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INNOVATION IN SENIOR TOURISM: CREATING ENERGY EFFICIENT AND HEALTH SUPPORTED TOURIST OFFER

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ABSTRACT

Recent studies show that seniors will soon become one of the major prospective segments in hospitality and travel industry. Given that population aged 65+ is usually retired with pensions, they have leisure time for travelling at any time of the year. They are also the most demanding expecting services excellence and high-level security while at the same time 63% of seniors aged 65-74 reported some sort of chronic illness. Hence, energy-efficient and health-focused facilities can be a significant potential for tourism development in Sarajevo region, which is a popular destination considering its unique nature, rich gastronomic, cultural and historical heritage. However, currently there is no market segmentation tailored to specific needs of senior tourists and research aims to explore opportunities for this type of services with the objective of introducing accommodation facilities for elderly based on eco-smart solutions with highlighted focus on well-being and health. Setting of still water machines and installation of renewable energy system for electricity, ventilation and heat can have various positive effects increasing security, providing more healthy conditions, influencing life expectancy and counteracting the aging. Methodology includes feasibility study of eco-smart and health-oriented facility for seniors while practical implications for future actions are given in the conclusion.

Keywords:
innovation; senior tourism; eco-smart energy; health care; sustainable development

1. INTRODUCTION

Aging of population in majority of nations along with other changes regarding mature population such as socio-demographics, health status and travel behavioral patterns is one of primary reasons for the development of appealing tourism target group that can be referred to as the senior tourists segment, which is nowadays a part of the global tourism and travel industry (Patterson, 2006; Schroder et al., 2007; Nimrod et al., 2010). Abovementioned socio-demographic trends influencing traveling behavior patterns of elderly population are significantly determined by economic factors and social conditions such as the slowing of population and household growth and an increasing segmentation of travel markets implicating the shift from production market to market research and the promotion at smaller target groups, including senior population, such as regional and local marketing (Nedelea et al., 2011). The importance of current and future mature population is explained in several works highlighting the desirability of not limiting tourist offer to the specifications of the elderly consumers today, but also exploring the potential buying patterns and preferences of the future generations in regard to products and services that they will expect and want to buy in the near future while traveling (Tongren, 1988; Littrell et al., 2013).

The improvement in general health condition of older population in the contemporary world society as well as the substantial developments of technology and travel management convenience has produced strategies specifically aimed at the potential activation of tourism which can be expected from the demographics 25-30 years from now. However, nowadays 63% of seniors aged 65-74 reported some sort of chronic illness and recent studies found that activation intervention in the form of traveling is a potentially promising approach to a changing senior population lifestyle that can to some degree improve chronic disease outcomes and in general improve their general health status (Frosch et al., 2010). Travelling can increase one's life expectancy and change daily routine of elderly (Alén et al., 2012). Being active in later stages of life help seniors to improve their mental and physical health. Mostly, they travel for relaxation, socializing and meeting new people, visiting new places and enriching experiences (Fleischer and Pizam, 2002). Specifically, older tourists are motivated to travel for seeking rewards rather than escapism (Le Serre et al., 2013) and thus according Jang and Wu (2006) main push travel motivations for elderly include visiting friends and relatives, health, and rest and relaxation. Taking in consideration what was above mentioned, energy-efficient and health-focused facilities can be a significant potential for tourism development in Sarajevo region, which is a popular destination considering its unique nature, rich gastronomic, cultural and historical heritage. Bosnia and Herzegovina with its capital was always open for tourists from foreign countries which is shown in the tourist's flows, i.e. almost 966.870 tourist visits in 2015 from neighboring Croatia (12,8%) and Serbia (9,4%),

but also other countries including Italy (8,7%), Turkey(8,6%) , Slovenia (5,9%) and Poland (5,2%), (National Agency for Statistics, 2015)[1].

However, currently there is no market segmentation tailored to specific needs of senior tourists in Sarajevo and research aims to explore opportunities for this type of tourism services with an objective of introducing accommodation facilities for elderly based on eco-smart solutions with a highlighted focus on well-being, health and active lifestyle and traveling. The aim is to deepen understanding of senior tourism as a relatively newer concept of tourism and explore opportunities of opening a new tourism facility in Sarajevo region in the form of a feasibility study and strategic plan specially designed for senior tourists. Statistics regarding the subject matter implicate that the segment of population aged 55 and older will increase the overall volume of revenue generated in tourism sector the most compared to other target groups since these elderly adults´ characteristics include broad travel experience, which makes them more demanding customers, but also allowing tourist demand to shift away from peak periods of the year because they are usually retired with pensions and have leisure time for travelling at any time of the year (Alen et al., 2012).

2. METHODOLOGY

Methodology of the paper is based on several descriptive analytical methods, namely PEST concept analysis incorporating the numeric evaluation of factor influence, industry sector analysis including development phase through the life cycle prism and the Porter model aimed at a long-term structural analysis of the particular industry, its attractiveness and profitability, which are further explained in detail. PEST concept represents commonly used analytical approach in consideration of business external environment examining political, economic, social and technological influence and describing a macro factors framework which is an important component of the strategic management environmental scanning (Gupta, 2013). Industry sector analysis consists of the determination of specific industry for which the business is relevant to and its phase of adjustment as well as the Porter model of evaluation of attractiveness and profitability of the segment. Porter model consists of five forces, specifically threat of new entries, negotiation of power of suppliers as well as buyers, substitution possibility and competition analysis is considered as a crucial framework of strategic planning for the business (Jaradat et al., 2013). Application of Porter model is a very helpful business tool in evaluating the company`s environment and deepening business understanding of its core competitive position that extends beyond the current competition threat. Abovementioned analytical methods were selected in order to fulfill the main objective of the research related to exploration of trends in tourism industry

1 Tourism statistics, 9/11, Agency for statistics of Bosnia and Herzegovina (BHAS), http://www.bhas.ba/saopstenja/2016/TUR_2015%20M%2001-11_001_%2001_hr.pdf

that are specific for Sarajevo region and analysis of the possibilities of creating a novel tourist offer in the particular region specially customized to senior population and their customer preferences in regard to socio-demographic perspectives of international travel and tourism industry. Since the nature of analyzed business includes a comprehensive use of eco-smart and health-supporting solutions and technology, concepts of sustainability, efficacy and health are discussed. At the end of the paper, practical implications for future actions are highlighted and explained.

3. RESULTS

The following macro environmental influences that are specific for the potential eco-smart and health-oriented business operating in Sarajevo region were identified (shown below in Table 1.):

Table 1.: Identification of External Environmental Factors - Macro Environment

Political and Legal Factors	**Economic Factors:**
- Political climate/government stability - European Union integration process - Tax administration policy-VAT - Government spending for tourism - Present/future laws in tourism sector	- Gross Domestic Product trends - Inflation rate stability - Interest rate fluctuations - Expenditures - Unemployment rate
Social and Cultural Factors	**Technological Factors**
- Changes in lifestyles of tourists - Habit and behavior changes - Changes in the use of disposable income - Attitudes toward the job responsibilities and leisure time - Educational level	- Use of Information technology in tourism industry such as computer reservation systems (CRS) - Technological advances enabling the efficient use of energy and sustainable development of tourism

Source: Autors'

Political and legal environment: Current political situation is relatively unstable resulting in insufficient number of foreign tourists. However, according to the official statistics the country's tourism revenue in 2013 reached an all-time record and the growth of 18% is estimated for 2014. Correspondingly, there is a tendency towards the stabilization of political scene as well as the intention to open governmental institutions and agencies which will positively influence the image of the country and its international tourist perception. The harmonization of economic instruments and tourism policies regarding the European Union integration process, among other things, make tourism movements much easier. Laws and regulations control relations within the national economy and society in general, but also strengthen the international relations of Bosnia and Herzegovina, including the creation of conditions for a more open economy that is stable and systematic. When it comes to the tourism in

Sarajevo region, Federal Law on Tourism (Official Gazette 32/09) is the most relevant law which regulates the tourism industry, types of services offered, conditions and models of performing these activities, including entities which can be engaged.

Economic environment: According to the National Agency for Statistics (Kozic et al., 2014), GDP growth in the last year was 0.6% and 26,297 in millions of KM, while GDP per capita amounted to 6,862 KM. Also, GDP growth remains on a declining trend in most of the European Union countries as well as world-wide. But, at the same time we can expect that discretionary income will continue to go up at least when it comes to the foreign senior guests and that will have a direct repercussion on increasing the spending on tourism services. Namely, it is a myth that senior citizens have no disposable income, particularly in the developed countries (foreign tourists). Senior population has low fixed living costs, 82% of all seniors own their home outright and most of them own cars. The fact is that lower income does not mean lower available cash and for instance in the USA 40% of discretionary income at national level belongs to elderly people. Hence, the senior market is one of the fastest growing areas of tourism and this trend is evident in Bosnia and Herzegovina too, but mostly when it comes to foreign senior tourists. The importance of the senior citizen segment, in general, is determined by the process of aging, which is linked to improvements in the economic status and the health conditions of this group. They tend to be more active and travel more. Given that population aged 65+ is usually retired with pensions or social benefits, they have leisure time to devote to travelling at any time of the year. Furthermore, regarding the inflation, our country is very stable given that the long-term orientation is to keep the inflation under control, managed by the Central Bank Currency Board.

Social and cultural environment: This type of environment is particularly interesting and attractive to senior tourists. Namely, Sarajevo is the capital of Bosnia and Herzegovina. Sarajevo is the country's administrative, economic, cultural, educational and sport center. For more than four centuries, Sarajevo has been the city of multiculturalism and the place where Catholics, Muslims, Jews and Orthodox live together. Sarajevo has a rich history ranging from the early Neolithic to medieval period, including impressive influences of the Ottomans and Austro-Hungarians on culture and arts. Sarajevo region also has envious natural heritage such as the second deepest canyon in the world (Rakitnica canyon), Olympic Mountains as well as thermal springs which are significant for medical tourism particularly when it comes to the senior tourism. Also, national cuisine and festivals such as Jazz Fest, Sarajevo Film Festival, MESS and many other should not be neglected in tourism potential analysis.

Technological environment: The use of IT-based solutions in tourism influenced the increase of quality of tourist travel and quality of visitations. More and more tourist destinations are available through detailed tourist information web systems. Unfortunately, in Bosnia and Herzegovina this type of environment, at least in tourism industry, is not sufficiently developed. After identifying relevant factors, the evaluation of their influence is performed with regard to two basic aspects: influence

evaluation of identified factors by grading a threat from -5 to 0, and an opportunity from 0 to +5 and importance evaluation of business strategic factors by grading them from 0 to +10. The evaluation of identified factors for tourist market regarding company's request is shown below (Table 2.).

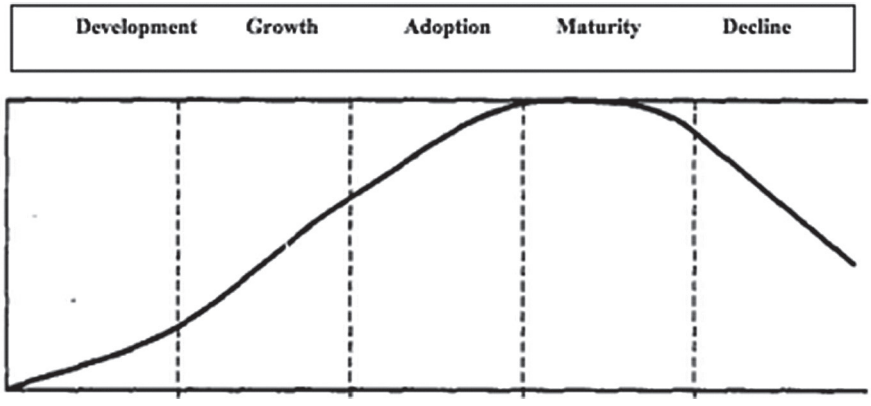
Table 2.: Factor Influence and Importance Evaluation

Environment	Factor influence	Factor importance	Opportunity (+); threat (-)
Political/Legal (P)	-3	8	-24
Economic (E)	3	7	21
Social/Cultural (S)	2	6	12
Technology (T)	2	4	8
Total	-	-	17

Source: Autors'

From the positive value of threats and opportunities, it is clear that opportunities exceed threats, meaning that the business strategy for EMS introduction and senior guests focus represent good opportunities for hotel's future. Taking into consideration that environmental factors are by nature complex and dynamic, we are not able to use the trend method for forecast. That is the reason why we applied the "planning scenario" option. In order to emphasize all relevant aspects of the particular industry, it is necessary to do Industry Sector Analysis for the potential business. The relevant industry is the hotel industry and tourism. Life cycle prism is shown below (Figure 1.).

Figure 1.: Industry Development Phase Representation through Life Cycle Prism



Source: Autors'

Generally, the relevant industry is in the beginning phase of adjustment. World Economic Forum publishes the Travel and Tourism Competitiveness Report annu-

ally and Bosnia and Herzegovina's Travel and Tourism Competitiveness Index for the year of 2013 was 3.8 which gives the country a rank of 90 out of 140 countries with comparable data (Blanke et al., 2013). Further results present the long-term structural analysis of industry, its attractiveness and profitability using Porter model.

Table 3.: Long-term structural analysis of industry using Porter model

Observed Porter model force	Results of analysis	Explanation
The threat of new entry	medium	Relatively high initial investments (makes high entry, but also exit barriers); Low brand loyalty and narrow location
Negotiation power of suppliers	low	Large number of potential suppliers
Negotiation power of buyers	high	Service replacement costs are very low; Tourists are very sensitive consumers (requiring good quality services)
Substitution possibility	low	No market segmentation or tourist offer tailored to the specific needs of a particular group, including elderly population
Competition degree	emphasized	There is a substantial competition in tourism industry, but there are no specific facilities
General conclusion	attractive industry	There is no single tourism offer based on energy-efficient and eco-smart facilities tailored to specific needs of elderly

Source: Autors'

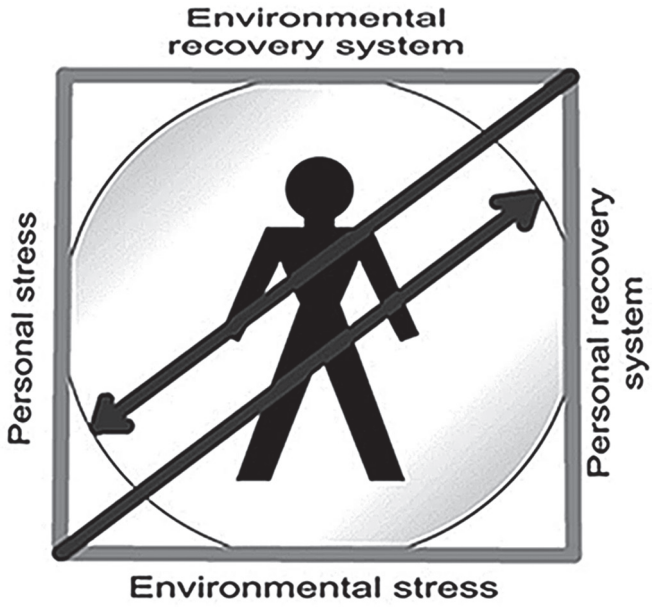
In order to better understand the competition degree in tourism/travel industry and attractiveness of the particular economy segment in Sarajevo region, the available hotel offer was evaluated. Currently, in Sarajevo region there are 61 registered hotels operating in the tourism industry grouped into categories as follows: 3 five-stars hotels, 11 four-stars hotels, 28 three-stars hotels, 8 two-stars hotels, 3 one-stars hotels and 8 hotels without a category (but most of them are in the process of obtaining categorization). The majority of hotels fall under three-star category and their offer fulfills cost benefit balance of an average consumer in terms of condition and cleansings. However, none of 61 hotels that were evaluated does not have any type of service based on eco-smart and energy-efficient solutions or adapted for elderly guests.

3. DISCUSSION

Environmental influences refer to all physical, biological and chemical factors that have an impact on an individual, i.e. its health and behavior. Therefore, the estimate and control of all environmental factors as well as their contamination and protection, represents an important issue of mankind for decades regardless of the level of societal development and productiveness across the planet. These issues are put in the limelight of science with an emphasis on its current relevance and it is easy to come to conclusion that healthy environment is not abundant directly negatively influencing the living biological system, especially senior citizens (Stankovic, 1995). Directly in reference to these facts, the sustainable development theory attempts to reduce the level of negative influences of biological factors on persons' physical, psychological and social well-being through the harmonization of social, economic and environmental factors (Vasovic et al., 2007). Given that health is the result of a mechanism of mutual adjustment of human beings and their environment, modern and urban lifestyle represents a direct stress for elderly citizens and their already slow physiological system failing to make an adequate adjustment.

For instance, inability of the interior environment to repeatedly establish a necessary balance with the fast changing exterior environment has resulted in a number of diseases emergence of which the most common are circulatory system diseases, locomotor diseases and other neuro-psychological, endocrine, metabolic and immune system diseases (Wigle, 2003; Wells et al., 2010). Out of total area of Sarajevo region, 65.43% is covered with forests (82.998,88 ha), which means a tremendous potential for the development of eco-smart tourism that can meet almost all physiological and social needs of elderly citizens. Human beings' origin is in nature and they have never completely separated from it, so it is expected that third age persons, governed by their instincts, always opt for such locations with high natural potential as their vacation spots. The latest scientific research in cell physiology has proved that system repair mechanisms can only be initiated in natural conditions. It has also been confirmed that environment can increase or reduce stress (Figure 2.).

