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**STUDENTS ON THEIR WAY TO SCIENCE**

**(undergraduate, graduate, post-graduate students)**

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## **UNDERGRADUATE LEVEL ABSTRACTS**

# IMPROVEMENT OF THE LEGISLATIVE SYSTEM OF LAND USE AND PROTECTION IN KAZAKHSTAN

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In a market economy control over the rational use of land conducted by the state authorities, is becoming increasingly important. Legislation on land reform provides extensive rights to landowners, land users, leaseholders for independent management on the land. Tasks of the state administration are to ensure that application of observation of land legislation, discovery and elimination of nonobservance of legislative acts of Republic of Kazakhstan, application of standards of land use and ownership rights, correctness of the land cadastre and land management, as well as implementation of measures for the rational use and protection of land is realized by governmental institutions, physical and legal persons.

Currently inefficient use of land resources, their pollution and contamination is a part of general ecological problems in the Republic of Kazakhstan. However, for management of efficient land use sustainable environmental factor often is not determinative. Analysis of legal relations according the land shows that the origins of this problem are often in the field of legal regulations, associated with inefficient implementation of land legislation [1, 2].

Land Code of the Republic of Kazakhstan in the sphere of the state control over land use separates authorities between the governmental institutions [3].

Currently Kazakhstan faces the problem on preventive measures to eliminate further degradation of the land and provide arrangements for regeneration and further rational use of natural resources, including land. According land use Kazakhstan is a country with very different - continental and dry climatic conditions, plains of the steppe and desert landscape are its characteristic feature. About 50% of territory is occupied by ecosystems, which are highly vulnerable to human impacts, can be easily destabilized and have poor ability to self-improve. Intensive cultivation of the land, excessive exploitation, low level of agricultural use and environmental preventive measures has led to the development of desertification, degradation of the vegetation cover, overexploitation of arable land, changes in soil water regime and erosion.

In Kazakhstan is performed control and expertise of changes of qualitative conditions of the land, are implemented measures to eliminate contraventions of land legislation, measures for conservation of degraded and contaminated land, use of which in future may lead to the threat of human life and health, emergencies, disasters, destruction of historical and cultural heritage and natural landscapes, the adverse environmental effects and contamination of agricultural products and water sources [4].

Ensuring of protection of land resources and realisation of constitutional rights of citizens of Kazakhstan to healthy environment are the main problems that have to be solved in the process of improving of land use and protection legislation in Kazakhstan [5].

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# SUSTAINABLE URBAN PLANNING PROBLEMS

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Research work has been carried out based on Final Report by international team of four students in Technical University of Denmark during European Project Semester (spring 2013).

Sustainable development influence today's urban planning process. CO<sub>2</sub> emission and sustainability became an important issue worldwide over the last years. It is important to formulate main characteristics of sustainable city – “compact, efficient land use; less automobile use, yet better access; efficient resource use; less pollution and waste; the restoration of natural systems; good housing and living environments; a healthy social ecology; a sustainable economy; community participation and involvement; and preservation of local culture and wisdom” [5]. One of the main issues in urban planning process is dealing with increasing usage of cars – proposing more sustainable urban design concept and traveling opportunities.

„Transport causes a large proportion of the total carbon emissions. In 2010, transport in Copenhagen alone caused 22% of the total volume of carbon discharged. So, Copenhagen has set a goal that by 2025, at least 75% of all trips must be done on foot, by bike or public transport. If Copenhageners do go by car, the aim is that as many as possible use electric, or hybrid and hydrogen cars, while heavier vehicles should run on new fuels such as biogas”[2]. Deliberative infrastructure system design stimulates inhabitants to prefer advantages of sustainable traveling.

The City of Amsterdam has been mentioned as a successful example of using mean - electric cars. „Hundreds of charging stations for 10 000 electric cars (including 5000 plug-in hybrids) and scooters will be installed in the city by 2015. Electric transport will be further increased to 40 000 electric vehicles, including 10 000 plug-in hybrids from 2015 to 2025. There must be 200 000 electric cars (including 100 000 plug-in hybrids) in the city before 2040”[1].

Car sharing is already introduced in Copenhagen. “Usage of this mean is typically considerably cheaper than owning, leasing or renting a car if you drive between 1000 and 15 000 km a year”[3]. “In calculating the space that would be required to park each of the four to eight cars that are replaced by each Car-Sharing vehicle, you find that at least 40 to 80 m<sup>2</sup> of public street space or at least 80 to 160 m<sup>2</sup> of space in car parks or on private land with its own entrance is freed up”[4]. This idea could be one of the solutions for parking place problem in overloaded city centres.

Research shows that it is realistic to reduce the amount of emitted CO<sub>2</sub> in transport or building sector implementing sustainable urban planning. It is important to take into consideration desired result and expected influence. Most of the problems appear in large developed cities and it is impossible to make new design, urban planners have to prepare solutions which can be implemented in current situation with greater effect.

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# **DEVELOPMENT OF GEODESIC SUPPORT NETWORK IN THE TRACK SECTION SKRĪVERI – KRUSTPILS**

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The coordinate reference system in nature is provided by geodesic network, consisting of geodesic marks in the area. Geodesic marks are the media for a long time period.

The primary aim of the geodesic network is to provide the necessary geodesic reference points for surveying works such as the cadastral survey, the topographic surveying of all scales, civil engineering works and other economic needs [3].

In the summer of 2013, in connection with the project of the State Joint Stock Company "Latvian Railway" for the second track construction and design in the track section Skrīveri – Krustpils there was conducted surveying work, which led to the installing of a new railway compartment band into the regional geodesic reference network.

The total railway section length is 58 km from the station Skrīveri to the station Krustpils. There are totally installed 63 geodesic network points.

According to the rules Nr.479 of the local geodesic network, the distance between the given points is selected from 1 to 2 kilometers, depending on the intensity of the existing constructions of the area.

The newly in the area installed geodesic points are secured by the ground, hard cover or wall signs [2]. In this case, surveying points are secured by specially designed ground plates.

The created geodesic network is linked with three points of the national network. All geodesic network points were measured using the global positioning RTK (Real Time Kinematic) method. As a result, to determine the coordinates of the rail Skrīveri - Krustpils geodesic network in systems LKS92 and BAS77 for each point there were made static measurements of DGNS in two sessions (1-1.5 hours each) at the same time with 8-10 geodesic sensors (TOPCON, TRIMBLE, LEICA) using GNSS of two frequencies produced by different companies.

In addition to the monitoring there were carried out 20-25 RTK measurements for each point. Leveling points, encircled by vegetation that covers the horizon, GNSS measurements were made in a stem, where the horizon is clear, and with the relevant leveling attachment point on the N1.

For march smoothing of geodesic measurements there were used software methods of least squares linear equations and Helmert's transformation of seven parameters adjustment.

The national support network set of points to determine coordinates and the used measuring methods provided precision of the coordinates to 4.9 mm [4].

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# REAL ESTATE IN REAL ESTATE MARKET

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Ownership is the full right of control over property, i.e., the right to possess and use it, obtain all possible benefit from it, dispose of it and, in accordance with prescribed procedures, claim its return from any third person by way of an ownership action. [1]. Real estate is immovable property, which is an item of property that cannot be moved without destroying or altering it - property that is fixed to the earth, such as land or a house

The real estate market has a certain set of mechanisms through which the rights of the real estate has been transfer to the new owner. The market is a mechanism of certain goods and services, as well as sellers and buyers that determine the market price of the commodity.

The real estate market is a social - economical and political framework within which occurs exchange of goods (immovable property) at an agreed price for a given time and place, taking into account the restrictions on real estate transactions which has been given by the law.

The data of real estate market transactions in Latvia has been maintained by the State Land Service [2].

The aim of the research is to explore the real estate market in Latvia.

Foreign citizens can easy purchase an apartment in Latvia, there are no restrictions for that. The foreign citizens, especially Russian citizens purchased the property in order to obtain temporary residence permits. 30% of the total apartment market transaction amount is purchases by foreigners [3]. A similar situation is happening in Lithuania.

Currently in both countries- in Latvian and Lithuanian happens a consideration for the opportunity to purchase agricultural land to foreign citizen [4]. The aim of the consideration is to limit the purchase of agricultural land by foreign citizen. Both countries are already experiencing a situation where part of the agricultural land is owned or rented to foreign companies who has established a small business in Latvian / Lithuania and whose parent company is situated in Denmark or Sweden.

Despite the fact that the Lithuanian real estate market in recent years has been quite slow, there has seen a slight increase in prices. The same situation has been also in Latvia- in the last year there is little increase in real estate prices.

Overall, the situation in Latvian and Lithuania are quite similar.

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# LEGAL REGULATION OF TERRITORY ZONING IN KAZAKHSTAN

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The total area of land resources of Kazakhstan is 272 million hectares, therefore land relations as an object of study is of great interest. Land legislation in the legal system of Kazakhstan is one of the fastest growing spheres and intensive legislative work is going on in the field of regulation of the land relations.

Increased focus on problems of legislative regulation of territory zoning is caused due to the fact that the existing for many decades system of determination of the legal regime of the land does not serve to the modern requirements.

Before the adoption of the Land Code it was considered that it is enough with land division into certain categories according to the purpose of use. Territory zoning was considered as a support tool for adjustment of the legal regime of individual territories. Currently, a set of rules on territory zoning should be assessed as an independent legal institution where different approaches come into contact with inherent aspects of market and planned (administrative) economy. This manifests the simultaneous application of rules on division of the land into categories and on territory zoning.

Zoning is determination of the territory to establish the purpose of use and regime of use. Zoning includes classification of territory into zones with determination of boundaries of each zone with following establishment of legal regime of land parcels within each zone [1].

On solving of the problems of territory zoning lack of proper and harmonized legislation, as well as the theory and practice in the area of zoning have negative effect.

The only category of land, boundaries of which can be clearly established by law, is land of settlements. The question about boundaries of other land categories still remains open. To prove cognizance of a particular territory to other categories often is difficult. Sometimes subdivision of the land to a certain category essentially means allocation of territorial zones. For example, land of specially protected natural territories and objects is divided into:

- land of protected areas, including therapeutic areas and resorts;
- land of environment protection;
- land of recreational use;
- land of historical and cultural significance;
- other high-value land [2].

The law “On architectural, planning and construction activities in the Republic of Kazakhstan” according to the land is a regulating issue of zoning much broader than the Land Code, where permitted use of the land and zoning documents is only mentioned [3].

Acuity, complexity and generality of issues of zoning require a cautious approach to the legal regulation of land relations. How quickly and competently in the country modern approaches to the determination of the legal regime of land will be introduced – of it directly depends the problem of forming civilized mechanisms of land management. The world practice shows that at this stage there is no more effective way to ensure rational use and protection of land as territory zoning.

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# ELIMINATION OF LAND DEGRADATION PROCESSES

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Land degradation is decline or even disappearance of economic and ecological values of the land and related resources. Land degradation is caused by human activities or inactivity and natural conditions. Main aim of elimination of land degradation is sustainable use of land. Land is degraded if agricultural land is covered with bushes or bogged-up, if there is a case of coastal erosion, unsuccessful drainage system maintenance, abandonment of agricultural land and built-up areas, pollution, landslides and soil degradation. Soil degradation is soil change with reduced potential to use it for economic, environmental and cultural functions. Soil degradation is caused by human activities and natural conditions. Soil degradation might be recognized as soil erosion, organic matter decline in soil, decline in soil biodiversity, compaction, decrease of soil pH and soil pollution [1].

Survey of agricultural land made by Rural Support Service in 2013 shows that in Latvia 238 447 ha of agricultural land is unused, while 69 850 ha area is overgrown [2]. About 15% of agricultural land is unmanaged or in other words, it is affected by land degradation process.

Over the past 30 years, the drainage systems are not maintained in the required order. They are destroyed, polluted and overgrown as a result they are not functioning properly. Inappropriate condition of drainage systems endangers an adjacent land to land degradation process [3].

Due to the deteriorating economic situation of the country, increased the number of cases where the land is abandoned and no longer occupied [4]. Rural land abandonment increases with decreasing number of people, especially it is seen in region of Latgale.

A framework for rational land use and protection is necessary and needed in Latvia. New Land Administration law will provide that degraded areas will be identified and marked in territorial planning documents and included in the territorial development planning information system. Local governments will provide the necessary and needed land use conditions for degraded areas. Actions of elimination of land degradation in the common interests of the public will perform local governments despite of the ownership.

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# REGULARITY OF ALLOCATION OF NON-AGRICULTURAL LAND IN KAZAKHSTAN

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Historically, in Kazakhstan existed grassland- nomadic community, people were nomadic and semi-nomadic, and they had settlement- crop-growing life. And although in the middle of the twentieth century there was built first industrial facilities, regulation of land relations was carried out by customary law of Kazakhs, and land was not classified according sector ownership.

Analysis of land registration data shows that in 2011 and 2012 land area of sector categories was changing. In the structure of land stock of Kazakhstan is dominating land of land stock reserve - 108 million hectares (42%) and agricultural land - 93 million hectares (36%). On 1<sup>st</sup> of November, 2012 all other sector categories covered 22% of total area of Kazakhstan.

Changes in the area of sector categories can be explained with transfer of the land from one category to another in connection with provision of land for different purposes and precision of their areas in result of ongoing land inventory.[1]

Land Code (1990) classifies the land into following categories- agricultural land, land for industrial, transport, communication, defense and other non-agricultural purposes, land of settlements, land of protected areas, health, recreational, historical and cultural destination, land of forest stock [2, 3]

In the investigation is analyzed legality of inclusion of agricultural land in the categories of non-agricultural purposes.

Agricultural use not always can be associated with agriculture production as main purpose of the land use. Agricultural use can be considered as an additional, not contrary to the main objective, and only in case when land is used according to its main purpose. In this case better is to use the term “permitted agricultural use”. That means that allocation of agricultural land use in territory of settlements is illogical because for agricultural purpose will be used land, already having non-agricultural purpose [3].

Agricultural land inside of specially protected natural areas, which is used for agricultural production, can be assigned for mentioned purposes to people, living in settlements which are located within the boundaries of protected area.

Agricultural land unused for forestry purpose and located inside of forest stock may be granted to individuals and legal entities for agricultural purposes in accordance with legislation in forest sphere.

Analysis let us conclude that reason for classification of the land with their allocation to non-agricultural land is the fact that its permitted use is agricultural use. Since the legislation does not specify otherwise, as non-agricultural land should be classified land for industrial, transport, communication, defense and other non-agricultural purposes, land of settlements, land of protected areas, land of forest stock, land under water, except land, main purpose of which is agriculture [5].

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# ASSESSMENT OF WATER BODY OVERGROW USING GIS TECHNOLOGIES: CASE STUDY OF LAKE USMA

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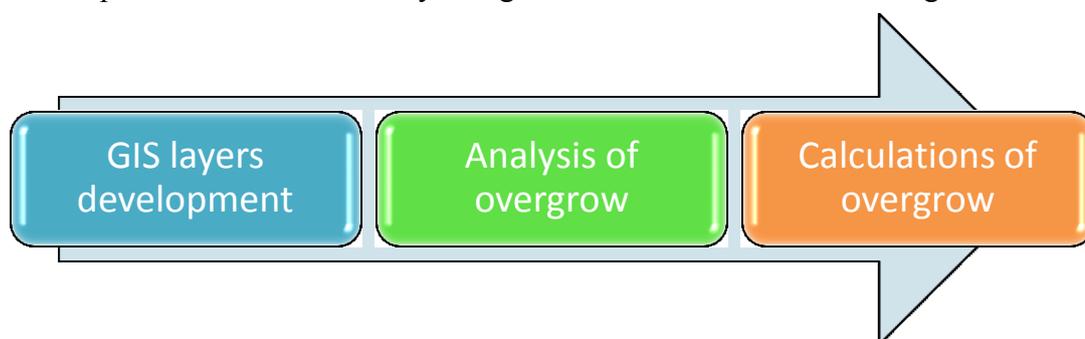
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In Latvia there are more than 3990 water bodies with the area larger than one hectare. The water bodies cover 1,5% of the territory of Latvia, however, the water bodies overgrowing proportion is from 30 till 60 % [1]. The intensity of water body overgrowing is dependent on the geomorphological conditions and nitrogen concentration in the water body. The amount of water body overgrowing is not the only indicator of the water ecosystem quality but also an important factor of tourism industry development and sustainable water body management.

With development of environment monitoring technologies there are alternative possibilities to assess the intensity of water body overgrow. The aim of the research work is to develop methodology of water body overgrow assessment using topographic and satellite photo maps and GIS, using the Usma Lake as the pilot water body [2]. To achieve the defined aim there are three main objectives: firstly, to review previous research of water body overgrow, secondly, to develop methodology of water body overgrow assessment using topographic and satellite photo maps and GIS, thirdly, to verify the methodology using the case study of Usma Lake.

The methodology of water body overgrow is based on the possibilities of geographic information systems. In this research work as a reference period the topographic map of Latvia is taken developed in the sixties of the 20th century and the satellite photo maps of 2005 and 2011. The maps were featured in GIS system. The main components of the water body overgrow assessment are shown in Figure 1.



**Figure 1. Main components of water body overgrow assessment**

The verifying water body overgrow assessment methodology was made using the Usma Lake case. The first results of methodology assessment show that using GIS and satellite photos for water body overgrow assessment the quality of satellite photo maps is very important [3].

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# PEAT EXTRACTION IMPACT ON HYDROLOGICAL REGIME OF HIGH MOSS

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Peat resources are important for Latvia economical development; however their use is not without damage to nature. Peat extraction depredates valuable swamp habitat and depletes biological diversity. The environmental impact can be reduced by restoring of hydrological regime of depleted swamps and promotion of the natural swamp habitat restoration. In case of new peat extraction site development there is a need to understand the impact of peat extraction areas on natural swamps. Still, there is not enough research in this area.

The aim of this research work is to clarify the possible long-term impact of peat extraction using the carrier method to natural swamp areas. To assess the defined aim there are three main objectives: firstly, to review previous research of swamp hydrological regime, secondly, to analyse the swamp hydrological regime monitoring data, thirdly, to develop the peat extraction field impact area of Zalais swamp using GIS.

At the end of 2012 there were installed 20 monitoring wells to understand the Zalais swamp hydrological regime. The depth of the monitoring well is 2 meters. In each monitoring well there were installed data loggers that record every half hour the ground water level and the water temperature of water.

For the hydrological regime analysis there were used data records of one year. The impact was evaluated using the graphical method and the statistical methods t- test and ANOVA. The analysis of the monitoring data showed that there was 180 m wide impacted territory in the Zalais swamp eastern part and 240m wide area at the north site which is related with impact of small ditches.

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# STUDY OF RADIATION LEVELS IN LATVIAN CITIES

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Radioactive pollution causes serious threat, not only to the environment, but it also has bad impact on human health. The Baltic Sea is one of the most polluted seas in the world, because it is inner sea and water exchange is very small – approximately 1% [1]. The causes of radiation pollution could be 9 nuclear power plant activities on the Baltic Sea coast [2]. These nuclear power plants create great amount of radioactive waste. Chernobyl nuclear power plant explosion and war period have also contributed to that. On the sea coast radiation levels are noticeably higher, than in Latvia's central region.

The research aims are to analyze radiation monitoring results, gathered in the period from 2010 to 2014 and evaluate the maximum radiation levels. The research was carried out about 15 monitoring stations in Latvia. Scientific work deals with substances that increase the level of radiation, and established sources of radiation.

A statistic analysis of the obtained data was carried out using Microsoft Excel extension XLSTAT. The results were compared with The Cabinet of Ministers of the Republic of Latvia rules Nr.149 of radiation protection recommended radiation dose. Radiation level fluctuations were detected and exceeding of the allowable maximum level by more than 19% was recorded in Ventspils. By the use of Mann–Kendall test there was determined long term radiation level variability from year 2010 to 2014. Radiation level variability has seasonal character [3]. The highest increase level was detected in November and December, but decreasing was observed in January and February. To compare radiation levels in the cities of Latvia, ANOVA analysis was applied and Post-Hock Tukey test from the programme SPSS. The data were also collected from the Northern Europe monitoring stations around the Baltic Sea and checked, if radiation levels in January 2014 did not exceed the maximum allowed levels.

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# **SENSITIVITY TEST OF HYDROLOGICAL MODEL METQ**

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Latvia is located in the humid climate zone and the hydrological regime of watercourses is characterised with a spring and autumn peak as well as winter and summer minimum [1]. It is necessary to determine as accurately as possible the maximum flood run off, as well as other important hydrological measures that are important of the engineering structure design. The hydrological model METQ is developed by Professor A. Ziverts, but the mathematical model has to be continuously developed according to the latest technologies and advancements in statistical science [2].

The aims of this research work were to test the operation of the hydrological calculation model METQ using the sensitivity test and develop proposals to improve the performance of the model. To understand the operation of the hydrological calculation model METQ the model development stages were reviewed. The sensitivity test was applied using 10 years of daily weather observations data collection (temperature, precipitation and humidity deficit). The sensitivity test was carried out for each sub - basin, separately changing the set of model coefficients in 50 % range.

The results were analyzed using the graphical method and the statistical methods t -test and ANOVA. The research results show that most of the model parameters are stable; however, it is necessary to pay particular attention to the seven parameters of the model. They showed significant impact ( $p < 0.05$ ) on the model outcome. As well as there was significant impact on the model outcome - not only distribution of sub basins but also the hydrological coordinates.

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# DETERMINATION OF LAND DEGRADATION IN ENGURE MUNICIPALITY BY REMOTE SENSING

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Land degradation is a process in which the value of the biophysical environment is affected by combination of human – induced processes acting upon land or natural means. In nowadays it's important to talk about it, because land degradation has impact on agronomic productivity, the environment and other issues.

Land degradation processes are mainly caused by improper land use. Bushes grow in agriculture land, coast erosion, improper irrigation and drainage management systems, swamps forming, built up areas elimination, pollution [1].

The main types of land degradation are soil erosion, soil organic matter decrease, soil compression, poor soil, decrease of soil pH, land pollution, landslip and soil degradation [1].

Remote sensing satellites gather information about the earth's surface by measuring electromagnetic radiation. This satellite technology carries the sensors that help to acquire information about an object without physically coming in contact with the object. For example in Africa remote satellite images are being used worldwide to determine food security through the measurement of rainfall and the growth of vegetation and remote sensors have numerous applications for the humanitarian community [2].

Remote sensing satellite has a growing relevance in the modern information society. Latvia also should use remote sensing to determinate land degradation.

The research is based on the analysis of geospatial applications in program ERDAS Imagine. ERDAS Imagine is a remote sensing application with raster graphics editor abilities. By manipulating imagery data values and positions, it is possible to see features that would not normally be visible. The level of brightness, or reflectance of light from surfaces in the imagine can be helpful for example with swamping determination or land overgrowth with bushes. ERDAS Imagine will determine areas of land degradation in Engure Municipality [3].

Owner or legal possessors are responsible of the realization of land degradation protection. The local municipality monitors and marks areas of land degradation, also provide the necessary measures of land use [1.]

Establishing the detailed baseline data and information about land degradation is greatly required, to identify land degradation areas.

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## **DEVELOPMENT OF WATER SUPPLY SYSTEM IN JELGAVA**

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Water is essential to man and all nature, without it they just couldn't exist. So it is important for every resident to have access to this resource. Most people are living in cities and they are continuously growing and becoming modern, so development of water supply system is important. In my work, I deal with water extraction and supply development, progress, solutions and results.

Initially the residents received water through open channels (since 1650th) and underground, bored wooden pipes (till 1882nd). Over time, the wooden pipes were replaced with cast iron pipe pressure line [1]. Responsible, for water supply in Jelgava, is enterprise "Jelgavas ūdens". Since 2000th this enterprise in collaboration with European Union, implements project "Development of Water Supply and Sewerage Services in Jelgava", which are made within the existing water system reconstruction and construction of new systems, such as water mains supply and water network reconstruction, new artesian wells and recovering the old ones, etc.

The most effective water production is artesian well, which can be 30 or more meters deep. Water is located in the deeper solid layers, locked between two water-tight layers. If the bore is installed and operated properly, then it is protected from contamination, but it still isn't chemically pure [2]. For example, a major challenge in Jelgava is iron content in the water.

Pump is used for lifting the water from bore, it is placed in the bore, so that on all sides it is enclosed by water. Installation phase for pump should be straight, but the sand content in the water cannot exceed 0.01% [3].

Current water supply situation in Jelgava is promising, as it is implemented in an ambitious project for the reconstruction of the whole system, so it can be said that the city is becoming more and more modern.

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# PRECIPITATION QUALITATIVE INDICATOR ANALYSIS AT THE MONITORING STATION RUCAVA

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Since the rapid growth of industrial manufacturing and development of transport and technology, precipitation qualitative indicators and their change tendencies is a topical issue. If the demand for these industries grows, the result can be the increase of dust particles in the atmosphere, which in turn, affects composition and the quality of precipitation. Increased amount of various chemical materials, like lead, arsenic, cadmium, sulphur, etc., in the composition of precipitation can negatively affect human and animal health and also the surrounding environment.

Long term changes have not been researched in detail. The study was carried out about air mass movements' effect on the composition of precipitation, as well as precipitation quality differences between Rucava and Zosenu meteorology stations. The study was carried out in the time period from 1985 to 2000 (Assessment report..., 2004). The data and precipitation qualitative indicator readings for years 1985 to 2013 have not yet been summarised and accounted for. It is important to find out how increasing and decreasing tendencies of various materials affect precipitation, and whether it is necessary to worry about the decrease in precipitation quality, therefore polluting the environment in Latvia. The aim of the research was to study the long term change of precipitation qualitative indicators. The tasks included –combining precipitation qualitative and quantitative data, which have been gathered from the time period of June 1985 till August 2013 in monitoring station Rucava; describing precipitation qualitative indicators, their origin and the effect on humans and wildlife; analyzing the changes of precipitation amount and the materials it contains.

For data processing the following programmes were used; Ms Excel, and with the help of Time trend data for statistical analysis programmes, the Mann-Kendall statistical analysis test was produced, the diagrams were made and the obtained results were analyzed. Together 11 different materials that are found in the precipitation were studied ( $\text{SO}_4\text{-S}$ ,  $\text{NH}_4\text{-N}$ ,  $\text{NO}_3\text{-N}$ , Mg, Ca, Na, K, As, Cd, Ni, Pb). The precipitation pH was also studied. The indicator had a tendency to show an increase, which is positive, because it reduces the possibility of precipitation acidification problems in Latvia. Researching every change in the qualitative indicators, a conclusion can be made on the quality of atmospheric content. From the qualitative indicators that were studied, 9 had a tendency to decrease, a possible reason being a recession in the industrial field in 1990, when Latvia underwent political system changes. Two materials had a slight tendency to increase -  $\text{NH}_4\text{-N}$  and K.  $\text{NH}_4\text{-N}$  gets into the atmosphere through the usage of chemical fertilizers, industrial pollution etc., if an increase is too big, it negatively affects the environment and is harmful for human health. The other substance K gets into the atmosphere through burning of the biomass and different biological processes, plants need it to help their growth process. (Klaviņš, 2012)

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# LAND COVER CHANGES AND CORRELATIONS IN LATVIA FROM 2000 TO 2006

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For any life existence it is necessary to have a suitable environment. By changing it, we endanger not only different kinds of species of flora and fauna, but also ourselves. Living in an appropriate, clean and aesthetically attractive environment has become an important issue in recent years. At the same time the demand for resources of agriculture, forestry and other industries are increasing.

Land cover is an essential climate variable - it can act as a cause and a consequence of climate change (Herold M. 2009). In recent decades land cover has been dramatically changed by anthropogenic impact, causing extinction for different kind of species.

The changes in land cover affect the environment in Latvia as well. Agriculture and forestry industries are the main contributors to Latvia's environmental issues. During the recent past, scientific research has not been carried out on land cover changes, including investigations in correlations, tendencies and possible consequences of land cover change. Therefore, it is difficult to predict any future changes and decide on appropriate action plans.

The main objective of this scientific research was to compare Corine Land Cover data created in 2000 and 2006, where the subject of research is land cover changes in the territory of Latvia, 5 different regions in Latvia and Berze river basin. Statistical methods were used for data interpretation and comparison.

The tasks of the work were as follows:

1. To collect Corine Land Cover data created in 2000 and 2006 that represents the study area.
2. To compare the obtained Corine Land Cover data of 2006 with the data of 2000 and estimate changes.
3. To estimate the significance of land cover changes and to analyse the correlation of changes within all scales of the study by using mathematical statistical methods.
4. To create cartographic material representing the results.

The obtained data were analysed within the scale of Latvia, 5 regions, Berze river basin and Berze river subbasins. The data were processed and statistically analysed using ArcGIS for Desktop, MS Excel and SPSS software.

By doing estimation of mathematical statistics, no significant changes were found. The changes of Land cover from 2000 to 2006, viewed within the framework of the study, are not the factors affecting the surrounding ecosystems, biodiversity and environment. When carrying out a more detailed data analysis it was found that land cover changes are covering important area than the difference between area of certain land cover class in 2000 and 2006. For example, increase and decrease of forests can happen at the same time in different locations, but after summarizing land cover changes are relatively small.

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# DECONTAMINATION OF GROUNDWATER FROM PETROLEUM PRODUCTS USING MULTI PHASE EXTRACTION METHOD

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Based on the Latvian Environment, Geology and Meteorology Centre data, Latvian first categories of contaminated sites are 243, of which 166 are contaminated with petroleum products. Most of the contaminated sites are former gas stations, the freeport of Riga and historical sources of pollution - old, abandoned aviation or other function storage buildings, which have been used for or stored in petroleum products (LEGMC, 2012).

The most effective reclamation method is selected depending on the type of pollution and theoretical calculations of the site, which also includes other specific parameters of the object and situation. However, the created mathematical models and theoretical calculations do not always correspond with the real conditions and results of the facility. Comparing the obtained results from several sites, where this remediation technology was applied, and using mathematical methods would increase reliability of the results and improve the decontamination process.

The aim is to compare performance of the multi phase method in several objects where remediation was made, and make recommendations, how to bring calculations to reality, making calculations with a limited amount of data.

The object of the research: pollution of light petroleum products in aqueous phase in sandy sediments of the pressureless groundwater horizon.

To achieve the aim the following tasks are set:

- 1) provide a description of the quantitative reduction methods, that can be applied in contaminated soil by petroleum and petroleum products in aqueous phase layer, and their limiting factors / parameters;
- 2) obtain and collect data from various sites that applied continuous and skimmer type vacuum extraction methods of contaminated soil by petroleum and its products in aqueous phase layer reduction;
- 3) compare and analyze practical calculations that have been used in specific cases/objects (Ltd. "Ūdeka", "Rumbula" - abandoned aviation object, Ltd. "Ventspils Nafta") with scientific approach calculations.
- 4) give recommendations how to simplify and approximate calculations closer to the scientific method for practical remediation in Latvia.

In the study scientifically collected remediation process data from Ltd. "Ūdeka", JSC "Ventspils Nafta" and from the former aerodrome "Rumbula" contaminated sites will be compared and analyzed.

The expected results will be achieved by processing the field monitoring data with the American Petroleum Institute developed treatment programs for light petroleum products dynamic analysis in soil.

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# LATVIAN POSITIONING SYSTEM BASE STATION INSTALLING IN VALKA

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The Global Navigation Satellite System Continuously Operating network of Latvia (LatPos) includes continuously operated 24 GNSS base stations. Data from each GNSS receiver have been sent to the data processing centre every second (365 days of year), storing the received data and broadcasting them to users. As the number of GNSS users has grown, LatPos makes it possible to establish co-ordinates quickly in Vidzeme region. In order to achieve a measurement accuracy of 2 centimetres – it was decided to install a LatPos base station in Valka. Valka base station would allow faster and more convenient measurements for both, in the city and the surrounding area. It is especially necessary in the areas, where geodetic networks do not provide sufficient coverage [1]. For installing the base station it is necessary to collect and analyze information, evaluate LatPos systems network data before and after the installing process. This can be done evaluating the accumulated post-processed data for the entire network.

Examining various aspects for the geodetic antenna it was decided that the most optimal location is the Valka gymnasium roof. The roof does not contain reflective elements and does not interfere with other transmitter signals; also it is important that the antenna is positioned to have maximum exposure towards the sky, especially in the south, enabling to receive signals from all possible satellites.

