are extracted for the production of phosphorus, nitrogen, potassium and other fertilizers. The issue of food security, inferiority and malnutrition in the world deserves attention. According to the data of 2018 (Global hunger continues to grow...; Hutorov, 2013) the number of starving people in the world has increased to 821 million people, i.e. every ninth inhabitant of the planet is short of food and more than 150 million children have health problems due to malnutrition.

Thus, there is a need to develop organic production as an alternative to industrial agricultural systems, the possibility of restoring the ecological balance of agro-ecosystems and the production of safe agricultural products that will support the health of not only people but also the environment and soils.

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## 2. LITERATURE REVIEW

When analyzing the latest research in this area, it should be noted that the spread and development of organic production in Ukraine pays great attention of numerous Ukrainian and foreign scientists. E.V. Milovanov in his works highlights the experience of foreign countries in the field of state support of organic agricultural production (Mylovanov, 2018), emphasizes the advantages of organic food compared to conventional (Mylovanov, 2019) and the importance of organic agricultural production for rural development.

V.G. Granovska also pays attention to the study of the domestic and foreign markets of organic products with the proposal of the mechanism of stimulating the development of organic enterprises. V.I. Artysh studied the process of organic production management (Artysh, 2013; Artysh, 2014). N.A. Berlach in its scientific works the need to establish active participation of Ukraine in regulating the process of trade in organic products in the international space with a proposal of ways of legislative regulation in the field of organic agriculture (Berlach, 2009).

However, in our opinion, the issues of comparing world and Ukrainian trends in the development of the organic market with the possibility of transferring existing global trends to the Ukrainian organic agricultural sector, taking into account the peculiarities of its development, remain insufficiently studied.

## 3. AIM OF THE STUDY

Interest in the development of the organic agricultural sector is present in Ukraine. But domestic organic agriculture is developing gradually, at a much slower pace than the world. Thus, the purpose of our article is to analyze the world and domestic market of organic products, track global trends in organic production, compare the situation on the world and Ukrainian organic agricultural markets to assess the prospects of domestic organic agricultural business and transfer global trends to Ukrainian realities.

## 4. RESULTS AND DISCUSSION

Environmental problems are extremely relevant for agricultural production, because, unlike industry, agriculture is largely involved in the consumption of the world's natural resources. Organic production is a practical implementation in the field of agricultural production of the concept of sustainable development, which provides a combination of economic growth, social development and environmental protection as interdependent and complementary elements of strategic development, which will guarantee high quality food as an important component of food security (Artysh, 2009).

According to the latest research of the Research Institute of Organic Agriculture FiBL in cooperation with the International Federation of Organic Agriculture IFOAM will analyze the market of organic farming products (The World of Organic Agriculture, 2019). As of the end of 2017, statistical information on organic agriculture was provided by 181 countries, which is almost 53.6% more than in 2001. Worldwide, 69.8 million hectares belong to organic agricultural land (including land in conversion).

The area of the world's organic agricultural land increased by 52.5 million hectares compared to 2001, when it amounted to 17.3 million hectares, i.e. quadrupled. According to V.G. Granovska, a significant increase in the area of world organic land "... provides a basis for expert assessment of expectations of annual growth of more than 25%,

dynamic growth of the world organic market, increased competition in it” (Hranovska, 2017).

The regions with the largest area of organic agricultural land include Oceania (35.9 million hectares, or 51.0%), which is home to almost half of the world's organic agricultural land. It is followed by Europe (14.6 million hectares, or 21.0%) and in third place – Latin America (8.0 million hectares, or 11%) (Fig. 1).

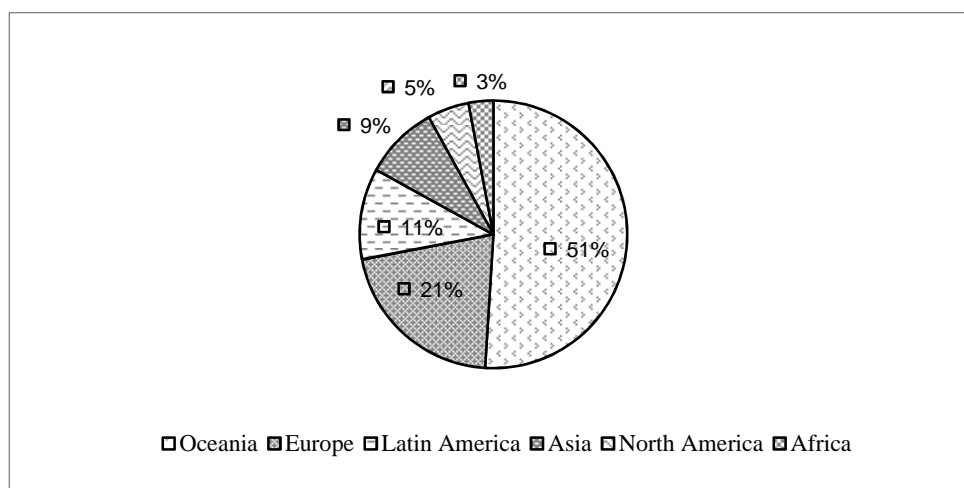


Fig. 1. Distribution of organic agricultural land by region, 2017

Source: (The World of Organic Agriculture, 2019).

The largest organic agricultural land is concentrated in Australia (35.65 million hectares), as 97% of the country's agricultural land is represented by large pastures, which are likely to be used in organic agriculture, including livestock. The second largest land in Argentina (3.39 million hectares), the third place is occupied by China (3.02 million hectares). In seven more countries of the world the area of the agricultural lands processed in an organic way makes more than one million hectares.

The total area of these ten countries is 54.85 million hectares, which is three quarters (78.58%) of the total amount of organic agricultural land in the world.

More than one percent (1.4) of the world's agricultural land is organic. The largest organic share in the total area of agricultural land on the continents as of 2017 – in Oceania (8.5%), followed by Europe (2.9%) and Latin America (1.1%). In other regions, the share of organic land is less than one percent. However, in some individual countries the percentage of organic agricultural land is much higher: Liechtenstein (37.9%), Samoa (37.6%) and Austria (24.0%) have a large share of organic land (Fig. 2).

In eight countries of the world, the share of organic land cultivated according to the principles of organic farming is at least 10% of the total area of agricultural land. In some island states, the share of agricultural land used for organic production is high, in particular Samoa and Saint Thomas and Prince. However, in 56% of countries with official statistics, the share of land under organic management is less than one percent.

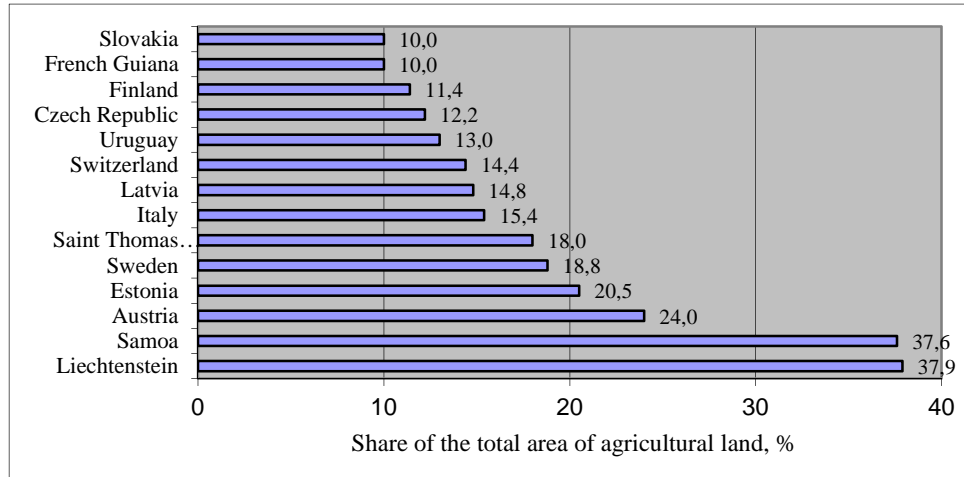


Fig. 2. Countries with the largest share of organic agricultural land, 2017

Source: (The World of Organic Agriculture, 2019).

In 2017, compared to 2016, the amount of organic land in the world increased by 11.6 million hectares, or 20%. The highest growth of organic land is observed in Oceania, Asia and Africa, where they increased by 31.3%, 24.9% and 14.1%, respectively. The absolute increase in land in these regions is: 8.5 million hectares in Oceania, more than 1.2 million hectares in Asia and plus 1 million hectares in Europe (Table 1). This increase is mainly due to an increase in organic land in Australia by 8.5 million hectares. China (absolute increase of more than 0.7 million hectares), Argentina – almost 0.4 million hectares more, the Russian Federation – almost 0.34 million hectares and India (almost 0.3 million) also contributed to the global increase of organic lands. Ninety-three countries reported an increase in the area of their organic agricultural land, while a decrease in land was reported by 36 countries.

According to the data shown in the Table 1, the area of organic agricultural land in the world for ten years has increased by an average of 75–100% in most regions, while in Ukraine the increase in the area of organic land in 10 times smaller – only 15%. Thus, the world organic agricultural sector is developing much faster than the Ukrainian one, and the domestic one has unused reserves for development.

As of 2017, there are almost 2.9 million organic producers worldwide, their number increased by 4.7% compared to 2016, and by 105.3% over the last ten years, mainly due to a large increase in India. The countries with the largest number of organic producers are India (835,000), Uganda (210,352) and Mexico (210,000).

Forty percent of the world's organic producers are producers in Asia, followed by producers in Africa (28 percent) and Latin America (16 percent), and therefore more than 80% of the world's organic producers are concentrated in these areas. More than two thirds of organic agricultural land as of 2017 belongs to perennial pastures (almost 48.2 million hectares). Arable land occupies 12.1 million hectares of organic agricultural land, which is 17% of all organic land in the world and 0.8% of all arable land on the planet.

Table 1. Growth of organic agricultural land by regions of the world, 2016–2017, 2007–2017

Region	Organic agricultural lands, 2016 (ha)	Organic agricultural lands, 2017 (ha)	Gain for 1 year (ha)	Gain for 1 year (%)	Gain for 10 years (ha)	Gain for 10 year (%)
Africa	1 801 699	2 056 571	254 872	14,1	1 163 089	130,2
Asia	4 897 837	6 116 834	1 218 997	24,9	2 757 650	82,1
Europe	13 535 235	14 558 246	1 023 011	7,6	6 261 881	75,5
Latin America	7 479 288	8 000 888	521 600	7,0	762 714	10,5
North America	3 130 332	3 223 057	92 725	3,0	645 554	25,0
Oceania	27 346 986	35 894 365	8 547 379	31,3	23 783 698	196,4
World	58 186 980	69 845 243	11 658 263	20,0	35 372 713	102,6
Ukraine	381 173	289 000	-92 173	-24,2	92 173,00	15,7

Source: compiled by the author on base of the (World of Organic Agriculture, 2019).