Figure 2.: Relationship between Internal Environment and External Environment



Source: Autors'

Therefore, stress caused by noise, which is part of a modern lifestyle, accelerates the production of stress proteins in elderly persons that block cells of the immune system causing the feeling of anxiety, depression, high blood pressure and muscle tension, which are starting point for the incidence of the aforementioned diseases. Stress is a big medical problem of the modern society and therefore it is extremely important to offer a stress-free environment during vacations, especially to elderly persons in order to maintain a normal functioning of physiological system with the possibility of activating intracellular reparation systems for the improvement of the overall human well-being, especially of senior population (Kaplan et al., 1989; Evans, 2001). Apart from forests, Sarajevo holds thermal springs. The most famous one is located in Ilidza municipality. These thermal springs are sulphuric waters rich with calcium, sodium, potassium and hydrocarbons. Hence, they are used for prevention and treatment of all diseases suffered by elderly persons such as rheumatism, neuralgia, anemia, skin, digestive system and urinary tract diseases. Sulphur, as the main ingredient in these waters, is very important for glucose metabolism. The lack of this chemical element in elderly persons leads to musculoskeletal disorders, obesity and metabolic syndrome. The latest scientific research has proved that one of the causes of Alzheimer's disease is a significant reduction of the amount of sulphur in such patients when compared to healthy persons (Anderson, 2007).

4. CONCLUSION

Tourism represents a quiet dynamic industry which includes unique characteristics that can be observed as an essential segment of national economy in developed countries as well as developing countries such as Bosnia and Herzegovina. Travel industry contains all the phenomena and relationships covering interactions between tourists, suppliers and vendors of tourist services, national and local governmental bodies and host communities in the process of attracting and welcoming tourists at a particular destination (Hadiani et al., 2011). Performances and outcomes of these relationships in tourism industry considerably influence national economy results in the form of employment rate and its impact on economic and social development as well as environmental sustainability including protection of natural resources through creation of energy-efficient solutions. Tourism industry in Bosnia and Herzegovina with its capital in Sarajevo records a positive trend for all crucial indicators of growth in the last decade or so (Bidzan et al., 2015). These trends in tourism/travel industry can be a solid base for initiation of further economic and societal development by creating specific target group and customer segmentation in terms of tourist offer that would be specially tailored to elderly population due to socio-demographic characteristic of future senior citizens on the global level.

There is also a substantial space for additional use of its indisputable potential that involves extensive natural resources such as Olympic mountains Bjelasnica, Igman and Jahorina located only half an hour drive from the Sarajevo downtown, long and well-known heritage/tradition, exciting and restless history, favorable geographic location on the crossroads between eastern and western cultures, internationally popular events such as Sarajevo Film Festival, outstanding gastronomic offer at a reasonable price and the status of still unknown tourist destination for the majority of foreign tourists outside European continent. Setting of still water machines and installation of renewable energy system for electricity, ventilation and heat can have various positive effects increasing security, providing more healthy conditions, influencing life expectancy and counteracting the aging in elderly population. These practices can be observed as possible strategies of creating a unique hotel facility in Sarajevo region customized to needs of senior tourists. Strategic management tools have shown that there are business, socio-demographic, biological and psychological (health-related) rational for creating an eco-smart and energy-efficient tourist facility in Sarajevo that could become profitable in a short period of time.

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THE ANALYSIS OF ORGANIZATIONAL CULTURE VALUES IN PUBLIC SECTORS IN LATVIA

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ABSTRACT HEADING

Organizational culture is an important issue because of its` big influence on enterprises' productivity and consequently on realization of their objectives and goals. The validation and harmonization of organizational values and employees' values has an important role in increasing operational efficiency. It has long been established that enterprises and organizations, where creative and interested employees who support and understand the organizational values of the company work, operate more effectively. In this article elements of organizational culture are studied with a particular focus on the meaning of organizational culture values. This article also reveals an evaluation of the organizational culture in public sectors in Latvia (based on publicly available data and sources of information). In the research there is an in-depth analysis of official public organizational culture values included. The analysis has been done in the context of rating different leaders' organizational values. In this article we analyze the conclusions of various writers on the subject of organizational culture framework characterization. The research of values guidance as well as a view of cultural meaning and influence on both individual and organizational development is described here. The authors analyze the results of empirical research about official public values of companies and the results of a public leaders' survey (as well as the personal values of employees) which provide an opportunity to compare organizational employees' values with the common results of organizations. Conclusions shows public characterization of values and values distribution in potentially limitative and positive values. The in-depth research of organizational values is based on A. Maslow's (Maslow 2000) hierarchy of needs approach and developed on R. Barrett`s (Barrett 2006) sample of seven levels of consciousness.

Keywords:
cultural entropy; organizational culture values; personal employee's values

1. INTRODUCTION

Organizational culture is a hot topic because of its great impact on company productivity and goal realization. Today it is recognized that companies who employ those who understand, support and reconcile organizational values with their own personal values operate more effectively.

Organizational culture is significant in the development of an organization because the values uniting an organization and its employees contribute to its development. The detection of organizational and employees` values (as well as awareness and harmonization of them) are a largely hidden part of the culture of a work environment.

Culture is a complex phenomenon and, as Dubkevics (2009) suggests, it comes about in the process of socialization and in a particular environment: it is not genetically inherited and its ambiguity is confirmed by large amounts of different definitions - according to Renge (2007) 250 different definitions of culture have been identified. Culture can be explained from philosophical, political, sociological and many other different points of view. Latvian philosophers Maija Kule and Rihards Kulis (1998:35) emphasize that "there is no such field of human existence, such a form of behavior to which the word "culture" could not be added".

The majority of authors on the subject (Schein, 1985; M. Vēbers, 1994; Cameron and Quinn, 1999; Praude and Belcikovs, 2001; Reņģe, 2007; Dāvidsone, 2008; Dubķēvičs, 2009) define organizational culture as a set or a system of common values, assumptions and cognitive systems that characterizes an organization, its managers and employees.

Leadership development professor Manfred Kets de Vries (2001) in his book "The Leadership Mystique" writes about culture as a system of values which affects every individual` s character, behavior, style of decision making and leadership style.

Dutch psychologist Gert Hofstede (Hofstede and Hofstede, 2005) defines organizational culture as the daily life of an organization, the set of values, traditions and rules that make up understanding of the power holding the organization together.

Recently the reduction of staff turnover in organizations has become a relevant issue. One of the most successful solutions for this problem is in the study of employees` values because it provides managers with information directly from employees: from those at whom decisions of the administration are aimed.

The objective of the study is to analyze and research significance of organizational culture values and to define the level of organizational culture entropy in organization X.

2. PERSONAL AND ORGANIZATIONAL CULTURE VALUES IN ORGANIZATION X

As it has been shown in many surveys a large part of modern society does not trust public authorities. That is why this article looks at personal and organization culture values in public sector organizations and analyses them in order to assess interaction between personal values, stated values and the actual values of organization.

German philosopher F. W. Nietzsche indicates that values are the largest quantity which can be arrogated by a person (Nīče, 2008:267). The value systems developed gradually and, in addition, every society had its own culture and its own dominant system of values.

In attempting to explain the existence of the world and the meaning of life in their treatises, ancient Greek philosophers also interpreted values. Plato (2006) emphasized that there is no perfection in the world but that one ought to strive for it as eternal values must be maintained. Such values as honesty, compassion and kindness have survived through the centuries and are core values today.

Latvian values are brightly depicted in Latvian folklore, which remains an important part of Latvian identity even today.

Latvian folklore urges us to do good deeds for other people and encourages everyone to join to the regimen of good works doers: it chimes with A. Maslow`s (2000;1998) and R. Barrett`s (2008;1998) theory. Richard Barrett (Barrett, 2008) has suggested The Seven Levels of Consciousness model which is based on Maslow`s (Maslow, 2000) hierarchy of needs. American psychologist A. Maslow (2000) had a non-traditional approach: he tried to understand human nature without going into various pathologies. Maslow (Maslow, 2000) studied mature, successful, satisfied and happy people concluding that everybody is able to be such: this is the reason why in the hierarchy of needs the main accent is placed on human needs. The most important things to which a person is moving are their goals and beliefs.

When speaking about the significance of organizational values in achieving the goals of an organization we should not forget how important it is that employees accept these values, through which a high level of loyalty in the working environment in can be reached.

Green (Grīns, 2008) acknowledges that the work and the task themselves stimulate employees` natural motivation rather than mere materialism, as sometimes people mistakenly believe. Studies show that in most cases people do not work because of material remuneration, except in the cases when the person is located on the lowest part of income scale. An employee works in order to demonstrate their professional skills, to certify themselves in society, to receive satisfaction, assessment, all because work is associated with the most important thing for a person - with value.

Davidsone (2008) accentuates that in both levels - in individual and in organizational - values perform three basic functions:

- values are the driving force of motivation;
- values determine samples of desired individual and organizational behavior;
- values set standards which are used in evaluation of individual or organizational behavior.

By clarifying individual and organizational values it is possible to build mutual benefit based employment relationships. If the work in an organization corresponds to the employees` value system, they obtain significant or meaningful work. At the same time organizations obtain loyal employees who are willing to survive short-term crisis and major changes together with the organization (Dāvidsone, 2008).

Realization of organizational values is an understanding about organizational culture and values, as well as about social, political and economical aspects that contribute in achieving results (Boitmane, 2006).

When defining the values in general, these are the principles and standards, which form the basis for decision-making, judgement and selection of action occur (Van der Wal et al., 2006).

In the context of organizational values there are regulatory guidelines, that determine desired attitudes and behavior, creating the moral basis for goals and activities (Christensen et al., 2007).

Organizational values are the deepest, non-visible layer of organizational culture, they can be open and hidden. Open or declared values are usually defined at the managerial level of an organization. They are included in organization documents, as well as occasionally reflected in short slogans and phrases which defines objectives and the nature of an organization. But organizational values, which as mentioned can be slogans and mottos, do not always reflect the true values of an organization. Sometimes they are hidden in the rush to profit, the non-recognition and hiding of failures, spying on competitors etc.

Values are the driving force that determines the desirable model, standard of behavior for individual or organization.

In the modern political and economic environment public authority organizations have to be able to respond rapidly to the changes in society and in the world, as well as being able to compete with the private sector for limited human resources and talents in the labor market.

Thus, the public sector starts to inherit those values that so far were more allocated to the private sector - innovations, efficiency, productivity.

The OECD states one of the main challenges facing the public sector is the need to find a balance between two sets of values. On the one hand such values as efficiency and productivity are the ones which should be implemented and developed, but on the other hand, there are traditional ones as democratic, morally ethical and people-oriented values which are characteristic to public authority organizations and need to

be saved. The integration of both sets of values is indispensable for public authorities in order to increase their competitiveness and the ability to react dynamically to the changes, but at the same time their core values should not be compromised (OECD 2009).

3. RESEARCH METHODS AND PARTICIPANTS

Lots of scientists have studied issues of organizational culture, providing us with important scientific insights, (Cameron & Quinn, 1999; Kets de Vries, 2001; Barrett, 2008). In this study in depth research of organizational culture values is viewed based on R. Barrett`s "Seven Levels of Consciousness method".

R. Barrett underlines the significance of creating a value-oriented organizational culture and offers the conception of transformation for entire culture system.

A high level of cultural entropy characterizes the culture of inflexible and weak organization (Barrett, 2008). If the level of organizational culture entropy is high, then elasticity in organization is low. Cultural entropy is an issue of values influenced by four factors: personal contradictions, structural contradictions, contradictions in values and contradictions in mission awareness. Cultural entropy is the proportion of all votes cast for potentially limiting values. The level of cultural entropy is calculated as follows - the number of votes for potentially limiting values divided by the number of votes given for all values and multiplied by 100.

In the middle of 20th century American psychologist A. Maslow (1998; 2000) invented his Hierarchy of Needs theory. Maslow`s (1998; 2000) theory is widely used in business, management and marketing in order to stay oriented to clients` and customers` needs. The basic thesis of this theory detects the motivation of people, as the causes of conflicts often lie in dissatisfied needs, the theory is also often used in conflictology. A. Maslow arranged human basic needs in five hierarchical levels, starting with the lowest - physiological, the second - safety, the third - love, belonging, the fourth - the basic need of self-esteem and ending with the highest level of needs - need of self-actualization. In R. Barrett`s (2008; 1998) theory the first, second and third level corresponds to the first, second, third and fourth level of Maslow`s (1998; 2000) Hierarchy of Needs, and Barrett`s (2008; 1998) fourth, fifth, sixth and seventh level corresponds to Maslow`s need of self-actualization level.

This model is based on seven stages of personal development. Each stage has an actual, vitally important need, which corresponds to a particular situation and is the main motivating force. The lowest or basic needs (1. - 3. Level) apply to our physical survival, physical and emotional security, and emotional self-esteem. While the "highest" needs (5. - 7. Level) are mental and apply to finding the meaning of life, transforming the world and service. In the first tree levels the personal benefit is dominant, and all the needs of a person`s ego are satisfied. In the three highest levels the needs of a person`s soul is satisfied. The fourth level is a level of transformation, because within

it a shift between personal benefit and common wealth happens. Seven vital needs are depicted in Figure 1. "Seven Levels of Personal and Organizational Consciousness".

Figure 1.: Seven Levels of Personal and Organizational Consciousness

Source: Barrett (1998)

R. Barrett`s "Seven Levels of Consciousness" model can be applied to a person, groups of people or organizations. R. Barrett`s "Seven Levels of Consciousness" model is used to create diagnostics for organizational culture. Cultural transformation instruments (Cultural Value Assessment, CVA) are used to make diagnostics of organizational culture. CVA is based on the concept that any style of behavior refers to one of the seven levels of consciousness.

Namely, each level of consciousness corresponds to certain values. Besides all values are divided in two categories - positive (P) and potentially limiting (L). Table 1. shows the breakdown of values / styles of behavior in positive (P) and potentially limiting (L) according to seven levels of consciousness.

Table 1.: The compliance of values / styles of behavior with the levels of consciousness

Level	Motivation	Positive Values (P)	Limiting Values (L)
7	Service	Social responsibility, future generations, compassion	-
6	Making a Difference	Mentoring, volunteer work, environmental awareness	-
5	Internal Cohesion	Trust, commitment, honesty, integrity, enthusiasm	-

Level	Motivation	Positive Values (P)	Limiting Values (L)
4	Transformation	Adaptability, continuous learning, accountability	-
3	Self-esteem	Productivity, efficiency, professional growth	Bureaucracy, arrogance, image, information hoarding
2	Relationship	Open communication, customer satisfaction, conflict resolution	Blame, internal competition, rivalry, manipulation
1	Survival	Financial stability, profit, employee health	Control, chaos, caution, job security

Source: Barrett (2008)

CVA is used to detect and to assess:

- personal values of members of the organization;
- current organizational values in perception of members of the organization;
- desired organizational culture values from the point of view of members of the organization.

The assessment of personal consciousness, current culture and desired culture is made not only in the organization as a whole, but also in constituent demographic categories. In order to create an appropriate list of values from all values possible, the adapted cultural values templates for evaluation of cultural values are composed at the very beginning.

When the template of personal values and organizational values is made, as well as the list of demographic categories, the next step is creating a tool for online survey, using which employees will be able to give their assessment of cultural values.

In order to obtain the data necessary for assessment, the survey respondents are asked to evaluate which of the values corresponds to employees` personal values, current values organizational values and desired organizational values the best.

Evaluation and analysis of the data obtained in survey provides us with an insight into compliance of employees` personal values with the current cultural values of the organization and conformity of current cultural values to desired cultural values.

At the same time data processing and analysis allows to define the level of cultural entropy in the organization. Barrett defines Cultural Entropy as: *a proportion of the energy, which is wasted by organization or any group of people in unproductive activities, for example, bureaucracy, internal competition, "the construction of the Empire" etc.* (Barrett, 2008:2)

The level of cultural entropy indicates either a healthy functioning of the organization, or shows that some minor or even major improvements are necessary. The detailed explanation of the meaning of the level of cultural entropy as well as recommendations for advisable actions are given in Table 2. „Significance of Different Levels of Cultural Entropy".

Table 2.: Significance of Different Levels of Cultural Entropy

Cultural entropy	Implications
≥ 40%	Critical Issues—Requiring cultural and structural transformation, selective changes in leadership, leadership mentoring, leadership coaching, and leadership development
30 - 39%	Serious Issues—Requiring cultural and structural transformation, leadership mentoring, leadership coaching, and leadership development
20-29%	Significant Issues—Requiring cultural and structural transformation and leadership coaching
10-19%	Minor Issues—Requiring cultural and/or structural adjustment
<10%	Prime—Healthy functioning

Source: Barrett (2008)

As the organizational culture in public sector organizations in Latvia has not been studied from value perspective, Barrett`s "Seven Level of Consciousness method" is chosen as the most appropriate to achieve the aim of the study. Empirical data collection and survey is carried out in this study and in order to compile the collected data the statistical data processing is used.

The question of this study:

- What is the level of cultural entropy in public organization X?
- What are the personal values of employees?
- Do the employees` personal values in public organization X correspond to managers` opinions about values necessary to the employee?

The object of the study: organizational culture values in public administration organizations.

The following tasks were defined in this study:

(1) to analyze declared values in public sector organizations in Latvia with the aim of identifying dominant values and characteristic values of institutions on the basis of publicly available data and information sources.

(2) To study and to analyze declared values in public administration of organization X, harmonization of organizational culture values and personal values of employees to identify positive and potentially limiting values and to evaluate level of entropy in organization.

This research is based on 64 public authorities and one public administration organization which have 30 departments in different regions of Latvia. Within the study were 56 different levels of executives (6 men and 50 women) and 271 employees of public administration organization (27 men and 244 women) were surveyed. The average age of respondents: executives, 53 years; average years of service in current organization, 17 years; average age of employees, 42 years; average years of service in current organization, 11 years.