Considering that solar activity this year will only increase, it should be taken into account that a significant impact on the measurement error will be caused by the ionosphere effect.

For this reason, it is appropriate to use the mobile application Swepos which is made in Sweden, which allows keeping track of activity in the ionosphere, during the measurements, because currently there is no such an option for Latvian surveyors [2].

The base station installing process is compared with the existing Latvian base station installation, which will take place in the research and the project [3]. The main error sources are analysed offering possible solutions. In cooperation with the Latvian Geospatial Information Agency the new network stability and accuracy will be determined. It is expected that the Estonian town Valga and its neighbourhood will also be able to use the accumulated data of the LatPos new base station. Such a possibility in the long run allows building good cooperation in the field of geodesy with our neighbour country.

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# WATER QUALITY ANALYSIS OF THE TĒRVETE RIVER AND RESEARCH OF MOST AFFECTING FACTORS

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The catchment of the Tērvete River is located in a nitrate sensitive territory that is stated in accordance with the Nitrate Directive [1]. There are increased demands against dissipation of organic fertilizers. According to the terms of the Cabinet No. 33 “Regulation Regarding Protection of Water and Soil from Pollution with Nitrates Caused by Agricultural Activity” and the Nitrate Directive admissible concentration of nitrate ions in surface water is  $50 \text{ mg} \cdot \text{l}^{-1}$  or  $11.3 \text{ mg} \cdot \text{l}^{-1}$  nitrate nitrogen concentration [1]. Leakage from agricultural lands and domestic wastewaters are injected in the Tērvete River; this increases the risk of reaching or exceeding the nitrate nitrogen concentration level that is stated by the law [2].

The purpose of this paper is to determine the changes of the water quality indicators and to characterize the factors affecting them. The paper has three main objectives – to determine the Tērvete River catchment, to analyze the water quality indicators, and to characterize the main factors that influence these factors. Nitrogen and phosphorus compounds (nitrates, ammonium ions, phosphates, total nitrogen, and total phosphorus) were studied in the water analysis. The water samples were obtained in accordance with the methodology mentioned in the Agricultural catchment (wastewater) monitoring guide. The chemical composition analysis of the obtained water samples was conducted in the Environmental laboratory of the State Ltd. „Latvian Environment, Geology and Meteorology Centre” and the Environmental Quality and Monitoring laboratory of the University of Latvia, Faculty of Geology and Earth Sciences.

Analyzing the obtained data, there were several infringements found during the time period from the beginning of 2007 till the end of 2008, but from the beginning of 2009 no infringement of nitrate nitrogen concentration regulated by the terms of the Cabinet No.33 regulation were found. By the means of ArcGis software, the Tērvete River catchment area cartographic material was created that helped to identify the critical factors affecting the quality of the water.

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## **ANALYSIS OF SEWAGE AND STORM WATER SYSTEM**

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A worldwide problem in urban areas is collecting storm waters and directing them away from population. On July 2<sup>nd</sup> 2011 Copenhagen witnessed a huge rain water storm. In less than 3 hours more than 150mm of rain water fell. Traffic was paralysed because in some places in the city centre there was more than a meter of water. Public gathering places had to be evacuated and all types of houses were full of water. It causes a great resonance in society, why this kind of chaos could happen and how to avoid it? So, the author participated in the project, the purpose of which was for 4 unknown persons to meet and to analyse Copenhagen sewage and storm water systems and look for solutions for the flooding problem.

To solve this problem in our project we used tools like: brain storming, Gantt chart, created project structure, work brake down structure and responsibility matrix, field work etc.

We came up with the main causes of the problem: 1. Urban heat island effect 2. Combined sewage and rain water system and that they are not designed for extreme events. 3. Out of date drainage system 4. Geographical location.

After we had defined what causes the problem we searched for solutions. We came up with more than 12 possible solutions. For example: update or modify the drainage system, collect and reuse water, use drainage asphalt, create urban corridor for water, use green tools to accumulate water and reduce the urban heat island effect, work with urban planning to safely manage water and use streets as drainage systems, etc. Afterwards we did evaluation and calculations on ideas.

The input of the author in this project was determined by his speciality, He was only member who studies civil engineering, and therefore, in addition of the group determined work he did calculations, cost benefit and technological analysis for the project.

Topicality of the problem: In Latvia this problem has not yet escalated in such a level, but every year after heavy (not necessarily extreme) rain falls some parts of streets are flooded and in these places transportation is blocked.

Conclusions: There is not a universal solution which could be applied on any place based problem. Solutions have to be evaluated on individual situations; this has to be done according to the situation. Often solution has to be combined to get the best cost benefit and overall solution. All solutions request some investment of money, but if solutions are correctly assessed, than it is possible to get the best out of it with available resources.

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# GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) APPLICATIONS FOR HIGH DEFINITION

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The Global Navigation System (GNSS) offered functions are more commonly used in today's society; this system is used all over the world: in automobile industry, medicine, agriculture, and also in land surveying, which is the main theme of the author's master thesis. The aim of this paper is to establish precision of the GNSS system when the height is measured and if these data meet the requirements of the normatives. The theme is topical because of increasing use of the GNSS offered opportunities.

Most international maps and charts are produced on the WGS84 datum, which essentially is equivalent to the ITRF (International Terrestrial Reference Frame) at the centimetre level. Other impacts of the GPS (Global position system) on datum and control networks include: in addition to the traditional levels of national control network, additional high-accuracy control points established using ultra precise GPS geodesy techniques now form the "backbone" of new datum and future maintenances. Although the GPS is used to establish 3-D coordinate networks, many applications still distinguish horizontal positioning/mapping from the determination of the heights above the sea level. Hence, GNSS, geoids, and levelling are inextricably linked [1].

The analysis of the research shows how the GNSS evolves. In the future accuracy of the GNSS will increase and become more accurate and precise, what will demand to renew the obsolete reference system. Not only the GNSS system needs to be introduced, but also it is necessary to discuss the system maintenance.

According to Lockheed Martin, GPS III satellites will have a 25 percent longer spacecraft life, deliver three times better accuracy, and provide eight times more effective anti-jamming capabilities [2].

Development of the technology leads to increased accuracy and these satellites are going to be better and more accurate than the previous GPS satellites.

Class 0 of the global positioning network (G0) with an accepted standard deviation 0 mm, only LatPos base stations with the standard deviation of co-ordinates 20 mm versus a network of Class G0. Class 1 of the levelling network (N1) with the standard deviation 1.0 mm/km [3].

In the law standard deviation of the national geodetic network is stated, unfortunately, there is no law which mentions standard deviation when measured with the GNSS receiver. It is determined by the geodetic instrument manufacturer. Therefore, in the future these problems should be addressed and gaps in the law should be prevented.

In the regulations of the Republic of Latvia the exact accuracy when the GNSS receivers are used is not stated. The positive aspect is that GPS III satellites are launched and the data that will be received using these satellites are going to be more precise.

The research is going to be continued by measurements in different weather conditions, which will show the accuracy of the GNSS receivers. In the height system maintenance more precise geometric levelling and GNSS measurements should be used.

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# UNMANAGED HYDROTECHNICAL STRUCTURES ON RIVERS OF LIELUPE RIVER BASIN- THREAT TO ENVIRONMENT

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The aim of the research work is to identify unmanaged hydrotechnical structures- the former water mills and hydroelectric stations on the rivers of the Lielupe river basin and to develop preliminary recommendations for construction supervision.

Unmanaged and uncultivated hydrotechnical structures pose a threat to the surrounding population and property. The major potential threat is during the spring flood period, causing the rise of water levels in the river and flooding the surrounding areas.

There were 16 surveys made of abandoned hydrotechnical structures for eight rivers in the Lielupe river basin (Bērze, Iecava, Mēmele, Misa, Mūsa, Sesava, Tērvete and Vilce), which were photo fixated and evaluated for the visual status. Also the maximum flow rates were calculated.

By using the cluster analysis, the unmanaged hydrotechnical structures were grouped in categories of potential threat according to the Ward's method, but the difference between the studied objects was measured by Euclidean distance. The researched features were classified into four criteria- earth dam condition, overflow dam condition, water level difference between the upper and lower water levels (identified from photo fixation) and spring flood peak flow rate  $Q_{1\%}$  in relation to the size of the catchment area of the hydrotechnical structures (specific runoff).

The hydrotechnical structures were divided into three danger classes according to their risk to the population and possible damage to the property and environment. Threat was posed by five hydrotechnical structures (Kanteiku and Zelmeņu hydrotechnical structures, Apgulde, Parūķu and Vilce mills). This hydrotechnical structure class describes the existing earth dam and overflow dam, the water level difference between the upper and lower water levels which are affected by specific runoff. Eight hydrotechnical structures were identified as less harmful (Ausekļu, Butku, Iecava upper, Iecava middle, Leijerta, Millas, Jukatu mills and Mūsa HES). This class contains hydrotechnical structures with a partially remaining or not remaining earth dam and overflow dam, they do not have water level differences between the upper and lower water levels and they are not affected by specific runoff. Three hydrotechnical structures (Bauska I, Bauska II and Skaistkalne mills) do not endanger the surrounding buildings and people. In this class, hydrotechnical structures do not have an earth dam, overflow dam, the water level difference between the upper and lower water levels and they are not affected by specific runoff.

Preliminary recommendations for supervising unmanaged hydraulic structures were developed in order to prevent danger to people and their property.

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# MARINE LITTER ON LATVIAN SEACOAST BEACHES

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Poor waste management quality and human irresponsibility have led to a large amount of waste being disposed in natural environment. Marine litter has a negative impact on tourism and leisure activities; it is a threat to wildlife and it also raises the cost of clean beaches. For the above mentioned reasons, it is important to identify and assess Latvian coastal pollution caused by waste, as well as to assess the factors affecting the amount of waste, and try to find solutions to this problem.

The first monitoring of Latvian seacoast marine litter was carried out in the summer of 2012 during the campaign “My Sea”, which was a part of the project “Baltic Marine Litter: Marlin”. This campaign was continued in 2013.

Using the UNEP/IOC methodology, which was adapted to the Baltic Sea region, 35 beaches located along the Latvian seacoast from Pape lighthouse to Kuiviži were monitored. According to the methodology, litter measurements in the beaches were made by counting waste units which can be classified into 10 categories (plastic, foam rubber, fabric, glass and ceramics, metal, paper and cardboard, rubber, wood, organic waste and other waste, which refers to waste that does not belong under the above mentioned categories) and 79 subcategories.

Classification of the beaches was made based on the data obtained through monitoring and using agglomerative hierarchical clustering. In the cluster analysis the distance between observations was measured using Euclidian distance measure. The Wards method was chosen as an algorithm for creating dendrograms. The cluster method allowed dividing beaches into four main categories. The first category represents beaches with high total amount of waste and a particularly large amount of plastics, rubber and fabric. The second category also includes beaches with high total amount of waste, but these beaches are characterized by high amount of metal, glass and ceramic waste. The third category comprises beaches with average amount of waste, whereas the fourth category includes the cleanest beaches.

The beach classification method allows making an objective judgment about the amount of waste on beaches along the Latvian seacoast and it can serve as a tool for making decisions in national and local governmental institutions. It can also be used in scientific research. The author of this research has analyzed the materials and types of beach litter that can be found on the Latvian seacoast. The factors that can influence the amount of waste have been assessed and proposals for reduction of marine litter amount have been given in the research.

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## **NEW CONCEPT OF LIVING - ECOVILLAGE**

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Ecovillages are idea of small groups of different kind of people around the world who are coming together to live in perfect harmony with nature and with each other, and everybody is responsible for the global ecological crisis, lack of support in social and cultural structures. As a global knowledge community the ecovillage movement is remarkable both for its unity and its diversity. Ecovillages have taken root in tropical, temperate and desert regions; their religious orientations include all the major world religions as well as paganism and atheism. Some of their practices vary according to cultural context; they also have a low impact way of life and good supportive social environment. They have a different kind of aspect of ecological design and building, green productions, sustainable energy, community- building and religious/spiritual practices. Combining a supportive social environment with a low-impact lifestyle, ecovillages are consciously seeking to birth new ways of living that transcend the modern dichotomies of urban vs. global. Beneath this commitment to social and ecological sustainability, one may discern a worldview premised upon holism and ground up while simultaneously constituting a global network for education and social change [1]. And then, they represent a new perspective of lifestyle, and it's not just about merely deconstruction of modernity but about construct a viable alternative.

The main aim to ecovillage dweller is to create a diverse model of living according to the local social and physical contexts, and that will be "successfully continuable into the indefinite future" [2]. Their buildings are constructions in three interrelated dimensions: ecology, community, and spirituality.

If the dominant human systems on the planet are not sustainable, as increasingly seems to be the case, then the rise of the global ecovillage movement is of urgent practical consequence. As a living expression of a worldview fundamentally different from that of secular modernity, the eco village movement is also of theoretical interest for the history (and implementation) of ideas [3].

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## INTEGRATING SOUND BARRIERS IN LANDSCAPE

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Every day we are surrounded by different kinds of sounds. Noise pollution is getting more and more serious. It reduces the quality of the urban environment and human health. Performing tasks requiring concentration while exposed to high levels of traffic noise results in fatigue, annoyance, mistake making and long-term exposure to traffic noise increases the risk of heart disease. Increased stress caused by noise-induced communication disturbance results in changes in blood pressure, which in turn can lead to gastrointestinal disease, hypertension and other heart and circulatory diseases. Such effects are well understood by anyone who has worked in noisy conditions. The permissible sound level range is between 40 - 50 dB, but highway traffic causes 80 - 90 dB loud noise levels.

Today we can say that "Noise is a landscape issue". Landscape architects usually see noise barriers as something disturbing that leaves a significant impact on the landscape. Sometimes the effect related to the attractive visual appearance is predominant over the effective acoustical benefit. For example, comparing a metal barrier and a woven willow vegetative noise barrier with earth fill, both being the same size, it should be noted that the willow barrier gets higher rates because of its visual attractiveness, not noise reduction.

Barrier design is a complicated process. The best results are likely to be achieved through the co-ordinated services of qualified acousticians, civil and structural engineers, landscape architects and architects. Other professional expertise may also be required, including advice from geotechnical, ecological, irrigation, horticultural and other environmental and planning specialists.

There are two ways to build sound barriers – by using plant material and earth mounds or building up solid barriers of any dense or absorbing material. Solid barriers reduce noise in two ways - by reflecting or absorbing noise. It has been investigated that a solid wall is more effective at blocking noise than plants, but it is important to integrate it into the local landscape. It can be done by using different plants. The material, location, dimensions and shapes of barriers can affect the acoustical performance. Landscape architects and other specialists should pay more attention to integrating the sound barriers into the landscape and keeping the best efficiency of sound reduction.

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# WATER PURIFICATION USING BIOFILTRATION SYSTEM

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Statistics show that more than 3.4 million people die each year from water, sanitation, and hygiene-related causes. Nearly all deaths, 99 percent, occur in the developing world. The expression - clean water is our life – is not working in this case. That is the reason why we should treat it in a respectful way. As we all know there are a lot of techniques to clean water, for example, mechanical treatment, chemical treatment or biological treatment. This research deals with biofiltration systems.

Biofilter was first introduced in England in 1893 as a trickling filter for wastewater treatment and has since been successfully used for the treatment of different types of water. Biological treatment has been used in Europe to filter surface water for drinking purposes since the early 1900s and is now receiving more interest worldwide. It is important to get rid of the wastewater and the biofiltration system is a good way how to do it. The oxygen content in these waters is affected – it is called BOD or biochemical oxygen demand. It is proved that the biofiltration system releases water from suspended solids (85-90%), BOD (85-95%), N (30-50%), P (30-35%). These data are quite spectacular.

Biofilters (also called bioretention systems or biofiltration systems) are a potentially promising solution for reducing nutrient stormwater discharge to receiving waters. In biofilters, nitrogen compounds can be transformed (by coupled nitrification and denitrification) into nitrogen gas which is released back to the atmosphere.

Biofilters have been traditionally constructed as vegetated buffers on the top of a soil, sand or gravel filtration medium in shallow trenches, basins or landscaped areas. Stormwater flows over the vegetation, and may be subject to temporary ponding, during which time the stormwater slowly seeps through the filter material towards the effluent. During infiltration, the stormwater undergoes several treatment processes, such as sedimentation, adsorption, ion exchange, decomposition, and bioremediation. At the bottom of the biofilter a perforated pipe collects the treated water for conveyance to downstream waterways.

Overall this is an industry that is still not sufficiently researched and developed. That is why deeper study should be carried out concerning its practical use.

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# **EFFECT OF PROBIOTIC „EFFECTIVE MICROORGANISMS” ON SELECTED PARAMETERS OF MILK PERFORMANCE OF COWS AND RESULTS OF BREED AND HEALTHINESS OF CALVES POLISH HOLSTEIN-FRESIAN BLACK-AND-WHITE**

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The probiotic „Effective Microorganisms EM” is used in many countries as a stimulator of growth and development of plants and farm animals. Thanks to the useful microorganisms which are contained in this preparation, yielding of crops and animal wellbeing and healthiness could be improved [1,2,3]. It should be emphasized that any research on dairy cattle has not been found in the references up to now. Few studies have focused on using EM in pig and goat farming. That was the reason for the implementation of this research. The aim of this study was to evaluate the effect of probiotics „Effective Microorganisms EM” on the selected parameters of milk performance of cows and the results of bred and healthiness of calves Polish Holstein-Fresian Black-and-White.

In the study a positive effect of the use of „Effective Microorganisms” on milk performance of cows has been found. The calves which received EM did not have problems with functioning of the digestive system, received better increases in body weight and improved their health.

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## POSSIBILITIES OF INTEGRATED DISEASE CONTROL OF RYE SOWINGS

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Winter rye (*Secale cereale*) is widely spread in Latvia. There is relatively not much research on rye diseases in Latvia and Europe. Research findings in various countries on the harmfulness of diseases and on the possibilities of their control differ. The aim of the study was to identify the most important rye leaf diseases and to evaluate the different schemes of fungicide treatment efficiency.

Field trials were conducted at the State Stende Cereals Breeding Institute in 2012 and 2013. Each trial was one-factor design with three variants of fungicide treatment: control (no fungicide applied), standard treatment (during heading), and treatment according to the decision support system (DSS). The treatments according to the DSS were based on the number of rainy days after the beginning of stem extension (more than 7 days) and/or on the incidence (> 30%) of diseases. The registered doses of Tango Super s.e. (epoxiconazole 84, g L<sup>-1</sup>, fenpropimorph, 250 g L<sup>-1</sup>) were applied. Two types of rye cultivars were used in the trials: the open pollinated cultivar 'Kaupo' (in all years), and hybrids 'Agronom' or 'Gradan'. The incidence and severity of rye diseases were determined once in a week. The area under the disease progress curve (AUDPC) was calculated to describe the impact of diseases during the whole vegetation season. Statistical analysis (one-factor ANOVA) was performed to evaluate the significance of the yield differences. Leaf scald, caused by *Rhynchosporium secalis*, and brown rust, caused by *Puccinia recondite*, were the most important diseases in both years. Similar results have been obtained also in other investigations [1,2,3]. The first symptoms of leaf scald appeared during stem extension, but brown rust appeared only at the time of flowering.

Standard application of fungicides decreased the values of AUDPC by 30% for 'Kaupo' and by 50% for 'Gradan' in 2012, and by 40% for 'Kaupo' and by 27% for 'Agronom' in 2013. DSS treatments were not effective, which means that the number of rainy days is not a suitable threshold.

Fungicide application increased the yield by 8% on average. The highest yields were achieved by standard treatment in both years. The yields of hybrid varieties were 8.65 t ha<sup>-1</sup> and 9.05 t ha<sup>-1</sup>, of the open pollinated cultivar – 7.68 ha<sup>-1</sup> and 7.97 ha<sup>-1</sup>. The yield differences between the control variant and standard variant were statistically significant in all cases ( $F_{\text{fact}} > F_{\text{crit}}$ ). The efficacy of DSS was inconsistent. Further investigations are necessary to improve the control system of rye diseases.

### Acknowledgments

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# SUITABILITY OF MAZE HYBRIDS FOR PRODUCTION OF FODDER IN LATVIAN CIRCUMSTANCES

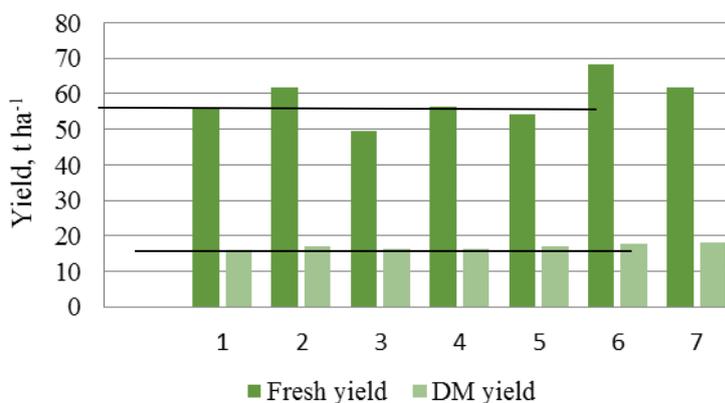
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Despite the southern origin of maize (*Zea mays* L.), this crop is used for forage more widely with every year in Latvia: the sowing area with maize was 20.6 thousand ha in 2012. The right choice of maize hybrid is critically important for production of optimum quality fodder in the conditions of Latvia. Development of maize depends on the weather conditions. During the study the weather conditions were radically different (sum of active temperatures (above 10 °C) in 2012 was 1980 °C, but in 2013 – 2255 °C). The aim of our investigation, carried out in the Research and Study Farm “Vecauce” of the Latvia University of Agriculture (2012 to 2013), was to analyse the yield of seven different maize hybrids and their fodder quality. Six maize hybrids with different maturity rating, as defined by FAO number (Beethoven (FAO 200), ES Regain (FAO 200), Drim (FAO 220), Saludo (FAO 220), ES Marco (FAO 220), and Gilberto (FAO 230)) were investigated and compared with well-known (in Latvia) standard hybrid characterized by FAO 210 (Standard). It is considered that in circumstances of Latvia optimal maize earliness is characterized with FAO number below 220 [1]. Earliness of maize hybrid is very important to provide the content of dry matter in the yield more than 25%, which is necessary for production of good quality maize silage. The results showed significant ( $p < 0.05$ ) correlation between the fresh maize yield and FAO number: the higher the FAO number, the higher the fresh yield. But the most important thing in production of maize fodder is the dry matter (DM) yield and DM content in fresh matter. Although DM yields of maize on average per two years were significantly different ( $p < 0.05$ ), the difference between average DM yields of different hybrids was not significant ( $p = 0.15$ ). Average DM content of all hybrids was also significantly different depending on the trial year: 25.69% in 2012 and 32.28% in 2013.



## Fresh and DM yields of maize hybrids in RSF “Vecauce” (2012-2013):

1-Standard (FAO 210), 2-Drim (FAO 220), 3-Regain (FAO 200), 4-Saludo (FAO 220), 5-Beethoven (FAO 200), 6-Gilberto (FAO 230), 7-Marco (FAO 220).

The hybrids ‘Gilberto’ and ‘Marco’ provided slightly higher average two year DM yields than other hybrids. The result showed that during poor weather conditions production of high maize yield with an appropriate DM content depends more on hybrid earliness, but during years with good weather conditions, high and good quality yields can be harvested from almost all included hybrids.

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# ROVE BEETLES (COLEOPTERA: STAPHYLINIDAE) - NATURAL ELEMENTS OF PEST MANAGEMENT IN WINTER WHEAT FIELDS

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The family of rove beetles (Staphylinidae) is a species-rich taxonomic group of insects inhabiting almost all terrestrial ecological niches. The most of rove beetle species are carnivores or fungivores, but some species also can be saprophagous and phytophagous (Frank and Thomas, 2004). World-wide studies show that rove beetles are natural enemies of pests and causal agents of plant diseases in different crops. These beetles also can be indicators of sustainable agriculture and integrated pest management. Up to now no studies have been carried out on these issues in Latvia (Gailis and Turka 2013).

Since this is the first such study in Latvia, the objective of it is to investigate fauna of rove beetles inhabiting winter wheat (*Triticum aestivum*) fields. The research was carried out at the Research and Study Farm 'Peterlauki' (56°30'39.38''N; 23°41'30.15''E). Twelve sample plots (0.3 ha) with different soil treatments and pre-crops were used for the study. Beetles were collected by pitfall traps. Exposition of them started on 17 April 2012 and ended on 31 July 2012. The traps were emptied every seven days. Species were identified after H. Freude et al. (1964, 1974).

The first results show that circa 40-50 rove beetle species inhabit winter wheat fields. The real number of species is still unknown due to complicate identification of species included in Aleocharinae subfamily. The most abundant species were *Tachyporus chrysomelinus* (Linnaeus, 1758), *T. hypnorum* (Fabricius, 1775) and *Philonthus decorus* (Gravenhorst, 1802). They are predators, mainly feeding on aphids (Aphididae) and other invertebrates, but *Tachyporus* individuals also can be fungivores. Also high density of Aleocharinae specimens belonging to two or three species was observed. Ecology of Aleocharinae species is not very well known. Some species are parasites of flies (Diptera) pupas, thus they also can serve as beneficial insects in various crops.

In future, different soil tillage methods and crop rotation effects on rove beetles within winter wheat fields will be analysed. Such studies can be made after precise identification of species. The acquired knowledge will help to establish which farming practices are more suitable for rove beetles, thus it will be possible to use these beetles effectively as natural mechanisms for controlling pests and plant diseases in winter wheat and maybe other winter cereals.

The study was supported by the Latvian State Research programme „Sustainable Use of Local Agricultural Resources for the Development of High Nutritive Value Food Products”, subproject No. 3.1 “Sustainable Use of Soil as the Main Resource for the Production of Safe and Qualitative Food and Feed from the Main Agricultural Crops”.

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# DEVELOPMENT OF WHEAT LEAF DISEASES DEPENDING ON CULTIVATION TECHNOLOGY

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Winter wheat (*Triticum aestivum*) is one of the most important and profitable crops in Latvia. Distribution of wheat diseases is an important risk factor in wheat management, especially when intensive technologies are used. Reduced soil tillage and wheat monoculture have become increasingly widespread technologies in Latvia. The aim of this study was to estimate the development of winter wheat crown and root rot depending on soil tillage and crop rotation.

Two-factor experiments were conducted in the Study and Research Farm “Peterlauki” of the Latvia University of Agriculture in 2012–2013: 1) crop rotation (continuous wheat sowings or wheat after other pre-crop), and 2) soil management (conventional ploughing or shallow tillage). Incidence and severity of diseases were noted each week. The total impact of diseases during the period of vegetation was estimated by calculating the area under the disease progress curve (AUDPC).

Tan spot, caused by *Pyrenophora tritici-repentis*, and Septoria leaf blotch, caused by *Zymoseptoria tritici*, dominated in the investigation period. The development of Septoria leaf blotch did not depend on crop rotation and the soil tillage method. The severity of tan spot first symptoms differed sharply depending on the technologies applied: reduced soil tillage in combination with continuous wheat sowings promoted the emergence of more severe symptoms in spring and during all vegetation season. The level of this disease was significantly influenced by reduced soil tillage where the value of AUDPC increased by 80% compared to conventional ploughing. Continuous wheat sowings essentially (by 90%) increased the development of tan spot. A similar situation has been observed in the United States of America, where tan spot was the dominant wheat disease [1]. Both investigated factors – the soil tillage system and crop rotation – were important measures to control tan spot, but combination of these two factors (reduced soil tillage and lack of crop rotation) significantly increased the risk of tan spot. Similar results have been obtained by other researchers: continuous wheat sowings combined with reduced tillage significantly increased the level of tan spot [2]. The differences in the development of both dominating diseases could be explained by the various life cycles of pathogens. The main source of infection by *P. tritici-repentis* is the plant debris on the surface of soil, where fruiting bodies develop. *Z. tritici* overwinter in infected plants and spread by rain splash, therefore meteorological conditions are the most important factors influencing the development of this disease.

## Acknowledgement

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# INFLUENCE OF MICROORGANISMS ON IMPROVEMENT OF ECO FRIENDLY BIOFERTILIZERS FOR INCREASING CROP YIELDS

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The work was aimed to investigate the influence of different combinations of microorganisms in biofertilizer on growing crops.

Experiments with two types of bacteria with control and three replications were completed under greenhouse conditions. The present results have shown that the vegetative and reproductive growth accomplished successfully by application of biofertilizers.

However, the present experimental conditions in the association of the *B.megaterium* had a pronounced effect on the cell number of *A.chroococcum*. There were perceptible increases in viable population of *B.megaterium* when these bacteria grew in the presence of *A.chroococcum*. The stimulation by *A.chroococcum* resulted in increasing the cell population of both bacteria, equaling the population of *A.chroococcum* and rising approximately 1000 times more than their respective population in pure cultures [1].

So, in this experiment interaction between these two types of microorganisms has been identified as a good alternative to chemical fertilizers in order to increase soil fertility and crop production in sustainable farming.

Research and development of technology for production of biological fertilizer based on the simultaneous use of different types of strains of microorganisms are the continuation of earlier work of biotechnological methods of biofertilizer production [2].

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plant uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. They accelerate certain microbiological processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants [3].

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# THERMOGRAPHICAL EVALUATION OF ADAPTATION ABILITY OF CHINCHILLA TO VARIOUS ENVIRONMENTAL TEMPERATURES

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The long-tailed chinchilla (*Chinchilla lanigera*) is a small, grey rodent once found living in the wild in the present territories of the Andes mountain range in Chile, Bolivia, Argentina and Peru. The necessity to survive the severe weather conditions 3000-5000 m above the sea level had endowed chinchillas with silky, dense fur coat – the main reason for this species popularity over the centuries [1].

The softness and warmth of the chinchilla fur was discovered and appraised even before the Inca Empire. The native Indian tribe Chinchas (the chinchillas were named after them) used their pelts for clothing and blankets due to their thermal insulating properties. After the Spaniards returned from their voyage to the South America in the 15th century, they introduced this fashion novelty to the aristocracy in Europe, thus starting the chinchilla fur boom - resulting in excessive hunting and almost complete destruction of this species in the 19<sup>th</sup> century. In 1923 a mining engineer Mathias F. Chapman managed to capture 11 animals – the ancestry of all the today's captive-bred chinchillas - and transported them to California thus launching the chinchilla fur breeding industry worldwide [3].

The secret of the chinchilla fur popularity lies within the fur density which is the highest of all the terrestrial animals – more than 20 000 hairs per cm<sup>2</sup>. Even 75 hairs can come out of one single follicle, every single one of them separately being too tiny to see with a naked eye. This noteworthy fur structure speciality leads to the remarkable ability to endure low temperatures [2]. Since no previous research about chinchilla fur thermal insulating abilities could be found, an experiment using thermal imaging camera was conducted. Thermography is a relatively new diagnostical method based on the detection of the emitted infrared radiation. By determining thermographical changes in various environmental temperatures, we want to visualize the high thermal insulation ability of the chinchilla fur and to explore the thermoregulation of this animal at various environmental temperatures after the room aeration in winter. The calculated results indicate close linear positive correlation (n=50; r>0.8) between the environmental temperature and the temperature of such anatomical regions as *reg. auricularis*, *reg. frontalis* and *reg. scapularis* - meaning a significant temperature decrease in these body parts in case environmental temperature decreases. The temperature of *reg. orbitalis* and *reg. nasalis* is not significantly affected by the environmental temperature fluctuations since only a weak linear positive correlation exists. This leads to a conclusion that the chinchilla fur effectively prevents cooling and successfully adapts to the environmental temperature decrease to + 2 °C.

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# ANTIMICROBIAL RESISTANCE AMONG FECAL INDICATOR BACTERIA OF DIVERSE DOG POPULATIONS

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The occurrence of antimicrobial resistance in companion animals may however be of significance to human health. Cats and dogs represent potential spreading sources of antimicrobial resistance due to the extensive use of antimicrobial agents in these animals and their close contact with humans [2,3].

Normal intestinal flora is a reservoir for resistance genes. The prevalence of resistance in commensal *Escherichia coli* is a useful indicator of antibiotic resistance in bacteria in the community [1].