Most organic arable land (almost 60%) is located in Europe, Asia (22%) and North America (12%). They are mainly used for food grain including rice (4.5 million hectares), green fodder (2.8 million hectares) and oilseeds (1.2 million hectares), as well as legumes (almost 1 million hectares) and spinning crops 0.68 million hectares) (Fig. 3).

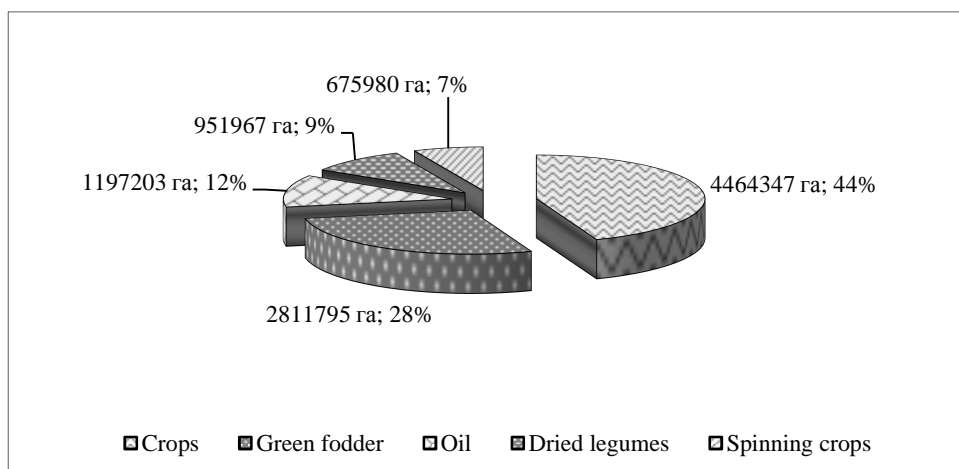


Fig. 3. Area and share of major crops in the structure of organic lands of the world, 2017

Source: built by the author based on the (World of Organic Agriculture, 2019 data).

Perennial crops cover seven percent of the 4.9 million hectares of organic agricultural land, or 2.9% of all land under perennial crops. Most of the land under perennial crops is located in Europe (33%), Africa (26%) and Latin America (20%). The most important crops are coffee and olives, which account for almost 30% of the harvest of organic perennials on an area of about 0.9 million hectares each. Important crops are also nuts (0.6

million hectares), grapes (0.4 million hectares) and tropical fruits (almost 0.4 million hectares) (Fig. 4).

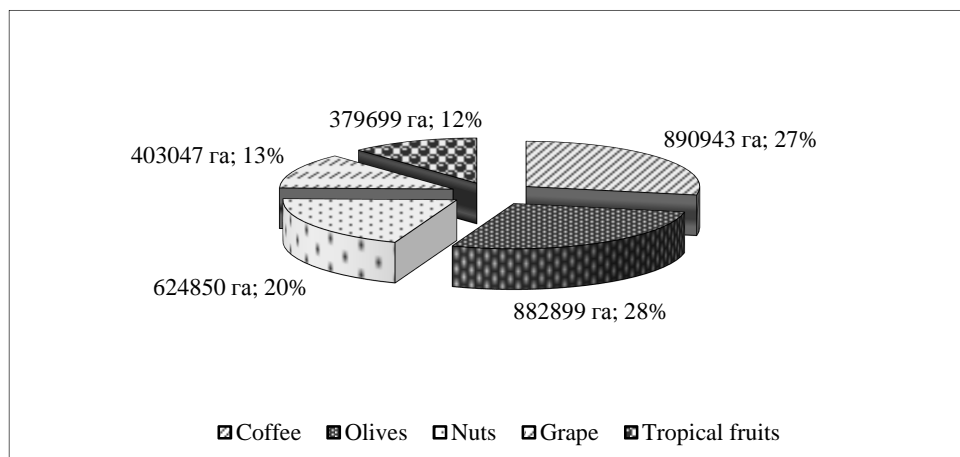


Fig. 4. Area and share of perennial crops in the structure of organic lands of the world

Source: built by the author based on the (World of Organic Agriculture, 2019 data).

The organic global market continues to grow. Global sales in 2017 reached \$ 97 billion. In terms of regions, North America and Europe are the leaders, accounting for almost 90% of world income, although these regions together occupy only a quarter of the area of organic land. In addition to the fact that the United States has the largest single market – at \$ 48.7 billion in 2017, almost 40% of Americans already consume organic products. At the same time, 37% of them consume these products more than once a day, 39% consume organic products at least once a week and only 24% consume organic products irregularly (Chaika, 2011). The European market for organic products is the second largest in the world and reached 39.6 billion dollars. Europe has the world's largest concentration of organic food retailers. A significant part of the profits falls on retail market participants – hypermarkets, supermarkets and discounters, which sell organic products under their private labels in order to obtain the largest sales of organic products.

The field of catering and food services draws consumers' attention to organic food. The number of restaurants, cafes and canteens, which offer visitors dishes of organic products and ingredients, is growing. Some governments encourage schools and government canteens to use organic food. It is important to note that domestic markets, in particular Asia, Africa and Latin America, are developing. Much of the organic crops grown in these countries are destined for export markets.

The growing trend towards healthy eating, which previously spread in Europe and the United States, is gradually spreading in Ukraine. Every year, the Ukrainian consumer becomes more careful and demanding when choosing food. The best taste and health properties of organic products compared to traditional ones, the absence of preservatives and chemical dyes, genetically modified organisms – these are just a few significant benefits of organic farming for human.



The total area of agricultural land occupied for organic production in Ukraine in 2017 compared to 2001 has almost doubled and is 289,000 hectares, which is 1% of agricultural land in Ukraine (Fig. 5).

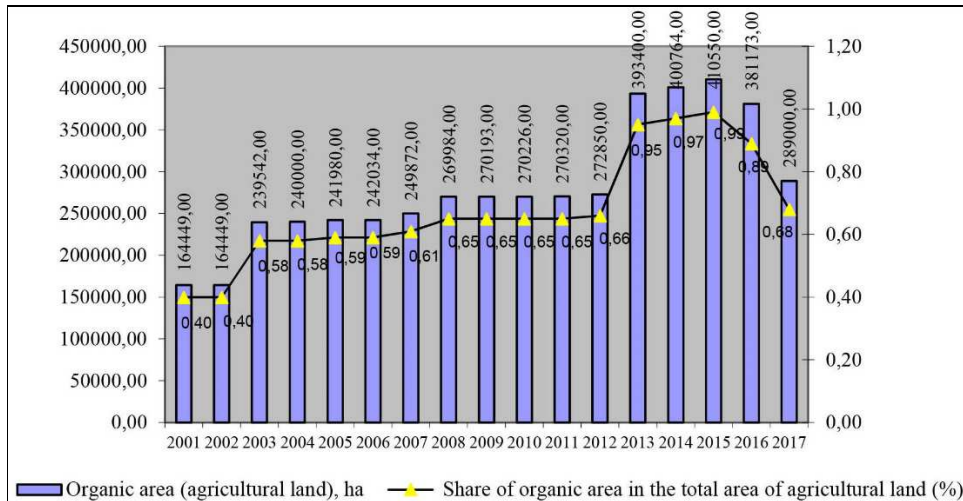


Fig. 5. Dynamics of the area of organic lands of Ukraine and its share in the total area of agricultural lands, 2001–2017

Source: built by the author based on the (World of Organic Agriculture, 2019 data).

According to O.V. Trofimtseva, the share of organic lands can be at least 5%. According to the author, the development of the organic sector in Ukraine is still hampered by weak marketing. Ukraine ranks 24th among the world's producers of organic products by area of organic land. The share of organic area in the total area of agricultural land in Ukraine increased from 0.4% in 2001 to 0.68% in 2017. In 2017, 304 farms were engaged in the production of organic farming products in Ukraine. In addition to direct producers, organic market operators are also traders, processors and entrepreneurs engaged in logistics, which as of 2018 there are 132. According to a survey of Ukrainian exporters of organic products conducted by the certification body "Organic Standard", almost 80% of Ukrainian organic products in 2016, it was sent for export, the volume of which amounted to almost 300 thousand tons in the amount of more than 65 million dollars (Organic products market in Ukraine).

The domestic domestic consumer market of organic products has been actively developing since 2008. In 2004, it amounted to 100 thousand euro, and as of 2017 increased 290 times to 29.4 million euro. In the domestic market in 2016, organic products were sold for 21 million euro, which is approximately equal to 0.5 euro per person. In 2017, this figure rose to 0.69 euro per person, but remains catastrophically low compared to the world's countries with the highest *per capita* consumption of organic products, including Switzerland (274 euro), Denmark (227 euro) and Sweden (197 euro).

The market share of Ukrainian organic goods is about 0.1% of the market of all food products. Organic food and beverages make up 90% of all organic products in Ukraine.

The other 10% are cosmetics and hygiene products. In our country, Odessa, Kherson, Poltava, Vinnytsia, Zakarpattia, Lviv, Ternopil, and Khmelnytsky regions are most involved in the production of organic farming products.

In order to assess the export potential of the organic market of Ukraine, we analyzed the information of the promotional community of producers and exporters of Ukrainian organic products Organic Ukraine Business Hub, which represented a delegation of participants from Ukraine at the annual world exhibition of organic products Biofach in 2019. Thus, among the 50 domestic enterprises-producers of organic products, which, most likely, are already exporters of organic products, or have a desire to become them, 44 – direct producers and processors of organic products, the other 6 are organizations and enterprises, providing ancillary services: inspection and certification services, analytical services, fertilizer and bio soil producers.