4. RESULTS OF THE RESEARCH

By analyzing the data about declared values in the public sector in Latvia using statistical method it was concluded, that 64 institutions in total have declared 58 differing values. Thirty-three of all the values declared by all organizations are values determined as characterizing and were pointed out by just one participating institution. This suggests that these declared values are specific and related to the institution`s functions. 12 of the values are specific in two to three organizations. Three of the values are inherent in five to seven institutions. Ten of the values are inherent in more than ten organizations and are dominating values.

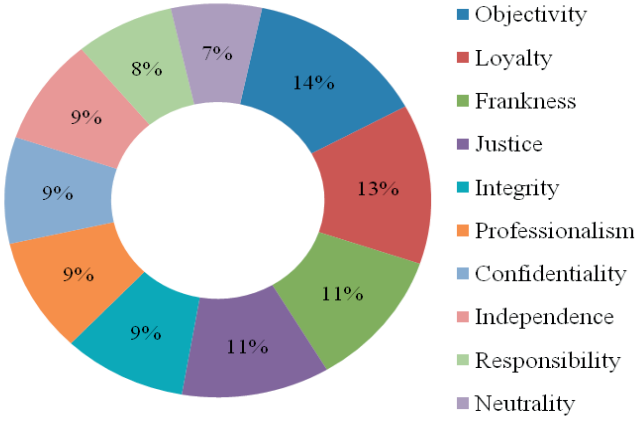
While analyzing the content of declared values, a surprising fact that came to light was that "Clients` satisfaction" was declared only by three organizations. Also of note was that the values do not cover the full spectrum of values, for example, there are no values defined in Survival level.

It is the reason why the overall impression was formed that for institutions the process of defining the value is completely formal, as it does not reflect today`s innovations and possibilities.

Although in the public sphere public authorities are often criticized for insufficient availability of information to the public, while carrying out this study, in 92% of cases information about declared values was published on the authority`s website, ensuring that everybody is able to get acquainted with the declared values of the public authority. By doing this what actions and attitude can be expected by employees and society, and what atmosphere is created in workplace is readily identifiable.

The ten most frequently mentioned values are shown in Figure 1. "Declared values in public authorities", according to percentage breakdown.

Figure 1.: Declared values in public authorities



Source: the authors` calculations based on publicly available data

The most classical values were Objectivity, Frankness, Justice, Integrity, Professionalism and Independence, but such values as Legality, Honesty, Equality, Collegiality, Purposefulness and Accuracy were also often declared in public organizations. Among less frequently mentioned values there were such values as Reliability, Tolerance, Striving to be better, the Succession and Self-support.

Declared values are specific as they are focused on a wide range of the public and may not reflect all of the values of the organization, however, following the formal approach of public authorities it denies them the opportunity to use values as a tool for development within the organization.

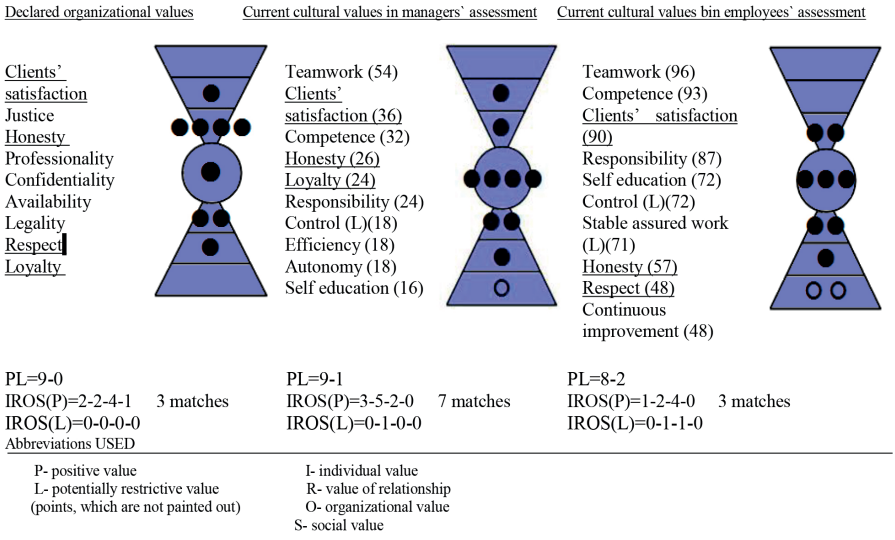
Managers of those organizations should pay more attention to organizational values, in order to strengthen and maintain or, if necessary, change them. The aim of every public authority is to strengthen exactly the values that actually will guide the organization to progress and will successfully repel all external threats and pressures.

Within the study about the values of public organization X a survey was carried out in which different level managers and employees of the public authority were asked to make an assessment of values. Managers separately highlighted current organizational values and desired personal values of employees, and employees of the public organization separately accentuated current organizational values and their personal values.

A summary of the results of this survey is arranged in levels according to R. Barrett` s Seven Levels of Consciousness Method. R. Barrett's (Barrett, 2008) method has an original approach, which allows us to analyze personal values of employees in organizations, organizational cultural values and transformation of culture, aloof which provide an assessment of values.

Organizations, which want to achieve success maintaining vitality have to acquire all seven levels of consciousness - the first - level of Survival, the second - level of Relationship, the third - Self-esteem level, the fourth - level of Transformation, the fifth - Internal Cohesion level, the sixth - level of Making Difference and the seventh - Service level.

Figure 2.: Breakdown of values in public organization X



Source: authors'

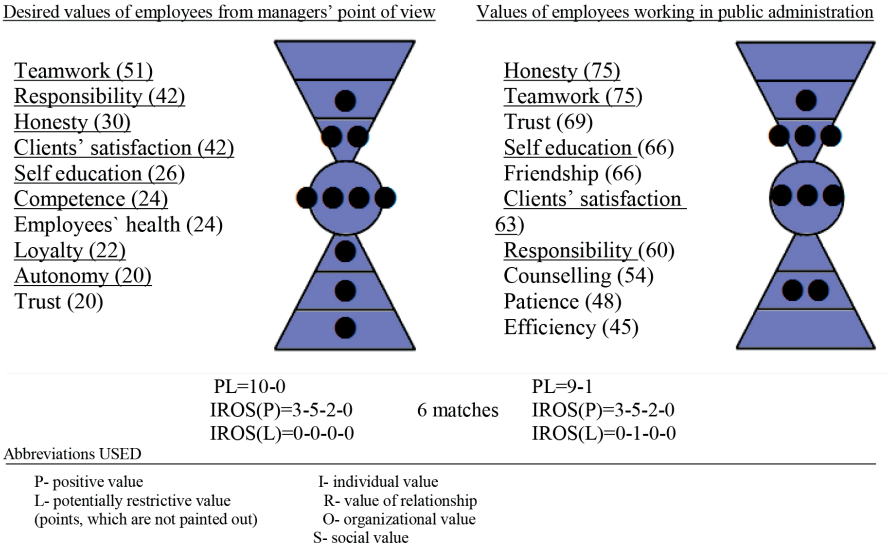
Current cultural values and declared values of public organization X are shown in Figure 2. The values are arranged according to the number of votes (number in brackets after each value). Each shaded circle represents one of the positive values, each unfilled circle represents one of the potentially restrictive values obtained the biggest number of votes. Barrett (2008) points out, that potentially restrictive values appear in organization only then, when managers and ordinary employees act managed by their own ego and start to become a threat to common wealth.

By analyzing the results, it can be concluded, that there exists conformity between declared and current cultural values within managers` and employees` assessment, there are three matches of values in assessment given by managers - Clients` satisfaction, Honesty and Loyalty, and by employees - Clients` satisfaction, Honesty and Respect, so it can be concluded, that employees and managers of public organization are aware of declared values, they have accepted them and know, what actions and attitude they are entitled to expect from each other and what atmosphere is created in the workplace.

One of the most positive results of the value assessment is that there are seven value matches between employees` and managers` assessment of current cultural values, six of which are positive values - Teamwork, Clients` satisfaction, Competence, Responsibility, Self education, Honesty - and one potentially restrictive value - Control. These systems of values show that managers and employees see their organization relatively equally, as well they show the fact, that both groups assessed the values of their organization objectively. However, potentially limiting value - Control - can testify to the fact, that this public authority has exaggerated monitoring, pro-

cedure control, prudence, as well as tendency to avoid risk; as a result, employees do not feel confident about their future. Relatively similar distribution of the values on the level of transformation indicates that teamwork and communication skills are promoted in organization, and there is strong focus on improvement of processes. Transformation points to the changes, in result of which the structure of organization and procedures change, the responsibilities of employees and managers change, but it does not mean, that the whole team of organization is oriented to the same goal, and that` s the reason why the transition to the fifth level - Internal Cohesion - is necessary. As Barrett (2008) points out the main objective of fifth level of consciousness is to join together in unified culture and to develop collective capacity.

Figure 3.: Breakdown of values in public organization X



Source: authors'

The breakdown of values according to the "seven levels of consciousness" is deployed in Figure 3. done in order to represent what values managers want to see in their employees and if these values comply with the values of current employees.

By analyzing the results, it can be concluded that desirable values of employees within managers` assessment almost cover the full spectrum, and it shows that professionalism and qualification of managers in this organization are on a high level. They are able to transform organizational culture in a way which leads to successful and effective functioning.

The set of values on the fourth level shows that both managers and employees have reached such a level of consciousness that allows striving for transformation of the organization and it can be concluded that there is a very high conformity between desirable values of employees and personal values of employees, that is to say, there

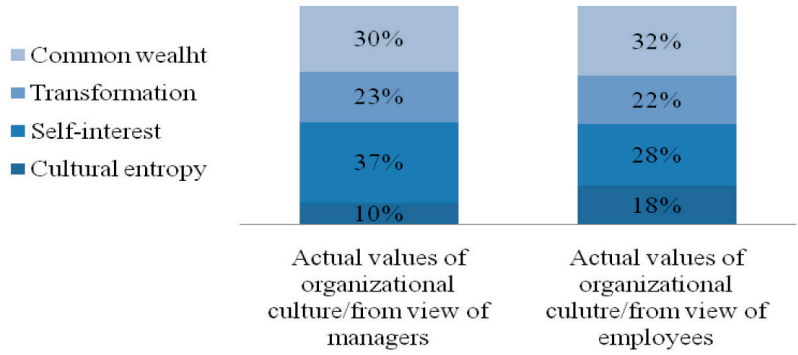
are six matches of values - Honesty, Teamwork, Trust, Responsibility, Clients` satisfaction, Self education.

Overall employees of this organization have the values which managers would like to see in their employees. However, employees do not act as if managed by the full spectrum of consciousness.

The level of cultural entropy in the organization describes the amount of energy which is spent inefficiently by employees and the organization as a whole.

The level of cultural entropy in public sector organization X is shown in Figure 4. Barrett (Barrett 2008) recommends certain models of action which should be chosen by an organization when it has reached a certain level of entropy. If the level of entropy is up to 10% then the organization is able to function healthily but if the level reaches 20%, the organization has to take serious decisions as such a level of entropy indicates the need for cultural and structural transformation.

Figure 4.: Level of cultural entropy in organization X (%)

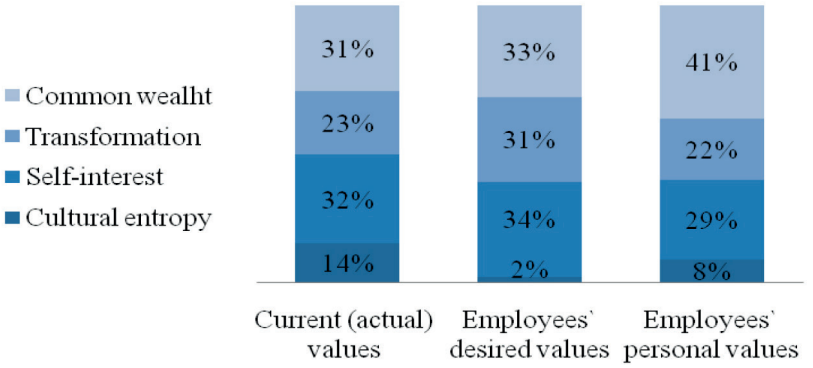


Source: authors'

By analyzing the assessment of organizational values given by the organization's managers and employees it is obvious (Figure 4.) that assessment is relatively similar in the level of Transformation and Common wealth, but the level of Self-interest and Cultural entropy is different. In assessment of managers, the level of cultural entropy is 10%, but in the assessment of employees it is 18%. According to results obtained it is possible to conclude that public authority organization X has to solve organizational issues - changes in organizational culture are needed. The organization has to revise its structure, tasks of departments, and responsibilities, as well as to focus on vales that are essential to employees. The results showed that there are pressing and important values for employees of public authority organization X at the Survival level which managers must not ignore. In order to compare the level of entropy and the level of cultural entropy of current

values, the desired values of employees and employees` personal values in public organization X will be inspected.

Figure 5.: Level of cultural entropy in organization X (%)



Source: authors'

By analyzing personal values of employees it is obvious, that employees` personal values are coherent to organizational values (as it is seen in Figure 5.). The share of employees` personal values in the level of Common wealth is the highest when compared to the assessment of other two value categories.

The employees have reached a high level of consciousness because Common wealth is rated at 41%(Transformation - at 22%, Self-interest - at 29%). The level of cultural entropy is 8% and this assessment confirms that it is necessary to make corrections to meet the basic needs. The breakdown of values in public organization X: level of Common wealth - 31%; Transformation - 23%, Self-interest - 32%. The level of cultural entropy though is at 14%. This clearly indicates the need to solve current issues - corrections in cultural structure or meeting other needs are necessary.

Employees` desired values divides as follows: level of Common wealth - 33%; Transformation - 31%; Self-interest - 24%. However, level of cultural entropy is 2%. This means that by selecting employees with such values healthy functioning of organization would be ensured. As it can be seen, the level of current cultural entropy in public organization X is higher, that is why managers should strive towards reinvigoration of these values in their organization.

5. CONCLUSION

(1) The results of the study show that managers of the organization realize and are able to define the personal values of employees which are essential to reach the goals of the organization. Analysis of the results of the survey show when desired values of employees and managers correlate, the level of cultural entropy can be low (2%) and in such a way the optimal functioning of the organization can be ensured.

(2) The results of the research showed that current values of public organization X do not cover the full spectrum, which indicates that learning, training and experience are needed to act in the full spectrum of levels of consciousness. Potentially restrictive values indicate that energy is possibly being used inefficiently in controlling and monitoring and as a result employees are unable to express their creativity and they do not feel secure about their future. In its turn, the fact that the current level of cultural entropy is significantly (by 12%) higher, indicates that managers use available resources and tools insufficiently. Managers should bring to life all the values which ensure that the organization is able to operate for a common future, common wealth and with the unifying goal where common values serve as the guide in decision making and set the limits of responsible freedom.

(3) The research about declared values in the public sector reveals one significant deficiency - there are not any declared values in the survival level and service level in public administrations. It is one of the ways in which it is possible to develop, taking into account the fact that organizations work most successfully when their values cover the full spectrum of the levels of consciousness model.

(4) The results of the study of public organization X could hereafter help to set priorities in work, to improve relationship between managers and employees, to help managers in making rational well-considered decisions about employees and in the development of the organization, as well as helping with improvement of mutual communication and drawing up of strategy.

(5) Personal values of the employees are broadly consistent with managers' opinions on values which are required for employees. However, the results of this research highlighted a peculiar inadequacy. Managers have chosen the value Loyalty - for them it is important that employees are loyal to the organization - but employees haven`t stated such a value at all. We can look at it from two different perspectives. From one side it is related to managers` fear of losing talented employees, but from other side that communication is not successful enough. The management has to commit itself to improving the quality of communication and decision making. In this way they will be able to contribute to the loyalty of employees. This will give a chance to develop new ideas

and to implement reforms which are necessary to improve the performance of the organization. In order to ensure that initiated reforms and direction of the development are implemented successfully it is recommended to make a periodical reevaluation of the level of cultural entropy in the organization.

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INNOVATION IN TOURISM: PERCEPTION OF TOURISM PROVIDERS FROM CROATIA AND SERBIA

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ABSTRACT

Innovations represent a challenge that every company faces during its life cycle no matter what kind of business sector it operates in. In today's world of competition and fast-growing industries, it is paramount to be innovative, especially in tourism. The main aim of this study was to determine how businesses and their employees in two countries - Croatia and Serbia, are directed toward new innovations, which innovations are most important to them, what are the main barriers to implementation and if there is a difference between innovation implementation in those two countries. For this purpose, the study was conducted in 13 tourism companies in Croatia and 20 in Serbia, in the period July-October 2016. The results indicate that companies in Croatia (M=3.86) are more open to innovations than Serbian tourism companies (M=3.50). Furthermore, the study showed that respondents have similar wishes and motives when implementing new ideas or innovations, such as educated workforce, health and well-being of people or improved business management. However, when it comes to key areas for innovation implementation, in Croatia emphasis should be on training and education of the workforce, while in Serbia emphasis should be placed on the introduction of new technologies. In addition, the key limiting factors of innovation implementation that stood out only in Serbia are lack of funds and poor ownership structure. However, there is willingness to implement innovations and readiness to work towards it. Education and a capable workforce are deemed essential to accomplish and implement new innovations in most companies.

Keywords:
innovation; tourism; Serbia; Croatia; tourism providers; SMEs in tourism

1. INTRODUCTION

Nowadays, innovations are important factors that can ensure company's continued growth and income, but on the contrary, if a company is not innovative, it risks the possibility to become uncompetitive on the market. In terms of tourism innovations, one should certainly mention several market brands or individual entrepreneurs such as Thomas Cook, or even global enterprises such as South West Airlines, Expedia, TripAdvisor and Booking. Likewise, when it comes to innovative destinations, places like Las Vegas or Dubai should firstly be mentioned.