The aim of the present study was to compare the antimicrobial resistance detected of indicator bacteria isolates from healthy dogs rectum of diverse dog populations.

Rectal swabs were collected from 20 individually owned dogs kept indoor and 15 dogs from an animal shelter. The samples were placed in Transwab® Amies transport medium (Liofilchem, Italy). Each swab was inoculated on different agars: McConkey, Tryptone Bile X-Glucuronide, Kanamycin Esculin Azide (Liofilchem, Italy). Antimicrobial disk susceptibility tests were performed using the disk diffusion method (CLSI, 2007).

A total of 10 *E. coli* isolates were recovered from 15 fecal samples (66.66 %) of dogs from the animal shelter. Among the isolates of *E. coli* the multidrug-resistance was observed against neomycin, polymixin, ampicillin (100 %), followed by gentamicin and tetracycline (90 %) ( $p < 0,001$ ). Enterococci were isolated from rectal swabs of 6 dogs (40 %).

Enterococci showed multidrug-resistance to erythromycin, lincomycin, tetracycline, penicillin and enrofloxacin (100 %) ( $p < 0,001$ ). A total of 18 *E. coli* isolates were recovered from 20 fecal samples (90 %) of the dogs kept outdoor. Among the isolates of *E. coli* the highest resistance was observed against neomycin (83.33 %). Enterococci were isolated from 6 dogs (55 %). Enterococci showed high resistance to erythromycin and gentamicin (81.81 %).

Close physical contact by touching, petting and licking occurs at high frequency on the basis of the current perception of household pets as actual family members what tremendously increases the risk of transmission of antimicrobial resistant bacteria from pets to humans [1,3].

The results of this research demonstrate that the acquired antimicrobial multidrug-resistance in the intestinal microbiota of dogs depends on the social environment of the investigated population. Multidrug resistance between the *E. coli* and enterococci isolates were detected more frequently in animal shelter dogs than those from individually owned.

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# INTERRELATIONSHIP BETWEEN CERVID ANIMALS AND HUMAN

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Anthropogenic factors associated with human compared to the natural factors, are new, unusual and often – drastic. Animal response to the anthropogenic factor is not innate – anthropogenic factors are not reflected in phylogenesis of animals, but the human factor effect, repeated for many years, leaves traces in animal memory.

Ungulates animal fauna of Lithuania formed after the ice age to the present day has changed significantly. This was due to changing of natural and climatic conditions, then - direct and indirect human activities.

**Red deer (*Cervus elaphus* L.).** Red deer are distributed in Europe, Asia, North Africa and North America. Red deer are located in the forests, steppes, mountains and even deserts.

**Roe deer (*Capreolus capreolus* L.).** Roe deer tribe is one of the oldest in the cervid animal family and there are no other close related modern tribes [1].

Human and animal communication is to be construed as one of the instances of interspecific communication. Cervid animals positively react to human food products, although the evolutionary point of view, these are new, unaccustomed to their diet. Additional animal feeding changes intraspecific, interspecific relationships, animals often become dependent waiting for someone to feed them and not trying to find the food. Also it can be a negative reaction of the animal. Animals often make a mistake - for example, in order to meet the need of salt, roe deer, red deer lick scattered fields of fertilizers and die [2].

One of the main anthropogenic factors is hunting. Hunting and hunters are an important factor which has positive and negative impacts on the state of biodiversity.

Fenced-in animals are fed throughout the year and such fencing is close to the agricultural sector. It is also generally recognised that after the production of milk it is the most profitable branch of agriculture [3].

Herbaceous vegetation is dominated in deer food allowance. In forest which is the living environment and food sovereignty is a relatively stable ecosystem, constantly new cutting sites appear and it is a positive anthropogenic factor [4].

Anthropogenic factors on deer animals are significant. Animal response to the consequences of human activity is primarily dependent on the human attitude towards animals.

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## **YORKSHIRE TERRIER DOG BREED GROOMING**

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A dog's coat is a physical barrier to prevent the animal from chemical substances and active microbes [1]. Improper grooming can disrupt these functions.

Yorkshire Terrier hair has a similar structure to the human's, therefore their coat requires special care [3].

The aim of this research was to evaluate the Yorkshire Terrier dog breed grooming.

During the study three 2-year-old Yorkshire Terrier dogs were explored. The dogs' body hair was cut short and the hair of head, limbs and tail remained long. During the study it was tested if the dogs' hair was close to the body, if it was glossy, not frayed and if there were no tangles. Whether the hair keep tight in skin was determined by picking out hair in different areas of the body (10 spots). Hair elasticity was determined by compressing plucked tuft of hair. The dogs' owners were questioned how many times a week they comb their dogs, what tools they use and how often they bath them. It was also investigated whether dogs have fleas.

The hair of all dogs in the study was close to the body, glossy, not frayed and with no tangles. Hair clung to the skin. Picking out hair in different areas of the body (10 spots), 3-4 hairs in average were plucked from the dog No. 1, from the dog No. 2 - 1-2 hairs in average, from the dog No. 3 - 2-3 hairs in average. All dogs had elastic hair. After compression of the plucked hair tuft they did not break. Due to the unusual structure of the coat Yorkshire Terriers should be brushed every day using a brush with blunt pins [2]. The dog No. 1 was brushed 2-3 times a week with a comb, the dogs No. 2. and No. 3 were brushed every day with a brush and a comb. The dog No. 3 was brushed using a brush with sharp pins which scratched the dog's skin a bit. It is recommended to bath Yorkshire Terriers once in every 3 weeks [2]. All dogs were bathed one time every 3-4 weeks, using special shampoo and balsam for Yorkshire Terriers. All dogs did not have any fleas.

Conclusions: the dog's No. 2 coat was cared properly. The dog's No. 1 coat was brushed too rarely (2-3 times a week). The dog's No. 3 coat was brushed with improper brush (sharp pins).

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## BIOPRINTING – REVOLUTION IN VETERINARY MEDICINE

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There are about eight million animal species on the Earth and billions of human beings. The world is getting more crowded and that increases the possibility of getting injured or diseased. We have many diseases that are difficult to deal with without leaving an influence to inner organs and body condition in general. Animals used in high level sporting activities can suffer majorly from injuries that can expel them from competitions. Even minor skin damages can have an influence on the results of animals used in show arenas. In the recent 20 years a new method for dealing with these problems has raised and it can influence veterinary medicine majorly, starting with improving the study techniques for veterinary students; ending with expanding the methods of laboratory testing and transplanting organs into live animals.

One of the bioprinting pioneers is Organovo in the USA. Scientists working in Organovo describe bioprinting as a method that combines the synergistic potential of engineering and biology to create living tissues that mimic the form and function of native tissues, including dense cellularity and the presence of multiple cell types. They say that creation of tissues by 3D printer is automated and highly reproducible. It works consistently yielding tissues within vivo-like micro-architecture [2].

The results of the scientific research done by the scientists of Organovo show that we have already reached a point where we can actually make a real 3D tissue and use it in laboratory testing for cosmetics and drugs. This gives us much more precise results and reduces the number of animals used in laboratories. Other scientists are already trying to go further by developing techniques that will enable cells to be printed directly onto or into the human body in situ. Already a team of bioprinting researchers lead by Anthony Alata at the Wake Forrest School of Medicine have developed a one-of-a-kind 3-D printer to produce organ and tissue prototypes. The researchers believe that soon they will be able to successfully replace skin or muscle. They are now performing pre-clinical studies in a large animal model (pig) [3].

First experiments of printing skin directly on a live animal have already been done and are successful. This technique can allow us to cure wounds in a shorter period of time and without extra transplantation which makes it healthier and safer for the animal.

As bioprinting for universities in Latvia is something we still have to wait for at least a couple of years, there is something we can start with right now. FabLab of the University of Latvia is an open prototyping workshop where entrepreneurs, inventors, engineers and practical people can materialize their ideas as physical objects. Open prototyping workshop means that it is available to all those wishing to make product prototypes or individual components using the FabLab available tools and materials [1].

We can use an ordinary 3D printer for printing models of inner organs or body parts that we can use in biology, anatomy and histology studies.

Students can benefit from this 3D technology by using plastic organ models in their studies. For scientists and veterinarians bioprinting can make a medical revolution that will change the way we treat and care for our animals.

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# RUMEN DEVELOPMENT AND LIVE WEIGHT GAIN OF ONE TO EIGHT WEEKS OLD CALVES DEPENDING ON FEED MATERIALS

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Calves are ruminants who have multi-chambered stomach. Rumen of a young calf is relatively underdeveloped but as soon as it starts to consume dry food, rumen develops very quickly. The development is affected by optimal feeding.

Feeding calves with hay stimulates greater amount of saliva going into the digestive tract and that improves the development of the muscular layer of the rumen, in addition promoting rumen motility. However, hay fed together with milk, does not provide adequate levels of volatile fatty acids for the villi of the rumen to have the best development, therefore, it is necessary to add those grain crops for food that provide rumen with the necessary amount of volatile fatty acids [1].

According to Dr. Jim Quigley, in order to improve the development of the muscular layer of the rumen and to preserve rumen epithelium, it is important to feed calves with hay [2], while other sources suggest that hay has the opposite effect on rumen because newborns in their rumen do not have the proper enzymes and microorganisms have not been stabilized yet to digest fibers including hay. It fills up the space, that in other circumstances would be taken by grain crops and proteins that can be digested and utilized [3]. These differences in opinions are the reasons of our research.

The aim of the research is to clarify whether feeding hay influences the development of the rumen and find out its effect on live weight gain of 1 to 8 weeks old calves. The calves were separated in two groups with different feeding diets (n=9). The first group was fed with hay, milk and a starter for calves, the second group was fed by milk and the starter. Later, in the age of 8 weeks, four calves of each group were slaughtered, then histological samples were taken and coloured with hematoxylin and eosin and the measurements were performed. The difference from the apical tip of the epithelium of the villi apex to the basal edge of the epithelium of the villi base was measured. The average results in the first group were 458,3µm, but in the second group- 414,175 µm. It shows that between both groups there is no big difference. Also measurements of their live weight were performed once a week for each calf in both groups and the results showed that the greatest increase in live weight was in the group, which was fed with hay, milk and the starter, it was 23 percent higher.

In conclusion, it was confirmed that feeding milk, hay and starter the villus length did not differ, but greater live weight gain was observed.

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# POSSIBLE CAUSES OF BAT FATALITIES AT WIND TURBINES IN WESTERN LATVIA

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Each year thousands of bats are found dead at wind farms worldwide. It has been estimated that more than 200 000 bats are killed annually by wind turbines located in Germany [2] and more than 600 000 in the United States [3]. The aim of our study was to determine, the cause of death of bats found at wind turbines in Western Latvia.

Two main theories, that explain the cause of death, are barotrauma and traumatic injury [4]. Barotrauma involves tissue damage to air-containing structures caused by rapid or excessive pressure change [1]. Key diagnostic features of pulmonary barotrauma include microscopic detection of haemorrhage and oedema in airspaces with vascular congestion and interstitial bullae. Signs of traumatic injury include diaphragmatic hernia, self-bitten tongues, external lacerations, and subcutaneous haemorrhage as well as different bone fractures [4].

Altogether we necropsied 30 bats of 4 species: *Pipistrellus nathusii* (17), *Pipistrellus pygmaeus* (1), *Eptesicus nilssonii* (11), *Vespertilio murinus* (1). These bats were found below 7 wind turbines in Western Latvia from August 6 until August 28, 2013. As a part of our study we took radiographic images of 13 bats and histopathologic samples from the two bats with the least amount of post-mortem changes. 17 bats were in severe state of decomposition or skeletization and were not useful for any assessment. We also assessed possible factors affecting the quality of histologic samples of the bats, such as carcass decay and handling. We determined the possible cause of death of 6 bats (20%) being blunt force trauma causing fractures of spine, pelvis or humerus. The main factor that made determination of the cause of death impossible was severe autolysis of soft tissues and skeletization. Freshly collected and better preserved bats are needed in order to assess frequency of barotrauma in the bats found dead at wind turbines.

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# BACTERIAL COUNTS AND THEIR REDUCING POSSIBILITIES IN CANINE ORAL CAVITY

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Mouth cavity is the initial stage of the digestive system, where the main components are teeth. Dog learns about the world with the help of its mouth, therefore, the belief that a dog's mouth is cleaner than a human's mouth is not true. Dog's mouth is full of different kinds of bacteria, depending on what it has tasted, chewed or ingested. The bacteria in the mouth cavity can affect the state of health of the whole animal body, so it is important to take care of the dog's mouth cavity in time, by cleaning its teeth using toothpastes which are meant for animals, giving different kinds of chew-bones, sprays etc.

There is an enabling environment for microorganisms in the mouth. There are definite kinds of bacteria populations in the dog's mouth cavity. The changes of the microbial specter of the mouth cavity are closely connected with the pathologies in the mouth and the digestive system. Many bacteria are a normal part of the mouth microflora, but a number of pathogenic bacteria can cause a variety of mouth cavity and teeth diseases. During the variety of diseases, for example, periodontitis, the amount of bacteria will be bigger in comparison with the amount of the bacteria in the dog's mouth cavity which teeth are cleaned [1].

Taking care of the mouth cavity and teeth is a very important process soon after the birth. Although periodontal disease primarily affects dogs over five years old, it is best to get your dog used to regular brushing when he is young thus preventing the possibility of getting plaque, as the main reason of the formation of the periodontitis is considered to be plaque. It is pointed out, that during the first living days in the dog's mouth cavity *Streptococcus spp.* prevail, to which later join bacteria like *Escherichia coli*, *Staphylococcus*, *Enterococcus*, *Enterobacter*, *Bacillus* etc. [2].

One of the effective means in dog's teeth care are toothpastes, which can be with the antibacterial effect and without it [3], therefore, we have carried out an experiment, the aim of which was to point out 2 toothpastes, and to find out the effect of the *Lactobacillus reuteri* on the mouth cavity *in vitro*. 12 dog's mouth cavity bacteriological samples were collected from the upper jaw in the 4<sup>th</sup> premolar and 2<sup>nd</sup> molar tooth area. During the experiment the dogs were divided into 3 groups: dogs, which teeth were cleaned, dogs, which teeth were not cleaned and dogs with clinical diseases of the mouth cavity.

In conclusion, it was pointed out that the amount of the dogs' mouth bacteria in dogs, which teeth were cleaned and in dogs, which teeth were not cleaned, do not differ much ( $p > 0.05$ ), but dogs with clinical diseases have ( $p \leq 0.05$ ) bigger amount of bacteria. Furthermore, considerable depression zone for aerobic and anaerobic conditions was observed in only 1 toothpaste.

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# RADIOGRAPHIC INVESTIGATION OF TUSK TO DETERMINE THE AGE OF A DOG

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The development of teeth does not end with their eruption; on the contrary, it is a long and complex process followed by dentin development and ends with its mineralization [3]. Any disorders of the tooth development may result in development of pathological processes, the presence of which is not always visible, both within the tooth and the surrounding tissue. It is known that a tooth consists of the outer layer – enamel (*enamelum*), middle layer - dentin (*dentum*), and the central layer – the dental pulp cavity (*chamber*) occupied by dental pulp (*pulpa dentis*). The root of the tooth (*radix dentis*) consists of all these structures, but instead of enamel there is cementum. The line of the tooth neck or cervix is an anatomical outline (*cementoenamel junction*) between the tooth crown and root as well as the transfer from *enamel* to *cementum* [1].

The first deciduous teeth in dogs erupt early in the first week of age, but at the age of six weeks all 28 deciduous teeth have erupted. At the age of 4 – 7 months, all deciduous teeth are replaced by the permanent teeth [2].

The postnatal development of the teeth microstructure and the possible deviation from the norm can be determined histologically only after their extirpation [4]. The aim of the study is to find out if it is possible to use radiographic examination to evaluate the macrostructure of teeth in dogs in various periods of their postnatal development.

A conclusion may be drawn that the digital radiogram can be used to evaluate the process of the teeth replacement and their macrostructure. It was found out that using a digital radiogram at higher magnification, in medium large dogs, it was possible to see clearly the pre-matured permanent teeth and to follow the process of teeth replacement. Layers of macrostructure of the deciduous and permanent incisors and premolar teeth were poorly seen while those layers of the canines (*dentis canini*) and molars were distinguished clearly. Tusk dentin thickness varies according to the dog's age – when animals get older, it becomes thicker. The dog is getting older according to the decreasing width of tusk tooth pulp. The dentine and pulp morphological measurement varies according to the ratio between the dog's ages. Dog dentine volume increases and decreases in pulp intensively during the first 48 months. Dog tusk dentin and pulp percentage ratio comparisons can be used for determining the age of the animal.

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## NEW SOFT DRINKS MADE FROM NATURAL RAW MATERIALS

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Today soft drinks are known as water-based flavoured drinks. Besides for the taste and sparkle carbon dioxide is added and as sweetening agents nutritive, non-nutritive, and/or intense sweeteners are used [1].

As an alternative to traditional ingredients in the production of soft drinks also various natural raw materials can be used, what this research offers to highlight.

The new soft drinks contain hemp syrup which is obtained from hemp seed (*Cannabis sativa L.*) milk whey and extra ingredients such as quince (*Pyrus cydonia*) syrup, chokeberry (*Aronia melanocarpa*) juice, also used mint (*Mentha x piperita*), hemp (*Cannabis sativa L.*) and fireweed (*Chamerion angustifolium*), tea to enrich the taste of drinks and to create refreshing and natural drinks. All new soft drinks are based on hemp syrup because hempseeds are an excellent source of nutrition. Hempseeds and also food products made from hempseeds are rich in protein, oils, including polyunsaturated oils, significant amounts of vitamins and minerals, and they contain only to them characteristic aroma and taste [2].

For the quality assessment of products sensory evaluation and stating of the consumer liking are necessary using the hedonic and line scale that have distinct advantages over simple choice [3].

According to the results of sensory evaluation the consumers positively evaluate the unique taste and flavour of hemp which was amplified with the other mentioned ingredients. As shown by the results of sensory evaluation Latvian consumers especially like soft drinks with hemp syrup and quince syrup additive. In the market the existing soft drink range could be complemented by a range of new drinks prepared from hemp syrup, so that consumers increase a chance for choice of soft drinks, made from natural raw materials and with hemp taste and aroma.

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## POSSIBLE OPTIONS OF LACTULOSE PRODUCTION

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Lactulose (4-0- $\beta$ -D-galactopyranosyl-D-fructofuranose), is a synthetic disaccharide composed of two sugar molecules fructose and galactose bonded together with  $\beta$ -1,4-glycosidic bond. Lactulose is 1.5 times sweeter than lactose. It has a prebiotic property, because it stimulates the growth of health-promoting bacteria in the gastrointestinal tract, such as bifidobacteria and lactobacilli and at the same time inhibits pathogenic bacteria such as *Salmonella* [1].

Prebiotics are defined as non-digestible food ingredients that may beneficially affect the host by selectively stimulating the growth and/or the activity of a limited number of bacteria in the colon. Prebiotics must escape digestion in the upper gastrointestinal tract and be used by a limited number of the microorganisms comprising the colonic microflora. Prebiotics are principally oligosaccharides [2].

Lactulose can be produced by isomerization of lactose by regrouping the glucose residue to the fructose molecule. The large number of complex reagents, alkalis or enzyme can be used as catalysts for the isomerization of lactose to lactulose. The catalyst must have properties of being low cost, easy to remove from the medium, eco-friendly, safe and non-toxic. The formation of lactulose by means of LA rearrangement has been realized in different matrices either using additional catalysts or catalysing processes. The process includes expensive separation and purification steps to remove the by-product. The lactose isomerization process into lactulose depends on lactose concentration in the feed solution. Systematic analysis of data on lactulose production showed significant variability of this parameter and it varies in the range of 5 – 60%. Moreover, the choice of lactose optimal concentration in the feed solution depends mainly on the type of the catalyst. Using hydroxides (sodium, potassium or calcium) as catalysts and in order to determine the optimal lactose concentration giving the maximum lactulose reaction rate with minimum coloration of the final solution, experiments with lactose concentrations varied between 5% and 30% were carried out. Lactose used in this work was of food grade but not refined. It was purified from proteins to avoid reaction between lactose and protein amine groups [3].

Isomerization reaction was carried out by using sodium hydroxide as a catalyst with an initial solution pH of 10.5 under 72 °C and the reaction time of 65 min. The reported data showed that lactulose concentration in the solution was 40%.

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## FORESTRY SIMULATORS

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Forestry simulators are machines that are intended to learn forestry machine working basics and to teach experienced operators how to maximize their work productivity [1]. Simulators offer a safe and cost-saving method for studying the basics of harvester controls and working techniques, and are often used for gaining extensive experience before starting to operate real machines, and as such operating a simulator must be as close to operating the real thing as possible.

The development of forest machines has accelerated in recent years. Today's machines are in many ways different compared with just a few years ago. Simulators are now a major feature of starting learning the machines [2]. The training program in the simulator takes the operator to a completely new level, through basic training to full operation in the forest. Different exercises train precision in crane operation in preparation for operating a real machine in the forest starting with planning a stand and finishing with stacking cut timber at the roadside – and it all happens in the classroom. Simulators offer entirely new opportunities to improve the training of current and future forest machine operators [3]. Trainees can practice operating several machines at the same stand and even at the same time.

Forestry simulators are not just machines which you drive around the forest. These machines have their own programs which can show you detailed measurements of all machine functions and help achieve and maintain high productivity, and maintain the optimal condition and performance.

To use forestry machines with their maximum possible options, you need to learn how to take control of all the given data and optimize your style of working to the maximum [4]. If the data are not optimized to the maximum possible value, inefficient working will not regain any value of the money of the machine price, because these machines are very expensive and need to work overnight and all the time, and with maximum productivity. Therefore, all forestry machinery companies create simulators to help operators improve their skills and learn new things.

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## VERSATILITY OF ENGINEERED WOOD PRODUCTS

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Engineered wood (sometimes referred to as composite) is comprised of wood veneers, lumber, panels, fibers or strands bound together with an adhesive. Generally, engineered wood is more dimensionally stable and consistent than solid wood. Common engineered wood products are laminated veneer lumber (LVL), oriented strand board (OSB), and plywood (both hardwood and softwood). Structural beam products include I-joists, glulam, and I-beams [1].

The types of engineered wood, their positive and negative sides of use in woodworking, carpentry and construction are analyzed in the present paper.

One of the most common types of engineered wood is oriented strand board. OSB consists of wood strands bonded with adhesives to form a mat. Like veneer in plywood, these mats are layered and oriented for maximum strength, stiffness and stability. The individual strands are typically three to four inches long. OSB is widely used as construction sheathing, as the web material for wood I-joists, as the structural membranes of structural insulated panels (SIPs), and in a growing number of other applications [2].

Typically, engineered wood products are made from the same hardwoods and softwoods used to manufacture lumber. Sawmill scraps and other wood waste can be used for engineered wood composed of wood particles or fibers, but whole logs are usually used for veneers, such as plywood, MDF or particle board. Some engineered wood products, like oriented strand board (OSB), can use trees from the poplar family, a common but non-structural species [3].

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## AMAZING WOODEN THINGS

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There are many amazing structures, things, inventions nowadays, but they are mostly made of common materials like steel, glass, plastic and so on. The question arises whether it is possible to replace these materials with wood, which is much more nature – friendly and is a renewable source. The present paper is based on the study of several sources on amazing things made of wood, in which the authors provide information on how wood can be used to make incredible objects or buildings. Finland is considered as a special place because it feels like everything is made of wood in there but there are some very interesting things elsewhere as well [1]. In addition, almost each country has something very special because wood has always played an important role in the humankind history.

People often like to compose different rankings, and objects made of wood are not an exception. A lot of relatively new things like a mobile phone, a clockwork watch, a car, a car-boat, even USB sticks and many other things have been included on such lists. Each of these things has this one property that makes it really special and noticeable. Details play a significant role and the pictures provided on the website help to understand better why this particular thing is so amazing and unique [1]. These objects are really hard to compare because of their sizes and the skills required making them, so they cannot be arranged in any particular order.

One of the most impressive and surprising sites in the world is Kizhi Pogost, the Russian Orthodox Church buildings, which are completely made of wood, without a single nail or other metal fastener. In order to be built, this structure requested a lot of knowledge in physics. Kizhi Pogost is noticeable in Russia since it has been standing there for more than 150 years. Furthermore, it is the tallest wooden building in the world up to date (37.5 metres), and it has kept the record of its entire existence. The craftsmanship skill required to construct a building on such an amazing scale can only be appreciated up close [2].

Another amazing building is Metropol Parasol, which is the largest, probably the most expensive and the newest wooden structure in Spain, Seville. The building does its purpose just fine, which means it connects the history with nowadays, as this fashionable, modern-day urban centre was constructed on the site of the Roman ruins [3].

In the conclusion, we would like to point out that everything is possible. Would you like to have a wooden car? No problem. Or would you like to make a wooden combination lock? Consider it is done. All it needs is a little inspiration, golden hands and a lot of patience.

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## SNOWBREAKS IN SCOTS PINE FOREST STANDS IN LATVIA

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Snowbreak – breakage of the tree top or stem in the forest stand influenced by weight of snow [1]. Not all trees in the stand break, some of them stay bent.

In recent few years in Latvia two notable snowbreaks have been observed - first in 2010, second, the most damaging, in January of 2013. These two snowbreaks differ from the usual ones before, because of raining while temperature was below 0 °C. Snowbreaks impact the timber quality negatively while breaking and bending trees. Falling trees are severing apart electric lines. A. Breidaks (2013) says that young forest stands are extremely damaged, the forest cycle is ruined – foresters need to ‘move back’ ten to fifty years and start the cycle from the very beginning. For preventing massive attack of forest pests the damaged trees have to be removed from the stand.

The most severe damage appears in young forest stands which are untended, not thinned timely or tended improperly, the trees are growing thin and lengthy with unilateral crowns [3]. In the period of removing the damaged trees exploitation of other usual stands is delayed because all forces are mobilized to eliminate the effect of snowbreaks [5]. Because of small basal area which is left after removal of the damaged trees in many occasions clear felling is the last stage in such territories. That is economically disadvantageous – the main part of the felled trees is used as pulpwood.

The studies have shown that Scots pine forest stands are more susceptible to snowbreaks than other species, Scots pine trees of untended forest stands are in greater risk to be broken or uprooted than Norway spruce [4]. The crown of Scots pine is located near the top of the stem unlike Norway spruce, snow piles up only on the top of it that is why it is especially important that the crown is not unilateral. Any snowbreak will be more dangerous to coniferous trees than to deciduous trees because in winter existence of needles creates a larger place for snow to pile up.

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## ANALYSIS OF STATE OF HERITAGE TREES IN LATVIA

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As the landscape of Latvia cannot be imagined without forests, the rural cultural landscapes cannot be imagined without separate tree groups, tree avenues and without heritage trees (also known as noble, secular, venerable trees) [4]. The condition analysis of heritage trees must be performed to assess the current condition of trees and to evaluate the hazard factors and possible protection measures.

Heritage trees are the oldest and largest tree specimens, notable specimens because of their size, form, shape, beauty, age, colour, rarity, genetic constitution, or other distinctive features of both local and introduced tree species [3,4]. Heritage trees are bioindicators of the quality of environment. Heritage tree is a value by itself but it is also a living space for birds, insects, fungi, lichens and other organisms, including rare and endangered species. Heritage tree is an independent ecosystem [1].

A tree to be considered as a heritage tree must meet the criteria of heritage trees which are stated in the Republic of Latvia Cabinet Regulation No 264 “General Regulations on Protection and Use of Specially Protected Nature Territories” in Annex 2 “Protected Trees – Noble Trees of Local and Introduced Species” adopted on 16 March 2010. The ruling criterion of heritage trees is the diameter at breast height (at 1.3 m height). These criteria of heritage trees have changed during times [2]. These changes are shown in Figure 1.

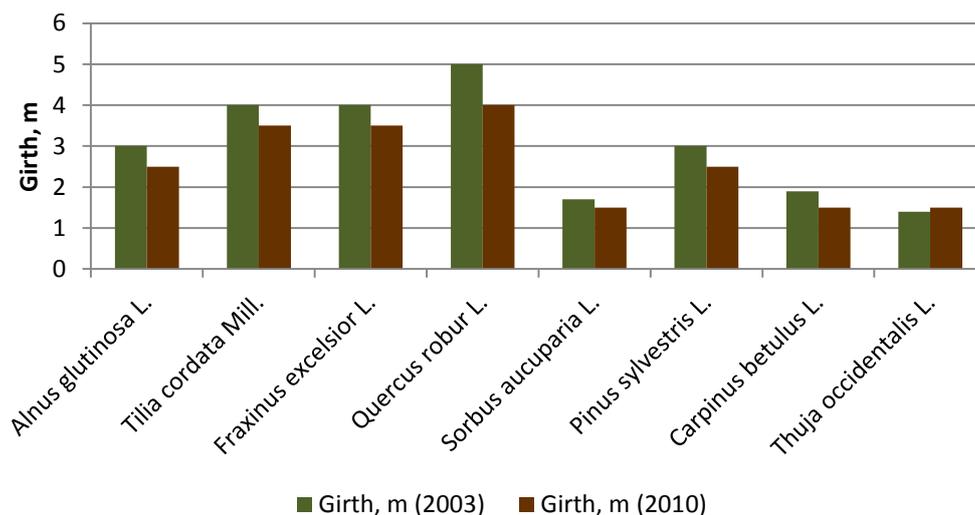


Fig.1. Girth of heritage trees.

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## RADIAL INCREMENT OF EUROPEAN LARCH IN LATGALE FORESTRY

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European larch comes from the pine family and the tree height can reach 40 m. The bark of European larch is fawn-coloured with hardened top bark [1]. The crown is widely pyramidal. Needles of European larch are soft, slim and pyramidal. European larch is light-demanding [2].

In wild this specie is found in Central Europe and Southern Europe. In Latvia European larch has been introduced and from the data of the State Forest Service the area of European larch forest stands form 780 hectares. European larch forest stands are found in wide areas in Poland and Lithuania that is why in these countries there are done relatively more studies comparing to Latvia.

Growth of a tree results in enlargement of the tree phytomass. Different fractions of tree growth are distinguished (trunk, wood, bark, branches, roots). In spring and in the first part of summer tree growth prevails comparing to the second part of summer and in the autumn. The result of that is well seen in the tree-rings as early and late wood, thereby making annual rings distinguishable [3].

Annual growth changes are visible for a number of reasons, such as changes of the climate, pollution, etc. If these changes exist then it can be seen on the annual rings of the tree in all its lifetime because the tree reacts on external changes [5].

According to the study of the Polish scientists average annual growth in a year of larch trees in the regions of Poland varies in the range from 1.57 mm to 1.93 mm. According to the study the average temperature increase has enlarged the width of the annual rings in one of the regions but in general it affects negatively, because in the result of the increase of average temperature the amount of water that the tree needs changes [4].

In Latvia European larch forest stands are not deeply studied, measurements will be made and the findings analyzed in European larch forest stands with different age. While analyzing the findings the changes of the tree lifetime affecting factors (temperature, precipitation) will be seen. The results of the study can be compared with the studies of Lithuanian scientists because the territorial range in Latvia is not very different from Lithuania.

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## RADIAL INCREMENT OF PEDUNCULATE OAK IN NORTHEAST VIDZEME FORESTRY

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Pedunculate oak *Quercus robur* L. is the only species of *Fagaceae* family which is growing naturally in Latvia. Oak is a summer green tree with strong roots. *Quercus robur* is a deciduous tree what grows on slightly acid, deep, fresh soils. It is a frost tolerant species that can resist short periods of drought [1]. Oaks in Latvia are found in compact stands growing in pure stands and also in mixed species stands. Currently in Latvia a small amount of oak stands is registered, about 0.1% of all forest territory. Different species of oaks (*Quercus spp.*) are frequently studied in Europe owing to their longevity and relatively well cross datable ring width pattern [3].

For a quite long time radial growth of pedunculate oak in relation to the environmental factors has been studied in Central Europe. However, we do not have that much information about oak growth in the Baltic region [2]. Radial growth is the increase in the tree radius over a period of time (e.g., 10 years or period between measurements) at the breast height or occasionally at the base of a trunk.