Among the organic products that Ukraine can offer for import, the most represented are cereals and legumes (offered by 25 companies, a total of 18 crops), oilseeds (22 companies, a total of 7 crops), as well as fruit and berry (16 companies, a total of 22 crops). Six of the presented operators offer cereals, sugar, oil, as well as vegetables, melons (watermelons) and roots. Four companies produce flour, honey, spices, medicinal crops and industrial crops. The offer of meat, pasta, dairy products and cheeses, as well as tomato paste and sauces is limited. Thus, the supply of grain and legumes is the most export-oriented, as the grain itself has a long shelf life, which provides good prospects for its implementation both in the foreign market and in the domestic market. The permit for the export of organic products is opened through the procedure of obtaining a license, in which, as a rule, exporters are assisted by certification bodies working at the international level. Organic products, mainly in the form of raw materials, are mostly exported to European countries (Italy, Germany, Holland, Belgium, France, Austria), partly to North America (including the USA and Canada) and Japan. The most popular products of Ukrainian organic exports include corn, wheat, honey, raspberries and frozen berries. Only a part of organic food is produced in Ukraine. Other organic products are imported from the European Union, including Germany, Poland, France and Italy. Imported mainly cereals, cereals and pasta, then – beverages (coffee, tea, wine, beer), chocolate, sugar, organic butter and baby food. According to the consultant of the analytical department of Pro-Consulting Andriy Mokryak, technologically in Ukraine it is possible to produce more than half of the imported organic products and achieve an import substitution rate of 62.1% (20). In different parts of the world, more and more consumers prefer agricultural markets, organic supermarkets or organic stores in stores. In contrast to its European neighbors, where organic products are quite available to the public in the retail network, in Ukraine there are fewer specialized stores of organic food. Most outlets, including small specialty stores and individual supermarket shelves, are located in large cities and regional centers. Organic products are presented in the network of supermarkets Metro, Silpo, Furshet, Auchan, Good Wine, Megamarket. Consumers have the opportunity to order and purchase organic products and goods via the Internet in stores that have their own sites, as well as through social networks.

The introduction of organic agricultural production technologies in Ukraine is quite relevant, as organic farming promotes the reproduction of depleted natural resources, soil fertility, humus recovery, prevents soil erosion caused by traditional intensive farming. The process of using organic technologies requires lower energy and fuel costs, abandonment of synthetic fertilizers, pesticides and herbicides, the prices of which are

constantly rising. In particular, with professional (taking into account the natural potential of the soil, crop rotations, crop interactions, etc.) organic farming costs are reduced by 20–25%. It is important to note that more and more consumers are thinking about living a healthy lifestyle, their own health and their future, and are becoming more responsible for the environment. According to Yu.O. Lupenko, “potential consumers of organic products are about 5% of the population of large and about 1–2% of the population of medium-sized cities of Ukraine” (Lupenko, 2013).

Ukraine has significant potential in implementing the principles of organic farming as our country has almost 50% of the world's black soil reserves. Farming on the principles of organic farming is an opportunity to compensate for depleted due to intensification of agriculture soil resources of Ukraine, as the use of organic fertilizers gradually increases the humus content in the soil, and thus increases its fertility (Dzhyhyrei, 2006). However, the transition from conventional to organic agriculture in Ukraine is hampered by a number of environmental, economic and social problems. The main one is the low solvency of the market, due to which only 20% of domestic products of organic agriculture remain in the domestic market, and most of it is exported. Domestic consumers, even with information about the safety, health benefits of organic products and the contribution of the production process to the preservation of the environment, do not have the financial means to buy and consume it. We agree with the opinion of V.I. Artysh that “the growth of welfare of the population of Ukraine will lead in the long run to an increase in effective demand for organic products and stimulate its development in Ukraine” (Artysh, Chorny, 2010).

## 5. CONCLUSIONS

The analysis of the world and European markets of organic agricultural products demonstrates the significant dynamics and prospects for the implementation of a wide range of products in these markets. Due to the fact that Ukraine has low logistics costs for potential exports to the European market, on the one hand, and low cost of organic products due to low labor costs, on the other hand, and significant potential for land resources, we believe that the export of organic products to the European market is very promising.

Analysis of the domestic market of organic products allows us to draw conclusions about the relatively small dynamics, which is due to low purchasing power. In the near future, as the level of purchasing power of the population of Ukraine does not tend to increase significantly and rapidly, the same low growth rates of sales of organic products in the domestic market are likely. Thus, we have a mismatch between the potential of production and the domestic market. Thus, the development of the domestic organic agricultural sector in general and the way out of this situation for producers in particular, we see in the study and study of foreign markets and export orientation. Because, in addition to the low purchasing power of the population in Ukraine, the export of Ukrainian organic products is also due to another important factor – the price, which in Europe is much higher for organic products.

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## EXPLORING RETAIL CUSTOMER SERVICE, A CASE OF RETAIL FOOD CHAINS IN KWAZULU-NATAL

This study aimed at determining and evaluating the efficacy of customer service in independently owned retail food chains within the province of KwaZulu-Natal in South Africa; managers; between customer's expectation and their perceived satisfaction. Furthermore, it included assessing the level of retail service quality, current customer service tools employed by independent food chains in KwaZulu-Natal, and the extent to which customer service tools are being used. The study was also about establishing if there was a significant relationship between retail service quality and customer satisfaction. The study targeted both customers and managers of independent food chains in KwaZulu-Natal from whom a sample of four managers were interviewed and 444 customers were conveniently selected to participate in the study. Both qualitative and quantitative methods were employed in the collection of data.

The findings revealed that the majority of the customers were generally dissatisfied with the quality of services offered by independent food chains owing to lack of complementary services (ATM terminals, parking, and toilets), facilities for shoppers with special needs (physically handicapped, wheelchair, or translators), inability to offer customers credit, failure to provide wide product assortment, short operating hours and general appearance of the store (cleanness, good product display, presentation on how to use merchandise and availability of shopping trolleys, signage to locate and identify merchandise). The results, however, revealed that there is a relationship between customer's expectation and their perceived satisfaction. Equally significant, the results showed that customers were satisfied with the accessibility and safety of the stores and that they will be considering independent food chains in KwaZulu-Natal as their primary stores.

**Keywords:** Customer service, Independent food chains, service quality, retailing, customer service quality

### 1. INTRODUCTION

Independent food chains play an integral part in the distribution chain of goods and services, uplifting the economy and advancement of the retailing industry (Radder, 1996). More recently, independent food chains in South Africa have begun entering the townships and expanding into rural areas. The opening of independent food chains has provided exposure to new segments of the population. Whereas many of the independently owned retailers have been seen as being culturally and empathetically linked with their customer base, larger national firms have emphasized issues such as

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customer service, operational standards, and organizational training (De Bruyn and Freathy, 2011). It is therefore unknown as to what customer service strategies independently owned food chains are embarking on to counter the strategies of national retailers in competing for a shrinking share of consumers' wallets; preference; and patronage. Moreover, the customer service phenomenon is increasing, but little is known about its role (Hunter, 2006).

Customer service is about understanding the needs of different customers, keeping promises, and consistently delivering high product and service standards. The success of any retail entity is determined by customer service (Kimando and Njogu, 2012), as customer service has that ability to heighten the level of customer satisfaction and act as a differentiating factor amongst retailers aiming to have the competitive advantage over their competitors (Srivastava et al., 2015). It further, can increase product quality, gaining profitable opportunities, and eventually increasing sales and income (Jahanshani et al., 2014).

Recent surveys have also confirmed that consumers think retail customer service is inadequate in retail outlets, and realizing the escalating importance of customer service, an increasing number of retailers have attempted to improve their service strategy (Bishop Gagliano and Hathcote, 1994), by improving their service quality to the customers, which has become the basic tool for retailers to enhance the shopping experience, customer satisfaction, revenues, cross-selling and also repeat purchase behaviour (Chandel, 2014). Delivering high-quality service and having satisfied customers are viewed as indispensable for gaining a sustainable advantage (Shemwell, Yavas, and Bilgin, 1998). However, retailers are still unable to effectively cater to the needs and wants of customers and risk not only losing dissatisfied customers to competitors but also the erosion of profits and consequently failure (Wong and Sohal, 2003).

Measuring customer service quality in the retail setting is different from any other product or service environment. It is for this reason that Dabholkar, Thorpe, and Rentz developed the Retail Service Quality Scale (RSQS) for measuring retail service quality. It should, however, be strongly emphasized that service quality in retailing is different and complicated from any pure service environment, as it incorporates a mix of merchandise and services offered concurrently (Siu and Tak-Hing Cheung, 2001). This is because of the unique nature of retailing, and as such, improvements or measurements of quality in retailing cannot be approached in the same way as in any services setting. In a retail environment, it is, therefore, necessary to look at quality from the perspective of services as well as goods and derive a set of items that accurately measure this construct.

## **2. LITERATURE REVIEW**

Found in the literature review is a detailed discussion of an overview of two constructs namely, retailing and customer service.

### **2.1. Retailing**

Retailing is the set of business activities that adds value to the products and services sold to consumers for their personal or family use and also involves the sale of services (Levy and Weitz, 2012). It is the heart of marketing and it is not a new concept in the history of marketing, retailing is the interface between the producer and the individual consumer for buying personal consumption. It is the final activity in the supply chain



(Chakraborty, 2014), and also a tail activity in the business chain that links the end-user and last middlemen in the business process (Prabhakar, 2012).

The retailing concept is an overarching business philosophy that creates superior value for customers (Themba and Marandu, 2013) by attracting, recruiting, and retaining a competent workforce to successfully compete in the 21st century. Retailers operating under the retail concept provide services and assist in providing more product selections (Liao, Chen and Wu, 2008). The concept further encourages retailers to provide time, place, and possession utility through their store location, environment, merchandise, and salespeople (Singh, 2009), by also providing an assortment of products and services, breaking bulk, holding inventory, and providing services (Levy and Weitz, 2012).

Retailing in South Africa is a rapidly changing scenario with new competitors and technological advances in doing business. South Africa has a wide range of retailers who have evolved to serve the needs of a marketplace that is characterized by many different groups of potential customers in terms of race, income, and culture (Terblanche, et al., 2013). The retail industry is divided into organized and unorganized sectors. Organized retailing refers to trading activities undertaken by licensed retailers, while unorganized retailing, on the other hand, refers to unlicensed or informal retailers (Bawa, Gupta, and Sharma, 2013). Retailers are classified into two major areas, namely: food retailers and general merchandise retailers. The most common food retailers that are apparent in South Africa are full-service supermarkets, hypermarkets warehouse clubs, and convenience stores (Terblanche et al., 2013). The South African food retail sector is highly concentrated and dominated by four retailers namely: Pick 'n Pay, Shoprite/Checkers, SPAR, and Woolworths. All the larger retailers in South Africa have been expanding their activities within South Africa, the number of retail stores in South Africa increased by 77 percent to a total of 2 125 stores from 1994 to 2005. Growth in the retail sector is also sustained and stimulated by the good performance of the South African economy and the emergence of a strong black middle socio-economic class (Bienabe and Vermeulen, 2007).