However, innovations are not limited to the travel system, they may refer to a small family hotel launching its first website, or just a restaurant that will enrich its offer with a new meal - innovation represents an improvement and a desire to develop an enterprise and adapt its offer to the market needs. Sources of innovation in the tourism industry may originate from outside the tourism sector. One such example is information and communication technology (ICT) which is primarily responsible for innovative tourism development (online services such as e-check-in and online reservation systems). Tourism is also the initiator of many innovations, such as those in the financial sector when it comes to credit cards that allow online purchases and reservations (Hall and Williams, 2008).

Companies that are willing to work on their products or launch new ones are certainly far ahead of their competition. Technology changes, so do the needs of the customers and their way of life. In order to survive the company must monitor its market and keep up with the progress of ICT. Therefore, innovation is the key to success in any industry. Innovation does not imply only new products and services, but also refers to the improvements of the production process, thereby competing with better and new industrial plants, employee education, new work conditions, etc. Producing something in a more economical or cheaper way, or of a higher quality, also has a major strategic role.

The purpose of this paper is to emphasize the importance of innovation specifically for the tourism sector. Moreover, the aim was to explore how ready tourism companies are to implement innovations, how managers and employees are directed toward new innovations, which innovations are the most important to them, what are the main barriers to implementation, etc. Furthermore, the aim was to investigate differences between the two countries in terms of innovation implementation. As Croatia and Serbia are countries with different level of economic development, but also on different stage of development of tourism market, differences on innovation implementation are quite expected in those countries. Hence, the authors assumed that there will be differences between the Croatian and Serbian tourism companies regarding the implementation of innovations, especially regarding key areas for implementing innovations and limitation factors.

Based on this, three main research hypotheses have been drawn:

H1: Croatia is expected to be more open to new innovations than Serbia.

H2: Services will be recognized as key areas in which companies should make investments in Croatia, while technology will be primary field for innovation in Serbia.

H3: Low financial resources are expected to be a major obstacle in both analysed countries.

This paper consists of five chapters. The literature review provides an outlook on the term of innovation and reviews key research on the topic of innovation in tourism. The second and third chapter deal with the research methodology and results: namely, tourism employees from Croatia and Serbia were interviewed regarding their attitudes towards innovation. Discussion is presented along with results, while the last section points out concluding remarks.

2. THEORETICAL REVIEW

2.1. Innovation

"Innovation refers to the process of bringing any new, problem solving idea into use. Ideas for reorganizing, cutting costs, putting in new budgetary systems, improving communication or assembling products in teams are also innovations. Innovation is the generation, acceptance and implementation of new ideas, processes, products or services.... Acceptance and implementation are central to this definition; it involves the capacity to change and adapt." (Hall and Williams, 2008: 5). One of the better known definitions of innovation is that of Schumpeter (1934). By innovation he means, the introduction of new products, new production methods, new markets, new suppliers or setting up new organizational structures of any business. Furthermore, Myers and Marquis (1969) considered that the overall innovation is the total process of certain interrelated "subprocesses", and that innovation is not always the concept of implementation of new ideas, the invention of a new device or the development of new markets, but the sum of all activities of these processes. Innovation, according to one theory, is the "deliberate novelty that brings sustainable benefits" (Mađarić, 2016). These benefits may be directly financial, or represent an increase in quality and safety. An innovation is sustainable when, at least in the medium term, achieves the return on investments along with an increased business stability. Therefore, innovations are intentional, they are not caused by an external "force majeure" (i.e. changing market conditions, sudden change in legislation or a social or a natural disaster). Innovations are the result of research and development capabilities of the individual (innovators) or organized groups of experts.

The term innovation refers to something "completely new or a novelty for the neighbourhood (achieved by transferring other people's experiences to a particu-

lar environment which previously have not been used), such as contributions that enrich and enhance already known solutions. Unlike scientific discoveries, which cannot be appropriated and legally protected, innovation can be legally protected as intellectual property". (Lexicographic Institute Miroslav Krleža, 2016).

Amabile (1996) defines innovation as successful implementation of creative ideas in any organization or company, and believes that creativity of an individual or a group is the starting point of every innovation. According to the same author, innovation is important because of several reasons:

- lifestyle is changing rapidly and therefore the development of innovations should be adapted to it,
- innovations that manage flexibility are part of the creation of agreements regarding operation of enterprises. Innovations thus require originality, flexibility and creativity.

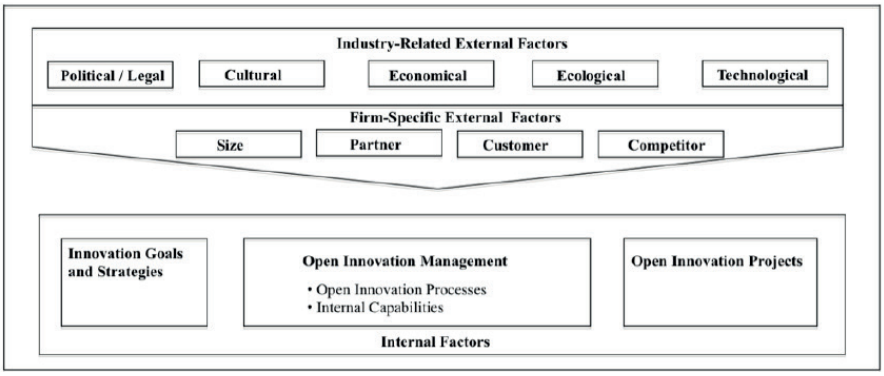
Hall and Williams (2008: 6) distinguish three types of innovation:

- Incremental - does not require adjustment of the market or new technology, but is manifested as improvement or business growth e.g. reducing waste in the hotel kitchen, acquisition of new cars in a rent-a-car company
- Distinctive - typically requires adjustment of demand and eventually of company organization e.g. an improved system of purchasing plane tickets at a discount.
- Breakthrough - involves a new approach to consumers, new technologies or a new organizational structure e.g. self-check-in or e-tickets.

Whether it is about new products or services, or improvement of existing ones, innovation means change, and in relation to that, Prester (2010: 14) lists three main categories of innovation: product innovation, innovation of the production process and managerial innovations. The latter are defined as "the implementation of new management practices, processes and structures that represent a significant deviation from existing practices and norms" (Jung Erceg and Prester, 2007: 82). Malerba (2001) introduces a "Sectoral system of innovation in production" (SSIP) as a system of innovation which includes several new and already established products and systems from several agents who carried out market and non-market research to create, produce and sell certain products. The sectoral system has the knowledge, technology, resources (inputs) and demand that can be existing or potential. The so-called "agents" which form such systems may be organizations or individual businesses and non-profit organizations. The key elements of SSIP are: products, demand, skills, agents, network interaction, institutions and research and development processes.

Furthermore, there are certain factors that affect innovation, and according to Schrade (2012) these include: technological development, legislation, cooperation and standardization, consumer habits, the price structure, protection of intellectual property.

Figure 1.: Factors influencing the creation of innovation.



Source: Stucki, A. (2009)

Factors that influence the creation of innovation are, according to Stucki (2009), divided into external factors that affect the industry in which the company operates, external factors closely associated with the operation of the company and internal factors (Figure 1.).

2.2. Research on innovations in tourism

Keller (2004) states that innovation in the world of tourism started to develop in the 19th century with the first organized trips by Thomas Cook and later on developed according to the needs and desires of tourists, allowing them to create their own holidays with modular and dynamic packaging and by offering tailor made holidays. In addition, tourism destinations over the years learned to recognize the wishes of tourists and developed some new attractions and offers (Stipanović, Rudan, 2014). Information technology is now driving the development of new innovations in tourism.

Developments in transportation allow passengers to travel faster and easier, which will open up new markets (EU-Lex, 2011). In his multiple case study on ICT-driven and supported innovations in tourism Keller (2004) considers that the right ICTs and freedom of passengers during the organization of their travel are innovations in tourism that are gaining an increasing importance.

Doblin Inc. (2007) presented a comparison of airline companies, accommodation providers and restaurants clients' needs. The survey showed that passengers, when booking their flights, primarily focus on distribution services, while when booking accommodation they value the website, a simple booking process and the perceived quality of service. The restaurant business revealed similar innovation needs as the accommodation one.

By adhering to the element of knowledge, Martinez - Fernandez (2005) presented the KISA concept, "Knowledge intensive service activities", as an important

part of knowledge and learning in the development of tourism in Australia. His research, which involved 44 tourism companies, showed significant innovations in the implementation of products, new processes and changes in the organization of enterprises, and these innovations are usually incremental. It showed that 39 of 44 companies (89%), made some changes that involved new products, processes or other related changes, 64% of them presented a new product, 52% have implemented a new process, and 50% have established some other changes, for example, a new way of managing human resources.

The types of innovations in tourism according to Aldabert, B., Dang RJ, and Longhi, C. (2010) are: product and service innovation (most typical), process innovation and innovation in marketing. The research of Martinez - Fernandez (2005) shows that 89% of Australian companies established innovation in the products or services sector. But innovative approaches in tourism do not necessarily include innovation in services, products and customer experiences, or even operational processes. Innovations are also needed in establishing tourism policies, and therefore Kruger (2004), based on the policy of the Federal Republic of Germany, investigated the importance of innovative approaches in the preparation of tourism policy. He pointed out some specific questions which will be answered with the establishment of a policy which embraces four issues: increasing mobility, the role of new information technologies, population aging and sustainability. In order to achieve such a policy, joint action of the government, organizations, companies and regions is necessary. This innovative tourism policy would have a coherent and synergical effect on the tourism industry.

Regarding the hotel industry and policies hotels should implement in order to be competitive and in line with demand trends, Orfilasintes (2005) discovered that hotels which are part of a hotel chain reported a greater desire for innovation and greater effectiveness in the implementation of innovations in comparison to independent hotels. However, human capital is basic for both individual hotels as well as hotel chains, making investments in human resources a particular innovation or source of innovations. Orfilasintes (2005) also concludes that hotels with higher rating (4* and 5*) are more innovative than other accommodation facilities. Sundby (2007) showed that innovative hotels use more professional management tools, have a positive attitude towards ICT and that their innovative behaviour depends greatly on their size: the larger the company the greater the desire for innovation, which coincides with Orfilasintes (2005) who concludes that among tourism related enterprises, the most innovative are the ones operating in accommodation, transport and F&B (mainly restaurants).

3. METODOLOGY

The current study on innovation in tourism was conducted with representatives of a certain number of companies engaged in tourism business. Questionnaire (Appendix 1.) was used for collecting data, while the technique used was interview. The survey used for this research was "*Unleashing the power of innovation*" that has been developed and conducted by "PwC" - Price Waterhouse and Coopers & Lybrand, and refers to the 19th global questionnaire designed for company directors.

Besides existing questions, authors provided additional ones, in order to adjust the research to the field of innovations in tourism. The interview involved employees of 13 tourism companies operating in the Republic of Croatia, in the region of Istria and Kvarner. The same survey was simultaneously conducted in Serbia on the territory of cities of Novi Sad and Belgrade. On the territory of Serbia employees from 20 different tourism companies were interviewed. Participants were from the sector of accommodation, tourism organisation offices, and travel agencies. The interview consisted of 8 questions related to the innovative ideas of the company, the desire for innovation, openness to new ideas, vision of personal role in the implementation of innovation, future plans related to innovations, personal opinion on best "ingredients" for successful innovation, as well as obstacles to the realization of this goal.

Interviews were conducted by telephone and in direct conversation in the period 20/07/2016 -30/08/2016 in Croatia and 21/10/2016 - 29/10/2016 in Serbia. It is important to note that the interviews were conducted during the tourist season and many respondents were not able to participate, so only 13 companies in Croatia and 20 in Serbia agreed to participate in the conversation. Moreover, only one company owner in Croatia participated in the study, while five owners in Serbia were interviewed. The rest of the respondents were employees on different positions in tourism companies. Responses were collected via the website www.surveymonkeys.com, in a way that the author entered the answers manually, they were later processed and are shown in the next chapter.

4. RESULTS AND DISCUSSION

The principal purpose of the paper was to explore the importance of innovations for tourism sector, as well as to investigate to what extent companies and their employees are focused towards innovations, what kind of innovations are the most important and what are the limiting factors in their realization. Results of the research will be presented simultaneously for Croatia and Serbia, with the main purpose of comparing the results.

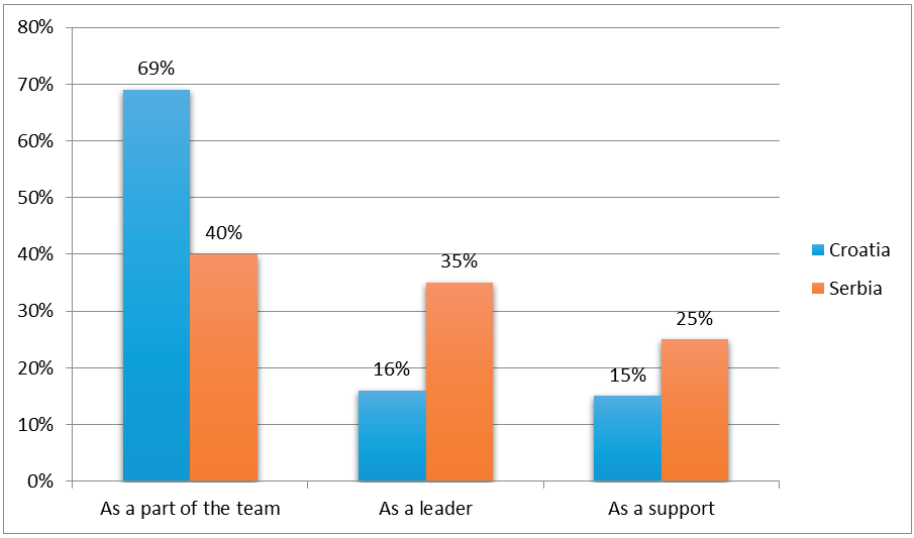
The first question concerned employees' opinion on if their company is open to new ideas and innovations. The answers were measured on a 5-point Likert scale (1- Not open at all, 5 - Very open). The results indicate that mean value of this question

for Croatian companies (M=3.86) is higher than for Serbian companies (M=3.50), which confirms the hypothesis 1. This finding implies that companies in tourism, both in Croatia and Serbia, are not yet truly open to innovations, but they are willing to make an effort to retain a certain level of creativity. The lower mean value for Serbia may be explained by the fact that Serbia is still not so attractive tourist destination as Croatia, so tourism companies are not so motivated to implement innovations in their business.

In the second question, respondents were asked which of the four statements in the best way describes willingness of their company to implement innovations. The majority of respondents in Croatia (62%), as well as in Serbia (55%) answered „We appreciate innovations and easily recognize new ideas and implement them. The lowest percentage of companies in Croatia (8%) and Serbia (10%) stated „Innovations are our priority, we are creative and like new approaches in our business". An equal percent of companies in Croatia (15%) stated that „Innovations are not our priority because of the market in which we do business" and „Innovations are our priority and we are good in development and implementation of new ideas", while in Serbia 20% of them stated „Innovations are not our priority because of the market in which we do business", and 15% said „Innovations are our priority and we are good in development and implementation of new ideas". When comparing the answers, the situation is quite similar in two analysed countries, with the fact that Serbia still has a higher percentage of those who believe that innovations are not their priority because of the market they work with, which may be explained by the fact that travel market in Serbia is less developed than in Croatia, therefore companies in Croatia are more compelled to keep up with the trends and implement innovations.

Furthermore, respondents were asked to describe how they see their role in innovation implementation in their company (Figure 2.). In Croatia, the highest percent (69%) of respondents said they see their role as a part of the team, while in Serbia higher percentage of respondents said they see their role as a leader (40%). The fact that in Serbia a higher percentage of respondents said they see their role in innovation implementation as a leader can be explained by the fact that higher number of company owners in Serbia participated in this research and they are responsible for innovation initiation.

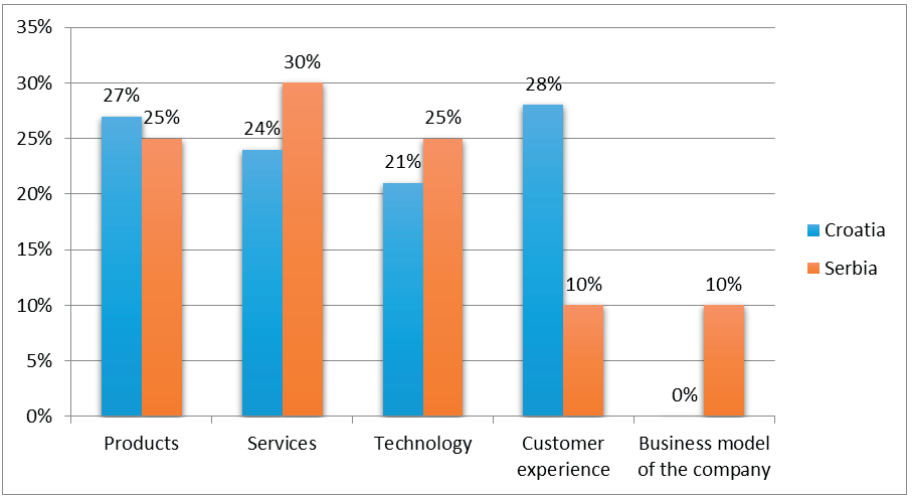
Figure 2.: Perception of the role of respondents in innovation implementation in their company



Source: authors'

The respondents were also asked to state which segment of their business they would like to be improved in the next three years. The results are presented in Figure 3., from which we can see that, in both countries, Products, Services and Technology are the top areas that require innovation. This is in line with the studies conducted by Camison (1999) and Monfort (2000), who emphasized the key factors for success and higher competitiveness in tourism development of Mediterranean countries. These factors are as follows: innovation and desire for change, organizational innovations, and modernization of technology, products, services and IT. Monfort (2000) also indicates that willingness of the company to develop and innovate its products, services and technology is necessary if it wants to stay competitive in the market. Serbia, as a less developed country, especially in terms of tourism development, was expected to recognize technology as a top area for innovations, but research has shown that it is almost equally important in both countries. Customer experience has higher priority in Croatia, while Serbian companies believe that changing the business model is important.