Average tree-ring width, according to scientific work in the Netherlands, is 1.53 mm per year (earlywood width = 0.51 mm and latewood width = 1.02 mm) [5]. Climatic signals significantly have changed during the 20<sup>th</sup> century. The tree-ring width has lost sensitivity to winter temperature and has increased in sensitivity to July temperature [4]. We can say that tree rings are widely applied environmental recorders [3]. In the recent 30 years, the tree-ring width has rapidly reduced below the expected tree-ring width [4].

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# EFFECTS OF ASH AND MINERAL FERTILIZERS ON NATURAL AFFORESTATION OF PEATLANDS

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Peatlands have a low ability of restoration, especially after mechanical harvesting (Huotari, N. et al., 2007). Fertilization of these areas can facilitate the revival of vegetation, thereby promote tree growth. Applying wood ash has been proven to promote tree growth and can have an effect lasting up to 50 years (Huotari, N. et al. 2011). It also has the ability to increase the soil pH value (Molainen, M. et al., 2012), making peatlands habitable to more species. In general, the amount of mineral nutrients in peat soils is low (Renou, F. et al., 2000), specifically potassium and phosphorus. Mineral fertilizers have shown to have a contributing effect on the diameter and height of a tree (Hånell, B. et al., 2003). The studies were carried out on mined peatlands where tree ash (10t\*ha<sup>-1</sup>) and mineral fertilizers (0.5t\*ha<sup>-1</sup>) have been applied. The aim of the study is to find out whether tree ash or mineral fertilizers promote better tree restoration in peatlands. The data were obtained from six 25m<sup>2</sup> plots, where trees were counted, their height was measured and the tree species recorded. From the results indicators were obtained on: the percentage of a particular tree species occurring; the average tree height by species and treatment; and the number of trees per square meter by species and treatment. The results show the existence of four tree species – birch, pine, aspen and spruce. Birches were found more often and showed active growth, regardless of the treatment. No aspen trees were present in the plots fertilized with mineral fertilizers, however, in plots fertilized with tree ash aspen trees made 17% of the total species composition. The number of trees per square meter was greater for plots with tree ash - 4.64 trees per m<sup>2</sup> - in comparison to the plots with mineral fertilizers, where it was 3.19 trees per m<sup>2</sup>. Still the application of mineral fertilizers promotes tree growth, particularly for pines, that were 44% taller than the ones where ash was applied. Though spruce appeared in all of the plots, it did not show a significant presence or an active growth for either of the treatments. The application of wood ash can be considered environmentally friendly, economically beneficial and it is obtained as a residue from, e.g., a thermal power plant. The application of wood ash also displays a wider species composition - all of the four recorded species were found in ash plots. Mineral fertilizers seem to have a beneficial effect on the height of birch, spruce and especially pine trees.

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# SOCIAL NETWORK “VKONRAKTE” AS ADDITIONAL EDUCATIONAL RESOURCE OF FOREIGN LANGUAGE TEACHING

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Currently prospects of development of competence-based approach are more associated with increasing in trends of a broad use in teaching interactive forms of education in combination with extracurricular work to create and develop the professional skills of students. One of the requirements to the conditions of implementation of major educational programs on the basis of the GEF to the formation and development of professional competencies of students is the widespread use in the educational process of interactive forms of training combined with extracurricular work with a view. This directive of the Federal state standards of higher professional education (HPE GEF) of the third generation [1, section 7.3] requires careful thought and consideration of the forms of interactivity in relation to each individual discipline curriculum.

The term "interactive" means the ability to interact or to be in a dialogue with anyone (person) or anything (PC). Interactive learning is a dialog learning during which there is the interaction either with a teacher and a student, or between students directly in an audience or remotely.

Social networks come to the fore when a person learns foreign language using information technologies because they have the most communicative potential for English teachers. A characteristic feature of the existence of this kind of environment intends productivity, i.e., the result of activities in the social network is a product of communication, dialogue, etc. Social resource "VKontakte" is the most popular social network among the students in Russia. Access to this site gives a person the opportunity to use a huge amount of additional educational materials that allow him or her to enrich knowledge via variety of exercises, share different contents (spread record, share with classmates educational information).

Teachers can create study groups, spread the necessary academic information in the created group, check homework. For example, students of the SPbSTU form the dialogues with each other, speak them in a couple and send screenshots to the English teacher's electronic page. Imperfect monologue of diffident students acquires dialogic quality that is the main attribute of pair work when a teacher uses interactive teaching methods [2]. This method not only promotes the development of such features as the ability to cooperate but also the development of skills of self-organization, self-education.

Social network "VKontakte" has the necessary educational potential that makes it an effective tool in the educational process of modeling and interaction in real time during extracurricular time.

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# USAGE OF SECURITY TESTING TOOLS AND ANALYSIS OF VULNERABILITY

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Protection of information is one of the topical themes within the field of software development. The research comprises the study on the question of security, particularly, software testing and organisation of documentation that is implemented in the bachelor paper. At the moment many various fees and free specialized tools exist for security testing; each of these tools has its own functions, and before the process of testing it is necessary to choose the tool that is appropriate for the particular situation. Within the framework of the research, comparison and usage of the particular tools is implemented by analysis of the gained results [1].

According to statistical data of the level of Latvia, during the recent years infections via browsers, server hacking, phishing, DoS and other current issues constantly remain up to date within the framework of system security policy [3]. They become more important because nowadays web technologies in the information system development are based on the workings of cloud computing, thus creating additional threat to unauthorised data access, information theft and other unauthorised activities.

In order to reduce the potential risks, security activities are carried out already during the system development. One of them is testing security aspects during which it is verified whether the particular system has any particular vulnerability. The types of vulnerabilities and their popularity are reflected by various kinds of statistics. This information is widely offered by The Open Web Application Security Project [2]. Within the framework of the research OWASP 2013 TOP 10 vulnerability survey is carried out by implementing more popular vulnerability survey in a real system, using specialized tools, for instance, Burp Suite potential SQL injection and Cross-site scripting for vulnerability identification [1].

In this way more popular vulnerabilities of web application are studied, as well as tools for their identification, and conclusions are drawn on the viewed themes. In order to successfully analyse the results of the done test examples, particular procedures of scenario implementation, documentation and analysis are established.

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# EMULATOR AS THE WAY OF POLYMORPHIC VIRUSES DETECTION

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Computer technologies have been introduced into all spheres of human life, and it is becoming quite clear that they need information systems protection. A specialist is needed to prevent the cases of information theft or violation. And this specialist has to work in the field of protection against computer viruses. The main problem of modern viruses is that it is difficult to detect them. Modern antivirus programs use emulation to detect a polymorphic virus.

In computer terminology a polymorphic code is the code that uses a polymorphic engine to mutate while keeping the original algorithm intact. That is, the code changes itself each time it runs, but the function of the code (its semantics) will not change at all. For example,  $1+3$  and  $6-2$  both achieve the same result while using a different code [1].

A common virus can be easily identified by a specific sequence of commands in the assembly language while scanning a file. However, a polymorphic virus cannot be determined in this way, since its code does not have a permanent fragment. The sequence of commands in each virus program will be different. The program will decrypt itself, changing the fragments of random access memory. Because of this, the malicious code, which did not exist before, appears in the memory.

The CPU instructions represent a sequence of bytes, and it is possible to make the correspondence between the sequences of incomprehensible binary digits and quite understandable commands in the assembly language [2].

Reading the file with the binary code, we can understand what commands there are and what operands they work with. Then we work with the operands depending on the command. In contrast to the actual execution of the program, we do not work directly with these registers in the processor, but with the memory allocation in RAM. The commands will not have the direct access to the processor, and the system will not be damaged.

The checksum is calculated by CRC32 (cyclic redundancy check) algorithm. The checksum is a value constructed in a specific pattern on the basis of the encoded message [3].

Since the VCG generator creates a polymorphic program that prints a line with the name of the generator, then to detect the virus means to detect this line in RAM. We can do it comparing the checksum (which is used like a signature) of this line with the checksum of a definite address, where this line should be placed. This is done to save the memory, because any modern antivirus program has a vast base of signatures. If the checksums are the same, it means, that the required sequence of commands has been found. In this case we can understand that the emulator program has decrypted the polymorphic program correctly.

Summing up, it is necessary to underline, that this program is needed for complicated viruses detection, that decrypt themselves on the way of executing.

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# **LOAD TEST EFFICIENCY ASSESSMENT IN WEB-INTERFACE TESTING WITH HTML UNIT DRIVER**

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The Internet is an excellent platform for communication. So the Internet access and communicational problem prevention has become an essential task where one of the tools is web-interface testing, with load testing providing reliable assessment. The tool is based on the process of putting demand on a system or device and measuring its response [2]. When the load on the system is raised beyond normal usage patterns, some functioning disorders can be revealed and in order to test the system response at peak loads, special assessment methods are to be developed known as stress tests [1]. In this project the demo version of web- interface of the firewall FNP Light has been tested with HtmlUnitDriver. This kind of testing is an efficient tool of interface performance assessment for companies specialized on development, production and implementation of the modern technical facilities dealing with computer networking.

To assess networking we should remember that an important factor of interface efficiency is the access threshold. The main objective of our testing was to check operability of the interface if the number of the registered users is large. Another task was to analyze the time of each user adding with increasing number of added users. We also carried out the test aimed at the determination of both - the maximum users' number and the active fire-wall users. It is important that the program code in the Java language was introduced with the implementation of the specially written set of automatic tests for demo version testing of the fire-wall web interface. The approach gave a possibility to get the following results: the maximum number of successfully added new users of a fire-wall which was 123, the maximum number of the active users – 10 and registration of new users and their authorization was successfully carried out.

The developed approach and the tests set for web-interface assessment can be implemented in the wide areas of networking, where the need for simultaneous communication between a number of users exists, for example, in business, commerce and distance leaning.

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## NEXT GENERATION OF REPORT CREATING SYSTEMS

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Creation of reports dates back in history way more before computers were invented, and a report as a document had to be created manually or later by a typewriter [1]. Electronics gave the ability to save reports and to edit them for reusing purposes, giving the ability to create and print them faster [2], but still all numbers had to be entered manually. Personal and programmable computers introduced the information systems – an ability to store data and calculations so that the reports can be reused and the data can be read from the data base or file, so the whole report could be fully automatically generated, but the program is required that would create it.

Oracle reports [3], Cristal report [4] and other similar products gave the ability to program report creating tools and automatic reports more easily, but it still took a lot of time and there were problems if the report had to be changed, because the code had to be edited. Company “Datorikas institūts DIVI” has their own developed tool DIREPO that gives the ability to store the report code in the database. Each report in the database contains multiple INFO\_SET – information about the report structure, and page formatting. Each INFO\_SET can contain several INFO\_UNIT – information about the blocs used to calculate, select or change formatting of columns. INFO\_SET language gives full graphical user interface for report defining and editing. Since the reports are stored next to the data in the database this gives the ability for one tool to be used in different solutions. DIREPO gives the ability to save reports on various formats, but mostly it is used for Microsoft office readable files. Microsoft developed new formats for saving documents as xml files, created Open XML SDK [5] that allowed direct parsing from SDK object to document file. Because XML files have object oriented approach, now Microsoft office files can be directly parsed into open SDK objects. So, now the template can be read directly from the document. Next generation reports might be fully automatic and require no coding at all. If the document is created in the office and contains an info set explaining from where to read the data it might be able to store it in database, create documents with current situation, and report editing would be as simple as editing a word document.

The author works as the developer for DIREPO tool, and now the tool is able to create reports in popular formats, like DOC, XLS, and the newest version supports printing the DOCX and XLSX as well and the next version is planned to be able to read the report structure directly from the template file.

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## ANIMATED CHANGES OF THE BALTIC SEA WATER LEVEL

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The aim of the work is to explore and practice 3D visualization and animation opportunities by using freeware programs such as „Blender” and „QGIS”. The main task is to create an animated 3D model of Latvia, showing the changes of the water level in the Baltic Sea.

The necessary information to visualize QGIS data in 3D with Blender can be found in the article “Visualizing QGIS data with Blender” [1].

There are many types of GIS software offering 3D visualization of data but in order to animate the data, additional 3D software such as “Blender” is necessary.

Many sources of information have been studied in order to create a correct simulation of the possible water level changes in the Baltic Sea. One of the sources is a web page “Climate changes in Latvia” [2].

Approximate water level rise every year is around 0,9 cm but that is not the only influence on the coastline changes. There are other different aspects such as glacier melting, temperature changes and others which must be considered.

In this report, a design for a three dimensional model of possible water level changes has been presented. The key features are the gathered data about metrical water level changes in different regions of the Baltic Sea shore around the territory of Latvia. The terrain model is made by using the altitude map.

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# HOW TO BUILD YOUR FIRST 3D PRINTER AND YOUR VOCABULARY

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Nowadays 3D printers are spread worldwide and coming to any prototyping. That is because you can easily make any part for your structure just making a 3D model and printing it. There are several 3D printing processes, the most widespread one being Fused Deposition Modelling (FDM), i.e., pushing plastic through a heating nozzle where plastic is melted and extruded through the nozzle that moves to build, layer by layer, the solid object. This technology is becoming a household appliance with many people, using their own 3D printers at homes, and many more going to [1]. So, the author is building his too and would like to share the experience in this area.

To start building your own 3D printer you should choose what kind of printer you need. There are some types of FDM printers that differ by the way the printer positions its nozzle. The author has chosen the printer with a heating platform going X-axis and extruder going YZ. Choosing the most suitable model you need to find out what machinery you have access to, because usually you need a 3D printer to build a 3D printer. This is the ideology of the RepRap community that develops self replicating printers, containing printable plastic parts [2].

For a beginner in this area the best option is probably a durable frame that has been probed by many users with detail assembly documentation and complete bill of materials (BOM). Yet this is an easy way that was not chosen, thus the author is building his own modification of Prusa i3 printer. Firstly, it is recommended to check if the structure can actually be assembled. For this you can use any CAD program, or if you have a perfect imagination, assemble it in your mind. Read the BOM attentively and check if all items are accessible. The most expensive parts are steppers, hotend (heating nozzle) and electronics, but they are same for all printers. The assembly starts with the X carriage and frame, then the YZ carriage and extruder, finally mounted together. It is recommended to place linear bearings on smooth rods before fixing carriages to them. The most common solution to control the printer is Arduino board with RAMPS1.4 shield that is what the author is using. Then do the wiring. Now it is time to calibrate the printer. Upload the firmware to the board, install printer software and calibrate the firmware so that the distances in the program are identical to the actual printer distances. Stick the Kapton tape to the heating bed and you are ready for the first prints. To tell the printer what to do you need a slicing program that will generate an operating track. To find a place to do all this work is a different issue. The author's printer is being built in the Fab Lab Polytech (fabrication laboratory), that gives students an opportunity to implement their technological ideas [3].

In this work the main steps of building your first 3D printer are described. 3D printing is not only a prototyping technique; it is a really exciting hobby that will keep you interested for a long time. 3D printing brings new vocabulary since building it you should read the documentation in English. 3D printer makers use specific terms like abbreviations: BOM, IDE FDM; merges of everyday words: firmware, steppers, stopend; common words that acquired new meanings: slicer, extruder, filament, machine zero. It should be noted that specialists use some of them without translation and they can stay in language as neologisms.

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# FACTORS THAT INFLUENCE DATA STATISTICAL PROCESSING IN EDUCATIONAL RESEARCH

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Data statistical processing performs a two-fold role in research: data statistical processing is inter-connected with the interpretation of statistical results and generalisation. Therefore, data statistical processing has attracted a lot of research efforts in all the research fields including educational research. Use of descriptive and inferential statistics in data statistical processing is under on-going debate: as descriptive statistics can only be used to describe the group that is being studying, and the results cannot be generalized to any larger group [2], inferential statistics is preferred. On the other hand, a skilful and transparent descriptive data analysis is considered to be sufficient [3]. However, little attention has been given to the analysis of factors that influence data statistical processing in educational research. The research question is as follows: what factors influence data statistical processing in educational research? The aim of the research is to analyze factors that influence data statistical processing in educational research underpinning elaboration of a new research question for further studies. The present research involves a process of analysing the meaning of the key concepts *statistical analysis*, *generalisation*, *population*, *sample*, *measurement procedures* and *factors*. Moreover, the study demonstrates how the key concepts are related to the idea of “data statistical processing”. The theoretical findings of the research allow drawing the conclusions on factors that influence data statistical processing in educational research: external factors include access to the sample and resources (time, personnel as well as competences and experiences), technical support, and measurement procedures, and internal factors comprise researcher’s aims of research, aims of generalisation (comparison, typology, etc) [3], research methodology, motivation, interest, skills, and experience. The following research question has been formulated: what are the principles of data statistical processing in educational research? Directions of further research are proposed.

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## TEACHER AND STUDENT RELATIONSHIP IMPROVEMENT

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Radical changes between teacher and student relationships occur because of changing the education paradigm from teaching to learning in all education levels, including the general learning process. Students have grown up in new environment – in the technology era with different values of life. Today's students have become more active and self-confident. Teachers and students have to experience changes in the process of improving the relationship between teachers and students. If the work of the teacher is appreciated, the teacher gets motivation to work creatively and with new methods in school. A motivated and glowing teacher can teach students to be interested, that will provide good relationship in the learning process.

Basics of the research methodology consist of theoretical cognition of pedagogues and psychologists about relationship between teachers and students in the learning process (Eriksons,1998; Pļavniece,2002; Reņģe,1999; Vorobjovs,2002). Attention should be paid to the specificity of student development. The article is based on personality humanitarian and psychological theories, which V. Reņģe has gathered in edition of lecture courses. E. Eriksons is the author of the psychosocial development theory, which emphasizes personal development.

Students have to take into consideration the main teenager psychological specificities analyzing the primary school learning process. Teacher has to be able to quick responding and finding compromises, because teenagers have desire to satisfy all their needs at once. In the investigational age period students are looking for a perfect person – ideal, perfect, which they could resemble. That is the reason why teachers have to think about their behaviour, appearance and try to live modern and healthy lifestyle. Teacher has to inspire students to be opulent of initiatives and responsible for their actions. Teenagers have desire to be grown-up and independent, that is why the teacher has to assign different tasks and responsibilities, which the student can acknowledge himself in class, school and private life. Teacher has to be competent and subjective in student work evolution. Objective and positive evaluation of work is the basics of student motivation [1,3,4]. Social psychology researches interactions and relationships between people, including teacher and students relationships. Interaction is communication with mutually related effect, when the first side behaviour is inducement to the second side reaction. The teenagers age period is considered as privileged, because this period is the most easiest to build relationships. Teacher has to use this privilege to make positive and friendly relationships with students. These relationships have peculiar configuration – teachers help teenager manifest, acknowledge himself, trust and be open for recommendations. But teachers also have to be careful, because these relationships are fragile and can easily fail. Teacher has to find out the right approach and the best methods how to encourage and motivate students. Successful relationships are the key of student success [2,4].

Theoretical research knowledge is summarised in the article:

- if teachers want to build successful relationship with students, then they have to get and find out teenager age period characters, that will help assess the students' needs in this age period;
- if relationships are based on respect, understanding and tolerance, then it has positive and successful effect on the quality of the learning process.

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## LEARNING PROCESS QUALITY IMPROVEMENT

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Increasingly, society discusses the quality of the learning process and its impact on pupils learning outcomes and learning motivation. The learning process quality improvement is necessary, because pupils work very slowly in lessons, they do not execute or have difficulties to execute all amount of work, they not always attend the lessons and do not see the theory and the work they use in real life. The teacher's work affects the quality of the learning process, because each pupil needs an individual approach, the teacher has to spend extra time and energy to attract the pupils' attention to work that they have to do.

The theoretical methods - pedagogical, psychological and methodological literature analysis and evaluation – are used. The theoretical framework consists of D. Albrecht (Dz. Albrehta), B. B. Aismontas (Б. Б. Айсмонтас), I. Kiet and G. Sukhanov (I. Ķiete, G. Suhanova), I. Maslo thinking about the learning process and its quality. An empirical study is done using the survey method. The survey involved 57 pupils from the grade 8.

The learning process quality depends on how extent the functions of the learning process are executed. D. Albrecht distinguishes between the following learning process functions [1]: educate, nurture and evolve. In a qualitative learning process active interaction takes place between the teacher, pupil and the learning subject resulting in purposeful interaction with a common goal to acquire knowledge, skills, beliefs, learning orientation forms and attitudes [4]. In a qualitative learning process pupils must acquire the necessary amount of information provided, pupils must be promoted for acquirement of views, impressions and active, creative thinking must be developed. The individual approach is considered as one of the key criteria of the learning quality [2]. The learning individualization usually affects not only the learning process, but also the learning outcomes - the acquirement levels and amount of curriculum links can differ [4]. The learning process quality improvement may be done by evaluating the standards and curricula of the learning subjects, by using as big variety of teaching methods as possible. Persuasion, exercises, evaluation and self-assessment methods must be used [5].

The following conclusions can be made:

- The detection/measurement of the learning process quality is a difficult process because there are many different learning quality criteria, and their evaluation is a time consuming process.
- There is a wide range of opportunities to improve the quality of the learning process – first being determination which criteria do not meet the desired result. Then working out a plan and implementation of the necessary measures to avoid the weaknesses and improve the quality.

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## **BUCHER SCHOERLING BALTIC WORKING AS A TEAM**

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Today more companies invest a lot of money and energy into team development as such companies do understand how important team building is. One of the most important criteria of success in business is well trained, motivated, skilled and consolidated workers.

As a great example for teamwork the company HILTI can be mentioned. For 20 years this company has been investing a lot of money and energy to the team building. Beginning from the top management, finishing with workers on the floor – everybody has had regular trainings. Every year HILTI tries to create 30 new products and they are very close to this target, as every worker is interested in sharing his ideas and skills for the company. “Give me the HILTI” has become a synonym on any construction site worldwide with the demand of “Give me the power tool”.

At “Bucher Schoerling Baltic” we are trying to reach the same target – develop a great team. At our factory workers receive special training, which matches the needs for the workplace they are working on. BUCHER has had different projects already and is trying to innovate some new for consolidating workers and making workplaces more efficient so they would spend less time and less energy doing their job. Young people are getting opportunities for growing, plus company is getting a new, fresh look at different things, which helps as well doing business. Department leaders are receiving special training so their departments would perform well. In case when something is not going well, support from colleagues will come.

“A good leader does not look into the mirror and praise himself, but looks out of the window and praises the performance of his people”- Mr Baschera, Chairman of the Board of Directors of Hilti.

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## LIQUID PETROLIUM GAS SYSTEMS FOR CARS

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Nowadays, when environmental protection is very important, there are a lot of environment requirements that car manufacturers have to fulfil. By making that kind of changes cars become more economical, too. But it will take a long time for the old automobiles to be replaced with new ones so that they would conform to the new requirements. How can car manufacturers do that? To comply with the requirements automobile manufacturers set up a lot of systems that reduce exhaust gas emissions and in the same time reduce fuel consumption. For example, a system that controls fuel dosage by measuring the exhaust gas composition, adjusts air dosage, and uses several filters.

Of course, the environment requirements are not the same for a 20 years old car and a new car, so there are six classes that are called EURO 1-6 (1 for cars manufactured until 1996 and 6 – from 2013). Each class covers approximately 3 years. It means, if you have an older car you do not need to conform to the latest requirements.

But everyone wants to drive economically, no matter how old the car he/she is driving is. Today there are a lot of ways how to save money spent on fuel and make your car environmentally friendly. It is done by rebuilding engines, changing control unit settings, or making your car run on alternative fuels such as gas (Liquid petroleum gas - LPG, Compressed natural gas - CNG), hydrogen, methanol, ethanol, bio diesel or even electricity.

Very often we think that gas as a fuel for cars is something new, but the first engine that worked on gas was made in 1913. However, this system was only like a laboratory experiment. Few years later in the World War II cars were equipped with gas systems, after the war this idea became common in Italy and Holland. Later in the 90's LPG systems became such as we know them today – working in closed loop and electronically managed.

From that time there are already 6 generations of gas systems. The first was very simple; it was managed only by few electromagnetic valves that start/end LPG supply when you press the switch. The gas flowed into the air intake through a simple injector. Starting with the second generation the systems were equipped with the electronic control unit (ECU) that controlled how the system works. Next systems became even smarter; they worked based on information programmed by the original manufacturer of ECU. Developing the next generation gas systems manufacturers tried to make them more similar to the original fuel systems and used as less as possible components. The 5<sup>th</sup> generation is no longer equipped with a vaporizer (mechanism that reduces gas pressure and transforms it from liquid to gas form as it happened in all previous generations) and gas is injected in the intake channel in liquid state as petrol or diesel. This year the 6<sup>th</sup> generation will show up in the market. It will no longer need several mechanisms, since it will use the same injectors as petrol or diesel, and the same sensors as original ECU; so, there will be less unnecessary parts.

One of the ways how to make your car more environmentally friendly and reduce money usage on fuel – set up LPG system. Of course, there are not only good things that you get by installing it, the car trunk becomes smaller or the spare wheel place is occupied; however, there are no good things without bad ones.

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## **ANTI-LOCK BRAKE SYSTEMS**

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Anti-lock brake systems (ABS), generally also referred to as anti-lock systems (ALS) are designed to prevent the vehicle wheels from locking as a result of the service brake being applied with too much force. The idea is to maintain cornering forces on braking wheels to ensure that the vehicle retains its driving stability and maneuverability as far as possible. The available power and grip should also be utilized to minimize the braking distance and maximize the vehicle deceleration.

Benefits of anti-lock brake system (ABS):

- Guarantees stable braking characteristics on all road surfaces.
- Maintains steerability and generally reduces the braking distance.
- Prevents vehicle combinations from jackknifing.
- Reduces tire wear.

Disadvantages of ABS- although ABS is an effective safety device, it cannot suspend the physical limits. Even a vehicle with ABS can come out of control if driven fast around a corner. Therefore, ABS is not a license for a dangerous driving style or failure to observe the proper safety distance.

Anti-slip regulation (ASR) is typically, but not necessarily, a secondary function of the anti-lock braking system (ABS) on production motor vehicles, designed to prevent loss of traction of driven road wheels. When invoked it therefore enhances the driver control as the throttle input applied is mis-matched to the road surface conditions due to varying factors being unable to manage the applied torque.

Benefits of anti-slip regulation:

- Traction power and cornering forces are maintained.
- Stable driving behavior is ensured when accelerating and negotiating corners on slippery roads.
- Tire wear is reduced to a minimum, and the vehicle drive train is protected.
- The risk of accidents is further reduced.

Disadvantages of ASR- the traction capacity of an all-wheel-driven commercial vehicle cannot be achieved by a motor vehicle with only one driving axle- not even with optimal ASR.

Anti-slip regulation represents a worthwhile addition to anti-lock braking systems. All that is required to turn ABS/ASR on is an engine management system with additional ASR function and a few additional components for controlling the differential brake and the engine. This is why ASR is only available in combination with ABS.

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## **PERPETUAL MOTION DEVICES**

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Nowadays, the majority of academic curricula consist of theory and mathematical models, which are supposed to educate students about the physical, electrical and mechanical processes of the world. Such emphasis on theory is understandable as it saves time and breaks down the process for understanding, but such education poses different hardships. In reality, the only way to truly comprehend certain processes is to see the process in action, if it be 1:1 model or just a geometric one. Students need to link processes with real devices for the knowledge to be sustained over longer periods of time.

Certain devices, more than others, have been subjugated to such mistreatment. These are perpetual motion devices, largely believed to be impossible, because of the laws of conservation of energy. "Energy in a system may take on various forms (e.g., kinetic, potential, heat, light). The law of conservation of energy states that energy may neither be created nor destroyed. Therefore, the sum of all the energies in the system is a constant." [3].

Nevertheless, there have always been people who believed in such a machine and that, in a certain form, it is viable. "The atom electrons, if not disturbed, circulate around the nucleus forever without energy loss." [2]. Many have said that the purest and most efficient forms can be found in nature.

Within the boundaries of this research, a certain perpetual motion device will be built to illustrate why and how the device does not work and to give the notion that practical engineering for students is a necessity, for giving them the link between certain theoretical studies and reality: "There must be one substance that exists that causes and connects the many things we experience. And describing reality in terms of only one substance is obviously also the most simple solution." [1].

Perpetual motion machines, even if not applicable for energy markets, are one of the best ways for showing future specialists the cornerstones of specific academic areas where most of the students get lost.

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## INTERNAL COMBUSTION ENGINES WITH FREE VALVE SYSTEM

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To achieve more advantageous operation car engines are being improved by engineers constantly. The valve system is an important part of an engine that also needs to be updated.

On a conventional engine valves are driven by a camshaft, in that way they work together, in a fixed order and their adjustment possibilities are limited. Although there are systems for making adjustments, they are quite insignificant.

Swedish manufacturer Koenigsegg has found a new solution - a system when valves are completely independent - the free valve system.

All the valves are independent from each other and the piston position. It can be compared to, for example, playing the piano - on a conventional engine you simply put a hand over the keys and push them down all at once, but here you can play each key separately with fingers as necessary. Activators or launchers are used, which work electronically with a compressed air to open the valves, and a spring closes them. It means that valves are opening and closing very fast.

This system has many benefits. For example, 30% more power, 30% more torque, fuel consumption reduced by 30%, hazardous emissions reduced by 50%. It can be safely used at very high engine speeds (up to 20 000rpm), that would allow it to be used for Formula 1 and motorcycles. Even more, a reduced engine weight and size, the engine itself is lower, shorter and narrower because there are no camshaft and timing belt. The system can be also installed on a conventional engine. Koenigsegg's test car with this system has been working perfectly fine without any problems for more than three years.

At this moment it is not in the commercial production and it is only being tested, but, it is possible that after 3-4 years it would be offered as a series option. It is definitely the future of an internal combustion engine, because it means the increase of efficiency, reduced costs and saving the resources.

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# GASOLINE AND DIESEL IGNITION PROCESSES AND THEIR ADVANTAGES

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Diesel engines and HCCI (homogeneous charge compression ignition) engines rely solely on heat and pressure created by the engine, in the compression process for ignition. The compression level that occurs is usually twice or more than for a gasoline engine. Diesel engines take in air only, and shortly before peak compression, spray a small quantity of diesel fuel into the cylinder via a fuel injector that allows the fuel to instantly ignite. HCCI type engines take in both air and fuel, but continue to rely on unaided auto-combustion process, to higher pressures and heat. This is also why diesel and HCCI engines are more susceptible to cold-starting issues, although they run just as well in cold weather once started. Light duty diesel engines with indirect injection in vehicles and light trucks employ glowplugs that pre-heat the combustion chamber just before starting to reduce no-start conditions in cold weather. Most diesels also have a battery and charging system. Most new engines rely on electrical and electronic engine control units (ECU) that also adjust the combustion process to increase efficiency and reduce emissions. Diesel engines are much more economical than gasoline engines, but their maintenance is much more expensive than for gasoline engines.

Gasoline engine ignition systems generally rely on a combination of an alternator or generator and lead-acid battery for electrical power. The battery supplies electrical power for cranking, and supplies electrical power when the engine is off. The battery also supplies electrical power during rare run conditions where the alternator cannot maintain more than 13.8 volts. As alternator voltage falls below 13.8 volts, the lead-acid storage battery increasingly picks up electrical load. During virtually all running conditions, including normal idle conditions, the alternator supplies primary electrical power.

Gasoline engines take in a mixture of air and gasoline and compress it to not more than 12.8 bars. When the mixture is compressed, as the piston approaches the cylinder head and maximum stroke, the spark plug ignites the mixture.

The necessary high voltage, typically 10,000 volts to over 30,000 volts, is supplied by an induction coil or transformer. Some ignition systems are capacitive discharge types. CD ignitions use step-up transformers. The step-up transformer uses energy stored in a capacitance to generate electric spark. With either system, a mechanical or electrical control system provides a carefully timed high-voltage to the proper cylinder. This spark, via the spark plug, ignites the air-fuel mixture in the engine cylinders.

While gasoline internal combustion engines are much easier to start in cold weather than diesel engines, they can still have cold weather starting problems under extreme conditions. This unit was quite popular until electric engine block heaters became standard on gasoline engines sold in cold climates.

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## **HYBRID VEHICLES**

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The article is about hybrid vehicles, hybrid technologies and the future of hybrid technologies. The general idea of it is to motivate people to think about future, to take care about our nature and to help people save money. In our country hybrid vehicles are not as popular as in the United Kingdom, Germany and other countries.