The retail sector in South Africa continues to grow exponentially, as evidenced by the increase in the number of new shopping malls. South Africa has some of the largest retail enterprises in the world and is the largest economy in Africa (Mafini and Dhurup, 2015). Over the past decade, supermarkets have emerged as important agents of change in developing countries. Supermarkets have gone beyond the upper-income consumers to penetrate the mass market middle class, lower middle class, and the poor (Neven et al., 2006). South Africa's retailing industry has also witnessed an increase in hypermarkets. While hypermarkets have been in existence in South Africa for quite a while, the past decade has seen a remarkable shift from convenience store investment to hypermarket investment (Chinomona and Omoruyi, 2015).

Since the late 1990s, the number of supermarkets in South Africa has been steadily growing (D'Haese and Van Huylenbroeck, 2005), and have progressed exponentially in the retailing field in the last two decades. Such progression is evident in the retail sector, where major retail stores (including supermarkets and hypermarkets) were responsible for more than half of South Africa's turnover on groceries, toiletries, and confectionery (Dhurup, Venter and Oosthuyzen, 2014). Supermarkets are not a new phenomenon in South Africa. OK Bazaars introduced the concept of the supermarket into South Africa in 1948 and by 1999 the top five South African supermarket chains had a total of 1763 stores and a 72.1 percent market share. The other six major chains are Shoprite, Pick 'n Pay,

Woolworths, Spar, Massmart, and Metro Cash and Carry (Metcash) with the last two performing both retail and wholesale functions (Louw et al., 2007). Supermarkets are spreading quickly in developing countries, the take-off is driven by an avalanche of foreign direct investment (Reardon and Hopkins, 2006), and as such South African supermarkets have expanded their operations into foreign countries and are beneficial to small-scale farmers in those host countries. South African supermarkets expand their market share in foreign countries through buying other supermarkets, franchising, and forming partnerships with other supermarket chains (Emongor and Kirsten, 2009).

The South African retail trade environment in townships and rural areas was dominated by small, mainly informal, business traders offering basic products to a low-income consumer market. Now of late, South African townships are emerging as the new markets for national retailers, especially supermarket chains. The increasing movement of formal retailers into previously untapped middle-and low-income markets has increased shopping center development in townships (Tustin and Strydom, 2006).

## **2.2. Customer service**

According to Andreassen and Olsen (2008), customer service comprises creating and delivering the service in the customer's presence, providing information, making reservations, and receiving payment. It is an element of the retailer's market offering that takes place in all phases of a service's life cycle in the pre-purchase phases (e.g. providing information to make a better decision or training customers in using the service), during the purchase (e.g. front-line employees service mindedness, skills, and competences when attending and responding to customer needs) and post-purchase (e.g. providing information about usage, honoring guarantees or providing repair and spare parts). Customer service is the provision of service to the customers before, during, and after a purchase (Dhammi, 2013). It is all about the retailer activities that increase the value received by consumers when shopping. Customer services are tangible or intangible value increasing activities that are related to products or services directly or indirectly to meet customer expectations and finally to provide customer satisfaction and loyalty (Kursunluoglu, 2014).

The customer service process is defined as structured sets of work activities that lead to specified business outcomes for customers (Setia, Venkatesh, and Joglekar, 2013) which can be categorized into three tiers. The first tier is reliability, which means performing the basics well. The second tier is resilience or the ability to respond to failures of the customer service systems. The third tier is referred to as creativity or innovation. Creativity means developing value-added programs for customers such as direct store delivery or packaging innovations (Theodoras, Laios, and Moschuris, 2005). Elements of customer service comprise all the external factors that incite the consumer's mind. The interpretation of the individual elements of Customer service is considered a cognitive activity that involves interpretation within established schemata in memory that are based on existing knowledge structures (Marx and Erasmus, 2006). Customer service can be measured in many dimensions such as service empathy, access time, and courtesy of staff but this study will consider the main dimension of service quality, service speed, and responsiveness (Hassan, 2013).

Customer service has become a dominant objective for retail managers. In this competitive world, high levels of service have become a minimum requirement for establishing and maintaining a presence in the market (Schary, 1992). It is how the retailer

would like to have the services perceived by customers, employees, and shareholders. It is also referred to as the retailer's business proposition or customer benefit package, things that provide benefit and value to the customer (Goldstein, et al., 2002). Customer service is seen as another source of competitive advantage with greater revenue-generating potential among retailers (Sade, Bojei, and Donaldson, 2015). Fallah (2011) affirms that customer service is a competitive means that differentiate retailers. Customer service greatly affects customer satisfaction and loyalty, which results in the organisation's profitability. Therefore, providing satisfactory service levels to customers must be the priority for any retailer. Providing high service levels is costly, so it is important to set service levels cost-effectively.

### **3. ROLE AND BENEFITS OF GOOD CUSTOMER SERVICE**

In today's competitive retail environment, retailers must understand the importance of consumer services. For retailers to be successful, retailers should develop a culture that embraces service ideologies, thus encouraging the retention and growth of their customer base (Beitelspacher, Richey & Reynolds, 2011). Investing time and resources to satisfy customer's perceptions and expectations show the retailer's orientation to develop a long-term relationship with customers, which, in turn, encourages the customers to stay in that relationship and sets an expectation of reciprocation. When a retailer makes any kind of relationship investment for customers, it creates a favorable impression in the minds of customers (Deb, 2014) and pays off because it creates true customers who are like annuities, they keep pumping revenues into an organization (Kimani et al., 2012).

As observed by Bouzaabia, Bouzaabia, and Capatina (2013), retailers must understand the needs of customers and provide them with the highest value. A certain number of factors contribute to the customers' experience: comfort, product availability, the delivery, the return policy to satisfy the customer, and consequently to guarantee loyalty. If the customer's needs are unmet, the effects of dissatisfaction can quickly multiply. The consumer may go to another store, enjoy another retail experience, and complain about the earlier negative experience. Retailers that have recognized and implemented several customer services programs have derived benefits including increased customer satisfaction, customer retention, customer loyalty, and positive word-of-mouth, increasing opportunities for cross-selling, employee benefits, improved corporate image, profit gains, and financial performance (Kumar, Shivashankar & Manjunath, 2012).

Customer service is an important means for retailers to gain a competitive advantage, customers who are satisfied tend to return for future business and sometimes assist in marketing service organization through word-of-mouth (Hassan, 2013). Good customer service can significantly influence store loyalty, customer satisfaction (Hirogaki, 2014), high revenues, increased customer retention and leads to repeat customer purchase behaviour which ultimately increases the market share of the retailer (Ramakrishnan & Ravindran, 2012). Generally, good customer service enhances customer trust and satisfaction with the retailer. Customers may be more willing and intend to do something beneficial to the strategic health of the retailer as a result, customer loyalty will gradually form. It is believed that positive perceptions of customer service increase the chance of customers being involved in supporting the firm and developing loyalty behavior (Yuen & Chan, 2010).

Hassan (2013) concludes that customer service could aid a retailer in continually satisfying its customers and lead to increase sales growth and employee growth. Hence, customer service acts as a driver of organizational growth.

#### **4. OBJECTIVES**

This study aims to determine and evaluate customer service undertaken by independent food chains in KwaZulu-Natal and the applicability of any strategies thereof. To accomplish the primary objective, several secondary objectives have to be met, namely:

- To assess retail service quality in independent retail food chains; and
- To assess the level of customer satisfaction from services offered by independent retail food chains;
- To identify what customers, perceive to be their key influential factors of retail customer service;

#### **5. METHODOLOGY**

The target population was all customers of independent food chains in the Kwa Zulu Natal. A total of 444 useable responses were gathered.

The study engaged both qualitative and quantitative interviews to gather data from customers. The researcher constructed an interview schedule that listed all the questions that were asked. A funneling approach was adopted, whereby questions were arranged to start from broad questions and gradually leading to more focused questions (Tofade Haines and Elsner, 2013), to allow the respondents to gradually adapt to the line of the questioning. The Interviews were recorded on an audio-tape and responses were recorded with notes taken during the interviews which both formed part of the raw data that was analyzed.

Responses were recorded coded, and analyzed using a qualitative research software (NVivo) and SPSS for quantitative responses. NVivo helped to manage, shape, and make sense of unstructured information, it reduced a great number of manual tasks and gave the researcher more time to discover tendencies, recognize themes and derive conclusions (Hilal and Alabri, 2013).

#### **6. ETHICAL CONSIDERATION**

Along with the request to cooperate in the study, participants being customers and retail managers were provided with an explanation of the purpose, outline, and ethical considerations of the study in writing and verbally. It was explained and emphasized that participation in the study was voluntary, that agreeing to be interviewed was taken as consent to participate in the study, and that the anonymity of the respondents would be protected. Furthermore, all of the processes involved in this study were conducted following the research plan as approved by the ethics committee of the Faculty of Management Sciences, Durban University of Technology. Ethical clearance was obtained as per regulations of the university before recruitment of participants, as ethics in research do not solely rest upon the relationship between the researcher and participants but upon the wider research community (Miller and Brewer, 2003), and participants were also

entitled to withdraw their participation from the study at any point (Jirojwong, et al., 2014: 70).

## **7. RELIABILITY**

Reliability pertains to the consistency of scores (Ritter, 2010), dependability, and replicability of the results obtained from a piece of research (Zohrabi, 2013), and the extent to which results are consistent over time (Bashir, Afzal, and Azeem, 2008). Sekaran and Bougie (2013) further postulate that the reliability of a measure indicates the extent to which it is without bias (error-free) and, hence, ensures consistent measurement across time and the various items in the instrument. In other words, the reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the goodness of a measure.

To provide a measure of the consistency and validity, Cronbach's alpha was used as an important measure of reliability (Tavakol and Dennick, 2011), as it is a test reliability technique that requires only a single test administration to provide a unique estimate of the reliability for a given test (Gliem and Gliem, 2003). Cronbach's alpha measured how well a set of items (or variables) measured a single one-dimensional latent construct (Hussain, 2012), and the interrelatedness of a set of items (Grau, 2007).