Figure 3.: Business segments that companies would like to improve in the next three years



Source: authors'

In the next question, respondents were asked to state the key factor for successful innovations in companies. The results for both countries are presented in Table 1.

Table 1.: The key factors for successful innovations in companies

Factors for successful innovations	Croatia (%)	Serbia (%)
Strong vision of a manager	15	15
Good organisation culture focused on innovation	12	20
Desire for new challenges and taking risk	10	10
Good cooperation with consumers	10	5
Creativity	7	15
Having skills to recognize the need for new innovations in the company	20	15
Know how to train and educate the right people	13	5
Use of new technologies	5	10
Creating a good financial strategy	8	5

Source: authors'

Results indicate that in both countries respondents consider "Strong vision of a manager" and "Having skills to recognize the need for new innovations in the

company" are among the most important factors for successful innovation. In Serbia, a higher percentage of respondents opted for "Use of new technologies", "Good organisation culture focused on innovation" and "Creativity", while in Croatia they opted more for "Know how to train and educate the right people". In terms of factors which positively affect innovation implementation in the company, it is interesting to mention the research by Nemeth (1997), whose study indicates that those factors are: clear company aims, skilful staff, feedback and adequate award system. From this it can be concluded that preferences and opinions have not significantly changed, as clear aims and educated as well as skilful staff are still of great importance for innovation implementation. A new skill, which is necessary for companies, is certainly the ability to recognize the need for new innovations in the company, as it is important to know when is the right moment for decision making and innovation implementation. The need for innovations has not changed significantly over the years, but there are some new needs that follow modern trends in tourism.

Furthermore, the research aimed to determine obstacles which prevent the company from being innovative. The results for both countries are presented in Table 2.

Table 2.: Key obstacles for successful innovations in companies

Factors for successful innovations	Croatia (%)	Serbia (%)
Current organisation culture	30	20
Politics and law	30	20
Low financial resources	0	15
Bad state/private leadership	0	15
The lack of employee talent	30	10
Out-of-date technology	10	20
There are no obstacles for our innovativeness	0	0

Source: authors'

From Table 2., it can be concluded that in the case of Croatia, respondents think that Current organisation culture, Politics and law and The lack of employee talent are the major obstacles for innovation, but they also think that Out-of-date technology could be a problem (10% of respondents). In Serbia, however, factors such as Low financial resources and Bad state/private leadership are considered obstacles, while in Croatia this is not the case. This indicates that hypothesis 3 can be only partially accepted. In addition, more respondents from Serbia think that Out-of-date technology is a problem, while The lack of employee talent is not as big an obstacle as in Croatia. The current study can be connected with the findings of Weiermair (2004), who studied innovation development of tour operators, airlines, hotels, restaurants and theme parks in Northern America and Europe and found that major obstacles for implementing innovations are as follows: lack of time and money, not taking risk,

lack of skilful employees, modern technology and bureaucracy, conservative opinions and lethargy. By analysing the findings of both studies, it can be observed that bureaucracy, lack of skilled employees and adequate technology, while conservative opinions and lethargy can be connected with organisation culture.

Finally, the respondents were asked which statements should be a priority for the government or companies. In Croatia, the majority of respondents stated that these are „Educated and skilful employees" (68%), „ High employment rate" (21%) as well as „Adequate infrastructure" (11%). The same priorities were confirmed in Serbia - „Educated and skilful employees" (50%), Adequate infrastructure" (25%), „High employment rate" (15%) as well as "More equal incomes for citizens" (10%).

5. CONCLUSION

Tourism innovation process has started moving upwards, particularly with the increasing development of information and communication technologies and the availability of the Internet that greatly assist the development of innovation. Based on this it can be stated that ICT represents the cornerstone of global tourism development. The innovation process in tourism enterprises contributes to their greater competitiveness, and besides new products and services, innovations are also reflected in new ways of conducting business and in the reform of organizational structure.

Innovations are affected by many factors which must be taken into account in innovation planning so that company could successfully respond to their demands. Not every innovation is suitable for every company. In order to enable entrepreneurs to know when, how and in which innovations to invest their finances, time and knowledge, it is necessary to understand the company's business, its advantages and disadvantages. In addition, there are many other conditions, which must be fulfilled in order for successful implementation of innovations, and that companies could efficiently use the results brought by innovations. In this research, conducted among employees of tourism companies in Croatia and Serbia, the main conclusions indicate that employees are willing to work as a team in order to provide their consumers and tourists with unique experiences, by learning and by establishing new ideas and innovation. They believe that the key to success are good leadership of the company and recognizing the need for innovation, as well as trained and educated workforce. When it comes to key areas for innovation implementation, in Croatia, the emphasis should be on training and education of the workforce, while in Serbia, emphasis should be placed on the introduction of new technologies. Furthermore, the lack of funds and poor ownership structure stand out as obstacles to the innovation implementation only in Serbia, and these are the areas that should be improved in the future. In Serbia, unlike Croatia, there is a higher percentage of those who believe that innovations are not a priority because of the tourist market in which they do business, which indicates that companies in Serbia still

believe that tourist market is not sufficiently developed, and therefore, they do not need to invest in innovations. The authors believe that this view is fallacious, as introducing innovations could make tourist market more competitive and would result in better service, which would in turn attract more tourists.

When comparing this study with relevant research, it can be concluded that there are similarities in the needs for the development of innovation in the tourism industry, since the priority areas are products and service development, technology, professional staff and a clear vision of company managers.

Similar to other related studies on the topic of innovation in tourism, it is evident that the largest number of innovations is related to products and services, in both directions, whether it is about improving existing ones or introducing entirely new ones (most innovations are implemented in larger companies or hotel chains that have a more professional approach to business management). Along with the indispensable ICT, innovations in products and services, as well as in customer experience, in both Croatia and Serbia, stand out as priority areas of innovation, which again is in line with the general hypothesis that products and services are among priority fields for innovation.

Among soft management skills, a new one should be cherished: the ability to recognise the need for innovation. Other managerial implications are related to leadership - having a strong vision and creating an organisational culture that is aimed at creativity, problem solving and empowerment with the adequate support of lifelong learning for both managers and employees.

The possible limitation of this research is a relatively small number of managers who have participated in this exploratory study. The future studies should include more tourism companies and involve in the survey both managers and other employees. The comparison of their opinions could be beneficial for determining the problems of innovation implementation in companies.

Although innovation in tourism is essential, the research on this subject is still in its infancy, considering its complexity as a phenomenon that cannot be reduced to selling products and services; which makes this a call to action for future research.

Appendix 1. Questionnaire (without demographic questions)

1. Please rate from 1 (min.) - 5 (max.) how open is your company for new ideas and innovation?

a) 1

b) 2

c) 3

d) 4

e) 5

2. Which of the following statements best describes your company's appetite for innovation?

a) Innovation is not a priority for us in the markets in which we operate.

b) We value innovation. We're good at recognising new ideas and approaches and adopting them quickly

c) Innovation is one of our priorities. We are good at generating new ideas and approaches.

d) Innovation is our primary focus. We are creative and regularly pioneer cutting edge ideas and approaches.

3. Which of the following do you see as your primary role in driving innovation within your organisation?

a) Leader

b) Visionary

c) Layer

d) Sponsor

e) Part of the team

f) Support

4. In which of the following areas is your company looking to innovate over the next 3 years?

a) Products

b) Business model

c) Customer experience

d) Technology

e) Supply chain and channels to market

f) Services

g) System and processes

h) None / don't know

i) Other

5. What do you think are the most important ingredients for successful innovation at a company?

a) Strong visionary business leadership

b) Having the right culture to foster and support innovation

c) The willingness to challenge organisational norms and take risks

d) Collaborating with customers

e) Having a capacity and capability for creativity

f) The ability to capture ideas throughout the organisation

g) Being able to locate and train the right people

h) Collaborating with suppliers

i) Being able to secure the right levels of funding

j) Use of new tech (such as social media) to support innovation

k) None/Don't know

6. Which of the following constraints is stopping you from being more innovative?

a) Financial resources

b) Existing organisation culture

c) Lack of talent

d) Political and regulatory factors

e) Inadequate technology

f) Nothing is stopping me from being innovative

g) Weak governance/leadership

7. Which of the following statements should be a priority to government/ company in the country your organisation operates?

a) Adequate infrastructure (physical and digital)

b) Educated and skill workers

c) A high level of employment

d)Reduction of negative impact on environment

e) Equal distribution of basic citizen incomes

f) Health and welfare of the human resources

g) Diversity of employees and their social activism

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MOTIVES AND BARRIERS TO THE CONSUMPTION OF INNOVATIVE FOOD PRODUCTS BY POLISH AND UKRAINIAN CONSUMERS

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ABSTRACT

The significant increase in the number of new food products means consumers have the opportunity to choose from among a wide range of innovative foods, which bring a variety of benefits to consumption, but can also, for some, raise uncertainty, opposition and suspicion. The article reviews the literature on innovative food products and their acceptance by consumers. The results of own research on the purchase motives and barriers to consumption of such products are presented in the context of theoretical considerations. The study is presented in relation to the issue of consumer innovativeness as a determinant affecting the approval or rejection of new products. The respondents' degree of innovativeness was evaluated according to Rogers' concept and the impact of this variable on the respondents motives of to purchase innovative products. For the comparative analysis of Polish and Ukrainian consumers' behaviour on the innovative food products market, international research was conducted in 2015 on a sample of 340 Polish and 255 Ukrainian respondents (595 respondents in total). The results clearly show consumer types differing from the Rogers distribution, as well as differences between Polish and Ukrainian consumers' appetite for innovation. Analysis of the literature and the research results together indicate that the motives and barriers to consuming innovative food products come down to features of the innovation (including price, functionality, healthiness, convenient packaging, taste), consumer characteristics (neophilia, neophobia, innovativeness) and environmental characteristics (trends in consumption, marketing and social communication). Those consumers who are innovators play an important role in shaping the positive attitudes of buyers in relation to innovative food products. Products possessing attributes consumers consider to be essential may also help in the desire to adopt innovation. Basing on the research results certain implications for managers responsible for introducing new food products to the market were presented in the paper.

Keywords:
innovations; innovativeness; consumer; motives; barriers

1. INTRODUCTION

Consumer adoption of innovative food products has been studied across a number of scientific disciplines. Differences can be seen in the analyses at the macroeconomic level, where the focus is on the costs and benefits of disseminating innovation, and on the microeconomic level, where the focus is on the individual, his attitude, and the motivations and barriers to purchasing innovation (Ronteltap et al., 2007).

Today's consumers enjoy a wide assortment of foods that possess innovative qualities and are beneficial to consume. However, consumers view some innovation with disapproval and suspicion. Companies bringing innovative products to the market face neophobia, which is an unjustified fear, fear of the unknown or anything new, and is pronounced where food products are concerned. Neophobia affects above all food products and foodstuffs classified as innovative (Earle et al., 2007). Food neophobia can be defined as the „phenomenon of avoiding new, unknown foods" (Pliner and Hobden, 1992).

It seems that consumers who possess the qualities of innovators in their social groups play an important role in overcoming neophobia. As people who command a thorough understanding of innovation in the market and a willingness to communicate, innovators influence the formation of consumer attitudes towards other new and innovative food products. Equipping innovative products with attributes essential for acceptance by consumers can help in their adaption. Such attributes can be market-related—functional or organic foods—or not, such as complexity or the opportunity to try innovation.

To achieve the aims of our research, the following definition of innovative food products was included in the questionnaire: a new food product that has never been offered on the market or an enriched and improved version of a product that does already exist on the market (one with modified ingredients or packaging, for instance easy to prepare, consume and store); being beneficial for one's health, physical condition or intellect; a genetically modified product (gmo); an ethnic product known only to a certain group of people; an organic product. The definition applies to groups of products proposed as innovative foods by Tourilla et al (2001). No food products have been enumerated or presented to the respondents as examples or as a particular object of study.

2. THE AIM, MATERIALS AND METHODOLOGY

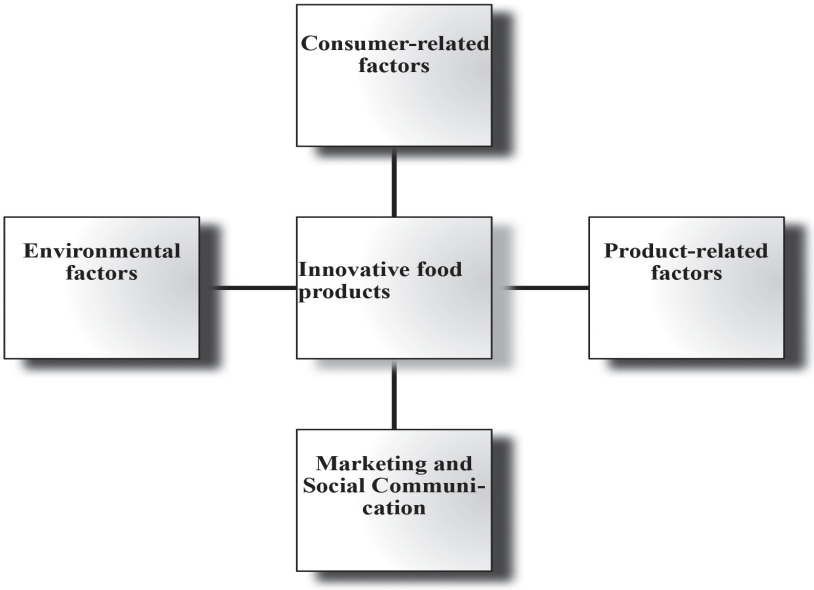
The aim of the article is to present issues concerning the motives and barriers to consuming innovative food products by Polish and Ukrainian consumers.

The literature on consumer behaviour on the innovative foods market was used to inform the writing of the article. In the context of the theoretical considerations, selected results of our own international, survey-based research were presented, comparing the behaviours of Polish and Ukrainian consumers on the innovative food products market. The research was conducted in 2015 on a sample of 340 Polish and 255 Ukrainian respondents (595 respondents in total). The survey in Poland was conducted using an online survey while the one in Ukraine was done with an auditorium survey. The results are not representative, and should be interpreted with a dose of caution, as they express the opinions only of those individuals who wished to take part in the research. Nonetheless, some differences in the behaviors of the two groups are statistically significant.

3. THE MOTIVES AND BARRIERS TO CONSUMING INNOVATIVE PRODUCTS IN THE LIGHT OF THE SUBJECT LITERATURE

Numerous aspects determine the adaption of new products on the food market, including the characteristics of the innovation itself, consumer characteristics, environmental characteristics (eg. the social system), and social communication and marketing (Figure 1.). In addition to objective factors at work, there are also subjective ones reflecting the perception of different facts by consumers (Jeżewska-Zychowicz, 2012). All of these aspects can function as barriers to the consumption of innovation, or encourage consumers to try it.

Figure 1.: Conditions of acceptance of innovative food products by consumers



Source: the authors' studies and synthesis based on Marzena Jeżewska-Zychowicz, (2012)

The reactions of consumers to new foods can be conditioned to a large degree by their demographic, psychological and social charactertistics, as well as their economic status. Labay and Kinear (1981) have observed that education, age, phase of life, professional activity and income influence one's acceptance of new food products. Additionally, innovate products can stimulate in some a desire to become familiar with them. while others feel no such need. This is determined by the tendency to adapt and human curiosity (Jeżewska-Zychowicz, 2007). The purchaser seeks primarily to experience pleasure and positive emotions, and to avoid negative ones. Maximum willingness forms when there is little or no fear. Arts et al. (2011) state that consumers tend more frequently to adopt those innovations which are more complex, and better suited to their needs, thus reducing the uncertainty they perceive. Some consumers are by nature fearful, and therefore their level of openness to innovative products is very low. Differences between consumers resulting from the stimulation or susceptibility to fear condition their reactions to new products (Jeżewska-Zychowicz, 2014).

The characteristics of innovative products to a large degree determine whether consumers have a positive or negative attitude to them. Packaging, price, taste, and general appearance have been considered in research on the adoption of innovative food products (Lowe and Alpert, 2015). Today's consumers assess products on the basis of their health and nutritional qualities. From a wide variety of products, buyers ever more

often choose those which do not contain chemical preservatives and artificial colours, but are rich in vitamins, fibre, and minerals, and low in fat and sugars (Górska-Warsewicz , 2003). Price can also be an essential factor in the decision to purchase a product. Higher prices tend to reduce consumer purchasing (Laskowski and Górska-Warsewicz, 2014) .

Environmental factors such as consumption trends also figure into the acceptance of innovation. Changes occurring in consumer behaviour are often a result of and causative factor in the appearance of certain trends. Many consumers pay attention to the health and environmental apects of food. Choosing to eat high-quality foods is more and more often becoming a lifestyle choice, and leading consumers to look for new types of food that meet their expectations (Adamowicz, 2008). Finally, formal and informal marketing and social communication also influence consumer decisions (Kraszewska, 2011).