Hybrid-electric vehicles (HEVs) combine the benefits of gasoline engines and electric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools.

The advanced technologies used by hybrids include, for instance, the following: regenerative braking, electric motor drive/assist and automatic start/shutoff.

The electric motor applies resistance to the drivetrain causing the wheels to slow down. In return, the energy from the wheels turns the motor, which functions as a generator, converting energy normally wasted during coasting and braking into electricity, which is stored in a battery until needed by the electric motor.

The electric motor provides additional power to assist the engine in accelerating, passing, or hill climbing. This allows a smaller, more efficient engine to be used. In some vehicles, the motor alone provides power for low-speed driving conditions where internal combustion engines are least efficient.

Automatic start/shutoff automatically shuts off the engine when the vehicle comes to a stop and restarts it when the accelerator is pressed. This prevents wasted energy from idling.

It is a big problem to introduce a new technology in Latvia, but our team hopes that this idea will be successful. Our future is in our hands.

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## **RENEWABLE ENERGY INDUSTRY ROADMAP FOR LATVIA**

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Renewable energy industry is continuously developing both in Latvia and all over the world. The transition from fossil fuels to renewable energy is slow and difficult, because the costs of fuel and energy efficiency are incommensurable. The mankind has realized that resources of fossil fuels and gases are not endless. Therefore, it is necessary to move to renewable and sustainable sources of energy.

Latvia is dependent on imports of primary energy resources. Lacking fossil resources, Latvia has a high level of import dependency on oil and gas imported mainly from Russia. Hydropower and gas provide nearly all of the domestic supply of electricity, with wind and biomass added to the mix in recent years. Self-sufficiency in energy supplies reaches 35.8% (2012), therefore security of supplies and liberalization of the energy market are vital [1].

However, renewable energy sources are substantial. Forests cover approximately half of the territory of Latvia, making biomass the largest domestic resource currently used in heat generation. Hydropower is already the biggest contributor to electricity generation and still has unused potential. Wind power has gained more importance in recent years and has good potential as wind is plentiful. This is particularly the case along the coast where, in addition, the transmission network is particularly developed [2].

The Latvian Cross-Sectoral Coordination Centre plans support programmes for transition to renewable energy resources in the transportation sector and provision of the required infrastructure through assistance only for those alternative energy resources that are economically advantageous, and by supporting innovation resulting in the promotion of the use of economically advantageous alternative energy resources. The proportion of energy produced from renewable energy resources in the total gross energy consumption will reach at least 40% in 2020 [3].

Development of recycling technologies of renewable energy resources will give opportunities for Latvia to get independence in the energy industry. Latvia is able to produce energy better and cleaner than it has done so far.

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## POTENTIAL USE OF FLOATING WIND TURBINES IN LATVIA

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Wind energy is a renewable energy source and is practically inexhaustible. Machines that convert the kinetic energy of wind into mechanical energy and do work have been around since 200 B.C. Modern wind generators are usually located on dry land or in shallow waters. This limits wind speed, contaminates landscape and disturbs shallow water fishery. Moving wind turbines to the open sea would result in better performance and less polluted view.

The mean wintertime wind speed in the Baltic Sea is 8m/s-10m/s, but in spring - 6m/s [2].

Wind is a large scale movement of atmosphere gasses. In the open sea the air motion along the water level is undisturbed, however, on land topographical features such as forests, hills or dunes decrease the wind speed.

The given formula suggests that power of the wind generator is proportional to the rotor area and to the cube of the mean value of wind [1].

In the dry land regions of Latvia with the highest wind speeds, wind blows at a speed of 5 m/s, but in the open sea - 6 m/s – 10 m/s. The difference is significant by itself, even more, since the calculation of the wind turbine power includes the wind speed raised to the third power, the difference in wind speeds results in higher power and more generated energy.

The formula allows calculating the Costal Zone of Visual Influence (CZVI). The square root of two times the product of the Earth radius and tower height gives the distance from which the tower will not be visible [3].

Visual pollution is a huge problem in urban areas. Since the largest wind parks in Latvia are located close to the cities like Ventspils, Liepaja and Grobina, it increases the overall visual pollution of those areas. Moving wind turbines to the open sea and locating them outside the CZVI, the pollution from wind turbines would be decreased to zero.

The potential of floating wind turbines is enormous. They perform better and the costs of the floating plant are lower. However, the armoured underwater cable that connects the generator to the dry land grid could increase the overall costs since it is several kilometres long. All in all, the floating wind turbines are a great way to diminish the power dependency in Latvia.

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## **ALCOHOL FUEL**

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The use of alcohol as a fuel for internal combustion engines, either alone or in combination with other fuels, has been given much attention mostly because of its possible environmental and long-term economical advantages over the fossil fuel.

The first four aliphatic alcohols (methanol, ethanol, propanol, and butanol) are of interest as fuels because they can be synthesized chemically or biologically, and they have characteristics which allow them to be used in internal combustion engines. The general chemical formula for alcohol fuel is  $C_nH_{2n+1}OH$ . Methanol and ethanol can both be derived from fossil fuels, biomass, or perhaps most simply, from carbon dioxide and water. Ethanol has most commonly been produced through fermentation of sugars, and methanol has most commonly been produced from synthesis gas, but there are more modern ways to obtain these fuels. Enzymes can be used instead of fermentation. Methanol is the simplest molecule, and ethanol can be made from methanol. Methanol can be produced industrially from nearly any biomass, including animal waste, or from carbon dioxide and water or steam by first converting the biomass to synthesis gas in a gasifier. It can also be produced in a laboratory using electrolysis or enzymes [1].

Because of the steps involved in its manufacture, alcohol has always been more expensive than gasoline to produce. But now, with dwindling crude oil supplies, the price of gasoline is skyrocketing, and soon gasoline itself will probably have to be synthetically manufactured, at a cost far greater - since the production process is much more complicated than that of alcohol.

Propanol ( $C_3H_7OH$ ) and butanol ( $C_4H_9OH$ ) are considerably less toxic and less volatile than methanol. In particular, butanol has a high flash point of 35 °C, which is a benefit for fire safety, but may be a difficulty for starting engines in cold weather [2].

Alcohol is a superior fuel to gasoline! It has 105 octane, burns with less vibration, is less flammable in case of accidents, is 98% pollution-free, has lower evaporative emissions, and deposits no carbon in the engine or oil, resulting in a tripling of engine life. Specialized alcohol engines can get at least 22% better mileage than gasoline or diesel ones [3].

We can easily use alcohol fuel in the vehicles we already own. Unmodified cars can run on 50% alcohol or converted engines can run on 100% alcohol fuelling. We can make alcohol fuel out of what we have, where we are. Alcohol fuel can efficiently be made out of many things, from waste products like old food, grass clippings, wood chips-even ocean kelp. The process of producing and using alcohol is relatively clean, because alcohol is made from plants, its production takes carbon dioxide out of the air, with the result that it reverses the greenhouse effect. And compared to gasoline, ethanol emits about 20 percent less hydrocarbons and carbon monoxide.

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## IGNITION SYSTEM DISTRIBUTORS

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One of the main things in the ignition system is a distributor. The distributor gives a spark to the correct cylinder that ignites the fuel, which allows the cylinder to move up and down. Over the years ignition system distributors have been modified by materials, a trigger mechanism, timing controls and other items. Now there are more than 100 different types of distributors which differ by size, shape, price, height in order to adapt to different needs [1].

Ignition system distributors consist of a high voltage lead from the coil, a cap, a rotor, a clip, a condenser, a cam, a terminal, a shaft, a drive gear, a vacuum advance diaphragm, a diaphragm spring and more if the distributor is advanced. On most valve engines the shaft is driven by a gear on the camshaft, but on overhead engines - directly to the camshaft. The distributor shaft may also drive the oil pump. From the ignition coil the attached high voltage cable is connected to the metal part of the rotor. This metal part of the rotor arm passes close to (but does not touch) the output contacts which connect high tension leads to the spark plug of each cylinder. When the rotor is spinning inside the distributor, it creates a functional system which is able to give a spark from the ignition coil. In the distributor also a capacitor is attached, which prevents excessive wear of the points. The capacitor is connected parallel to the breaker points. Spark timing is so important for the engine performance that on most cars points are not used, instead of them a sensor is used that tells the engine control unit the exact position of the pistons [3].

In the new modern engine designs the high voltage distributor and coil have been abandoned. Now there are laser distributors, distributors with low voltage pulse to an individual coil on each spark plug or one coil for each pair of distributors of companion cylinders in an engine. That means two coils for four cylinders, three for six, etc. Laser distributors are a new innovation, which is more for natural gas fuelled system engines [2].

Ignition system distributors are still used, because they have worked very well. Distributors in science only have developed better with more functions. The average distributor price is 300\$, it depends on the manufacturer and mark up. In future ignition system distributors will be cheaper, which will allow people to save more money [4].

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## **HYDROGEN ENGINE AND ITS USE**

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The work is about hydrogen as a fuel in engines that could be used by any owner of the vehicles. By introduction of hydrogen as a fuel it would be possible to reduce CO<sub>2</sub> emissions in the air, making it possible for drivers to switch to cleaner and cheaper energy. Hydrogen use in internal combustion engines will not to change their power significantly because many motorists are and will remain users of it as the main engine power. Engine performance and power, of course, may vary but improving the engines, the performance indicators may increase.

Using hydrogen as a fuel will lead to more natural surroundings, cleanliness, and will save you money.

It is also possible to use another environmentally friendly option. It can act as compressed natural gas - gas injectors installed in the machine and H<sub>2</sub> balloon. It is a myth that H<sub>2</sub> is more dangerous than natural gas. It is not - if there is a leak, the lightest gas H<sub>2</sub> immediately goes into the air, including the flame. But if the escape of flammable propane / butane occurs, which is much heavier than air, everything will come out from under the vehicle, which is much more dangerous.

The main tasks are to collect information about hydrogen as alternative oil fuel, to perform hydrogen research, find ways of hydrogen use in engines, put together a hydrogen operated engine prototype, to draw the conclusions of the work carried out. After the conclusions are made to popularise hydrogen use in engines.

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## TWO-STROKE AND FOUR-STROKE ENGINES

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Today, most people do not know what the difference is between two-stroke engines and four-stroke engines, which are often confused, or simply known as the engine itself. In this article the author would like to discuss each individually with which it differs from the other, and where it is used more widely.

A two-stroke, two-cycle, or two-cycle engine is a type of internal combustion engine which completes a power cycle in only one crankshaft revolution and with two strokes, or up and down movements of the piston in comparison to a "four-stroke engine", which uses four strokes. Gasoline (spark ignition) versions are particularly useful in lightweight (portable) applications such as chainsaws and motorcycles. The heat transfer from the engine to the cooling system is less in a two-stroke engine than in a four-stroke. This adds to the overall engine efficiency. Two-stroke engines have higher exhaust emissions than four-stroke engines.

A four-stroke engine (also known as four-cycle) is an internal combustion engine in which the piston completes four separate strokes which comprise a single thermodynamic cycle. While risqué slang among some automotive enthusiasts names these respectively the "squeeze," "bang" and "blow" strokes, they are more commonly termed INTAKE: this stroke of the piston begins at the top dead center. The piston descends from the top of the cylinder to the bottom of the cylinder, increasing the volume of the cylinder. A mixture of fuel and air is forced by atmospheric (or greater) pressure into the cylinder through the intake port. COMPRESSION: with both intake and exhaust valves closed, the piston returns to the top of the cylinder compressing the air or fuel-air mixture into the cylinder head. POWER: this is the start of the second revolution of the cycle. While the piston is close to the top dead centre, the compressed air-fuel mixture in a gasoline engine is ignited by a spark plug in gasoline engines, or which ignites due to the heat generated by compression in a diesel engine. The resulting pressure from the combustion of the compressed fuel-air mixture forces the piston back down toward the bottom dead centre. EXHAUST: during the exhaust stroke, the piston once again returns to the top dead centre while the exhaust valve is open. This action expels the spent fuel-air mixture through the exhaust valve.

So in today's world both engines are popular. Each has its own priorities and different applications. Two-stroke engines are mainly used in chainsaws, motorcycles and other small gasoline engines, while the four-stroke engines are mainly used in cars and tractors and other self-propelled machines.

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## PROBLEMS WITH MITSUBISHI OXYGEN SENSOR

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Problems with the Mitsubishi ASX 2.0 diesel engine are investigated and described. As the author has encountered these problems it was decided to describe them for other people to know, because maybe some of these may turn out to potential owners of this car.

This Mitsubishi ASX model is equipped with a 2.0 turbo diesel engine. The car body design is jeep, which indicates that the car is also provided for driving off-road, but unfortunately it is not, because the oxygen sensor mounted in the exhaust pipe is not protected. As a result, when driving on rough roads it is very easy to cast off the oxygen sensor wires giving effect to the engine. Tearing the wire the oxygen sensor does not work anymore and the engine starts to operate in emergency mode because the engine management system is no longer able to properly calculate the necessary amount of fuel injection. Therefore, the emergency fuel is injected sharply higher than normal, and the engine can no longer burn.

This problem recurred twice for the author. Discussing with others, it turned out that for owners of this car that was not the first time they had faced with this type of problem. On the other hand, this car has twice been withdrawn by the Mitsubishi center to prevent industrial mistakes. After this event, a conclusion can be drawn that a car that looks like a jeep is not always used as an off-road car.

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## **EXTERNAL COMMUNICATION IN THE „EURO BUREAU” OF MINISTRY OF FINANCE OF THE REPUBLIC OF LATVIA**

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External communication (hereafter – EC) is a complex, but a necessary process by which an organization communicates with the public, presents the news, shares information and ideas. The author believes, that External communication is very important in the foundation of the organization and provides its development and sustainability.

Since January 1st, 2014 Euro – the European Union's single currency, is the new currency in Latvia, hence, it is a hot topic in society. The specifics of External communication is determined by the aim of the communication and by the target audience.

“Euro Bureau’s” of the Ministry of Finance of the Republic of Latvia (hereafter – Euro Bureau) EC is complex, because the aim of the communication is to prepare the society about the upcoming changes and reach the target audience which is all regions in Latvia. The topic is timely and important precisely for these reasons.

The aim of the study was to research “Euro Bureau’s” EC with inhabitants of Riga before changeover to the Euro by analyzing theoretical literature and doing practical research. To achieve the goal, the author used quantitative research method – surveys and qualitative research method – the interview. To find out the public awareness about the Euro implementation in Latvia, the survey was made amongst 90 inhabitants of Riga and its district. At the same time as the survey, the interviews were conducted with the “Euro Bureau’s” employees to find out their opinion on public information activities, regarding the Euro implementation in Latvia.

According to the performed theoretical literature study and interview with the department employees – External communication is a direct process in which the communication between the community and the organization occurs. The hardest task for “Euro Bureau’s” EC is to reach the part of society with perception problems and the part which speaks a different language. As proved by the opinion of experts, social media plays an important role in “Euro Bureau’s” External communication with the public.

Through questionnaires among the residents of Riga, the author concluded that the residents of Riga are adequately informed about the Euro implementation in Latvia. As demonstrated in the results of the survey the most popular acquisition channels among inhabitants of Riga are publications – Magazines, Newspapers, TV and News Portals. The residents of Riga are not sufficiently aware of the organizations involved in the public awareness introduction, regarding the implementation of Euro. As demonstrated in the results of the survey, the information on the euro changeover people receive in schools, banks, work place and in public institutions.

After the completion of the practical research, author thinks that the EC is implemented successfully, but the author also highlights three proposals for its improvement. Explain to the society not only the positive aspects of the changeover to the Euro project but also possibly negative aspects in order to reduce the anxiety of people and create awareness of the currency change. Decrease print handouts as much as possible by collecting the same type of information in a single channel to reduce the quantum of the information to the recipient. Create a game for children that allows to get to know the value of the Euro and to create awareness of the new currency.

## STRATEGIC MANAGEMENT ANALYSIS: THE CASE OF PLC " OLAINFARM"

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Nowadays strategic management plays an important role in the company's management. In the competition for the market share and customers, companies should provide a strong competitive position and a solid performance in the long run. In order to provide a solid competitive position and good financial indicators, the company has to set specific goals ranging from operational objectives to strategic objectives which the company must achieve in a longer period of time. These strategic goals can maximize the development. [1].

PLC "Olainfarm" is the second leading Latvian pharmaceutical company with more than 40 years of experience in the manufacture of medication. The company's vision is to become the leading manufacturer of medication and chemical-pharmaceutical products in the Baltic states, whose products are known and available worldwide. In 2013 PLC „Olainfarm purchased the third largest Latvian pharmaceutical company LTD "Silvanols" shares, which allows PLC "Olainfarm" to decide further LTD "Silvanols" development direction, combining both companies experience and export opportunities and developing joint projects. [2].

"Olainfarm" earnings over the last 5 years have increased. In 2012 they amounted to 14.24 million euros. Comparing with the financial year of 2010 the earnings increased by 182%. Accordingly, the company's other financial performances have also increased. This financial increase has allowed to strengthen the position of "Olainfarm" in domestic and overseas market. Return on equity in the financial year 2012 also had maximum growth. In 2012 it was 27.5%, which is about 8.4% higher comparing with 2010.

At the moment „Olainfarm" is concentrating on medicine promotion in foreign markets. The company has to continue to use the strategy of improving competitiveness. PLC „Olainfarm" and LTD „Silvanols" staff have to continue using a cooperative principle which allows to make an effective strategic position in foreign markets and implement strategic management in the long run.

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## **OPEN-AIR CINEMA POSSIBILITY FOR THE TOWN OF SALDUS**

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Initially meant as a social project with the purpose of reviving cinema in Saldus, this project now serves as a characteristic feature of the current situation in the field of cinema in the town of Saldus. The reason why Saldus was chosen is because of the lack of a cinema environment there and Saldus is the native city of the author of this research work and the author is concerned about it. From various opinions of people who work for the town municipality or who are inside the field of cinema, this research work justifies the necessity of an open-air cinema, investigates the current situation and tries to predict the future situation, and also how such a technique could help the community of Saldus.

The tasks of this research work are, first of all, to ascertain the necessity of an open-air cinema [1] in the town of Saldus, second, to clarify the procedure of film licensing in Latvia and third - most important – to clarify the options of open-air cinema acquisition. The methods of research used were - the study of literature, interviews and questionnaires.

At first it may sound impossible for Saldus to ever gain such technical equipment since it could cost much, but that is not true, for example, because one way is through the supplier Open Air Cinema [2] that ships such equipment from the United States to Latvia at an affordable price thus reducing the costs.

The author of this research interviewed the executive director of Saldus, director of the town's Centre of children and youth, founder of the association "Kinopunkts" and even made contact with the National cinema fund. The author also made a questionnaire for the community of Saldus. From the information gathered, the author of this work summarized the opinions of the use of the above mentioned open-air cinema equipment in the town of Saldus [3].

In conclusion the author of this work deduced that the inhabitants of Saldus believe that open-air cinema would contribute to the environment of culture in town. It would be useful for the town's Centre of children and youth to watch showcase films as a perfect visual remedy for various activities. And, of course, it would also contribute to the integration of the community of Saldus and would ensure purposeful use of free time.

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## DESCRIPTION OF EXTERNAL ENVIRONMENT OF FOREST TRAVEL LTD.

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Entrepreneurship is a one of the precondition for the economy. It was founded for the production of goods or services. In order to build a developed economy it is important to start with a creation of favourable business environment model.

The state role in nowadays economy is to provide an environment that would promote new business start-ups, development of existing business and enhance their competitiveness [1].

Existing business environment has to give a chance to every company to develop their economic activity, but not to create barriers that limit these processes. However, when we talk about economic growth in country, we need to think about things that provide it, not only about the result.

Availability of infrastructure, government support and regulatory environment of company has a big impact on doing business [3].

Government's task is to do everything to support every company at least with regulatory environment. It means that tax policy and laws have to be easy to understand and favourable for doing fair business.

In Businessman opinion, business environment is getting even worse, because of still existing barriers, which are related with increasing inflation, tax rates, service costs, informal economy, corruption and high bureaucracy level [2].

All these things have a bad impact for creation and realization of new business ideas, and that is why government has to do serious reforms to improve business environment.

"Forest Travel" Ltd. is a company that is dealing with 3 kinds of different businesses: 1) woodworking, 2) hunting tourism agency and 3) manufacturing of hunting trophy. Company has such a big variety of businesses to avoid risks that are mostly related with finance. The impact of external factors for "Forest Travel" Ltd. are not so positive as well. Company's turnover is about 80 000 euro per year which means that company is small. Although, company's monthly costs consist about 80% – 90% from incomes, because of 2 reasons - expenses for taxes are very high and company is buying a lot of services from other companies. "Forest Travel" Ltd. has competitors only in woodworking field and has free access to costumers in 2 other fields, which decrease its competitiveness. The biggest and in the same time the worst impact for this company has bureaucracy, tax rates and inflation. These factors are limiting company's activities, increasing costs and time they need to spend for doing all kind of reports, that are required by laws of Latvia.

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## **YOUTH MOTIVATION TO READ BOOKS**

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For centuries, a book is one of the best sources of information and its keepers. There have been many different studies demonstrating an important role of reading books: reading makes people smarter and develops analytical thinking, as well as reading helps to achieve emotional maturity and develops our imagination, emotions, logical thinking, passion, patience and tolerance [1].

Discoveries of the 21st century - tablet PCs , laptops, SLR , iPad and iPod - is an integral part of everyday human life. Of course, this technology simplifies life, but also by modern technology the younger generation is losing the opportunity to get a better intellectual memory, use of language, thinking into context, literacy itself because young people do not read books. However, if somebody does not read traditional books, also does not read e –books [2]. It seems that for reading books nowadays young people should have a great need for motivation.

Young people are busy with other activities and one of the reasons why the book is picked up in the hands so rare, is lack of time or interest to read because every answer what they need they can find in the NET. This is demonstrated by the research carried out in December, 2013. The results of the research show that almost half of the respondents (89%) read books, but 75% of them admit that it is better to spend free time in front of the computer or TV. 11% of the respondents do not read books. The majority of the young people say that their motivation to read books is stimulated by a recommendation from friends (34%) or popularity of the book (36%). The study hypothesis that nowadays young people are not motivated to read books because they prefer to spend time in use of modern technologies has been confirmed.

It should be remembered that literature is a rich source of information reality and a powerful tool for personal development, and we just have to hope that the book, which lives for centuries, will not cease to enrich the human moral ideals of creation.

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## ASSESSMENT OF RISK MANAGEMENT IN LTD MADARA COSMETICS

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One of the preconditions for a successful business is the assessment and management of risks, which has a significant impact on the stability, competitiveness and future development of the company [1]. In order to facilitate the profit rise, an essential requirement is the ability to effectively manage the risks [2]. Scientific studies show that the risk can be controlled using a variety of techniques that allow predicting the contingency and taking steps to reduce the level of risk [3]. This is also possible in producing biological cosmetics, so the aim of the research is to assess the risks influencing the activities of Ltd Madara Cosmetics and to determine their management activities. To achieve the aim the descriptive method was employed to explore the essence, significance and types of risks in the business. The company risk identification and evaluation was made by using the SWOT analysis, risk assessment base on points system (measured by the likelihood of the realization of risk and risk exposure time), the risk exposure areas and the risk analysis quantitative matrix. For the in-depth analysis of the financial risks of Ltd Madara Cosmetics, the statistical analysis methods were employed.

In the research 20 risks are identified in total affecting Ltd Madara Cosmetics activities but 13 of them are located at the minimum risk area, it means that these risks cannot produce significant losses to the company. After the risk assessment methods there were identified five risks that significantly can affect the operations of the company and development. Ltd Madara Cosmetics activities significantly can affect the appearance of new competitors and the potential loss of customers, resulting in a lower demand for the products sold. A significant risk is the rise in prices of raw materials and non-partner debt, which could affect the financial situation of the company.

In order to reduce the potential losses linked to emergence of new competitor's risks and the reduction of regular customers, the company needs to work on expansion of the product portfolio and improve the current product offerings to expand its customer base. This risk prevention can cost up to EUR 200 000 created by the fact that the creation of a new product line is a lengthy process and may require new technological equipment. Besides, to attract customers marketing activities are needed and the customer loyalty program should be improved.

To reduce the risk of industry raw materials, the company should efficiently use all available production resources as well as to reduce the cost of production. To minimize the potential difficulties in meeting financial obligations, the managers of the company should consider the loan requirements when searching for the best option. To avoid the partners' debt risk of failure, the company has to reduce the invoice repayment terms as well as to introduce advance payment.

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## **ESSENCE OF INTERNAL CONTROL**

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The Latvian Republic Legislation ensures that the chief executive must ensure the internal control development and implementation, as efficient operation of any business is based on the internal control system of a company, the regular system supports and controls operation [1]. Internal control is a process and company management plan adopted by the organization as well as all the methods and procedures which are established, implemented and maintained by those entrusted with the control of the company, management and other personnel to ensure proper and efficient conduct of the business and of the company goal achievement [2]. This system is the policy of a company, different procedures and tools created to preserve the company assets and ensure the obtained data and information product reliability and safety, to promote operational efficiency, observance of relevant legislation, as well as to protect the company from adverse events, possibility of fraud and crime [1].

The internal control system consists of control environment and procedures. The control environment is the internal control implementation conditions laid down by the management of general awareness, attitudes and behavior in relation to control. It is composed of various elements associated with the management policies of the company and management awareness of the processes going on as well as a reasonable organization structure based of the company size and the type of operation [2]. The control procedures are specific activities which facilitate control policy implementation, and it is important to carry out these procedures by all levels of employees. The most important internal control procedures are control using the assets of the company, special control principles, process-mounted controls and performance monitoring [3].

With the introduction of specific control principles, the company introduces the distribution of responsibilities reducing the unprofessional actions, waste or unauthorized operational risk and the possibility of errors, in order not to adversely affect the property of the company. Using the resources of the company it is possible to ensure a high level of staff competence as employees who are familiar with the strategy of the company, its organizational structure, document circulation scheme and other key organization documents, are able in a much shorter time and with better quality to carry out their tasks. With the introduction of the process control incorporated, the company defines the responsible person who performs quality control and reliability, ensures rational use of resources, reveals defective products, provides quality for buyers, accurately accounts materials and prevents shortages or surpluses.

Consequently, implementing and enforcing the internal control system elements and procedures, the company will ensure the preservation of its property, financial records for accuracy and reliability, operating compliance with formal legal norms, as well as it will facilitate the tracking of the company business strategy which is the right direction towards success and development of the company.

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## AQUAPLANING ON THE ROAD

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Aquaplaning is a dangerous phenomenon that arises on wet surfaces, like sliding on ice. Worn tires with insufficient water pressure lose traction while driving only 50 km / h, properly inflated tires are stable up to 70 km / h, and a new tire keeps the grip up to 100 km / h. The tire front part is full of water and lifts the tire pressure. Water pressure is proportional to the density of water and twice the speed. The speed at which the tire completely tears off from the road is called the critical aquaplaning speed [2].

Under these conditions, the car starts to slide, the exposed inertia brake does not work anymore and the car gets out of control. Occurrence of aquaplaning is due to three main factors: tire condition, tread depth, including the pressure therein, driving speed and surface wetness. One of the signs of aquaplaning is too loosely controlled by the steering wheel and rear-end slide across. If braking is unavoidable, and the car does not have the ABS system, breakage should be a gentle, pulsating motion by pressing the pedal. In 2013 ample rainfall weekdays road accidents increased by 9 percent compared with January of the same year holidays. In the rain, even in low rain last weekend the average accident rate grew to 35 percent and may range on weekdays by 2-7 percent compared with the same year respective dry days [3].

The following conclusions can be made: it is necessary to keep track of the technical condition of the car - to periodically check the vehicle chassis components, steering; use the manufacturer's set sizes of tires and wheels, wide tires increase the possibility of aquaplaning; adjust the wheel geometry once a year; once felt that the car begins to "float", do not make any sudden action - do not brake hard, do not press the accelerator pedal, do not turn the steering wheel.

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# APPLICATION OF INTERMODAL TECHNOLOGIES IN SUSTAINABLE DEVELOPMENT OF TRANSPORT POLICY

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The focus on transport promotion striving to the principle of sustainable development in the documents of European Union (EU) is revealed in the article. The importance and priorities of international carriage are presented and Lithuanian examples of intermodal technologies application are analysed.

The transport sector is one of the most important spheres of the EU policy, efficient functioning of which influences the vitality and compatibility of economics of the whole EU as well as Lithuania. Rapidly developing transport system confronts such transport problems as traffic jams on the main roads, harmful impact on environment, increase of the number of accidents, excessive use of transport means, etc. A new communication from the European Commission “A Sustainable Future for Transport” of 2009 and the “Greening Transport Package” of 2008 promote creation of integrated technological progressive and user friendly transport system emphasising the necessity of fostering the efficiency of separate transport kinds and their interaction [1]. The European Conference of Ministers of Transport (ECMT) describes intermodal transport as “organisation of intermodal door-to-door transport by transferring goods from one mode of transport to another without changing the loading unit” [2]. Having analysed Lithuanian governmental strategic documents, it can be stated that while arranging intermodal carriages and striving to reduce negative transport phenomena, special attention is focused on the development of the railway system. The following projects have been implemented with a huge potential: container train “Vikingas” will soon carry cargo not only from Ukraine but also Turkey (in 2009 European Intermodal Transport Association (EIA) awarded the project with the “Best practice intermodal project” [3]; container train “Nemunas”, the platform of which can carry trucks and trailers, commute between Lithuania and Belarus. That is a unique decision of logistics in the Middle and East Europe [4]; container train “Saulė”, connecting West Europe with China via Kazakhstan and Lithuania, has also got a great potential. Having analysed the distribution of the amounts of cargo carriage according to transport kinds, consecutive increase of application of technologies has been revealed.

Application of intermodal technologies in cargo carriage will further have huge potential, but big investments are needed striving to adapt the transport infrastructure.

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## **RENEWABLE RESOURCES BOOM**

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The European Union has raised a goal: in 2020 the energy received from renewable sources will have to make up one fifth of all energy consumption in Europe. In the last decade, due to promotion in the EU level, the capacities of renewable sources have significantly increased, which by far surpass these of conventional power stations. The cost of solar battery panels has reduced by a half in the recent five years. In 2009 the turnover of the sector of renewable sources made up 70 bn Euros, and over half a million of people were employed there. The sector will be rapidly increasing in the future as renewable sources occupy an important place in the EU long-term strategy due to small quantities of fumes that increase the global greenhouse effect, and reduction of dependence on energy import. The development of this sector of economics confirms that Europe is capable of creating new energy technologies which provide conditions to create the so-called environmentally friendly job vacancies and receive big added value from export [1]. The possibilities to use local sources for energy needs in Lithuania – Lithuanian oil, peat and chemical process energy – are very limited; therefore, wider use of renewable energy sources is of great importance [2].

The part of renewable energy sources increased from 15% to 19,7% in 2005 – 2010, which shows that Lithuania fulfilled its national action plan of renewable energy sources that foresaw reaching 16,6%. The biggest part of renewable sources in 2010 was taken up by Sweden (49.1 per cent of the used energy was received from environmentally friendly sources), while the smallest part was registered in Malta (0.4 per cent). The Vice-Minister of Energy has admitted that it will be difficult for Lithuania to achieve production of 23 per cent of energy from renewable sources as achievement of these goals will require large financial funds [3].

The following conclusions can be made:

1. Promotion of energy production of renewable sources helps creation of job vacancies in the country and development of a corresponding industrial sector.
2. Energy production of renewable sources does not create ecological problems typical of other kinds of fuel, and develops independence of countries from their energy import.
3. Lithuania is implementing a national action plan of renewable energy sources and has Publication already implemented the goal of the 1<sup>st</sup> stage.

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## ANALYSIS OF ORGANIC DAIRY FARM IN TELŠIAI DISTRICT

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In the Europe the ecological or organic farming comming more popular. After Lithuania joined in the European Union in our country agriculture came organic farming fashion and altogether in the dairy farming too. Lithuania dairy farm - one of the most important branches of agriculture. In 2011, milk production accounted for about one-fifth of the total agricultural production [1]

Modern organic farms compared with industrial farms are faced with a much bigger problem. Organic dairy farms requires a much higher cost and effort compared to ordinary dairy farms, but they are in comparison to the last is much more promising, milk is higher quality, uncontaminated by chemicals [2,3] Therefore, more and more dairy farmers switching to organic farming.