## **8. DATA ANALYSIS AND DISCUSSION OF FINDINGS**

All the data in the sections below were statistically analyzed in an attempt to determine and evaluate customer service undertaken by independent food chains in KwaZulu-Natal. The research instrument consisted of 82 items, with a level of measurement at a nominal or an ordinal level. The questionnaire was divided into 7 sections which measured various themes as illustrated below:

### **Biographical data**

1. The physical aspects of independent food chains
2. The reliability of services provided by independent food chains
3. Personal interaction with independent food chains
4. Problem-solving at independent food chains

The results were presented in descriptive and inferential statistics. The descriptive statistics were in the form of graphs, cross-tabulations, and other figures for the quantitative data that was collected. Inferential techniques include the use of correlations and chi-square test values; which are interpreted using the p-values.

## **9. DEMOGRAPHIC INFORMATION OF THE RESPONDENTS**

This section summarises the biographical characteristics of the respondents. In total, 500 questionnaires were despatched and 444 were returned, which constituted a response rate of 88.8%. Respondents were described in terms of the following demographic characteristics: age and gender (Table 1), educational qualification (Fig. 1), and the frequency of their shopping (Table 2). Respondents were mainly females (64.0%), with males constituting (36.0%). The results are in line with observations by Dholakia (1999) who observed that women enjoyed going shopping more than men and that shopping is still considered a gendered activity with women assuming primary responsibility for

household grocery shopping. Overall, the ratio of males to females is approximately 1:2 (36.0%: 64.0%) concluding that women are the predominant shoppers.

In terms of age group, 29.5% of respondents were between 18–29 years old; 25.0% were between 30–40 years old, 27.5% were between 41–55 years old and 18.0% were between 56–65 and above years old. It is worth noting that in the age category of 30–40 years, 37.8% were male. Within the category of males (only), 26.3% were between the ages of 30 to 40 years. This category of males between the ages of 30 to 40 years formed 9.5% of the total sample.

In terms of the frequency respondents going shopping, 36.0% shopped once a week, 33.8% shopped twice a week, and 30.2% shopped thrice or more in a week. It is worth noting that two-thirds (50.5%) of the respondents reported that the choice of the store they shopped was influenced by the prices offered by the retailer as outline in (Table 3), and 19.8% of them indicated that complementary services such as ATM terminals, parking, and toilets were the best service offered by the store as illustrated in (Table 4).

Table 1. The overall gender distribution by age

			Gender of Male	respondents Female	Total
Age in years	18-29	Count	49	82	131
		% within Age in years	37.4%	62.6%	100.0%
		% within Gender of respondents	30.6%	28.9%	29.5%
		% of Total	11.0%	18.5%	29.5%
	30-40	Count	42	69	111
		% within Age in years	37.8%	62.2%	100.0%
		% within Gender of respondents	26.3%	24.3%	25.0%
		% of Total	9.5%	15.5%	25.0%
	41-55	Count	39	83	122
		% within Age in years	32.0%	68.0%	100.0%
		% within Gender of respondents	24.4%	29.2%	27.5%
		% of Total	8.8%	18.7%	27.5%
56-65 and above	Count	30	50	80	
	% within Age in years	37.5%	62.5%	100.0%	
	% within Gender of respondents	18.8%	17.6%	18.0%	
	% of Total	6.8%	11.3%	18.0%	
Total	Count	160	284	444	
	% within Age in years	36.0%	64.0%	100.0%	
	% within Gender of respondents	100.0%	100.0%	100.0%	
	% of Total	36.0%	64.0%	100.0%	

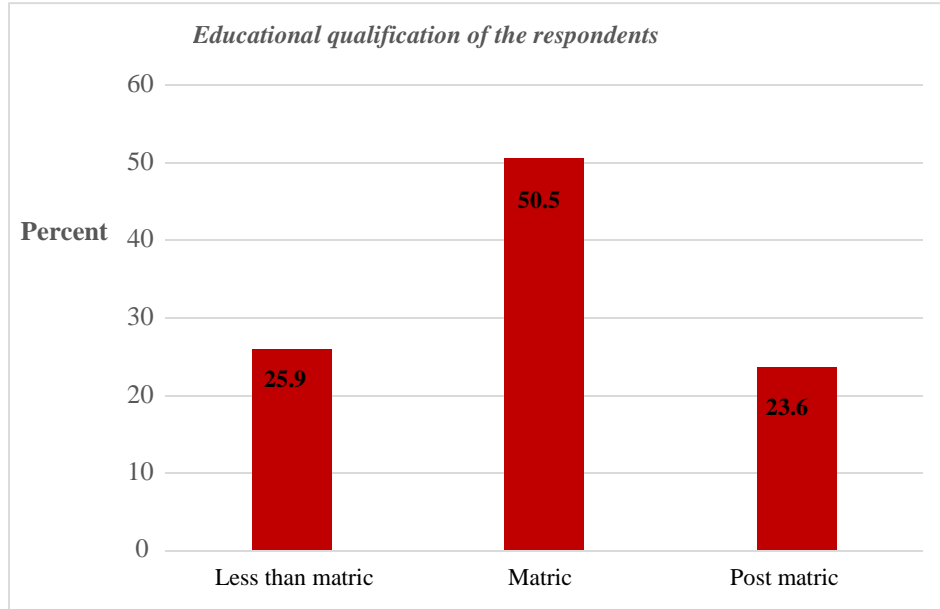


Fig. 1. Educational levels of the respondents

Fig. 1 depicts that 25.9% of the respondents had less than a matriculation certificate, while 50.5% of respondents do hold a matriculation certificate and 23.6% of the respondents had post matriculated. Therefore, the majority of the respondents (50.5%) had a matric qualification. It can, therefore, be concluded that the majority of customers of independent food chains in KwaZulu-Natal have higher education.

Table 2. Frequency of shopping

	Frequency	Percent
Once a week	160	36.0
Twice a week	150	33.8
Thrice and more	134	30.2
Total	444	100.0

Illustrated in Table 2, 36% of respondents indicated that they did their shopping once in a week, 33.8% of them did their shopping twice in a week and 30.2% did shopping thrice and more in a week. The results imply that the majority of customers visit independent food chains in KwaZulu-Natal more than twice in a week. Maruyama and Trung (2009) also observed a similar trend in Vietnam and concluded that almost all supermarket consumers shop at least five or six times a week or every day or even more.

Table 3. Key factors that influence store choice by customers

	Frequency	Percent
Prices offered by the retailer	252	56.8
Convenience of the store	101	22.7
Services offered by the store	53	11.9
Other	38	8.6
Total	444	100.0

As exemplified in Table 3 above, the majority of respondents indicated that price is the key influencer on their store choice, followed by the convenience of the retailer, and services offered by the retailer. Munnukka (2008) further supports the finding that price is an important element that affects store choice. Other influencers of the store as noted by Sinha and Banerjee (2004) are the prices offered by the store, nature, and quality of product and service, and customer proximity of residence to the store. It is therefore apparent that the majority of customers shop at independent food chains because of the prices they offer and convenience.

Table 4. Factors that describe good customer service offered by retailers

	Frequency	Percent
Helpfulness of store staff	81	18.2
Complementary services offered by the retailer (ATM terminal, parking, and toilets)	88	19.8
Appearance of store (cleanness, good product display, and presentation)	84	18.9
Store operating hours (Extended hours)	57	12.8
Facilities for shoppers with special needs (physical handicapped, wheelchaired or translators)	45	10.1
Ability by the retailer to offer customers credit	40	9.0
Providing wide product assortments	49	11.0
Total	444	100.0

Customers were then again asked to rank what they would consider good customer service offered by independent food chains. Complementary services offered by the retailer which few include ATM terminals, parking and toilets constituted 19.8%, the



appearance of the store made 18.9%, helpfulness of store staff 18.2%, store operating hours 12.8%, product assortment 11%, facilities for shoppers with special needs (physical handicapped, wheelchair or translators) 10.1% and ability by the retailer to offer customers credit constituted 9%. It is worth noting that majority of customers perceived complementary services offered by retailers to be good customer service practices. It is therefore recommended that independent food retailers further adjust their setting and offer more complimentary service to allure more consumers into the unplanned purchase, thus boosting the sale volume and profits. Retailers should further place more attention on keeping the fresh and healthy shopping atmosphere as this will entice consumers to stay longer and become more loyal to the retailer (Cho, Ching, and Luong, 2014).

### 10. PHYSICAL ASPECT OF INDEPENDENT FOOD CHAINS

A large proportion of the respondents (60.8%) disagreed that the merchandise of related products is shelved together. Similarly, and as shown in Table 7, 54.7% of the respondents disagreed that the independent store has modern-looking equipment and fixtures, while 50.0% of them also disagreed that the physical facilities at the store are visually appealing. It was no surprise that the majority of the respondents (40.8%) disagreed that materials associated with the independent store's services such as shopping bags, catalogues, or statements are visually appealing.

40.8% of the respondents disagreed that the store layout makes it easy for customers to find what they need, and 45.9% of them equally disagree that the store layout makes it easy for customers to move around in the store. This may be related to the general ergonomic layout of the independent food chain stores. As was observed that 50.0% of the respondents disagree that the stores' ventilation system is satisfactory, and 53.4% of them also disagree that the store can handle a lot of people. In contrast, the majority (50.2%) of the respondents, agreed that the stores provide appropriate lighting.

In general, a noteworthy attribute of the respondents' description of the physical aspects of the independent stores was that majority of their opinions were negative with the average level of disagreement indicated as 47.9% (Figure 2). This was further expressed by the majority of the respondents who disagreed that the stores provide directional signs to merchandise and departments (51.1%); the store provides parking facilities (57.2%); the store has clean, attractive, and convenient public areas (48.8%); and the store offers online shopping or mobile application (62.4%).