4. CONSUMER INNOVATIVENESS

Numerous authors believe that the acceptance or rejection of innovation depends to a large degree on consumer characteristics, including the degree of their innovativeness (Goldsmith and Hofacker, 1991). According to Goldsmith (2001), the term „consumer innovativeness" describes buyers who have a need to discover new products on the market and own them. They possess knowledge about innovative products, are not overly price sensitive and are frequent users of such goods.

According to Everett Rogers, who penned the theory of the diffusion of innovation, the individual innovativeness is the degree to which a given individual adopts innovation earlier than other individuals in a system. The consumer who adopts innovative products sooner than others is perceived as more innovative. Rogers divided consumers into five groups according to how quickly they adopted innovation, with consideration of the characteristics of each group and their role in diffusing innovation in society. Rogers' five groups, which other researchers have also described, include: Innovators, Early Adopters, the Early Majority, the Late Majority, and Laggards.

The innovators are, at 2,5% of society (according to Rogers), the mavericks. They do not feel close ties to society, and it is they who bring innovations to the market. Whether innovation exists on the market depends upon them. They have a talent for advanced technology, seek challenges and do not fear the risk in purchasing products. They like to demonstrate their originality and progressiveness, and command high economic and social status. They are often disloyal consumers, being fascinated with new products only briefly then quickly losing interest as newer, more attractive ones appear.

Comprising 13,5% of society, the early adopters are open to new products and are regarded as successful. Their opinions are the vanguard; they are respected and often followed, so they are essential in diffusing innovation, because given their rela-

tively high numbers and network of connections in their respective groups, they help speed up the diffusion process. They are educated and other groups of consumers treat them as well-informed experts. Foxall i Bhate (1993) observe that early adopters buy more innovative food products than do innovators probably, they maintain, because they are more involved in a consistent pattern of healthy consumption, so one would expect them to actively seek innovative food products with 'health food' attributes, which is to say organic and functional foods. According to researchers, the greatest number of 'food neophiles' - those consumers who prefer above all unknown food products and actively seek new types of products - will be found among the early adopters.

Comprising 34 percent of society, the early majority are cautious individuals who carefully weigh their every purchase. They have numerous connections to the system and are involved. According to Klincewicz (2011), they are pragmatists and „not interested in products that do not have „reference purchasers". For them, only time can determine if a product is worth purchasing.

Also accounting for 34 percent of society by Rogers' calculations, the later majority are extremely cautious and sceptical of new products. Their decision to adopt a product is often tied to its economic benefit and pressure from others.

Finally, at 16 percent of society, the laggards are traditional, suspicious, isolated and don't like change. They have limited financial means, avoid risk and fear wasting money. To decide to purchase a new product, they need concrete arguments convincing them it is the right purchase. The laggards have a high „innovation threshold", which means that a lot of consumers must be using a new product (eg eating a new food) before they will adopt it too.

Steenkamp et al. (1999) also note that high consumer innovation is a function of being independent, extroverted and impulsive, while Foxall and Bhate (1993) maintain that innovation also suggests a sense of self-worth, open-mindedness and tolerance for ambiguity.

5. RESEARCH RESULTS

Empirical research intended to investigate consumer innovation with a particular focus on identifying the motives and barriers to buying innovative foods was done in Poland and Ukraine. The research sample included 595 respondents—340 Poland and 255 Ukrainians. 411 were women (246 Polish and 165 Ukrainian) and 184 men (94 and 90, respectively). The ages varied, though 81 percent of the Ukrainian sample was largely made up of young people up to the age of 25. Nearly 48 percent of the Polish sample were 25 or younger, 40 percent were 25-39 and 12 percent were older than 40. A large majority of the sample was single (80 percent of Ukrainians and 69,5 percent of the Poles) and had not finished their university degree (74 and 53 percent). 60 of the Ukrainians (23,5 percent) and 144 Poles (42 percent) indicated

they held a university degree. Most of the sample belonged to three- or four-member households (74 and 52 percent, respectively).

The most Polish and Ukrainian respondents (41 percent) reported monthly income around the minimum wage. 27 percent of Ukrainian and 22 percent of Polish respondents reported income per person in the household amounting to twice the minimum wage while 15 and 25 percent of respondents reported income below the minimum wage. The Polish and Ukrainian version of the questionnaire lists the minimum wage in, respectively, PLN and UAH - hryvnia. and the appropriate times, so that respondents could select the appropriate answer. Some respondents reported income of three-four times the minimum wage.

One way to measure the innovativeness of consumers is to examine their willingness to purchase new products. To this end, the Rogers scale was used, whereby the innovative consumer is a function of the time required to assimilate innovation. Understandably, the consumers surveyed did not accept innovative products at the same pace, hence justifying their division into five groups (Rogers, 2003) by rate of acceptance (Table 1.).

Table 1.: The innovativeness of Polish and Ukrainian consumers on the food market using the Rogers scale (%) ($\chi 2$ = 22,9033; df = 4, p = 0,0001)

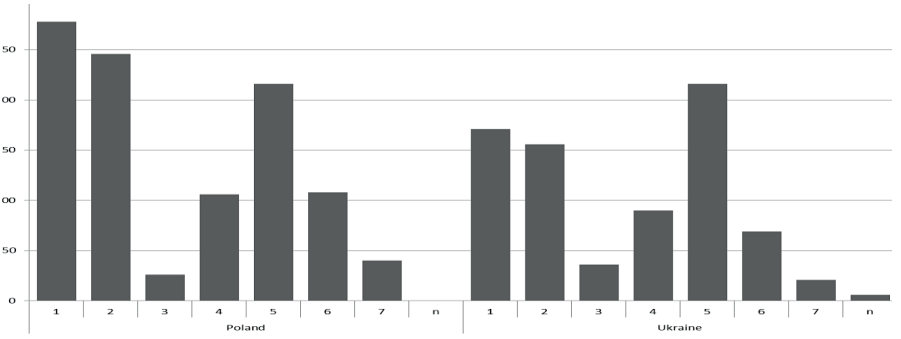
Specification	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
Rogers Model	2,5	13,5	34	34	16
Polish consumers	5,9	35,3	25,9	23,5	9,4
Ukrainian consumers	4,7	24,7	23,5	41,1	5,9

Source: the authors, Everett M. Rogers, (2003)

The empirical data collected show that Polish respondents were characterised by a higher level of innovativeness as measured by the pace of acceptance of new products. Among the Polish respondents there were more innovators (5.9%), adopters (35.3%) and early majority (25.9%), or those who buy products after they have been tested by others. At 41,2 percent, the greatest share of Ukrainian respondents belonged to the late majority, or consumers who buy new foods only after most of their friends have already acquired and expressed their approval of them. The differences between the Polish and Ukrainian samples are statistically significant. The results of the study population differ from Rogers' theoretical model. In another study, Polish researchers also observed a distribution of different types of consumers that did not match Rogers' categorisation (Gutkowska and Ozimek, 2005). The differences in test results obtained by different authors are probably dictated by the different methodological approaches, which are related mainly to the method of sampling used for the testing.

The study's participants were asked to identify their three main motivations and barriers, by answering multiple-choice questions. With regard to the motives, most of the Polish respondents pointed to the fact that they like a variety of foods and are interested in new products on the market. 278 (81.7%) and 246 (71%) of the respondents indicated these motives. Caring for one's health was the factor most indicated by the Ukrainian consumers (216 persons - 84.7%). Figure 1 shows the motives that guide the Polish and Ukrainian respondents when choosing innovative foods. The motives that were least frequently indicated by both the Poles and Ukrainians were those associated with the impact of the external environment, namely the desire to impress and meet the expectations of relatives. The motives identified in the study confirm that today's consumers are paying attention to the health aspects of food, and it is widely known that the awareness of eating high-quality food is one of the elements of a modern lifestyle.

Figure 2.: The motives in consuming innovative foods among Polish and Ukrainian consumers (number of responses)

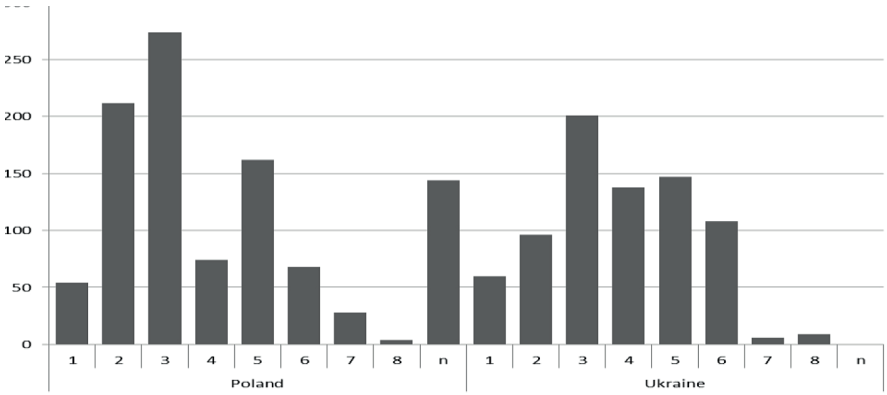


1. I like a varied diet
2. I'm interested in new food
3. I want to impress others
4. I'm interested in nutritional issues
5. I care about my health
6. Intensive promotion of such products
7. Relatives expectations

Source: authors' survey results

As regards the barriers, the highest number of both Polish and Ukrainian consumers—274 and 201, respectively—indicated the high prices of innovative foods. This is clearly the main barrier, not least because the manufacturers of innovative food products often use the strategy of high prices in the product launch phase. Polish consumers also pointed to the poor availability of these products, while Ukrainian consumers named a lack of information as an additional barrier. In addition to product-related factors, marketing communications issues also present hurdles to consumption. The number of indications for specific barriers for Polish and Ukrainian consumers is shown in Figure 3.

Figure 3.: Barriers to consuming innovative foods among Polish and Ukrainian consumers

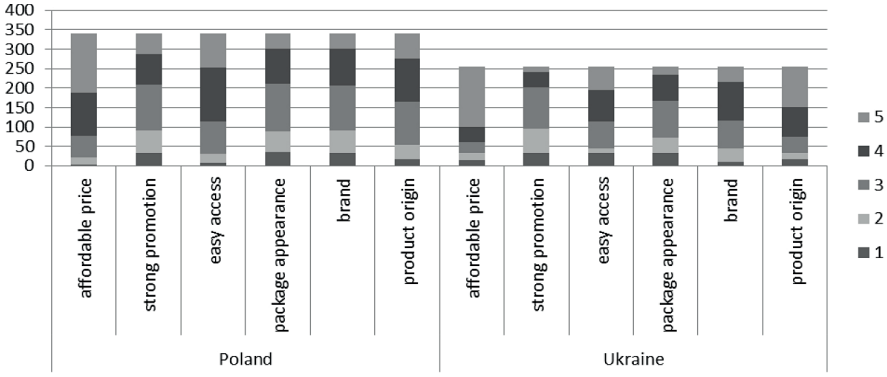


1. Few new products in the market
2. Limited availability
3. High price
4. Experts, doctors do not recommend such food
5. Limited information
6. Preference for traditional products
7. It does not matter what I eat
8. Other

Source: authors' survey results

Factors determining the purchase of innovative food products were identified, and assessed on a scale of 1 to 5, with 1 being unimportant and 5 extremely important. The questions were multiple choice, with six factors potentially influencing a purchase: affordable price, strong promotion, easy availability, appearance of packaging, brand and product origin. The answers to the questions are presented in Figure 4.

Figure 4.: Assessment of factors determining the purchase of innovative food products, 1 - unimportant, 5 very important (number of indicators)



Source: authors' survey results

Among the Polish consumers, 262 (77 %) said affordability and 226 (67%) indicated easy access were the most important factors (and hence assigned them a 4 or 5 on the importance scale. Among Ukrainian consumers, affordability (195 respondents - 76 %) and product origin (180 respondents - 70 %) were ranked the highest. To analyze the responses to this question, an indicator of the similarity of structures described by the following formula was used:

$$\omega_p = \sum_{i=1}^{k} \min(\omega_{1i}; \omega_{12})$$

where w_{1i} are the variants of the answers for Poland, a w_{2i} are the variants of the answers for Ukraine.

The value measure belongs to the interval [0,1], and the closer the value is to unity, the more similar the structure of the community will be. Based on the results of the study, it was calculated that the structure of the response to the Polish respondents were the most similar to the structure of the responses from the Ukraine in the evaluation of the factor *appearance of packaging.* In this case, the similarity of the structure was nearly complete, amounting to 0.96. The least similar response—the similarity measure was .75—was observed for *product origin*. The similarity measure for the remaining factors was: *affordable price* - 0.77, *strong promotion* - 0.82, *easy availability* - 0.87, and *brand* - 0.85.

6. RESEARCH IMPLICATIONS

Research results present certain remarks for managers responsible for introducing new food products to the market. Special attention needs to be drawn to the pricing strategy of these products, as high prices are the main barrier to buying innovative food products. In most cases, the strategy used when introducing innovative products consists of high prices which are lowered as the product gets more popular. The appropriateness of this strategy should be evaluated. The availability of these products should also be considered. Very often, innovative food products are mainly available in big retail chains with limited availability in smaller towns and villages. Traditional trade should also be considered in regards to availability improvements, with innovative products also being introduced to the market through this distribution channel.

7. CONCLUSIONS

Introducing innovation is seen as a fundamental factor for companies seeking to boost competitiveness and achieve success on the market. However, for a company to benefit from doing so, the innovation must be accepted and purchased by

consumers. Only a small percentage of new products are diffused and accepted by consumers today. Whether they are depends to a large extent on innovative consumers appearing with a propensity to purchase innovative products within a short time of their appearing on the market. Rogers' model, which measures the likelihood of consumers to purchase a new product, is widely used to measure consumer innovativeness. The research done for this paper employed the Rogers model to examine how innovative Poles and Ukrainians are as consumers. The results clearly show a distribution different from the Rogers distribution of consumers, as well as differences between the innovation of Polish and Ukrainian consumers. The Polish and Ukrainian consumers also proved somewhat different in terms of the motives and barriers they perceive to purchasing innovative foods. One thing is certain: all of the survey's respondents focus on taking care of their health, which was one of the key motivators. Both groups also indicated that the high prices innovative products command stand in the way of their purchasing them.

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REVIEW OF METHODS FOR THE SURVEILLANCE AND ACCESS CONTROL USING THE THERMAL IMAGING SYSTEM

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ABSTRACT

This paper presents methods for human detection for application in the field of national security in the context of state border surveillance. Except in the context of state border security, the presented methods can be applied to monitor other protected object and infrastructure such as ports and airports, power plants, water supply systems, oil pipelines, etc. Presented methods are based on use of thermal imaging systems for the human detection, recognition and identification. In addition to methods for the detection of persons, are presented and methods for face recognition and identification of the person. The use of such systems has special significance in the context of national security in the domain of timely detection of illegal crossing of state border or illegal movement near buildings, which are of special importance for national security such as traffic infrastructure facilities, power plants, military bases, especially in mountain or forests areas. In this context, thermal imaging has significant advantages over the optical camera surveillance systems because thermal imaging is robust to weather conditions and due to such an infrared thermal system can successfully applied in any weather conditions, or the periods of the day. Featured are procedures that has human detection results as well as a brief survey of specific implementation in terms of the use of infrared thermal imagers mounted on autonomous vehicles (AV) and unmanned aerial vehicles (UAV). In addition to the above in this paper are described techniques and methods of face detection and human identification based on thermal image (thermogram).

Keywords:
national security, negative effects on the national economy, infrared thermal imaging, area surveillance and access control, human detection and identification

1. INTRODUCTION

Safety and security are perhaps the most important issues in the modern world in almost every aspect of human work and life, but the most significant is in the area of national security in terms of protection of state border and other objects that represent a significant national interest. The importance of preserving security in the domain of national security, of particular importance in preventing and cutting of terrorist activities, as well as other illegal activities such as smuggling of narcotics across the border and human trafficking. In this regard, special emphasis is placed on the timely detection of the persons who illegally cross the border with the objective of carry out terrorist attacks or committing other illegal activities as a direct attack on national security, and the freedom and security of citizens and private or state property, which in the end has a direct negative impact on the entire economic system of each state which may be manifested in the form of a reduced number of tourist arrivals, increasing business risk, etc. Therefore, the continuously evolving technology, techniques and methods for the implementation of security measures especially when it comes to the security of the state level, or the level of each economic subject. Each country seeks the application of different security measures and techniques to increase the level of security to all citizens, and limits and protect areas and facilities that are of significant importance for the state and its citizens. In this context, developing methods and techniques (and ways of their implementation) that enable easy and timely detection of potential threats, especially in context of illegal border crossing, as well as access to certain facilities that are of national importance. Each country, as well as enterprises seek to maintain the cooperation and coordination of security policies and practical actions in the fight against the so-called, asymmetric security challenges, risks and threats - terrorism, organized crime, illegal migration and human trafficking, especially women and children.

Given the above, this paper presents methods of using thermal imaging systems, as well as computer vision, in border control, as well as other protected areas. The paper is structured so that in second part are described the fundamentals of infrared thermal imaging, in third an overview of research in the domain of application of thermal imaging in surveillance and human detection, and fourth part describes methods of face recognition and identification of persons based on thermogram.