In 2013 in the Telšiai distr. was 119 certified organic farms, of which 61 are in the dairy farm. From all organic dairy farms the 90% are of family farms.

The main task of this work was investigate cows herd, quality of milk production, feed and nutrition, environmental conditions and healthy in one Telšiai distr. organic dairy farm.

In the investigate organic farm are considered 63 Lithuanian Black and White cows from them 39 is milking. This farm was establish in the 2007. The milk indicators are controlled every month. The milk fat content is 4,41 and proteins - 3,17. The fed are used only own produced and major part of the feed are hay and silage. For cows healthy big part influencing the feed, conditions and keeping. The main problems of this farm are infections deseases mastitis. For these diseases prophylaxis are strictly comply the requirements of feeding, keeping and environmental conditions.

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## **GRADUATE LEVEL ABSTRACTS**

# INCLUSION OF FLOOD-LAND MEADOWS INTO CLASSIFICATION OF TYPES OF LAND USE

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Meadow is an ecosystem consisting of perennial plant community. Generally meadows are formed as a result of long-term grazing and mowing. Latvia is located in the zone of forests. This means that no meadow can persist without specific maintaining - grazing or mowing. If meadows are not grazed or mowed, they gradually become overgrown with trees or bushes [1].

Nowadays in Latvia many meadows are overgrown and nature returns to its original condition – the forest. Man-made landscape for thousands of years has been extremely transformed in the last century. Many species of meadows flora and fauna have become rare and may of them disappear. Protection of meadows is one of the most complicated problems in the world, because meadows habitat is imperilled by two completely contrary processes - intensive agriculture and interruption of farming, leading to collapse of environmental values.

In Latvia there are decreased areas both of dry and wet meadows. The area of flood-land meadows has decreased due to efforts of people to dry any wet place on their land. Even lakes have been emptied and drainage of meadows is carried out very often. The number of birds living on flood-land meadows has decreased throughout Europe. One of the main reasons is disappearance of suitable nest sites due to drainage, flooding or overgrowing of flood-land meadows. Flood-land meadows as habitats have to be protected throughout Europe.

Classification of the land into types of land use has historically developed and improved with the development of land management. Over time, according to land use development, classification of the land into types of land use has been perfected. Generally with the term “type of land use” a particular territory is meant, which differs from others with its natural conditions, as well for a long time use for certain purposes. Information on the types of land use is required in all public formations for performing governmental functions, as well as for other purposes. Involving land into land management process, the location and role of each land plot must be determined. The types of land use and their composition are significant factors, affecting the use of land, land property value, amount of real property tax, etc. [2, 3].

In Latvia agreed principles are established on classification of types of land use, which are binding for all public authorities and local municipalities, for landowners and other persons. The classification of types of land use is defined by the Cabinet of Ministers. Determination of types of land use has to be done in the field taking into account stated criteria. Land is classified into categories of land use and types of land use [4].

This classification does not provide for such individual type of land use as flood-land meadows therefore due to improper handling of these territories species and habitats of flood-land meadows are endangered. Determination of flood-land meadows as individual type of land use and specific recognition criteria will promote preservation and proper management of nature.

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## HISTORICAL RUINS IN LATVIAN LANDSCAPE

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The ruins are a traditional element of the Latvian landscape. In towns and villages fragments of the historical buildings are often preserved that currently have not been used and their fate is uncertain. Such historical ruins are an important element of the landscape, which can be transformed in an attractive and cognition contributing public domain. The research focuses on the historical stone building ruins, which have not been granted a protection status, but, nevertheless, they have been important for the development of specific localities.

Historical building ruins have both age value and historical value, based on the historical events related to a particular building, its surroundings and inhabitants. Heritage value is largely determined by our own knowledge and understanding [2,5,6].

The fragments of historical buildings protected from decay are elements that build up the identity of a place. Often the ruins of the buildings are not only the witnesses of the settlements origins, but in the past with ongoing activities in these buildings have promoted or changed the historical development of location.

Historical ruins of the building together with the surrounding landscape are an attractive environmental object and can contribute to the identification of the place. Such areas have the potential to develop for public recreation and heritage value places at both the local and regional levels [1,3,4].

With the growing population, continuing urbanization and migration it is more important to provide easily accessible recreational areas. With the increase in people's interest and opportunities to travel, popular tourist destinations in the season are overcrowded with visitors. To some extent it interferes with the necessity to rest from the bustle of the city, so there is a need to search for other scantily visited alternative outdoor recreational areas. Comfortable, easily accessible recreational areas with interesting sights can attract tourists and contribute to the identification of the settlement and strengthen local people's awareness and feeling of belonging to their place of residence.

Without human intervention, as a result of adverse weather conditions and the reckless activity, the ruins continue to decline. Unaware of the ruins' cultural and historical significance and scenic value, they can be demolished. Delaying the evaluation of the ruins, with their maintenance-related decision-making and realization of appropriate measures, the unique heritage features can be irreversibly lost.

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## EUROPEAN VERTICAL REFERENCE SYSTEM IN THE BALTIC COUNTRIES

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Baltic Normal Height System 1977 is used for the height determination in all three Baltic countries – Latvia, Estonia and Lithuania. During I class levelling 2000 – 2010 in Latvia there were 3 border connection points made with I class levelling network of Lithuania and 4 connection points with I class levelling network of Estonia.

But Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) defines the use of European Vertical Reference System as national height system in all European Union member states [1].

For transformation to European Vertical Reference System Federal Agency for Cartography and Geodesy in Germany has made a transformation formula for each European country. The transformation formula has a reference point of transformation  $P_0$ , which is different in each country. Latitude of the reference point for the transformation formula for Latvia is  $56^{\circ}58' N$  and longitude –  $24^{\circ}53' E$  [2]. The reference point is located in Mālpils municipality.

The calculation results of transformation show the height difference between Baltic Normal Height System 1977 and European Vertical Reference System [3]. The difference is not equal but depends on the point location in the country and distance to a reference point of transformation  $P_0$ . In Latvia the difference between both height systems will be 137 mm in the Latvian south-eastern part and will increase to 169 mm in the Latvian north-western part. This could make additional error for height determination between points. In Lithuania the difference between height systems will be 80 mm in the southern part till 150 mm in the northern part of the country. In Estonia 185 mm in the south-eastern part till 207 mm in the north-western part of the country. The European Vertical Reference System will cause unequal height values on border connection points – on the state border the height difference of same point in Latvian and Estonian or Latvian and Lithuanian height system will be up to 33 mm.

There are also different opinions between Baltic States about the adoption of European Vertical Reference System – in Latvia the new height system will be adopted on August 1<sup>st</sup> 2014, but Estonia and Lithuania still have no terms for adoption of the European Vertical Reference System.

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# CHANGES OF LAKE HYDROLOGICAL CYCLE: CASE STUDY OF LAKE USMA IN LATVIA

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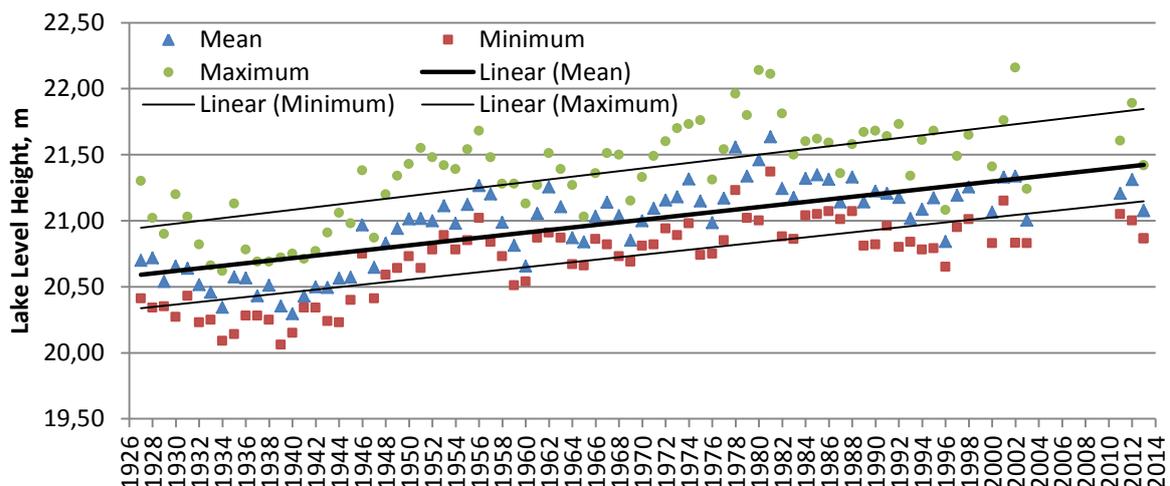
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The monitoring of the river and lake hydrological regime has been made during the past hundred years [1]. There is strong evidence that long term changes of the lake hydrological regime is caused not only by the climate change but also by anthropogenic factors. Lake Usma is unique with hundred years old natural reserve and Natura2000 territories in one part of the lake and developing tourism industry in the other part of the lake. During the last ninety years the water level of Lake Usma increased for approximately one meter (Fig.1.), which caused coast erosion, changed the soil ground water level in large territories around it and it is regarded to be an important factor for the lake ecosystem functioning [2]. To find a sustainable management solution of Lake Usma there is a need to understand the causes of the hydrological cycle changes.

In this research work the Lake Usma water level cycle changes are analysed since 1926 in annually, monthly, daily and hourly scales, to find the natural and anthropogenic factors impacting the Lake Usma hydrological cycle [3]. The result shows significant impact of natural and anthropogenic factors. The significant climate impact on the Lake Usma water level started since late 80ties. However, during the last sixty years there are significant anthropogenic impacts in case of land reclamation measures in the Lake Usma basin and hydro technical buildings downstream of Usma Lake.



**Fig.1.** Lake Usma minimum, mean and maximum level height 1926-2003; 2012-2013.

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# INCLUSION OF ENCUMBERED TERRITORIES INTO INFORMATION SYSTEM OF ENCUMBERED TERRITORIES (ISET)

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One of the responsibilities of the State Land Service is to keep information about encumbered territories and objects. Institution supervises the Information System of Encumbered Territories (hereafter – ISET), information system is still under development. The author has dealt with the analysis of the laws and regulations about operation of ISET and determination, accumulation and operation with data.

Currently in the spatial data of National Real Estate Cadastre Information System are depicted only road easements –its geometric borders and identifiers [1].

ISET will ensure intersection of actual data of encumbered territories and objects and cadastre map. Information system automatically draws a border of the protected zone and automatically redraws the border of the protected zone following the changes in regulatory enactments.

Since the year 2000 the lack of information about encumbrances in land parcels has become topical. In the year 1997 the Protection Zone Law was adopted, but despite the fact, the normative base of Real estate encumbrances was very controversial [2].

The state and local governments poorly administered the processes of encumbrances and did not contribute to the collection of information about the existing encumbrances.

The data in the ISET are obtainable from data providers. The data providers are the owners of the object or institution, which is responsible for data preparation, encumbered territory creation and its boundary allocation [3].

The data must be obtained from approximately 400 data providers. The main data providers are local governments, companies "Latvenergo", JSC "Latvijas Gāze", "Lattelecom", authority "StateForestService", etc.

Currently the data providers have a lot of manual data on old maps and plans. No electronic information about the real situation is available. There are problems with area determination because legislation has many shortcomings. ISET will provide society with actual data. The data from ISET will be easily available by webservices, replication of database, online data transmission mode, using web browser and in paper form. A positive aspect is automatic registration of encumbrances of Real property in Cadastre text data. ISET is implemented within the project "Development and implementation of State Land Service geospatial data geographic information system" co-financed by European Reconstruction and Development Fund.

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# BRITISH RESEARCH ESTABLISHMENT ENVIRONMENTAL ASSESSMENT METHOD PRACTICE IN LATVIA

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BREEAM (British research establishment environmental assessment) is one of the most popular worlds' rating systems for buildings, very good known in Europe countries. The building quality is rising and consumers want to buy top quality products with affirmative documents.

For nowadays more than 250000 houses have a BREEAM certificate. The certificating system is not easy and quick. To get the BREEAM certificate a lot of requirements already in the designing period, and later in construction need to be accomplished. BREEAM rating system includes rating of energy usage, health and wellbeing, construction material usage, pollution, land usage and ecology, transport availability, water usage, amount of waste, house usage management. This building rating system is used by funders, developers, property agents, design teams, managers.

THE BREEAM quality criteria are available in Latvia. They are modified according to the legislation of Latvia. The BREEAM criteria are made for commercial buildings to ideate sustainable building designing, construction and exploitation.

For certificated experts BREEAM has made an assessor manual, which provides fair, transparent rating criteria for buildings. The main aims of experts are to mitigate the impacts of buildings on the environment, enable buildings to be recognised according to their environmental benefits, provide a credible, environmental label for buildings, and stimulate the demand for sustainable buildings.

The aim of the research is to find out BREEAM system usage and popularity in Latvia. The results should give a reason why this system is usable or unusable for Latvia, what needs to be done for rising usability in our country and if it is worth to popularize it.

To do the research it is necessary to study the theoretical basis of the BREEAM criteria for evaluation, to understand the structure of the evaluation system and how it is adapted for Latvia. The main part of understanding the criteria is to do practical research with a certificated expert.

The building rate system is a complicated process, where different field professionals are searching for the best solution, which reduces construction and exploitation damage to nature, improves human living environment.

The first investment for designing and construction is higher than usually, but in long term it pays off.

Evaluation is usable for understanding the quality of the product, also for the production process. Nowadays, people want to spend money for quality things that are made ecologically, with less pollution for nature and environment we live. The evaluation system is a good mechanism to make similar criteria for different types of buildings, so people can understand which construction product is with higher quality and why it is so.

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## **FREEZING INDEX IN CONDITIONS OF LATVIA**

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The foundation is one of the main components of the building. When projecting the foundation it is necessary to consider the features of the soil, climatic conditions, mission of construction and, certainly, design of the building. Correctly designed foundation is a key to long service life of a structure.

The relevance of the current study is caused by decrease in expenses of building materials and mechanisms as well as decrease in terms of construction as these are the main factors influencing the building industry nowadays.

The purpose of the research is to develop the technical solutions of the warmed and not warmed foundations in the conditions of Latvia, which could prevent the risk of freezing of the foundations. Aspects need to be taken into account for effective design decision and the economic effect is considered. The tasks of the research are:

1. To calculate the freezing index in the conditions of Latvia, to define the influencing factors on the building foundation;
2. To calculate and develop a technical solution of not a warmed foundation in the conditions of Latvia according to LBN 207-01;
3. To calculate and develop a technical solution of a warmed foundation in the conditions of Latvia according to LVS EN ISO 13793:2003;
4. To determine the economic effect for a construction of the foundation and to make recommendations of a solution of a warmed foundation.

The methodology of the study:

- Meteorological data from the Internet are processed and used for the freezing index calculation [1].
- Use of the Latvian construction standard LBN 207-01 “Geotechnics. Building foundations and base” to calculate a not warmed foundation. The method in this standard shows how to design a foundation without special procedures – the foundation depth should extend below the depth of frost penetration in frost-susceptible soil [2].
- Use of the Latvian Standard LVS EN ISO 13793:2003 “Thermal performance of buildings - Thermal design of foundations to avoid frost heave” to calculate a warmed foundation. The method in LVS EN ISO 13793:2003 describes how to find the necessary thickness, depth, heat conduction and constructive placement of thermal insulation [3].

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# INVESTIGATION OF AZOTOBACTER CHROOCOCCUM CONCENTRATION BY USE OF POLYCOMPLEXES OF WATER-SOLUBLE POLYMERS WITH SURFACTANTS

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Nowadays one of the most topical biotechnology applications in agricultural fields is the production of various types of bacterial fertilizers, because the micro flora of soil has an influence on harvesting. Microorganisms, used for production of bacterial preparations, promote the provision of plants not only by elements of mineral feeding, but also by physiologically-active substances [1].

The scheme of bacterial fertilizer production includes methods of biomass concentration from cultural liquid. For this purpose various surfactants are widely used, possessing flocculant properties. In this work processes of microorganism biomass concentration by the use of flocculants based on water-soluble polymers have been investigated.

Nowadays studies in the colloid-chemical properties of polyelectrolytic water-soluble polymers discover new possibilities for the increase of their application-oriented meaning, and for substantiation of their use. Earlier it was established that the surface activity of complexes of water-soluble polymers with surfactants is increased, and standard free energy of polymer adsorption is reduced. Colloid-chemical properties of hydrolyzed polyacrylonitrile compositions with surfactants allow to predict their use for the obtaining of bacterial preparations, because compositions reveal larger activity on the interfaces [2].

We have researched the possibility to use compositions of hydrolyzed polyacrylonitrile with surfactant as a flocculant for biomass concentration. For this purpose a pure culture of microorganisms was obtained. To obtain a pure culture *Azotobacter* we should select a wild strain from the soil. The appearance of slime on the surface of the soil indicates the development of *Azotobacter* bacteria. On solid medium of Ashbyput on 0.1g isolated slime layer from the soil surface via microbial loop. We carry out a morphological analysis of the culture using a microscope. Bacteria of the genus *Azotobacter* cells are relatively large (1-2mm in diameter), and actually have an oval shape, but can take various forms - from spherical to rod-like. On microscopic preparations cells can be placed singularly, in pairs, irregular clusters, and young forms have flagella and are able to move slowly. For the obtained rybiological preparation we carried out reseeded in the liquid Fedorov's medium for biomass accumulation. The culture forms round colonies with a diameter of 4 mm, convex, with smooth edges, a cream-colored slime consistency.

After cultivation of *Azotobacterchroococcum* microorganisms we added solutions of water-soluble polymers with surfactants. After centrifuging the culture, liquid separated from the microorganisms. The resulting mass dried in the oven.

The findings allow the authors to conclude that by the addition of Hydrolyzed Polyacrylonitrile with surfactant leads to an aggregation of biomass.

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## QUANTITATIVE EVALUATION OF TEAR SECRETION IN PIGS

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The purpose of the study is to set the pigs quantitative lacrimal gland secretion rates and assess the factors which influence them. The study was carried out in 2012-2013 LUHS KK (Kaunas clinics) Cardiology Center, during various types of operations, cohort of 20 clinically healthy subjects of various age (4-12 months) Lithuanian White pigs. All pigs were divided into groups A and B (10 pigs in each group: 5 gilts and 5 castrates). Before induction of general anaesthesia, each pig was immobilized and tear volume measurement with the Schirmer test was performed in each eye. After measurement of the animal tear secretion capacity they were differentiated by age, gender, left/right eye. In Group A of pigs after thiopental induction of anaesthesia, the pig was intubated and anaesthesia was maintained with isoflurane. Group B pigs were inducted with midazolam, and anaesthesia maintained with isoflurane. To measure the lacrimal secretion capacity the Schirmer test was performed before anaesthesia and 30 minutes from the start of narcosis in both groups. For statistical analysis Microsoft Office Excel 2003 program was used.

Analysing the influence of the gender on the animal lacrimal secretion rate the following data were obtained: male pigs (n=10)  $17.17 \pm 0.8$  mm/min. (range: 10-22 mm/min) and females (n=10)  $14.73 \pm 0.86$  mm/min (range: 9-28 mm/min). We investigated and found the influence of animal age on tear quantity. The following data were obtained: 4-8 months old pigs (n=10)  $16.56 \pm 1.00$  mm/min. (range: 10-20 mm/min), 9-12 months (n=10)  $15.33 \pm 0.79$  mm/min (range: 9-22 mm/min). We analyzed and compared the eye lacrimal secretion level in 20 clinically healthy pigs before and 30 minutes into the narcosis. Such Schirmer test results were found: before anaesthesia -  $15.83 \pm 0.62$  mm/min. (range: 9-22 mm/min) after 30 min. from anaesthesia induction  $12.83 \pm 0.66$  mm/min. (range: 6-19 mm/min). We did not detect significant difference in pig eyes tear secretion between the right and left eyes ( $p \geq 0.05$ ) and between gilts and castrates in all eyes. By analyzing the different agents used for anaesthesia to cause the influence upon tear secretion, the following results were obtained: using thiopental - isoflurane pigs (n=10) in the eyes the Schirmer test readings after 30 min. from the beginning of anaesthesia were  $13.50 \pm 0.86$  mm/min. (range: 6-19 mm/min) using midazolam - isoflurane (n=10) the Schirmer test readings after 30 min. from the beginning of anaesthesia were  $12.15 \pm 1.01$  mm/min. (range: 9-19 mm/min).

It was found that in 4-8 months old pigs tear secretion was in average  $1.23 \pm 0.21$  mm/min. stronger than in older ones. It was found that in male pigs eye tear glands produce more tears than in females:  $2.44 \pm 0.06$  mm/min.

It was found that after 30 min. from the beginning of anaesthesia in pigs tear secretion significantly reduced, averaging  $3.00 \pm 0.04$  mm/min. We also found that thiopental - isoflurane combo significantly decreases tear secretion (by an average of  $3.35 \pm 0.06$  mm/min.) and midazolam - isoflurane (average  $2.65 \pm 0.05$  mm/min.).

The following conclusions can be drawn: the tear secretion rates and eye moisture varies depending on the animal's age: younger pig tear glands produce more tears than older. Eye tear glands in pig males produce more tears than in females. Narcosis decreases the amount of tears. Thiopental - isoflurane combo inhibits the secretion of tears more than midazolam - isoflurane. Suggestion: when pig surgery is done under general anaesthesia it is necessary to protect the cornea from drying out.

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# ANTICOAGULANT EFFECTS ON FISH BLOOD PARAMETERS

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Hematology can be a useful tool for welfare and health status of fish monitoring, detecting the potential illness and following the progress of disease. Physical and chemical components of fish blood are very sensitive to environmental changes, pathogens and diseases [3,6]. Information on the hematological characteristics is an important indicator that can be used in monitoring physiological and pathological changes in fish health.

Michael K. Stoskopf writes that heparin used in appropriate concentrations has the least effect on blood pH, divalent cation concentration and hematocrit. EDTA (ethylenediamine tetra acetic acid) acidifies blood, whereas oxalate and citrate raise blood pH to a smaller extent. Heparin can also cause erythrocyte clumping, and it can be variable from vial to vial [6].

In Terry C. Hrubec et al. study about tilapia (*Oreochromis* hybrids) hematology and plasma chemistry blood tubes containing EDTA were used for hematological analysis [4]. EDTA is not a suitable sample tube for blood chemical analysis, because it will interfere with chemical tests [1]. Also in the study it is mentioned that clotted or insufficient volume samples were discarded [4], but possible reasons for the damage of the samples were not mentioned.

In the study K. Darvish Bastami et al. about hematological characteristics of the wild carp (*Cyprinus carpio*) heparine was used as stabilizer and anticoagulant [2]. In other studies for mammals heparine is used for chemical analysis. This suggests that general accepted principles for mammals do not work in fish medicine. Heparin as an anticoagulant was used also in M. Rabhar et al. study about hematological parameters of perch (*Perca fluviatilis*) [5].

The aim of the research is to estimate the influence of hematological anticoagulants in various fish species and to find anticoagulants that can be used for many fish species and would less change the samples. The analysed literature has shown that the same blood sampling technique is often used in many studies, but the stabilizers in blood tubes differ. But the studies do not mention in how many cases blood gets damaged during the sample collection, that is why in this work the attention was paid especially to the materials and methods during the sample collection. More studies have been done with wild carps, perch, but less with fish species that are common in Latvia, for example, pike and tench. Therefore, there is no information available about the best anticoagulants used for blood sampling for the mentioned fish species.

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## NUTRITION VALUE OF HEMP SEEDS

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Hemp seeds (*Cannabis Sativa L.*) are one of the less used edible seeds in human diet, but they are rich in protein, oil, minerals and other significant nutrients that are vital for the human body.

Nutritional value of hemp seeds depends on the chemical composition, which significantly affects the peculiarities of the variety, soil, fertilizer, weather conditions, geographical location and other factors. The hemp seed variety "Finola" is suitable for Latvian conditions.

That is one of the most popular varieties of non-drug hemp, which is the shortest plant, and earliest to bloom of any variety of hemp, and that produces abundant grain at high latitude (50-60 N), and is not a product of genetic manipulation [1].

According to the literature hemp seed is an excellent source of nutrition, what was also confirmed by this study. Hemp seeds from the "Finola" variety, grown in Latvia, with the moisture content 6.4%, has a high content of proteins (25.23%) and oil (32.20%), most of which are unsaturated fatty acids.

Hemp seeds contain omega 3 and omega 6 fatty acids in optimal ratio that is 3:1 and without traditional omega 3 and omega 6 seeds also they contain omega 9 that is not in traditional fish oil [1]. Hemp protein contains all of the essential amino acids in more nutritionally significant amounts and at a ratio closer to "complete" sources of protein (like meat, milk and eggs) than all other oil seeds except soy [2].

Hemp seeds contain minerals calcium (Ca) 140 mg 100g<sup>-1</sup>, phosphorous (P) 1040 mg 100g<sup>-1</sup>, sodium (Na) 10 mg 100g<sup>-1</sup>, magnesium (Mg) 410 mg 100g<sup>-1</sup>, zinc (Zn) 6.5 mg 100g<sup>-1</sup>, manganese (Mn) 8,18 mg 100g<sup>-1</sup>, iron (Fe) 15.21 mg 100g<sup>-1</sup>. It should be noted that hemp seeds have high content of iron because with 100 grams of hemp seeds it is possible to get the recommended daily intake of iron for adults. This is important because iron is an important element in our body, participates in the synthesis of hemoglobin, oxygen transportation to the tissues [3].

Hemp seeds are a product with high biological value, which contains all the nutrients that the body needs, so research should be carried out on seed application possibilities in creating new products, focusing on products intended for vegans who have deficiency of variety of nutrients.

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# POSSIBILITIES OF ADDING IRON IN PRODUCTS OF SUGAR CONFECTIONARY

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More often people feel tiredness, weakness and inability to concentrate. One of the reasons is the rapid pace of life. More rarely we have time to pay attention to the food we eat and the reason of feeling weak and tired could be iron deficiency in our nutrition. According to the World Health Organization, 30% of the world's population have anemia – most of all iron deficiency anemia and also 15% of Latvian population have iron deficiency anemia [1].

Iron is an important dietary mineral that is involved in various biochemical processes, including electron transfer reactions, gene regulation, regulation of cell growth and differentiation, but one of the most important tasks is to bind and transport oxygen [2].

Enriching iron to the food, including sugar confectionery, is one of the ways to increase their value. To expand our assortment of pastries, many manufacturers in Europe have started to use healthier ingredients already in now available products in the market, which is achieved by selecting an alternative to artificial colorings, as well as including components in higher nutritional value in the manufactured products [3].

Latvia is not currently producing sugar confectionery enriched with iron to the base on toffee. Sugar confectionery available in the Latvian market is mainly produced in Belarus and Lithuania, and they are enriched with animal origin - heme iron, so vegetarians can not include these products in their diet, but developing products enriched with plant – non heme iron, they could be used also by vegetarians.

The aim of this work was to develop sugar confectionery with high iron content. Experiments have been carried out at the Latvia University of Agriculture, Department of Food Technology. This experiment was conducted in cooperation with the Latvian candy manufacturing company "Skriveru saldumi". For the developed products as a non heme iron source Goji berries or Tibetan barberry, pumpkin seeds, sesame seeds, CIA seed, nettle, mint and strawberries were used, as a source of heme iron - food black albumin. In order to ensure better iron absorption in the developed sugar confectionery raw materials rich in plant-based vitamin C were added, for example, sea buckthorn, as well as pharmacologically designed ascorbic acid.

In the developed products the amount of iron and Vitamin C was determined, as well as pH, hardness, color, and microbiological analysis of the samples was done.

Experimentally it was found that the addition of different types of raw materials rich in iron gives a possibility to develop iron-rich sweets determining the most appropriate raw materials and quantities to ensure optimum amount of iron in the product.

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# GREY ALDER *ALNUS INCANA* L. (MOENCH.) STANDS BIOMASS QUANTITY IN KLĪVES PERAMBULATION

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Questions about renewable resource (including wood) usage in power sector turn more topical in the world and also in Latvia. Grey alder area and growing stock in Latvia extended due to increasing of abandoned agricultural land (Miezīte, 2008). According to the State Forest service data (VMD, 2012) in Latvia there are 202.5 thousand ha of grey alder stands, 63 percent from total are overgrown and at this moment it compiles growing stock approximately 22.7 mil m<sup>3</sup>. These stands can be used as biomass sources.

Grey alder silvicultural, ecological and mechanical characteristics are substantiating its usage as a biomass resource. Grey alder quick growing demonstrates enormous wood growth in the first 15 years.

Grey alder also does not have many diseases and pests which are very relevant factors for tree growth (Lange, Mauriņš, Zvirgzds, 1978). Also there is no need for extra fertilization unlike other energetic cultivated plants.

Cogeneration stations at smaller cities and countryside have been built because of the short distance to wood resources. Previously in Latvia and other countries (Muukkonen, Mäkipää, 2006) several researches have been made in the methods of estimation of grey alder above-ground biomass that helps calculate it. Miezīte O., and Dreimanis A. (2009) developed equations for grey alder biomass estimation for trees up to 3.0 cm and trees from 3.1 to 26.0 cm diameter in naturally moist and absolutely dry conditions for independent variable using the breast height diameter and stand basal area.

In Latvian State forest Klīves perambulation area there are 21 stands with average age 32 years. Klīves perambulation stands approximate above-ground tree biomass is 3056.20 m<sup>3</sup> of which stem biomass is 2482.85 m<sup>3</sup>, branches 434.53 m<sup>3</sup>, leaves 138.82 m<sup>3</sup> (Miezīte, *et al.*, 2011).

Grey alder is one of faster growing and profitable fuel wood and biomass obtaining species in Latvia considering various factors and facts, that is why more detailed research for establishing precise existent and available grey alder wood quantity at this moment is needed.

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# ASSESSMENT OF DECIDUOUS WOODLAND KEY HABITATS IN “VILKU DĀRZS” IN ELEJA”

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Due to anthropogenic action and forest fragmentation the biological diversity in Latvia is decreasing, continuous intensive management of forests does not stimulate the preservation of species characteristic to habitats. Today those broad-leaved habitats which had perished due to intensive farming and forestry now have recovered with deciduous pioneer tree species, for example, with aspen, birch, black alder and grey alder (Ek et al., 2002).

Woodland key habitats (WKH) and potential woodland key habitats (PWKH) are essential for the preservation of the biological diversity in forests and for the sustainable existence of specific habitat species and indicator-species. Those are voluntarily protected areas in state owned forests. The maintaining of woodland key habitats is included in the basic guidelines and criteria of forest management which must be followed in order to certify the forests and to obtain the FSC (Forest Stewardship Council) certificate - an international certificate of sustainable forest management which ensures environmentally-friendly, socially responsible and economically profitable forest management all at once. For all state-owned forests the FSC standard of Latvia is obligatory, which includes the protection and stocktaking of woodland key habitats (Timonen et al., 2010). The main task of the research is to assess the vegetation of deciduous woodland key habitats. Four sampling plots with an area of 0.1 ha (20 x 50 m) were established in Eleja (in „Vilku dārzs”). The accounting of growing and decaying or windfallen trees, snags and downed logs (coarse woody debris), the measurement of diameter, height and/or length for growing and decaying trees was done in every sampling plot. The degree of decomposition of dead wood was established. The Braun-Blanquet method was used for the assessment of vegetation.

In the deciduous woodland key habitats the average volume of growing trees is 310.4 m<sup>3</sup> ha<sup>-1</sup> (80% of the total wood volume), but the average of dead wood constitutes 78.7 m<sup>3</sup> ha<sup>-1</sup> (20% of the total wood volume). The vegetation of deciduous woodland key habitats consists of 50 species (ten tree, seven shrub, 24 herbaceous plant and nine moss species), in total - five of them are determinant species of European broad-leaved woodlands, which allows to conclude that these forest objects correspond with European broad-leaved forests, furthermore, the broad-leaved forest plant group is represented mostly there. A strong influence of the edge has not been observed in deciduous woodland key habitats, because they are located in the habitat concentration place and it preserves their biological values. The management - the cutting of spruces is not necessary because their projective cover is less than 1%; the creation of the buffer zone is not possible because these objects are surrounded by agricultural lands.