Table 5. Respondents scoring pattern on the physical aspect of independent food chains

	Agree		Uncertain		Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %
I encounter problems with merchandise display in this store	250	56.3%	100	22.5%	94	21.2%
The merchandise of related products is shelved together.	138	31.1%	36	8.1%	207	60.8%
This store has modern-looking equipment and fixtures.	144	32.4%	57	12.8%	243	54.7%

Table 5 (cont.). Respondents scoring pattern on the physical aspect of independent food chains

	Agree		Uncertain		Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %
The physical facilities at this store are visually appealing.	137	30.0%	85	19.1%	222	50.0%
Materials associated with this store's services (such as shopping bags, catalogues or statements) are visually appealing.	140	31.5%	123	27.7%	181	40.8%
The store layout at this store makes it easy for customers to find what they need	149	33.5%	91	20.5%	204	45.9%
The store layout at this store makes it easy for customers to move around in the store.	155	34.9%	81	18.2%	208	46.8%
The store's ventilation system is satisfactory.	149	33.6%	71	16.0%	224	50.5%
The store provides appropriate lighting.	223	50.2%	89	20.0%	132	29.7%
The store can handle a lot of people.	123	27.7%	84	18.9%	237	53.4%
The store provides directional signs to merchandise and departments	141	31.8%	76	17.1%	227	51.1%
The store provides parking facilities.	99	22.3%	91	20.5%	254	57.2%
This store has clean, attractive, and convenient public areas (toilets).	147	33.1%	89	20.0%	208	46.8%
The store offers online shopping or mobile application.	94	21.2%	73	16.4%	277	62.4%

## 11. RELIABILITY OF SERVICES PROVIDED BY INDEPENDENT FOOD CHAINS

With regards to the respondents' perceptions of the reliability of services provided by the independent food chain stores, results were statistically different. A point deserving mentioning is that majority (57.9%) of the respondents agreed that an independent food chain store has merchandise available when customers want it.

Table 6. Reliability of service provided by independent food chains

	Agree		Uncertain		Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %
When this store promises to do something by a certain time, it will do so.	109	24.5 %	87	19.6 %	248	55.9 %
This store provides its services at the time it promises to do so.	126	28.4 %	52	11.7 %	266	59.9 %
This store performs the service right the first time.	145	32.7 %	49	11.0 %	250	56.3 %
This store has merchandise available when customers want it.	257	57.9 %	38	8.6%	149	33.6 %
This store insists on error-free sales transactions and records.	162	36.5 %	61	13.7 %	221	49.8 %
The store does promote its product offerings.	238	53.6 %	70	15.8 %	136	30.6 %

## 12. PERSONAL INTERACTION WITH INDEPENDENT FOOD CHAINS

On the issue of customer's interactions with the independent food chains, the majority of the respondents were in disagreement that employees in the store know to answer customer's questions (59.2%); that the behavior of employees in the store instills confidence (50.7%); employees in the store give prompt service to customers (54.1%); employees in the store tell customers exactly when services will be performed (39.2%); employees in the store are never too busy to respond to customers request (53.6%); the store gives customers individual attention (54.1%); employees in the store make customers feel important and appreciated (52.9%); employees in the store have a positive attitude, helpful, and friendly towards customers (51.6%); employees in the store are consistently courteous with customers (53.4%); employees in the store understand customers' needs and want (50.9%), and employees in the store go an extra mile to make customers shopping experience enjoyable and memorable (51.6%). Despite the negative agreement on customers' interaction with independent food chains, it was worth noting that the majority (49.1%) of the respondents agreed that customers feel safe in their transactions with the store, while (47.1%) of them also agreed that employees in the store are readily available and accessible to help the customers.

Table 7. Personal interaction with independent food chains

	Agree		Uncertain		Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %
Employees in this store know to answer customers' questions.	106	23.9%	75	16.9%	263	59.2%
The behavior of employees in this store instills confidence in the customer.	125	28.2%	94	21.2%	225	50.7%
Customers feel safe in their transactions with this store.	218	49.1%	47	10.6%	179	40.3%
Employees in this store give prompt service to customers.	136	30.6%	68	15.3%	240	54.1%
Employees in this store tell customers exactly when services will be performed.	157	35.4%	113	25.5%	174	39.2%
Employees in this store are never too busy to respond to customers' requests.	125	28.2%	81	18.2%	238	53.6%
These stores give customers individual attention.	130	29.3%	74	16.7%	240	54.1%
Employees in this store make customers feel important and appreciated.	142	32.0%	67	15.1%	235	52.9%
Employees in this store have a positive attitude, helpful, and friendly towards customers.	148	33.3%	67	15.1%	229	51.6%

Table 7 (cont.). Personal interaction with independent food chains

	Agree		Uncertain		Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %
Employees in this store are consistently courteous with customers.	133	30.0%	74	16.7%	237	53.4%
Employees in this store understand customers' needs and want.	144	32.4%	74	16.7%	226	50.9%
Employees in this store are readily available and accessible to help customers.	209	47.1%	69	15.5%	166	37.4%
Employees in this store go the extra mile to make customers' shopping experience enjoyable and memorable.	127	28.6%	88	19.8%	229	51.6%

### 13. PROBLEM-SOLVING AT INDEPENDENT FOOD CHAINS

With regards to problem-solving abilities at the independent food chains, 50.9% of the respondents believe that when a customer has a problem, the store does not show a sincere interest in solving it. Similarly, 51.6% of them believed that the employees at independent food chain stores cannot handle customer's complaints directly and immediately. As such, it was understandable that 45.5% of the respondents disagreed that employees resolve customer's complaints speedily, efficiently, and fairly. This is concerning, particularly as 45.0% of the respondents think that the stores do not seek customer's opinions and suggestions. Overall, there was a general disagreement amongst the respondent on the problem-solving abilities of independent food chain stores with the level of disagreement given as 45.65%. Notwithstanding this, and in terms of the accessibility of the independent food chain stores, 46.2% of the respondents are in agreement that the store is easily accessible.

Table 8. Respondents scoring pattern on problem-solving at independent food chains

	Agree		Uncertain		Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %
This store offers high-quality merchandise.	125	28.2%	142	32.0%	177	39.9%
When a customer has a problem, this store shows a sincere interest in solving it.	143	32.2%	75	16.9%	266	50.9%
Employees resolve customers' complaints speedily, efficiently, and fairly.	175	39.4%	67	15.1%	202	45.5%
The store does seek customers' opinions and suggestions.	141	31.8%	103	23.2%	200	45.0%
The store is easily accessible.	205	46.2%	58	13.1%	181	40.8%

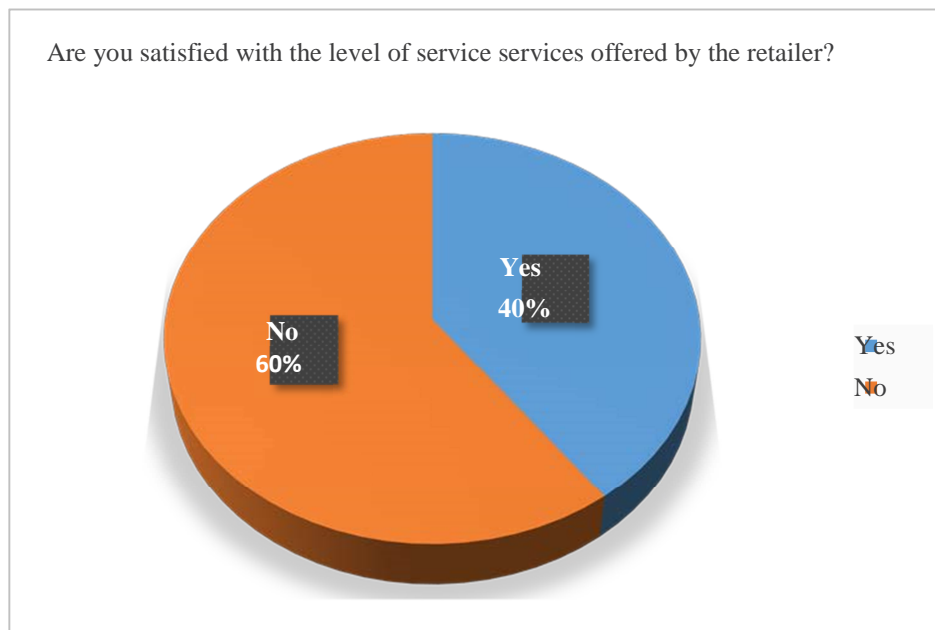


Fig. 2. Customer's satisfaction of service received from the retailer

Figure 2 depicts customers' satisfaction levels with services received from independent food chains. 60% of the respondents were not satisfied with the level of service they received from independent food chains, while 40% of the respondents were satisfied. Similar trends of results were also observed by Grzeskowiak, Sirgy, Foscht, and Swoboda (2016) and they recommend that retailers may, for example, structure assortments around different shopper lifestyles and also retail services and the presentation of products could be used to reinforce the connection between the retail experience and shopper identity.

#### **14. RECOMMENDATIONS**

The study concludes by recommending that independent retail food chains study their customer profiles as it was evident during interviews that customer profiling or segmentation was not undertaken in detail; retailers are edged to identify and establish customer service needs and requirements so as to facilitate proper product and service mix design; retailers are also recommended to keep regular communication with customers to inform them about promotions or any new developments taking place; retailers should introduce customer loyalty programs; provide regular staff training on customer service continuously through workshops and follow-up refresher courses; retailers should offer quality merchandise and incorporate latest technological innovations; handle and process third party payment; meet and exceed customer service expectations of customers; upgrade their facilities to accommodate customers with disabilities; and finally retailers should have well defined returns policy, parking facilities, restrooms and introduce trolleys with baby seating facility

#### **15. FUTURE RESEARCH**

It is recommended that other studies using a survey and observation method be done that will explore and discover, in-depth, more about retail customer service. It was also noted that some respondents needed to say more about customer service and service quality but the questionnaire was not designed in a manner that allowed them to elaborate. Therefore, further research is recommended.

It is further recommended that other studies of a similar nature be undertaken or extended to other provinces as this would be of great benefit to the South African retail sector. This type of researches could enable independent retail food chains to learn more from one other or provide a platform to share good and best practices.

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## LEGAL CONDITIONS FOR CYBERSECURITY OF THE ENERGY SECTOR

The aim of this paper is to review selected legislative acts governing the protection of the energy sector in terms of cybersecurity. The energy supply system is an area increasingly dependent on IT solutions. Rapid technological progress, interconnectedness between sectors, digitization and automation of energy networks, and finally the construction of the so-called smart networks increase the amount of data collected and, consequently, the need for computerization. Computerization of electricity business exposes the energy system to cyberattacks and incidents that can compromise security of energy supply. We are seeing increased sensitivity of energy infrastructure, and this requires a proper assessment of all threats, including cybersecurity threats, and the creation of tools to prevent and minimize the impact of identified threats.