2. FUNDAMENTALS OF INFRARED THERMOGRAPHY

The use of infrared (IR) thermal imaging systems is not new, since the thermal imaging camera is already widely applied in different areas, security and surveillance, medical diagnostics and detection of various anomalies in architecture, civil engineering, building construction, mechanical engineering, etc. Infrared (IR) thermal sensors are special types of sensors designed to detect the infrared radia-

tion of different wavelengths. IR offers the capability of imaging scenes based upon either the IR light reflectance or upon the IR radiation they are emitting. IR radiation is emitted in proportion to heat generated/reflected by an object and, thus, IR imaging is commonly referred to as thermal imaging. As IR light is invisible to the human eye, IR illumination and imaging systems offer a useful method for covert surveillance, as such; IR imaging commonly forms the basis for night-vision systems (Solomon and Breckon, 2011). The importance of the application of thermal imaging systems in border control and the fact that modern thermal imaging cameras have extremely high reliability and scope in the context of human and vehicles detection. Both individual systems have the ability to detect people at distances up to 20 km, and vehicles even through 20 km, regardless of atmospheric conditions. The application is particularly suitable for the colder part of the year when the temperature difference between the environment and the observed object is even more pronounced. In connection with that, it should be emphasized that the possibility of detection at long distances solely related to the detection of thermal silhouettes of people, while the possibility of applying the recognition of faces and possible identification of the person is reduced to a distance of several dozen meters (Systems, Inc. FLIR, 2016).

The infrared spectrum (IR) of electromagnetic radiation is not visible to the human eye as it has a greater wavelength, and therefore a lower frequency. The infrared spectrum covers the wavelength range from 0.7 to 300 microns, which corresponds to the frequency range from 1 to 430 THz, which is larger than the wavelength of the spectrum of visible light, but shorter than the wavelength of terahertz microwaves.

Infrared is primarily divided into three sub-areas:

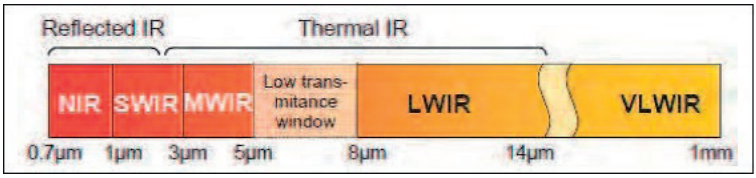
- IR-A in the range of 0.7 to 1.4 microns;
- IR-B in the range from 1.4 to 3 microns;
- IR-C in the range from 3 to 1000 m.

In addition, the spectrum of infrared radiation can be divided according to the following scale:

- Near-Infrared - NIR, ranges from 0.7 to 1 microns (μm);
- Short-Wave infrared - SWIR, ranges from 1 to 3 μm;
- Mid-Wave Infrared - MWIR, ranges of 3 to 5 μm;
- Long-Wave Infrared - LWIR, ranges from 8 to 14 μm;
- Very Long-Wave infrared - VLWIR, in a range greater than 14 μm (Figure 1).

In this context, the authors, point out that the NWIR and SWIR bands are sometimes referred to as "the reflected infrared radiation" while MWIR and LWIR bands called "thermal infrared radiation", which do not require an additional light source and heat, considering that the emitted thermal radiation sensors can detect completely passive and thus get an image of the environment solely by reading the emission of thermal energy of the observed object (Bhowmik, M. K., Saha K., Majumder S., et al., 2011).

Figure 1.: Infrared band of the electromagnetic spectrum showing the different IR sub-bands



Source: Bhowmik, M. K., Saha K., Majumder, S., et al., 2011

The most commonly used systems are FLIR (Forward Looking Infrared) systems that are using MWIR and LWIR wavelength infrared radiation (Figure 2.), show the visibility of faces in different band of electromagnetic and IR radiation. It should be emphasized that, as a rule, comes to video cameras system for signal processing and human detection sent to a continuous video signal which requires extra processing steps of the input signal and in this case it's called real-time detection, or online processing and detection. Such results have the highest value since it enables timely reaction, especially when it comes to national security in terms of movement detection in the monitored area. In addition to the online system, there are also offline systems, which recordings are saved and after that, starts image processing in order to detect people or vehicles. Although the results of such systems have less information value in border control and monitored regions, its application in the different areas where it is not necessarily reporting real-time human detection (Bhowmik, M. K., Saha K., Majumder, S., et al., 2011).

Figure 2.: A face simultaneously imaged in the (a) visible spectrum, 0.4 - 0.7 μm; (b) short-wave infrared, 1.0 - 3.0 μm; (c) mid-wave infrared, 3.0 - 5.0 μm; (d) long-wave infrared, 8.0-14.0 μm.

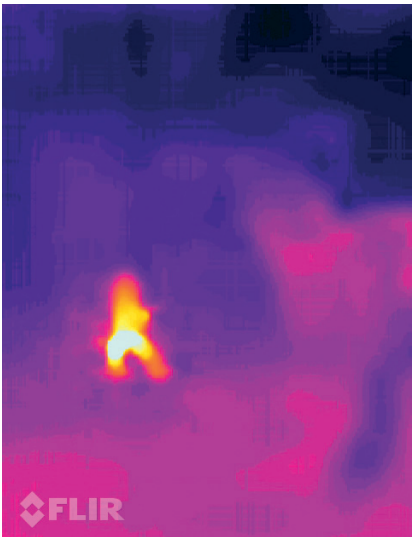
(a) (b) (c) (d)

Source: Bhowmik, M. K., Saha K., Majumder, S., et al., 2011

3. HUMAN DETECTION USING INFRARED THERMOGRAPHY

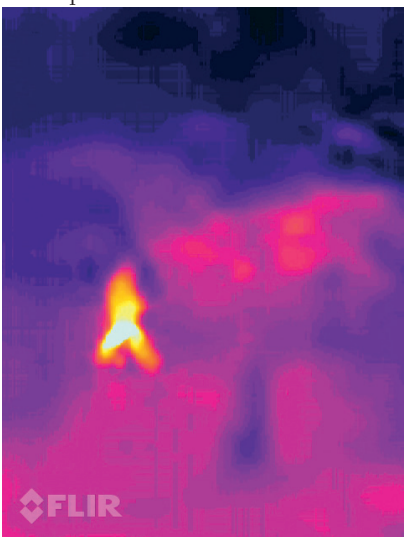
Human detection primarily relates to the detection of movement of persons, without attempting identification. In the context of state border surveillance and access control, motion detection is sufficient for an adequate and timely response, especially when it comes to illegal border crossings. Figure 3 shows the thermal silhouette of a person in motion. The person was recorded at night, normal and harsh weather conditions (rain) at a distance of about 50 meters. The objective is to demonstrate the robustness of thermal imaging cameras to weather conditions, which highlights the main advantage of this system compared to standard optical cameras that do not have the ability to record in these conditions. Recording was conducted using thermal camera implemented in smartphone CAT S60, and the recording resolution is 640x480 pixels, 25 FPS. Implementation of thermal cameras in smartphones further demonstrates the possibilities of application of infrared thermal imaging in the field of control of persons and access control. Although in this case a relatively short distance, surname of this type of camera allows timely reaction in certain segments, such as close supervision of supervised areas, and mobility devices is definitely an added advantage since it is extremely mobile and most unobtrusive, given that a small sensor that can be hidden in a variety of items that will raise doubts in people who are planning to make unauthorized access to a controlled area. A visual analysis shows that the thermal silhouette of a person clearly visible, and further research and development of algorithmic support can contribute to the development of a fully autonomous system control area.

Figure 3.: Thermal silhouette of a person - rain



Source: Author

Figure 4.: Thermal silhouette of a person normal weather conditions -



Source: Author

In the context of the application of thermal imaging systems in the control of the protected areas Dulski et al., (Dulski, R., Kastek M., Trzaskawka, P., et al., 2011), describe the use of systems based on a combination of different sensors. Specifically, these authors present a system that uses a combination of radar system (using radar millimeter wavelengths, which is detecting objects at a distance of 780 m), passive infrared thermal imaging camera (shooting from a distance of 480 m) and standard optical cameras that covers the visual part of the electromagnetic spectrum (recorded from a distance of 760 m), as input sensors for image acquisition. The authors point out that such systems increase the probability of detection of an intruder in the protected area, but our focus is on thermal imaging systems.

In the context of thermal imaging cameras, as one of the input sensor, it was pointed out that the input image necessarily need preprocessing using standard techniques of digital image processing such as detection of objects, edge detection, detection and recognition of colors, textures, etc. (Solomon and Breckon, 2011; Zhou , H., Wu, Y., Zhang, J., 2010). In addition, processing of thermogram has some specifics in relation to the processing of standard optical images taken in the visible spectrum. Dulski, et al., (Dulski, R., Kastek M., Trzaskawka, P., et al., 2011), state that the infrared thermal imaging must be binarised, based on detection thresholds set in advance, so that the application of the mask can define different levels of objects emission of the infrared radiation. Masks are defined by the level of brightness (or white level) of individual segments of the image that have a value above the set threshold, while all other segments are assigned a lower level of illumination (to black) and have a value below the set threshold, and are marked as background.

Breckon, et al., (Breckon, T. P., Ji, W. H., Richardson, J., 2012), also describe a combined autonomous system for surveillance and human detection, which also can be applied for vehicles detection, using optical and thermal images. The authors propose a two-stage approach to automatically detect people and vehicles with a time filtering. This approach primarily to detect the initial segments within the scene that might contain object, followed by feature extraction of isolated segments based on which carried out a secondary classification of persons/vehicle. In order to achieve effective detection of real-time segments within the initial scene, the isolated sub-regions which can contain objects, and then through the extraction of features and classification of selected sub-regions it is possible to achieve real-time processing. Further improvements can be achieved using adaptive background model based on the Mixture of Gaussian (MOG). This approach allows each pixel to be processed as a set of Gaussian distribution, and enables the simultaneous operation of changes in movement or the noise of each pixel of each image affected by a certain period of time. Ultimately, this model makes it possible to capture a new image every time situation is changed in a way that evaluates each pixel in order to evaluate whether it is a front (object pixels) or background pixels that are discarded. The whole process of modeling is taking place "in the background system" which enables automatic identification of the foreground (object) segments each image that comes from the input video signal making it possible to conduct effective extraction of features and classification of each new object that appears on the scene, but also objects appear on the scene and remain motionless after appearing (e.g. a hiding person). Furthermore, the authors state that the use of this model and applying the selected classifier, such as SVM, Bayes classifiers, Artificial Neural Network, KNN (Witten, I. H., Eibe, F., Hall, M., A., 2011; Harrington, P., 2012), can classify objects based on offline classifiers training and direct online application to input images. Breckon, et al., (Breckon, T., P., Ji, W. H., Richardson, J., 2012), as a classifier in the last phase of identification, describe the use of Support Vector machine - SVM (Burges, Christopher J.C., 1998), and Decision Forest - DF, (Breiman, L., 2001), algorithms.

Breckon, et al., (Breckon, T., P., Ji, W. H., Richardson, J., 2012), conducted an independent learning system for examples of identification of cars and people, as well as for each type of image (optical and thermal), with the application of additional classifiers for the classification of sub-categories (civilian/soldier). Furthermore, authors put a significant emphasis on the temporal filtering in terms of high frequency input images into the system in relation to the possible occurrence of a person on the recordings. The experiment used a camera that captures 25 frames per second (FPS), and therefore it is clear that a certain number of the images do not contain the object and should be rejected. By rejection of background pixels, the processing system retains only images where objects are detected based on pixels with high intensity lighting, or only images containing a person and which are suitable for further processing and classification. Extracted images, which contain an object,

during processing, are grouped into time groups that actually makes only a small part of the total recordings and a smaller part of the time slot in relation to the entire period of training supervision (recording). In this sense, for moving objects (the same is for static objects) changes the scale, perspective in observing the object as well as the level of the presence of noise, can significantly affect the distribution of the extracted features of any segment of the image that can contain the object. These variations can largely be systemic, in terms of changes with respect to the scale and perspective of observation, or may be random with respect to the level of noise present, and thus may have a certain impact on the detection and identification of the selected object images. In conclusion, this paper pointed out that the simple time filtering effect for reporting the detection of the object, with respect to the sensors used, is very important. Namely, it is emphasized that in this way reduces the number of duplicate reports detection of objects, this approach ultimately leads and to reduce the number of false positive detection. It was also noted that this approach largely sets the framework for further research and integration of multi-modal system for object detection and reporting of users in the post-classification stage. Further development opportunities are open especially in the context of the robustness of the sensors as well as in the field of combining different types of sensors to the smooth and continuous operation of the system to be functional even in the event that one of the sensors fails.

In the context of monitoring the open areas with the goal of detecting people and vehicles, Breckon, et al., (Breckon, T., P., Gaszczak, A., Han J., et al., 2013), also described a combined monitoring system based on optical and thermal images, and further combined with the radar signal. In the mentioned paper is described the use of combined systems installed on unmanned ground vehicle (UGV), and unmanned aerial vehicle (UAV). The emphasis of the paper is on automatic processing, fusion of input signals, and reporting the results of the surveillance in the classes of persons/vehicle. The authors describe in detail used platforms (UGV and UAV) with descriptions of the technological capabilities of vehicles and equipment installed on these platforms. The focus was put on automatic processing, detection and interpretation of recordings. Regarding the use of UGV, the authors state that the automated detection based on a two-phase system which is the first stage relies on the rapid localization of regions that may contain object using Haar cascade classifier (Viola, P., and Jones M., 2001), while the second stage is to confirm the presence of the object by using SVM (Burges, Christopher J.C., 1998). Presented system, during the first phase, using Haar cascade classifier for identifying objects in certain segments of the input image. The concept is designed in a way that combine more related weak classifiers to create a strong classifier, and the authors cite the example of the use of boosted classifiers using Haar features (Viola, P., and Jones M., 2001). Haar features are obtained from the spatial response of Haar basic function and its derivation, but in practice is calculated as the sum of the difference between varying rectangular localized sub-regions, which, although limited to the individual features, can very effec-

tively calculate (relying only on integer math). Individually, these features are weak discriminative classifiers, however, when connected in cascade yields a strong discriminative classifier based on a calculation of the difference in brightness and color. Breckon, et al., further point out that the resulting classifier is trained using the AdaBoost algorithm (Dollár, P., Tu, Z., Tao H., Belongie, S., 2007), in order to choose the maximum discriminant subset of Haar features from around the extensive feature set. Final Haar classifier cascade consists of a series of key weak classifiers. Mention simple classifiers actually represent degenerative decision tree that Haar features taken as input for the weak classifiers and returns a response aisle/rejection. Selected segment images must give a positive answer to all classifiers in cascade in order to be classified as an instance of an object on which to learn a strong classifier. The classifier can be tested in the input image based on a number of levels and the location of use of a sliding window of credit. Nature cascades, arranged according to the most discriminative features, provides early rejection of most of the window based on the results in searching the minimum features subset to be used for evaluation of the cascade. Haar cascade classifier successfully combine multiple classifiers and initially reject the negative image regions and focuses on segments that have the potential, which certainly saves resources and time (Breckon, T., P., Gaszczak, A., Han J., et al., 2013). The same authors state that the system in the second phase requires the confirmation of the object, which is based on the use of SVM classifiers. Classifier generation is performed, following the aforementioned methodology, for both people and vehicle by performing training over a set of manually labeled positive and negative examples. For people detection, they use a data set of approximately 2000 positive examples (people) and approximately 11,000 negative (non-people) examples randomly selected from the same source imagery. The negative set is again randomly sub-sampled to generate 2000 negative (non-people) examples for each stage of the cascaded Haar classifier training whilst it is used in full for training the secondary SVM classifier with the addition of another 2400 negative examples. This training procedure is performed for both visible-band and thermal-band imagery to generate a trained classifier for detection that operates independently in each modality. For thermal imagery, an additional two-stage classifier pair is generated using only the upper-torso of the human body to train detection in some partial occlusion cases. The tests were conducted in the optical and thermal band of the spectrum, but in this paper, focus is only on the results of testing the thermal spectrum. The authors created additional pair of two-stage classifiers only for the person upper torso in order to train detection in cases where the body is partially hidden. On thermal images, people have shown in various environmental and weather conditions as well as in different positions of the body. Human detection is carried out in relation to the buildings and openings (windows, doors) on the building. Before the process of detection of persons, is performed detection of openings on the building using detection of edges, and then the straight lines extracted by using PCA method. Detec-

tion of human thermal traces on windows or doors of the building are obtained using the average pixel value that is set as the threshold, with a predetermined sub-region of the thermal image, which corresponds to the dimensions of the any openings in a building and scaled to the dimensions of 50 x 50 pixels. From this, the rated areas extracted eigenvector that covers the form of distribution of thermal trace of the opening of the building and the ratio of openings before scaling. Eigenvector is designed chaining vertical and horizontal histograms projection scaled images with the set threshold and ratio for each opening. The resulting eigenvector generates input set for four class neural network (full body, half body, empty hole, non-person) and carried out the detection of whether the visible whole person, half the person and ignore the holes in which no person or non-person. In the context of detection of persons using thermal imaging cameras mounted on unmanned aircraft (UAV), authors also used the procedure described above, but they in the second phase used multivariate Gaussian detector forms to confirm the detection of human thermal silhouette. The authors also described the process of determining the location and measured the distance from the sensors. Results showed that the presented system, and proposed techniques for the construction of an autonomous system for human detection give good and reliable results ranging from 90 to 100% with error in estimating the distance of ± 5 m. Although the present system gives a good result, in some situations it is less than 100%, which is not enough for absolute reliability for application in the field of national security. For absolute reliability and use in national security, the result always must be 100%; due to a slight deviation can lead to misinterpretation and wrong decision. Wrong measuring distance can also lead to making the wrong assessment, given that the deviation of 5 m, may mean that the person is not detected crossed the state border and did not enter the monitored and protected area, and to conduct the police to such a person, if it comes to the state border, could lead to violations of the border areas, and even an international incident, especially when it comes to crisis areas between the countries. In addition, a negative effect may arise in the case of using such a system on the UAV for offensive action, when a deviation of 5 m can result in unintended victims, or to miss targets.