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# ROLE OF TEACHER PROFESSIONAL COMPETENCE FOR PROMOTION OF PUPILS' CREATIVE THINKING

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Education in the 21st century identifies new requirements for the teachers and needs to improve and develop their professional competences continuously. The teacher must ensure the environment where pupils develop their creative thinking as it opens the opportunities for the knowledge, skills and competence used throughout their lives adapting and transforming them. The pupils' level of creativity is subjected to the teacher's professional competence. Therefore, the author considers that it is required to research the role of the teacher's professional competence for promotion of pupils' creative thinking in elementary school.

The basic task of the system of education is the formation of free and safe personalities and society with the individual liable attitude towards themselves, their peers, own country and higher values [3]. Nowadays, the system of education requires pupils being at the training centre and the teachers must be aware of new didactic educational models and theories to be adapted to the relevant learning environment and conditions.

The aim and the objectives of learning should be clearly formulated and knowledge, skills, competence criteria and levels should be developed. This is where the competence of the integrative function expresses, but the process of the competence acquisition and learning subject interaction are not emphasized. This is the European Qualifications Framework for lifelong learning (EQF) which acts as a frame of reference where the knowledge, skills and competency guidelines at all levels of education are summarized [1].

Being creative means to stop prejudices and be open to everything new. Creative personality is characterized by nonstandard behaviour, marked ability of creation, perceptivity, comprehension and well developed creative imagination [3]. Creativity lies in all of us. It is possible to increase our general level of creativity with certain techniques and training [2]. One of the factors to promote pupils' creative thinking is a professional and competent teacher who has new ideas and approaches to motivate them.

By developing creative thinking pupils are provided not only with specific knowledge. They are given means in making the right decisions, drawing conclusions and this is the way of becoming an independent person. Creative thinking opens the individual path in growing to free and harmoniously developed personality.

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# ROLE OF HIGHER EDUCATION IN REGIONAL DEVELOPMENT

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Nowadays, the education system as a public institute not only regulates public relations but also shapes the future. It is important that the education system provides graduates not only with a certificate of graduation but also with the skills and competences needed for their working life [1]. It is also essential that by means of their education, graduates are able to contribute not only to raising the individual standard of living but also to raising the standard of living in their city and region, and in the entire country and to improving the economic situation of the nation.

Non-stop interaction takes place between the society and higher education institutions, which should finally lead to the formation of a single interactive system by the social groups and institutions engaged in education, which in its turn would be able to provide the labour market with competitive employees and the society with active citizens [2]. One of the most significant ways how to improve and stimulate the development of a region through higher education is to facilitate cooperation between the parties engaged.

First, education can contribute to increasing the suitability of human capital to the labour market requirements, which in its turn increases the labour productivity, thus contributing to the economic growth of a territory (Neoclassical Theory Growth). Second, education can increase the capacity of innovation in economy as well as create new knowledge and technologies and products, thus fostering growth (Endogenous Growth Theory). And third, education can promote the transfer and spread of knowledge that are needed to understand and process new information and successfully develop new technologies, thus facilitating economic growth [3].

After processing the survey data, one can conclude that, according to the students, higher education affects the overall development of the region, its economic growth, and raises its competitiveness. The most important factors through which higher education can foster the development of the region are the preparation of professionals for the regional needs, the stimulation of entrepreneurship, as well as the generation of new ideas for the needs of the region. The most important factors through which the region can affect improvements in education are the enhancement of study programmes, the availability of practical training placements for students as well as various kinds of assistance to students.

According to the expert interviews, higher education plays an important role in the development of the region if the professionals trained by higher education institutions meet the regional labour market requirements. In Zemgale region, cooperation with education institutions is insufficient and the exchange of information on the research performed by HEIs and on the research necessary to the region does not take place. Cooperation and information exchange have to be improved to foster the development of the region and to improve higher education in the region.

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## HEAT GENERATED BY LIGHT FIXTURES

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Today, energy prices are constantly rising, so people need to think about effective use of resources. At night we use artificial light sources, in order to improve the quality of lighting on the work surface, but only some people know that any light source emits light and heat. The presentation will show how effective the most frequently used light fixtures are and how much they emit heat that can reduce the heat generator power.

Energy conversion lamps emit visible light, infrared light and convection heat in the air. High temperature light bulb (incandescent bulb, high pressure fluorescent lamps) heat is excreted predominantly as infrared radiation. Low temperature bulbs emit mainly through heat convection [1]. The energy consumed by a 100-watt GLS incandescent bulb produces around 12% heat, 83% IR and only 5% visible light. In contrast, a typical LED might produce 15% visible light and 85% heat [2]. Especially with high-power LEDs, it is essential to remove this heat through efficient thermal management. Without good heat sinking, the internal (junction) temperature of the LED rises, and this causes the LED characteristics to change [2].

It is estimated that to get adequate lighting in the room using different types of lamps, the least effective incandescent and halogen bulbs are, as only up to 5% of the supplied electricity is converted to light and the rest of the energy is converted into thermal energy. Incandescent lamps are less efficient artificial light sources in the room to get adequate lighting with most consumed electric power, but it also has its own benefits as incandescent heat produced reduces the heat generator power by about 30%.

Halogen bulbs have higher light output than incandescent bulbs; the heat generator allows you to reduce power by about 15%. Other artificial light sources released by heat have little effect on room temperature.

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# **JELGAVA WASTEWATER HEAT USAGE IN SEWAGE TREATMENT PLANT BUILDING HEATING SYSTEM**

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Nowadays, Latvia and the whole world are currently dealing with two very actual inter-related issues: energy- fuel resources savings and reduction of environmental pollution. One of the effective solutions for fuel savings is solar energy that is accumulated in the air, water and solid, however, at low temperatures this source of energy cannot be used for space heating directly, therefore conversion is required.

Heat pumps are used for thermal converters. The heat pump is a machine that provides heat transfer from the environment with a lower temperature (e.g., waste water) to the environment with higher temperatures (e.g., room air). This is one of the cleanest and most economical forms of heating, which allows partially eject organic fuels and provide heat with a minimum of primary energy consumption [1;2].

The purpose of the work is to investigate the opportunity of the usage of wastewater heat potential for Jelgava sewage treatment plant building heating system.

Now there are three buildings in Jelgava sewage treatment plant which are heated in the following way: one is equipped with the central heating system but the other two have the most expensive heating type – it is an electrical heating system (60 kW and 90 kW electric heating elements). Therefore, there are high expenses for heating. A heating system equipped with the heat pumps can be offered as an alternative to the existing heating system.

Two type possible ways of the heat pumps implementation have been investigated. According to the first option the heating pumps could be set for three buildings. According to the second option the heating pumps could be set for the buildings where there is the electric heating system. It is expected to set a heat pump collector after a settling tank – in a contact tank and gutters.

The calculations show that wastewater heat potential in Jelgava sewage treatment plant on average on the heat remover is 1,84 MW and the heat losses from the buildings are 91 kW. Also it has been calculated that both options will become profitable in four-year time. However, the first one is more profitable because in ten year time it will save more money comparing with the second one.

The received findings have shown that introduction of the heating system heat pumps, based on use of the heat capacity of sewage, is economically more beneficial for heating the buildings of Jelgava water treatment plant than the existing system of heating.

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# ENERGY BALANCE AND ITS REDUCTION POSSIBILITIES IN JELGAVA MUNICIPAL WASTE WATER PURIFICATION PLANT

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Wastewater treatment plant (WWTP) is a major infrastructure of a modern city and its correct and continuous operation is particularly important from an ecological point of view. Currently and in the near future biological waste water treatment is and will be one of the most effective wastewater treatment solutions.

The purpose of the work is to explore Jelgava wastewater treatment plant energy consumption balance and develop solutions for improvement, focusing on failures due to the facility design and construction stages. In order to investigate and analyze energy consumption balance of Jelgava WWTP, the power consumption data for the period from January 2010 to March 2013 were collected. Average electricity consumption per month in 2012 is 144,703 MWh, which is equivalent to 1060 private houses in Jelgava city average monthly electricity consumption.

Since wastewater aeration system consumes a significant proportion (40-80% depending on the geography of the country and applied wastewater treatment technologies) of the total wastewater treatment plant energy balance, the selection and optimization of the electric drive control process is essential in order to achieve the optimal technical - economical solution for the specific wastewater treatment facility [1,2].

The results of the data analyses show that the minimum concentration of oxygen in wastewater both summer and winter time is in average of 3.6 mg/l. The maximum values in January 2012 are 3.83 mg/l while in the summer they climbed up to 4.4 mg/l. This shows that concentration of oxygen in aeration tanks is constantly maintained higher than it is required (2 – 2.5 mg/l) [2]. The calculated oxygen utilization coefficient ( $\eta_o=0.34$ ) shows that in the aeration process oxygen is not effectively utilized. This means that a large part of oxygen escapes into the atmosphere and is not used in the purification process. It depends on the increased oxygen flow maintenance (decreased oxygen bubbles contact time with wastewater) and the diffuser immersion depth (5.5 m), as well as the diffuser density (0.4 discs/m<sup>2</sup>), compared with the recommended by the company FLYGHT density (0.6 - 6 discs/m<sup>2</sup>) is selected below the recommended limits [3].

Taking into account the data analyses and calculation results and exploring WWTP technical drawings a technical problem was revealed - incomplete coverage of diffusers along the edges of the aeration tank. In these areas active sludge settling is increased, which leads to the necessity to increase the capacity of air blowers that increases the energy consumption during the wastewater purification process.

The received findings, aeration process simulation results and economical calculations have shown that removing the existing technological challenges of Jelgava WWTP, the total predicted energy savings in one year are about 635 MWh, which reduces the total energy consumption of the facility by 36%.

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# THE ROLE OF THE TERMINAL IN MULTIMODAL LOGISTICS CHAIN

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The Strategy "Kazakhstan-2050" is a new policy of state held as close as possible to the life and people, and specified in terms and figures, which shows that people's lives will improve in the future.

The President has assigned the country seven major tasks, the fourth of which states that it is necessary to develop the sector of logistics services. First of all, it is about maximizing the use of the Customs Union to transport our goods [1].

According to the electronic database of foreign trade, the turnover of the Akmola region, excluding trade with the Customs Union countries, amounted to \$1.4 billion, the amount of imports - \$ 660 million, and the amount of exports - \$727million [1].

The main exported products are wheat, flour, barley, uranium ore, agricultural machines, polyethylene and cars.

For Kazakhstan, the ways of communication are important in terms of its location between Europe and Asia, the North and the South. The completion of the construction of the motorway NIJ "Western Europe-Western China" through Beyneu is coming to an end, a railroad was built in Turkmenistan and Iran, with access to the Persian Gulf. In the future, Kazakhstan will have to invest in the establishment of logistics centres in the countries with access to the sea. To date, a railroad "Zhezkazgan-Shalkar–Beyneu is under construction." It will directly connect the East and West of the country and allow passage through the Caspian Sea and the Caucasus to Europe in the West and the Pacific Ocean via China in the East [1]. This requires the expansion of organization of cargo transportation through terminals, called terminal transportation. The importance of this type of transportation in modern micro- and macro-logistical systems has increased greatly, which is predetermined primarily by the integration of a large number of logistics activities.

Terminal transportation arose abroad primarily in mixed systems, with the intercity and international communications cargo delivery: in major seaports, transportation hubs, and then over land freight traffic in parts of Western Europe and North America. The organizers of the terminal traffic act usually forwarding firms or operators of different modes of transport, using the universal or specialized terminals and terminal facilities for different methods of transportation [2].

Today terminals are not only points of accumulation of small shipments, but they play the role of major freight distribution centres and supply bases, thus becoming more important elements of logistics chain manufacturers.

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## TO QUESTION OF ELASTICITY OF DEMAND FOR TECHNICAL SERVICE

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In developed countries, proprietary "life support system" agricultural machinery is used, which suggests that all costs of production stages compensate the consumer. The same situation is with the basic machinery for agricultural purposes.

For quality repair harvesters, both capital and current, specialized repair enterprises, equipped with the latest relevant equipment are required, where highly qualified engineers and specialists must work. To date, however, it is increasingly found that the quality of repair leaves much to be desired. Currently, the requirements stipulated that after major repairs the harvester reliability indicators should not be below 80% of such indicators of a new machine. But in fact, this requirement in most of parts does not keep, and the resource of the machine greatly decreases to 40-50% [1].

To provide high quality technical services it is necessary to solve some of technical, economic, organizational and other problems. For starters, there is a need to put under strict control compliance with all technical requirements in the provision of technical service. Then, to establish "feedback" between the repair enterprises and those who exploit the machinery. Due to this connection, it will be possible to keep records not only of the general reliability targets, but also the number of failures, their characteristics and causes. In this way, based on these findings, we can constantly make adjustments to the process of repair or even the production of combines. Foreign representatives have practiced this method during the last five years. Annually, dealer companies, which not only sell agricultural machinery, but do as well after-sales service, send the factory ten the most frequently occurring failures after one season.

In conclusion, we can add that modern technical service of tractors and combines in the northern part of the Republic of Kazakhstan, is a high-tech complex activity receiving proper support from the government with support of the market system.

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## LATVIAN ELECTROMOBILITY - HISTORY AND PERSPECTIVES

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Today, the accent is on the need to think about the environment and saving opportunities. In transport, one of these options is electric vehicles. There is a hybrid which is expressed in the internal combustion engine and an electric engine, and 100% electric vehicles. This time special attention is paid to pure electric cars, just as in the Environmental Protection and Regional Development Ministry project competition organized by the Climate Change Financial Instrument for financial support for electric vehicles and the charging infrastructure in Latvia that ended on April 8.

Since the early days of the automotive industry people have been looking for a better alternative to the internal combustion engine and electric cars first came up with the first cars already 100 years ago. The U.S. Company "Anderson Electric Car Company" produced the first electric car "The Detroit Electric" that was created in 1907 and with a full charge it had the ability to drive 130 kilometers. Latvian RAF factories created the first electric car in 1980, the Moscow Olympics needs were a hypothetical minibus RAF-2210 with electric drive. Later in the 80th lot of its products delivered goods for stores in Riga.

In today's front-line the resource for electric car mileage is not much increased - on average they are 140-190 km. All is expressed by the battery capacity – the USA produced the electro vehicle Tesla S that can be produced for a single charge can travel 500 km, but the capacity of the battery, as well as the price, is double [1], [2].

For many people the dream for an electric vehicle cannot be implemented for two main reasons – the electric vehicle is more expensive than a car with a traditional engine and Latvians do not have a wide network of charging stations for enjoying a long trip. The Environmental Protection and Regional Development Ministry issued a call for Latvian registered merchants, authorities and derived public persons to apply for climate change financial instrument for financial support for electric vehicles and the Latvian charging infrastructure. Entry for this competition was finished on the 8<sup>th</sup> of April. The maximum grant per M1 and N1 Electric vehicle is 18 500 Euros: for companies purchasing electric vehicles, up to 35 to 55 percent, while state and local government bodies (administrations or public persons) - up to 85 percent [3].

Electric vehicles - enough good dynamics, quiet and comfortable ride, multiple economy compared to the traditional internal combustion engine options and a dream of friends of nature - are now within the reach of Latvia. Of course, the lack of charging stations is currently a problem, but it will be solved. Electro vehicle is most based on car use in the city and surrounding counties, charging is not particular worry - connect your car at night with a normal electrical outlet, but the next morning you can go again on the way.

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## PERFORMANCE AND EMISSION CHARACTERISTICS OF A DIESEL ENGINE FUELED WITH BIOETHANOL-BIODIESEL BLENDS

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Nowadays transport sector consumes a significant amount of energy and is also one of the main sources of environmental pollution due to using basically fossil fuels. The problem could be resolved using different biofuels (biodiesel and bioethanol), which contain oxygenated components and therefore have a higher potential than fossil fuels for reduction of tailpipe emissions. Both of the mentioned fuels are produced from organic feedstock and are widely studied during the last years mainly for a separate use in engines: bioethanol – for the use in spark ignition engines, biodiesel – for the use in compression ignition engines. If biodiesel in diesel engines could be used without any problems, then the use of ethanol can be done only as an alcohol-diesel fuel emulsion or blend, alcohol fumigation, and also in dual injection. Facing all the advantages of ethanol in reduction of tailpipe emissions [1,2], different fuel compositions were searched for, which allowed to use the potential of bioethanol and biodiesel in compression ignition engines.

The experimental work was done in the laboratory of the Motor Vehicle Institute at the Latvia University of Agriculture. During the preparing of blends it was taken into account that the use of these blends will not require modification of the diesel engine. The engine was operated on diesel fuel (DF), biodiesel (BD) and on its blends: 10% (v/v) of bioethanol with 90% (v/v) of biodiesel (B90E10), 20% (v/v) of bioethanol with 80% (v/v) of biodiesel (B80E20). The results showed that the addition of bioethanol leaves an impact on the main physico-chemical properties of biodiesel. The analysis of the combustion process showed increase of the indicated pressure for all tested conditions of the engine using bioethanol-biodiesel blends compared to DF, but maximum pressures were reached at the largest loads. Also essential reduction of the main exhaust components was observed – nitrogen oxides (NO<sub>x</sub>) and hydrocarbons (HC) – based on testing regime and the amount of the added bioethanol to biodiesel. For example, using B90E10 reduction of NO<sub>x</sub> by 14.5% was observed and HC by 19.0% compared to DF. During the tests there was also observed slight increase (till 11%) of fuel consumption using bioethanol-biodiesel blends compared to DF.

The analysis of the research confirms that diesel engines can be fuelled with bioethanol-biodiesel blends, but more detailed combustion process research of it would be necessary in future.

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# THE IMPORTANCE OF PUBLIC PROCUREMENTS IN THE CONSTRUCTION SECTOR IN LATVIA

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According to the Eurostat data the construction sector constitutes 10.4% of the EU GDP and employs 7.2% of the population of the EU. Construction is one of the largest sectors of industry in Europe with the annual turnover exceeding 1200 billion euros. The construction sector is a strategically important sector not only for the EU, but also for the economy of Latvia.

The basis of the construction sector of Latvia is to ensure alignment of the buildings and infrastructure, therefore these factors are important for other economic sectors as well. In accordance with the data of the Central Statistical Bureau moderate growth of the construction sector was observed in Latvia after the economic crisis in 2008, in 2008 employment in the sector was 11.4%, but in 2012 only 7.1% of the able-bodied population of Latvia were employed, more than 36 thousand work places were provided and about 6% of the State gross domestic product was provided.

In 2012, 6273 companies operated in the construction sector in Latvia. Most of the companies of the sector are small and medium-sized enterprises. Public procurements serve as the basis of the business strategic plan of the companies.

The Report from the European Commission "Europe 2020" also mentions procurements as a strategically important instrument based on the market in order to improve capital availability, rational resource utilisation and increase energy efficiency through the life cycle of a building which may have a positive impact on society, economics and the environment [1].

By applying the Diamond model of M. Porters for evaluation of the construction sector from the aspect of public procurements it is stated that four groups of factors work which support or hamper the advantages of the companies of the sector not only in global competition, but also in the development of the sector [2].

Employment in the sector is closely subordinated to the increase or decrease in the number of the public procurements. Pursuant to the data of the Procurement Monitoring Bureau the total number of the published procurements in 2012 decreased by 9% as compared to 2011. In 2012, the total sum of the contract price indicated in the notifications decreased by 21.7%. From 2008 to 2012 the number of procurements of the construction works decreased by 19.4 % in 2012 [3].

Procurement is a service for the companies to increase, improve or vary their production possibilities, and during the process of making procurements the public sector is an important client for the construction sector. Therefore an open and transparent construction information system is necessary for development of the public procurements in the construction sector. That would help control the construction processes, professional activity of construction specialists and inform the society about the decisions regarding construction procurements taken by the State and local governments which would also prevent the possibility of corruption in the decision making process [4].

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## THE MARKET OF AGRICULTURAL LAND IN LATVIA

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Land is the most important industrial resource of agriculture. At the moment the market of agricultural land has the fastest development in the real estate market. The rapid rise in prices has caused the increase of cadastral value by 10 – 15%, in some rural areas even 20 – 30 %.

The activity of the market of agricultural land is determined by the law “Law on Land Privatisation in Rural Areas”[3]. According to the law foreign natural persons are not allowed to acquire land, nevertheless, they can acquire land by becoming legal persons registered in the Republic of Latvia. May 1, 2014 is the end of the transition period, which means that the citizens and legal persons of the European Union member states are going to have equal conditions for land acquisition with the citizens and enterprises of Latvia.

According to the information given by the State Land Service of the Republic of Latvia [2], in 2012 the average land prices reached the pre-crisis level. The highest prices are in Zemgale region, i.e. at the end of 2013 they ranged from 2500 euro/ha to 6000 euro/ha; whereas the lowest prices are in Latgale region – ranging from 700 euro/ha to 2600 euro/ha. However, the most rapid increase in prices is observed in Kurzeme region (28%). The highest number of transactions connected with agricultural land can be observed in Latgale region. In 2011 it increased by 50%. The second place is taken by Vidzeme region. The year 2013 was not an exception for Latgale and Vidzeme regions in terms of the number of transactions. In 2012 in Vidzeme and Latgale agricultural land with the total area of 24 ha was sold, in Latgale alone – 16 ha, which is twice as much as in Zemgale or Kurzeme. The data present the evidence that the proportion of speculative transactions is considerable, in some areas, for instance, in Aluksne, it could reach 17% out of 30% - the total number of transactions.

In order to preserve the land for agricultural purposes the Ministry of Agriculture has prepared amendments to the law “Law on Land Privatisation in Rural Areas”, which change the rights to acquire more agricultural land than 5 ha and the management provisions [1]. The most important terms provide that a written declaration will be needed confirming that in three years’ time the land will be used for agricultural purposes. Natural persons and new agriculturists will need to have an appropriate education or experience in agriculture.

The amendments were supported by the Cabinet of Ministers, which has led to an ambiguous question – if the land market is closed, will it expose to danger or, on the contrary, promote the development of agriculture? Opinions about the consequences of the amendments differ among the representatives of the society, enterprises and industry specialists. Definitely changes are expected in the market participants and the number of transactions, the present amendments will considerably decrease the amount of speculative transactions. Nevertheless, the prices of agricultural land are expected to increase gradually.

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# PEDAGOGICALLY PSYCHOLOGICAL ENVIRONMENT IN ADULT EDUCATION

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The learning process, including an interaction among the trainer and participants, automatically involves the importance of the environment in successful realization of this process. There are many authors emphasizing the importance of psychological environment in the basic principles of the pedagogical process and the teacher's role in shaping this environment. Also the author's work experience in the field of adult education affirms this.

Educational environment and pedagogical situations are created by the teacher together with participants of the learning process. Psychological environment and situations have to provide free, creative, effective, as well as purposeful learning process (Briede, Pēks, 1998). Every member of the society at any point of one's life has to be offered an open and inclusive educational environment suitable to one's interests, needs, knowledge, skills and abilities (Katane, Kalniņa, 2010). These factors are important to be remembered when working with adult groups as their members usually represent different age groups and, therefore, they are characterized by very individual interests, needs, knowledge, even if they do have the same skills and abilities. Whereas children groups in the education process mostly consist of the same age group members with analogous degree of knowledge, skills and abilities.

Primary differences between the learning process of children and adults are defined by one of the most significant researchers of the adult pedagogy M.S.Knowles: adults are characterized by self-determination, they take more responsibility for their studies, adults learn much more independently as they feel an inner need for knowledge. Adults use their life experience in the learning process (Knowles, 1980). The specifics of the adult learning process determine the significance of pedagogically psychological environment when working with this audience. There are moments in the adult learning process when they might disagree with the information provided by the teacher, as they are lead by the practical experience (Ivanova, 2012). That is another obstacle affecting the pedagogically psychological environment of the adult learning process. When the trainer denies or fails to recognize the training participant's point of view, pedagogically psychological environment can fail to be positive and encouraging the learning process. Because of these differences mentioned above the adult educator has to pay special attention to communication and creating a contact when working with adult groups.

The author's more than 5 years of experience in teaching adults suggests that awareness of social perception of participants in terms of training venue arrangement, teacher's position and movement, as well as group dynamics (Lonstrup, 1995) and the corresponding choice of communication factors, as well as the awareness and prevention of communicative barriers is a way to provide positive and successful pedagogically psychological environment for the learning process for adults.

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# IMPORTANCE OF CONSTRUCTIVISM AND COOPERATIVE LEARNING IN DEVELOPMENT OF ENTREPRENEURIAL

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The European Parliament and the Council have identified the sense of self-initiative and entrepreneurship as one of the eight key competencies (2006). Junior Achievement Latvia offers practical knowledge of entrepreneurship which program pack includes the educational method "Student companies". The Latvian Ministry of Education and Science approved the use of this method in the learning process and Jelgava Spidola Gymnasium has been integrated it in the educational process for 19 years, based on insights of cooperative learning and constructivism.

A. Artz and C. Newman (1990) define cooperative learning as "small student group cooperating as a team, to solve problems, meet challenges or achieve a certain goal".

E. von Glasersfeld (1989) describes constructivism as a theory of knowledge with roots in philosophy, psychology and cybernetics. But P. Thompson (1993) emphasizes that the constructivist learning theory is not a learning theory but a knowledge model that can be used in the learning theory. Considering the authors' insights it can be concluded that the constructivism in pedagogy is an innovative and developing model of getting knowledge, skills and competence focussing on a persons's potential development.

Entrepreneurship helps develop competence which combines appropriate human qualities but they cannot be developed if there would not be the theoretic base of different branches of science. Constructivism is based on human experience, and also enterpreneurial is based on human experience.

V. Bikse (2011) describes entrepreneurship as an individual's personal qualities, characteristics and abilities that ensure success of a business. It includes: creativity and innovation skills, contacting, organizing, project management, business planning, and their risk-taking ability, susceptibility, as well as the knowledge and skills that are needed to form a new company and the embodied, practical ideas for successful development.

All these individual's personal qualities and characteristics, and abilities ensures also the ability to make a successful career and that is the main aim that teachers need to gain.

The educational method "Student companies" teaches a student not just to work alone, but also feel the responsibility for other participants of the group. They develop not just their own skills and competences, but also help other students develop their skills and competences.

In the learning process it is very important that a teacher has a big range of educational methods. But also it is important that teachers want and have an opportunity to use these educational methods in the learning process. The educational method "Students companies" cannot be used if all necessary conditions for the learning process are not ensured.

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## CREATIVITY IN EDUCATION

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Creativity is defined as the generation of ideas or products that are both novel and appropriate (correct, useful, valuable, or meaningful) (Amabile, Collins, 1995). J.P.Guilford (1950) on American Psychological Association presidential emphasised that only 186 from 121 000 entries in Psychological Abstracts had dealt with creativity topic. Since 1950 the situation has changed dramatically: approximately 250 dissertations, articles and books regarding creativity have appeared each year since 1970 (Barron, 1981). Nowadays the tendency of creativity on daily agenda is much more widespread, and clear shift from the IQ to the creativity has appeared when analyzing factors of the competitiveness of societies. Education is the key factor for developing and boosting creativity.

Latvian academic R.Bebre emphasizes that creativity is a congenital characteristics and, therefore, every person is characterized by it in a particular degree (Bebre, 1997). Children's creativity is the first step for developing creativity of the general society. L.Vigotsky believes that children's creativity is evolved by a purposefully organized spiritual atmosphere of the school. He also points out that pupils' creativity can be encouraged by their teachers (Выготский, 1991). Creativity is directly dependent on the richness and diversity of the one's life experience, as this experience provides the material for creating fantasy. The more a child has seen, heard and experienced, the richer will be person's creative potential.

One of the most significant academics exploring adult education, M.S. Knowles, points out that there is a difference between learning process of a child and one of an adult. A child learns information chosen by an adult. Though adults are described by self-determination; they take more responsibility of their studies, adults learn much more independently as they feel an inner need for knowledge. Adults use their life experience in learning process (Knowles, 1980). Therefore, there is a difference for using creative activities in adult education. An adult can develop creativity in him/herself as well, if he or she is open for change, ready to work on him/herself and his/her way of thinking.

From more than 25 years of participation in education system, as well as unstructured peer interviews, authors conclude that the significance of creativity as a topic both in contents and environment of education in Latvia has experienced a significant increase only during the last decade. During this period of time psychological freedom and security have been one of the most powerful factors increasing significance of creativity. As the result, creativity has become the new key factor for success in 21st century both on individual as well as collective level in modern society.

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**POST-GRADUATE LEVEL ABSTRACT**

# MARINE SPATIAL PLANNING CHALLENGES AND RELATION TO ENVIRONMENTAL IMPACT ASSESSMENT

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The Ministry of Environmental Protection and Regional Development of Latvia has started preliminary work out of marine spatial planning which intercrosses with the strategic environmental assessment. The initial idea is to divide the territory of the sea in four categories of the use, as general use area (the use of the vast marine compartments which do not present significant conflicts with other interests such as fishing, tourism, marine scientific research), priority use area (such as fairways, cable location, wind power parks where other use is prohibited), reserved use area (determines activities which should be preferred, as long as they do not cause significant conflicts with other interests, concrete actions in these areas require additional detailed studies), prohibited use area (prohibiting a certain use of the territory, such as military landfill sites, shipping restricted areas) [1].

There might appear two main issues regarding this development.

The first issue relates to the fact that the Baltic Sea is located between Central and Northern Europe, and its basin countries are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. It is expected that the marine spatial planning will become one of the most topical issues in the nearest future, although there are differences of the development of spatial planning and strategic environmental assessment between the countries of the basin of the Baltic Sea. Thus, the Baltic Sea must be considered as the territory with specific features which requires coherent strategic environmental assessment work out in the region. Although there has been done some work at a political level for achieving this goal, the preparation of a coherent regional strategic environmental assessment is a future challenge [2].

The second point is linked to the existing legal framework of environmental impact assessment in Latvia. For the moment it is mainly regulating the territorial planning of land use.

The publication is dealing with these above mentioned issues, in determining the challenges for marine spatial planning in a larger context (regional level) [3], the meaning of these processes for Latvia and analysing the legal framework – existing law, needed improvements or changes of law in the field of marine spatial planning, strategic environmental assessment and environmental impact assessment.

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## MAIN ENVIRONMENTAL PROBLEMS OF MANKIND

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The problem now is rather large waste production; such a chain of production needs to decide another important task: save those natural resources that people use in their productive activities. The challenge now is to develop a comprehensive, unified system for protection of the biosphere and it is already on its base to a more reasonable differentiated approach to rational use of individual resources.

Therefore, the primary task is to make eco-friendly production profitable. Thus, the concept of ecological safety of the natural areas of personality, society and state are closely linked to local, regional and global scales [1].

Agriculture is such branch of economy, in which production is most closely connected to the nature; however, technical development and translation process of this sphere of human activity on an industrial basis have resulted in many adverse changes in the environment. The major factors of approaching ecological catastrophe are already well-known: pollution of air, ground and fresh waters, desertification, accumulation in the atmosphere of the gases which give a hotbed effect, acid rains, violation of the ozone cloud protecting from space radiation. The biosphere is enriched with various elements which influence the metabolism of both - plants and animals. Antibiotics and pesticides, getting into animals, will penetrate also into our organism, mainly with meat and vegetables. Mineral fertilizers poison our life in another way. Washed away by rains, they flow down in the rivers, causing eutrofication - grassing of waters. The rivers turn to a dead green swill [2].

From the philosophical point of view the environmental problem is a particular case of a more general problem of "artificial" and "natural". The problems demanding the decision of the specified problem are:

- 1) Analysis of dependence of ecologically focused and ecologically non-focused opinions on certain understanding of moral values;
- 2) Management of human behaviour according to moral values;
- 3) Analysis of modern lines of life transformation.

To solve environmental problems, we need an all-uniting idea, which could rally all layers of the society, political parties and public organizations of Russia, in the name of its revival and the world community - in the name of preservation of the life on the Earth.