**Keywords:** cybersecurity, cyber incidents, energy sector, ENISA

### 1. INTRODUCTION

The energy sector is one of the first industries that began to use various control solutions on a larger scale, and is currently one of the most computerized. OT (Operational Technologies) systems responsible for monitoring and controlling technological processes play a key role in entities in this sector – such as SCADA (Supervisory Control and Data Acquisition), DMS (Distribution Management System) and EMS (Energy) Management System) in the case of energy. Production installations (e.g. power units at power plants or installations at refineries) are controlled in turn by means of DCS (Distributed Control System) solutions which are comprehensive integrated systems responsible for controlling and visualizing the industrial process. Currently, the energy network is an extensive system of cooperating industrial facilities, consisting of a huge number of computers connected to the network. This significantly increases its vulnerability to cyber attacks. The cyber attack on the Ukrainian power system, which took place on December 23, 2015 is considered to be the first known effective cyber attack on electrical networks. Hackers successfully hacked into the computer systems of three Ukrainian distribution companies and temporarily disrupted the supply of electricity to consumers (Gapiński, 2016).

Attacks on IT systems and automation controlling energy infrastructure are one of the key identified threats that affect the level of national security. Energy networks are

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interconnected, violating their security may have a cascading effect on other sectors of the economy (European Commission, 2013). A cyberattack on energy infrastructure facilities can have catastrophic consequences not only for property, health of employees, but also for the environment, the entire economy, or even the national security. Given the nature of activities in cyberspace and its aterritorial nature, there is a need for cooperation at transnational level in the field of prevention of electricity crises and crisis management, as they cannot be considered as a purely national task. In this regard, a number of important legislative actions are taken in the European Union. Initially, EU activities in the field of cyberspace protection focused on protecting users, combating illegal content, promoting security activities (European Parliament&Council, 2005), protecting personal data, privacy and consumer rights (European Commission, 2009), and securing the interests of end users of electronic services (European Parliament&Council, 2009). Over time, undoubtedly as a result of attacks aimed at power grid operators, large manufacturing companies, oil pipeline operators and equipment suppliers, actions aimed at ensuring cybersecurity in the energy sector were taken at the EU forum (European Parliament, 2016).

## **2. MAIN ACTS OF EU LAW ON CYBERSECURITY IN THE ENERGY SECTOR**

The first element of the Union's horizontal cybersecurity legislation, developing national cybersecurity capabilities, increasing cooperation at EU level and introducing security obligations and reporting incidents on companies called 'key service operators' is Directive (EU) 2016/1148 of the European Parliament and of the Council of July 6, 2016 on measures for a high common level of security of network and information systems within the Union – the so-called NIS Directive. This document provides for the implementation of cyber security preparedness measures by designated entities, taking into account horizontal guidelines issued by the cooperation group on network and information security established pursuant to Art. 11 of the Directive on network and information security. This cooperation group, composed of representatives of the Member States, the European Union Agency for Cybersecurity (ENISA) and the Commission, has adopted guidelines on security measures and incident reporting. The EU NIS-Directive includes critical sectors in the energy industry, transport, banking, financial market infrastructure, the healthcare sector, drinking water supply and distribution centers and digital infrastructure.

In June 2018, the Network and Information Security Cooperation Group created a special energy intervention area. The activities of EU bodies and institutions aim to ensure that all processes, services and devices connected to the network meet the highest cyber security criteria. This postulate is to be served by the EU certification system, created under the supervision of ENISA. The European certificate is to guarantee that smart devices have been designed with attention to cyber security. A review of the implementation of the NIS directive in individual member states is planned for 2021.

Within Commission Recommendation (EU) 2019/553 of 3 April 2019 on cyber security in the energy sector, the Commission identified the main actions to implement appropriate cyber security preparedness measures in the energy sector. The document indicates the need to expand knowledge and skills related to cyber security in the energy sector. Member States should integrate these issues into their national cybersecurity frameworks, in particular in strategies, laws and regulations. Member States' actions

should aim to ensure that energy network operators and technology providers, in particular key service operators, implement appropriate cyber security related preparedness measures related to real-time requirements in the energy sector. Power grid operators should first and foremost apply the latest security standards for new installations and consider complementary physical security measures when the functioning base of old installations is not sufficiently protected by cybersecurity mechanisms. It was also recommended to implement international cybersecurity standards and relevant specific technical standards for secure real-time communication as soon as relevant products become available on the market, and to include real-time limitation in the overall concept. The Commission indicated that private networks should be considered for IT protection systems to ensure the level of quality of service required for real-time restrictions. When using public communications networks, operators should consider ensuring special bandwidth allocation, delay requirements and security measures for communication. The Commission recommends dividing the entire system into logical zones and specifying time and process restrictions for each of the zones in order to enable appropriate cyber security measures or alternative protection methods to be taken into account. The document indicates that Member States should ensure the implementation of appropriate cyber security preparedness measures related to cascading effects in the energy sector. Power grids and gas pipelines are strongly interconnected throughout Europe, and a cyber attack leading to shutdowns or disruptions in part of the energy system can cause far-reaching cascading effects in other parts of the system. In addition, the need to implement appropriate cyber security preparedness measures related to the combination of existing and state-of-the-art technology in the energy sector was emphasized.

Cybersecurity of energy systems is primarily about securing intelligent networks. Their progressing creation is also associated with the implementation of fifth generation (5G) network technologies as one of the most important factors contributing to the development of future digital services and the priority of the digital single market strategy. Due to the dependence of many critical services on the 5G network, the consequences of systemic and widespread interference would be particularly severe. As a result, ensuring 5G cybersecurity is a strategic issue for the Union at a time when cyberattacks are gaining momentum and are becoming more sophisticated. In Commission Recommendation (EU) 2019/534 of 26 March 2019 on Cybersecurity of the 5G network, the Commission adopted an action plan for the 5G network so that the EU could have by 2020 the telecommunications infrastructure necessary to carry out its digital transformation. To this end, Member States should assess the 5G network infrastructure for risk, including the most sensitive components whose security breach would have a significant negative impact. Member States should also review the security requirements and risk management methods applicable at national level to identify threats to cybersecurity arising from technical factors (specific technical parameters of the 5G network) and other factors such as the legal framework and policy framework, to which suppliers of information and communication equipment in third countries are subject.

Another important document for cybersecurity in the energy sector is Regulation (EU) 2019/881 of the European Parliament and of the Council of 17 April 2019 on ENISA and the certification of cybersecurity in the field of information and communication technologies and the repeal of Regulation (EU) No 526/2013 (Cybersecurity Act). The Regulation significantly strengthened the mandate of the European Union Agency for Cybersecurity in supporting Member States in combating cybersecurity threats and

cyberattacks. This act provides the basis for the creation of a European framework for the certification of cybersecurity for products, processes and services in force throughout the Union, which is of particular importance for the energy sector.

Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on preparedness in the electricity sector and repealing Directive 2005/89/EC lays down common rules on how to prevent, prepare and manage electricity crises. It requires Member States to increase transparency during the preparation phase and during the electricity crisis and to ensure the efficiency and coordination of the actions taken. The Regulation points to the need to properly identify the risks arising from cyber incidents and to adequately reflect the remedies taken to address them in emergency preparedness plans.

Provisions on cybersecurity are also contained in Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market in electricity. It provides that the Commission within the Energy Union is empowered to establish network codes covering m.in. sectoral rules on cybersecurity aspects in cross-border electricity flows, including rules on common minimum requirements, planning, monitoring, reporting and crisis management.

### **3. LEGAL REGULATIONS ON THE CYBERSECURITY OF THE ENERGY SECTOR IN POLAND**

In the Polish legal system, until 2018 the obligation to protect information systems operating in the energy sector stemmed from the provisions on critical infrastructure. The legal definition of critical infrastructure contained in the Crisis Management Act (Art. 3(2) of The Act of 26 April 2007 on crisis management, Journal of Laws of, item 1398.) includes systems and functionally related facilities, including construction facilities, installations, services critical to state security and its citizens and to ensure the proper functioning of public administrations, as well as institutions and entrepreneurs. The entry into force of the Crisis Management Act has created basic mechanisms for organised protection of critical infrastructure and defined the systems that are part of it.

Accordingly to Article 3(4) of the Crisis Management Act is the protection of critical infrastructure that seeks to ensure the functionality, continuity of operations and integrity of critical infrastructure in order to prevent risks, risks or weaknesses and to reduce and neutralise its effects and to rapidly reproduce that infrastructure in the event of failures, attacks and other events interfering with its proper functioning.

Critical infrastructure security programming documents set out a holistic approach to critical infrastructure protection, including: (1) ensuring physical security, a team of organisational and technical activities aimed at minimising the risk of disrupting critical infrastructure following the actions of persons who have attempted to enter or are in critical infrastructure; (2) technical safety assurance – a set of organisational and technical activities aimed at minimising the risk of disruption of critical infrastructure following a disruption of technological processes; (3) ensuring personal security – a set of organisational and technical activities aimed at minimising the risk of disruption of critical infrastructure following the actions of persons who have the right access to critical infrastructure; (4) ensuring ict security, a set of organisational and technical activities aimed at minimising the risk of disruption of critical infrastructure following an unauthorised impact on control equipment and ict systems and networks; (5) ensuring

legal certainty, a set of organisational and technical activities aimed at minimising the risk of disruption of critical infrastructure following the legal actions of external actors; (6) business continuity and playback plans, understood as a team of organisational and technical activities leading to the maintenance and restoration of functions carried out by critical infrastructure (Council of Ministers, 2018).

Critical infrastructure protection tasks are defined in Article 10. 6 and include: collection and processing of information on critical infrastructure threats; developing and implementing procedures in the event of critical infrastructure threats; restoring critical infrastructure; cooperation between public administrations and owners and owners of self-proclaimed and dependent facilities, installations or facilities of critical infrastructure in the field of its protection.

Owners, independent and dependent holders of critical infrastructure facilities, installations or facilities shall be required to protect them, in particular by preparing and implementing, in accordance with the risks envisaged, critical infrastructure security plans and maintaining their own reserve systems ensuring the safety and maintenance of the operation of that infrastructure until it is fully reproduced.

Today, the importance of cybersecurity can be seen as the foundation for the functioning and security of critical infrastructure. This is due to two factors. Firstly, in Poland, ICT networks are one of the systems belonging to critical infrastructure. Secondly, ICT systems are part of different critical infrastructure systems by supporting and often conditioning their proper functioning.