Gilmore, et al., (Gilmore, E., T., Ugbome, C., Kim C., 2011), described the thermal imaging human detection system in urban environments implemented with a Matlab on a laptop platform interfaced with a low-end microcontroller. This system primarily focuses on digital, infrared thermal imagery and pedestrian candidate selection and detection using available detection algorithms, and on simple, economical implementation, which is possible through the direct interfacing between the algorithm in Matlab and low-end external hardware for indication of the detection result. The objective was to achieve the human detection almost in real time. The authors described a system that is based on a three steps. The first step, preprocessing is done to obtain hotspots from the image using the methods of histogram equalization and segmentation by a threshold approach. A threshold approach is a technique

often used to separate foreground objects from background environment based on their differences in image intensity. In a simple threshold approach, a single intensity threshold is used to generate a binary image from the original image. A simpler approach is based on determining a single binary threshold intensity of the original image. The second step involves the implementation of morphological operations to remove background noise from the image, in this case, techniques of erosion and dilation are successfully removed most of the noise from the image, and the application of these techniques have been successfully detected regions of interest (ROI) in the images. The third stage is the selection of the appropriate characteristics of the human body using different metric measures such as the ratio restrictions, local histogram filters and/or matching morphological human model. Gilmmore et al., for human detection used height and width and are thus automatically remove all non-human objects in the image. The results of the tests given by the accuracy of detection of 90% with 10% false positives, which the authors characterize as a good result given the equipment used in the testing and algorithmic support. As main advantages, the authors pointed out the possibility of application platforms developed in Matlab and use simple microcontroller, which enables the successful implementation of all steps in terms of online, and offline data processing, formatting, image detection and calculates the difference and simplicity in use, flexibility and efficiency. As the shortcomings pointed out the weakness of their algorithm to perform analysis of complex image and the inability to simultaneously, detect more people with regard to the threshold set by only one person. A major drawback of the system is the inability to detect people in different positions (lying, stoop, squat, etc.).

Despite some disadvantages presented system is a good indication that it is possible to develop a cost-effective and efficient system for human detection and therefore economic viability given that shows how thermal imaging system for detecting people as possible built using very simple techniques and inexpensive components. It is also extremely important that the system despite its simplicity has a high detection rate. The disadvantage is, as the authors themselves noted, the inability to simultaneously detect more than one person, what can be achieved by applying more advanced classification algorithms, and the question remains how the system is based on components of this type can be a reliable long-term, due to the control of the state border and other protected area requires high reliability for continuous (24/7) long-term use.

Miezianko and Pokrajac (Miezianko, R., and Pokrajac D., 2008), presented a method for detecting people in low-resolution infrared videos. Presented system use feature set based on a recursive model patches. Feature extraction based on the histogram edges orientation without creating a dense grid. The basic premise of the feature set is to extract information on the gradient and display them as an integral image to quickly compute the difference between a "patches". One set of "patches" is defined as the relative position in the search window, while the other set of "patches"

is used to yield more local descriptors. Details of the detection and the human presence are obtained by calculating the histogram ratio between different "patches", followed by a linear SVM trained on the individual thermograms. In the first stage, the image is converted to grey scale image (if the input image is not black and white), followed by computing the edge gradient of every pixel that is composed of the gradient scale and orientation. Followed by construction of 3D images in a way that every part of the 3D image is one orientation bin highlighted as an integral image, and the sum of the pixels. This representation allows rapid extraction of features histogram's gradient of the sub region of the input image of any size using permanent access to the integral image. For each search window, is calculated expensive models location "patch", a corresponding histogram vector is calculated from the resulting 3D image. The ratio between the histogram of each set of patch models becomes an eigenvector. Linked eigenvectors all sets of patch model in the search window, linear SVM classified it as a human/non-human. In the same paper, the authors pointed out that the calculation of the eigenvectors must take several steps. Initially, the edge detection is performed by convolving vertical and horizontal Sobel masks used in object detection (Levi, K. and Weiss, Y., 2004). Except of Sobel masks, proposed by the authors, other methods for edge detection probably can achieve equally good results, such as Canny edge detector (Nadernejad, E., Sharifzadeh, S., Hassanpour, H., 2008), which is one of the most commonly used edge detectors of which should implement appropriate tests and comparisons with the proposed Sobel masks. In conclusion, the authors (Miezianko, R., and Pokrajac D., 2008), pointed out that the application of the described model - using histogram gradient for the construction of 3D images and models histogram ratios, recursive model for the calculation of eigenvectors and use linear SVM classifier gives as good results in the human detection in infrared thermal imaging video of low resolution.

4. FACE DETECTION AND IDENTIFICATION

In addition to the previously described human detection methods, another promising area of application of infrared thermal imaging in the field of national security, and surveillance of protected buildings is face recognition on thermal imaging footage and possible identification of a person based on face thermograms.

With regard to detection and face recognition to thermal imaging, footage reveals a certain advantage over standard optical image. Thermal imaging is insensitive to the level of the lighting conditions. The standard photo and video sensors record image based on the reflection of the visible part of the spectrum of the subject. On the other hand, infrared thermography uses infrared band of the spectrum, and depending on the amount of radiation of the detected objects, in this case the human body or face. In this regard, it should be noted that the infrared thermal imaging sensors have the ability to record the structure of veins structure and tissue on the face, which can

be further utilized in the field of face detection and identification of a person (Jafri, R., Arabnia H., R., 2009).

Cutler (Cutler, 1996), noted that the structure of veins and facial tissue is unique for each person, such as a fingerprint or papillary lines. Based on that, he spent experiment using eigenfaces and infrared images to do automated face recognition. 24 subjects were used in a database of 288 images. A recognition accuracy of 96% was achieved for frontal views, 96% for 45° views, and 100% for profile views. This compares favorably with visible light techniques. However, to the structure of blood, vessels and tissue were visible on the thermogram; the images must be high resolution. Cutler experiment used an image resolution of 160 x 120 pixels on which the structure was only moderately visible. Jafri and Arabnia (Jafri, R., Arabnia H., R., 2009), pointed out the disadvantages in the use of thermograms for face recognition. Although the infrared thermal imaging system is robust to a wide range of impacts on the record because the focus is on capturing thermal radiation of the observed person, significant gaps lie in the economic viability due to the usually high cost of thermal imaging systems, then as other types of problems. Jafri and Arabnia (Jafri, R., Arabnia H., R., 2009), as one of disadvantages, also mentioned low resolution of thermal sensors and high noise in the captured images (although the previously described specific techniques that successfully solved the problem of noise), and an additional problem is the high sensitivity thermal imaging camera on the glass (or glasses) as the glass is an obstacle to recording thermograms high resolution, or any other resolution because thermal radiation can't penetrate through glass.

Bebis, et al., (Bebis, G., Gyaourova, A., Singh, S., Pavlidis, I., 2006), emphasized one of the major problems in face detection and possible identification of person, the high impact of emotional and health status of people on results. In fact, this is perhaps one of the most significant problems of thermal imaging to identify a person on the basis of the thermogram as the different emotional and medical conditions greatly affect the body temperature which is why solving these problems are very difficult and demanding. Solutions of the mentioned disadvantages can be found in combining techniques of infrared thermal imaging with optical recording of persons with regard to the techniques recorded completely different facial characteristics. Bebis et al., have proposed an approach that is based on the simultaneous recording of optical and thermal imagery and their subsequent merger in order to obtain maximum characteristics with both images. The authors describe two approaches, one based on analyzing pixels (pixel-based) and the second to feature extraction (feature-based). To calculate the optimal border mergers obtained recordings authors have proposed the use of genetic algorithms (GA). The authors also conducted extensive research on the available data, and the results showed that the approach based on analyzing pixels gave better results than an approach based on the calculation of the intrinsic characteristics, although this approach is more computer demanding.

Socolinsky et al., (Socolinsky, D., A.,. Wolff, L., B., Neuheisel, J., D., Eveland, C., K., 2001), described face recognition and identification using thermograms and they conducted parallel analysis of the thermal and optical images with a singularity. The authors, for the purposes of the study, developed a special sensor capable of simultaneous recording of optical and thermal images (CCD and LWIR micro bolometer). The resulting recordings have special significance since it shows an identical recording in two different areas of the spectrum, which is not the case with the previously described techniques, which are normally used footage captured separately. Face detection on the obtained images were tested using two algorithms - eigenfaces and ARENA algorithm that is somewhat simpler and describe it as an algorithm with a nearest neighbor (1-NN). ARENA algorithm first reduces the dimensionality of the image pixel at a very coarse resolution by replacing each pixel corresponding mean values of gray values on the square adjacent pixels. The test images were taken under different lighting conditions except that the brightness setting for each person changed several facial expressions. The results show that both the tested algorithm provides differently on optical images when changing the brightness (illumination while the thermogram had no impact), however the thermograms were encountered problems when a person is wearing glasses, although this problem successfully solved using the eigenfaces with respect to the reduced impact of eye region on the overall score. Ultimately, better results are achieved by using thermograms than optical images and the use of eigenfaces methods than the ARENA algorithm.

Seal et al., (Seal, A., Ganguly, S., Bhattacharjee, D., Nasipuri, M., and., Basu D., K., 2013), described a method for automated person identification based on face thermograms respectively using image of facial veins structure. The authors present a new approach to the identification of a person based on the structure of facial veins structure based on the assumption that this structure is unique for each person. The application of the three methods for obtaining the image of the facial veins face thermograms. The first is bit-plane slicing, and transformation around the medial axis, the second is morphological erosion gray values with a transformation around the medial axis and the third is the application of the Sobel operators for the extraction of data on the blood flow. Method of bit-plane slicing is a method wherein each pixel is displayed in black and white in 8 bits, which means that the image is made up of eight one-bit planes (bit-1) starting from the 0-plane bit, which is the least significant (LSB plane) to the bit-plane 7, which is the most important plane (MSB plane). The advantage of this method is that the yield relative importance of each bit in the pixel. The unique aspect only four bit-planes of higher order (4 to 7) contain most of the visually significant information, while the bit-plane of the lower visual order contain fewer important information as they are obtained from a lower contrast. This is the method used for extraction of thermal physiological features of the face of grey scale images and create folders contour areas with constant temperature. The transformation of the medial axis is used for the extraction of lines connecting all points of

equal temperature in order to obtain the image structure of the blood vessels (similar to the application of isothermal lines connecting areas of equal temperature on maps weather forecasts). Another commonly used method is the morphological erosion of grey values, and is also used in order to extract the thermal physiological features of the face and create a region of constant and equal temperature, after which, as with previous methods used by the transformation of the medial axis in order to obtain images of structure blood vessels of the face. The third proposed method is the application of Sobel operators to obtain images of facial veins structures, and is based on the detection of discontinuities in the image. In this case, as the dashed changes in pixel intensity, and the operator is composed of a pair of 3 x 3 mask. The masks are designed to correspond to the maximum discontinuities in intensity values, and move vertically and horizontally with respect to the grid of pixels provided that is used by one mask for each direction (one vertical, one horizontal movement). Masks are combined in order to find the maximum gradient magnitude at each orientation point gradient. After applying some of the methods presented extracted detailed (key) points or minutiae that are commonly used in identifying person's fingerprint and that is the main similarity identification of people using the structure of the blood vessels of the face. The facial veins structures structure arranges similar to the fingerprint ridges (with fingerprint analysis of the structure of the ridge on the print) on the basis of which it receives a single thermal face print. Additional processing and extraction of eigenvectors of the structure of minutiae that connect areas of equal temperature of the resulting vectors will have different lengths for each person and for the classification of eigenvectors they proposed multilayer perceptron which has achieved recognition accuracy of 95.24%. Regarding the above, it should be noted that the person is recorded with thermal imaging camera at close range (from a distance of about 60 cm) in order to obtain maximum distinguishable facial thermogram. As the main advantage of this approach the authors pointed out the ease of implementation provided that it is not necessary knowledge of geometry or the specific features of the face, but the disadvantage is the necessity of recording the face at close range, the applicability of the system to a single face with a constant background, considering that with the changing background can get bad results. Although this system, because of its limitations, is not applicable for the identification of people with longer distances, according to the authors, is likely to be successfully implemented in the context of authentication access protected buildings and other areas of national security.

Bourlai and Čukić (Bourlai, T., and Čukić, B., 2012) presented the results of research regarding the problems related to the intra-spectral and inter-spectral face recognition in different conditions and with different recording distance. The authors examine the advantages and disadvantages of face recognition in images taken in different band of the infrared spectrum compared to images taken in visible light in controlled and uncontrolled conditions. Infrared images are captured outdoors at night from a distance of 30 to 120 m. It is also performed to test the recognition

between different distances from which the recording picture, as well as relations between the images taken in different spectra and different distances. Comparison of the performance of facial recognition are performed between the images recorded in the shortwave infrared (SWIR) in relation to the images from the visible part of the spectrum, and from images taken in medium infrared spectrum (MWIR vs. MWIR), as well as between the images taken in the visible spectrum and MWIR band of the spectrum in a controlled environment, and between the images captured in the spectrum near infrared region (NIR) as well as between the NIR images and images from the visible part of the spectrum with the change of the shooting distance. Test results showed that the inter-spectral face recognition level of 100% between images from the visible part of the spectrum and SWIR image when all the images from the database recorded in controlled conditions from a distance of 30 m. In the case of half-controlled conditions and shooting distance of 50 m, the recognition rate is reduced to 90%, and when the distance is further increased (to 106 m), the recognition rate is reduced to 80%. In the most demanding scenario, or in a completely uncontrolled, the results were unsatisfactory at the border, and mainly because they were non-cooperative target person and are recorded under different conditions. Decreased percentages of recognizing the different scenarios have been shown in testing MWIR of the infrared spectrum compared to other parts of the spectrum. However, promising results are obtained when it comes to comparison between MWIR images at reasonable terms when they are comparable with the results of the comparison images from the visible part of the spectrum, and the added benefit is that these images can capture in complete darkness. Testing conducted in the NIR part of the infrared spectrum, which was conducted at different distances from 30 to 120 m, as authors expected, showed worse results, especially when the recording distance is increased to more than 90 m when the facial features significantly less prominent due to weather conditions. The same trend was also evident when testing between different parts of the spectrum and between different shooting distances when comparing them with images from the NIR spectrum recorded with a 30 m. Nevertheless, when compared to images from the visible part of the spectrum and NIR regions that were taken from a distance of 120 m, using Bayes ML algorithm, the recognition accuracy is achieved of 92%. The described experiment is just one in a series of experiments and research that can be carried out regardless of facial recognition in demanding circumstances and recording conditions.

5. DISCUSSION

The use of thermal imaging cameras in the area of national security shows promising results. However, there are rare cases in which achieved 100% accuracy, which in some segments of national security is not sufficiently reliable. One area of the state border surveillance and protected facilities, where necessary absolute re-

liability of the control system in the context of detection and control of movement of persons in controlled areas. On the other hand, thermal imaging systems show absolute reliability when it comes to just about detecting movement, which in some cases may be good enough. Such examples are the use of infrared thermal imaging in the semi-autonomous systems where large investors human operator who makes the final decision whether a person or an animal, and the system performs the localization of regions of interest in the video to the human crew could quickly has made a decision on further action.

6. FUTURE WORK

For future research opens up a completely new field for improving the efficiency and reliability of thermal imaging systems. In the context of identifying persons to thermal silhouette of the whole body, opens the possibility of developing the system for identification by way of walk, considering that human gait unique to each person and people can identify known people by gait at greater distances. In this context, possible research in terms of identifying a person and distinguishing authorized/unauthorized person so that the autonomic system can detect unauthorized persons and to activate the alarm.

The study of the thermal imaging system, except in the area of national security, it is possible in other areas such as the expertise of traffic accidents in the context of detecting invisible traces of braking due to thermal footprint remains on the tarmac for some time after leaving the car, however, remains to investigate how long the thermal footprint remains and what is the reliability of such a sign for calculation of braking distance and vehicle speed. Further research in this direction could be the creation of a database of thermal traces of well-known manufacturers of tires and rubber based on the mark to determine the type of vehicle.

7. CONCLUSION

Based on the review of methods described above, it is clear that the application of infrared thermal imaging in the context of detection of people in open areas gives good results, both in urban areas and in areas outside of urban areas. In this regard it should be noted that in the context of the control of open areas of the application of reduced solely to the detection of persons without any possibility of identification with respect to thermal imaging cameras when shooting from long distances have the option of recording only the thermal silhouette of a person. On the other hand, to infrared thermal imaging system successfully applied to identify people based on facial thermogram recording faces must be carried out at close range and only one face, because only in this way can get a picture of the entire structure of the blood vessels of the face.

The described fields of application certainly open wide spectrum regarding future research in this area, especially in the context of identifying people based on facial thermograms. Furthermore, in the context of state border described techniques and methods it is possible, with some adjustment used at border crossings to detect hidden objects, or when you view the baggage or cargo space. In this context, it should be noted that thermal imaging has certain advantages over other methods that are currently being applied. It is certainly the most important application in order to detect hidden persons (illegal immigrants) within the cargo, which is a common method of attempting to illegally cross the state border.

The above models and ways to detect people in the infrared thermal imaging recordings are not the only, or in certain segments closest to the ideas related to the development of future dissertation. The dissertation topic will be primarily focused on the description of automatic unattended system detection of persons using infrared thermal imaging camera. Furthermore, the idea is also to be part of such research conduct analysis of images obtained on the basis of which it will be possible to calculate the eigenvalues of the whole person and the most common postures when illegal attempts to cross the border or unauthorized access to the protected areas (upright, hunched, crawling, etc.). It will also further attention be focused on the detection of persons on the basis of partial visibility, or will seek to define the characteristic vectors by which it will be possible to establish unequivocally that it is a person.

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