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# ASYMMETRY OF SELECTED BILATERAL TRAITS OF SKULL IN SMALL CHINCHILLA (CHINCHILLA LANIGER, MOLINA1789) BORN IN SINGLE AND MULTIPLE LITTERS

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In the world literature there are an increasing number of study reports on fluctuating asymmetry index as an indicator of stress [1]. In the context of the findings of the asymmetry research, it is interesting to consider the possible effect of the increasing number of fetuses on the level of this indicator. Animals that come from multiple pregnancies represent a good material for this type of research. Chinchillas, which under natural conditions usually give rise to one individual, under intensive breeding give birth to two, three or more offsprings in a litter. Studies on the asymmetry of epigenetic traits of chinchilla skulls demonstrated that significantly more asymmetric bilateral traits appeared on specimens obtained from multiple litters [2]. The aim of the present study was to address the question whether the litter size affects the values of the asymmetry metric traits of the cranial skeleton in the chinchilla. The material for the study involved 300 chinchilla skulls derived from carcasses of farm animals housed in cages in livestock buildings. Metrics were obtained for the following traits: 1. Height of the orbital ring; 2. Intersection *Sutra zygomatica maxilliaris – Prosthion*; 3. *Processus temporalis ossis zygomatica – Sutura zygomatica maxilliaris*; 4. Maxillar tooth row length; 5. Mandibular tooth row length; 6. *Ectorbilate – Entorbitale*; 7. *Protuberantia occipitalis externa – Processus paracondylaris*; 8. *Bregma – Ectorbitale*; 9. *Bregma – Processus mastoideus*; 10. *Margo parietalis squamae temporalis – Processus mastoideus*; 11. *Akrokranion – Infraorbitale*; 12. Zygomatic arch length; 13. Posterior edge of the tympanic cavity – *Prosthion*. Using the Statistica v.10 PL we calculated relative asymmetry (AW) and fluctuating asymmetry (FA). Significance of differences was estimated using the Wilcoxon matched pairs test and confirmed with the sign test. The values of FA were significant ( $P \leq 0.05$  and  $P \leq 0.01$ ) for the following traits: the intersection *Sutra zygomatica maxilliaris – Prosthion*, mandibular tooth row length; area of the cervical surface (*Protuberantia occipitalis externa – Processus paracondylaris*), the height of the skull (*Margo parietalis squamae temporalis – Processus mastoideus*), zygomatic arch length, and total cranium length (from posterior edge of the tympanic cavity to *Prosthion*). With respect to such traits as the zygomatic arch length and the cranial length – i.e., spanning over a long distance and involving numerous structures, including those belonging to neurocranium and viscerocranium – an increased litter size resulted in an almost twofold increase in fluctuating asymmetry. On the basis of the measurements it can be concluded that an increase in the litter size in the chinchilla may result in asymmetry of cranial lateral features.

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# PAX2 PROTEIN EXPRESSION IN DEVELOPING CENTRAL NERVOUS SYSTEM OF HUMAN EMBRYOS

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Development, regional specification and neurogenesis of the human brain seem to be controlled by Pax2. However, data about the developmental role of Pax2 protein in human nervous system formation are limited. Therefore, the aim of the study was to determine spatial and temporal expression of Pax2 protein during the early stages of developing spinal cord and brain in human embryos. In this study, Pax2 protein expression was examined in the developing neural tube by immunohistochemistry methods in 30 human embryos of Carnegie stages (CS) 10-20 collected after legal abortions. The study was approved by the Ethics Review Committee on Human Research of the University of Tartu. The embryos were fixed in 4% paraformaldehyde and embedded in paraffin according to standard methods. Tissue blocks were cut serially in transversal direction, the sections were incubated with the primary antibody Pax2 (4 µg/ml dilution in PBS) and on the next day the sections were incubated with the universal secondary antibody (Vectastain ABC Universal Kit). The labeling was expressed by a subjective scale ranging from 0 to 3.

Pax2 expression was seen in the developing forebrain, midbrain, hindbrain and in the wall of developing spinal cord. However, Pax2 expression was found to be stronger in the developing brain than in the spinal cord of the same young embryos in CS 10-14. At later stages (CS 16-20) Pax2 expression was observed in the midbrain-hindbrain boundary and also in the developing diencephalon and cerebellum. In the wall of developing spinal cord Pax2 expression was detected in the ventricular, mantel and marginal layers. Pax2 expression was seen to increase throughout the later stages of spinal cord development and significantly stronger expression was found at CS 16-20 compared to CS 10. Furthermore, spatially restricted expression of Pax2 was observed along the compartmental dorsal-ventral axis of the spinal cord. In conclusion, Pax2 protein expression in the developing spinal cord and brain of the human embryos mostly resembles descriptions of the role of Pax2 in the neurogenesis of animals, where Pax2 is associated with the establishment of craniocaudal and ventrodorsal boundaries within the developing neural tube and with migration of specific neural cell populations.

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## NUTRITIONAL COMPARISON OF PULSES

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Pulses (grain legumes) are dry seeds of leguminous plants which are mainly cultivated for human consumption and distinguished from leguminous oilseeds by their low fat content [1]. Pulses are staple foods for millions in developing countries, and have always been a part of Latvian diet. Traditional pulses in Latvian cuisine are garden peas (*Pisum sativum* L.), broad beans (*Vicia faba* L.), lima beans (*Phaseolus lunatus* L.), as well as white and pinto beans (*Phaseolus vulgaris* L.). Lentils (*Lens culinaris* Medik.), chickpeas (*Cicer arietinum* L.) and mung beans (*Vigna radiata* (L.) R. Wilczek) are also widely used in the world.

Pulses are nutritionally important since they usually provide the bulk of the diet and are an excellent source of nutrients with a low glycaemic index. Protein content in pulses is equal to the protein content of meats; however, pulse proteins are incomplete because of relatively low quantities of the essential amino acid methionine. Nevertheless, most plant proteins are incomplete and by combining complementary foods from two or more incomplete protein sources, e.g., pulses and grains or pulses and seeds, a complete protein can be created.

Pulses with the highest protein content are lentils, broad and mung beans (24.2-26.1%), followed by garden peas and navy beans (21.1-25.0 %) and chickpeas, pinto and lima beans (18.2-22.4 %) [2].

Pulses have shown numerous health benefits, e.g., lower glycaemic index for people with diabetes, increased satiation, cancer prevention, reduction in cholesterol levels, prevention or alleviation of constipation, and protection against cardiovascular diseases, due to their dietary fiber content [1]. Pulses with the highest dietary fiber content are lentils (30.5%) followed by broad beans (25.2 %), and mung and pinto beans (10.0-18.9 %). Fiber content in split peas, navy and lima beans and chickpeas is 3.8-8.0 % [2]. One serving (½ cup) of pulses covers about 25 % of daily fiber needs [1].

Pulses contain such minerals as iron, zinc, calcium, magnesium, phosphorus and copper (2.4-4.3 %) and are low in fat (0.8-3.4 %); the major fatty acids in pulses are oleic, linoleic and linolenic acid, and they also contain phospholipids and glycolipids. It should be noted that pulses contain anti-nutritional factors that interfere with the absorption of iron, zinc and calcium [2]. They are a good source of B vitamins. One serving of pulses covers about 50% of thiamine (B<sub>1</sub>), 20% of riboflavin (B<sub>2</sub>), 20% of niacin (B<sub>3</sub>), 30% of pyridoxine (B<sub>6</sub>) and 90% of folic acid recommended daily intake. Such pulses as lentils and chickpeas also contain about 10% of vitamin A (as beta carotene) recommended daily intake [3].

Chickpeas contain 364 kcal per 100 g dry weight (1523 kJ). Nutritional value of dry lentils, pinto and mung beans is 345-348 kcal per 100 g (1444-1456 kJ) followed by garden peas, broad, navy and lima beans with 335-337 kcal per 100 g (1402-1410 kJ) [3]. Cooked (boiled) pulses contain 5-6 times more moisture than dry ones. Nutritional value of cooked pulses is about 40 % of the calories in dry pulses.

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# JUSTIFICATION OF SPRAT SALTING METHOD FOR FISH PRESERVES WITH ANTIHYPERTENSIVE EFFECT PRODUCTION

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Small herring fish preserves production is an important part of the Kaliningrad region fishing industry. However, they are contraindicated for people suffering from high blood pressure. One of the socially significant ways to improve production is the development of preserves with hypotensive effect technology.

This would not only expand the range of preserves, but also improve the quality of life by reducing the risk of cardiovascular diseases.

Hypotensive effect achieving is possible due to the replacement of table salt for prevention salt with low sodium content and water plant extracts with a hypotensive effect using (chokeberry Aronia, hawthorn berries, lemon balm, peppermint and horsetail leaves, cranberries, oregano, peppermint).

The main technological operations in the preserves production is ambassador at which there are biochemical processes causing organoleptic and physico-chemical characteristics of the finished product.

There is suggested the preliminary flavoring salting method of ungutted sprat in saline extracts of antihypertensive plants supplemented with prophylactic salt.

Substantiation of the optimum values of the factors was carried out using mathematical modeling, the varying factors were duration of salting, hydromodule and the concentration of salt in brine and partial responses - organoleptic properties, content of vitamins C and P, the salt content in fish.

As a result, there is the salting process mathematical model made, the optimal values of the factors: hydronic (sprat-brine) -1:2, salt concentration in brine 10%, duration of salting - 72 hours. Geometric interpretation of the process of salting with coordinates in the said extremum point is constructed.

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## **POLYUNSATURATED FATTY ACIDS OF SALMON IN FUNCTIONAL FOOD**

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Polyunsaturated fatty acids – docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) – are the most important components of food. They promote improvement of the cardiovascular system and prevention of such diseases as heart attacks, strokes, thromboses. DHA and EPA are only in seafood; therefore the majority of the population of Russia has constant deficiency in these important substances. Steady growth of cardiovascular diseases which make today 50% in the general structure of mortality is connected with it [1].

The composition was developed for creation of functional products on the basis of salmon fat. Fat was received from the waste which is forming at cutting – the heads and spines. Fat was received by melting, and then it was exposed to centrifugation at lowered temperature for separation of saturated acids [2]. For ensuring stability in the course of storage in a concentrate CO<sub>2</sub> the extract of rosemary in number of 0,2% to the weight was added. The ready concentrate of PUFAs received the name “EssencioilPhyto”. It represents oily liquid of bright orange color, transparent at a temperature over 5°C, possessing a light smell of fish with the expressed shade of rosemary. The quality indicators – acid end peroxide values – are not higher than 2 mg KOH / g and 4 millimol of active oxygen / kg respectively.

For the purpose of use of the received concentrate as an active component of a functional product white bread was chosen. White bread is the product which is used practically by all groups of the population daily and it possesses high comprehensibility. It was offered to replace 30% of sunflower oil for the concentrate “EssencioilPhyto” in the basic compounding of white bread. It made 1,5% to the mass of a finished product. The analysis showed that this quantity has no negative impact on the organoleptic indicators of the product and does not affect its expiration date. The calculations show that the use of 150 g of the bread containing even 1% of a concentrate satisfies the daily need for PUFAs for 30%.

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## **BIOTECHNOLOGY OF DRIED SNACKS OF A HIGH NUTRITIONAL VALUE**

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Utilizing by-products from fish processing is very important for the fish industry. When the fish is first filleted, an additional 8-12 percent flesh can be separated from the filleting waste.

The objective of our research was to develop a technology of dried snacks from flesh obtained from salmon backbones and Jerusalem artichoke tubers. J. Artichoke tubers accumulate inulin instead of starch. As a result, J. artichoke has a very low glycemic index and slightly affects blood sugar levels. It also contains food fibers (prebiotics) that provide some benefits for the intestinal tract. Salmon provides a good source of high quality protein and contains vitamins A, D, E and K, omega-3 fatty acids and minerals.

The samples were produced based on the following process scheme. J. artichoke tubers were washed, cleaned and boiled. Salmon meat was separated from backbones. All ingredients were placed in a blender. Technological additives were added. Then we minced the ingredients. The mince was placed between two layers of a breathable film and rolled out to the thickness of 6mm. Then the semi product was hung on rods and dried at the room temperature. After that it was cut into strips of 80 mm length, 5 mm width and 2 mm height.

Optimal value factors of investigated process were obtained based on methods of the mathematical modeling. The drying time is 9.9 h. The percentage of J. Artichoke is 27.7%. The experimental samples were produced taking into consideration the determined technological characteristics. The organoleptic evaluation was conducted. The snacks had firm and elastic texture. The surface of the snacks was dry and clean with slight oily shine. There weren't cracks and other damages on it. The color of snacks was from bright red. The dried snacks had pleasant taste of the salty fish without plant note. The chemical content of the dried snacks was investigated. The content of water is 21.0%, protein-31.5%, fat-17.3%, carbohydrate-22.2%, ash-8.0%.

We may recommend the snacks not only for diabetics, but for children, sportsmen and active people.

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## **ACTIVE PEPTIDES FOR SPORTS NUTRITION FROM FISH COLLAGEN BY-PRODUCTS**

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There is a deficit of peptides for sportsmen, which accelerates wear fabrics, leads to a weakening and aging of the whole organism. This greatly speeds up the wear of fabrics, lead to aging and weakening of the whole organism [1]. In the technology of supplements for sports nutrition in order to obtain active peptides - fragments of amino acid chains with a molecular weight less than 50 kD, investigated the possibility of using fish by-products - ocean fish scales. It is converted into assimilable form by hydrolysis of its native protein. Two types of hydrolysis are considered. These processes are fermentolysis and hydrothermolysis.

In the first case the effect of three enzymes on the fish scale collagen protein are compared: collagenase, acidic and neutral proteases. The amount of enzyme was 2 % by fish scale weight, duty of water - 11.5. Collagenase is possessed the most activity. Rational duration of hydrolysis using collagenase was 48 hours. Amino nitrogen content reached 81.2 mg/100 g.

Analysis of the fraction composition of the hydrolyzed scales protein by hydrothermolysis showed these mixtures are presented mainly low and medial molecular weight peptides. Fractional composition medium mode had the following distribution along the length of the molecules: 20-50 kD (24,6%); 10-20 kD (22,8%); 5-10 kD (18,2%); 1-5 kD (13,8%). In the case of strong mode of hydrothermolysis the mixture of peptides is obtained with a predominant content of fine peptides fractions: 1-5 kD (36,3%), 5-10 kD (31,4%), 10-20 kD (17,9%), 20-50 kD (6,5%). The value of hydroxyproline content in mixtures as an indicator of the depth of hydrolysis was used. It was 8,64-9,20% by weight scales.

The hydrolyzate was mixed with bee pollen collected on one of the apiaries of the Kaliningrad region. Anabolic effect of bee pollen is the presence of all the essential amino acids in a perfectly balanced ratio of all known vitamins and minerals, as well as active male sex hormones flowering plants and ets. [2] The general chemical composition of bee pollen is investigated: water – 7,63%, protein – 38,14%, fats – 7,00%, carbohydrates - 23%, minerals - 3,82%. In total supplement for sports nutrition has a powerful firming effect, enhances mental and physical activity of the body.

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## **INCREASING THE EFFICIENCY OF PREVENTIVE COFFEE DRINK**

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At the Food Biotechnology department of Kaliningrad State Technical University the technology of production of coffee substitute is developed. In structure of the coffee drink natural coffee was replaced with raw materials of vegetable origin: Jerusalem artichokes. New drink has preventive properties and it is recommended for people with diabetes diseases. However, the number of deaths from the disease on a global scales precisely the cancer ranks third place after infectious and cardiovascular diseases. In 2008, almost 8 million people died because of cancer. Cancer and cancerous growth process - is a complex multistage process of evolution, when the cell, the process of changing from normal to cancerous, accumulate multiple changes and a variety of mutations. The active component choice for my research is based on the analysis of literary data on a development of breast tumors, colon, prostate, and low consumption of cruciferous plants (broccoli, cauliflower, kohlrabi). It was found that the active ingredients of these products - indole-3-carbinol, sulforaphane and sinerigin - are powerful protectors against cancer. They are able to change the exchange of estrogen in the liver, inhibiting the growth of tumor cells and the biochemical activity of receptors in tumor cells or epithelial cells, increase the activity of liver enzymes responsible for the elimination of toxins, neutralize toxins, including carcinogenic [1]. In my thesis I'm aiming at the inclusion of active compounds of broccoli (indole-3-carbinol, sulforaphane, sinerigin) in the powdered coffee substitute based on Jerusalem artichokes. The finished product will not be a cure, and it can be recommended for patients not only with diabetes diseases but with cancer. Adding the active ingredients in the powdered coffee substitute supposed by microencapsulation [2].

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## TECHNOLOGY OF ROLLS FROM HERRING AND CHITOSAN

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Nowadays the consumption of a fish products increases constantly. Japanese cuisine is also wide spread. Rolls from salty fish fillets, rice, kelp and spices are very popular[1]. But these products don't belong to functional products, have short shelf life and are fragile consistency.

The Atlantic herring was chosen as a filling, apple vinegar solution of the chitosan was entered to composition for the decision of these problems. Thereby, the blended kelp was added into the rice as a source of a bio available iodine. According to the newest research, consumption of the herring decreases risk of developing cardio-vascular diseases due to the increasing of high density lipoproteins in a human body [2].

The chitosan has high sorption and antineoplastic properties. It is not toxic. The chitosan bounds heavy metals and removes toxicants from the body. It inhibits the secretion of hydrochloric acid in the stomach, lowers blood cholesterol, improves the immune system and has anti-allergic action [3]. According to the State Standards of Russian Federation 52349-2005 developed rolls are called functional products, because of the chitosan and iodine contents. Nutrition recommendation is developed. The optimal recipe and technological characteristics were determined as result of mathematical modeling.

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## **ACTIVE PEPTIDES FOR SPORTS NUTRITION FROM FISH COLLAGEN BY-PRODUCTS**

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There is a deficit of peptides for sportsmen, which accelerates wear fabrics, leads to a weakening and aging of the whole organism. This greatly speeds up the wear of fabrics, lead to aging and weakening of the whole organism [1]. In the technology of supplements for sports nutrition in order to obtain active peptides - fragments of amino acid chains with a molecular weight less than 50 kD, investigated the possibility of using fish by-products - ocean fish scales. It is converted into assimilable form by hydrolysis of its native protein. Two types of hydrolysis are considered. These processes are fermentolysis and hydrothermolysis.

In the first case the effect of three enzymes on the fish scale collagen protein are compared: collagenase, acidic and neutral proteases. The amount of enzyme was 2 % by fish scale weight, duty of water - 11.5. Collagenase is possessed the most activity. Rational duration of hydrolysis using collagenase was 48 hours. Amino nitrogen content reached 81.2 mg/100 g.

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## ANALYSIS OF TREE SPECIES SUITABILITY TO CLIMATIC CONDITIONS

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Rapid climatic changes are occurring and affecting the forest, as demonstrated by numerous observations, e.g., of tree ring chronologies [1] and phenological indicators (as compiled in the Pan European Phenology database – [www.pep725.eu](http://www.pep725.eu)); and the rate of change is predicted to increase in future [2]. Therefore, intensive work has been carried out to understand better the changes at the local and landscape scale in different countries including Latvia [3]. The results have been linked to characteristics of individual tree growth, stand development dynamics, from which country-wide or global predictions of impacts of climatic change on forest ecosystems are created ([4]; [5]; [6]) and coupled with the recommendations for forest management measures to boost the adaptive capacity and reduce the possible harmful effects to forest stands [4].

Two additional measures are commonly recommended for forest management facing rapid climatic changes: a) use of mixture of tree species at the landscape or stand scale to increase resilience forests and spread the risks [7]; b) use of exotic non-invasive tree species suitable for the predicted climatic conditions in forests or plantations. For these measures in Latvian conditions it would be important to determine suitable provenances of species that have been suggested to reduce the impact of climatic change in Western Europe. In order to do that, a complex analysis of the influence of climatic conditions on trees has to be carried out. Therefore, the aim of the present research is to assess how different climatic indices affect different traits of trees such as height, survival and stem diameter, as well as to summarize the most popular methods for the analysis of climatic conditions and incorporate these methods in the analysis of species suitability.

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## LOSSES IN INDUCTION MOTOR

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Around 90 per cent of the electrical motors used in industry and domestic locations are either three-phase induction motors or single-phase induction motors. Three-phase induction motors (IM) are used as drive motors in pumps, lifts, cranes, hoists, compressors, large capacity exhaust fans, driving lathe machines, crushers, in oil extracting mills, textile and paper mills, etc. The main limiting factor for how much an IM can continuously be loaded, is usually the temperature. Exceeding the thermal limits means the oxidation process in insulation materials is accelerated, which eventually leads to loss of dielectric property and failure of the IM [1,3].

Losses in an IM cause heating and temperature rises of the IM parts. These are core losses, resistive losses in the rotor and stator, mechanical losses, stray losses and additional losses. Resistive losses in the stator and rotor are due to the resistance of the stator and rotor windings. Mechanical losses are due to bearing, friction and windage. Core losses in iron are due to the fundamental magnetic field. No-load stray losses consist of losses in iron and eddy current losses in inductors. Additional losses consist of similar components as the no-load stray losses, end losses and losses due to skew leakage flux [1, 2].

Losses of an IM can be defined as no-load and load losses. Load losses are current-dependent and no-load losses depend on power supply voltage and frequency. Load losses consist of resistive losses in the stator and rotor windings and additional losses. No-load losses consist of core losses, stray losses and mechanical losses [1].

Experimental investigations of a 4 kW and 15 kW IM were performed by Kylander [1] to determine losses of an IM. Losses were obtained directly (measuring) and indirectly (calculating) at 3 operation conditions (idle, rated and overload). For each of the three operation conditions of the IM the frequency and voltage was changed from 10Hz and 75V to 90Hz and 600V. Results show that for the 4 kW IM, resistive losses in the stator and rotor windings were mainly dependent on load. The small difference in total losses at different frequencies can be explained by heat transfer (convection) change at the different fan rotating speeds. Mechanical losses and core losses increased 20 times in the 90 Hz and 600 V tests compared to the 10 Hz and 75 V tests. Stray losses only increased 5 times. For the 15 kW IM mechanical and core losses increased by 25 times, but stray losses increased 15 times.

Analysis shows that losses of an IM change due to load, voltage and frequency. The magnitude of losses can change significantly by changing the frequency from 10 to 90 Hz and the voltage from 75 to 600 V. The total loss distribution can change depending on the size and power of the IM. Therefore, the operation conditions and parameters of the IM need to be taken into account to choose the proper protective device to protect the IM from overheating and prevent its failure.

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## CULTURAL HERITAGE ON STUDENT REFLECTION

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Many researches evidence that the modern world is characterised by two quite explicit trends: the expansion of globalisation in the economy, politics, and culture and, at the same time, the preservation of national identity; the preservation of national cultural heritage and the use of it in real life are emphasised as significant indicators of national identity.

The learning and appreciating of cultural heritage and the use of cultural heritage in everyday life may contribute to:

- raising the self-esteem of the nation, which is important under globalisation;
- increasing economic activity, thus providing opportunities for the development of entrepreneurship, including for the enterprises engaged in tourism;
- fostering the development of regions and raising the competitiveness of the regions by increasing employment, thus ensuring the population stay in their region, and by raising the viability of the region;
- expanding international cooperation with tourism institutions of other countries, thus increasing the mutual flows of tourists [1].

As any phenomenon, the role and use of cultural heritage, too, in the processes taking place within the region are affected by both objective (economic and social policies implemented in the country, the legislation and micro-entrepreneurship development) and subjective factors (the level of knowledge on cultural heritage, readiness to consume the products of local producers) [2].

Accordingly, an important research task is to assess the understanding of the significance and preservation of cultural heritage from the new generation perspective, as the preservation and use of cultural heritage may be ensured only through the engagement of the new generation. A survey of 171 students - youths representing all the cultural and historical regions of Latvia gives insight into the situation in the country as a whole and in each cultural and historical region and allows identifying the key priorities for popularising the cultural heritage among the young generation.

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## FARM SUCCESSION – A WAY HOW TO BUILD RESILIENCE IN RURAL COMMUNITIES

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The aim of the doctoral thesis of the author “Farm succession and rural communities resilience in Latvia” is to develop a theory of farm succession in the framework of rural sociology, based on the empirical data and analysis of rural scientists theoretical arguments in the field of rural communities resilience. The assumption is that farm succession has complex theoretical profile that is empirically legitimated and described as one of the indicators of rural communities resilience.

The assumption follows from the master thesis “Farm succession in beef cattle farming in Latvia” that shows a conceptual framework of farm succession outlining succession as a constructed process caused by the interaction between older and younger generations. The results allow developing further research questions. As an example, what is perspective to change, adapt and dive into farm succession and how the analysis of farm succession could be integrated in measurement of resilience in rural communities. As well as what is the link between external stress conditions in rural and enabling environment of succession and how to analyze relationship between social changes in rural and communities resilience.

Referenced by W. Neil Adger “Social and ecological resilience: are they related?” social resilience describing related concepts will be analysed and answers found on questions how to measure it. It is an important point of the analysis that social resilience is defined at the community level rather than individuals. Social resilience therefore is observed by examining aspects of such factors like social exclusion, marginalization and social capital.

The third referenced article is Asia-Pasific Human Development research “Raising rural resilience” that describes why it is important to talk about rural resilience. The article draw attention to communities resilience from geographical, political, economical and social context raised transdisciplinary discussions. Some arguments about the approach based on communities development will be explored.

To conclude, farm succession could be considered as one of the indicators of rural communities resilience. It should be considered in associated with the ability to adapt to changes that are acquired and adapted over time.

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# THEORETICAL ASPECTS OF THE ECONOMIC IMPACT STUDIES IN TRADE SHOW INDUSTRY

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Trade shows have been known to the world for centuries and have quite detailed history. Today this segment is one of the fastest growing segments of the global tourism industry. In addition to this also evaluation of economic impacts of trade shows and MICE (meetings, incentives, conventions and exhibitions) industry is growing. Dimmock & Tiyce (2001) indicated that research into the impacts of events is increasing because of the growing number of events being held, and because of a growing recognition of the impacts, both positive and negative, that events can have on the host communities [2].

There are a variety of approaches for measuring the economic impact of events. Jeanrenaud indicates that the basic principle of an economic impact study is very simple – hosting an event creates an increase of demand for goods and services in the region [1].

An economic impact analysis traces the flows of spending associated with tourism activity in a region to identify changes in sales, tax revenues, income and jobs due to tourism activity. Economists distinguish direct, indirect and induced economic effects. The total economic impact is the sum of direct, indirect and induced effects within a region [3]. Direct economic effects are usually understood as changes associated with direct business decisions or immediate effects of changes in expenditures. Indirect effects are changes resulting from various rounds of re-spending in linked industries. Induced effects or impacts are understood as changes in economic activity resulting from household spending of income earned directly or indirectly in affected businesses [3].

Trade show economic impact studies are evolving along with the growing significance of events held in communities in both developing and developed economies. In addition to economic impacts of the trade show, the social and environmental effects should be evaluated.

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## ASSESSMENT OF EFFECTIVENESS OF THE HEALTH CARE REFORM IN LATVIA

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The health care reform in Latvia, as in many countries of Eastern Europe was started in the 1990s of the 20<sup>th</sup> century. The key directions of the reform have been dedicated to the implementation of the market economy principles, introduction of the alternative types of financing and private insurance, ensuring the availability, effectiveness and economic efficiency of health technologies. The health care system reform is still in progress with many stages of the development, however not all the goals have yet been achieved.

Within the framework of this research, the author evaluates the efficiency of the health care reform in Latvia. To achieve the goal of the research, the methods of the theoretical research (literature analysis, content analysis, and electronic resources analysis) were used alongside with the methods of empirical research (data collection methods: document analysis and database statistical analysis). For data processing and analysis, methods of statistical analysis and methods of economic analysis were used. To perform this research the author created a three-level performance evaluation model based on macro-level evaluation (policy impact assessment), meso-level evaluation (system analysis, functional and economic efficiency measuring) and micro-level evaluation (production function, allocative and technical efficiency measures).

The appropriate measures of the macro impact results, policy outcomes and performance outputs are defined to evaluate the effectiveness of the performed health care reform. Taking into account that health care is only one of the mechanisms to achieve the public health goals, the author assumes that the macro impact results are specified for public health, the policy outcomes are determined to health care, as well as pharmacy, while the performance's outputs are representative for detail analysis of all levels.

The policy outcomes are measured by the functional effectiveness and economic efficiency indicators. The ex-post evaluation of the Latvian health care reform leads to the conclusion of its temperate low functional effectiveness. At the same time the reform shows a substantial productive efficiency in scores of the institutional reorganisation.

One of the appropriate measures of the economic efficiency of the medication and medical devices reimbursement system is the treatment costs of a unique patient and this measure shows that in circumstances of the reduced state budget funding the reimbursement has been provided to increased number of patients. The general conclusion shows that the economic efficiency of the reimbursement system is sufficient and at the same time there is a tendency to move towards technical efficiency, rather than total economic efficiency (technical and allocative efficiency), as the treatment alternatives (nutrition program, physician's time by consultation or manual therapy etc.) are not sufficiently taken into account.

The allocative efficiency in health economics is also associated with the market efficiency and effectiveness of the treatment process. There are no perfect competition market conditions for health care products and services, so it is necessary to use the additional methods of economic analysis, such as the cost-benefit analysis, which is one of the most appropriate methods in consideration of health care.

## **POLICY ON SUCCESSFUL AGEING IN MUNICIPALITIES OF LATVIA**

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The challenges of ageing population are a global phenomenon becoming important in many countries around the world. The course of ageing population depends on the level of development of each country and other influencing factors, which in turn affect the socio-economic situation in the country. It is projected that the total population in 2060 will be greater, however, about every third European will be at least 65 years old [1]. In many countries around the world the implementation of the society's successful aging policy is being worked on.

This study aims at exploring the successful ageing of society support policy in municipalities of Latvia and developing recommendations for its advancement based on 'good practice' examples in Latvia and abroad.

Firstly, society's successful aging ideas in Latvia have not been dealt with so far, as well as successful aging as a concept is a novelty in relation to the positive aspects of ageing. The World Health Organization claims that successful aging aims to extend healthy life years and improve the quality of life for the aging [2]. Thus, the implementation of the idea of successful ageing is to be carried out by introducing a particular policy which shall minimize social exclusion and poverty in society.

Secondly, in accordance with the European Union approaches, successful aging is defined as a multinational balanced strategy to enable a good ageing society [3].

The EU Member States are encouraged to work on policy making within the scope of an ageing society. One of the solutions in order to promote the quality of life for seniors in Latvia is to implement the initiatives at the national and local level, based on the experience of foreign countries.

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## QUALITY OF WORKING LIFE

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Work is an important part of the value system of people. The quality of working life affects not only job satisfaction, but also many other areas of life, such as family, leisure, social life and also financial areas. It takes an important place in the people's time budget and a good work place is a precondition for increasing the level of the quality of life. The quality of working life is a complex, multidimensional concept and a number of researchers have tried to identify the quality of working life and its empirical measurement.

Some jobs are better than others. Everyone recognizes this fact, both - when they discuss jobs in daily conversation and when they must actually choose among jobs (Jencks, Perman, Rainwater, 1988). People spend a large part of their life at work; all of us want to work in a job with high quality of working life conditions, as well as to increase the overall quality of life. High quality of working life may reduce poverty and social exclusion, diminish the pressure on the welfare state and improve social cohesion, also boost competitiveness, promote motivation and productivity.

Different researchers and managers have come up with different categories and factors to define and measure the quality of working life (Gallie, 2000). Economists tend to focus on the aspects as hourly wages, working hours, fringe benefits - particularly monetary benefits. At the same time, psychologists often emphasize non-economics aspects of work, for example, job satisfaction and well-being. Sociologists study the occupational prestige or status, autonomy and control etc. However, there is no agreement about the measures; several researchers have pointed out that it is important to measure both, monetary and non-monetary work indicators. These measurements examine the quality of working life levels and dimensions. For example, the dimensions like work environment, job security, wages and rewards, work life balance, job satisfaction and so on.

Measuring the quality of working life is not a simple task as jobs are made up of many components. There is no consensus on what constitutes a good job. There are both, subjective and objective indicators (Mills, 2007). There are two approaches as to how to measure the overall quality of working life. The first evaluates the quality of working life along earnings, promotion opportunities, intrinsic rewards and security. The second asks workers about their degree of job satisfaction. This approach does not measure all relevant job characteristics, but comes up with an overall assessment.

Work itself is changing, at the same time people have become more diverse in the needs and wants that they expect to fulfil through their work. We need not only more jobs, but better jobs.

### References

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