An important step in the construction of cybersecurity was the adoption of the Law of 5 July 2018 on the national cybersecurity system, which implements the so-called "cybersecurity system". Network and Information Systems Directive (NIS), on network and information security, providing the basis for the creation of a national cybersecurity system (NCS). The national cybersecurity system includes: 1) key service operators; 2) digital service providers; 3) CSIRT MON; 4) CSIRT NASK; 5) CSIRT GOV; 6) sectoral cyber security teams; 7) public finance sector entities referred to in art. 9 points 1–6, 8, 9, 11 and 12 of the Act of 27 August 2009 on public finance (Journal of Laws of 2017, item 2077 and of 2018, items 62, 1000 and 1366); 8) research institutes; 9) National Bank of Poland; 10) Domestic Holding Bank; 11) Office of Technical Inspection; 12) Polish Air Navigation Services Agency; 13) Polish Center for Accreditation; 14) National Fund for Environmental Protection and Water Management and voivodship funds for environmental protection and water management; 15) commercial law companies performing public utility tasks within the meaning of art. 1 clause 2 of the Act of 20 December 1996 on municipal economy (Journal of Laws of 2017, item 827 and of 2018, item 1496); 16) entities providing cybersecurity services; 17) competent authorities for cyber security; 18) Single Contact Point for cyber security, hereinafter referred to as the "Single Contact Point"; 19) Government Representative for Cyber Security, hereinafter referred to as "Representative"; 20) College for Cybersecurity, hereinafter referred to as "College", whose composition and operating principles are specified in the Regulation of the Council of Ministers of October 2, 2018 regarding the scope of operation and the mode of work of the College for Cybersecurity. The creation of the NCS is intended to ensure the unimpeded provision of key services and incident handling by achieving an adequate level of security for information systems for the provision of those services. The NIS Directive is an example of minimum harmonisation. The Polish legislature has taken advantage of the possibility of more detailed regulation.

The Act introduced an obligation for key service providers, digital service providers and public entities to report incidents (Banasiński, Rojszczak, 2020). The legislator has designated three Computer Security and Incident Response Teams (CSIRTs – a team of IT security experts whose task is to respond to incidents and provide services aimed at ensuring IT security and the possibility of resuming operations after removing the threat.) of a national level with a clearly established range of responsibility. The cooperation mechanisms of the three CSIRTs of the national level in case of the critical incidents and the rules for the supervision of operators of essential services in the various sectors of the economy, who are responsible for identifying operators (on the basis of an administrative decision), preparing recommendations for actions that will strengthen the cybersecurity of the sector, supervision of operators in a given sector, participation in exercises and processing of personal data necessary for the performance of tasks. The key service operator is required to ensure that at least every two years, an audit of the security of the information system used to provide the key service is carried out. The audit may be carried out by: a conformity assessment body accredited in accordance with the provisions of the Act of 13 April 2016 on conformity assessment systems and market surveillance (Journal of Laws of 2017, item 1398 and of 2018, item 650 and 1338), to the extent appropriate for undertaken security assessments of information systems; at least two auditors holding: a) certificates specified in the provisions of the Regulation of the Minister of Digitization of October 12, 2018 on the list of certificates authorizing to conduct an audit (including: Certified Internal Auditor; Certified Information System Auditor; Auditor's certificate the leading in-formation security management system according to PN-EN ISO / IEC 27001 issued by a con-formity assessment body accredited in accordance with the provisions of the Act of 13 April 2016 on conformity assessment systems and market surveillance (Journal of Laws of 2017, item 1398 and from 2018, item 650 and 1338), in the scope of certification of persons; Certifi-cate of the auditor of the leading business continuity management system PN-EN ISO 22301 issued by a conformity assessment body accredited in accordance with the provisions of the Act of 13 April 2016 on systems conformity assessment and market surveillance in the field of certification of persons; Certified Information Security Manager (CISM); Certified in Risk and Information Systems Control (CRISC); Certified in the Governance of Enterprise IT (CGEIT); Certified Information Systems Security Professional (CISSP); Systems Security Certified Prac-titioner (SSCP); Certified Reliability Professional; Certificates entitling to hold the title ISA / IEC 62443 Cybersecurity Expert) or b) at least three years of practice in the field of infor-mation systems security audit, or c) at least two years of practice in the field of audit of in-formation systems security and holding a post-graduate diploma in security audit information systems, issued by an organizational unit which, on the day of issuing the diploma, was entitled, in accordance with separate provisions, to confer a doctoral degree in the economic, technical or legal sciences; sectoral cyber security team, established within the sector or subsector, if the auditors meet the above-mentioned conditions.

It is worth noting the introduction of a formula of a sectoral cybersecurity team, set up by competent authorities, which accepts reports of incidents and helps to handle incidents, but also analyses the impact, develops proposals and cooperates with the relevant CSIRT national level. The Regulation of the Council of Ministers of November 15, 2018 on the types of documenta-tion regarding the cybersecurity of the information system used to provide the key service (Journal of Laws 2018, item 2080), obliges to have documentation



covering normative and operational documentation. The sectoral cybersecurity team can also exchange information about major incidents with other European Union countries.

The Act introduces an obligation to prepare a five-year Cybersecurity Strategy of the Republic of Poland, which sets strategic objectives and appropriate policy and regulatory measures to achieve and maintain a high level of cybersecurity. Strategic and political coordination over the cybersecurity system in Poland is carried out by the Representative and the College for Cybersecurity.

The National Cybersecurity System Act provides for the adoption of a number of implementing acts allowing for the full implementation of its provisions. The Regulation of 10 September 2018 on organisational and technical conditions for cybersecurity service providers and the internal organisational structures of key cybersecurity service providers (Journal of Laws of 2018, item 1780) obliges the cybersecurity service provider to create certain organisational conditions, including:

- 1) to have and maintain an information security management system meeting the requirements of the Polish Standard PN-EN ISO/IEC 27001;
- 2) ensuring the continuity of the incident response service, consisting in taking action in the recording and handling of events affecting the security of information systems in accordance with the requirements of the Polish Standard PN-EN ISO 22301;
- 3) holding and making available in Polish and English a declaration of its policy of action in the scope of the document specified by the Internet Engineering Task Force (IETF);
- 4) provide support to the key service operator 24/7 all days of the year, with response time appropriate to the nature of the key service;
- 5) the disposal of personnel with skills and experience in identifying risks with regard to information systems, (b) analysing the malware and determining its impact on the information system of the key service operator, (c) securing forensic traces for law enforcement proceedings.

The Regulation in question also sets out the minimum standards to be met by technical safeguards adequate to the carried out risk assessment of premises, which are to be at the exclusive disposal of cybersecurity service providers and the internal organisational structures of key cybersecurity service providers. The requirements are also formulated as regards technical equipment, including:

- 1) (a) automatic recording of incident reports, (b) analysis of software code deemed harmful, (c) examination of the resilience of information systems to compromise, (d) securing forensic traces for law enforcement investigations;
- 2) communication measures enabling the exchange of information with the entities for which they provide services and the competent Computer Security Incident Response Team operating at national level.

The Regulation of the Council of Ministers of 11 September 2018 on the list of essential services and materiality thresholds for the disruptive effect of the incident for the provision of essential services (Journal of Laws of 2018, item 1806) sets out a list of the key services and the materiality thresholds of the incident-distorting effect for the provision of key services. Key services in the energy sector have also been grouped by subsectors: mining of mines, (extraction of natural gas, extraction of oil, extraction of lignite, coal mining, copper extraction), electricity (electricity generation, electricity transmission, electricity distribution, electricity marketing, electricity storage, system

services, quality and management of energy infrastructure), heat (heat generation, heat marketing, heat transfer, heat distribution), crude oil (liquid fuel generation, oil transmission, liquid fuel transmission, storage of crude oil, oil transshipment, storage of liquid fuels, transshipment of liquid fuels, marketing of liquid fuels or marketing of liquid fuels from abroad, production of synthetic fuels), gas (production of gaseous fuels, gaseous fuel transmission, marketing of gaseous fuels and marketing of natural gas from abroad, transmission of gaseous fuels, distribution of gaseous fuels, storage of gaseous fuels, liquefaction and regasification of Liquid Natural Gas and importing and loading), supply and services to the energy sector (supply of systems, machinery, equipment, materials, raw materials and provision of services to the energy sector), other services provided by supervised and subordinate entities (production of radiopharmaceuticals, management of radioactive waste, maintenance of strategic reserves and stocks of oil, petroleum and natural gas products, Research & Developments or implementation or technological research for the energy sector).

The Regulation also sets out the materiality thresholds for the disruptive effect of an incident for the provision of a key service, which include the following indicators: the number of users dependent on the key service provided by the entity concerned, the dependence of other sectors on the service provided by that entity, the impact that the incident, in terms of scale and duration, could have on economic and social activities or public security, the share of the principal service provider in the market, the geographical coverage associated with the area to which the incident might be affected, the entity's ability to maintain a sufficient level of provision of a key service taking into account the availability of alternative means of provision, other factors specific to the subsector concerned.

The Regulation of the Council of Ministers of 31 October 2018 regarding the thresholds for recognizing an incident as serious (Journal of Laws of 2018, item 2180) sets out the thresholds for the classification of the incident as serious by type of event in the various sectors and subsectors defined by the National Cybersecurity System Act.

On the basis of the provisions of the Law on the National Cybersecurity System on October 22, 2019 the Council of Ministers adopted a resolution on the Cybersecurity Strategy of the Republic of Poland for the period 2019-2024 (Resolution No. 125 of the Council of Ministers of October 22, 2019 on the Cybersecurity Strategy of the Republic of Poland for 2019–2024, M.P., item 1037). The National Cybersecurity Strategy of the Republic of Poland points to the need to increase the cybersecurity of key and digital services and critical infrastructure, especially with regard to information technology and industrial control systems. Their smooth operation is crucial for the proper functioning of economic sectors, especially the energy sector.

#### **4. CONCLUSION**

The legislator recognises at both EU and national level the importance of the energy sector and takes into account the need to protect it, including its cybersecurity. Changes in Polish legislation will significantly improve the protection of the energy sector against cyberattacks, as, unlike the rules on protection of critical infrastructure, cybersecurity regulations are moving away from the concept of sanction-free protection of key sectors for the functioning of the state, citizens and economy. However, it is important to be aware that the EU and Polish legislators must monitor on an ongoing basis the changes

that are taking place in the cyberspace environment and respond to emerging threats on an ongoing basis.

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